



ENERGY STAR[®] Program Requirements Product Specification for Clothes Washers

Eligibility Criteria Final Draft Version 7.0

Following is the **Final Draft Version 7.0** product specification for ENERGY STAR certified clothes washers. A product shall meet all of the identified required criteria if it is to earn the ENERGY STAR.

Note: Comments on the Final Draft Version 7.0 specification may be submitted to appliances@energystar.gov no later than January 17, 2014.

- 1) **Definitions:** Below are the definitions of the relevant terms in this document. Where noted below, definitions are identical to the definitions in the U.S. Department of Energy (DOE) test procedure at 10 CFR 430, Subpart B, Appendix J2 or in 10 CFR 430.2 and 10 CFR 431.152. When in conflict, the definitions in the Code of Federal Regulations (CFR) take precedence.
 - A. Residential Clothes Washer¹: A consumer product designed to clean clothes, utilizing a water solution of soap and/or detergent and mechanical agitation or other movement, and must be one of the following classes: automatic clothes washers, semi-automatic clothes washers, and other clothes washers.
 1. Residential Clothes Washer with Optional Dry Cycle: A Residential Clothes Washer that has an optional add-on dry cycle, where drying is accomplished through use of electricity or gas as a heat source and forced air circulation; drying cannot be selected independently from a wash cycle.
 - B. Commercial Clothes Washer²: A soft-mounted front-loading or soft-mounted top-loading clothes washer that is defined for use in applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas and coin laundries.
 - C. Combination All-in-One Washer-Dryer: A consumer product designed to clean and dry fabrics in a single drum, where a separate drying cycle uses electricity or gas as a heat source and forced air circulation.
 - D. Modified Energy Factor (MEF)³: The quotient of the cubic foot (or liter) capacity of the clothes container divided by the total clothes washer energy consumption per cycle, with such energy consumption expressed as the sum of the machine electrical energy consumption, the hot water energy consumption, and the energy required for removal of the remaining moisture in the wash load.
 - E. Integrated Modified Energy Factor (IMEF)³: The quotient of the cubic foot (or liter) capacity of the clothes container divided by the total clothes washer energy consumption per cycle, with such energy consumption expressed as the sum of the machine electrical energy consumption, the hot water energy consumption, the energy required for removal of the remaining moisture in the wash load, and the combined low-power mode energy consumption.
 - F. Water Factor (WF)³: The quotient of the total weighted per-cycle water consumption divided by the cubic foot (or liter) capacity of the clothes washer.
 - G. Integrated Water Factor (IWF)³: The quotient of the total weighted per-cycle water consumption for all wash cycles in gallons divided by the cubic foot (or liter) capacity of the clothes washer.

¹10 CFR 430 Subpart A, Section 430.2

² The ENERGY STAR definition of a commercial clothes washer differs from the DOE commercial clothes washer definition by: 1) not specifying a maximum capacity; and 2) not covering "other commercial applications."

³ 10 CFR 430, Subpart B, Appendix J2

- H. Basic Model⁴: All units of a given type of covered product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.

Note: EPA made only a minor correction to the definition of a basic model, changing the language from “Units of a given type” to, “All units of a given type” aligning with DOE. All other definitions remain unchanged from the Draft 2.

2) **Scope:**

- A. Included Products: Products with a clothes container volume that is not more than 6.0 cubic feet and that meet the definition of a Residential Clothes Washer or Commercial Clothes Washer as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2B.
- B. Excluded Products: The following products are not eligible for ENERGY STAR qualification:
- i) products with a clothes container volume of less than 1.6 cubic feet,
 - ii) products configured in any way other than a front- or top-loading design,
 - iii) Combination All-in-One Washer-Dryers, and
 - iv) Residential Clothes Washers with an Optional Dry Cycle.

3) **Qualification Criteria:**

- A. Modified Energy Factor (MEF) or Integrated Modified Energy Factor (IMEF):
MEF shall be greater than or equal to the Minimum MEF (MEF_{MIN}), as calculated per Equation 1.

Alternatively, IMEF shall be greater than or equal to the Minimum IMEF ($IMEF_{MIN}$), as calculated per equation 2.

Equation 1. Calculation of Minimum MEF

$$MEF_{MIN} = MEF_{BASE}$$

where,

MEF_{BASE} is the base MEF, per Table 1

Equation 2. Calculation of Minimum IMEF

$$IMEF_{MIN} = IMEF_{BASE} - IMEF_{Adder_Connected}$$

where,

$IMEF_{BASE}$ is the base IMEF, per Table 1

$IMEF_{Adder_Connected}$ is the IMEF connected allowance, per Table 2

Table 1: Base MEF/IMEF

Product Type	MEF_{BASE}	$IMEF_{BASE}$
Residential Clothes Washers, Front-loading (> 2.5 cu-ft)	NA	2.38
Residential Clothes Washers, Top-loading (> 2.5 cu-ft)	NA	2.06
Residential Clothes Washers (≤ 2.5 cu-ft)	NA	2.07
Commercial Clothes Washers	2.2	NA

⁴ 10 CFR 430, Subpart A, Section 430.2

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Table 2: Connected Allowance

Product Type	IMEF _{Adder_Connected} ²
Residential Clothes Washers ¹	0.05 x IMEF _{BASE}

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¹ Product must be certified using the final and validated ENERGY STAR Test Method (TBD) to use the allowance.

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² Calculated allowance shall be rounded down to the nearest hundredth before being applied in Equation 1.

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B. Water Factor (WF) or Integrated Water Factor (IWF):

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Table 3: WF/IWF

Product Type	Maximum WF	Maximum IWF
Residential Clothes Washers, Front-loading (> 2.5 cu-ft)	NA	3.7
Residential Clothes Washers, Top-loading (> 2.5 cu-ft)	NA	4.3
Residential Clothes Washers (≤ 2.5 cu-ft)	NA	4.2
Commercial Clothes Washers	4.5	NA

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Note: EPA has made minor changes to the criteria levels proposed in Draft 2 in this Version 7.0 Final Draft. Based on stakeholder feedback and supporting data that was shared on incremental costs associated with the proposed IMEF level of 2.11 and modifications to this level, EPA has modestly relaxed the requirement to 2.06. One stakeholder shared cost data showing that the proposed energy-efficiency requirements would necessitate more costly components for certain top load designs, such that the added cost and longer payback would outweigh the additional energy and cost savings attained through higher efficiency requirements. EPA evaluated this data and concluded that a modest relaxation of the level would reduce potential additional consumer costs and minimally affect their savings (change of < \$1 per year, relative to the estimated average annual savings of \$53 for a typical ENERGY STAR top load washer). EPA estimates that about 24% of models larger than 2.5 cubic feet currently meet the proposed levels, unchanged from the Draft 2 specification.

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After considering stakeholder feedback received on the proposal to have separate efficiency criteria for top-loading and front-loading clothes washer models larger than 2.5 cu-ft, EPA has retained the separate product classes. In response to the Draft 2, a number of different stakeholders offered new information that the cycle time of front loading clothes washers has improved and for some products, is now comparable with top loaders. Despite this, EPA has retained separate product classes after observing the latest market data indicates consumer preference for top loaders remains high in the U.S., with top load washers accounting for nearly 2/3 of sales in 2012. Separate requirements for front and top loading clothes washers provide the program with the ability to both continue to recognize a selection of highly efficient top loader clothes washers, while also defining front load clothes washer criteria that can better recognize and reflect the efficiency performance of front loaders that are available today. EPA will develop new savings messaging for consumers that reflects this approach, in support of the Version 7.0.

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118 Finally, EPA received stakeholder comments with different views on a separate product class for smaller clothes
119 washers (2.5 cubic feet and smaller). A number of stakeholders supported this separate product class, while
120 others were concerned that it differs from the set of DOE product classes used in the Federal standards program.
121 Consistent with stakeholders who supported the proposal, EPA believes it is important to continue to recognize
122 highly efficient smaller clothes washers due to the unique value they provide to consumers who have greater
123 space constraints. To this end, EPA selected a performance level based on the latest available data that
124 recognizes the most energy and water efficient washers, in this size category, currently available. In general, EPA
125 looks to leverage product classes created by DOE for the minimum standards program as long as it makes
126 practical sense to do so in the ENERGY STAR program. In this case, subjecting smaller clothes washers to the
127 same ENERGY STAR requirements as larger washers would limit selection for consumers requiring the smaller
128 size, since smaller clothes washers are not achieving the same levels of efficiency as many larger models. One
129 stakeholder suggested EPA instead adopt the level proposed for smaller clothes washers for all front load clothes
130 washers. This option is problematic since it fails to recognize the significant improvements made in front load
131 clothes washer efficiency and diminishes the value of the ENERGY STAR label for consumers by less effectively
132 differentiating the most energy and water efficient standard size front load clothes washers. The Agency also
133 notes that as many as 42% of clothes washers would already meet these levels. EPA believes this is
134 unacceptably high, especially considering the additional lead-time being provided to transition to the Version 7.0
135 requirements. Accordingly, EPA has maintained a separate product class and proposed level for smaller clothes
136 washers in the final draft.

- 137 C. Reporting Requirements for Residential Clothes Washer Cleaning and Rinse Performance:
138 TBD until an ENERGY STAR test procedure is available
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140 **Note:** EPA has maintained a placeholder for a reporting requirement for cleaning and rinse performance. Once
141 an ENERGY STAR test procedure is available, EPA will work with stakeholders to integrate further specificity for
142 this reporting requirement.

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144 D. Significant Digits and Rounding: All calculations shall be carried out as specified in Appendix J2 Subpart
145 B of Part 430, and 10 CFR Part 430.23(j).
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147 **Note:** EPA has corrected section D to refer to Appendix J2, only, consistent with Section 5.
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150 E. Model Numbers: Model numbers used for ENERGY STAR certified product submissions shall be
151 consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.
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153 4) **Connected Criteria:**
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155 The following optional connected criteria are applicable to Included Products, Section 2A, that meet the
156 definition of a Residential Clothes Washer.
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158 A. Connected Clothes Washer System

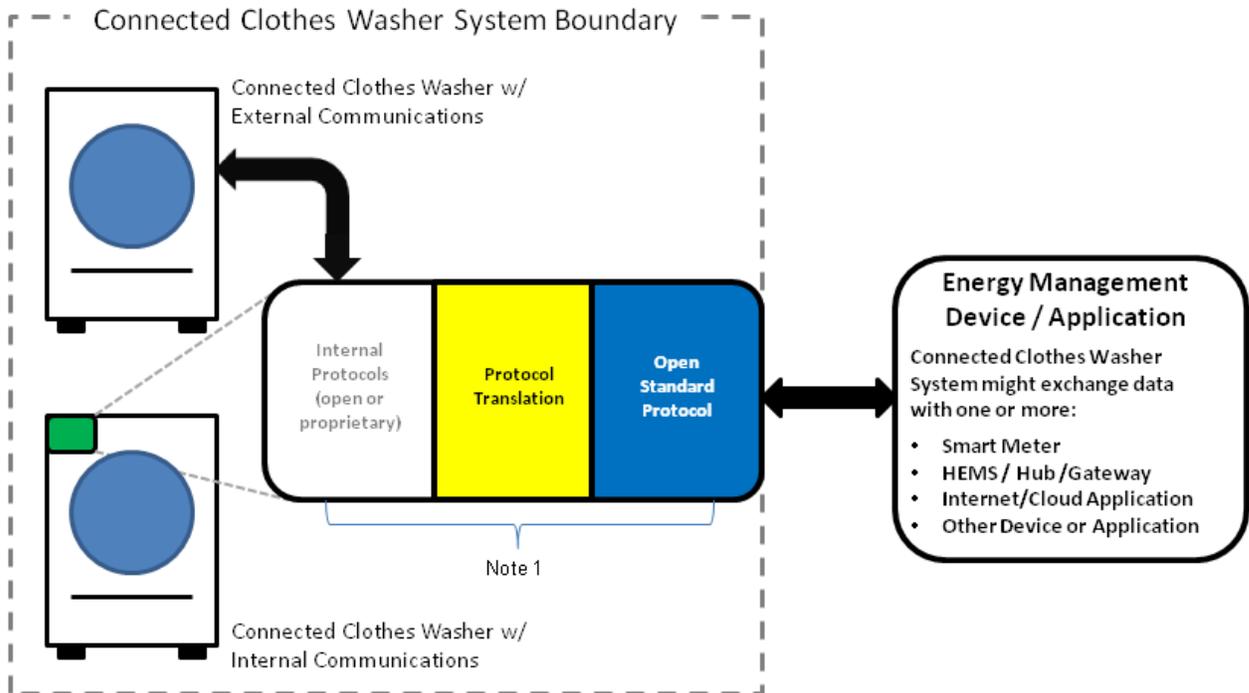
159 To be recognized as connected and to be eligible for the connected allowance, a “connected clothes
160 washer system” (Connected Clothes Washer System, as shown in Figure 1) shall include the base
161 appliance plus all elements (hardware, software) required to enable communication in response to
162 consumer-authorized energy related commands (*not including third-party remote management which may
163 be made available solely at the discretion of the manufacturer*). These elements may be resident inside
164 or outside of the base appliance. This capability shall be supported through one or more means, as
165 identified in section 4B2.

166 The specific design and implementation of the Connected Clothes Washer System is at the
167 manufacturer’s discretion provided it is interoperable with other devices via open communications
168 protocol and enables economical consumer-authorized third party access to the functionalities provided
169 for in sections 4D, 4F, and 4G. The capabilities shall be supported through one or more means, as
170 identified in section 4B2. A product that enables economical and direct, on-premises, open-standards
171 based interconnection is the preferred option for meeting this requirement, but alternative approaches are

172 also acceptable.

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174 The product must continue to comply with the applicable product safety standards – the addition of the
175 functionality described below shall not override existing safety protections and functions. The appliance
176 must meet manufacturer’s internal minimum performance guidelines, e.g., cleaning performance.
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178 **Figure 1. Connected Clothes Washer System Boundary – Illustrative Example**
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181 *Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between the*
182 *Connected Clothes Washer System and Energy Management Device/Application(s). These elements could be within the base*
183 *appliance, and/or an external communication module, a hub/gateway, or in the Internet/cloud.*
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186 **B. Communications**

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188 1. Open Standards – Communication with entities outside the Connected Clothes Washer System that
189 enables connected functionality (sections 4D, 4F, 4G) must use, for all communication layers,
190 standards:
- 191 a. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,⁵ and/or
 - 192 b. Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
 - 193 c. Adopted by the American National Standards Institute (ANSI) or another well-established
 - 194 international standards organization such as the International Organization for Standardization
 - 195 (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union
 - 196 (ITU), Institute of Electrical and Electronics Engineers (IEEE), or Internet Engineering Task Force
 - 197 (IETF).
- 198
- 199 2. Communications Hardware Architecture – Communication with entities outside the Connected
200 Clothes Washer System that enables connected functionality shall be enabled by any of the following
201 means, according to the manufacturer’s preference:
- 202 a. Built-in communication technology
 - 203 b. Manufacturer-specific external communication module(s) and/or device(s)

⁵ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

- 204 c. Open standards-based communication port on the appliance combined with open standards-
205 based communications module
206 d. Open standards-based communication port(s) on the appliance in addition to a, b or c, above
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208 If option b or c is used, the communication module/device(s) must be easy for a consumer to install
209 and shipped with the appliance, provided to the consumer at the time of sale, or provided to the
210 consumer in a reasonable amount of time after the sale.
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212 C. Open Access

213 To enable interconnection with the product, in addition to section 4B1 that requires open-standards, an
214 interface specification, Application Programming Interface (API) or similar documentation shall be made
215 available to interested parties that at a minimum, allows transmission, reception and interpretation of the
216 following information:
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- 218 1. Energy Consumption Reporting specified in section 4D (must include accuracy, units and
219 measurement interval);
220 2. Operational Status, User Settings & Messages specified in section 4F (if transmitted via a
221 communication link);
222 3. Demand Response specified in section 4G.

223 D. Energy Consumption Reporting

224 In order to enable simple, actionable energy use feedback to consumers and consumer authorized
225 energy use reporting to 3rd parties, the product shall be capable of transmitting energy consumption data
226 via a communication link to energy management systems and other consumer authorized devices,
227 services, or applications. This data shall be representative of the product's interval energy consumption.
228 It is recommended that data be reported in watt-hours for intervals of 15 minutes or less, however,
229 representative data may also be reported in alternate units and intervals as specified in the product
230 manufacturer's interface specification or API detailed in section 4C.
231

232 The product may also provide energy use feedback to the consumer on the product itself. On-product
233 feedback, if provided, may be in units and format chosen by the manufacturer (e.g., \$/month).
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235 E. Remote Management

236 The product shall be capable of receiving and responding to consumer authorized remote requests (*not*
237 *including third-party remote management which may be made available solely at the discretion of the*
238 *manufacturer*), via a communication link, similar to consumer controllable functions on the product. The
239 product is not required to respond to remote requests that would compromise performance and/or product
240 safety as determined by the product manufacturer.
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242 F. Operational Status, User Settings & Messages

- 243 1. The product shall be capable of providing the following information to energy management systems
244 and other consumer authorized devices, services or applications via a communication link:
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 - 246 • Operational / Demand Response (DR) status (e.g., off/standby, cycle in process, delay appliance
247 load, temporary appliance load reduction).
- 248 2. The product shall be capable of providing the following information on the product and/or to energy
249 management systems and other consumer authorized devices, services or applications via
250 communication link:
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 - 252 • At least two types of messages relevant to the energy consumption of the product. For example,
253 messages for clothes washers might address performance issues or report of energy
254 consumption that is outside the product's normal range.

255 **Note:** Several stakeholders supported including operational status reporting to help authorized entities determine
256 the load available for demand response. EPA has incorporated minor changes into this draft, by suggesting that
257 washers be able to report only two basic states - whether they are in a lower power state (e.g., off or standby) or a
258 cycle is running. Given the limited information available as to exactly what data elements will be most valuable,
259 EPA removed the suggestion that a product also report when it is in a delay start mode. EPA may consider
260 integrating such a requirement with greater specificity into future specification updates. The Agency welcomes
261 feedback from manufacturers and utilities as to how more detailed operation status reporting could improve a
262 utility's ability to implement a demand response program for appliances.

263 G. Demand Response

264 A connected clothes washer shall have the capability to receive, interpret and act upon consumer-
265 authorized signals by automatically adjusting its operation depending on both the signal's contents and
266 settings from consumers. At a minimum, the product shall be capable of providing the following:

- 267 1. *Delay Appliance Load Capability:* The capability of the product to respond to a signal in accordance
268 with consumer settings, except as permitted below, by delaying the start of an operating cycle beyond
269 the delay period.
 - 270 a. Default settings –The product shall ship with default settings that enable a response in
271 accordance with 4G1 for at least 4 hours.
 - 272 b. Consumer override – The consumer shall be able to override the product's Delay Appliance Load
273 response before or during a delay period.
 - 274 c. The product shall be able to provide a Delay Appliance Load response at the start of each
275 consumer initiated operating cycle, but is not required to provide more than three Delay Appliance
276 Load responses in a rolling 24-hour period.
- 277 2. *Temporary Appliance Load Reduction Capability:* TBD

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281 **Note:** EPA has further harmonized the minimum criteria for DR responses with the latest clothes dryer proposal
282 that requires products to be able to provide a minimum number of responses per consumer initiated operating
283 cycle. Some stakeholders were also concerned that consumers would be inconvenienced from being asked to
284 delay load too frequently, but suggested three times per 24-hours as acceptable. Therefore, the revised criteria ,
285 while requiring clothes washers to be able to delay the start of each cycle, does not require the product to be able
286 to delay load more than three times in a rolling 24 hour period. EPA's intention is to balance potential grid
287 benefits of reducing and deferring load through more flexible operation, with the need to continue to offer a good
288 consumer experience (e.g., avoid overly long and unexpected delays).

289
290 EPA also received feedback on the clothes washer Temporary Appliance Load Reduction (TALR) capability that,
291 as proposed in Draft 2, would require a 50% reduction in energy use over at least 10 minutes. Stakeholder
292 feedback received raised new considerations over how to define and test this capability. In response, EPA and
293 DOE are evaluating options for defining clothes washer TALR criteria and associated testing considerations.
294 EPA has added a placeholder in this Final Draft and plans to engage with stakeholders in 2014 in order to finalize
295 clothes washer TALR criteria.

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297 EPA and DOE note that the testing and test procedure development may yield further insights on clothes washer
298 DR capabilities. As this effort proceeds, EPA will work closely with DOE and clothes washer stakeholders to
299 consider whether any adjustments to the DR criteria listed above, should be considered.

300 301 H. Information to Consumers

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303 If additional modules, devices, services and/or infrastructure are part of the configuration required to
304 activate the product's communications capabilities, prominent labels or other forms of consumer
305 notifications with instructions shall be displayed at the point of purchase and in the product literature.
306 These shall provide specific information on what consumers must do to activate these capabilities (e.g.
307 "This product has Wi-Fi capability and requires Internet connectivity and a wireless router to enable

interconnection with an Energy Management System, and/or with other external devices, systems or applications.”).

5) **Test Requirements:**

A. One of the following sampling plans shall be used to test for qualification to ENERGY STAR:

1. A representative unit shall be selected for testing based on the definition for Basic Model provided in Section 1 above; or
2. Units shall be selected for testing per the sampling requirements as defined in Table 4:

**Table 4: ENERGY STAR
Sampling Requirements for Clothes Washers**

Residential Clothes Washers	10 CFR § 429.20, which references 10 CFR § 429.11
Commercial Clothes Washers	10 CFR § 429.46, which references 10 CFR § 429.11

B. When testing the energy and water efficiency of clothes washers, the following test method shall be used to determine ENERGY STAR qualification:

Table 5: Test Methods for ENERGY STAR Qualification

Efficiency Requirement	Test Method Reference
Residential Clothes Washers: IMEF and IWF	10 CFR 430, Subpart B, Appendix J2 ¹
Commercial Clothes Washers: MEF and WF	

¹ 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>

C. 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 evaluated using the **TBD** ENERGY STAR Clothes Washers Test Method to validate Demand Response in order to be eligible for the connected allowance.

Note: As mentioned above. DOE plans to develop a test method to validate the DR capabilities of residential clothes washers that will be cited in section C above, once complete.

As discussed in the Draft 2, the test procedure reference for commercial clothes washers has also been updated to Appendix J2. EPA plans to propose translations for the current commercial clothes washer MEF and WF levels included in Section 3 (based on Appendix J1), to MEF and WF levels based on Appendix J2, once DOE’s crosswalk analysis is available.

6) **Effective Date:** The ENERGY STAR Clothes Washer specification shall take effect on **March 7, 2015**. 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 on which a unit is considered to be completely assembled.

7) **Future Criteria Revisions:** ENERGY STAR 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 the ENERGY STAR qualification is not automatically granted for the life of a product model.