Anets GoldenFRY™ Gas Fryer Performance Tests

Application of ASTM Standard
Test Method F 1361-99

FSTC Report 5011.01.03

Food Service Technology Center
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Executive Summary

The Anets MX-14E stock fryer was powered by atmospheric burners with an input rating of 111,000 Btu/h. The fryer uses snap action thermostats, an electronic control panel with an integrated melt cycle. Figure ES-1 illustrates the MX-14E fryer tested at the FSTC. At the manufacturer's request, the FSTC did additional testing to the fryer by removing four burner orifices and lowering the input rating to 82,000 Btu/h.

Food Service Technology Center (FSTC) engineers tested the fryer under the tightly controlled conditions of the American Society for Testing and Materials' (ASTM) standard test method.[1] Fryer performance is characterized by preheat time and energy consumption, idle energy consumption rate, cooking energy efficiency, and production capacity.

Cooking performance was determined by cooking frozen French fries under three different loading scenarios (heavy—3 pounds per load, medium—1½ and light—¾ pound per load). The heavy-load cook time for the stock model was 2.58 minutes, while the modified model cooked in 2.92 minutes. Production capacity includes the cooking time and the time required for the frying medium to recover to 340°F (recovery time).

Cooking energy efficiency is a measure of how much of the energy that an appliance consumes is actually delivered to the food product during the cooking process. Cooking energy efficiency is therefore defined by the following relationship:

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[1] American Society for Testing and Materials. 2000. *Standard Test Method for the Performance of Open, Deep Fat Fryers.* ASTM Designation F 1361-99, in *Annual Book of ASTM Standards,* Philadelphia.

Executive Summary

Figure ES-1. Anetsberger MX 14E Golden Fryer.

$$\text{Cooking Energy Efficiency} = \frac{\text{Energy to Food}}{\text{Energy to Appliance}}$$

A summary of the test results is presented in Table ES-1.

Table ES-1. Summary of Fryer Performance.

	Modified	***Stock***
Rated Energy Input Rate (Btu/h)	82,000	111,000
Measured Energy Input Rate (Btu/h)	80,203	106,340
Preheat Time to 350°F (min) [a]	22.83	18.33
Preheat Energy to 350°F (Btu)	19,645	20,713
Idle Energy Rate @ 350°F (Btu/h)	11,545	12,103
Cooking Energy Efficiency		
Heavy-Load (%) [b]	34.7 ± 0.7	35.2 ± 1.2
Medium-Load (%) [b]	32.7 ± 1.3	32.7 ± 0.7
Light-Load (%) [b]	26.1 ± 0.7	25.0 ± 1.4
Production Capacity (lb/h) [c]	41.3 ± 1.7	60.5 ± 2.1
Average Frying Medium		
Recovery Time (min) [c]	1.43	0.40

[a] Preheat with melt cycle.

[b] This range indicates the experimental uncertainty in the test result based on a minimum of three test runs.

[c] Based on the heavy-load cooking test with a minimum 10-second preparation time between loads.

The Anets GoldenFRY™ gas fryer performed well when compared to similar atmospheric fryers of its class. Anets MX-14E stock (111,000 Btu/h) fryer exhibited higher efficiencies and production capacities, as well as faster recovery times, than the modified fryer (82,000 Btu/h) during heavy load testing. Table ES-2 compares heavy-load cooking performances for the stock and modified fryer. Both fryers had similar idle energy rates with a slightly shorter preheat time for the stock fryer. The modified fryer produced comparable cooking energy efficiencies relative to the stock fryer under all three cooking load scenarios.

Table ES-2. Heavy Load Test Results.

	Modified	***Stock***
Load Size (lb)	3	3
French Fry Cook Time (min)	2.92	2.58
Average Recovery Time (sec)	1.43	0.40
Production Rate (lb/h)	41.3 ± 1.7 [a]	60.5 ± 2.1 [a]
Energy Consumption (Btu/lb)	552	546
Cooking Energy Rate (Btu/h)	65,649	93,843
Cooking Energy Efficiency (%)	34.7 ± 1.7 [a]	35.2 ± 1.2 [a]

[a] This range indicates the experimental uncertainty in the test result based on a minimum of three test runs.

Figure ES-2 illustrates the relationship between cooking energy efficiency and production rate for the stock and modified Anets fryers. Figure ES-3 illustrates the relationship between the fryer's average energy consumption rates and the production rates. This graph can be used as a tool to estimate the daily energy consumption for the fryer in a real-world operation. Average energy consumption rates at 10, 30, and 50 pounds per hour for the 111,000 Btu/h model are 26,717 Btu/h, 53,429 Btu/h, and 80,141 Btu/h respectively.

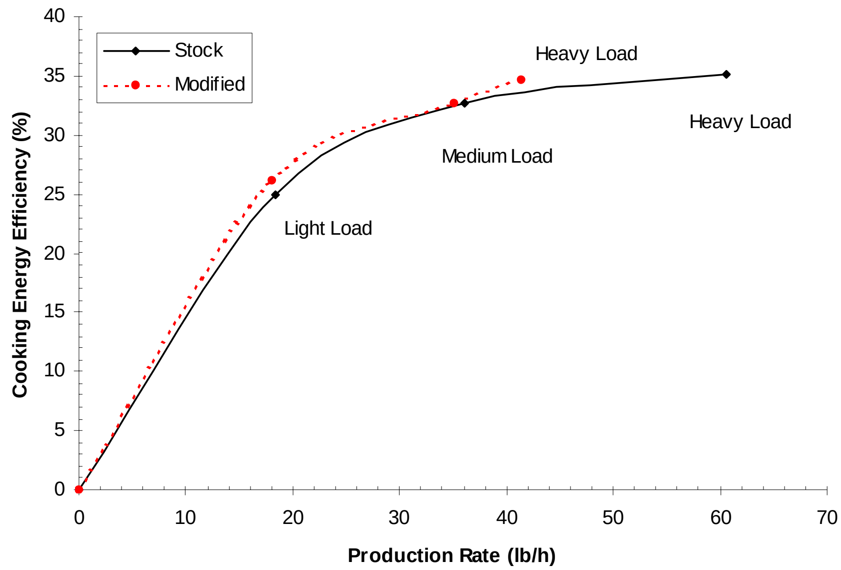

Figure ES-2.
Fryer part-load cooking energy efficiency.

Note: Light-load = ¾ pounds /load; medium-load = 1 ½ pounds/load; heavy-load = 3 pounds/load.

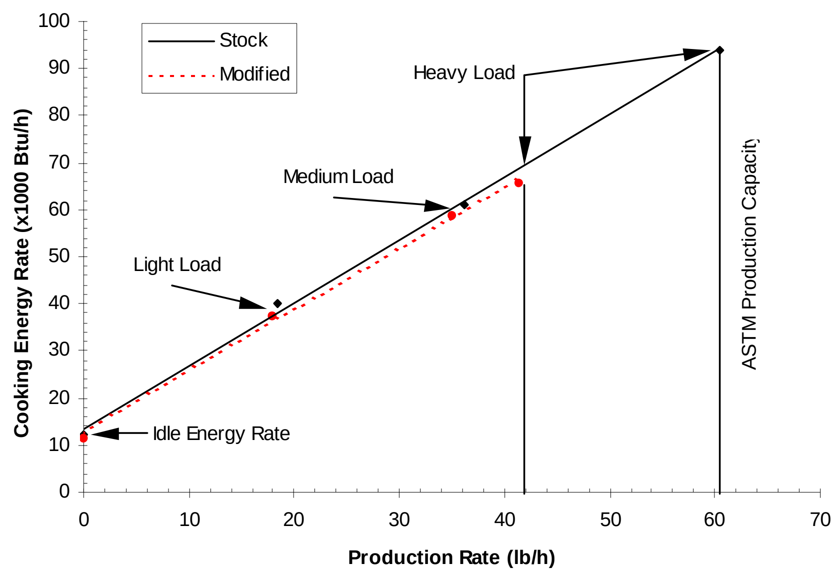

Figure ES-3.
Fryer cooking energy consumption profile.

Note: Light-load = ¾ pounds /load; medium-load = 1 ½ pounds/load; heavy-load = 3 pounds/load.

Table ES-3 summarizes the estimated energy consumption at 10,30, and 50 lb/h for both versions of the Anets GoldenFRY™ gas fryer.

Table ES-3. Energy Consumption Estimations.

Production Rate	*Modified*	*Stock*
10 lbs/h	25,598 Btu/h	26,717 Btu/h
30 lbs/h	51,856 Btu/h	53,429 Btu/h
50 lbs/h	--	80,141 Btu/h

The modified Anets fryer, demonstrated equivalent cooking energy efficiencies with respect to the stock fryer, but has longer recovery times and a subsequently lower production capacity than the stock version. In fact, the production capacity for the stock fryer was 32% greater than the modified fryer (60.5 lb/h vs. 41.3 lb/h). During the medium and light load testing the production rates were equal, indicating that the de-rated version would perform sufficiently well for a light-duty operation.

A food service operator that requires high production capacity with a quick recovery time during peak periods, while maintaining energy efficiency with smaller loads makes the stock model at 111,000 Btu/h a good choice. The modified fryer of 82,000 Btu/h offers food service operators the same energy efficiency and production capacity of the stock model but lacks the horsepower for the peak periods. Food service operations typically cook in medium and light load scenarios and may not require the horsepower of the stock model. The modified model, representing a lower first-cost alternative for the restaurateur, could be a cost-saving alternative with the equivalent cooking performance and production capacities of the higher input fryer during medium and light-duty cooking.

1 Introduction

Background

Fried foods continue to be popular on the restaurant scene. French fried potatoes are still the most common deep fried food, along with onion rings, chicken and fish. Recent advances in equipment design have produced fryers that operate more efficiently, quickly, safely and conveniently.

With today's food service operators becoming more sophisticated in their choice of equipment, the demand for objective performance data has increased. Since Pacific Gas and Electric Company is a dual-fuel utility, the food service industry felt that it would produce unbiased data for gas and electric appliances. Pacific Gas and Electric Company would benefit by passing this performance data on to its customers, helping them to select energy efficient equipment. With support from the Electric Power Research Institute (EPRI), the Gas Research Institute (GRI), and the National Restaurant Association, Pacific Gas and Electric Company has been involved in developing test methods for commercial cooking equipment for over ten years at its Food Service Technology Center (FSTC) in San Ramon, California.

In 1991, FSTC researchers developed a uniform test procedure to evaluate the performance of gas and electric fryers. This test method was submitted to the American Society for Testing and Materials' (ASTM) committee F26 on Food Service Equipment, and in January 1992, it was accepted as a standard test method (Designation F 1361-99).[1] Pacific Gas and Electric Company's *Development and Application of a Uniform Testing Procedure for Open, Deep-fat Fryers* documents the developmental procedures and test results of several gas and electric fryers.[2] Other Pacific Gas and Electric Company reports document results of applying the ASTM test method to different fryers.[3,4,5,6,7,8,9]

Introduction

Fryer performance is characterized by preheat time and energy consumption, idle energy consumption rate, pilot energy consumption rate, cooking energy efficiency and production capacity.

The Anets MX-14E fryer combines crossfire burners with a tri-clad stainless steel frypot, a stainless steel finish, and copper flash heat exchangers with a programmable frying computer. An integrated melt cycle prevents frying medium scorching during preheat.

This report presents the results of applying the ASTM test method to the Anets MX-14E fryer. The glossary in Appendix A is provided so that the reader has a quick reference to the terms used in this report.

Objectives

The objective of this report is to examine the operation and performance of Anets MX-14E, 14-inch gas fryer at a stock input rating of 111,000 Btu/h and a modified input rating of 82,000 Btu/h, under the controlled conditions of the ASTM standard test method. 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 350°F.
3. Characterize the idle energy use with the thermostat set at a calibrated 350°F.
4. Document the cooking energy consumption and efficiency under two French fry loading scenarios: heavy (3 pounds per load) and light (¾ pound per load).
5. Determine the production capacity and frying medium temperature recovery time during the heavy-load test.

Introduction

Anets MX-14E, 14-inch gas fryer has a stock power rating of 111,000Btu/h. The frypot is surrounded by crossfire burners with the flue gasses routed upward and out the back. The MX-14E was modified, by removing four of the burner orifices (two from each side) and lowering the input to 82,000 Btu/h (see Figure 1-1).

Appliance Description

Appliance specifications are listed in Table 1-1, and the manufacturer's literature is in Appendix B.

Table 1-1. Appliance Specifications.

Manufacturer	Anets
Model	MX 14-E
Generic Appliance Type	Open Deep Fat Fryer
Rated Input	Stock 111,000 Btu/h and Modified 82,000 Btu/h
Oil Capacity	50 lb
Controls	Programmable solid state thermostat with frying computer and integrated melt cycle.
Construction	Stainless Steel

Figure 1-1.
Anetsberger MX 14E Frypot.

2 Methods

Setup and Instrumentation

FSTC researchers installed the fryers on a tiled floor under a 4-foot-deep canopy hood that was 6 feet, 6 inches above the floor. The hood operated at a nominal exhaust rate of 300 cfm per linear foot of hood. There was at least 6 inches of clearance between the vertical plane of the fryers and the edge of the hood. All test apparatus were installed in accordance with Section 9 of the ASTM test method.[1] See Figure 2-1.

Researchers instrumented the fryer with thermocouples to measure temperatures in the cold and the cooking zones and at the thermostat bulb. Additionally, four thermocouples were welded onto the sides of the frypot, one in each of the four quadrants of the frypot, and a single thermocouple monitored flue temperature. Two thermocouples were placed in the cook zone, one in the geometric center of the frypot, approximately 1 inch above the fry basket support, and the other at the tip of the thermostat bulb. The cold zone thermocouple was supported from above, independent of the frypot surface, so that the temperature of the cold zone reflected the frying medium temperature, not the frypot's surface temperature. The cold zone temperature

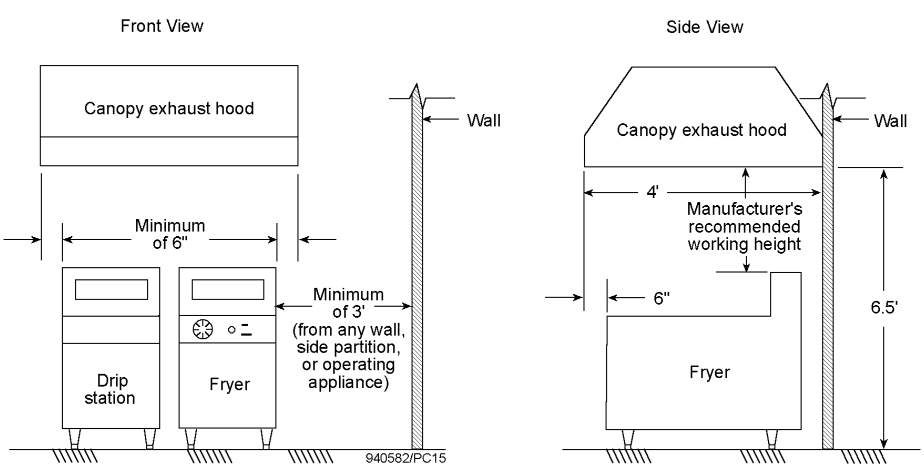

Figure 2-1. Equipment configuration.

was measured toward the rear of the frypot, 1/8-inch from the bottom of the pot. See Figure 2-2.

Natural gas consumption was measured using a positive displacement-type gas meter that generated a pulse every 0.1 ft^3. The gas meter and the thermocouples were connected to an automated data acquisition unit that recorded data every 5 seconds. A chemical laboratory used a gas chromatograph to determine the gas heating value on each day of testing. All gas measurements were corrected to standard conditions.

The fryer was filled with Melfry Brand, partially hydrogenated, 100% pure vegetable oil for all tests except the energy input rate determination test. This test required the fryer to be filled with water to inhibit burner cycling during the test.

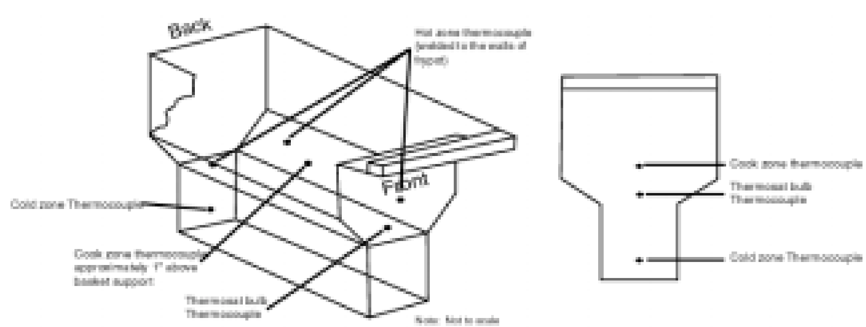

Figure 2-2. Thermocouple placement for testing.

Methods

Measured Energy Input Rate

Rated energy input rate is the maximum or peak rate at which the fryer consumes energy—as specified on the fryer's nameplate. Measured energy input rate is the maximum or peak rate of energy consumption, which is recorded during a period when the burners are operating (such as preheat). For the purpose of this test, the fryer was filled with water to the frypot's indicated fill-line. The controls were set to attain maximum output and the energy consumption was monitored for a period of 15 minutes after a full rolling boil had been established. Researchers compared the measured energy input rate with the nameplate energy input rate to ensure that the fryer was operating properly.

Cooking Tests

Researchers specified Simplot® brand ¼-inch blue ribbon product, par-cooked, frozen shoestring potatoes for all cooking tests. Each load of French fries was cooked to a 30% weight loss. The cooking tests involved "barreling" six loads of frozen French fries, using fry medium temperature as a basis for recovery. Each test was followed by a 10-minute wait period and was then repeated two more times. Researchers tested the fryer using 3-pound (heavy), and ¾-pound (light) French fry loads.

Due to the logistics involved in removing one load of cooked French fries and placing another load into the fryer, a minimum preparation time of 10 seconds was incorporated into the cooking procedure. This ensures that the cooking tests are uniformly applied from laboratory to laboratory. Fryer recovery was then based on the frying medium reaching a threshold temperature of 340°F (measured at the center of the cook zone). Reloading within 10°F of the 350°F thermostat set point does not significantly lower the average oil temperature over the cooking cycle, nor does it extend the cook time. The fryer was reloaded either after the cook zone thermocouple reached the threshold temperature or 10 seconds after removing the previous load from the fryer, whichever was longer.

The first load of each six-load cooking test was designated a stabilization load and was not counted when calculating the elapsed time and energy used. Energy monitoring and elapsed time of the test were determined after the second load contacted the frying medium. After removing the last load and allowing the fryer to recover, researchers terminated the test. Total elapsed time, energy consumption, weight of fries cooked, and average weight loss of the French fries were recorded for the last five loads of the six-load test.

Cooking tests were run in the following sequence: three replicates of the heavy-load test, followed by three replicates of the light-load test. This procedure ensured that the reported cooking energy efficiency and production capacity results had an uncertainty of less than ±10%. The results from each test run were averaged, and the absolute uncertainty was calculated based on the standard deviation of the results.

The ASTM results reporting sheets appear in Appendix C.

3 Results

Energy Input Rate

Prior to testing, the energy input rate was measured and compared with the manufacturer's nameplate value. This procedure ensured that each version of the fryer was operating within its specified parameters. The measured energy input rates for the modified and stock versions were 80,203 Btu/h and 106,340 Btu/h, respectively.

Preheat and Idle Tests

These tests show how the fryer uses energy when it is not cooking food. The preheat time allows an operator to know precisely how long it takes for the fryer to be ready to cook. The idle energy rate represents the energy required to maintain the set temperature, or the appliance's stand-by losses.

Preheat Energy and Time

Researchers filled the fryer with new oil, which was then heated to 350°F at least once prior to any testing. The preheat tests were conducted at the beginning of a test day, after the oil had stabilized at room temperature overnight. This fryer was equipped with a melt cycle, which would pulse the burners until the frying medium reached a minimum of 120°F. This feature was designed to minimize scorching during preheat. The stock model fryer was ready to cook in about 18 minutes. The modified model preheated in approximately 23 minutes. Figures 3-1 and 3-2 show the preheat characteristics for the two fryers.

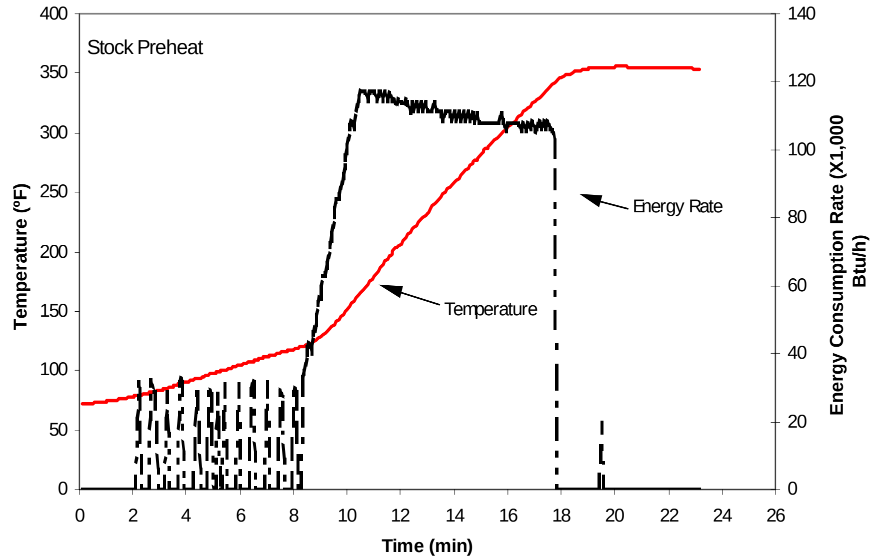

Figure 3-1.
111,000 Btu/h preheat with melt cycle characteristics.

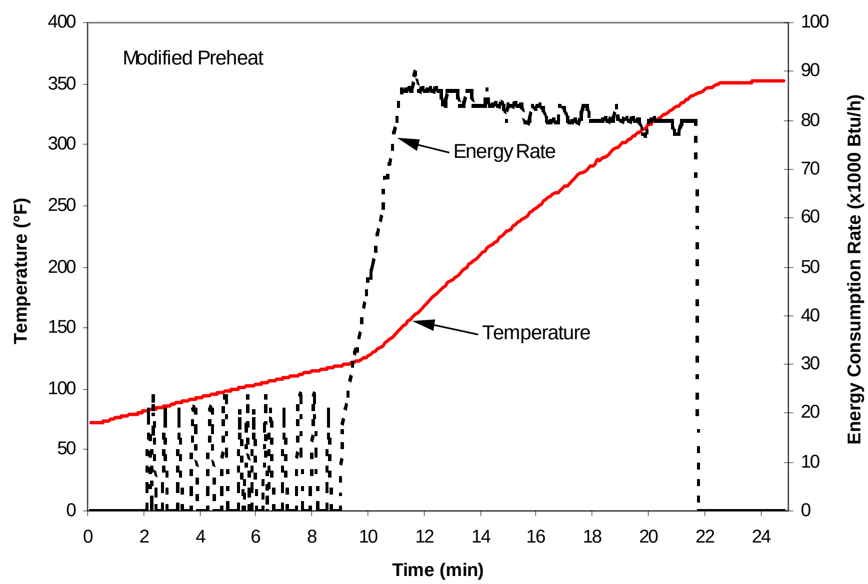

Figure 3-2.
82,000 Btu/h preheat with melt cycle characteristics.

Results

Idle Energy Rate

Once the frying medium reached 350°F, the fryer was allowed to stabilize for half an hour. Time and energy consumption was monitored for an additional two-hour period as each fryer maintained the oil at 350°F. The idle energy rate during this period for the stock fryer was 12,103 Btu/h and 11,545 Btu/h for the modified.

Test Results

Input, preheat, and idle test results are summarized in Table 3-1.

Table 3-1. Input, Preheat, and Idle Test Results.

	Modified	***Stock***
Rated Energy Input Rate (Btu/h)	82,000	111,000
Measured Energy Input Rate (Btu/h)	80,203	106,340
Preheat		
Time to 350°F (min) [a]	22.83	18.33
Energy (Btu)	19,645	20,713
Rate to 350°F (°F/min)	12.14	15.20
Idle Energy Rate @ 350°F (Btu/h)	11,545	12,103

[a] Preheat with melt cycle

Cooking Tests

The fryers were tested under three loading scenarios: heavy (3 pounds of fries per load), medium (1 ½ pounds of fries per load) and light (¾ pound of fries per load). The fries used for the cooking tests consisted of approximately 6% fat and 66% moisture, as specified by the ASTM procedure. Researchers monitored French fry cook time and weight loss, frying medium recovery time, and fryer energy consumption during these tests.

Heavy-Load Tests

The heavy-load cooking tests were designed to reflect a fryer's maximum performance. The fryers were used to cook six 3-pound loads of frozen French fries—one load after the other in rapid succession, similar to a batch-cooking procedure. Figures 3-3 and 3-4 show the average temperature of the frying mediums during the heavy-load tests. The first load was used to stabilize the fryer, and the remaining five loads were used to calculate cooking energy efficiency and production capacity. The average frying medium temperatures during the heavy-load test were 330°F for the stock version and 321°F for the modified version.

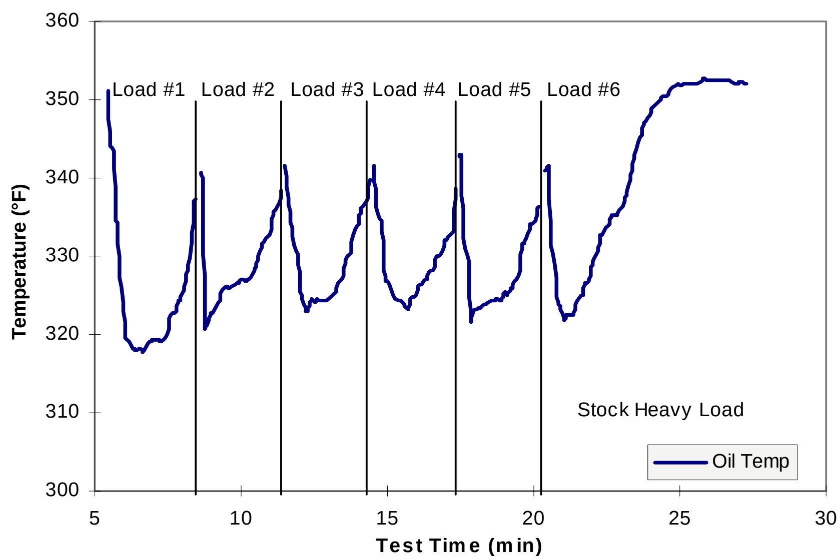

Figure 3-3.
Frying medium temperature during a heavy-load test for the 111,000 Btu/h fryer.

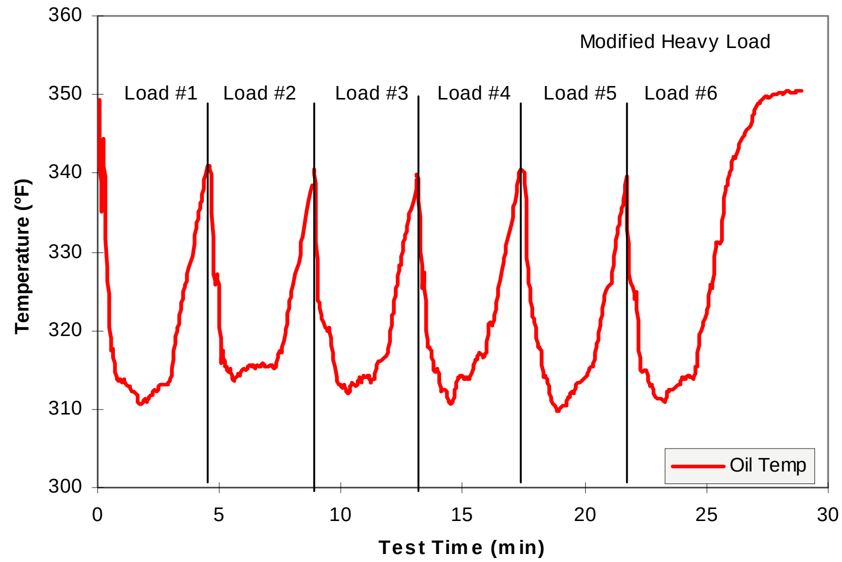

Figure 3-4.
Frying medium temperarture during a heavy load test for the 82,000 Btu/h fryer

The heavy load cook time for the stock model was 2.58 minutes with a recovery time of 0.40 minutes, while the modified model showed a heavy-load cook time of 2.92 minutes and a 1.43 minute recovery time. Figure 3-5 compares the temperature response of the two different models while cooking a 3-pound load of frozen French fries. Production capacity includes the time required to remove the cooked fries and reload the fryer with a new batch of frozen fries (approximately 10 seconds per load).

Test Results

Energy imparted to the French fries was calculated by separating the various components of the fries (water, fat, and solids) and determining the amount of heat gained by each component (Appendix D). The fryer's cooking energy efficiency for a given loading scenario is the amount of energy imparted to the fries, expressed as a percentage of the amount of energy consumed by the fryer during the cooking process.

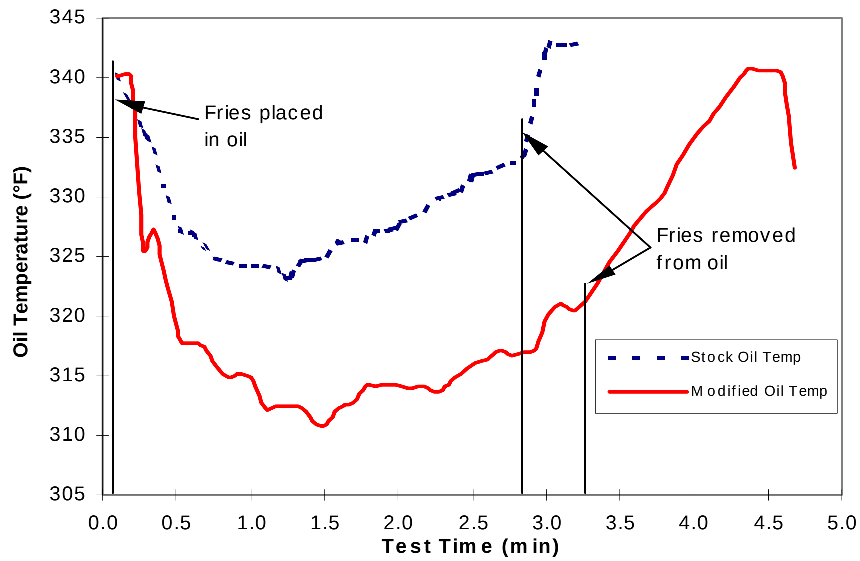

Figure 3-5.
Fryer cooking cycle temperature signature.

Heavy-load cooking energy efficiency results for the stock fryer were 35.4%, 34.7%, and 35.6%, yielding a maximum uncertainty of 1.2%. The modified fryer had cooking energy efficiency results of 34.9%, 34.9%, and 34.4%, yielding a maximum uncertainty of 0.7%. Tables 3-2 and 3-3 summarize the results of the ASTM cooking energy efficiency and production capacity tests.

Table 3-2. Stock Fryer: Cooking Energy Efficiency and Production Capacity.

	Heavy Load	Medium Load	Light Load
Load Size (lb)	3.00	1 ½	¾
French Fry Cook Time (min)	2.58	2.30	2.27
Average Recovery Time (min)	0.40	0.19	0.18
Production Rate (lb/h)	60.5 ± 2.1	36.1 ± 1.0	18.4 ± 0.2
Energy Consumption (Btu/lb)	546	553	543
Cooking Energy Rate (Btu/h)	93,843	61,029	38,806
Cooking Energy Efficiency (%)	35.2 ± 1.2	32.7 ± 0.7	25.0 ± 1.4

Table 3-3. Modified Fryer: Cooking Energy Efficiency and Production Capacity.

	Heavy Load	Medium Load	Light Load
Load Size (pounds)	3.0	1 ½	¾
French Fry Cook Time (min)	2.92	2.39	2.33
Average Recovery Time (min)	1.43	0.19	0.18
Production Rate (lb/h)	41.3 ± 1.7	35.0 ± 0.4	18.0 ± 0.1
Energy Consumption (Btu/lb)	552	550	547
Cooking Energy Rate (Btu/h)	65,649	59,231	37,586
Cooking Energy Efficiency (%)	34.7 ± 0.7	32.7 ± 1.3	26.1 ± 0.7

Figure 3-6 illustrates the relationship between cooking energy efficiency and production rate for this fryer. Fryer production rate is a function of both the French fry cook time and the frying medium recovery time. Appendix D contains a synopsis of test data for each replicate of the cooking tests.

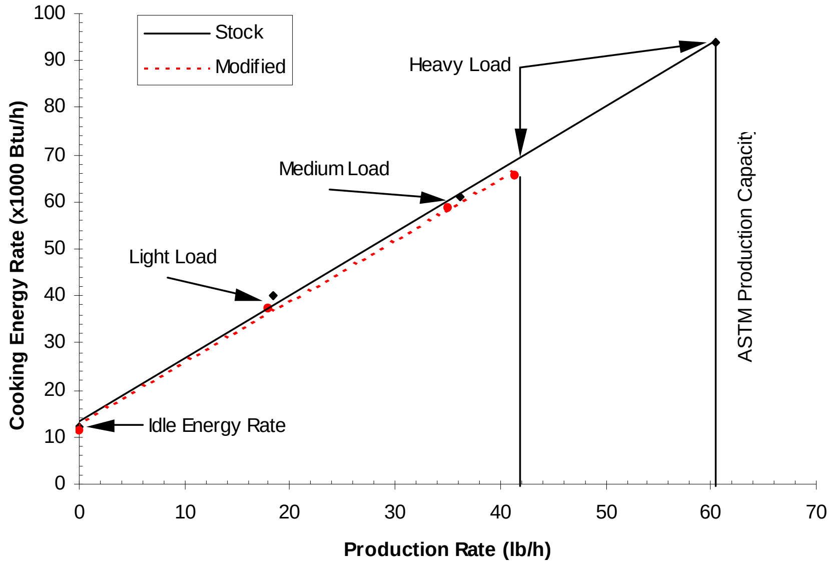

Figure 3-6.
Fryer part-load cooking energy efficiency.

Note: Light-load = ¾ pounds /load; medium-load = 1 ½ pounds/load; heavy-load = 3 pounds/load.

Figure 3-7 illustrates the relationship between the fryer's average energy consumption rate and the production rate. This graph can be used as a tool to estimate the daily energy consumption for the fryer in a real-world operation. Average energy consumption rates at 10, 30, and 50 pounds per hour for the stock model were 26,717 Btu/h, 53,429 Btu/h, and 80,141 Btu/h, respectively. For an operation cooking an average of 15 pounds of food per hour over the course of the day (.g. 150 lb of food over a ten hour day), the average daily energy consumption for the stock fryer would be 38,246 Btu/h. Table 3-4 represents the estimated energy daily consumption for all four fryers.

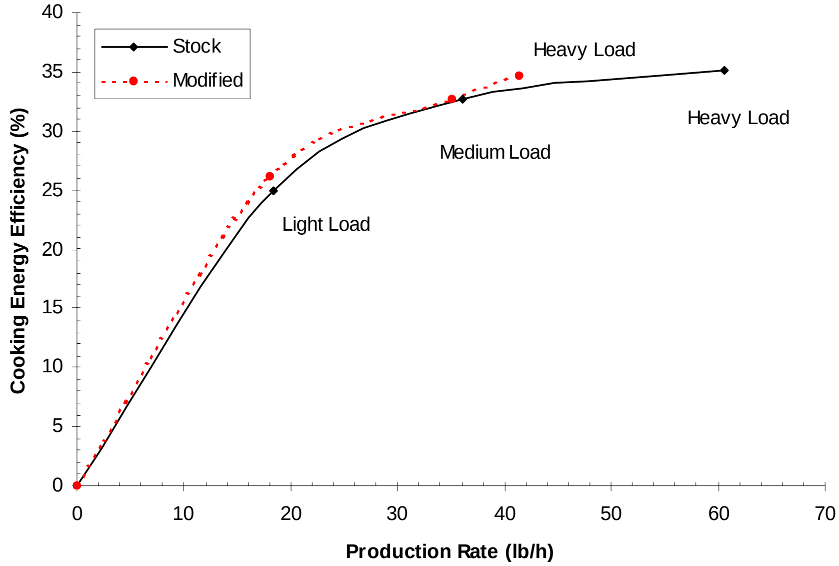

Figure 3-7.
Fryer cooking energy consumption profile.

Note: Light-load = ¾ pounds /load; medium-load = 1 ½ pounds/load; heavy-load = 3 pounds/load.

Table 3-4. Energy Consumption Estimations.

Production Rate	***Modified***	***Stock***
10 lbs/h	25,598 Btu/h	26,717 Btu/h
30 lbs/h	51,856 Btu/h	53,429 Btu/h
50 lbs/h	--	80,141 Btu/h

4 Conclusions

The modified Anets fryer demonstrated equivalent cooking energy efficiencies with respect to the stock fryer, but has longer recovery times and a subsequently lower production capacity than the stock version. The additional input of the Stock model fryer allowed for a 32% increase in production capacity without sacrificing energy efficiency. The extra power in the stock model provides faster response time and quicker recovery. During the medium and light load testing the production rates and cooking energy efficiencies were equal, indicating that the de-rated version would perform sufficiently well for a light-duty operation. The stock and modified both exhibited similar idle rates.

A food service operator that requires high production capacity with a quick recovery time during peak periods, while maintaining energy efficiency with smaller loads makes the stock model at 111,000 Btu/h a good choice. The modified fryer of 82,000 Btu/h offers food service operators the same energy efficiency and production capacity of the stock model but lacks the horsepower for the peak periods. Food service operations typically cook in medium and light load scenarios and may not require the horsepower of the stock model. The modified model, representing a lower first-cost alternative for the restaurateur could be a cost-saving alternative with equivalent cooking performance and production capacities of the higher input fryer during medium and light-duty cooking.

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Appendixes

A Glossary

Cooking Energy (kWh or kBtu)

The total energy consumed by an appliance as it is used to cook a specified food product.

Cooking Energy Consumption Rate (kW or kBtu/h)

The average rate of energy consumption during the cooking period.

Cooking Energy Efficiency (%)

The quantity of energy input to the food products; expressed as a percentage of the quantity of energy input to the appliance during the heavy-, medium-, and light-load tests.

Duty Cycle (%)
Load Factor

The average energy consumption rate (based on a specified operating period for the appliance) expressed as a percentage of the measured energy input rate.

$$\text{Duty Cycle} = \frac{\text{Average Energy Consumption Rate}}{\text{Measured Energy Input Rate}} \times 100$$

Energy Input Rate (kW or kBtu/h)
Energy Consumption Rate
Energy Rate

The peak rate at which an appliance will consume energy, typically reflected during preheat.

Heating Value (Btu/ft^3)
Heating Content

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)
Idle Energy Input Rate
Idle Rate

The rate of appliance energy consumption while it is "idling" or "holding" at a stabilized operating condition or temperature.

Idle Temperature (°F, Setting)

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.

Idle Duty Cycle (%)
Idle Energy Factor

The idle energy consumption rate expressed as a percentage of the measured energy input rate.

$$\text{Idle Duty Cycle} = \frac{\text{Idle Energy Consumption Rate}}{\text{Measured Energy Input Rate}} \times 100$$

Measured Input Rate (kW or Btu/h)
Measured Energy Input Rate
Measured Peak Energy Input Rate

The maximum or peak rate at which an appliance consumes energy, typically reflected during appliance preheat (i.e., the period of operation when all burners or elements are "on").

Glossary

Pilot Energy Rate (kBtu/h)
Pilot Energy Consumption Rate

The rate of energy consumption by the standing or constant pilot while the appliance is not being operated (i.e., when the thermostats or control knobs have been turned off by the food service operator).

Preheat Energy (kWh or Btu)
Preheat Energy Consumption

The total amount of energy consumed by an appliance during the preheat period.

Preheat Rate (°F/min)

The rate at which the cook zone heats during a preheat.

Preheat Time (minute)
Preheat Period

The time required for an appliance to "preheat" from the ambient room temperature (75 ± 5°F) to a specified (and calibrated) operating temperature or thermostat set point.

Production Capacity (lb/h)

The maximum production rate of an appliance while cooking a specified food product in accordance with the heavy-load cooking test.

Production Rate (lb/h)
Productivity

The average rate at which an appliance brings a specified food product to a specified "cooked" condition.

Rated Energy Input Rate
(kW, W or Btu/h, Btu/h)
Input Rating (ANSI definition)
Nameplate Energy Input Rate
Rated Input

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

Recovery Time (minute, second)

The average time from the removal of the fry baskets from the fryer until the frying medium is within 10°F of the thermostat set point and the fryer is ready to be reloaded.

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.

B Appliance Specifications

Appendix B includes the product literature for the Anetsberger GoldenFRY™ fryer.

Anets GoldenFry™ 14" High Efficiency Gas Fryer

Model MX-14E

Item No.

This Premier Model In The Anets GoldenFry™ Series Of Fryers Features High Performance And Superior Recovery To Meet Any Frying Requirement

Easy cleaning features, energy efficiency, and superior construction make this 14" fryer the choice for outstanding performance and design. Energy saving 111,000 BTUH cross-fire burners cook like 145,000 BTUH fryer due to a 4 sided heating system. To maintain direct heat transfer, the frypot is equipped with copper flashed heat exchangers. The tri-clad stainless steel frypot equipped with these heat exchangers provides remarkable temperature recovery.

STANDARD FEATURES

- Stainless steel frypot has a lifetime warranty
- Stainless steel front panel, trim and door
- Top quality tri-clad steel frypot provides efficient uniform heat transfer with the added benefits of a stainless steel finish
- Copper-flashed heat exchangers transfer heat directly into frypot for maximum efficiency
- Open vat design with sloped sides forces food particles to rapidly fall into the easily accessible cold zone
- Unique crossfire burners provide a 4 sided heating system
- Fully insulated cabinet keeps the kitchen cool
- Dual (35 to 50 lb.) shortening levels for varying cooking capacities
- Recessed Lexan faced control panel protects controls from damage
- Stainless steel basket hangers lift off for easy cleaning and access to the backsplash

ANETS GoldenFRY™

NSF UL

ANETS

Anetsberger Brothers, Inc. ▪ *Foodservice Equipment That Turns Food Into Gold*
180 North Anets Drive ▪ Northbrook, Illinois 60062
1-800-837-2638 ▪ Fax 847-272-1943

Anets GoldenFry™ 14" High Efficiency Gas Fryer

Model MX-14E

ANETS GoldenFRY™

SPECIFICATIONS

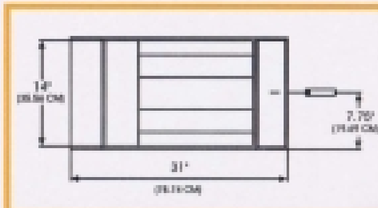
▪ Model	MX-14E, Basic MX-14D, Two 5 or 15 minute timers with buzzers
▪ Certification	UL, NSF
▪ BTUH	111,000
▪ Gas Pressure	NG 3.5" WC, LP 10" WC
▪ Gas Connection	3/4" NPT
▪ Electrical Requirements	MX-14E, 2 Amps MX-14D, 2 Amps
▪ Thermostat	Electric snap action type
▪ Temperature Range	200 to 375F, (93-191C)
▪ Burners	Atmospheric pre-mix
▪ Hi-limit	Safety control turns off main gas supply at 435 F (224C)
▪ Safety Pilot	100% gas shut off valve
▪ Spark Ignitor	Piezo electric
▪ Frypot	Tri-clad stainless steel
▪ Cabinet	Door, stainless steel Sides, painted Backsplash, stainless steel
▪ Shortening Capacity	35 lbs - 50 lbs
▪ Cooking Capacity	660 orders of shoestring french fries per hour

STANDARD ACCESSORIES

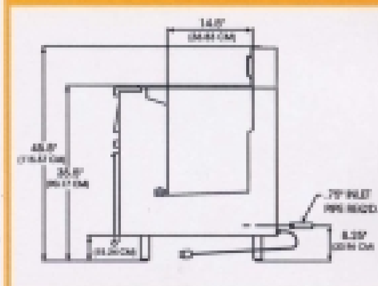
- 2 Twin nickel plated baskets
- Rack type basket support
- Clean out rod
- 6" Adjustable chrome plated legs
- Drain pipe extension

OPTIONS AND ACCESSORIES

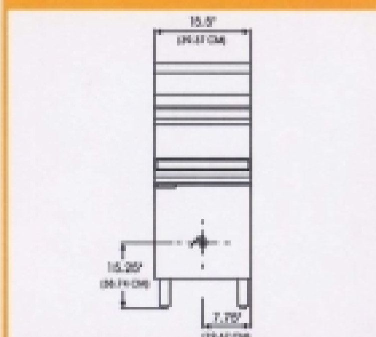
- Two 5 or 15 minutes timers with buzzers (MX-14D)
- Stainless steel sides
- Filter systems, built-in Filtronic or Filter Mate under fryer filter
- Fri-Tronic computer
- Shortening melter
- Can bank units at no additional charge
- Sediment tray
- Single or triple baskets
- Drain table
- Front drain tray
- Fryer cover
- Casters



Top View



Side View



Front View

Specifications subject to change without notice.
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ANETS

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1-800-837-2638 ▪ Fax 847-272-1943

C Results Reporting Sheets

Manufacturer: Anetsberger

Models: MX 14-E

Date: November 2000

Section 11.1 Test Fryers and Burners

Description of operational characteristics: The MX 14-E gas fryer rated at 111,000 Btu/h features electric snap action thermostats that control atmospheric burners, which heat copper flashed heat exchangers that are in direct contact with the stainless steel. The integrated control panel offers dual timers and a hidden boilout feature. The MX 14-E fryer also comes with an integrated melt cycle for solid shortening. The fryer was modified to operate at an input rating of 82,000 Btu/h.

Section 11.2 Apparatus

__√__ Check if testing apparatus conformed to specifications in section 6.

Deviations: None.

Results Reporting Sheets

Section 11.4. Energy Input Rate.

	Modified	Stock
Gas Heating Value (Btu/scf)	1025	1024
Name Plate (Btu/h)	82,000	111,000
Measured (Btu/h)	80,203	106,340
Percentage Difference (%)	2.19	4.20

Section 11.5 Thermostat Calibration

	Modified	Stock
Thermostat Setting (°F)	350	350
Oil Temperature (°F)	351	351

Section 11.6 Preheat Energy and Time

	Modified	Stock
Gas Heating Value (Btu/scf)	1024	1026
Starting Temperature (°F)	72	72
Energy Consumption (Btu)	19,645	20,713
Duration (min)	22.8	18.3
Preheat Rate (°F/min)	12.2	15.2

Results Reporting Sheets

Section 11.7 Idle Energy Rate

	Modified	Stock
Gas Heating Value (Btu/scf)	1021	1024
Idle Energy Rate @ 350 °F (Btu/h)	11,545	12,103

Section 11.8 Heavy Load Cooking Energy Efficiency and Cooking Energy Rate

	Modified	Stock
Gas Heating Value (Btu/scf)	1025	1025
Load Size (lb)	3.00	3.00
French Fry Cook Time (min)	2.92	2.58
Average Recovery Time (min)	1.43	0.40
Production Rate (lb/h)	41.3 ± 1.7	60.5 ± 2.1
Energy Consumption (Btu/lb)	552	546
Cooking Energy Rate (Btu/h)	65,649	93,843
Energy per Pound of Food Cooked (Btu/lb)	1,588	1,551
Cooking Energy Efficiency (%)	34.7 ± 0.7	35.2 ± 1.2

Section 11.9 Medium Load Cooking Energy Efficiency and Cooking Energy Rate

	Modified	Stock
Gas Heating Value (Btu/scf)	1024	1024
Load Size (pounds)	1.5	1.5
French Fry Cook Time (min)	2.39	2.30
Average Recovery Time (min)	0.19	0.19
Production Rate (lb/h)	35.0 ± 0.4	36.1 ± 1.0
Energy Consumption (Btu/lb)	550	553
Cooking Energy Rate (Btu/h)	58,885	61,029
Energy per Pound of Food Cooked (Btu/lb)	1,684	1,693
Cooking Energy Efficiency (%)	32.7 ± 1.3	32.7 ± 0.7

Results Reporting Sheets

Section 11.10 Light Load Cooking Energy Efficiency and Cooking Energy Rate

	Modified	Stock
Gas Heating Value (Btu/scf)	1020	1024
Load Size (pounds)	¾	¾
French Fry Cook Time (min)	2.33	2.27
Average Recovery Time (min)	0.18	0.18
Production Rate (lb/h)	18.0 ± 0.1	18.4 ± 0.2
Energy Consumption (Btu/lb)	547	543
Cooking Energy Rate (Btu/h)	37,586	40,064
Energy per Pound of Food Cooked (Btu/lb)	2,093	2,173
Cooking Energy Efficiency (%)	26.1 ± 0.7	25.0 ± 1.4

D Cooking Energy Efficiency Data

Table D-1. Specific Heat and Latent Heat.

Specific Heat (Btu/lb, °F)	
Ice	0.500
Fat	0.400
Solids	0.200
Frozen French Fries	0.695
Latent Heat (Btu/lb)	
Fusion, Water	144
Fusion, Fat	44
Vaporization, Water	970

Cooking Energy Efficiency Data

Table D-2. Stock Heavy-Load Fry Test Data.

	Repetition #1	Repetition #2	Repetition #3
Measured Values			
Total Energy (Btu)	23,061	23,735	23,004
Cook Time (min)	**2.57**	**2.58**	**2.58**
Total Test Time (min)	15.1	14.7	14.9
Weight Loss (%)	29.65	29.82	29.26
Initial Weight (lb)	15.000	15.000	15.000
Final Weight (lb)	10.553	10.528	10.611
Initial Fat Content (%)	6.1	6.1	6.1
Initial Moisture Content (%)	65.2	65.2	65.2
Final Moisture Content (%)	48.2	47.6	47.6
Initial Temperature (°F)	0	0	0
Final Temperature (°F)	212	212	212
Calculated Values			
Initial Weight of Water (lb)	9.780	9.780	9.780
Final Weight of Water (lb)	5.087	5.011	5.051
Sensible (Btu)	2,210	2,210	2,210
Latent - Heat of Fusion (Btu)	1,407	1,407	1,407
Latent - Heat of Vaporization (Btu)	4,542	4,618	4,579
Total Energy to Food (Btu)	8,159	8,235	8,196
Energy to Food (Btu/lb)	**544**	**549**	**546**
Total Energy to Fryer	23,061	23,735	23,004
Energy to Fryer (Btu/lb)	**1,537**	**1,582**	**1,534**
Cooking Energy Efficiency (%)	**35.4**	**34.7**	**35.6**
Cooking Energy Rate (Btu/h)	**91,754**	**97,141**	**92,635**
Production Rate (lb/h)	**59.7**	**61.4**	**60.4**
Average Recovery Time (sec)	**0.44**	**0.35**	**0.40**

Cooking Energy Efficiency Data

***Table D-3. Stock Medium-Load Fry Test Data*.**

	Repetition #1	Repetition #2	Repetition #3
Measured Values			
Total Energy (Btu)	12,696	12,601	12,790
Cook Time (min)	**2.28**	**2.31**	**2.32**
Total Test Time (min)	12.3	12.6	12.5
Weight Loss (%)	29.25	29.30	29.78
Initial Weight (lb)	7.500	7.500	7.500
Final Weight (lb)	5.307	5.303	5.267
Initial Fat Content (%)	6.1	6.1	6.1
Initial Moisture Content (%)	65.2	65.2	65.2
Final Moisture Content (%)	46.9	46.6	47.0
Initial Temperature (°F)	0	0	0
Final Temperature (°F)	212	212	212
Calculated Values			
Initial Weight of Water (lb)	4.890	4.890	4.890
Final Weight of Water (lb)	2.489	2.471	2.476
Sensible (Btu)	551	554	553
Latent - Heat of Fusion (Btu)	704	704	704
Latent - Heat of Vaporization (Btu)	2,327	2,344	2,341
Total Energy to Food (Btu)	4,136	4,153	4,149
Energy to Food (Btu/lb)	**551**	**554**	**553**
Total Energy to Fryer	12,696	12,601	12,790
Energy to Fryer (Btu/lb)	**1,693**	**1,680**	**1,705**
Cooking Energy Efficiency (%)	**32.6**	**33.0**	**32.4**
Cooking Energy Rate (Btu/h)	**61,783**	**59,960**	**61,344**
Production Rate (lb/h)	**36.5**	**35.7**	**36.0**
Average Recovery Time (sec)	**0.19**	**0.21**	**0.18**

Cooking Energy Efficiency Data

Table D-4. Stock Light Load Fry Test Data.

	Repetition #1	Repetition #2	Repetition #3	Repetition #4
Measured Values				
Total Energy (Btu)	8,283	8,375	7,920	7,916
Cook Time (min)	**2.25**	**2.27**	**2.27**	**2.27**
Total Test Time (min)	12.1	12.2	12.2	12.2
Weight Loss (%)	29.08	30.03	29.85	28.78
Initial Weight (lb)	3.750	3.750	3.750	3.750
Final Weight (lb)	2.660	2.624	2.631	2.671
Initial Fat Content (%)	6.1	6.1	6.1	6.1
Initial Moisture Content (%)	65.2	65.2	65.2	65.2
Final Moisture Content (%)	48.7	48.1	48.0	48.0
Initial Temperature (°F)	0	0	0	0
Final Temperature (°F)	212	212	212	212
Calculated Values				
Initial Weight of Water (lb)	2.445	2.445	2.445	2.445
Final Weight of Water (lb)	1.295	1.262	1.263	1.282
Sensible (Btu)	553	553	553	553
Latent - Heat of Fusion (Btu)	352	352	352	352
Latent - Heat of Vaporization (Btu)	1,113	1,144	1,145	1,126
Total Energy to Food (Btu)	2,018	2,049	2,049	2,030
Energy to Food (Btu/lb)	**538**	**546**	**546**	**541**
Total Energy to Fryer	8,283	8,375	7,920	7,916
Energy to Fryer (Btu/lb)	**2,209**	**2,233**	**2,112**	**2,111**
Cooking Energy Efficiency (%)	**24.4**	**24.8**	**25.9**	**25.6**
Cooking Energy Rate (Btu/h)	**41,074**	**41,055**	**38,823**	**38,806**
Production Rate (lb/h)	**18.6**	**18.4**	**18.4**	**18.4**
Average Recovery Time (sec)	**0.17**	**0.18**	**0.18**	**0.18**

Cooking Energy Efficiency Data

Table D-5. Modified Heavy Load Fry Test Data.

	Repetition #1	Repetition #2	Repetition #3
Measured Values			
Total Energy (Btu)	23,817	23,620	24,817
Cook Time (min)	**2.92**	**2.92**	**2.92**
Total Test Time (min)	21.7	21.5	22.2
Weight Loss (%)	29.99	29.96	29.94
Initial Weight (lb)	15.000	15.000	15.000
Final Weight (lb)	10.502	10.506	10.510
Initial Fat Content (%)	6.1	6.1	6.1
Initial Moisture Content (%)	65.2	65.2	65.2
Final Moisture Content (%)	47.0	47.6	47.4
Initial Temperature (°F)	0	0	0
Final Temperature (°F)	212	212	212
Calculated Values			
Initial Weight of Water (lb)	9.780	9.780	9.780
Final Weight of Water (lb)	4.936	5.001	4.982
Sensible (Btu)	2,210	2,210	2,210
Latent - Heat of Fusion (Btu)	1,407	1,407	1,407
Latent - Heat of Vaporization (Btu)	4,695	4,628	4,648
Total Energy to Food (Btu)	8,312	8,245	8,265
Energy to Food (Btu/lb)	**554**	**550**	**551**
Total Energy to Fryer	23,817	23,620	24,015
Energy to Fryer (Btu/lb)	**1,588**	**1,575**	**1,601**
Cooking Energy Efficiency (%)	**34.9**	**34.9**	**34.4**
Cooking Energy Rate (Btu/h)	**65,915**	**66,038**	**64,993**
Production Rate (lb/h)	**41.5**	**41.9**	**40.6**
Average Recovery Time (sec)	**1.41**	**1.37**	**1.51**

Cooking Energy Efficiency Data

Table D-6. Modified Medium Load Fry Test Data.

	Repetition #1	Repetition #2	Repetition #3	Repetition #4
Measured Values				
Total Energy (Btu)	12,816	12,812	12,300	12,606
Cook Time (min)	**2.38**	**2.42**	**2.39**	**2.37**
Total Test Time (min)	12.9	13.0	12.8	12.8
Weight Loss (%)	29.19	30.41	30.61	30.95
Initial Weight (lb)	7.500	7.500	7.500	7.500
Final Weight (lb)	5.311	5.220	5.205	5.179
Initial Fat Content (%)	6.1	6.1	6.1	6.1
Initial Moisture Content (%)	65.2	65.2	65.2	65.2
Final Moisture Content (%)	47.5	48.2	47.6	47.6
Initial Temperature (°F)	0	0	0	0
Final Temperature (°F)	212	212	212	212
Calculated Values				
Initial Weight of Water (lb)	4.890	4.890	4.890	4.890
Final Weight of Water (lb)	2.523	2.516	2.478	2.465
Sensible (Btu)	1,105	1,105	1,105	1,105
Latent - Heat of Fusion (Btu)	704	704	704	704
Latent - Heat of Vaporization (Btu)	2,291	2,301	2,337	2,349
Total Energy to Food (Btu)	4,100	4,110	4,146	4,158
Energy to Food (Btu/lb)	**547**	**548**	**553**	**554**
Total Energy to Fryer	12,816	12,812	12,300	12,606
Energy to Fryer (Btu/lb)	**1,709**	**1,708**	**1,640**	**1,681**
Cooking Energy Efficiency (%)	**32.0**	**32.1**	**33.7**	**33.0**
Cooking Energy Rate (Btu/h)	**59,565**	**59,269**	**57,475**	**59,231**
Production Rate (lb/h)	**34.9**	**34.7**	**35.0**	**35.2**
Average Recovery Time (sec)	**0.20**	**0.18**	**0.17**	**0.19**

Cooking Energy Efficiency Data

Table D-7. Modified Light-Load Test Data.

	Repetition #1	Repetition #2	Repetition #3	Repetition #4
Measured Values				
Total Energy (Btu)	10,744	11,919	11,140	11,726
Cook Time (min)	**2.30**	**2.28**	**2.28**	**2.28**
Total Test Time (min)	23.6	28.2	25.9	28.2
Weight Loss (%)	30.19	30.19	30.27	30.47
Initial Weight (lb)	3.750	3.750	3.750	3.750
Final Weight (lb)	2.618	2.618	2.615	2.608
Initial Fat Content (%)	6.1	6.1	6.1	6.1
Initial Moisture Content (%)	64.3	64.3	64.3	64.3
Final Moisture Content (%)	44.6	44.6	44.9	44.9
Initial Temperature (°F)	0	0	0	0
Final Temperature (°F)	212	212	212	212
Calculated Values				
Initial Weight of Water (lb)	2.411	2.411	2.411	2.411
Final Weight of Water (lb)	1.167	1.167	1.174	1.171
Sensible (Btu)	553	553	553	553
Latent - Heat of Fusion (Btu)	347	347	347	347
Latent - Heat of Vaporization (Btu)	1,207	1,206	1,200	1,203
Total Energy to Food (Btu)	2,106	2,106	2,099	2,103
Energy to Food (Btu/lb)	**562**	**562**	**560**	**561**
Total Energy to Fryer	10,744	11,919	11,140	11,726
Energy to Fryer (Btu/lb)	**2,865**	**3,178**	**2,971**	**3,127**
Cooking Energy Efficiency (%)	**19.6**	**17.7**	**18.8**	**17.9**
Cooking Energy Rate (Btu/h)	**27,270**	**25,360**	**25,837**	**24,982**
Production Rate (lb/h)	**9.5**	**8.0**	**8.7**	**8.0**
Average Recovery Time (sec)	**2.43**	**3.36**	**2.89**	**3.35**

Cooking Energy Efficiency Data

Table D-8. Stock Fryer Cooking Energy Efficiency and Production Capacity Statistics.

	Cooking Energy Efficiency			Production Capacity
	Heavy Load	Medium Load	Light Load	
Replicate #1	35.4	32.6	24.4	59.7
Replicate #2	34.7	33.0	24.2	61.4
Replicate #3	35.6	32.4	25.9	60.4
Replicate #4	—	—	25.6	—
Average	**35.2**	**32.7**	**25.0**	**60.5**
Standard Deviation	0.5	0.3	0.9	0.9
Absolute Uncertainty	1.2	0.7	1.4	2.1
Percent Uncertainty	3.4	2.0	5.5	3.5

Table D-9 Modified Fryer Cooking Energy Efficiency and Production Capacity Statistics.

	Cooking Energy Efficiency			Production Capacity
	Heavy Load	Medium Load	Light Load	
Replicate #1	34.9	32.0	26.3	41.5
Replicate #2	34.9	32.1	26.4	41.9
Replicate #3	34.4	33.7	26.3	40.6
Replicate #4	—	33.0	25.4	—
Average	**34.7**	**32.7**	**26.1**	**41.3**
Standard Deviation	0.3	0.8	0.5	0.7
Absolute Uncertainty	0.7	1.3	0.7	1.7
Percent Uncertainty	2.0	4.0	2.8	4.1