



ENERGY STAR® Program Requirements Product Specification for Clothes Dryers

Eligibility Criteria Draft 2 Version 1.0

Following is the **Draft 2 Version 1.0** product specification for ENERGY STAR qualified residential clothes dryers. A product shall meet all of the identified required criteria to earn the ENERGY STAR.

- 1) Definitions:** Below are the definitions of the relevant terms in this document. As noted below, definitions are identical with definitions in the DOE test procedure at 10 CFR 430, Subpart B, Appendix D1 or 10 CFR 430.2. When in conflict, the definitions in the Code of Federal Regulations (CFR) take precedence.
- A. Electric Clothes Dryer¹: A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is electricity and the drum and blower(s) are driven by an electric motor(s).
 - B. Gas Clothes Dryer¹: A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is gas and the drum and blower(s) are driven by an electric motor(s).
 - C. Compact size Clothes Dryer²: A clothes dryer with a drum capacity of less than 4.4 cubic feet.
 - D. Standard size Clothes Dryer²: A clothes dryer with a drum capacity of 4.4 cubic feet or greater.
 - E. Conventional (Vented) Clothes Dryer²: A clothes dryer that exhausts the evaporated moisture from the cabinet.
 - F. Ventless Clothes Dryer²: A clothes dryer that uses a closed-loop system with an internal condenser to remove the evaporated moisture from the heated air. Moist air is not discharged from the cabinet.
 - G. Water-Cooled Ventless Clothes Dryer: A ventless clothes dryer that uses cold tap water for internal condenser cooling.
 - H. Commercial Clothes Dryer: An electric or gas clothes dryer that is designed for use in:
 - 1. Applications in which the occupants of more than one household will be using the clothes dryer, such as multi-family housing common areas and coin laundries; or
 - 2. Other commercial applications.
 - I. 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.
 - J. 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.
 - K. Combined Energy Factor (CEF)²: The clothes dryer test load weight in pounds divided by the sum of the per cycle standby and off mode energy consumption and either the total per-cycle electric dryer energy consumption or the total per-cycle gas dryer energy consumption expressed in kilowatt hours (kWh).

¹ 10 CFR 430 Subpart A, Section 430.2

² 10 CFR 430 Subpart B, Appendix D2

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51 L. Basic Model³: Units of a given type of covered product (or class thereof) manufactured by one
52 manufacturer, having the same primary energy source, and which have essentially identical electrical,
53 physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency,
54 water consumption, or water efficiency.
55
56 M. Consumer Product³: Any article (other than an automobile, as defined in Section 501(1) of the Motor
57 Vehicle Information Cost Savings Act) which: (1) in operation consumes, or is designed to consume,
58 energy and (2) to any significant extent, is distributed in commerce for personal use or consumption by
59 individuals.

60 **Note:** EPA has updated the definition of CEF to be identical to the definition in the DOE's August 2013 test
61 procedure final rule, and included a definition of Consumer Product, a term used in Section 2, for clarity. The
62 definitions for Automatic Termination Control, Temperature Sensing Control and Moisture Sensing Control have
63 been removed because these terms are no longer applicable to ENERGY STAR qualification.

64 For added clarity, EPA has associated footnotes with DOE regulatory definitions, referencing the definition's
65 location in the Code of Federal Regulations (CFR) or Federal Register, and has incorporated new language
66 stating that in cases of conflict, the CFR takes precedence.

67 EPA welcomes stakeholder comments on latest set of definitions included in Section 1.

68 **2) Scope:**

- 69
70 A. Included Products: Products that meet the definition of an Electric Clothes Dryer or Gas Clothes Dryer,
71 and the definition of a consumer product as specified herein are eligible for ENERGY STAR qualification,
72 with the exception of products listed in Section 2B.
73
74 B. Excluded Products: Commercial Clothes Dryers, Water-Cooled Ventless Clothes Dryer, Combination All-
75 in-One Washer-Dryers, and Residential Clothes Washers with an Optional Dry Cycle as defined in
76 Section 1 are not eligible for ENERGY STAR under this specification.
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78 **3) Qualification Criteria:**

- 79
80 A. Combined Energy Factor (CEF): CEF shall be greater than or equal to the Minimum CEF (CEF_{MIN}) as
81 calculated per Equation 1.

82 **Equation 1. Calculation of Minimum CEF**

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

83 *where,*

84 *CEF_{BASE} is the base CEF, per Table 1*

85 *$CEF_{Adder_Connected}$ is the CEF connected allowance, per Table 2*
86
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³ 10 CFR 430 Subpart A, Section 430.2. Note: Definition of consumer product has been abbreviated to be specific to clothes dryers by omitting the regulatory definition's references to lighting and water.

Table 1: Base CEF

Product Type	CEF _{BASE} (lbs/kWh)
Vented Gas	3.48
Ventless or Vented Electric, Standard (4.4 cu-ft or greater capacity)	3.93
Ventless or Vented Electric, Compact (120V) (less than 4.4 cu-ft capacity)	3.80
Vented Electric, Compact (240V) (less than 4.4 cu-ft capacity)	3.45
Ventless Electric, Compact (240 V) (less than 4.4 cu-ft capacity)	2.68

Table 2: Connected Allowance

Product Type	CEF _{Adder_Connected} ¹
All Electric Dryer Types in Table 1 ²	0.05 x CEF _{BASE}

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

² Product must be qualified using the final and validated ENERGY STAR Clothes Dryers Test Method to Validate Demand Response to use the allowance.

- 88 B. **Reporting Requirement for Drying Time:** The elapsed time for the product to complete the test cycle shall
 89 be measured and reported as part of ENERGY STAR certification.
 90

91 **Note:** In Draft 2, EPA is proposing to reference the amended DOE clothes dryer test procedure published in late
 92 July 2013 (Appendix D2 to Subpart B of Part 430 – Uniform Test Method for Measuring the Energy Consumption
 93 of Clothes Dryers, hereby referenced as Appendix D2) in Version 1.0. This test procedure contains amendments
 94 to 10 CFR 430 Appendix D1, hereby referenced as Appendix D1, which more accurately measure the effects of
 95 clothes dryer automatic cycle termination that have been recommended by a variety of stakeholders.¹ In contrast,
 96 under Appendix D1, the clothes dryer cycle is stopped manually by the operator near the end of the cycle (when
 97 test load reaches between 2.5 and 5% remaining moisture content (RMC)), and fixed field use factors are applied
 98 to account for over drying. The Appendix D2 better reflects the way consumers use a clothes dryer, will more
 99 accurately measure the energy consumption of control clothes dryers, and allows for greater differentiation among
 100 clothes dryer efficiency. The test also provides manufacturers with the incentive to improve the technology that
 101 senses when a load is “dry” (sensors and control algorithms), that will reduce wasted energy at the end of the
 102 dryer cycle. The Appendix D2 test procedure also includes a separate test method for timer dryers, similar to the
 103 test method under Appendix D1, but the cycle is stopped manually by the operator when the test load reaches
 104 between 1 and 2.5% RMC to reflect a revised target final RMC of 2%.

105 ¹ “Joint Petition to Amend the Test Procedure for Residential Clothes Dryers to Include Provisions Related to Automatic Termination Controls”
 106 submitted to DOE by appliance manufacturers and efficiency advocates.
 107

109 **Note (cont):**

110 DOE tested a representative sample of 20 clothes dryers as part of its recent test procedure rulemaking process.
111 All of the dryers tested under Appendix D2 used more energy, resulting in a calculated lower CEF value, than
112 when tested to Appendix D1. Some additional energy expenditure was associated with the lower RMC target.
113 However, the sample of clothes dryers tested also showed significant variation in the amount of additional energy
114 use, ranging from just 4 percent more energy up to 62 percent more energy. The Appendix D2 test procedure
115 also revealed a greater differentiation in dryer energy efficiency. For standard electric clothes dryers, energy-
116 efficiency (assessed using the CEF metric) ranged from 2.71 to 3.51, a difference of 30% compared to 7% under
117 Appendix D1. Standard gas dryers' CEF efficiency ranged from 2.69 to 3.25, a difference of 21% compared to
118 5% under Appendix D1. Also notable, EPA observed that the relative efficiency (i.e., CEF rank) of some clothes
119 dryers changed when the cycle was permitted to run until the automatic cycle completes, further reinforcing the
120 importance of using Appendix D2 to characterize the energy-efficiency of clothes dryers in order to earn the
121 ENERGY STAR.
122

123 **Revised CEF Criteria**

124 The new CEF levels proposed in Table 1 above were developed using a data set consisting of: 1) the 20 units
125 tested by DOE during their rulemaking process, 2) test data from the CLASP 2013 report *Analysis of Potential*
126 *Energy Savings from Heat Pump Clothes Dryers in North America* and 3) additional test data submitted by utility
127 stakeholders. Additionally, as detailed in the supplemental documentation, EPA considered efficiency
128 improvements in the DOE Technical Support Documents (TSDs) and additional technical information shared with
129 EPA by manufacturers and other interested stakeholders through the specification development process. EPA's
130 data set, charts and supporting analysis are available for stakeholder review on the ENERGY STAR Version 1.0
131 clothes dryer specification development website. While the minimum energy efficiency criteria continue to be
132 expressed using CEF, it is important to note that the Draft 2 proposed CEF levels are not directly comparable to
133 the Draft 1 levels since they are based on two different test procedures.
134

135 The dataset illustrates the opportunity to meaningfully differentiate clothes dryers based on energy use.
136 Differences in dryers' automatic termination controls (sensors and control algorithms) that determine when the
137 load is "dry" in order to terminate the cycle appear to contribute significantly to this variation in energy
138 performance. From the set of clothes dryers tested, the best performing electric standard clothes dryers obtained
139 CEF values of 3.48-3.51. From those CEF performance levels, an additional 11% energy savings would be
140 necessary to reach the Draft 2 proposed CEF level of 3.93. EPA notes that this is well below the CEF values
141 achieved by a selection of European heat pump clothes dryers tested by CLASP, which ranged from 6.6 to 8.6.
142 (These models also appear to have relatively longer drying times, 70-100 minutes total, than dryers currently on
143 the U.S. market.) However, EPA has had several discussions with manufacturers regarding plans to introduce
144 more efficient electric designs into the U.S. market that offer similar dry times as standard designs e.g., the
145 recently released Emerging Technology Award winning dryer that uses at least 27% less energy than a standard
146 dryer and still offers a dry time of 75 minutes in a lower-heat, more energy efficient setting.
147

148 The best performing gas dryers in EPA's data set reached a CEF of 3.25; an additional 7% energy savings would
149 enable units to meet the proposed criteria. Based on stakeholder feedback and considering the number of
150 available design options for improving clothes dryer efficiency including improved automatic termination (sensors
151 and controls) that reduces wasted energy after the load is "dry", modulation, heat recovery, drum improvements,
152 insulation, and heat pump or hybrid heat pump technology, EPA expects multiple manufacturers will be able to
153 offer consumers clothes dryers that meet the proposed efficiency requirements at a price point that delivers
154 reasonable consumer payback. EPA has provided additional detail in the supplemental Excel data file found on
155 the dryers specification development webpage, and welcomes discussion on the data and proposed efficiency
156 requirements. EPA encourages stakeholder to share any additional information that can supplement this dataset.
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Note (cont):

EPA estimates the CEF levels identified in Table 1 represent a 20% and 21% energy savings for vented gas and electric standard clothes dryers, respectively. Together, these two product classes reflect approximately 98% of the residential clothes dryer market. To estimate energy savings, EPA multiplied the 2015 Federal standards (expressed in CEF) by the average change in dryers' assessed CEF between Appendix D1 and Appendix D2, seen in DOE testing for the test procedure rulemaking. EPA used the resulting CEF values as estimates of the baseline energy efficiency of clothes dryer in 2015. EPA used the DOE Appendix D2 to estimate consumers' savings from an automatic cycle termination dryer that meets the proposed efficiency requirements. Additional detail on energy savings analysis is provided in the supplemental Excel file. EPA encourages stakeholders to share any additional test data that would further inform the development of a baseline clothes dryer's energy use.

Under Appendix D2, EPA estimates consumers would save approximately \$9 annually with an ENERGY STAR certified vented gas and \$18 with an ENERGY STAR certified electric standard clothes dryer. These savings estimates may be conservative, as recent field data collection by Northwest Energy Efficiency Alliance (NEEA) indicated that on average annual clothes dryers in that territory was 920 kWh, which represents about 20% more energy than the Draft 2 baseline of 769 kWh/yr derived from DOE Appendix D2 test method. The difference in annual energy use appears to be largely driven by the different number of cycles (NEEA's research suggested 337 vs. the DOE test procedure in Appendix D2 specifies 283); EPA noted difference between the energy use per cycle is fairly small (< 3%).

EPA is also proposing revised CEF criteria for compact clothes dryers. Through its rulemaking process, DOE tested a total of four compact clothes dryer units that fall under the three compact product classes included in Table 1. The proposed levels represent an average energy savings of 21% over the assessed baseline. As with standard sized clothes dryers, the Agency estimated a baseline for energy savings by utilizing an adjusted 2015 Federal standard; taking into account differences in calculated CEF values under the two test methods: Appendix D1 and Appendix D2. The dataset for compact vented (120V and 240V) and compact ventless 240V residential dryer product classes is more limited. EPA is especially interested in any additional compact dryer efficiency test data that might be used to supplement the current dataset.

Product Classes

After considering stakeholder feedback, EPA has expanded two product class descriptions – Electric Compact 120V and Electric Standard – to include ventless as well as vented configurations. In response to Draft 1, some stakeholders commented that ventless dryers available in other countries might be introduced or modified and introduced, into the U.S./North American market. EPA is concerned that limiting the specification to the product types covered in Draft 1 may impede potential market advancements for high efficiency ventless clothes dryer designs. Therefore in Draft 2, EPA is proposing to explicitly include ventless standard electric and compact 120V configurations in the specification, using the same efficiency criteria as similarly configured vented dryers. EPA acknowledges that 240V Electric Compact Dryers have a separate product class and level (established by DOE for minimum standards). However, EPA has limited data at this time to evaluate separate levels for ventless electric standard clothes dryers and ventless electric compact 120V clothes dryers. EPA welcomes stakeholder feedback on the proposal to extend the criteria to additional types of ventless clothes dryers and the appropriateness of the levels proposed.

Connected Allowance

EPA corrected the note that the calculated CEF connected adder should be rounded down to the nearest hundredth place, instead of to the nearest tenth as proposed in Draft 1, before being applied in Equation 1. This aligns with the proposed CEF requirements that are rounded to the nearest hundredth place.

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Note (cont): New Reporting Requirement for Drying Time

Instead of the drying time requirement proposed in Draft 1, EPA is proposing in Draft 2 that the time to complete the DOE test at Appendix D2, be recorded during the test and reported for ENERGY STAR certification. In response to Draft 1, stakeholders raised a number of concerns with the proposed maximum drying time requirement and EPA agrees with many of these comments. The Agency understands that a key driver in the U.S. residential laundry market is for paired laundry units (clothes washers and clothes dryers) to have similar cycle times, enabling consumers to run serial loads. Given this and the difficulties with determining what constitutes a minimally acceptable dry time for consumers and the potential differences between the dry time of the DOE test cloth load and "real world" loads, EPA believes a first step is to gather consistent data regarding dryer cycle time to further understand if there is an inherent link between drying time and efficiency, and whether there are differences among product designs. The Agency is also considering making the reported clothes dryer cycle time available to consumers on the ENERGY STAR website with supporting information that about how dry time can vary based on the load, starting moisture content, and cycle selected. Providing this information on the website would allow consumers to have standardized information that enables them to compare the energy-efficiency and the length of the dry cycle of models. EPA welcomes feedback on the proposal to require that the length of the drying cycle be reported as part of ENERGY STAR certification and on making this information available for consumers on the ENERGY STAR website.

Removal of Automatic Termination Criteria

In Draft 1, EPA proposed specific design and operational requirements for dryers equipped with automatic cycle termination. The Agency has reviewed stakeholder feedback, some of which noted the prescriptive nature of the Draft 1 proposed design requirements might hinder potential innovation in automatic cycle termination controls/systems intended to improve efficiency. With the release of Appendix D2, the Agency feels that such design requirements are no longer necessary for ENERGY STAR as the updated test procedure will be capable of identifying effective automatic termination dryer design. EPA welcomes stakeholder feedback regarding this new path to evaluating performance of dryers' automatic termination functionality.

Removal of Warranty Requirements

There is precedence for including warranty requirements in ENERGY STAR specifications to ensure that performance is maintained with greater energy efficiency, particularly in sectors where new technologies are being brought to market that are yet to be vetted through extensive consumer use. The intention of including warranty requirements in the Draft 1 specification was to ensure that energy efficient dryer designs, especially those that include heat pump technology which U.S. consumers are not yet familiar with, meet consumer expectations for quality and performance longevity. However, in light of stakeholder feedback received on the Draft 1 and absent more specific data on quality or longevity of clothes dryers and their subcomponents, EPA has decided to remove warranty requirements for this Draft 2 specification. EPA is also not aware of such issues in other markets where heat pump dryers have been available for a number of years. The Agency welcomes stakeholder feedback on this change.

- C. Significant Digits and Rounding: All calculations shall be carried out as specified in Subpart B of Part 430 Appendix D2, as applicable; and 10 CFR Part 430.23(d)(3), as applied to Appendix D2.

Note: EPA and DOE have updated the significant digits and rounding requirements, to reflect the proposed DOE test procedure.

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

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4) Connected Product Criteria:

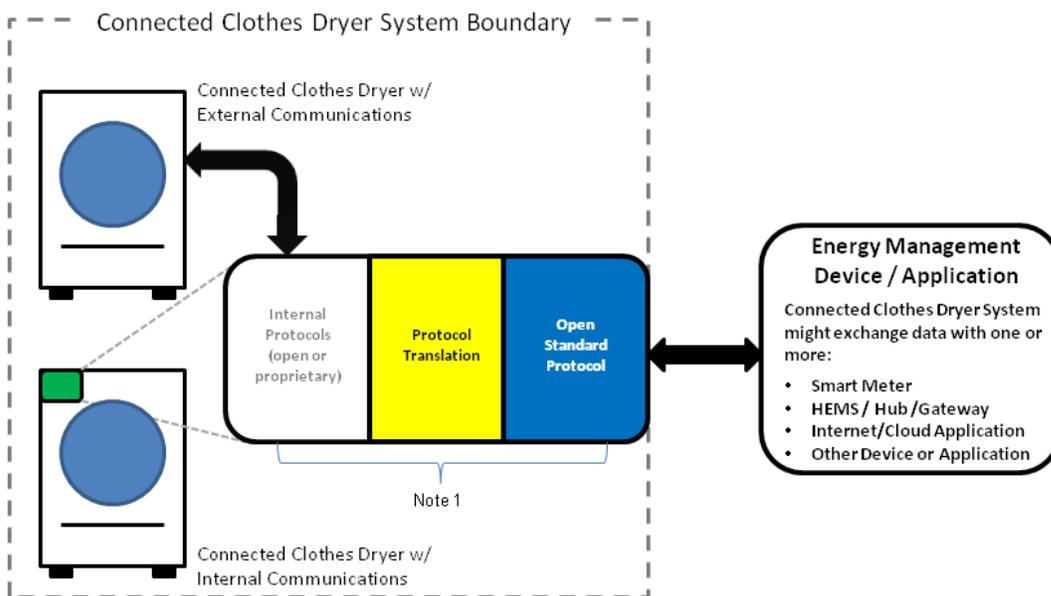
A. Connected Clothes Dryer System

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

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

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

Figure 1. Connected Clothes Dryer System Boundary – Illustrative Example



Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between the Connected Clothes Dryer 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.

281 **Note:** The ENERGY STAR program is helping advance the market for products with intelligent features in ways
282 that deliver immediate consumer benefit as well as support a low-carbon electricity grid over the long-term. As
283 part of this, EPA hopes to:

- 284
- 285 – Offer consumers a new functionality that can enable immediate energy savings and convenience
286 opportunities such as:
- 287 - receiving an alert there is a performance issue with your clothes dryer and enabling a service
288 center to make an initial assessment of the problem remotely and come prepared with necessary parts;
 - 289 - notification that your dryer has finished its cycle;
 - 290 - receiving a message that your refrigerator door didn't close; and
 - 291 - learning how much energy you might save from lowering your furnace setting a few
292 degrees with the help of your Climate Control.
- 293
- 294 – Help to ensure the consumer is being considered on the product side of smart grid deployment (e.g., ensuring
295 consumers have the ability to override any response); and
- 296
- 297 – Encourage manufacturers to begin to make available, products with future-oriented demand response
298 capabilities that could support a reliable, lower emissions electric grid (e.g., enabling greater penetration of
299 variable renewable energy sources).

300

301 The proposed connected criteria for dryers are based on those developed within a recent specification revision for
302 refrigerators and freezers that included extensive stakeholder engagement on connected criteria. The clothes
303 dryers connected criteria being proposed in Section 4 stress interoperability and the use of open protocols while
304 also reflecting a more flexible approach that allows for multiple paths of implementation. This approach provides
305 the Agency a basis upon which to consider products with connected functionality as they begin to enter the
306 market and make more prescriptive changes to the requirements, based on real-world market experience, as
307 warranted.

308

309 EPA will plan a strong role in consumer education to help further the understanding of additional convenience and
310 savings opportunities associated with connected ENERGY STAR products, as well as how to best capture the
311 new opportunities for energy savings (e.g. from diagnostics/alerts, use of energy saving modes), and new
312 opportunities for smart grid interconnection.

313

314 In Section 4, EPA is proposing the connected criteria be applicable to both gas and electric residential clothes
315 dryers, based on an initial understanding that some manufacturers are planning to bring both gas and electric
316 dryers to the market that offer connected features. EPA is specifically seeking more feedback on remote
317 management and demand response, as they pertain to gas dryers, as discussed in a later note box.

318 B. Communications

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- 320 1. Open Standards – Communication with entities outside the Connected Clothes Dryer System that
321 enables connected functionality (sections 4D, 4F and 4G) must use, for all communication layers, the
standards:
- 322 • Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,⁴ and/or
 - 323 • Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
 - 324 • Adopted by the American National Standards Institute (ANSI) or another well-established
325 international standards organization such as the International Organization for Standardization
326 (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union
327 (ITU), Institute of Electrical and Electronics Engineers (IEEE) or Internet Engineering Task Force
328 (IETF).
- 329
- 330 2. Communications Hardware Architecture – Communication with entities outside the Connected Clothes

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

331 Dryer System that enables connected functionality (sections 4D through 4G) shall be enabled by any
332 of the following means, according to the manufacturer's preference:

- 333 a. Built-in communication technology
- 334 b. Manufacturer-specific external communication module(s) and/or device(s)
- 335 c. Open standards-based communication port on the appliance combined with open standards-
336 based communications module
- 337 d. Open standards-based communication port(s) on the appliance in addition to a, b or c, above
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339 If option b or c is used, the communication module/device(s) must be easy for a consumer to install
340 and shipped with the appliance, provided to the consumer at the time of sale, or provided to the
341 consumer in a reasonable amount of time after the sale.
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343 C. Open Access
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345 To enable interconnection with the product, in addition to section 4B1 that requires open-standards, an
346 interface specification, API or similar documentation shall be made available to interested parties that at a
347 minimum, allows transmission, reception and interpretation of the following information:
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- 349 ▪ Energy Consumption Reporting specified in section 4D (must include accuracy, units and
350 measurement interval);
- 351 ▪ Operational Status, User Settings & Messages specified in section 4F (if transmitted via a
352 communication link);
- 353 ▪ Demand Response specified in section 4G

354 D. Energy Consumption Reporting
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356 In order to enable simple, actionable energy use feedback to consumers and consumer authorized energy
357 use reporting to 3rd parties, the product shall be capable of transmitting energy consumption data via a
358 communication link to energy management systems and other consumer authorized devices, services, or
359 applications. This data shall be representative of the product's interval energy consumption. It is
360 recommended that data be reported in watt-hours for intervals of 15 minutes or less, however,
361 representative data may also be reported in alternate units and intervals as specified in the product
362 manufacturer's interface specification or API detailed in section 4C.

363 The product may also provide energy use feedback to the consumer on the product itself. On-product
364 feedback, if provided, may be in units and format chosen by the manufacturer (e.g., \$/month).
365

366 E. Remote Management

367 Electric clothes dryers shall be capable of receiving and responding to consumer authorized remote
368 requests (*not including third-party remote management which may be made available solely at the*
369 *discretion of the manufacturer*), via a communication link, similar to consumer controllable functions on the
370 product. The product is not required to respond to remote requests that would compromise performance
371 and/or product safety as determined by the product manufacturer.
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373 F. Operational Status, User Settings & Messages
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- 375 1. The product shall be capable of providing the following information to energy management systems
376 and other consumer authorized devices, services or applications via a communication link:
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 - 378 • Operational / Demand Response status (e.g., off, standby, delay start, cycle in process, delay
379 appliance load, temporary appliance load reduction).

- 380 2. The product shall be capable of providing the following information on the product and/or to energy
381 management systems and other consumer authorized devices, services or applications via
382 communication link:
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384 • At least two types of messages relevant to the energy consumption of the product. For example,
385 messages for clothes dryers might address performance issue such as a clogged lint filter or
386 report of energy consumption that is outside the product's normal range.

387 **Note:** After further consideration of the nascent state of standardization for both price signaling and for price-
388 responsive devices, EPA has elected not to include specific criterion for price signal responsiveness in Version
389 1.0. Stakeholders have informed EPA that at a system level, price responsiveness may be implemented in
390 conjunction with Section G demand response functionality. EPA believes the importance of price responsiveness
391 is well recognized by utilities and the appliance industry and as such, expects the market will drive development
392 of appliances that are capable of tailoring their consumption in response to a dynamic pricing environment. EPA
393 will continue to monitor the marketplace and related technical developments and encourages stakeholder
394 feedback on this approach.

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396 In Section 4E, EPA has limited the remote management criterion to electric clothes dryers, only, with the
397 understanding that safety standards would preclude gas clothes dryers from being remotely operated. EPA
398 welcomes feedback on this proposal.

399
400 Section 4F1, operational / demand response status reporting criteria includes additional reporting, above that
401 required for refrigerators and freezers. This change has been proposed to ensure those entities authorized to
402 send demand response signals are able to assess the order of magnitude of dispatch-able clothes dryer load prior
403 to signaling. EPA expects that this change will be particularly important for products such as residential clothes
404 dryers that, while having high peak power consumption, are primarily in standby or off mode. Stakeholders that
405 commented generally supported a similar proposal made in the clothes washer specification revision, although
406 appliance manufacturers sought more clarity on what level of operational detail products would have to provide.
407 Above, EPA has listed: off, standby, delay start, and cycle in process – but encourages feedback from
408 stakeholders on these modes. Would more detail be helpful to utilities as they evaluating the behavior of
409 appliances' demand response functions and/or operate appliance demand response programs – and if so, what
410 detail? Should "cycle in process" reporting be accompanied by the estimated time left until cycle completion?
411 Should "delay start" status be accompanied by the amount of time before the cycle is scheduled to start? How
412 will consumer privacy be managed and protected? EPA encourages stakeholder feedback these topics.

413
414 G. Demand Response

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

- 418
419 1. *Delay Appliance Load Capability:* The capability of the product to respond to a signal by delaying the
420 start of an operating cycle beyond the delay period. Upon receipt of signal and in accordance with
421 consumer settings, except as permitted below, the product shall delay the start of the operating cycle
422 beyond the delay period.
- 423 a. Default settings –The product shall ship with default settings that enable a response in accordance
424 with 4G1 for at least 3 hours.
- 425 b. Consumer override – The consumer shall be able to override the product's Delay Appliance Load
426 response before or during a delay period.
- 427 c. The product shall be able to provide at least one Delay Appliance Load response at the start of
428 each consumer initiated operating cycle.
- 429
430 2. *Temporary Appliance Load Reduction Capability:* The capability of the product to respond to a signal
431 by providing load reduction for a short time period, typically 10 minutes. Upon receipt of signal and in

- 432 accordance with consumer settings, except as permitted below, the product shall restrict its average
433 power draw during the load reduction period to no more than 80% of the average power draw during
434 this period in the operating cycle as defined in the Test Method to Validate Demand Response.
- 435 a. Default settings - The product shall ship with default settings that enable a response in accordance
436 with 4G2 for a time period of at least 10 minutes.
 - 437 b. Consumer override – The consumer shall be able to override the product’s Temporary Appliance
438 Load Reduction response before or during a load reduction period.
 - 439 c. The product shall be able to provide at least two Temporary Appliance Load Reduction responses
440 during each consumer initiated operating cycle.

Note: The demand response (DR) criteria proposed in Section 4G have been informed by the recommended definition of a “smart” clothes dryer included in the smart appliance petition submitted to ENERGY STAR by the Association for Home Appliance Manufacturers (AHAM), and efficiency advocates and stakeholder comments on the connected criteria for other ENERGY STAR product categories including refrigerators, freezers and clothes washers.

The proposed demand response criteria for clothes dryers include default Delay Appliance Load (DAL) and Temporary Appliance Load Reduction (TALR) capabilities that set minimum durations of 3 hours and 10 minutes, respectively. Manufacturers are also free to implement default response durations that exceed these minimums. The DAL & TALR capabilities include a consumer override requirement identical to that in the ENERGY STAR Version 5.0 Refrigerators and Freezers specification.

The proposed DAL capability would require a 3-hour minimum default response period, while the TALR criterion specifies a 10-minute minimum default response. Additionally, for clothes washers, EPA recently proposed that products be able to provide at least one TALR and one DAL per rolling 24 hours. In response to this proposal for clothes washers – also a cycle based product – some stakeholders were concerned an ‘at least once per 24-hours’ type requirement may be implemented such that products have an absolute limit of only one TALR and one DAL response per 24 hours. Noting that this might be necessary for the satisfactory operation of continuously operating appliances such as refrigerators, stakeholders felt it was unnecessary for cycle-based products.

In consideration of this feedback, for clothes dryers in section 4G, EPA is proposing a minimum of one DAL response *per clothes dryer cycle*, considering that consumers’ experiences may be negatively impacted if their dryer receives and responds to multiple sequential delay load requests that creates a significant delay (e.g., 6 hours) before the drying cycle begins. Considering that the TALR would involve a shorter load reduction period, EPA is proposing products would need to provide at least two TALR responses *per clothes dryer cycle*. EPA encourages stakeholder feedback on both the proposed minimum durations and the criteria that specify, at a minimum, how frequently a dryer must be able to respond. Specifically, EPA is interested in feedback on whether there is an opportunity for dryers to enable additional and/or longer duration DAL/TALR responses without impacting consumer expectations and what, if any, performance considerations should be considered (e.g., the possibility that wet clothes may sit in the clothes dryer for a longer period of time before the drying cycle begins).

EPA encourages stakeholder comment on the proposed DR criteria for clothes dryers.

H. Information to Consumers

If additional modules, devices, services and/or infrastructure are part of the configuration required to activate the product’s communications capabilities, 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 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.*”).

485 **5) Test Requirements:**

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

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

490 2. Units shall be selected for CEF testing per the sampling requirements defined in 10 CFR § 429.21,
 491 which references 10 CFR § 429.11.

492 B. When testing the energy efficiency of clothes dryers, the following test method shall be used to
 493 determining ENERGY STAR qualification:
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Table 3: Test Method for ENERGY STAR Certification

	ENERGY STAR Requirement	Test Method Reference
Clothes Dryers	CEF	10 CFR 430, Subpart B, Appendix D2 ¹

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>

495 **Note:** EPA and DOE are proposing to update the test procedure reference to include Appendix D2, finalized in
 496 August 2013, which contains amendments to Appendix D1 that more accurately measure the effects of both timer
 497 and automatic cycle termination on energy performance. In response to the Draft 1, a number of stakeholders
 498 encouraged EPA to reference a test procedure that more accurately assesses energy use associated with the
 499 automatic cycle termination dryer settings that are typically used by consumers. The Agency believes the
 500 amended DOE test procedure will provide the accuracy that stakeholders are looking for in characterizing energy-
 501 use and relative energy-efficiency of clothes dryers used in the U.S. market while reducing the longer-term burden
 502 of having to re-test for ENERGY STAR purposes in order to capture the performance of automatic termination
 503 setting.

504 C. The length of the drying cycle shall be determined, as required by Section 3B, by measuring the test cycle
 505 time, t, for the drying test cycle specified in sections 3.3.1 and 3.3.2 of Appendix D2 for timer dryers and
 506 automatic termination control dryers, respectively, using a timer accurate to within 2 seconds.

507 For timer dryers, the following correction shall be applied to determine the drying cycle time:

$$508 t_{dry} = [55.5 / (W_w - W_d)] \times t$$

509 Where:

510 W_w = the moisture content of the wet test load as recorded in section 3.4.2 of 10 CFR 430,
 511 subpart B, appendix D2.

512 W_d = the moisture content of the dry test load as recorded in section 3.4.3 of 10 CFR 430,
 513 subpart B, appendix D2.

514 t = the measured test cycle time.
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516 For automatic termination dryers, the drying cycle time equals the test cycle time.
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518 D. Compliance with connected functionality, as specified in Section 4, shall be through examination of
 519 product and/or product documentation. In addition, demand response functionality shall be certified using
 520 the ENERGY STAR Clothes Dryers Test Method to Validate Demand Response (Ref TBD) in order to be
 521 eligible for the connected allowance.
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Note: DOE's test method at Appendix D2 requires timer dryers to be operated at the prescribed cycle settings until the test load reaches a moisture content between 1 and 2.5%, at which point the test cycle is stopped. Because a range of final RMCs is allowed so that test burden is minimized, Appendix D2 provides a correction calculation to normalize the drying cycle time to a reduction in RMC from 57.5% to 2%. For automatic termination dryers, the unit is allowed to run until the completion of the programmed cycle, including any cool down period. If the final moisture content is greater than 2%, the test is declared invalid. If the final RMC is 2% or less, the drying cycle time is equal to the test cycle time with no correction applied because the test cycle time directly measures the automatic cycle termination drying program.

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DOE also plans to develop a test method to validate the DR capabilities of residential clothes dryers that will be referenced in this specification. DOE's test method development will be dependent upon working with manufacturers to obtain products for connected testing. DOE is initiating this effort now and anticipates contacting manufacturers to obtain products for testing or working with them to witness connected product testing in the near term. This test is anticipated to be a separate, add-on test method. Products would need to be qualified using this final and validated ENERGY STAR test method to use the proposed allowance.

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DOE and EPA welcome stakeholder feedback regarding the proposed draft guidance for measuring the duration of a clothes dryer operating cycle under the DOE Appendix D2 test procedure, and the plan to develop a test method for validating clothes dryer demand response capabilities.

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6) Effective Date: The ENERGY STAR Clothes Dryer specification shall take effect on **TBD**. 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.

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Note: EPA anticipates finishing the Clothes Dryers Version 1.0 specification in early 2014 or possibly sooner depending on the nature of the stakeholder comment received on this Draft 2. EPA plans to engage with manufacturers over the next several months to gather information on their timelines for testing products to the amended DOE test method in Appendix D2 and having products that meet the ENERGY STAR requirements on the market. This information will assist EPA in identifying a date by which there will be a selection of ENERGY STAR products available for consumers to choose from.

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7) Future Specification Revisions: EPA reserves the right to change the specification should federal requirements, 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.