Traulsen Two-Door Reach-In Refrigerator Performance Test

In accordance with
ASHRAE 117-1992R Method of Testing Closed Refrigerators

FSTC Report 5011.99.73

Food Service Technology Center
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Prepared by:

Shawn Knapp
Fisher-Nickel, Inc.

Contributors:

David Cowen
Todd Bell
Greg Sorenson
Fisher-Nickel, Inc.

Prepared for:
Peter Turnbull, Senior Project Manager
Pacific Gas and Electric Company
Customer Energy Management
123 Mission Street, P.O. Box 770000
San Francisco, California 94177

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Specific appreciation is extended to Traulsen & Company, Inc., for supplying the Food Service Technology Center with a model G20010 refrigerator for controlled testing in the appliance laboratory.

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Executive Summary

The Traulsen & Company, Inc. has long been considered one of the refrigeration industry leaders. The company strives to manufacturer quality products. The Traulsen & Company wanted unbiased refrigerator performance data and asked the Pacific Gas & Electric Company Food Service Technology Center (FSTC) to test one of their reach-in refrigerator models. This request to test a refrigerator allowed the FSTC to gain experience in applying the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) 117 Method of Testing (MOT) Closed Refrigerators.

The tests were conducted under the tightly controlled conditions of the recently revised and proposed ASHRAE 117-1992R *Method of Testing Closed Refrigerators*.[1] The refrigerator was set up in the FSTC environmental room. Refrigerator performance is characterized by test simulator temperatures and energy consumption. A test simulator is a plastic container filled with a sponge material and a mixture of 50% water and 50% propylene glycol by volume. A thermocouple measures the center temperature of the test simulator. After each test simulator is installed in the refrigerator, the remaining refrigerator space is filled with a layer of filler packages. The filler packages are constructed just as the test simulators except they do not have thermocouples for measuring temperatures. The manufacturer supplied enough wire racks to make four shelves.

Six test simulators were used per shelf for a total of twenty-four. One test simulator was positioned in each of the four corners of each shelf and two

[1] American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1992. *Methods of Testing Closed Refrigerators*. ASHRAE Designation 117-1992R, Draft 1.01. Atlanta, GA. American Society of Heating, Refrigerating and Air-Conditioning Engineers.

test simulators were placed in the middle of each shelf at the shelf break. The two test simulators in the middle of the shelf were placed with one in front and the other at the back of the shelf. Each test simulator was numbered. The test simulators were numbered starting from the back to the front and then from the left to the right of each shelf. Figure ES-1 depicts the numbering of the test simulators. Figure ES-2 shows the test simulators and filler packages installed in the refrigerator.

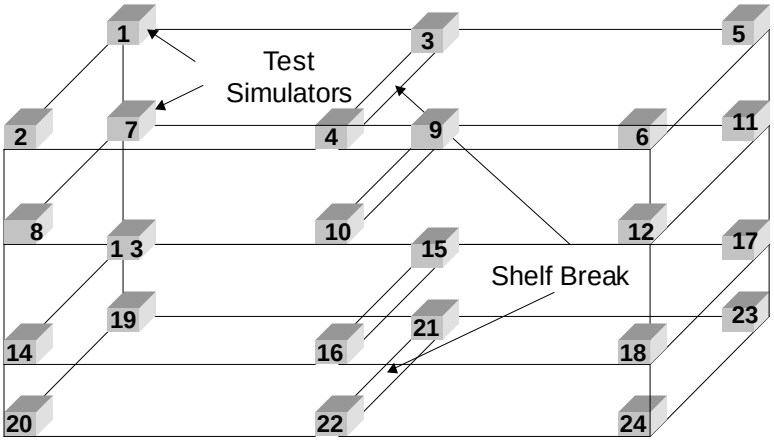

Figure ES-1. Test simulator positions

Figure ES-2. Refrigerator loaded with test simulators and filler packages

For the ASHRAE test, the refrigerator controls were set to maintain an average test simulator temperature of 38°F. The refrigerator consumed 6.22 kWh over the 24-hour test for an average energy consumption of 0.259 kW. The calculated compressor duty cycle was 26%. A summary of the test results is presented in Table ES-1. Figure ES-3 shows the average and maximum temperature variance of the test simulators during the ASHRAE 24-hour test. The Traulsen reach-in refrigerator exhibited good temperature control of the test simulators. The warmest and coldest test simulators were only a few degrees away from the overall test simulator average, which illustrates the tight refrigerator control of test simulator temperatures.

Table ES-1 ASHRAE Refrigerator Performance Test Results

Make and Model	Traulsen G20010
Ambient Dry-Bulb Temperature (°F)	75.4
Ambient Wet-Bulb Temperature (°F)	64.5
Test Room Wall Temperature (°F)	73.5
Test Room Ceiling Temperature (°F)	74.9
Integrated Average (AT) Temperature of all Simulators (°F)	38.0
Coldest Test Simulator Average (CTSA) Temperature (°F)	37.0
Coldest Test Simulator (CTS) Temperature (°F)	35.7
Warmest Test Simulator Average (WTSA)Temperature	39.7
Warmest Test Simulator (WTS) Temperature (°F)	40.4
Test Refrigerator Electrical Use (kWh/24 hr)	6.22
Refrigerator Energy Consumption Rate during 24 hr Test (kW)	0.259
Refrigerator Energy Consumption Rate during the 8-hr of Door Openings (kW)	0.343
Refrigerator Energy Consumption Rate during the 16-hr of Door Closed (kW)	0.219

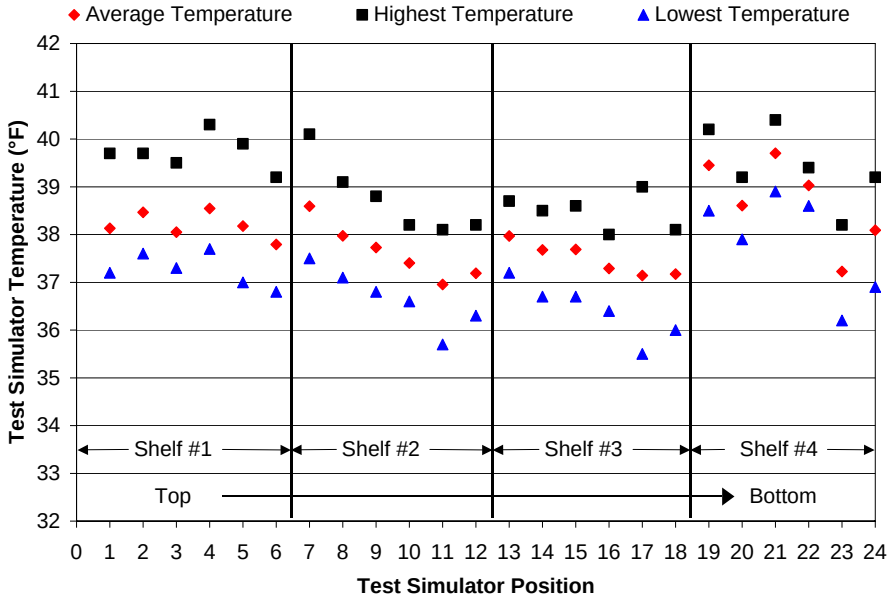

Figure ES-3.
Test simulator temperature range during 24-hr test.

Technical issues investigated in the application of ASHRAE 117-1992R were the effects of test room illumination, test room dimensions and door openings on refrigerator energy consumption. Test results revealed that reducing the test room illumination and test room dimensions had minimal effect on energy consumption and test simulator temperatures. Refrigerator door openings significantly increase energy consumption as compared to the baseline tests with the refrigerator doors closed. A summary of the energy consumption rates from the sensitivity tests is included in figure ES-4.

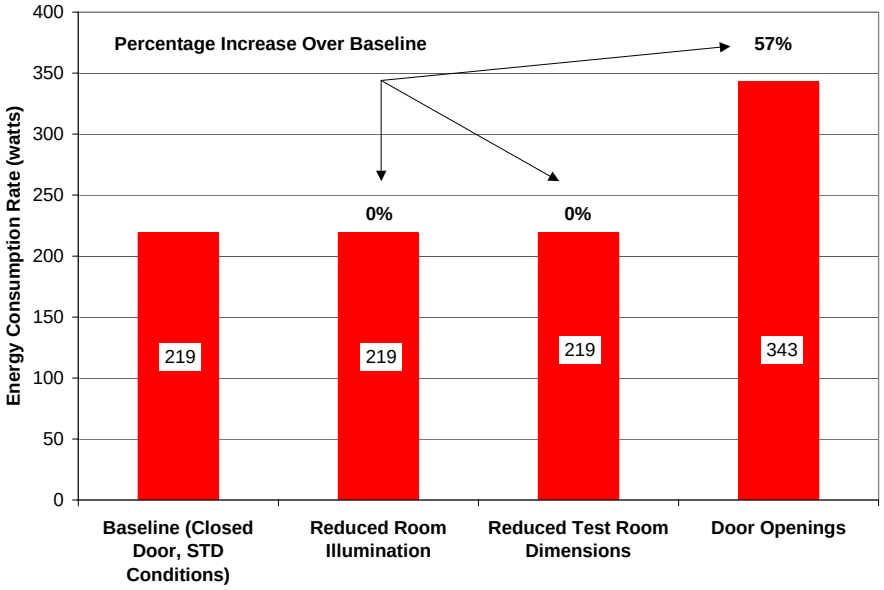

Figure ES-4.
Energy consumption rates for sensitivity tests.

1 Introduction

Background

The Pacific Gas and Electric Food Service Technology Center (FSTC) has been an active participant in refrigeration industry technical committees. Representatives from the FSTC have been members of the Canadian Standard Association (CSA) C827-98 Energy Performance Standard for Food Service Refrigeration and Freezers committee, and both of the American Society of Heating, Refrigeration and Air-Conditioning Engineers's (ASHRAE) 117 Method of Testing Closed Refrigerators and 72 Method of Testing Open Refrigerators for Food Stores Standard Project Committees (SPC).

Tests were conducted under the tightly specified conditions of ASHRAE 117

ASHRAE 117-1992 Method of Test Closed Refrigerators had reached the end of its five year review cycle and needed to be reballoted. The ASHRAE Technical Committee (TC) 10.7 Commercial Food Display and Storage Equipment waited for the Standard Project Committee (SPC) working on revising the ASHRAE 72 Standard to finish before forming a SPC to review and prepare the ASHRAE 117 Standard for reballot. The recently formed SPC 117-1992R committee used the ASHRAE 72 Standard as a working template with the hope to combine the two standards into one after each was completed. The "R" at the end of "117-1992R" means that this standard is the working revision version of the standard.

In order to provide technical feedback to the SPC 117-1992R committee, the FSTC applied the proposed ASHRAE 117-1992R Standard to a Traulsen two-door reach-in refrigeration unit at the FSTC lab. Test set up differences between the current ASHRAE 117-1992 and the proposed ASHRAE 117-1992R are discussed in detail in this study. Refrigerator performance is characterized by simulator temperatures and energy consumption during the ASHRAE testing. FSTC research staff also conducted tests to measure the effects of different test room conditions on the energy consumption.

The glossary in Appendix A is provided so that the reader has a quick reference to the terms used in this report.

Objectives

The primary objective of this study was to characterize the energy and temperature performance of the Traulsen G20010 refrigerator when tested in accordance with ASHRAE 117-1992R Method of Test Closed Refrigerators. Secondary objectives were for FSTC researchers to gain the technical experience of applying the ASHRAE 117-1992R Method of Testing Closed Refrigerators, investigate the differences between published ASHRAE 117-1992 Standard and proposed changes contained in ASHRAE 117-1992R and to document the impact of varying the test room specifications on energy consumption.

Appliance Description

The Traulsen G20010 refrigerator tested was a two-door model. The refrigerator had a stainless steel exterior for easy clean up. The unit was equipped with a top-mounted condensing unit. An evaporator fan forces air over the evaporator coils into the top of the refrigerator cavity, where the cold air is circulated around the cavity. The unit did not incorporate an active defrost system. Condensate water is collected in a pan where refrigerant waste heat evaporates the condenstate.

The unit came equipped with wire racks that could be located at different heights within the refrigerator space. For testing purposes, the shelves were equally spaced from top to bottom with the bottom of the refrigerator cavity also acting as a shelf. When in place the wire racks and the bottom of the box formed four shelves.

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

Table 1-1. Refrigerator Specifications.

Manufacturer	Traulsen & Company, Inc.
Model	G20010
Generic Appliance Type	Two-door reach-in refrigerator
Serial Number	T942830L97
Refrigerant	134a
Dimensions	52” x 35½” x 83”
Defrost	Off-cycle
Exterior Construction	Stainless Steel
Refrigerator Cavity Volume	44 ft^3
Shelf Locations	0”, 14½”, 30½” and 45” measured from bottom
Controls Setting	Position #3 on colder scale.

2 Methods

Setup and Instrumentation

The refrigerator was installed in the FSTC environmental room on a tiled floor (See figure 2-1). Test apparatuses were installed in accordance with Section 8 of the proposed ASHRAE 117-1992R Method of Test Closed Refrigerators. Temperatures were measured with T-type, immersible thermocouple probes. Thermocouples were calibrated to ensure that temperature readings were within tolerances. All data were logged using a Fluke Helios data logger and recorded on a personal computer, using software developed by FSTC engineers. Temperatures and watt-hours were recorded every 3 minutes by the Fluke data logger and down loaded to a computer with a direct serial connection.

Temperature Specifications

Both the ASHRAE 117-1992 and the proposed ASHRAE 117-1992R specify that the test conditions for the test room be maintained at 75.2 ± 1.8°F dry bulb (DB), 64.4 ± 1.8°F wet bulb (WB), a minimum room illumination of 74.4 foot-candles, and room air currents no greater than 49.2 fpm. Room temperature measurements were taken 24 inches away from the front of refrigerator and 5.9 inches above the highest point of the refrigerator and centered from side to side in accordance to the proposed ASHRAE 117-1992R and current ASHRAE 72 Standards. The published ASHRAE 117-1992 Standard specifies that the temperature be measured at the middle point height of the refrigerator, centered from left to right and a distance of 48 inches away from the front of the refrigerator. Multiple room temperature measurement tests showed that the average temperature for both measurement positions were within 0.4°F of each other.

Test Room Dimensions

The calorimeter room is constructed of insulated walls to reduce heat gain from the surrounding laboratory space. Air temperature and air flow within the room can be controlled by adjustable inlet and exhaust fans. Along one side of the room are two exhaust hoods which take up a portion of the available floor space. Researchers created movable walls that were positioned in front of the two hoods.

Both the published and proposed 117 Standards specifies that the refrigerator be positioned with at least 59 inches of clearance around is extremities. Researchers positioned the refrigerator in the middle of the newly formed room. The clearance between the front of refrigerator and the movable walls was approximately 30 inches with same clearance between the back of the refrigerator and the back wall of the calorimeter room. The clearances on the sides of the refrigerator where greater than 59 inches. FSTC researchers also rotated the refrigerator 90° so that clearance between any walls and the front and back of the refrigerator were greater than 59 inches while the clearances on the sides of the refrigerator were 30 inches. In both orientations the refrigerator recorded statistically the same energy consumption and test simulator temperatures. Figure 2-1 shows the refrigerator placement within the calorimeter room.

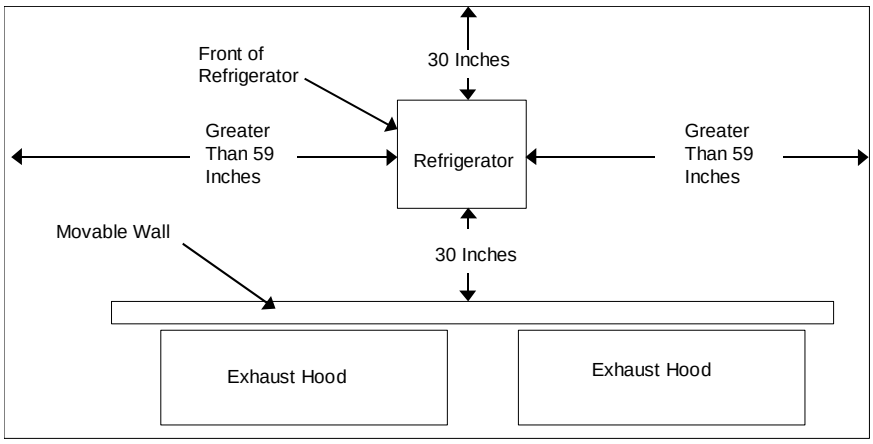

Figure 2-1.
Refrigerator placement within the environmental room

It was hypothesized that the minimum distance between the refrigerator and wall surfaces could be reduced as long as two conditions existed. The first condition is that air temperature around the exterior of the refrigerator be stable and reflect the measured test room temperature. The second condition is that air temperature across the condenser coils reflects the measured room temperature and that the air flow across the condenser coils be unrestricted.

To test this hypothesis researchers drastically reduce the distance between the refrigerator extremities and the room walls. Movable walls were placed 3 inches away from the sides and back of the refrigerator. A wall was placed 30 inches in front of the refrigerator. Energy consumption and test simulator temperatures were monitored and compared to the baseline set up of 30 inches of clearance in the front and back and greater than 59 inches on the sides. No appreciable differences in energy consumption or test simulator temperature were measured.

Measuring Product Temperatures

The published ASHRAE 117-1992 specifies that the refrigerator be loaded with test packages and dummy products. Both test packages and dummy products are composed of 1-pint plastic containers filled with a sponge material and a brine solution of salt and water. The solution is composed of 6% sodium chloride (measured by mass) and water. Each test package has a thermocouple in the geometric center to measure the temperature of the solution during the test.

The recently revised ASHRAE 72 Method of Testing Open Refrigerators for Food Stores specifies that the refrigerator be loaded with test simulators and filler packages. The ASHRAE 117-1992R SPC is modeling the revisions for the ASHRAE 117-1992R Standard after the new ASHRAE 72 Standard. In order to provide useful and up to date data to Traulsen, test simulators and filler packages were used instead of test packages and dummy products as specified by the published standard. The use of test simulators and filler packages instead of test packages and dummy products should have no effect

on energy consumption. Both test simulators and filler packages are composed of 1-pint plastic containers filled with a sponge material and a solution of propylene glycol and water. The solution is 50% -50%, propylene glycol and water by volume. Each test simulator has a thermocouple in geometric center to measure the temperature of the solution during the test. A photo of a test simulator is included in Figure 2-2.

Figure 2-2.
Test simulator

The Traulsen refrigerator has four shelves including the use of the bottom of the cavity as a shelf. Six test simulators were used per shelf for a total of twenty-four test simulators. One test simulator was positioned in each of the four corners of the each shelf. Also two test simulators were placed at the middle break at the front and rear edges of each shelf.

The ASHRAE 117-1992R Standard specifies that at least 20% of the remaining available refrigerator volume be filled with the filler packages. Figure 2-3 illustrates the test simulator placement on each shelf level. Figure 2-4 is a photo of both the test simulators and filler packages in the refrigerator.

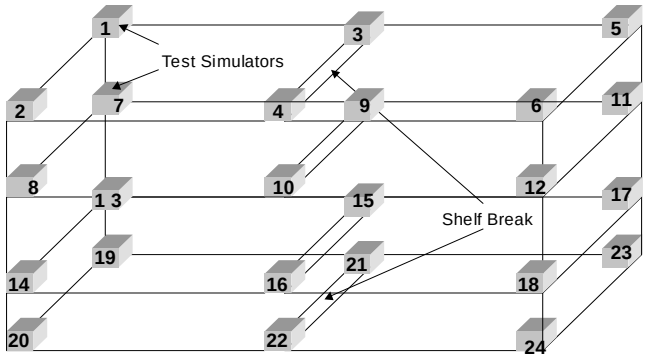

Figure 2-3. Test simulator placement

Figure 2-4. Refrigerator loaded with test simulators and filler packages

ASHRAE Refrigeration Performance Test

The refrigerator was allowed to stabilize at the desired operating conditions before starting the ASHRAE test. The test consists of monitoring test simulator temperatures and energy consumption for a 24-hour period. For the first eight hours of the test, the refrigerator is subjected to the door opening procedure. For the last sixteen hours of the test, the refrigerator doors remains closed. The ASHRAE 117 door-opening procedure is conducted by opening each door on the unit for six seconds, six times per hour for eight consecutive hours.

Sensitivity Test Room Conditions

Researchers also conducted sensitivity tests on test room conditions to determine their effect on refrigerator performance. Sensitivity tests were accomplished by changing one of the ASHRAE test room conditions while holding the other room conditions constant. Sensitivity tests individually investigated the following test conditions: reducing the light intensity inside the test room, reduced physical clearances around the refrigerator, and isolating the effect of door openings. Sensitivity test results were compared to an established baseline condition.

Room Illumination

The effect of room light intensity on refrigeration energy consumption was investigated by comparing test results with the room lights both off and on. The other test room conditions of average temperatures of 75.2°F DB and 64.4°F WB, doors in the closed position and air velocities below 50 fpm were held constant during the test.

Room Dimensions

Testing with reduced clearances between the refrigerator and the walls of the test room were conducted to measure the effect of test room (size) specification on energy consumption. The ASHRAE 117 Standard test room conditions of average temperatures of 75.2°F DB and 64.4°F WB, doors in the closed position and air velocities below 50 fpm were held constant during the test.

Door Openings

ASHRAE 117 specifies that the energy consumption shall be report as a sum of the energy use over the 24-hour test. The energy consumption rates during the 8-hour door opening procedure and the 16-hour door closed procedure are not separated out. Testing with the refrigerator doors being opened and closed was conducted to measure the “door opening” effect on energy consumption.

3 Results

ASHRAE Refrigeration Performance Test

The ASHRAE 117-1992R test incorporates two operating scenarios: 8 hours with door openings and 16 hours with the doors closed. Per the door opening scenario, the doors were opened for six seconds, six times a hour. Researchers recorded energy consumption and test simulator temperatures during testing. Table 3-1 presents the results from applying the ASHRAE 117-1992R Method of Testing Closed Refrigerators to the Traulsen refrigerator.

Table 3-1 ASHRAE 117-1992R Refrigerator Performance Test Results

Make	Traulsen
Model Type	Two-Door Reach-In
Ambient Dry-Bulb Temperature (°F)	75.4
Ambient Wet-Bulb Temperature (°F)	64.5
Test Room Wall Temperature (°F)	73.5
Test Room Ceiling Temperature (°F)	74.9
Average Temperature (AT) of all Simulators (°F)	38.0
Coldest Test Simulator Average (CTSA) Temperature (°F)	37.0
Coldest Test Simulator (CTS) Temperature (°F)	35.7
Warmest Test Simulator Average (WTSA) Temperature	39.7
Warmest Test Simulator (WTS) Temperature (°F)	40.4
Test Refrigerator Electrical Use (kWh/24 hr)	6.22
Test Refrigerator Electrical Consumption Rate during 24-hr (kW)	0.259
Test Refrigerator Electrical Consumption Rate during door openings (kW)	0.342
Test Refrigerator Electrical Consumption Rate during door closed (kW)	0.219

Results

The average temperature of all the test simulators during the ASHRAE 24-hour test was 38.0°F. The average energy consumption rate over the 24-hour period was 0.259 kW. The average energy consumption rate increased to 0.342 kW during the door opening scenario. The average energy consumption rate decreased to 0.219 kW during the door closed scenario. The maximum temperature variance and average temperature of each test simulator is plotted in figure 3-1. The average test simulator temperature for a given shelf becomes lower as one moves down from one shelf to another until the bottom shelf is reached where the average test simulator temperature is higher. The average test simulator temperature for each shelf is plotted in figure 3-2.

The old axiom that heat rises holds true for the top three shelves as the test simulators showed temperature stratification from shelf to shelf. The bottom shelf that is actually the bottom of the box differed from temperature stratification pattern of the upper three rows. The three upper shelves are constructed of a plastic coated metal grate. The grate has open space to allow air to flow through. Since the bottom shelve is solid, air can not circulated around the bottom of test simulators as well, this in turn reduces the ability of the refrigerator to cool the test simulators on the bottom shelf. With all that said about temperature stratification in figure 3-1 and 3-2, it should be noted that the maximum temperature deviation for any test simulator is not more than 2.5°F from the average test simulator temperature. Thus the refrigerator is doing a good job at maintaining a constant test simulator temperature.

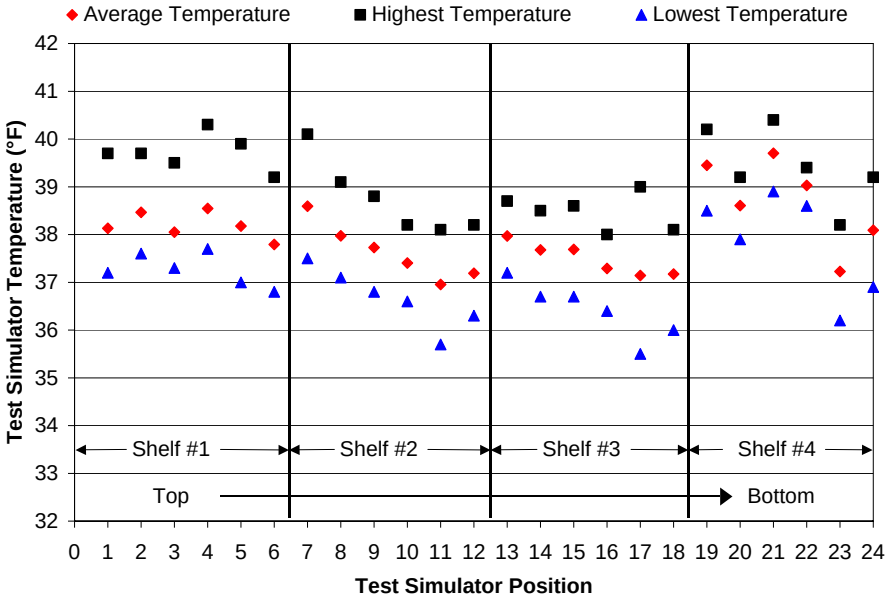

Figure 3-1. Maximum, minimum and average test simulator temperatures by position

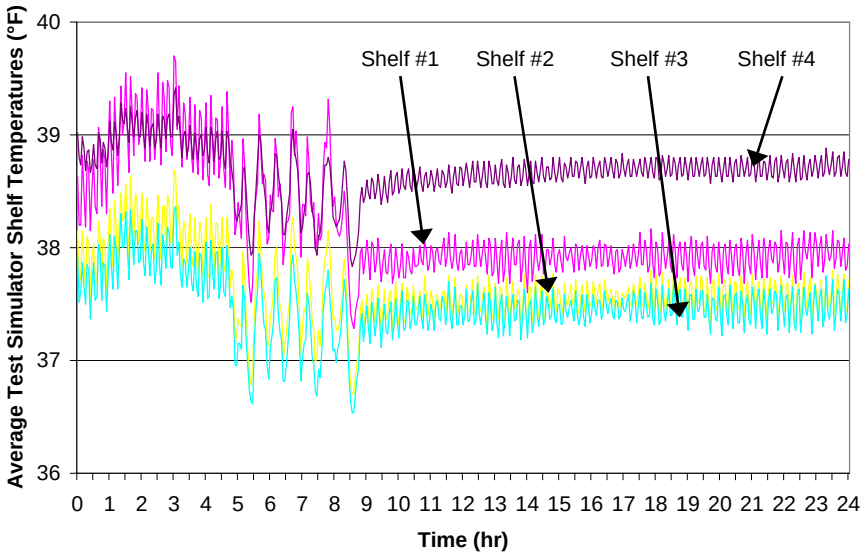

Figure 3-2. Average shelf test simulators temperatures

Results

CSA Standard

The Canadian Standards Association (CSA) has created an energy standard for commercial refrigerators and freezers, Energy Performance Standard for Food Service Refrigerators and Freezers, C827-98. The CSA standard specifies the ASHRAE 117-1992 Standard as the refrigeration testing standard for determining energy consumption. The CSA Standard sets the maximum annual energy consumption for reach-in refrigerators as a function of the refrigerator cavity volume using the equations shown in table 3-2. The Standard also identifies a level of energy consumption representative of a standard and high-efficiency model. The variable "V" in the equation in table 3-2 stands for measured volume in cubic feet.

Table 3-2 CSA Standard Maximum Annual Energy Consumption (kWh/yr)

Standard Efficiency Reach-In Refrigerator (less than)	59V + 1010
High Efficiency Reach-In Refrigerator(less than)	54V + 470

Researchers measured the dimensions of the usable interior cavity of the refrigerator and calculated a cavity volume of 44 ft^3. This calculated cavity volume may slightly vary from the method used by the CSA standard. The Traulsen unit used 6.22 kWh for 24-hr ASHRAE test. Researchers used the measured cavity volume and the 24-hr test results to calculate an annual energy use of 2270 kWh. This estimated annual energy usage puts the Traulsen unit below both the CSA standards maximum annual energy use for standard and high efficiency reach-in refrigerators. The Traulsen refrigerator annual energy consumption is 37% lower than the ceiling set for the standard efficiency units and 20% lower than the ceiling set for high efficiency units. The calculated CSA standards refrigerator maximum annual energy use and the calculated annual energy use for Traulsen refrigerator is included in table 3-3.

Table 3-3 Annual Energy Consumption for the Traulsen Refrigerator and the CSA Thresholds for a 44 ft^3 Refrigerator

CSA Maximum For Standard Efficiency Reach-In (kWh/y)	3606
CSA Threshold For High Efficiency Reach-In (kWh/y)	2846
Traulsen Reach-In Refrigerator (kWh/y)	2270

Test Conditions

Technical issues investigate in this report were the effects of illumination, test room dimensions and door openings on refrigerator energy consumption and test simulator temperatures. This cursory investigation revealed that test room illumination and test room dimensions had no effect on energy consumption and test simulator temperatures. The tests focusing on the effects of door openings showed that the door openings significantly increased energy consumption compared to the baseline tests with the doors closed. The "test condition" results are included in figure 3-3.

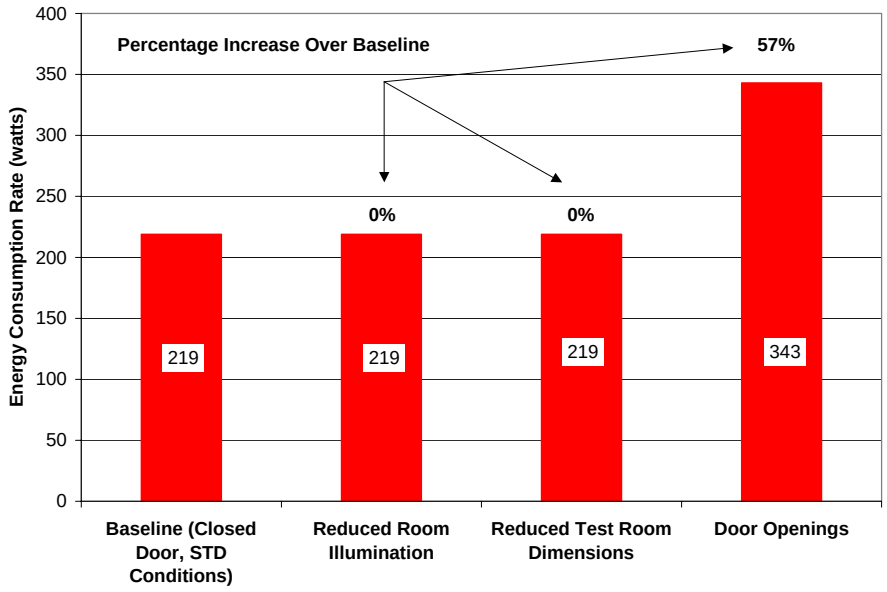

Figure 3-3. Comparison of test conditions results

4 Conclusions and Recommendations

Traulsen Performance

The Traulsen refrigerator was tested to the working draft of ASHRAE 117-1992R. The draft ASHRAE 117-1992R is basically the same test as the published ASHRAE 117-1992 with enhancements in data acquisition. The Traulsen two-door, reach-in refrigerator performed well under the rigorous conditions of the ASHRAE Method of Test, particularly with respect to the holding test simulator temperatures. The refrigerator maintained an average test simulator temperature of 38°F. Temperature variance of individual test simulators from the overall average was small (2.5°F).

The two-door refrigerator performed well under the rigorous test conditions of the ASHRAE 117.

The refrigerator's calculated annual energy use was over 20% lower than the CSA Standards maximum energy use definition for a high efficiency unit.[2] Figure 4-1 compares the Traulsen reach-in refrigerator estimated annual energy use with the CSA Standards maximum annual energy use thresholds for standard-efficiency and high-efficiency units.

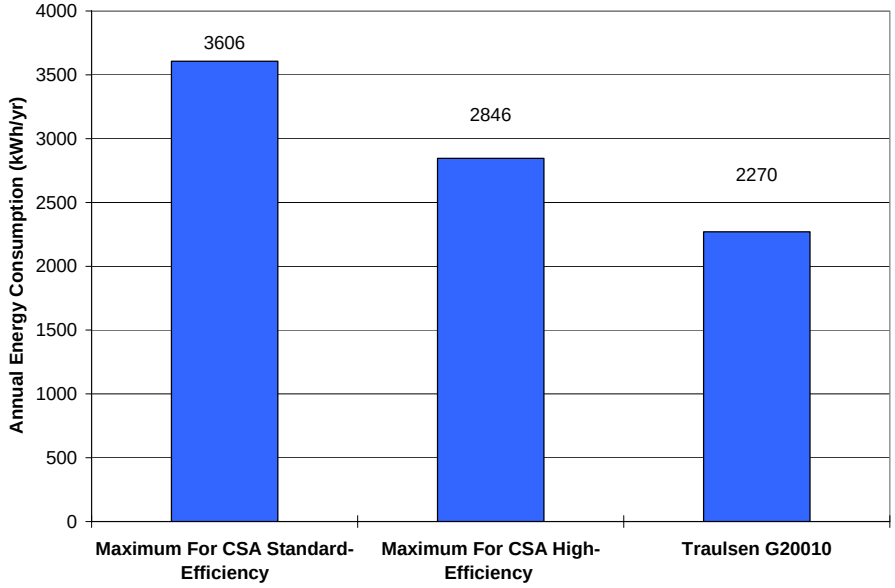

Figure 4-1. Comparison of Traulsen annual energy usage to CSA standard

Conclusions and Recommendations

Door Openings

ASHRAE 117 specifies that the energy consumption shall be reported as the sum of the energy use over the 24-hour test. The energy consumption rates during the 8-hour door opening procedure and the 16-hour door closed procedure are not separated out. Separating out the door opening energy consumption is not difficult and would provide end users with valuable energy usage information. Further more we recommend that the ASHRAE 117 Standard separate out the door opening and door closed energy consumption rates.

Test Room Configuration Requirements

The reduction of physical clearance around the extremities of the refrigerator had minimal effect on energy consumption when compared to the baseline conditions. Researchers recommend that the ASHRAE 117 SPC committee relax the test room clearance conditions so that the size of the facility needed to conduct a refrigeration test could be reduced.

5 References

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Appendixes

Glossary

Coldest Test Package Average, CTPA (°F)
: The test package with the coldest average temperature over the test period.

Coldest Test Package, CTP (°F)
: The coldest temperature reached of the test package with the coldest average temperature.

Coldest Test Simulator Average Temperature, CTSA (°F)
: The test simulator with the coldest average temperature over the test period.

Coldest Test Simulator, CTS (°F)
: The coldest temperature reached of the test simulator with the coldest temperature.

Compressor Duty Cycle (%)
: The calculated percentage compressor “on” time or run time.

Dry Bulb Temperature (°F)
DB temperature
: The ambient air temperature.

Dummy Product
: A 1 U.S. pint (473 ml) container holding a sponge and a brine (NaCl and H_2O) solution. The solution is composed of 6% NaCl by mass. The dummy product is used to fill refrigerator space not used by test packages as described in ASHRAE 117-1992.

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 draw down or cool down period.

Filler Package

A container holding a sponge and a 50%-50% solution of water and propylene glycol. The container is used to occupy refrigerator space not occupied by test simulators as described in the ASHRAE 117-1992R and ASHRAE 72 Standards.

Integrated Average Temperature, IAT (°F)
Average Temperature, AT (°F)

The average temperature of all of the test simulators over the test period.

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 compressor start up.

Relative Humidity (%)
RH

A measurement of the degree of saturation of air. Expressed as percentage of saturation. With 100 percent indicating completely saturated air and 0 percent indicating completely dry air.

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.

Test Simulator

A 1 U.S. pint (473 ml) container holding a sponge and a 50%-50% solution of water and propylene glycol with a thermocouple to measure the center temperature of the container. The test simulator is the standard measuring device used in newly proposed ASHRAE 117-1992R and ASHRAE 72-1983.

Test Package

A 1 U.S. pint (473 ml) container holding a sponge and a brine (NaCl and H_2O) solution with a thermocouple to measure the center temperature of the container. The solution is composed of 6% NaCl by mass. The test package is the standard measuring device use in ASHRAE 117-1992.

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.

Warmest Test Simulator, WTS (°F)
The highest temperature recorded of the test simulator with the warmest average temperature over the test period.

Warmest Test Package Average, WTPA (°F)
The test package with the warmest average temperature over the test period.

Warmest Test Simulator Average, WTSA (°F)
The test simulator with the warmest average temperature over the test period..

Wet Bulb Temperature (°F)
WB temperature
An air temperature where the temperature is a function of the saturation of the air.

B Appliance Specifications

Appendix B includes the product literature for the Traulsen two-door refrigerator.

Project	Quantity	Item #
Model Specified:		CSI Section 11400

"G-Series" Express Refrigerators/Self-Contained

Model G10010

Model G20010

One, Two and Three Section Models

G
EXPRESS

The G-Series Express models are designed to incorporate many of the most desired standard features on a cost effective platform for rapid delivery. Among the many top of the line features they offer are: next generation controls, balanced refrigeration systems, stainless steel doors and sturdy interior arrangements. Stock models are warehoused in Texas, New York and California to further your replacement or time critical delivery needs.

AVAILABLE MODELS

Single Section (Formerly Model GHT 1-32 WUT)

Model #	Door	Hinging
G10000	Half	Right
G10001	Half	Left
G10010	Full	Right
G10011	Full	Left

Two Section (Formerly Model GHT 2-32 NUT)

Model #	Door	Hinging
G20000	Half	Left-Right
G20001	Half	Right-Left
G20002	Half	Right-Right
G20003	Half	Left-Left
G20010	Full	Left-Right
G20011	Full	Right-Left
G20012	Full	Right-Right
G20013	Full	Left-Left

Three Section (Formerly Model GHT 3-32 NUT)

Model #	Door	Hinging
G30000	Half	Left-Right-Right
G30001	Half	Left-Left-Right
G30002	Half	Right-Right-Right
G30003	Half	Left-Left-Left
G30010	Full	Left-Right-Right
G30011	Full	Left-Left-Right
G30012	Full	Right-Right-Right
G30013	Full	Left-Left-Left

Standard Features

- Stainless Steel Front and Doors
- Anodized Aluminum Interior and External Sides (including returns)
- Three Epoxy Coated Shelves Per Section
- Self-Closing Doors with Stay-Open Feature at 120°
- Guaranteed For Life Work Flow Door Handle
- Guaranteed For Life Cam Lift Glide Hinges
- Next Generation Digital Control With Temperature Read-out
- Automatically Activated Interior Lighting
- One Piece Louver Assembly
- Stainless Steel Breaker Caps
- Automatic Non-Electric Condensate Evaporator
- Plasticized Fin Coil
- Magnetic Door Gaskets
- Heavy Duty Legs
- Door Locks
- Cord and Plug Attached
- 1 Year Parts and Labor Warranty

Approval: _____

C UL US LISTED

NSF

Listed by Underwriters Laboratories Inc., to U.S. and Canadian safety standards and Listed by NSF International.

New Microprocessor Control

KEY FEATURES

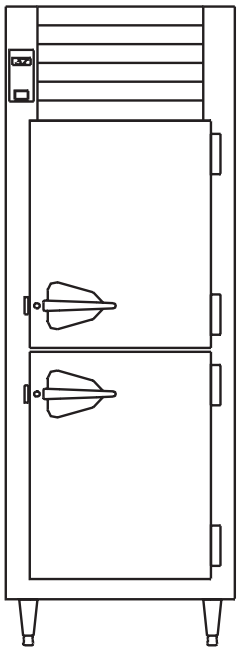
- 3-Digit LED Display
- Temperature Monitoring
- Internal Time Clock
- °F or °C Temperature Display Capability

Options & Accessories

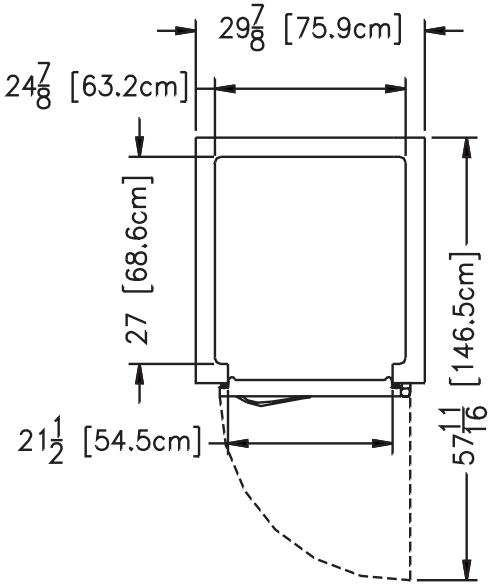
- Additional Epoxy Shelf Kits (each includes 3 shelves with pins)
- Optional Chrome Plated Shelves (mounted on standards)
- Tray Slide Kits
- Factory Installation of Optional Interior Arrangements
- Remote Applications
- Export Voltages
- G-Plus Option (stainless steel legs and exterior)
- Heavy Duty 6" High Casters
- Two Year Service/Labor Warranty Available
- Five Year Compressor Warranty Available

Traulsen

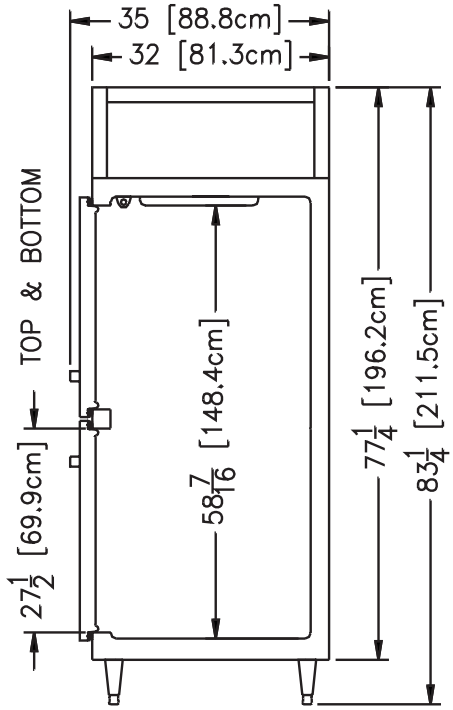
TRAULSEN & CO., INC.
4401 BLUE MOUND RD. FT. WORTH, TX 76106
PHONE 1 (800) 825-8220 FAX-MKTG. 1 (817) 624-4302
E-MAIL: traulsen@earthlink.net



G10000 Front View



G10000 Top View



All Models Side View

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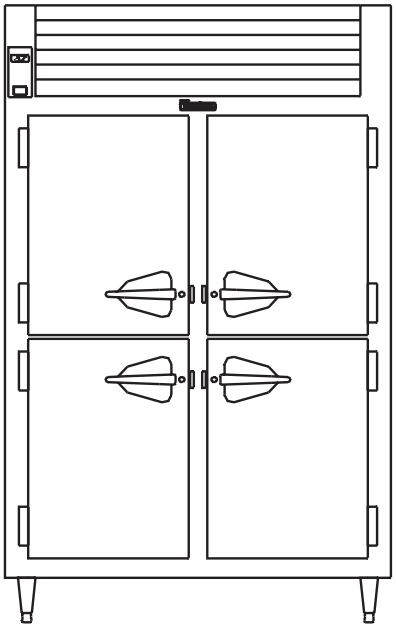
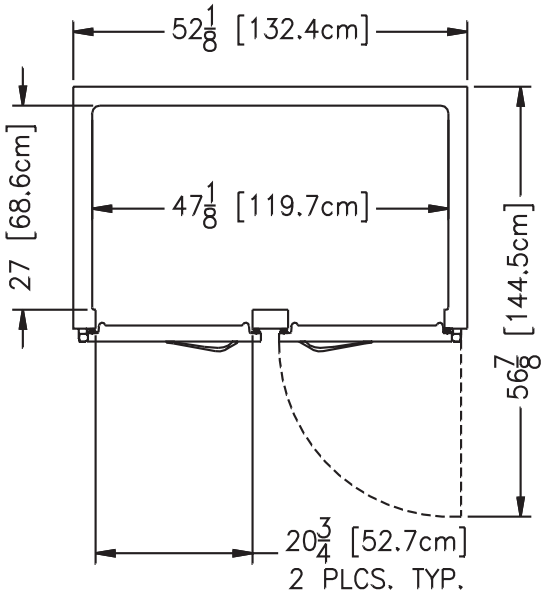
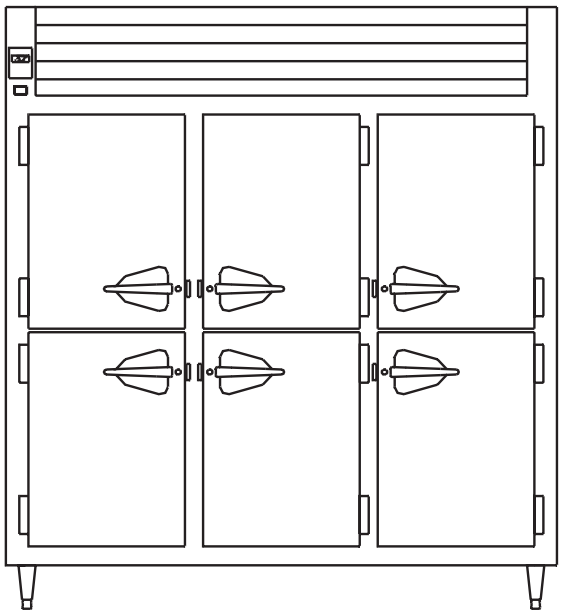


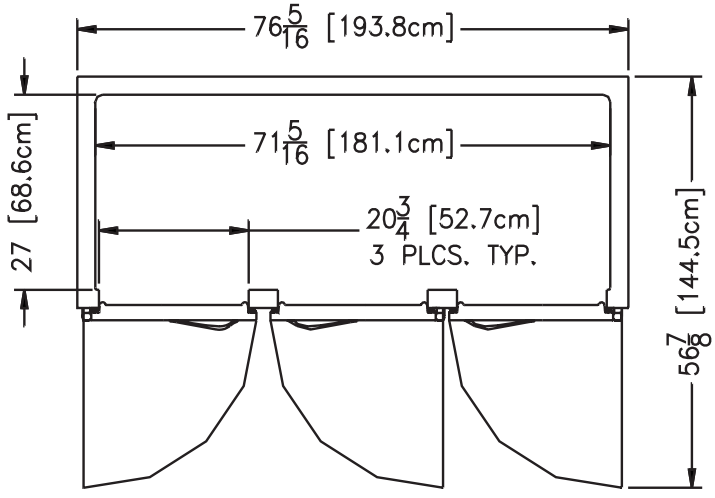
G20000 Front View



G20000 Top View



G30000 Front View



G30000 Top View

Project	Quantity	Item #
Model Specified:		CSI Section 11400

Specifications

Construction, Hardware and Insulation

Cabinet door, face and louver assembly are constructed of heavy gauge stainless steel. Cabinet sides (including returns), interior and door liners are constructed of anodized aluminum. Exterior cabinet top, back and bottom are constructed of heavy gauge aluminized steel. Adjustable 6" high legs are included.

Doors are equipped with removable plug cylinder locks and guaranteed for life cam-lift, gravity action, self-closing metal, glide hinges with stay open feature at 120 degrees. Hinges include a switch to automatically activate the interior incandescent lighting. Guaranteed for life, work flow door handle is mounted horizontally over recess in door which limits protrusion from door face into aisleways.

Easily removable for cleaning, vinyl magnetic door gasket assures tight door seal. Anti condensate heaters are located behind each door opening.

Cabinet and door contains high density, non-CFC, foamed in place polyurethane insulation.

DIMENSIONAL DATA	**1 Section**	**2 Section**	**3 Section**
Net Capacity cu. ft.	24.2 (686 cu l)	46.0 (1303 cu l)	69.1 (1958 cu l)
Length Overall in.	29⅞ (75.9 cm)	52⅛ (132.4 cm)	76⅝ (193.8 cm)
Depth - Over Body in.	32 (81.3 cm)	32 (81.3 cm)	32 (81.3 cm)
Depth - W/Door Open 90° in.	57 11⁄16 (146.5 cm)	56⅞ (144.5 cm)	56¾ (144.5 cm)
Depth - Overall in.	35 (88.8 cm)	35 (88.8 cm)	35 (88.8 cm)
Clear Door Width in.	21½ (54.5 cm)	20¾ (52.7 cm)	20¾ (52.7 cm)
Clear Half Door Height in.	27½ (69.9 cm)	27½ (69.9 cm)	27½ (69.9 cm)
Clear Full Door Height in.	57⅝ (146.3 cm)	57⅝ (146.3 cm)	57⅝ (146.3 cm)
Number of shelves	3	6	9
Shelf area sq. ft.	13.5 (1.3 sq m)	25.6 (2.4 sq m)	39.2 (3.6 sq m)
Height - Overall in.	83¼ (211.5 cm)	83¼ (211.5 cm)	83¼ (211.5 cm)
ELECTRICAL DATA			
Voltage	115/60/1	115/60/1	115/60/1
Feed Wires with Ground	3	3	3
Full Load Amperes	8.0	8.5	10.9
Wattage[3]	644	684	878
Full load amps/remote models	1.3	1.7	2.2
REFRIGERATION DATA			
Refrigerant	R134a	R134a	R134a
BTU/HR - HP[1]	2220 (1/3 HP)	2220 (1/3 HP)	4200 (1/2 HP)
CARTON DIMENSIONS Domestic Crated Only			
Length - Crated in.	35 (88.8 cm)	63 (160 cm)	91 (231 cm)
Depth - Crated in.	43 (109.2 cm)	43 (109.2 cm)	43 (109.2 cm)
Height - Crated in.	83½ (212.1 cm)	83½ (212.1 cm)	83½ (212.1 cm)
Volume - Crated cu. ft.	73 (2068 cu l)	131 (3711 cu l)	189 (5354 cu l)
WEIGHT DATA[2]			
Net Weight - Uncrated lbs.	305 (138 kg)	450 (204 kg)	610 (277 kg)
Gross Weight - Crated lbs.	395 (179 kg)	590 (268 kg)	790 (358 kg)

NOTES

NOTE: Figures in parentheses reflect metric equivalents.

1= Based on a 90 degree F ambient and 20 degree F evaporator.

2= For approximate remote weights deduct 40 lbs. from respective net or gross weight.

3= Wattage is determined by listed amps X listed volts X an average run time of 70% for refrigerators and 80% for freezers.

Continued product development may necessitate specification changes without notice.
Part No. TR-196 (revised 10/99)

Refrigeration System

A top mounted, self-contained, balanced refrigeration system using R-134a refrigerant is conveniently located behind the one piece louver assembly. It features a plenum effect blower coil, large, high humidity evaporator coil located outside the food zone, top mounted non-electric condensate evaporator, and an automatic preset time activated electric defrost (freezer models only).

Controller

The water resistant digital microprocessor control is provided. It includes an RS485 port for communications ability, in addition to features such as a defrost icon and lock-out (freezer models only).

Interior

Standard interior arrangements include three (3) epoxy coated steel wire shelves, mounted on shelf pins, per section. Recommended load limit per shelf should not exceed 225 lbs. Additional shelves or optional tray slides may be purchased in kits for easy installation on-site.

Warranties

The standard warranty includes a one year parts and labor warranty on all components and the cabinet, including the compressor. Additional warranties are available at extra cost. The microprocessor control is warranted by a two year parts and labor warranty.

Uses one NEMA 5-15 P Plug

NOTE: Freight charges are FOB destination for dock to dock delivery within the continental USA. Liftgate delivery charges are additional. For inside delivery charges, please consult factory.

NOTE: When ordering please specify: Voltage, Hinging, Door Size, Options and any additional warranties. For fast order entry: Fax 1 (800) 765-8728.

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