



ENERGY STAR® Program Requirements Product Specification for Residential Refrigerators and Freezers

Eligibility Criteria Draft 2 Version 5.0

Following is the **Draft 2 Version 5.0** product specification for ENERGY STAR residential qualified refrigerators and freezers. A product shall meet all of the identified criteria to earn the ENERGY STAR.

Note: This Draft 2 Version 5.0 specification contains EPA's proposed revisions for residential refrigerators and freezers. Please send comments via email to appliances@energystar.gov no later than March 23, 2012.

- 1) Definitions:** Below are the definitions of the relevant terms in this document. Unless otherwise specified, these definitions are identical with definitions in the DOE test procedures at 10 CFR 430, Subpart B, Appendix A1 and B1 or in 10 CFR 430.2.
- A. **Electric Refrigerator:** A cabinet designed for the refrigerated storage of food, designed to be capable of achieving storage temperatures above 32°F (0°C) and below 39°F (3.9°C), and having a source of refrigeration requiring single phase, alternating current electric energy input only. An electric refrigerator may include a compartment for the freezing and storage of food at temperatures below 32°F (0°C), but does not provide a separate low temperature compartment designed for the freezing and storage of food at temperatures below 8°F (-13.3°C).
 - B. **Freezer:** A cabinet designed as a unit for the freezing and storage of food at temperatures of 0 °F (-17.8°C) or below, and having a source of refrigeration requiring single phase, alternating current electric energy input only.
 - C. **Electric Refrigerator-Freezer:** A cabinet which consists of two or more compartments with at least one of the compartments designed for the refrigerated storage of food at temperatures above 32 °F (0°C) and below 39°F (3.9°C), and with at least one of the compartments designed for the freezing and storage of food at temperatures below 8 °F (-13.3°C) which may be adjusted by the user to a temperature of 0 °F (-17.8°C) or below. The source of refrigeration requires single phase, alternating current electric energy input only.
 - D. **Adjusted Volume (AV):** The sum of the fresh food compartment volume in cubic feet, and the product of an adjustment factor and the net freezer compartment volume.
 - E. **Compact refrigerator/refrigerator-freezer/freezer:** Any refrigerator, refrigerator-freezer or freezer with total volume less than 7.75 cubic feet (220 liters) (rated volume as determined in Appendix A1 and B1 of 10 CFR § 430 subpart B) and 36 inches (0.91 meters) or less in height.
 - F. **Built -in refrigerator/refrigerator-freezer/freezer:** Any refrigerator, refrigerator-freezer, or freezer with 7.75 cubic feet or greater total volume and 24 inches or less depth not including doors, handles, and custom front panels; with sides which are not finished and not designed to be visible after installation; and that is designed, intended, and marketed exclusively (1) to be installed totally encased by cabinetry or panels that are attached during installation, (2) to be securely fastened to adjacent cabinetry, walls or floor, and (3) to either be equipped with an integral factory-finished face or accept a custom front panel.
 - G. **Basic Model:** All units of a given type of product (or class thereof) manufactured by one manufacturer,

51 having the same primary energy source, and which have essentially identical electrical, physical, and
52 functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water
53 consumption, or water efficiency.

54 **Note:** EPA is proposing a new definition for a built-in refrigerator, refrigerator-freezer or freezer, to support the
55 built-in allowance being proposed in Section 3. This proposed definition is identical to DOE's built-in definition
56 located in 10 CFR 430.2. EPA has also added clarifying language (lines 14-16), that unless otherwise specified
57 definitions are identical with those in the DOE test procedures for refrigerators, refrigerator-freezers, and freezers
58 (10 CFR 430, Subpart B, Appendix A1 and B1).

59 In Draft 2, EPA is also proposing to remove the definition for System Operator since the revised criteria in Section
60 4 no longer reference a System Operator.

61 EPA welcomes comment on these proposed changes.

62 2) Scope:

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64 A. Included Products: Products that meet the definition of an electric refrigerator, electric freezer, electric
65 refrigerator-freezer, and/or compact refrigerator/refrigerator-freezer/freezer, as specified herein and the
66 definition of a consumer product as specified in 10 CFR § 430.2 are eligible for ENERGY STAR
67 qualification.

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69 B. Excluded Products: Commercial models, refrigerators and refrigerator-freezers with total refrigerated
70 volume exceeding 39 cubic feet, and freezers with total refrigerated volume exceeding 30 cubic feet are
71 not eligible for ENERGY STAR. Products that are covered under other ENERGY STAR product
72 specifications (e.g. Commercial Refrigerators) are not eligible for qualification under this specification.
73 Wine refrigerators, or other products not meet the definition of an electric refrigerator, electric freezer, or
74 electric refrigerator-freezer are not eligible for qualification under this specification.
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76 **Note:** In Draft 2, EPA has retained the changes proposed in Draft 1 that clarified wine refrigerators are not
77 currently eligible for qualification. EPA has also included additional clarification that products that do not meet the
78 definition of an electric refrigerator, electric freezer or electric refrigerator-freezer, are not eligible. No additional
79 changes are being proposed in this section.

80 3) Qualification Criteria:

81 A. Energy Use Requirements

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85 a. Annual Energy Consumption (AEC) shall be less than or equal to Maximum Annual Energy
86 Consumption (AEC_{MAX}), as calculated per Equation 1.

87 Equation 1. Calculation of Maximum Annual Energy Consumption Requirement

$$AEC_{MAX} = AEC_{BASE} + \sum_{i=1}^n AEC_{ADD_i}$$

88 where,

89 AEC_{BASE} is the annual energy consumption base allowance, per Table 1; and

90 AEC_{ADD_i} is an annual energy functional adder, per Table 2
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Table 1: Annual Energy Consumption Base Allowances

Product Type	Annual Energy Consumption Base Allowance, AEC_{BASE} (kWh/year)
Full-Size Refrigerators and Refrigerator-freezers	
<ul style="list-style-type: none"> Refrigerators and Refrigerator-freezers with manual defrost Refrigerator-freezers with partial automatic defrost Refrigerator-freezers with automatic defrost and top-mounted freezer All Refrigerators with automatic defrost 	$250 \times \tanh(0.050 \times AV - 0.1) + 175$
<ul style="list-style-type: none"> Refrigerator-freezers with side-mounted freezer 	$235 \times \tanh(0.050 \times AV - 0.1) + 270$
<ul style="list-style-type: none"> Refrigerator-freezers with bottom-mounted freezer 	$255 \times \tanh(0.045 \times AV) + 230$
Compact Refrigerators and Refrigerator-Freezers	
<ul style="list-style-type: none"> Compact refrigerators and refrigerator-freezers 	$255 \times \tanh(0.045 \times AV) + 230$
Full-Size and Compact Freezers	
<ul style="list-style-type: none"> Compact and Full-Size Upright freezers with manual defrost 	$330 \times \tanh(0.025 \times AV) + 198$
<ul style="list-style-type: none"> Compact and Full-Size Upright freezers with automatic defrost 	$430 \times \tanh(0.025 \times AV) + 284$
<ul style="list-style-type: none"> Compact and Full-Size Chest freezers 	$380 \times \tanh(0.025 \times AV) + 115$

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Table 2: Annual Energy Functional Adders

Description	Product Type	Annual Energy Consumption Allowance, $AEC_{ADD, i}$ (kWh/year)
Through-the-Door Ice Service	<ul style="list-style-type: none"> Refrigerator-freezers with top-mounted freezer 	30
	<ul style="list-style-type: none"> Refrigerator-freezers with bottom-mounted freezer 	40
	<ul style="list-style-type: none"> Refrigerator-freezers with side-mounted freezer 	35
Connected	All product types in Table 1 ¹	$0.05 \times AEC_{BASE}$
Built-in	<ul style="list-style-type: none"> Refrigerator-freezers with top-mounted freezer 	22
	<ul style="list-style-type: none"> Refrigerator-freezers with bottom-mounted freezer 	22
	<ul style="list-style-type: none"> Refrigerator-freezers with side-mounted freezer 	45

¹ Product must be qualified using the final and validated ENERGY STAR Program Requirements Product Specification for Residential Refrigerators and Freezers Test Method to Validate Demand Response to use the allowance.

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102 **Note:** In Draft 1, EPA proposed an adder for through the door (TTD) ice service, recognizing there is some
103 additional energy use associated with this feature, and to enable the most energy efficient models with this
104 functionality to qualify as ENERGY STAR. Based on stakeholder feedback, in Draft 2, EPA is providing some
105 additional energy use for the through-the-door ice adders for bottom-freezers and side-by-sides. For bottom-
106 freezers, EPA is proposing to increase the adder from 30 to 40 kWh per year. For side-by-sides, EPA is proposing
107 to increase the adder from 30 to 35 kWh per year. By increasing the adder levels for these two types of
108 refrigerator-freezers, the proposed changes accommodate a number of additional higher efficiency models with
109 TTD.

110 In response to stakeholder comments, EPA is also incorporating an adder for refrigerator-freezers classified as
111 “built-ins,” as defined in Section 1. Built-in refrigeration products are designed to blend in with kitchen cabinetry.
112 Appliance manufacturers have indicated there are additional technical challenges to making them more energy
113 efficient and that many built-in products already incorporate advanced design options to improve efficiency such
114 as variable speed compressors and vacuum insulation panels. In response, EPA reviewed its data on the energy
115 use and efficiency of built-in refrigerators, refrigerator-freezers and freezers. The most efficient built-in
116 refrigerator-freezer in the data set achieves a 26% reduction in energy use from the current Federal standard
117 while most products just meet the current ENERGY STAR V4.1 requirements, using 20% less energy than the
118 applicable Federal standard. EPA did not find any built-in refrigerator-freezer on the market that would meet the
119 Draft 1 proposed levels. Therefore, EPA is proposing an allowance of 22 kWh per year for refrigerator-freezers
120 with bottom mount freezers, which enables a number of built-in refrigerator-freezer models ranging from 10 to 21
121 cu-ft to be able to earn the ENERGY STAR. For refrigerator-freezers with a side mounted freezer, EPA is
122 proposing an allowance of 45 kWh per year that will enable a number of built-in side-by-side models that range in
123 size from 21 to 24 cu-ft to be eligible for qualification. The adder has been developed to balance the program’s
124 objective of helping consumers identify models with superior energy performance with our interest in preserving
125 consumer choice by not excluding products with certain features. Using its data set, EPA also found that a
126 number of built-in refrigerators and built-in full-size upright freezers, from different manufacturers, meet the
127 proposed levels. Therefore, the Agency is not proposing built-in adders for these product types in Version 5.0.

128 EPA also received feedback from stakeholders both supporting and expressing concerns over the proposed
129 allowance for connected functionality. EPA views this adder proposed for Version 5.0 as a temporary step that
130 will cost consumers little, if anything, as the proposed allowance for connected is offset by strengthened ENERGY
131 STAR energy efficiency requirements plus additional near-term benefits, and can be further offset by longer-term
132 societal and grid benefits that could be enabled by new demand response functionality. EPA has structured the
133 criteria and allowance to ensure that all products earning the ENERGY STAR -- including models that use this
134 temporary incentive in order to meet the energy criteria -- will continue to deliver significant, reliable and
135 quantifiable energy savings for consumers, while preserving consumer choice of different configurations and
136 features. Since this incentive is designed to help “jump start” the market, EPA does not envision the connected
137 allowance will become a permanent part of this specification.

138 EPA welcomes stakeholder feedback on the changes being proposed in Draft 2.

139 B. Determination of Adjusted Volume: Adjusted Volume (AV) shall be calculated using the following:

140 Refrigerator Adjusted Volume = Fresh Volume + (1.63 x Freezer Volume)

141 Freezer Adjusted Volume = 1.73 x Freezer Volume

142 C. Significant Digits and Rounding:

- 147 a. All calculations shall be carried out with directly measured (unrounded) values. Annual energy use
148 shall be rounded to the nearest kilowatt-hour per year, as specified in 10 CFR 430.23(a)(5) and
149 430.23(b)(5).
- 150 b. The Maximum Annual Energy Consumption specification limit, as determined by Equation 1, shall
151 be rounded off to the nearest kWh per year. If the equation calculation is exactly halfway between
152 the nearest two kWh per year values, the Maximum Annual Energy Consumption shall be rounded
153 down to the lower of these values.
- 154 c. Compliance with specification limits shall be evaluated using values rounded to the nearest
155 kilowatt-hour per year.
- 156 d. Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
157 website shall be rounded to the nearest significant digit as expressed in the corresponding
158 specification limit.

159 **Note:** EPA is proposing revised language in Section 3C to reference DOE refrigerator and freezer rounding
160 procedures found in 10 CFR 430.23(a)(5) and 430.23(b)(5) and to further harmonize with DOE regulatory
161 requirements. To this end, the new language in 3C(a) specifies that annual energy use be rounded to the nearest
162 kWh per year, as specified in the CFR. The language in 3C(c) specifies compliance with the specification limits
163 be evaluated using values rounded to the nearest kWh per year. In 3C(b), EPA is adding additional clarity that
164 the ENERGY STAR Maximum Annual Energy Use Consumption limit, as determined by Equation 1 in the
165 specification, must be rounded to the nearest kWh (if the calculation is exactly halfway between two whole
166 numbers, the Maximum Annual Energy Use must be rounded down to the lower of these values). EPA welcomes
167 feedback on the proposed changes.

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- 169 D. Model Numbers: Model numbers used for ENERGY STAR qualified product submissions shall be
170 consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.

171 4) Connected Product Criteria:

172 To be eligible for the Connected allowance, a refrigerator, refrigerator-freezer, or freezer shall have the
173 following capabilities. The product must continue to comply with the applicable product safety standards – the
174 addition of the functionality described below shall not override existing safety protections and functions. Any
175 reduction in load cannot adversely impact the product's operation, e.g., food preservation.

176 **Note:** EPA appreciates all of the stakeholder feedback received on the proposed Connected criteria that address:
177 home energy management (HEM) functionality, delay defrost capability, demand response (DR) functionality,
178 communication standards, open access and information to consumers. In response to comments received, EPA
179 is proposing a number of changes in Sections 4A through 4D, described below.

180 A. Home Energy Management (HEM) Functionality:

181 A Connected refrigerator, refrigerator-freezer, or freezer shall have the following capabilities:

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- 183 1. *Energy Consumption Reporting:* In order to enable simple, actionable energy use feedback to
184 consumers, the product shall be capable of transmitting interval energy consumption data to an
185 energy management system or other consumer authorized device, service or application via a
186 communication link. The data shall represent energy consumed by the product in watt-hours for
187 intervals of 15 minutes or less. In addition, the product may also provide energy use feedback to the
188 consumer on the product itself. On-product feedback, if provided, may be in units and format chosen
189 by the manufacturer (e.g., \$/month).
 - 190 2. *Remote Management:* The product shall be capable of receiving and responding to consumer
191 authorized remote requests, via a communication link, similar to consumer controllable functions on

192 the product. The product is not required to respond to remote requests that would compromise
193 performance and/or product safety as determined by the product manufacturer.

- 194 3. *Operational Status & Messages:* The product shall be capable of providing the following information
195 to the consumer either on the product or to an energy management system or other consumer
196 authorized device, service or application via a communication link:
- 197 a. Demand Response (DR) status (e.g., normal operation, delay load, temporary load
198 reduction), and
 - 199 b. At least two types of messages relevant to the energy consumption of the product. For
200 example, messages for refrigerators, refrigerator-freezers and freezers, might address: door
201 left open notification, a notification that product lost power, a reminder to clean refrigerator
202 coils, or report of energy consumption that is outside the product's normal range.
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204 **Note:** In response to a stakeholder comment, EPA has specified that a refrigerator, refrigerator-freezer or freezer
205 transmit interval (15-minute or less) energy consumption information in units of watt-hours. This standardization
206 of energy use reporting can provide greater reporting consistency among different end-use devices but does not
207 affect how energy-usage feedback is conveyed to consumers. EPA believes it is important that appliance
208 manufacturers and other 3rd parties have the flexibility to decide how feedback on energy consumption can be
209 most meaningfully communicated to consumers (i.e., kWh per day, \$ per day, \$ per year, etc.).
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211 EPA acknowledges stakeholder feedback requesting that, in lieu of energy consumption reporting, products be
212 permitted to report real-time power consumption. EPA is interested in further stakeholder feedback on
213 standardization efforts for both power usage and energy consumption reporting and how more flexible criteria
214 might be crafted to allow power consumption reporting without compromising usefulness of the reported data.
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216 EPA has also incorporated language that in addition to transmitting this information via a communication link, the
217 product may also provide energy use feedback to the consumer on the product itself. In response to feedback on
218 the proposed Draft 3 ENERGY STAR Room Air Conditioner specification (published January 23, 2012), EPA has
219 added language to Section 4(A)1 to help clarify that this feedback could be in any unit or format selected by the
220 manufacturer.
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222 Another stakeholder recommended EPA specify remote requests in Section 4A(2) be "consumer authorized."
223 EPA agrees that consumers should retain ultimate control over the product's operation including any remote
224 requests sent, and has incorporated this suggested language to 4A(2).
225

226 EPA welcomes feedback on these proposed changes and clarifications.

227 B. Delay Defrost Capability

228 A Connected refrigerator, refrigerator-freezer, or freezer with automatic defrost shall have a delay defrost
229 capability active by default, where the consumer can input or the product itself shall identify, the time of
230 day, and the product shall automatically move the defrost function outside of two 4-hour peak load
231 periods; 6am to 10am and 3pm to 7pm. The product shall provide the consumer with the option to modify
232 the scheduling of this functionality in order to, for example: respond to a short term request from the
233 utility, or align defrost avoidance periods with on-peak periods for their utility. In the event of a power
234 outage of 24-hours or lesser duration, after power is restored the product shall not require any interaction
235 from the consumer to maintain this defrost deferral feature with the same settings as prior to the power
236 outage.

237 Exception – A refrigerator, refrigerator-freezer or freezer with manual defrost or partial automatic defrost
238 is not required to comply with the Delay Defrost Capability.

239 **Note:** EPA is proposing that the delay defrost capability in Section 4(B) cover, at a minimum, two 4-hour peak
240 load periods: the 3-7pm period specified in Draft 1, and a new 6-10am period. EPA has added the 6-10am
241 avoidance period so that a product also avoids defrosting during morning hours when winter peak periods tend to
242 occur. EPA is proposing this change in response to comments received from the Electric Research Power
243 Institute (EPRI) who expressed concern that this capability, as proposed in Draft 1, would benefit summer peaking
244 utilities but would also increase the load during winter-peak times. EPRI also noted that approximately one-third
245 of utilities in the U.S are winter peaking, i.e., they have their highest annual peaks in early morning winter hours.
246 Therefore, EPA has specified a second peak-load avoidance period; EPA is also proposing that products provide
247 consumers with the option to modify the pre-set schedule (in Draft 1, this capability was optional).

248 In consideration of the morning peak period, EPA also considered an alternative option of specifying a product's
249 defrost could occur only during a certain window of time (e.g., 12 Midnight – 5am), which would also allow the
250 product to avoid defrosting during both peak times but provides a more narrow window (5 hours vs. 16 hours) for
251 defrost to occur. EPA welcomes feedback on whether this would be preferred by stakeholders.

252 For clarify, EPA has also added language specifying this capability is applicable only to products with automatic
253 defrost.

254 C. Demand Response (DR) Functionality:

255 A Connected refrigerator, freezer or refrigerator-freezer shall have the capability to receive, interpret and
256 act upon consumer-authorized signals by automatically adjusting its operation depending on both the
257 signal's contents and settings from consumers. At a minimum, the product shall be capable of providing
258 the following:
259

- 260 1. *Delay Appliance Load Capability:* The capability of the product to respond to a signal by providing a
261 moderate load reduction for the duration of a delay period.
 - 262 a. Upon receipt of signal and in accordance with consumer settings, except as permitted below,
263 the product shall:
 - 264 i. shift its defrost cycle(s) beyond the delay period, and
 - 265 ii. reduce its average energy consumption during the delay period by at least 13%
266 relative to that consumed during an average load over a 24-hour period as defined by
267 the DOE test procedure (10 CFR Part 430 Subpart B, Appendix A1 and/or B1).
 - 268 b. Exception – The product is not required to respond if the product is defrosting when the
269 signal is received and the signal requests a load reduction start time that is less than 10
270 minutes from the time the signal is received.
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- c. Default settings - The product shall ship with default settings that enable at least a 13% load reduction for at least 4 hours. The product may allow the consumer to modify the duration of this delay period.
- d. Consumer override - The consumer shall be able to override the product's Delay Appliance Load response before or during a delay period.
- e. The product shall be able to provide at least one Delay Appliance Load response in a rolling 24-hour period.

- 2. *Temporary Appliance Load Reduction Capability:* The capability of the product to respond to a signal by providing an aggressive load reduction for a short time period, typically 10 minutes.
 - a. Upon receipt of signal and in accordance with consumer settings, except as permitted below, the product shall restrict its average energy consumption during the load reduction period to no more than 50% of that consumed during an average load over a 24-hour period as defined by the DOE test procedure (10 CFR Part 430 Subpart B, Appendix A1 and/or B1).
 - b. Exceptions – Under the following conditions, the product is not required to restrict its average energy consumption by providing a Temporary Appliance Load Reduction response:
 - i. If a signal is received during a defrost cycle, that defrost cycle may finish. However, no additional defrost cycle(s) shall occur during the time period, and/or
 - ii. If there is a consumer-initiated function such as a door opening or ice/water dispensing during the load reduction period.
 - c. Default settings - The product shall ship with default settings that enable at least a 50% load reduction for a time period of least 10 minutes. The product may allow the consumer to modify the duration of this time period.
 - d. Consumer override - The consumer shall be able to override the product's Temporary Appliance Load Reduction response before or during the load reduction period.
 - e. The product shall be able to provide at least one Temporary Appliance Load Reduction response in a rolling 24-hour period.

Note: EPA received comments from a number of stakeholders that have supported EPA's proposal to help facilitate the market for smart grid or demand-response ready residential refrigerators and freezers. One stakeholder commented that residential appliances, including refrigerators, have the potential to address a wide range of demand response (DR) needs, but that the need and value of each type of service varies regionally (based on local circumstances), seasonally, and over time as grid needs change. To this end, they suggested the specific demand response types and levels indicated in this document might be better presented as a collection of minimum requirements. EPA's intention with Section 4C has been to establish a set of minimum capabilities. EPA has added language that relays this more explicitly by specifying that products, at a minimum, need to be able to provide the two responses detailed in this section -- Delay Appliance Load Capability (DAL) and Temporary Appliance Load Reduction Capability (TALR). Also in response to this comment, EPA has also added language specifying that more broadly, products must be able to receive, interpret and act upon a signal, responding based on the signal's content and consumer preferences; EPA notes this proposed language is consistent with "Smart Appliance" petition's definition of a "smart appliance."

A stakeholder further indicated that presently, utility signals issued that may result in end-use products altering their load fall broadly into categories such as: start load-shed, stop load-shed, and price-alerts. Standardized Temporary Appliance Load Reduction or Delay Appliance Load signals that include start times and event duration components do not currently exist. In light of this feedback, EPA has revised language in Section 4C to refer to Temporary Appliance Load Reduction and Delay Appliance Load as capabilities and responses, rather than signals.

EPA has added clarification that a product must be capable of sustaining a DAL response for at least 4 hours and a TALR response for at least 10 minutes. Since these are intended to be minimum responses, EPA feels the language should not prevent manufacturers from providing products that can provide longer response times. EPA

323 also incorporated clarification that a product must ship with default DAL settings that provide at least a 13% load
324 reduction for at least 4 hours and default TALR settings that provide at least a 50% load reduction for at least 10
325 minutes. Optionally, manufacturers could provide consumers the ability to modify the default time duration limits.
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327 An exemption to the DAL response was incorporated to address a scenario where product is defrosting when a
328 signal is received requesting near-immediate load reduction.
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330 In response to comments received from a stakeholder, EPA removed the reference to a system operator as the
331 originator of signals requesting that the product shed load. Although system operators are considered to be the
332 primary entity that will issue these signals, it may be potentially limiting and not necessary to specify in the context
333 of this specification.
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335 EPA also modified the TALR criteria to only specify the product's response in terms of a 13% load reduction.
336 Removing the option of moving ice making and instead, only specifying a 13% load reduction, provides a more
337 technology-neutral approach.
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339 Finally, EPA clarified that the 24-hour responsiveness requirement is intended to be a "rolling clock" rather than a
340 1-per calendar-day minimum capability. That is, if a product responds to a signal received at 11:45pm and
341 provides TALR, it would not be required to respond to subsequent request for a TALR received prior to 11:45pm
342 the following day.
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344 EPA welcomes stakeholder comment on the proposed changes in Section 4C.
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346 D. Communications, Open Access & Information to Consumers

347 1. *Communications:*

- 348 a. HEM – Communications that enable HEM functionality (Section 4A) may use built-in or
349 modular communication hardware. The connected product must include all necessary
350 hardware and software for HEM communications. If modular communication is used, at least
351 one compatible module shall either ship with the product or be provided to the consumer at
352 the time of sale. These module(s) shall be easily user installable.
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- 354 b. DR – Communications that enable DR functionality (Section 4C) may use built-in or modular
355 communication hardware. If modular communication is used, at least one compatible module
356 shall either ship with the product, be provided to the consumer at the time of sale, or within a
357 reasonable amount of time after the sale. These module(s) shall be easily user installable.
358 Exception– For DR functionality, communication modules, if used, do not need to
359 ship with product, be provided at the point of sale or within a reasonable amount
360 of time after sale if, for all communication layers associated with the modular
361 interface, the product uses only:
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- 363 ■ Standards included in the Smart Grid Interoperability Panel (SGIP) Catalog of
364 Standards, and/or
 - 365 ■ Standards being considered for inclusion in the SGIP Catalog of Standards,
366 and/or
 - 367 ■ Standards adopted by the American National Standards Institute (ANSI) or
368 another well established international standards organization such as the
369 International Organization for Standardization (ISO), International
370 Electrotechnical Commission (IEC), International Telecommunication Union
371 (ITU) or Internet Engineering Task Force (IETF).
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- 373 c. EPA **recommends** for all layers of HEM and DR communications, built-in or modular, the
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- Standards included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,¹ and/or
- Standards being considered for inclusion in the SGIP Catalog of Standards, and/or
- Standards adopted by the American National Standards Institute (ANSI) or another well established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU) or Internet Engineering Task Force (IETF).

EPA may consider more robust criteria in a future revision as relevant standardization efforts mature.

2. *Open Access:* To enable interconnection with the product for purposes of HEM and DR, the following shall be made available to interested parties:
 - a. Documentation regarding the accuracy of energy consumption reporting; and
 - b. An interface specification, API or similar documentation, that at a minimum allows transmission, reception and interpretation of the following information:
 - Energy Consumption Reporting
 - Remote Management
 - Operational Status & Messages (if transmitted via a communication link)
 - Demand Response Functionality
3. *Information to Consumers:* If additional modules, devices and/or infrastructure are part of the configuration required to activate the product’s communications capabilities specified in Section C, prominent labels or other forms of consumer notifications with instructions shall be displayed at the point of purchase and in the product literature. These shall provide specific information on what consumers must do to activate these capabilities (e.g. “*This product requires installation of a network module to enable interconnection with the Smart Grid, Energy Management System, and/or with other external devices, systems or applications.*”).

¹ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

406 **Note:** Based on stakeholder feedback, EPA revised the criteria for communications and open access. The
407 criteria addressing communications associated with DR functionality have been made more permissive. EPA
408 revised and clarified the language on modular communications, previously listed under Information to Consumers,
409 in Draft 1, and now addressed in Section 4(D)1. EPA has clarified that communications associated with DR and
410 HEM may use either built-in or modular communications. In response to feedback, EPA also clarified a connected
411 product must include all necessary hardware and software for HEM communications. If modular communications
412 are used to enable the HEM functionality, the module must either ship with the product or be provided at time of
413 sale, and be easily consumer installable.

414 EPA has included similar requirements for communications that enable DR functionality but with additional
415 flexibility. The communication architectures and business models that would support integration of appliances,
416 such as refrigerators, as DR resources are still in development. In Draft 1, EPA specified that the appliance
417 manufacturer supply this module by either shipping the module with the product, providing it at the point of sale,
418 or providing it in a reasonable amount of time (i.e., module is shipped to the consumer at a later date and a
419 consumer plugs it in). HEM and DR communications may use the same communication protocol, though they
420 may also use separate channels (e.g., Wi-Fi for the HEM, and Zigbee SEP 2.0 for DR communications). Based
421 on stakeholder feedback, EPA believes it is feasible that utilities and service providers could supply a
422 communications module that is compatible with their equipment. EPA has addressed this possibility in 4(D)1
423 through an exemption that specifies a product designed to use modular communications does not need to ship
424 with the communication hardware needed to receive DR signals, as long as it uses only standards-based
425 communications for all layers of the modular interface (e.g., such as CEA-2045 Modular Communications
426 Interface, currently in development). With this pathway, the communication module could be supplied later to the
427 consumer by either a manufacturer, utility, ISO/RTO, or other service provider, in order to activate the product's
428 DR capabilities. Specifying the port use standards-based modular communications will help ensure
429 interoperability with varied communication infrastructure deployment.

430 In Draft 2, EPA is *recommending* use of standards-based communications (those developed by ANSI or another
431 well established international Standards Developing Organization (SDO)) or standards listed (or being considered
432 for inclusion) in the SGIP Catalog of Standards. As noted in stakeholder comments, the Catalog of Standards is a
433 living document and expected to continue to evolve; at this point in time, some standards that appliances may
434 utilize, such as Smart Energy Profile (SEP) 2.0, have not been finalized and are not listed in the Catalog. EPA
435 plans to consider, in consultation with stakeholders, more robust language in future revisions as relevant
436 standardization efforts mature.

437 To help advance both interoperability and open access, EPA is specifying that technical documentation (such as
438 an API) be made available to provide interested parties with access to the product's identified data, messages
439 and capabilities, including both HEM and DR functionality specified in Section 4.

440 EPA welcomes comment on the proposed changes.

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443 **5) Test Requirements:**

- 444 A. One of the following sampling plans shall be used to test energy performance for qualification to
445 ENERGY STAR:
- 446 a. A representative unit shall be selected for testing based on the definition for Basic Model provided
447 in Section 1 above; or
 - 448 b. Units shall be selected for testing per the sampling requirements defined in 10 CFR § 429.14.
- 449 B. When testing energy consumption of residential refrigerators and freezers, the following test methods
450 shall be used to determine ENERGY STAR qualification:
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Table 3: Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference
Energy Consumption (kWh/year)	10 CFR 430, Subpart B
	Appendix A1 – Residential Refrigerators
	Appendix B1 – Residential Freezers

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- C. When determining energy performance for purposes of ENERGY STAR certification, the principles of interpretation, contained in 10 CFR 430.23 (a) (10), should be applied to the test procedure.
- D. Compliance with Connected functionality, as specified in Section 4, shall be through examination of product and/or product documentation. In addition, demand response functionality shall be verified using the ENERGY STAR Program Requirements Product Specification for Residential Refrigerators and Freezers Test Method to Validate Demand Response (Rev. Feb-2012) in order to be eligible for the connected allowance.

Note: The proposed test approach for connected proposed in Draft 1 is unchanged. Verification of connected functionality will be through examination of the product and/or product documentation. Additionally, the demand response functionality will need to be verified using the ENERGY STAR test method being developed and validated by DOE. Products must be qualified using the final test method in order to take advantage of the connected allowance. In this Draft 2, Section 5D has been re-structured to be consistent with the format used in the connected test method section of the proposed Draft 3 Version 3.0 ENERGY STAR room air conditioner specification (published January 23, 2012).

DOE has developed a Test Method to Validate Demand Response (Rev. Feb-2012), released with this specification for stakeholder comment. Throughout 2011, DOE requested pre-market Connected R/F units from manufacturers in an effort to validate the proposed Connected R/F test method; however, only one manufacturer provided DOE with a Connected R/F for testing. While DOE is seeking input on this draft test method, DOE will not finalize the test method until it can obtain additional Connected R/F products for testing, to ensure that the test method is applicable to multiple units and technologies.

- 6) **Effective Date:** The ENERGY STAR Residential Refrigerator and Freezer specification shall take effect on **January 1, 2013**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.
- 7) **Future Specification Revisions:** EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model.

Note:

Future Specification Revision

For a number of product types covered in the ENERGY STAR program for residential refrigerators and freezers, future 2014 Federal standard levels either meet or exceed the proposed Version 5.0 requirements (see table below). Manufacturers will need to comply with these new standards beginning September 15, 2014. In light of this, EPA is planning to review and revise the refrigerator and freezer specification in 2013 to develop new levels, where necessary. It is anticipated that these levels could become effective in September 2014, harmonizing with the timing of DOE's new standards for residential refrigeration products. EPA does not plan to propose levels for 2014, as mentioned in Draft 1, through the current Version 5.0 specification development process. EPA will instead consider levels for a Version 6.0 specification through a subsequent specification development process, allowing additional time for consideration and discussion with stakeholders on efficiency opportunities beyond the 2014 standard levels.

EPA plans to extend the approach used in Version 5.0 when developing Version 6.0. Certain product classes will need to be strengthened or sunset (i.e., at a minimum, where the new Federal standard nearly meets or exceeds the ENERGY STAR Version 5.0 requirement – see Table below). For certain product classes, including compact refrigeration products and full-size freezers, some stakeholders have raised concerns that there may not be additional cost-effective, energy-savings opportunities and that EPA should consider sunsetting certain product types from the program. EPA plans to consider efficiency options and cost-effectiveness for all product types as part of this review. EPA will also review the allowance provided through V5.0 for connected products. Since this incentive has been designed to help provide a “jump-start” to the market, EPA does not view it as a permanent part of the specification.

The Version 6.0 levels will be based on product performance as tested to the new DOE test procedures (Appendix A and Appendix B) that will be used by manufacturers to comply with the 2014 Federal standards. When energy performance data is not publically available, EPA's practice is to build a data set, with manufacturers' and other stakeholders' test data and information. The Agency plans to use available data as well as any supplemental information gathered to inform level setting. EPA is happy to discuss this approach and its data needs with stakeholders in advance of this specification revision.

ENERGY STAR Version 5.0 Requirements vs. 2014 Federal Standard Levels (Per Negotiated Agreement)

<i>Product Type</i>	Proposed V5.0 ENERGY STAR (Draft 2)	2014 Standard Level ¹ (Per Negotiated Agreement)
	<i>(% Better than 2001 Federal standards)</i>	
Refrigerator-Freezer with Top Freezer (19 cu-ft)	26%	25%
Refrigerator-Freezer with Bottom Freezer and TTD (25 cu-ft)	30%	20%
Refrigerator-Freezer with Side-Mounted Freezer and TTD (26 cu-ft)	30%	25%
Chest Freezer (compact, manual defrost)	10%	10%
Chest Freezer (full-size 15 cu-ft, manual defrost)	17%	25%
Upright Freezer (full-size 18.5 cu-ft, auto defrost)	21%	30%
Compact refrigerator-freezer (manual defrost)	20%	25%

¹ DOE's final rule with 2014 standard levels is available on DOE's website here: http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/refrig_finalrule_frnotice.pdf