



ENERGY STAR® Program Requirements Product Specification for Residential Dishwashers

Eligibility Criteria Final Draft Version 7.0

1 Following is the **Final Draft Version 7.0** ENERGY STAR Product Specification for Residential
2 Dishwashers. A product shall meet all of the identified required criteria if it is to earn the ENERGY STAR.

3 **1) Definitions:**

4 Below are the definitions of the relevant terms in this document. Where noted below, definitions are
5 identical to the definitions in the U.S Department of Energy (DOE) test procedure at 10 Code of
6 Federal Regulations (CFR) 430, Subpart B, Appendix C1 or in 10 CFR 430.2. When in conflict, the
7 definitions in the CFR take precedence.

- 8 A. Dishwasher¹: A cabinet-like appliance which, with the aid of water and detergent, washes,
9 rinses, and dries (when a drying process is included) dishware, glassware, eating utensils, and
10 most cooking utensils by chemical, mechanical and/or electrical means and discharges to the
11 plumbing drainage system.
- 12 1. Compact Dishwasher²: A dishwasher that has a capacity of less than eight place settings
13 plus six serving pieces as specified in ANSI/AHAM DW-1-2010 (incorporated by reference;
14 see §430.3), using the test load specified in section 2.7 of 10 CFR 430, Subpart B,
15 Appendix C1.
- 16 2. Standard Dishwasher²: A dishwasher that has a capacity equal to or greater than eight
17 place settings plus six serving pieces as specified in ANSI/AHAM DW-1-2010 (incorporated
18 by reference; see §430.3), using the test load specified in section 2.7 of 10 CFR 430,
19 Subpart B, Appendix C1.
- 20 B. Basic Model¹: All units of a given type of covered product (or class thereof) manufactured by
21 one manufacturer, having the same primary energy source, and which have essentially identical
22 electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption,
23 energy efficiency, water consumption, or water efficiency.
- 24 C. Consumer Product¹: Any product (other than an automobile, as defined in Section 501(1) of the
25 Motor Vehicle Information Cost Savings Act) which: (1) in operation consumes, or is designed to
26 consume, energy and (2) to any significant extent, is distributed in commerce for personal use or
27 consumption by individuals.

¹ 10 CFR 430, Subpart A, Section 430.2 Note: Definition of consumer product has been abbreviated to be specific to residential dishwashers by omitting the regulatory definition's references to lighting and water.

² 10 CFR 430, Subpart B, Appendix C1

28 **2) Scope**

29 A. Included Products: Products that meet the definition of a dishwasher and are a consumer
30 product as specified herein are eligible for ENERGY STAR certification, except for products listed
31 in Section 2.B.

32 B. Excluded Products: Product types not specifically identified in Section 2.A are not eligible for
33 ENERGY STAR certification under this specification. Products that are covered under other
34 ENERGY STAR product specifications (e.g., Commercial Dishwashers) are not eligible for
35 certification under this specification.

36 **3) Certification Criteria**

37 A. Energy Performance Requirements

38 Annual Energy Consumption (*AEC*) shall be less than or equal to Maximum Annual Energy
39 Consumption (*AEC_{MAX}*).

40 **Table 1: Annual Energy Consumption Base Allowances**

Product Type	<i>AEC_{Max}</i> (kWh per year)
Standard Dishwashers	240
Compact Dishwashers	155

41
42 B. Water Performance Requirements

43 **Table 3: Maximum Water Consumption**

Product Type	Water Consumption (gallons per cycle)
Standard Dishwashers	≤ 3.2
Compact Dishwashers	≤ 2.0

45
46 C. Significant Digits and Rounding: All calculations shall be carried out as specified in Appendix C1
47 to Subpart B of Part 430 and 10 CFR Part 430.23(c).

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

51 **Note:** In the Final Draft, EPA is maintaining the proposed criteria included in Draft 2 of the ENERGY
52 STAR residential dishwasher specification. EPA has found these levels to be consistent with ENERGY
53 STAR Guiding Principles, with the update being warranted because the current ENERGY STAR criteria
54 for residential dishwashers went into effect on January 29, 2016, and ENERGY STAR market share is
55 currently near 100%. The consumer payback associated with these levels is good, as confirmed by EPA's
56 refreshed payback analysis. The Agency identified models with similar features, aside from energy and
57 water efficiency (i.e., meets DOE standard vs. is ENERGY STAR certified) for comparison. Based on the
58 retail prices and efficiency of these pairs, EPA calculated a payback period range of 0-1.9 years. Through
59 this revision, a national savings potential of as much as 5,100 GWh could be realized. Additional

60 information can be found in the Final Draft Data & Analysis Package published on the [Dishwasher](#)
61 [Version 7 Development page](#).

62 Further, EPA found compelling reasons to include the cleaning floor. In earlier work completed by DOE to
63 support a dishwasher rulemaking, DOE conducted testing and found that approximately 40% of the ~30
64 dishwashers tested failed to meet a cleaning performance threshold of 65, raising the prospect for those
65 washers that consumers may select more energy and water intensive cycles or hand wash (which uses
66 far more energy and water than any dishwasher cycle) to compensate. EPA's experience since 2014 with
67 dishwasher models recognized as ENERGY STAR Most Efficient has shown that superior energy and
68 water efficiency can be delivered without sacrificing performance. Lastly, major brands support this
69 revision and have affirmed their plans to provide models that earn the latest ENERGY STAR
70 requirements to consumers.

71 **4) Connected Criteria:**

72 The following optional connected criteria are applicable to Included Products, Section 2.A, that meet
73 the definition of a standard dishwasher as defined in Section 1.A.1.

74 A. Connected Dishwasher System

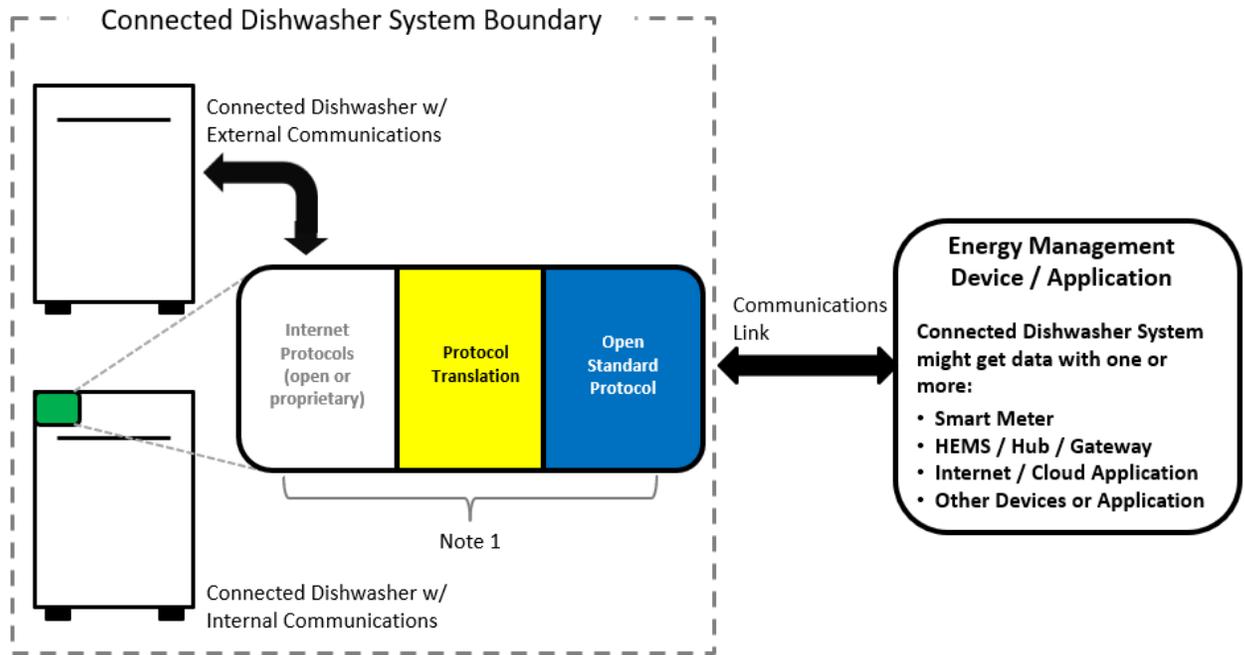
75 To be recognized as connected and to be eligible for the connected allowance, a "Connected
76 Dishwasher System" (as shown in Figure 1) shall include the base appliance plus all elements
77 (hardware, software) required to enable communications in response to consumer-authorized
78 energy related commands (*not including third-party remote management which may be made*
79 *available solely at the discretion of the manufacturer*). These elements may be resident inside or
80 outside of the base appliance. This capability shall be supported through one or more means, as
81 identified in section 4.B.2.

82 The specific design and implementation of the Connected Dishwasher System is at the
83 manufacturer's discretion provided it is interoperable with other devices via open communications
84 protocol and enables economical consumer-authorized third-party access to the functionalities
85 provided for in sections 4.D, 4.F, and 4.G. and the capabilities shall be supported through one or
86 more means, as identified in section 4.B.2. A product that enables economical and direct, on-
87 premises, open-standards based interconnection is the preferred option for meeting this
88 requirement, but alternative approaches are also acceptable.

89 The product must continue to comply with the applicable product safety standards – the addition
90 of the functionality described below shall not override existing safety protections and functions.
91 The appliance must meet manufacturer's internal minimum performance guidelines, e.g., cleaning
92 performance.

93

Figure 1. Connected Dishwasher System Boundary – Illustrative Example



94

95

96

97

Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between the Connected Dishwasher System and Energy Management Device/Application(s). These elements could be within the base appliance, and/or an external communication module, a hub/gateway, or in the Internet/cloud.

98

B. Communications

99

1. Open Standards – Communication with entities outside the connected dishwasher system that enables connected functionality (sections 4.D, 4.F, 4.G) must use, for all communication layers, standards:

100
101

102

103

104

105

106

107

108

109

110

111

2. Communications Hardware Architecture – Communication with entities outside the Connected Dishwasher System that enables connected functionality shall be enabled by any of the following means, according to the manufacturer's preference:

112

113

114

115

- a. Built-in communication technology
- b. Manufacturer-specific external communication module(s) and/or device(s)
- c. Open standards-based communication port on the appliance combined with open standards-based communications module

³ <https://sepapower.org/knowledge/catalog-of-standards/>

- 116 d. Open standards-based communication port(s) on the appliance in addition to A, B or C,
117 above
- 118 If option B or C is used, the communication module/device(s) must be easy for a consumer to
119 install and shipped with the appliance, provided to the consumer at the time of sale, or
120 provided to the consumer in a reasonable amount of time after the sale.

121 C. Open Access

122 To enable interconnection with the product, in addition to section 4.B.1 that requires open
123 standards, an interface specification, Application Programming Interface (API) or similar
124 documentation shall be made available to interested parties that at a minimum, allows
125 transmission, reception and interpretation of the following information:

- 126 1. Energy Consumption Reporting specified in section 4.D (must include accuracy, units and
127 measurement interval);
- 128 2. Operational Status, User Settings & Messages specified in section 4.F (if transmitted via a
129 communication link);
- 130 3. Demand Response specified in section 4.G.

131 D. Energy Consumption Reporting

132 To enable simple, actionable energy use feedback to consumers and consumer authorized
133 energy use reporting to third parties, the product shall be capable of transmitting energy
134 consumption data via a communication link to energy management systems and other consumer
135 authorized devices, services, or applications. This data shall be representative of the product's
136 interval energy consumption. It is recommended that data be reported in watt-hours for intervals
137 of 15 minutes or less; however, representative data may also be reported in alternate units and
138 intervals as specified in the product manufacturer's interface specification or API detailed in
139 Section 4.C.

140 The product may also provide energy use feedback to the consumer on the product itself. On-
141 product feedback, if provided, may be in units and format chosen by the manufacturer (e.g.,
142 \$/month or kWh/cycle).

143 E. Remote Management

144 The product shall be capable of receiving and responding to consumer authorized remote
145 requests (*not including third-party remote management which may be made available solely at
146 the discretion of the manufacturer*), via a communication link, similar to consumer controllable
147 functions on the product. The product is not required to respond to remote requests that would
148 compromise performance and/or product safety as determined by the product manufacturer.

149 F. Operational Status, User Settings & Messages

- 150 1. The product shall be capable of providing the following information to energy management
151 systems and other consumer authorized devices, services or applications via a
152 communication link:
- 153 • Operational / Demand Response (DR) status (for example: off, standby, cycle in process,
154 delay appliance load, temporary appliance load reduction).

- 155 2. The product shall be capable of providing the following information on the product and/or to
156 energy management systems and other consumer authorized devices, services or
157 applications via communication link:
- 158 • At least two types of messages relevant to the energy consumption of the product. For
159 example, messages for dishwashers might address performance issues or report energy
160 consumption that is outside the product's normal range.

161 G. Demand Response

162 A connected dishwasher system shall have the capability to receive, interpret and act upon
163 consumer-authorized signals by automatically adjusting its operation depending on both the
164 signal's contents and settings from consumers. At a minimum, the product shall be capable of
165 providing the following capabilities for all cycle and setting combinations, except where otherwise
166 noted:

- 167 1. *Delay Appliance Load (DAL) Capability*: The capability of the product to respond to a signal
168 in accordance with consumer settings, except as permitted below, by delaying the start of an
169 operating cycle beyond the delay period.
 - 170 a. Default settings – The product shall ship with default settings that enable a response for
171 at least 4 hours.
 - 172 b. Consumer override – The consumer shall be able to override the product's DAL response
173 before or during a delay period.
 - 174 c. The product shall be able to provide a DAL response per consumer initiated operating
175 cycle, but is not required to provide more than three DAL responses in a rolling 24-hour
176 period (with a maximum of one 4-hour response per dishwasher cycle).
- 177 2. *Temporary Appliance Load Reduction (TALR) Capability*: The capability of the product to
178 respond to a signal by providing load reduction for a short time period, typically 10 minutes.
179 Upon receipt of signal and in accordance with consumer settings, except as permitted below,
180 the product shall restrict its average power draw during the load reduction period to no more
181 than 250 watts.
 - 182 a. Default settings – The product shall ship with default settings that enable a response for a
183 time period of at least 10 minutes.
 - 184 b. The product is not required to provide a response if the consumer selected wash cycle is
185 a cycle explicitly designed or primarily intended for sanitization, such as those in
186 compliance with NSF/ANSI Standard 184. The product user documentation and/or the
187 product itself must indicate that the cycle is designed or intended for sanitization.
188 **Note:** EPA encourages products to provide TALR responses in these cycles whenever
189 consumer expectations would not be impacted.
 - 190 c. Consumer override – The consumer shall be able to override the product's TALR
191 response before or during a load reduction period.
 - 192 d. The product shall be able to provide at least one TALR response during each consumer
193 initiated operating cycle.

194 Illustrative DR Examples:

195 1. The product receives a DAL signal with a 10-hour delay period. The consumer overrides
196 and starts a load. The product need not respond to subsequent DAL or TALR signals during
197 that cycle. However, after this cycle completes, the consumer must initiate a 2nd override in
198 order to start a second cycle without delay.

199 2. While running a cycle, the product receives and responds to a TALR signal. During its
200 response, the product receives a DAL signal with a 4-hour delay period. Since the consumer
201 has elected to override, the product does not need to respond to the DAL signal in the current
202 cycle. However, after this cycle completes, if within the DAL delay period; the consumer must
203 initiate an override in order to start a subsequent cycle without delay.

204 3. While running a cycle, the product receives and responds to a TALR signal. After its
205 response and within the same operational cycle, the product receives a second TALR signal.
206 Since the product is required to provide one TALR response per operating cycle, it does not
207 need to respond to the second signal.

208 H. Information to Consumers

209 If additional modules, devices, services and/or infrastructure are part of the configuration required
210 to activate the product's communications capabilities, prominent labels or other forms of
211 consumer notifications with instructions shall be displayed at the point of purchase and in the
212 product literature. These shall provide specific information on what consumers must do to activate
213 these capabilities (e.g., "*This product has Wi-Fi capability and requires Internet connectivity and a*
214 *wireless router to enable interconnection with an Energy Management System, and/or with other*
215 *external devices, systems or applications.*").

216 **Note:** EPA continues to support the connected criteria in Section 4 of this specification, and
217 manufacturers may continue to self-report their products as Connected if the models meet the criteria.
218 ENERGY STAR was a leader in developing connected criteria for products (beginning in 2011) and has
219 recognized connected products across 17 categories to date. As is often the EPA value-add, the program
220 developed the criteria and definitions, and in some cases, with DOE's lead, a test method to measure DR
221 capability, all to foster national harmonization. Entities like the California Energy Commission have now
222 adopted these for use. This big step forward for connected reduces the need for an ENERGY STAR
223 market pull in the form of an efficiency credit. A 5% credit significantly reduces consumer energy savings.
224 To deliver the efficiency expected of ENERGY STAR dishwashers by consumers, EPA is removing the
225 5% credit. Lastly, a test procedure to measure DR capability does not yet exist, thus, no models are
226 currently relying on the 5% credit.

227

228 **5) Test Requirements**

229 A. One of the following sampling plans shall be used for certification to ENERGY STAR.

230 1. A representative unit shall be selected for testing based on the definition for Basic Model
231 provided in Section 1 above; or

232 2. Units shall be selected for testing per the sampling requirements as defined in Table 4:

233

Table 4: ENERGY STAR Sampling Requirements for Dishwashers

Product	Code of Federal Regulations Reference
Residential Dishwashers	10 CFR § 429.20, which references 10 CFR § 429.11

234

B. When testing energy and water consumption of residential dishwashers, the per-cycle cleaning index for the normal cycle, determined according to the Test Method specified in Table 5, must be 65 or higher for ENERGY STAR certification.

235

236

237

C. The following test methods shall be used to determine ENERGY STAR certification:

238

Table 5: Test Methods for ENERGY STAR Certification

ENERGY STAR Requirement	Test Method Reference
Energy Consumption (kWh/year)	10 CFR 430, Subpart B, Appendix C1*
Water Consumption (gallons/cycle)	
Cleaning Index	ENERGY STAR Test Method for Determining Residential Dishwasher Cleaning Performance (Rev. Feb-2014)

* And in accordance with any applicable DOE issued test procedure guidance, listed here: <http://www1.eere.energy.gov/guidance/default.aspx?pid=2&spid=1>

239

D. Compliance with Connected functionality, as specified in Section 4, shall be through examination of product and/or product documentation.

240

241

Note: For the Final Draft, EPA notes that once DOE’s proposed Appendix C1 with cleaning performance testing is in effect, stakeholders will certify to ENERGY STAR only using the Appendix C1 test. Until the proposed revision to Appendix C1 is in effect, ENERGY STAR will continue to reference the ENERGY STAR Final Test Method for Determining Residential Dishwasher Cleaning Performance. EPA will update the ENERGY STAR specification for residential dishwashers to reference DOE’s revised test procedure once it is required.

242

243

244

245

246

247 **6) Effective Date**

248

The ENERGY STAR Residential Dishwasher specification shall take effect on **July 6, 2023**. To certify as ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the 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.

249

250

251

252

Note: In recognition of simultaneous testing requirements associated with forthcoming changes to 10 CFR 430, Subpart B, Appendix C1 and ENERGY STAR, EPA has extended the transition period for Version 7.0 revision to 12 months.

253

254

255 **7) Future Specification Revisions**

256

EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. Revisions to the specification will be arrived at through industry discussions. In the event of a specification revision, please note that the ENERGY STAR certification is not automatically granted for the life of a product model.

257

258

259