

Frymaster H55 Gas Fryer Performance Tests

Application of ASTM Standard
Test Method F 1361-99

FSTC Report 5011.05.07

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Contents

	Page
Executive Summary	iii
1 Introduction	1-1
Background	1-2
Objectives	1-2
Appliance Description	1-3
2 Methods	2-1
Setup and Instrumentation	2-1
Measured Energy Input Rate	2-2
Cooking Tests	2-3
3 Results	3-1
Energy Input Rate	3-1
Preheat and Idle Tests	3-1
Cooking Tests	3-3
Energy Cost Model.....	3-7
4 Conclusions	4-1
5 References	5-1
Appendix A: Glossary	
Appendix B: Appliance Specifications	
Appendix C: Results Reporting Sheets	
Appendix D: Cooking-Energy Efficiency Data	
Appendix E: Energy Cost Model	

List of Figures and Tables

Figures

		Page
1-1	Frymaster H55 Frypot	1-3
2-1	Equipment Configuration	2-1
2-2	Thermocouple Placement For Testing	2-2
3-1	Frymaster H55 Preheat Characteristics	3-2
3-2	Frying Medium Temperature During A Heavy-Load Test For The H55 Fryer	3-3
3-3	Fryer Cooking Cycle Temperature Signature	3-4
3-4	Fryer Part-Load Cooking-Energy Efficiency	3-6
3-5	Fryer Cooking Energy Consumption Profile	3-7

Tables

		Page
1-1	Appliance Specifications	1-3
3-1	Input, Preheat, and Idle Test Results	3-2
3-2	Cooking-Energy Efficiency and Production Capacity Test Results	3-5
3-3	Energy Cost Model.....	3-8

Executive Summary

Frymaster's H55 gas fryer features infrared burners with a rated input of 80,000 Btu/h. A programmable cooking computer controls the input to the fryer and provides for a more consistent product. Figure ES-1 illustrates the H55 fryer, as tested at the Food Service Technology Center (FSTC).

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.



Figure ES-1.
Frymaster H55 Fryer.

Cooking performance was determined by cooking frozen French fries under three different loading scenarios (heavy—3 pounds per load, medium—1½ pounds per load, and light—¾ pound per load). The H55's heavy-load cook time was 2.43 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:

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

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

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*, West Conshohocken, PA.

Executive Summary

Table ES-1. Summary of Fryer Performance.

Rated Energy Input Rate (Btu/h)	80,000
Measured Energy Input Rate (Btu/h)	78,511
Preheat Time to 350°F (min)	10.5
Preheat Energy to 350°F (Btu)	13,951
Idle Energy Rate @ 350°F (Btu/h)	5,604
Heavy-Load Cooking-Energy Efficiency (%) ^a	55.2 ± 1.7
Medium-Load Cooking-Energy Efficiency (%) ^a	51.6 ± 3.1
Light-Load Cooking-Energy Efficiency (%) ^a	46.8 ± 1.0
Production Capacity (lb/h) ^a	68.9 ± 4.0
Average Frying Recovery Time (sec) ^b	< 10

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

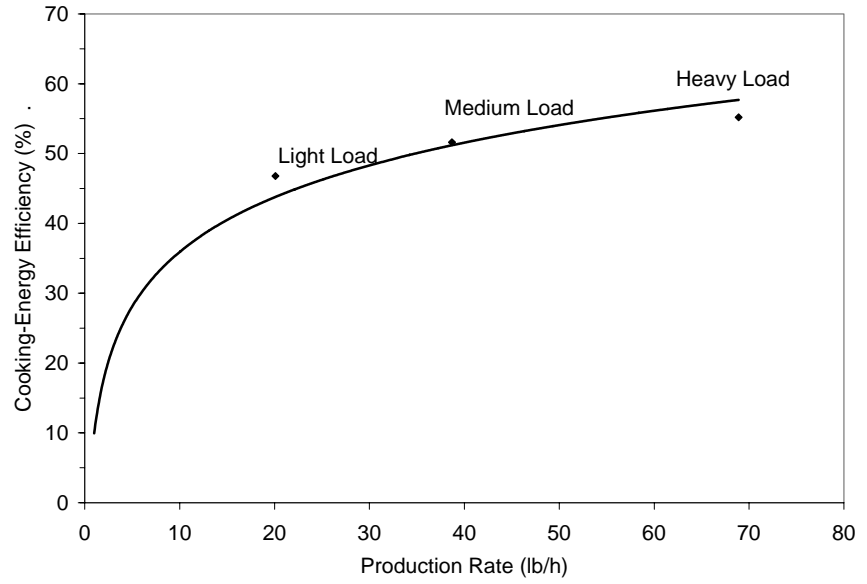
^b Based on the heavy-load cooking test with a minimum 10-second preparation time between loads.

During heavy-load testing Frymaster's H55 gas fryer demonstrated a production capacity of 68.9 pounds of French fries per hour, while achieving a cooking-energy efficiency of 55.2%. The H55 required 2.43 minutes to cook a single heavy-load test (3-pounds) of French fries, with the fryer recovered and ready-to-cook another load of French fries within the 10-second reload time specified by the test method.

Figure ES-2 illustrates the relationship between cooking-energy efficiency and production rate for the fryer. Figure ES-3 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 and probable demand contribution for the fryer in a real-world operation. Average energy consumption rates at 10, 30, and 50 pounds per hour for the H55 fryer are 15,400 Btu/h, 35,400 Btu/h, and 55,300 Btu/h, respectively. For an operation cooking an average of 15 pounds of food per hour over the course of the day (e.g., 150 lb of food over a ten hour day), the average energy consumption rate for the H55 fryer would be 20,400 Btu/h.

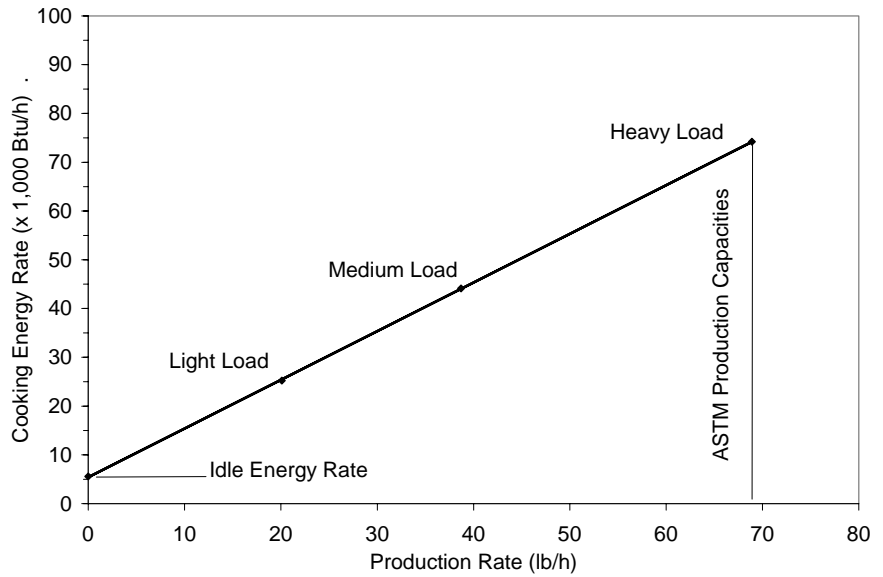
Executive Summary

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



Note: Light-load = ¼ pounds/load; Medium-load = 1½ pounds/load; Heavy-load = 3 pounds/load.

*Figure ES-3.
Fryer cooking energy
consumption profile.*



Note: Light-load = ¼ pounds/load; Medium-load = 1½ pounds/load; Heavy-load = 3 pounds/load.

Executive Summary

The ASTM test results can be used to estimate the annual energy consumption for the fryer 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 ES-2 summarizes the estimated annual energy consumption and associated cost based on the model.

Table ES-2. Estimated Fryer Energy Consumption and Cost.

Preheat Energy (kBtu/day)	14.0
Idle Energy (kBtu/day)	51.9
Cooking Energy (kBtu/day)	113.5
Annual Energy (kBtu/year)	65,445
Annual Cost (\$/year)^a	654

^a Fryer energy costs are based on \$1.00/therm = 100,000 Btu.

The estimated operational cost of the H55 gas fryer is \$654 per year. The model assumes the fryer is used to cook 100 pounds of French fries over a 12-hour day, 365 days a year. The model also assumes one preheat each day with the remaining on-time being in an idle (ready-to-cook) state.

Quick response times and rapid oil temperature recovery during cooking provide a food service operator with a workhorse fryer that can handle high volume, while its 55.2% cooking-energy efficiency securely places it among the top performing gas fryers on the market.

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.

Dedicated to the advancement of the food service industry, the Food Service Technology Center (FSTC) has focused on the development of standard test methods for commercial food service equipment since 1987. The primary component of the FSTC is a 10,000 square-foot appliance laboratory equipped with energy monitoring and data acquisition hardware, 60 linear feet of canopy exhaust hoods integrated with utility distribution systems, appliance setup and storage areas, and a state-of-the-art demonstration and training facility.

The test methods, approved and ratified by the American Society for Testing and Materials (ASTM), allow benchmarking of equipment such that users can make meaningful comparisons among available equipment choices. Since the development of the ASTM test method for fryers in 1991^{1,2}, the FSTC has tested a wide range of gas and electric fryers.³⁻¹⁸ End-use customers and commercial appliance manufacturers consider the FSTC to be the national leader in commercial food service equipment testing and standards, sparking alliances with several major chain customers to date.

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

Long considered the benchmark for high performance gas fryers, Frymaster's H55 features a stainless steel open frypot and backsplash design with infrared

Introduction

burners, and a programmable cooking computer. An integrated melt cycle prevents solid frying medium from scorching during preheat.

This report presents the results of applying the ASTM test method to the Frymaster H55 gas 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 Frymaster's H55, 14-inch gas fryer at an input rating of 80,000 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 three French fry loading scenarios: heavy (3 pounds per load), medium (1 ½ 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.
6. Estimate the annual operating cost for the fryer using a standard cost model.

Appliance Description

Frymaster's H55, 14-inch gas fryer has an input rating of 80,000 Btu/h. The fry pot is of stainless steel construction with heat transferred into the frying medium through two infrared gas burners located beneath the fry pot. The open fry pot design allows for easier cleaning than typical tube fryers. (see Figure 1-1). A cooking computer allows individualized programming for multiple food products.

Introduction



Figure 1-1.
Frymaster H55 frypot.

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

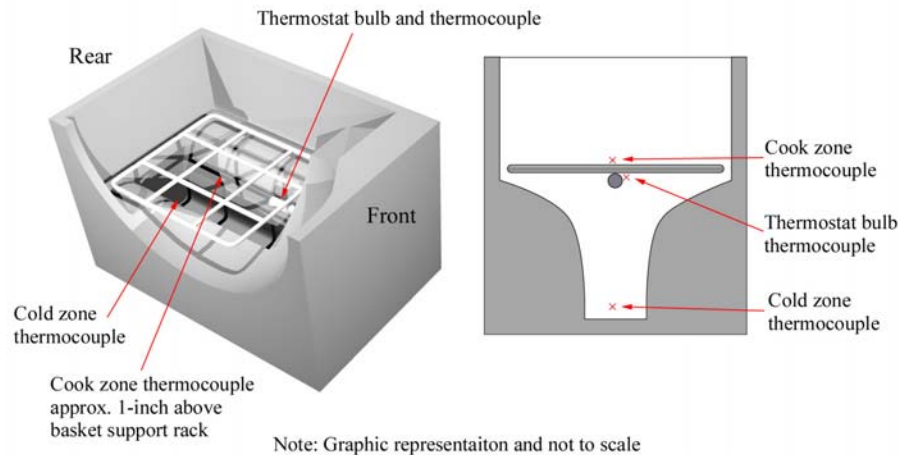
Table 1-1. Appliance Specifications.

Manufacturer	Frymaster
Model	H55
Generic Appliance Type	Open Deep Fat Fryer
Rated Input	80,000 Btu/h
Frying Area	13.50" x 14.75" x 20.25"
Oil Capacity	50 lb
Controls	Programmable cooking computer
Construction	Stainless Steel

Methods

Natural gas consumption was measured using a positive displacement-type gas meter that generated a pulse every 0.1 ft³. The gas meter and the thermocouples were connected to an automated data acquisition unit that recorded data every 5 seconds. A Cutler-Hammer calorimeter was used 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.*

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 firing (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

Methods

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 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), 1 ½-pound (medium), 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 did not significantly lower the average oil temperature over the cooking cycle, nor did 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 as a stabilization load and was not counted when calculating the elapsed time and energy consumed. 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.

Methods

Each loading scenario (heavy, medium and light) was replicated a minimum of three times. This procedure ensured that the reported cooking-energy efficiency and production capacity results had an uncertainty of less than $\pm 10\%$. 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 the fryer was operating within its specified parameters. The measured energy input rate was 78,511 Btu/h (a difference of 1.9% from the nameplate rating).

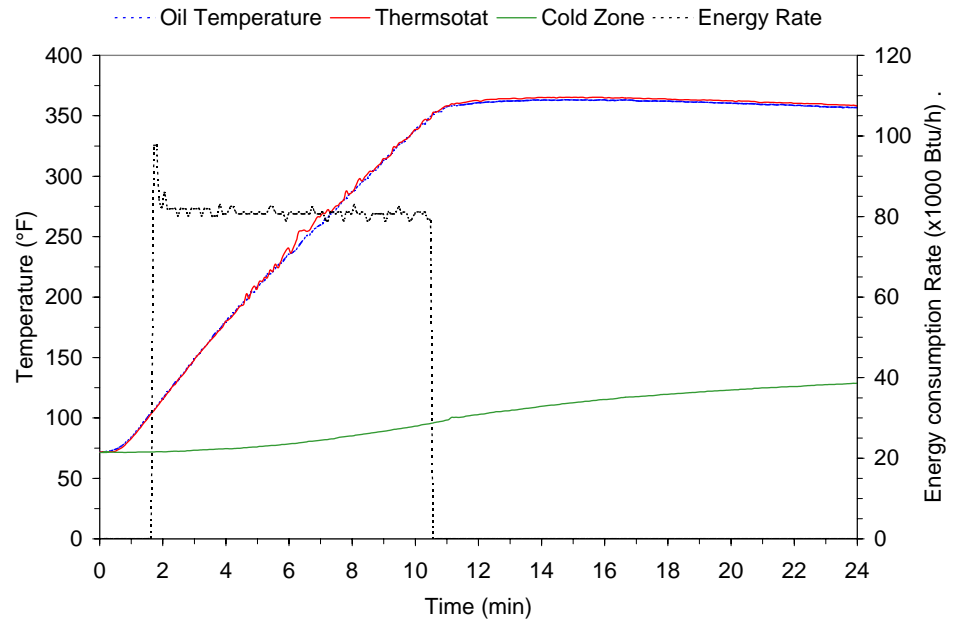
Preheat and Idle Tests

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 of 350°F, 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. Frymaster's cooking computer has an integrated melt cycle to prevent scorching of solid shortening, but this feature was disabled to accommodate the liquid shortening specified by the ASTM test procedure. Frymaster's H55 fryer was ready to cook in 10.5 minutes, while consuming 13,951 Btu during the preheat. Figure 3-1 shows the fryer's preheat characteristics.

Results



*Figure 3-1.
Frymaster H55
preheat characteristics.*

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 was 5,604 Btu/h.

Test Results

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

Results

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

Rated Energy Input Rate (Btu/h)	80,000
Measured Energy Input Rate (Btu/h)	78,511
Percentage Difference (%)	1.86
Preheat	
Time to 350°F (min)	10.5
Energy Consumption (Btu)	13,908
Control Energy (Wh)	12.6
Preheat Rate to 350°F (°F/min)	26.3
Idle	
Idle Energy Rate (Btu/h)	5,604
Control Energy Rate (W)	14.2

Cooking Tests

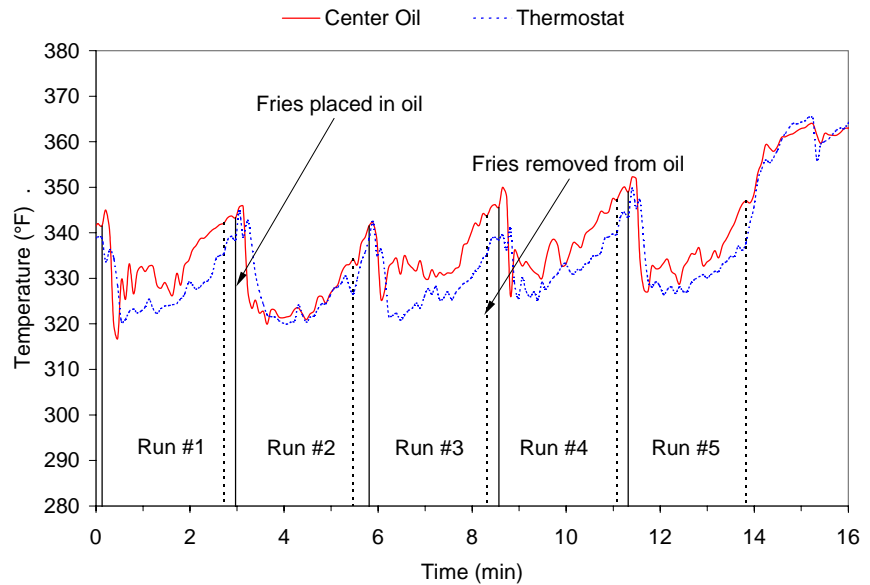
The fryer was tested under three loading scenarios: heavy (3 pounds of fries per load), medium (1 ½ pounds of fries per load) and light (¾ pound of fries per load). The fries used for the cooking tests consisted of approximately 6% fat and 70% moisture. Researchers monitored French fry cook time and 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 fryer was 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 3-2 shows the average temperature of the frying medium at the center of the cook zone during the heavy-load tests.

Results

*Figure 3-2.
Frying medium
temperature during a
heavy-load test for the
H55 fryer.*



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 temperature during the heavy-load tests was 335°F. The heavy-load cook time for the fryer was 2.43 minutes, and the fryer was recovered within the 10-second reload time. Figure 3-3 illustrates the temperature response of the Frymaster fryer 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).

Results

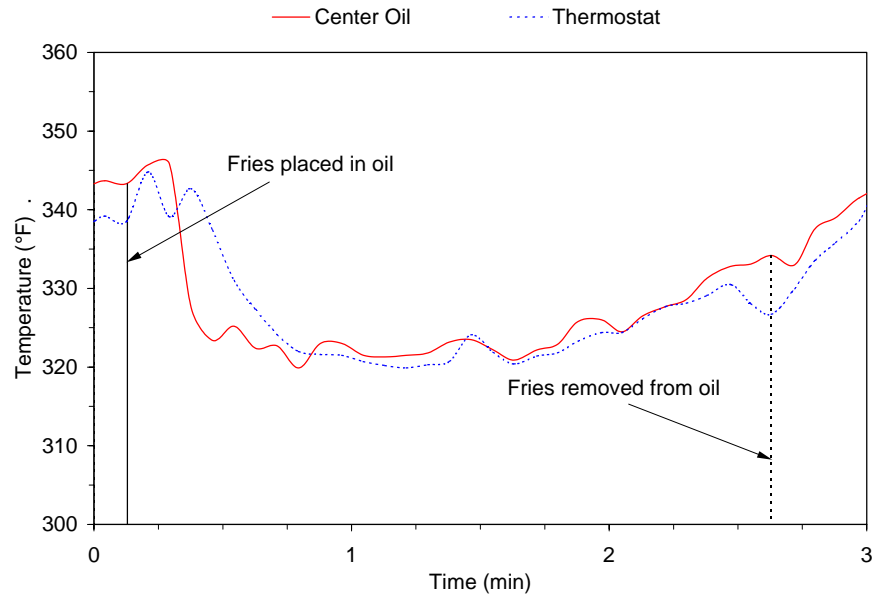


Figure 3-3.
Fryer cooking cycle
temperature signature.

Medium and Light-Load Tests

Medium- and light-load tests represent a more typical usage pattern for a fryer in cook-to-order applications. Since a fryer is often used to cook single basket loads in many food service establishments, these part-load efficiencies can be used to estimate the fryer's performance in an actual operation.

Both the medium- and light-load tests were conducted using a single fry basket. The medium-load tests used 1½ pounds of fries per load and demonstrated a cooking-energy efficiency of 51.6%, while producing 38.7 pounds of cooked French fries per hour. The light load tests used ¾ pounds of fries per load and resulted in a cooking-energy efficiency of 46.8% at a production rate of 20.1 lb/h.

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

Results

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.

Heavy-load cooking-energy efficiency results were 56.3%, 55.9%, 54.4% and 54.0%, yielding a maximum uncertainty of 1.8%. Table 3-2 summarizes the results of the ASTM cooking-energy efficiency and production capacity tests.

Table 3-2. Cooking-Energy Efficiency and Production Capacity Test Results.

	Heavy-Load	Medium-Load	Light-Load
Load Size (lb)	3.0	1 ½	¾
French Fry Cook Time (min)	2.43	2.20	2.10
Average Recovery Time (sec)	< 10	< 10	< 10
Production Rate (lb/h) ^a	68.9 ± 4.0	38.7 ± 0.9	20.1 ± 0.9
Energy to Food (Btu/lb)	586	590	589
Cooking Energy Rate (Btu/h)	74,254	44,112	25,184
Control Energy Rate (W)	66.6	43.8	29.6
Energy per Pound of Food Cooked (Btu/lb)	1,080	1,144	1,258
Cooking-Energy Efficiency (%) ^a	55.2 ± 1.7	51.6 ± 3.1	46.8 ± 1.0

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

Figure 3-4 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.

Results

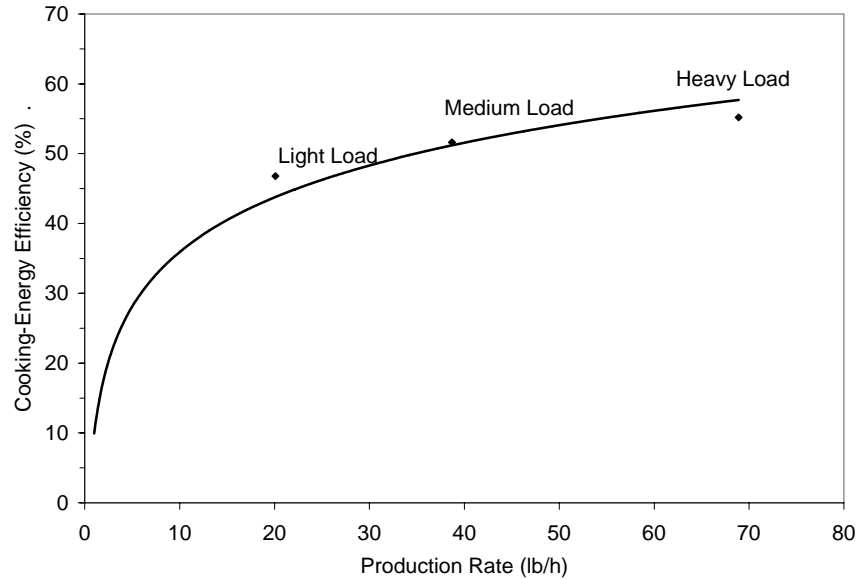


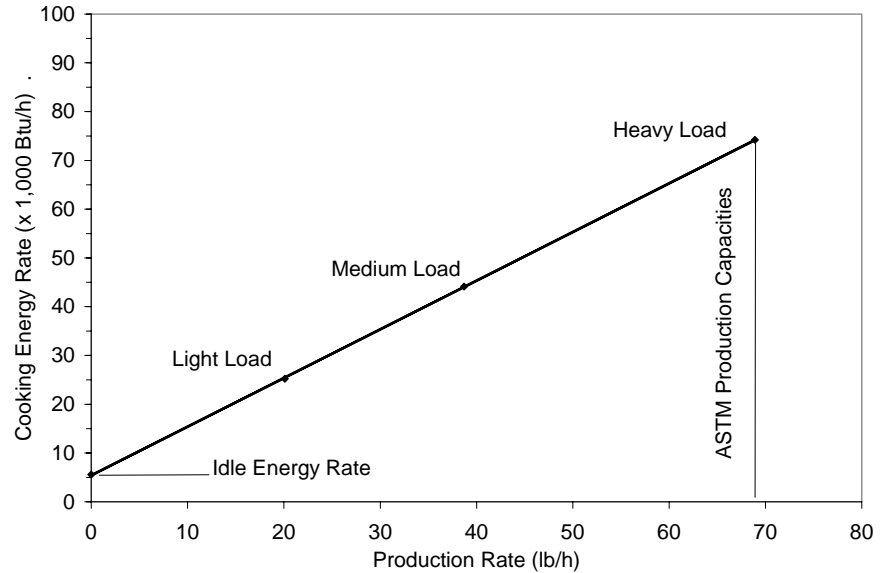
Figure 3-4.
Fryer part-load cooking-energy efficiency.

Note: Light-load = $\frac{3}{4}$ pounds/load; Medium-load = $1\frac{1}{2}$ pounds/load; Heavy-load = 3 pounds/load.

Figure 3-5 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 and probable demand for the fryer in a real-world operation. Average energy consumption rates at 10, 30, and 50 pounds per hour were 15,400 Btu/h, 35,400 Btu/h, and 55,300 Btu/h, respectively. For an operation cooking an average of 15 pounds of food per hour over the course of the day (e.g., 150 lb of food over a ten hour day), the average energy consumption rate for this fryer would be 20,400 Btu/h.

Results

*Figure 3-5.
Fryer cooking energy
consumption profile.*



Note: Light-load = ¼ pounds/load; Medium-load = 1½ pounds/load; Heavy-load = 3 pounds/load.

Energy Cost Model

The test results can be used to estimate the annual energy consumption for the fryer 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. For this model, the fryer was used to cook 100 pounds of fries over a 12-hour day, with one preheat per day, 365 days per year. The idle (ready-to-cook) time for the fryer was determined by taking the difference between the total daily on-time (12 hours) and the equivalent full-load cooking time. This approach produces a more accurate estimate of the operating cost for the fryer. Table 3-3 summarizes the estimated energy consumption and cost based on the model.

Results

Table 3-3. Estimated Fryer Energy Consumption and Cost.

Preheat Energy (kBtu/day)	14.0
Idle Energy (kBtu/day)	51.9
Cooking Energy (kBtu/day)	113.5
Annual Energy (kBtu/year)	65,445
Annual Cost (\$/year)^a	654

^a Fryer energy costs are based on \$1.00/therm = 100,000 Btu.

4 Conclusions

The performance of Frymaster's H55 gas fryer lives up to its reputation. The fryer demonstrated a low idle energy rate, high cooking energy efficiency and solid production capacity. In addition, the use of high efficiency infrared burners allowed for the fryer to be ready-to-cook (preheat) in a rapid 10.5 minutes. Studies have shown that fryers spend a good portion of the day in a ready-to-cook standby (idle) mode.¹⁹ The H55 exhibited low standby idle losses, with an idle energy rate of 5,604 Btu/h. To a restaurateur, this low idle rate means lower operating costs.

This low idle rate also translated to a competitive part-load performance. The H55 fryer posted excellent efficiencies compared to other top performing gas fryers with a medium-load efficiency of 51.6% and a light-load efficiency of 46.8%. Since most food service establishments operate at an average of 15 pounds per hour over a typical day, these performance figures are more representative of real world application.

The H55 fryer performed very well under heavy-load testing in comparison to other gas fryers tested at the Food Service Technology Center (FSTC).^{4,7-14} The fryer required 2.43 minutes to cook a single heavy-load test (3-pounds) of French fries, with the fryer recovered and ready to cook another load of French fries within 10 seconds. During heavy-load testing, the H55 fryer achieved a respectable production capacity of 68.2 pounds of French fries per hour, while demonstrating a competitive cooking-energy efficiency of 55.2%.

The estimated operational cost of the H55 gas fryer is \$654 per year. The model assumes the fryer is used to cook 100 pounds of French fries over a 12-hour day, 365 days a year. The model also assumes one preheat each day, with the remaining on-time being an idle (ready-to-cook) state.

Conclusions

Frymaster's H55 infrared gas burners transfer heat into the frying medium easily and effectively, allowing the fryer to have lower standby losses. Quick response times and rapid oil temperature recovery during cooking provide a food service operator with a workhorse fryer that can handle high production volumes.

5 References

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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/ft³) 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 holding or maintaining 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.

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

Glossary

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”).

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 warm 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 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.

Typical Day

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

B Appliance Specifications

Appendix B includes the product literature for the Frymaster H55 fryer.

Table B-1. Appliance Specifications.

Manufacturer	Frymaster
Model	H55
Generic Appliance Type	Open Deep Fat Fryer
Rated Input	80,000 Btu/h
Frying Area	13.50" x 14.75" x 20.25"
Oil Capacity	50 lb
Controls	Programmable cooking computer
Construction	Stainless Steel



ITEM NO.

AAA File No. 35-C111

H55 and H55-2 High Efficiency Series of Gas Fryers

Specifically designed for high production frying . . . Now 10% more efficient than the H50

STANDARD FEATURES

- Electronic ignition, melt cycle
- Open-pot design (split or full), easy-to-clean
- Durable centerline temperature sensor, 7- to 10-second response to loads
- Solid-state controller
- Deep cold zone
- Low flue temperature
- Boil-out mode
- Turbo jet infrared burners



Shown with optional computer and casters

The H55 has a maximum 50-lbs. (25 liters*) shortening capacity. The frying area is 14 x 15 in. (356 x 381 mm). This 80,000 BTU (20,151kcal) (23.4 kW) model is designed for high-volume frying with maximum fuel efficiency. The solid-state controller assures pinpoint accuracy of shortening temperature, extending shortening life and producing a uniformly-cooked product. The sensor is mounted in the center to permit quick sensing of any temperature drop caused by cold food placed in either side of the cooking area. The infrared power burner directs its heat on a large heat transfer area to fry more product with less fuel consumption. The open-pot design has no hard-to-clean tubes and can easily be wiped down and cleaned by hand.

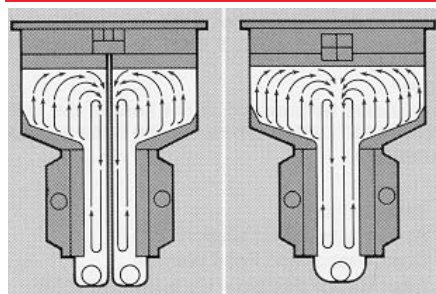
The large cold zone catches crumbs and sediment from the frying area. Since these particles are trapped in the cold zone, they do not carbonize, contaminate shortening or cling to fried products.

The H55 model uses a 120V (220V for export) supply. Multiproduct frying computers and basket lifts are available. FootPrint PRO® filtration is available with up to six (6) fryers battered together into a single system, or with a single H55 fryer and a spreader cabinet. The spreader cabinet can include an optional heat lamp and dump station. The heat lamp can be a choice of rod style or bulb type. The dump stations can use either cafeteria-style pan or scoop-type pan. The heat lamp and pans are integrated into the cabinet, making a complete warming station. The solid-state controls, electronic ignition and melt cycle are standard.

Boil-out mode is activated by setting the temperature to 200°F.

Each side of the H55-2 -- split pot fryer operates on 40,000 BTU/hr. (10,076 kcal/hr.) (11.7 kW), has a maximum shortening capacity of 25 lbs. (12 liters*), and has a frying area of 6-1/2 x 15 inches (165 x 381 mm). This fryer has all of the features and options of the H55 and gives the operator the discretion of using only half the fryer.

*Liter conversions are for solid shortening @70°F.



H55-2

H55

Unique frypot design with deep cold zone and turbocharged, infrared burners.



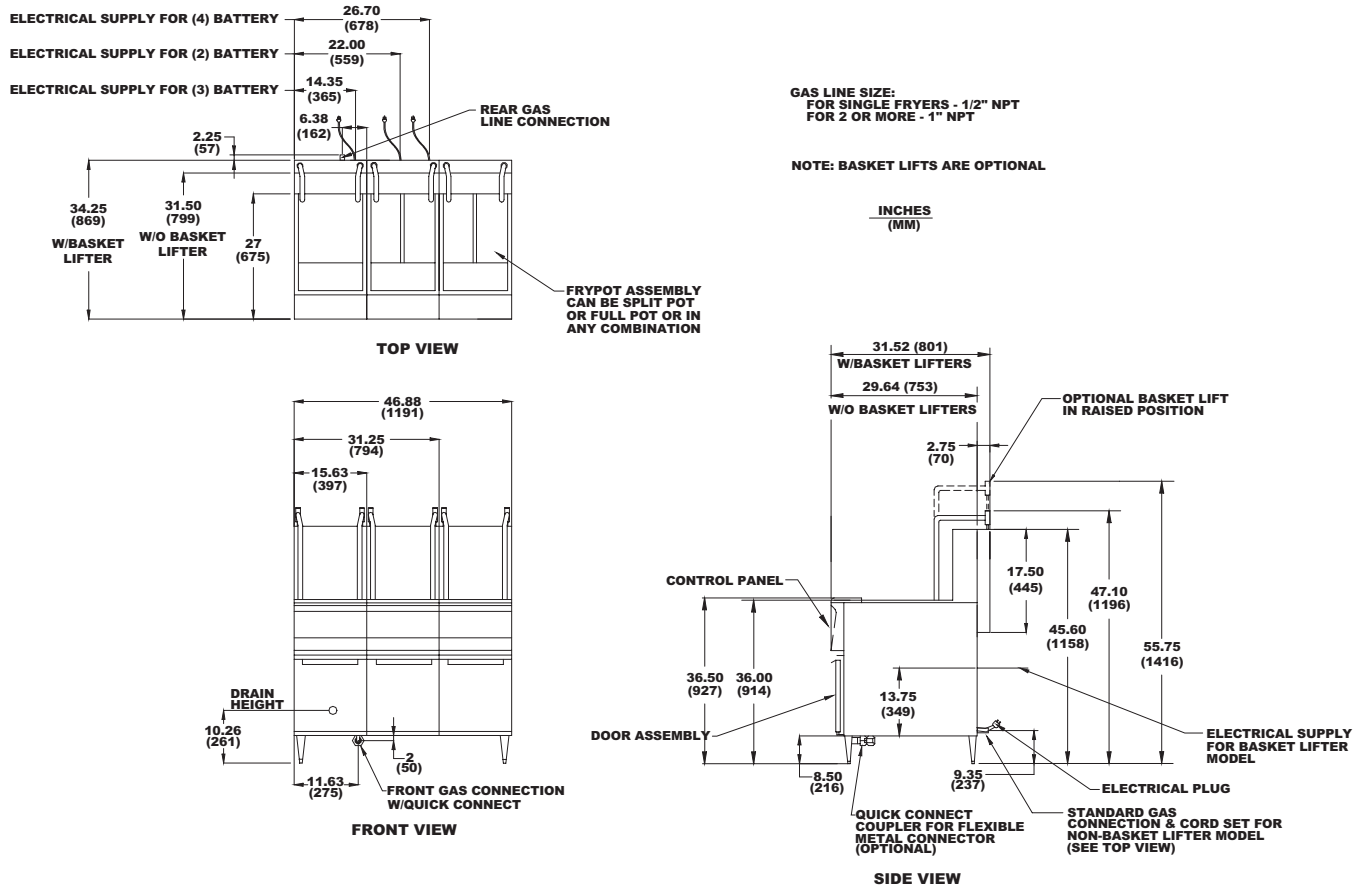
Frymaster, L. L. C.

8700 Line Avenue, P. O. Box 51000, Shreveport, Louisiana 71135-1000, USA, Phone 318-865-1711

TOLL FREE 1-800-221-4583 Fax 318-868-5987

Distributed in Canada by GARLAND COMMERCIAL RANGES, LTD., 1177 Kamato, Mississauga, Ontario L4W 1X4

H55 and H55-2 Gas Fryers



DIMENSIONS (Weights and dimensions are for single standard models only).

MODEL NO.	SHORTENING CAPACITY	OVERALL SIZE			DRAIN HEIGHT	NET WEIGHT	APPROXIMATE SHIPPING DIMENSIONS					
		HEIGHT	WIDTH	LENGTH			WEIGHT	CLASS	CUBE	DIMENSIONS		
H55	50 lbs. (25 liters)	45.6"	15.63"	29.64**	10.26"	160 lbs.	202 lbs.	85	21.32	H 46.50"	W 22"	L 36"
H55-2	25 lbs. (12 liters) ea. side	(1158 mm)	(397 mm)	(753 mm)	(261 mm)	(73 kg)	(92 kg)			(1181 mm)	(559 mm)	(914 mm)

*without basket lifts

POWER REQUIREMENTS				
MODEL NO.	NATURAL GAS	LP GAS	ELECTRICAL	EXPORT
H55	80,000 BTU/hr. input (20,151 kcal) (23.4 kW)	80,000 BTU/hr. input (20,151 kcal) (23.4 kW)	Non-basket lift 120V (1.0 AMP) 220V (0.5 AMP)	220V-240V 50 Hz. 3.5 AMP
H55-2	40,000 BTU/hr. input each side (10,076 kcal) (11.7 kW)	40,000 BTU/hr. input each side (10,076 kcal) (11.7 kW)	Basket Lift 120V (7.0 AMP) 220V (3.5 AMP)	

HOW TO SPECIFY

H55 Control panel, solid state controller, electronic ignition, melt cycle, sealed ON/OFF switch
 H55-2 Split pot with same features as full pot plus dual controls to operate each pot independently
 SD Stainless steel pot and door -- enamel cabinet
 SC Stainless steel frypot and cabinet sides

OPTIONAL ACCESSORIES

- Automatic basket lifters, computer or timer controlled Computer Magic^{III} Frying Computer (multi-product)
- Casters
- Frypot Cover
- Flexible metal connector with quick-connect coupler
- Stainless steel apron drain with basket (interchangeable right or left side)
- Sediment tray
- Screen type basket support
- Spreader cabinet
- FootPrint[®] PRO System -- Up to six units can be battered to the right side of the FootPrint[®] PRO System

NOTES

Supply Voltage 120V 60Hz -- Control Voltage 24V 60 Hz.
 120 VAC 5 ft. (1.5 m) grounded cord set provided.
 Recommended minimum store supply pressure to be 6" W.C. for NAT Gas, and 11" W.C. for L.P. Check plumbing codes for proper supply line sizing to attain burner manifold pressure of 3.0" W.C. natural or 8.25" W.C. L.P. Incoming supply line should be 1-1/2". Should flexible gas line be used, it must be AGA approved, commercial type and sized per the gas line size in above drawing.

CLEARANCE INFORMATION

A minimum of 24" (610 mm) should be provided at the front of the unit for servicing and proper operation, and 6" (152 mm) between the sides and rear of the fryer to any combustible material.



Frymaster, L. L. C.
 8700 Line Avenue, P. O. Box 51000, Shreveport, Louisiana 71135-1000, USA, Phone 318-865-1711
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C Results Reporting Sheets

Manufacturer: Frymaster
Model: H55
Date: December 2004

Test Fryer and Burners.

Description of operational characteristics: Frymaster's H55 gas fryer is rated at 80,000 Btu/h. The H55 fryer features an open frypot design with two infrared burners located below the fry vat. A cooking computer controls the burners with features such as a melt cycle and multiple programmable cook times.

Apparatus.

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

Deviations: None.

Energy Input Rate.

Rated (Btu/h)	80,000
Measured (Btu/h)	78,511
Percent Difference between Measured and Rated (%)	1.86

Fry Vat Capacity.

Oil Capacity (lbs)	50.4
--------------------	------

Results Reporting Sheets

Preheat Energy and Time.

Starting Temperature (°F)	71.8
Energy Consumption (Btu)	13,908
Control Energy (Wh)	12.6
Duration (min)	10.5
Preheat Rate (°F/min)	26.3

Idle Energy Rate.

Idle Energy Rate (Btu/h)	5,604
Control Energy Rate (Wh)	14.2

Heavy-Load Cooking-Energy Efficiency and Cooking Energy Rate.

Load Size (lb)	3.0
French Fry Cook Time (min)	2.43
Average Recovery Time (sec)	< 10
Production Capacity (lb/h) ^a	68.9 ± 4.0
Energy to Food (Btu/lb)	586
Cooking Energy Rate (Btu/h)	74,254
Control Energy Rate (W)	66.6
Energy per Pound of Food Cooked (Btu/lb)	1,080
Cooking-Energy Efficiency (%) ^a	55.2 ± 1.7

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

Results Reporting Sheets

Medium-Load Cooking-Energy Efficiency and Cooking Energy Rate.

Load Size (lb)	1 ½
French Fry Cook Time (min)	2.20
Average Recovery Time (sec)	< 10
Production Rate (lb/h) ^a	38.7 ± 0.9
Energy to Food (Btu/lb)	590
Cooking Energy Rate (Btu/h)	44,112
Control Energy Rate (W)	43.8
Energy per Pound of Food Cooked (Btu/lb)	1,144
Cooking-Energy Efficiency (%) ^a	51.6 ± 3.1

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

Light-Load Cooking-Energy Efficiency and Cooking Energy Rate.

Load Size (lb)	¾
French Fry Cook Time (min)	2.10
Average Recovery Time (sec)	< 10
Production Rate (lb/h) ^a	20.1 ± 0.9
Energy to Food (Btu/lb)	589
Cooking Energy Rate (Btu/h)	25,184
Control Energy Rate (W)	29.6
Energy per Pound of Food Cooked (Btu/lb)	1,258
Cooking-Energy Efficiency (%) ^a	46.8 ± 1.0

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

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. Heavy-Load Fry Test Data.

	Repetition #1	Repetition #2	Repetition #3	Repetition #4
Measured Values				
Electrical Energy Consumption (Wh)	14.50	14.56	14.50	14.00
Gas Energy Consumption (Btu)	16,112	15,967	16,306	16,258
Cook Time (min)	2.50	2.50	2.40	2.30
Total Test Time (min)	13.2	13.7	12.8	12.6
Weight Loss (%)	30.20	31.00	31.00	30.30
Initial Weight (lb)	15.000	15.000	15.000	15.000
Final Weight (lb)	10.467	10.356	10.344	10.459
Initial Moisture Content (%)	70.6	70.6	70.6	70.6
Final Moisture Content (%)	48.4	50.3	50.9	51.3
Initial Temperature (°F)	0	0	0	0
Final Temperature (°F)	212	212	212	212
Calculated Values				
Initial Weight of Water (lb)	10.590	10.590	10.590	10.590
Final Weight of Water (lb)	5.066	5.209	5.265	5.365
Sensible (Btu)	2,210	2,210	2,210	2,210
Latent – Heat of Fusion (Btu)	1,525	1,525	1,525	1,525
Latent – Heat of Vaporization (Btu)	5,358	5,220	5,165	5,068
Total Energy to Food (Btu)	9,093	8,955	8,900	8,803
Energy to Food (Btu/lb)	606	597	593	587
Total Energy to Fryer (Btu)	16,161	16,017	16,355	16,306
Energy to Fryer (Btu/lb)	1,077	1,068	1,090	1,087
Cooking-Energy Efficiency (%)	56.3	55.9	54.4	54.0
Cooking Energy Rate (Btu/h)	73,236	69,928	76,434	77,419
Control Energy Rate (W)	65.9	63.8	68.0	68.6
Production Rate (lb/h)	68.2	65.7	70.3	71.4
Average Recovery Time (sec)	< 10	< 10	< 10	< 10

Cooking-Energy Efficiency Data

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

	Repetition #1	Repetition #2	Repetition #3
Measured Values			
Electrical Energy Consumption (Wh)	8.10	8.89	8.50
Gas Energy Consumption (Btu)	8,441	8,777	8,441
Cook Time (min)	2.20	2.20	2.20
Total Test Time (min)	11.5	11.7	11.7
Weight Loss (%)	29.60	30.20	30.50
Initial Weight (lb)	7.500	7.500	7.500
Final Weight (lb)	5.280	5.234	5.209
Initial Moisture Content (%)	70.4	70.4	70.4
Final Moisture Content (%)	50.0	50.8	51.3
Initial Temperature (°F)	0	0	0
Final Temperature (°F)	212	212	212
Calculated Values			
Initial Weight of Water (lb)	5.280	5.280	5.280
Final Weight of Water (lb)	2.640	2.659	2.672
Sensible (Btu)	1,105	1,105	1,105
Latent – Heat of Fusion (Btu)	762	762	762
Latent – Heat of Vaporization (Btu)	2,575	2,557	2,544
Total Energy to Food (Btu)	4,442	4,424	4,441
Energy to Food (Btu/lb)	592	590	588
Total Energy to Fryer (Btu)	8,469	8,807	8,470
Energy to Fryer (Btu/lb)	1,129	1,174	1,129
Cooking-Energy Efficiency (%)	52.5	50.2	52.1
Cooking Energy Rate (Btu/h)	44,040	45,010	43,287
Control Energy Rate (W)	42.3	45.6	43.6
Production Rate (lb/h)	39.1	38.5	38.5
Average Recovery Time (sec)	< 10	< 10	< 10

Cooking-Energy Efficiency Data

Table D-4. Light Load Fry Test Data.

	Repetition #1	Repetition #2	Repetition #3
Measured Values			
Electrical Energy Consumption (Wh)	5.50	5.57	5.50
Gas Energy Consumption (Btu)	4,652	4,749	4,700
Cook Time (min)	2.10	2.10	2.10
Total Test Time (min)	11.1	11.1	11.4
Weight Loss (%)	30.20	29.20	30.50
Initial Weight (lb)	3.750	3.750	3.750
Final Weight (lb)	2.617	2.655	2.605
Initial Moisture Content (%)	69.0	69.0	69.0
Final Moisture Content (%)	48.4	47.6	48.6
Initial Temperature (°F)	0	0	0
Final Temperature (°F)	212	212	212
Calculated Values			
Initial Weight of Water (lb)	2.588	2.588	2.588
Final Weight of Water (lb)	1.267	1.264	1.266
Sensible (Btu)	553	553	553
Latent – Heat of Fusion (Btu)	373	373	373
Latent – Heat of Vaporization (Btu)	1,281	1,284	1,282
Total Energy to Food (Btu)	2,207	2,210	2,208
Energy to Food (Btu/lb)	589	589	589
Total Energy to Fryer (Btu)	4,671	4,678	4,719
Energy to Fryer (Btu/lb)	1,246	1,271	1,258
Cooking-Energy Efficiency (%)	47.2	46.4	46.8
Cooking Energy Rate (Btu/h)	25,146	25,670	24,737
Control Energy Rate (W)	29.7	30.1	29.0
Production Rate (lb/h)	20.3	20.3	19.7
Average Recovery Time (sec)	< 10	< 10	10.8

Cooking-Energy Efficiency Data

Table D-5. Cooking-Energy Efficiency and Production Capacity Statistics.

	Cooking-Energy Efficiency (%) ^a			Production Capacity
	Heavy-Load	Medium-Load	Light-Load	(lbs/h) ^a
Replicate #1	56.3	52.5	47.2	68.2
Replicate #2	55.9	50.2	46.4	65.7
Replicate #3	54.4	52.1	46.8	70.3
Replicate #4	54.0	—	—	71.4
Average	55.2	51.6	46.8	68.9
Standard Deviation	1.12	1.23	0.40	2.51
Absolute Uncertainty	1.78	3.05	0.99	3.99
Percent Uncertainty	3.22	5.91	2.12	5.79

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

E Energy Cost Model

Procedure for Calculating the Energy Consumption of a Fryer Based on Reported Test Results

Appliance test results are useful not only for benchmarking appliance performance, but also for estimating appliance energy consumption. The following procedure is a guideline for estimating fryer energy consumption based on data obtained from applying the appropriate test method.

The intent of this Appendix is to present a standard method for estimating fryer energy consumption based on ASTM performance test results. The examples contained herein are for information only and should not be considered an absolute. To obtain an accurate estimate of energy consumption for a particular operation, parameters specific to that operation should be used (e.g., operating time, and amount of food cooked under heavy-, medium-, and light-loads).

The calculation will proceed as follows: First, determine the appliance operating time and total number of preheats. Then estimate the quantity of food cooked and establish the breakdown between heavy- (two 1½-lb baskets), medium- (one 1½-lb basket), and light- (one ¾-lb basket) loads. For example, a fryer operating for 12 hours a day with one preheat cooked 100 pounds of food: 36% of the food was cooked under heavy-load conditions, 48% was cooked under medium-load conditions, and 16% was cooked under light-load conditions. Calculate the energy due to cooking at heavy-, medium-, and light-load cooking rates, and then calculate the idle energy consumption. The total daily energy is the sum of these components plus the preheat energy. For simplicity, it is assumed that subsequent preheats require the same time and energy as the first preheat of the day.

The application of the test method to a gas fryer yielded the following results:

Energy Cost Model

Table E-1: Gas Fryer Performance Parameters.

Test	Result
Preheat Time (min)	10.5
Preheat Energy (Btu)	13,951
Idle Energy Rate (Btu/h)	5,604
Heavy-Load Cooking Energy Rate (Btu/h)	74,254
Medium-Load Cooking Energy Rate (Btu/h)	44,112
Light-Load Cooking Energy Rate (Btu/h)	25,184
Production Capacity (lb/h)	68.9
Medium-Load Production Rate (lb/h)	38.7
Light-Load Production Rate (lb/h)	20.1

Step 1—The operation being modeled has the following parameters.

Table E-2: Fryers Operation Assumptions.

Operating Time	12 h
Number of Preheats	1 preheat
Total Amount of Food Cooked	100 lb
Percentage of Food Cooked Under Heavy-Load Conditions	36% (× 100 lb = 36 lb)
Percentage of Food Cooked Under Medium-Load Conditions	48% (× 100 lb = 48 lb)
Percentage of Food Cooked Under Light-Load Conditions	16% (× 100 lb = 16 lb)

Step 2—Calculate the total heavy-load energy.

The total time cooking heavy-loads is as follows:

$$t_h = \frac{\% h \times W}{PC},$$

$$t_h = \frac{36\% \times 100 \text{ lb}}{68.9 \text{ lb/h}},$$

$$t_h = 0.52 \text{ h}$$

Energy Cost Model

The total heavy-load energy consumption is then calculated as follows:

$$\begin{aligned}E_{gas,h} &= q_{gas,h} \times t_h \\E_{gas,h} &= 74,254 \text{ Btu/h} \times 0.52 \text{ h}, \\E_{gas,h} &= 38,612 \text{ Btu}\end{aligned}$$

Step 3—Calculate the total medium-load energy.

The total time cooking medium-loads is as follows:

$$\begin{aligned}t_m &= \frac{\% m \times W}{PR_m}, \\t_m &= \frac{48\% \times 100 \text{ lb}}{38.7 \text{ lb/h}}, \\t_m &= 1.24 \text{ h}\end{aligned}$$

The total medium-load energy consumption is then calculated as follows:

$$\begin{aligned}E_{gas,m} &= q_{gas,m} \times t_m \\E_{gas,m} &= 44,112 \text{ Btu/h} \times 1.24 \text{ h}, \\E_{gas,m} &= 54,699 \text{ Btu}\end{aligned}$$

Step 4—Calculate the total light-load energy.

The total time cooking light-loads is as follows:

$$\begin{aligned}t_l &= \frac{\% l \times W}{PR_l}, \\t_l &= \frac{16\% \times 100 \text{ lb}}{20.1 \text{ lb/h}}, \\t_l &= 0.80 \text{ h}\end{aligned}$$

The total light-load energy consumption is then calculated as follows:

$$\begin{aligned}E_{gas,l} &= q_{gas,l} \times t_l \\E_{gas,l} &= 25,184 \text{ Btu/h} \times 0.80 \text{ h} \\E_{gas,l} &= 20,147 \text{ Btu}\end{aligned}$$

Energy Cost Model

Step 5—Calculate the total idle time and energy consumption.

The total idle time is determined as follows:

$$t_i = t_{on} - t_h - t_m - t_l - \frac{n_p \times t_p}{60},$$
$$t_i = 12.0 \text{ h} - 0.52 \text{ h} - 1.24 \text{ h} - 0.80 \text{ h} - \frac{1 \text{ preheat} \times 10.5 \text{ min}}{60 \text{ min/h}}$$
$$t_i = 9.26 \text{ h}$$

The idle energy consumption is then calculated as follows:

$$E_{gas,i} = q_{gas,i} \times t_i,$$
$$E_{gas,i} = 5,604 \text{ Btu/h} \times 9.26 \text{ h}$$
$$E_{gas,i} = 51,893 \text{ Btu}$$

Step 6—The total daily energy consumption is calculated as follows:

$$E_{gas,daily} = E_{gas,h} + E_{gas,m} + E_{gas,l} + E_{gas,c,i} + n_p \times E_{gas,p}$$
$$E_{gas,daily} = 38,612 \text{ Btu} + 54,699 \text{ Btu} + 20,147 \text{ Btu} + 51,893 \text{ Btu} + 1 \times 13,951 \text{ Btu}$$
$$E_{gas,daily} = 179,302 \text{ Btu/day} = 1.793 \text{ therms/day}$$

Step 7—The annual energy cost is calculated as follows:

$$Cost_{annual} = E_{gas,daily} \times R_{gas} \times Days$$
$$Cost_{annual} = 1.793 \text{ therms/day} \times 1.00 \text{ \$/therm} \times 365 \text{ days/year}$$
$$Cost_{annual} = 654 \text{ \$/year}$$