



# ENERGY STAR® Program Requirements Product Specification for Clothes Dryers

## Eligibility Criteria Draft 1 Version 1.0

Following is the **Draft 1 Version 1.0** product specification for ENERGY STAR qualified clothes dryers. A product shall meet all of the identified criteria to earn the ENERGY STAR.

**Note:** This Draft 1 Version 1.0 specification contains EPA's proposed ENERGY STAR specification for clothes dryers.

Over the last two years, EPA has actively engaged with stakeholders to discuss efficiency opportunities with clothes dryers; these conversations have contributed to the establishment of Advanced Clothes Dryers as one of the ENERGY STAR Emerging Technology Award Categories in 2012, the development of the Agency's Scoping Report for Residential Clothes Dryers (released in November 2011),<sup>1</sup> the release of a specification development launch letter in July 2012, and this first draft of the clothes dryer specification. EPA is appreciative of stakeholder contributions to date and encourages feedback from all interested stakeholders on this Draft 1 specification and subsequent drafts.

The note boxes below discuss EPA's rationale for the proposed program requirements and identify specific topics on which EPA is seeking comment. Stakeholder comments are also welcomed on considerations not discussed in the note boxes. Please send comments via email to [appliances@energystar.gov](mailto:appliances@energystar.gov) no later than September 28, 2012.

<sup>1</sup> ENERGY STAR Residential Clothes Dryers Scoping Report - [http://www.energystar.gov/ia/products/downloads/ENERGY\\_STAR\\_Scoping\\_Report\\_Residential\\_Clothes\\_Dryers.pdf](http://www.energystar.gov/ia/products/downloads/ENERGY_STAR_Scoping_Report_Residential_Clothes_Dryers.pdf)

**1) Definitions:** Below are the definitions of the relevant terms in this document. Unless otherwise specified, these definitions are identical with definitions in the DOE test procedure at 10 CFR 430, Subpart B, Appendix D1 or 10 CFR 430.2.

- A. Electric Clothes Dryer: 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 Dryer: 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 Dryer: A clothes dryer with a drum capacity of less than 4.4 cubic feet.
- D. Standard size Clothes Dryer: A clothes dryer with a drum capacity of 4.4 cubic feet or greater.
- E. Conventional (Vented) Clothes Dryer: A clothes dryer that exhausts the evaporated moisture from the cabinet.
- F. Ventless Clothes Dryer: A clothes dryer that uses a closed-loop system with an internal condenser to remove the evaporated moisture from the heated air. The moist air is not discharged from the cabinet.
  - 1. Water-Cooled Ventless Clothes Dryer: A ventless clothes dryer that uses cold tap water for internal condenser cooling.

- 49 G. Commercial Clothes Dryer: An electric or gas clothes dryer that is defined for use in:  
50 (i) Applications in which the occupants of more than one household will be using the clothes dryer,  
51 such as multi-family housing common areas and coin laundries; or  
52 (ii) Other commercial applications.  
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- 54 H. Combination All-in-One Washer-Dryer: A consumer product designed to clean and dry fabrics in a single  
55 drum, where a separate drying cycle uses electricity or gas as a heat source and forced air circulation.  
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- 57 I. Residential Clothes Washer with Optional Dry Cycle: A Residential Clothes Washer that has an optional  
58 add-on dry cycle, where drying is accomplished through use of electricity or gas as a heat source and  
59 forced air circulation; drying cannot be selected independently from a wash cycle.  
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- 61 J. Combined Energy Factor: The quotient of the clothes dryer test load weight in pounds divided by the sum  
62 of "active mode" per-cycle energy use and "inactive mode" and "off mode" per-cycle energy use in kWh.  
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- 64 K. Automatic Termination Control: A dryer control system with a sensor which monitors either the dryer load  
65 temperature or its moisture content and with a controller which automatically terminates the drying  
66 process. A mark, detent, or other visual indicator or detent which indicates a preferred automatic  
67 termination control setting must be present if the dryer is to be classified as having an "automatic  
68 termination control." A mark is a visible single control setting on one or more dryer controls.  
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- 70 1. Temperature Sensing Control: A system which monitors dryer exhaust air temperature and  
71 automatically terminates the dryer cycle.  
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- 73 2. Moisture Sensing Control: A system which utilizes a moisture sensing element within the dryer  
74 drum that monitors the amount of moisture in the clothes and automatically terminates the dryer  
75 cycle.  
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- 77 L. Basic Model: Units of a given type of covered product (or class thereof) manufactured by one  
78 manufacturer, having the same primary energy source, and which have essentially identical electrical,  
79 physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency,  
80 water consumption, or water efficiency.

81 **Note:** Consistent with recent revisions to other ENERGY STAR appliance specifications, EPA is harmonizing the  
82 definitions in Section 1 with the definitions in the U.S. Department of Energy (DOE) appliance standards program,  
83 including the test procedure for clothes dryers located in Appendix D1 of 10 CFR Part 430 or the definitions  
84 section in 10 CFR 430.2. To this end, the proposed definitions for Electric Clothes Dryer, Gas Clothes Dryer,  
85 Compact size and Standard size Clothes Dryer, Conventional Clothes Dryer, Ventless Clothes Dryer, Automatic  
86 Termination Control, Temperature Sensing, Moisture Sensing, and Basic Model are identical to the DOE  
87 definitions. The proposed definition of Combined Energy Factor (CEF) is also consistent with Section 4.8 of the  
88 DOE clothes dryer test procedure (Appendix D1).

89 EPA also included definitions for several product types that the Agency is proposing to exclude from the scope of  
90 the Version 1.0 specification. These product types include Combination All-in-One Washer-Dryers and Clothes  
91 Washers with an Optional Dry Cycle; the proposed definitions for these product types are identical with the  
92 definitions in the Version 6.0 ENERGY STAR Clothes Washer specification. Similarly, for reasons discussed in  
93 the Section 2 note box, EPA is planning to exclude Commercial Clothes Dryers and Water-Cooled Ventless  
94 Clothes Dryers. Since EPA is not aware of existing industry definitions for these product types, the Agency has  
95 developed a Commercial Clothes Dryer definition by leveraging the existing definition of a Commercial Clothes  
96 Washer in Version 6.0 ENERGY STAR Product Specification for Clothes Washers and a definition for Water-  
97 Cooled Ventless Clothes Dryer based on the technical characteristics of this type of product.

98 EPA welcomes stakeholder comments on the definitions proposed in Section 1.

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**2) Scope:**

- A. **Included Products:** Products that meet the definition of an Electric Clothes Dryer or Gas Clothes Dryer as specified herein and the definition of a consumer product as specified in 10 CFR 430.2 are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B.
- B. **Excluded Products:** Commercial Clothes Dryers, Water-Cooled Ventless Clothes Dryer, Combination All-in-One Washer-Dryers, and Residential Clothes Washers with an Optional Dry Cycle as specified herein are not eligible for ENERGY STAR under this specification.

**Note:** In Version 1.0, EPA intends to focus only on residential clothes dryers due to the lack of available energy efficiency data on commercial clothes dryer performance. However, as discussed in Section 7, EPA welcomes feedback on the potential inclusion of commercial clothes dryers in future specification revisions. EPA is not proposing to set a size limitation for clothes dryers eligible for ENERGY STAR qualification in this Version 1.0 specification with the understanding that specifically excluding commercial clothes dryers based on intended application will be sufficient to exclude large, non-residential products.

As noted in the July launch letter, EPA is proposing to exclude combination all-in-one washer-dryers and residential clothes washers with an optional dry cycle from the scope of this clothes dryer specification. EPA is also proposing to exclude water-cooled ventless (condensing) clothes dryers from the Version 1.0 specification due to the amount of water they use. The Natural Resources Canada estimates water-cooled condensing dryers use about 8 to 40 liters/cycle (2 to 11 gallons/cycle).<sup>1</sup> Additionally, through initial research, EPA has been unable to find any water-cooled condensing clothes dryers being sold in the U.S. Ventless condensing dryers (excluding combination all-in-one washer-dryers) appear to mainly use air-cooled condensers with bins for collecting water extracted as the load is dried. Since water use is not a concern for air-cooled ventless dryers, EPA proposes to include this product type in the Version 1.0 specification.

EPA welcomes feedback on the proposed scope in Section 2.

<sup>1</sup> <http://oee.nrcan.gc.ca/equipment/appliance/2386>

**3) Qualification Criteria:**

- A. **Combined Energy Factor (CEF):** CEF shall be greater than or equal to the Minimum CEF (CEF<sub>MIN</sub>) as calculated per Equation 1.

**Equation 1. Calculation of Minimum CEF**

$$CEF_{MIN} = CEF_{BASE} - CEF_{Adder\_Connected}$$

where,

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

$CEF_{Adder\_Connected}$  is the CEF connected allowance, per Table 2

**Table 1: Base CEF**

Product Type	CEFBASE
Vented Gas	3.67
Vented Electric, Standard (4.4 ft <sup>3</sup> or greater capacity)	4.29
Vented Electric, Compact (240 V)	3.76

(less than 4.4 ft <sup>3</sup> capacity)	
Vented Electric, Compact (120 V) (less than 4.4 ft <sup>3</sup> capacity)	4.15
Ventless Electric, Compact (240 V) (less than 4.4 ft <sup>3</sup> capacity)	2.93

**Table 2: Connected Allowance**

Product Type	CEF <sub>Adder Connected</sub> <sup>2</sup>
All Electric Dryer Types in Table 1 <sup>1</sup>	0.05 x CEF <sub>BASE</sub>

<sup>1</sup> Product must be qualified using the final and validated ENERGY STAR Test Method (TBD) to use the allowance.

<sup>2</sup> Calculated allowance shall be rounded down to the nearest tenth before being applied in Equation 1.

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142 B. Drying Time: Dryers must complete drying cycle in  $\leq$  50 minutes.  
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**Note:** The primary objective of the ENERGY STAR Program is to recognize highly energy efficient products in the marketplace. In developing a specification, EPA considers the following Guiding Principles:

- Significant energy and/or water savings can be realized on a national basis;
- Product performance can be maintained or enhanced with increased efficiency;
- Purchasers will recover their investment in increased efficiency within a reasonable period of time;
- Efficiency can be achieved through one or more technologies such that qualifying products are broadly available and offered by more than one manufacturer;
- Product energy and/or water consumption and performance can be measured and verified with testing; and
- Labeling would effectively differentiate products and be visible for purchasers.

For Version 1.0, EPA is proposing minimum requirements for five types of residential clothes dryers. The product classes and efficiency metric used are consistent with those expressed in DOE's 2015 Federal standards for clothes dryers. In Sections 3A and 3B, EPA is proposing minimum energy efficiency requirements and maximum drying time requirement.

### Energy Efficiency Requirements

As discussed in the July launch letter, EPA is proposing minimum energy efficiency requirements expressed using Combined Energy Factor (CEF). Since a public database with CEF performance is not available, EPA developed minimum CEF requirements proposed in Table 1, based on information gathered through research and discussions with manufacturers and efficiency organizations on technologically-feasible and cost-effective options for improving the efficiency of clothes dryers, also leveraging the work done by the efficiency community over the last several years. EPA does not intend to assemble additional data for current models, as discussions with manufacturers indicate that products on the market when this specification takes effect will leverage known and well tested strategies for delivering efficiency. The Draft 1 proposed levels reflect a 13% reduction in energy use from a baseline electric model and a 10% reduction in energy consumption from a baseline gas dryer. The Agency has used the amended DOE standards, effective January 1, 2015, as a baseline. The proposed level is somewhat lower for the gas dryers because certain cost-effective energy efficient technology options used in electric dryers cannot be used in gas dryers (i.e., recycle exhaust heat/recirculation). EPA anticipates a range of models could be available and cost effective at that these efficiency levels starting next year.

174 To meet the proposed Version 1.0 levels, EPA anticipates manufacturers will mainly employ efficiency options  
175 such as modulation technology, heat recovery and recirculation, fan and motor efficiency improvements, and  
176 certain dryer control or drum upgrades (e.g. improved air circulation and modified operating conditions).  
177 Information available suggests that heat pump and hybrid heat pump technology holds greater savings potential  
178 but in the near term is expected to have a higher cost premium for consumers; EPA is assuming this technology  
179 is not necessary to meet the Draft 1 levels.  
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181 Today, an average electric standard size clothes dryer uses approximately 657 kWh/year (as tested under the  
182 DOE test procedure, Appendix D1). A standard sized electric dryer meeting the proposed Draft 1 requirements  
183 will save consumers about 83 kWh/year or \$153 over an estimated 16 year average lifetime of a clothes dryer. A  
184 standard size gas dryer meeting the proposed requirements will save consumers about 0.24 MBTU/year or about  
185 \$46 over the product's average lifetime. Based on these estimates as well as some factors discussed below,  
186 EPA believes the proposed levels will be cost effective, allowing consumers to recoup their investment within a  
187 reasonable timeframe.  
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189 EPA believes the above dryer energy use estimates are likely conservative as they do not factor in additional  
190 energy associated with drying more challenging real-world clothing loads instead of test clothes, and the heating,  
191 ventilation and air conditioning (HVAC) impacts from clothes dryers, where applicable. Testing results  
192 summarized in a 2011 Natural Resources Defense Council (NRDC) report indicate that loads intended to reflect  
193 real-world consumer loads (varying fabric types, load composition, and cloth thickness), require about 35% more  
194 energy to dry than DOE test cloths.<sup>1</sup> This difference is due to the additional time needed to fully dry the more  
195 challenging real-world load. Given this higher real world energy use, a closer approximation of the annual energy  
196 use for electric standard clothes dryers may be more on the order of 900 kWh/year; this higher baseline energy  
197 use substantially increases consumers' savings from a more efficient dryer. EPA is also aware that additional  
198 clothes dryer field metering is being conducted and plans to factor in relevant findings as they become available.  
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#### 200 **Connected**

201 EPA has begun to address the opportunities associated with "connected" functionality through several product  
202 specification revisions over the past year. Consistent with the Agency's proposals for other home appliances, EPA  
203 is planning to propose a set of optional connected criteria for residential clothes dryers in Section 4 and has  
204 proposed a supporting connected allowance in Section 3 for electric dryers. Products that demonstrate they meet  
205 the connected criteria could opt to use an allowance equivalent to 5 percent of the product's base CEF  
206 requirement once their performance is validated using a DOE-developed test procedure for residential clothes  
207 dryers demand response functionality. This proposal is reflected in Table 2 and Equation 1, above. Prior to the  
208 development of this test procedure, connected dryers can be qualified as connected through inspection of  
209 product/product documentation, but will not be eligible for the allowance.  
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211 As in other appliance categories, EPA intends this allowance to serve as a temporary incentive to help jump-start  
212 the market for connected appliances that provide immediate convenience and energy savings opportunities to  
213 consumers as well as future-oriented demand response (DR) and price awareness capabilities.  
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#### 215 **Drying Time Requirement**

216 In the launch letter, EPA raised the possibility of including a maximum drying time requirement to ensure that  
217 energy efficient dryers also meet consumers' expectations for quick performance, as this is perceived by users as  
218 the most time consuming laundry task.<sup>2</sup> As noted above, one of EPA's Guiding Principles for ENERGY STAR is  
219 that product performance be maintained or enhanced with increased energy efficiency. Testing from NRDC's  
220 2011 report shows that average drying time for standard electric and gas dryers is around 30 minutes when  
221 tested with the latest DOE clothes dryer test procedure, Appendix D1; drying times were somewhat longer with a  
222 real load of 50% synthetic – 50% cotton clothing, and significantly longer with a cotton only load.<sup>3</sup> Average drying  
223 time for one NRDC-tested European heat pump unit was about 60 minutes. Manufacturers have also indicated  
224 the importance of matching the clothes washer and clothes dryer cycle time. Consumer Reports' ratings indicate  
225 that many high efficiency clothes washers on the market in the U.S. have a cycle length (as tested in Consumer  
226 Reports' test) of approximately 45-85 minutes.<sup>4</sup> After considering these data points, EPA is proposing a maximum  
227 drying time requirement of 50 minutes, as tested under the DOE clothes dryer test procedure (Appendix D1; see  
228 Section 5 for additional discussion on testing drying time). In proposing this level, EPA's aim has been to help  
229 assure that consumer's expectations for drying time are met, while also providing a path for advanced  
230 dryer technologies like heat pump or hybrid heat pump designs, to qualify.

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232 EPA welcomes feedback on the proposed requirements for residential clothes dryers.

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234 <sup>1</sup> Denkenberger, D., Mau, S., Calwell, C. and E. Wanless. 2011. Residential Clothes Dryers: A Closer Look at Energy  
235 Efficiency Test Procedures and Savings Opportunities. Ecova prepared for Natural Resources Defense Council.

236 <sup>2</sup> Pescatore, P., and P. Carbone. High Efficiency High Performance Clothes Dryer: Final Report to Department of Energy.  
237 TIA. March 2005.

238 <sup>3</sup> Denkenberger, D., Mau, S., Calwell, C. and E. Wanless. 2011. Residential Clothes Dryers: A Closer Look at Energy  
239 Efficiency Test Procedures and Savings Opportunities. Ecova prepared for Natural Resources Defense Council.

240 <sup>4</sup> <http://www.consumerreports.org/cro/washing-machines.htm>

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242 C. Automatic Termination: In order to encourage the use of energy saving, automatically terminated drying  
243 cycles, the product shall comply with the following criteria:
- 244 a. The product shall be equipped with automatic termination control that utilizes both moisture and  
245 temperature sensing controls.
  - 246 b. Timed drying cycles, if used, shall:
    - 247 i. be limited to a maximum cycle time of 15 minutes, and
    - 248 ii. allow mid-cycle adjustment, such that total cycle time exceeds 15 minutes (may be  
249 implemented as administrator-only functionality)
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251 **Note:** EPA is proposing a requirement that ENERGY STAR clothes dryers have automatic termination control that  
252 uses both temperature and moisture sensing. Automatic termination can save energy by avoiding over-drying  
253 associated with timed drying cycles.

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255 Based on research, EPA understands that there are two types of automatic controls found in dryers on the  
256 market: temperature sensing, and moisture plus temperature sensing. Through manufacturer conversations and  
257 Internet research, EPA has learned that most dryers currently on the market have temperature sensing controls,  
258 while only about 20-25% of all dryers also have moisture sensing controls. Consumer Reports has found that  
259 dryers with a moisture sensor tend to do a better job at sensing when a load is dry (to avoid over-drying a load),  
260 than dryers with only a temperature sensor.<sup>1</sup> Some manufacturers have suggested that moisture sensing  
261 combined with temperature sensing will maximize the energy savings associated with avoiding over-drying  
262 clothes after they reach a consumer-acceptable level of dryness. Temperature sensors only detect dryer air  
263 exhaust temperature and are not able to directly measure the humidity of the air coming out of the drum or the  
264 actual moisture content of clothes being dried. It is possible for a temperature sensor to shut off the heater at the  
265 same point for a small, wet load and a large, damp load, if the exhaust temperature for both loads is the same,  
266 even though the moisture level for each load may differ. One manufacturer has noted that moisture sensors have  
267 the benefit over temperature sensors of either detecting the humidity in the drum through a semiconductor sensor  
268 or detecting the dryness of clothes by touching them, through an electrode sensor. EPA also anticipates that  
269 further innovations to improve the performance of moisture sensing technology could occur, i.e., through  
270 optimization of the location of an electrode sensor within the dryer drum. EPA has learned that some dryers locate

271 these sensors on the drum beams/paddles, as opposed to their traditional stationary location on the side of the  
272 drum, which could help expose the sensor to a greater assortment of clothes during the drying cycle.

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274 The DOE test procedure in Appendix D1 does not measure the effects of different automatic termination  
275 technologies. However, DOE has opened a new clothes dryer rulemaking process to further investigate the  
276 effects of automatic cycle termination on clothes dryer energy efficiency; EPA is closely working with the  
277 Department to follow its progress. As an interim step towards recognizing products with improved auto termination  
278 controls, EPA is proposing that ENERGY STAR qualified dryers also use moisture sensing controls.

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280 Based on discussions with manufacturer, EPA has learned that there is likely a significant portion of dryer users  
281 that continue to use timed drying instead of opting for a cycle with automatic termination. Timed drying can often  
282 lead to over-drying clothes (thus wasting energy and possibly damaging or shortening the lifetime of clothes)  
283 because the cycle ends at a pre-determined amount of time, rather than stopping based on the clothes reaching  
284 an appropriate level of dryness. In order to further encourage consumer use of automatic termination, EPA has  
285 proposed limiting timed-drying option to 15 minutes maximum. This criterion is intended to permit inclusion of  
286 certain short cycle modes (e.g. wrinkle release or refresh cycles), where the moisture and temperature sensors  
287 may not need to be used, and the cycle stops at a short, often predetermined amount of time.

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289 EPA notes that the DOE test procedure requires the use of a timed dry cycle. In order to ensure dryers can be run  
290 long enough to dry the load to the remaining moisture content (RMC) required by the DOE test, EPA has also  
291 specified that timed drying cycles permit mid-cycle adjustment so that the total drying time exceeds 15 minutes.  
292 This functionality may either be exposed to all users or may be protected so that it is accessible to test personnel,  
293 but not to consumers.

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295 EPA welcomes stakeholder comments on the proposed drying cycle criteria. EPA also welcomes any data or  
296 feedback documenting the amount of extra energy use from over-drying attributed to the use of timed drying  
297 cycles, or consumer behavior patterns for the use of timed drying vs. automatic termination drying.

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299 <sup>1</sup> <http://consumerreports.org/cro/clothes-dryers/buying-guide.htm>

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301 D. Warranty Requirements: The product shall have minimum warranties as follows: 3 years parts warranty  
302 on any control board (microprocessor), and 5 years parts warranty on any sealed system (compressor,  
303 condenser, evaporator, and all connecting tubing).

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305 **Note:** EPA includes warranty or lifetime requirements in ENERGY STAR specifications for a range of different  
306 product categories, including lighting and HVAC products, water heaters, and roof products. When considering  
307 whether to address lifetime or warranty in a specification, EPA considers factors such as whether there are known  
308 performance/quality issues that the Agency needs to consider and address in order to help ensure products meet  
309 consumers' expectation for efficiency with no sacrifice in performance or quality. The Agency also considers  
310 whether there are new/emerging technologies involved, where the inclusion of a warranty requirement can help to  
311 increase consumer confidence and adoption of a new energy-saving technology. For example, EPA currently  
312 requires manufacturers provide a minimum warranty of 6 years on the sealed system in ENERGY STAR heat  
313 pump water heaters.

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315 EPA believes minimum warranty requirements will help increase consumer confidence in new energy-saving  
316 clothes dryer technologies, and thus is proposing a minimum 3 year parts warranty for control boards  
317 (microprocessors) and a 5 year parts warranty on any sealed system that would be used in a heat pump or hybrid  
318 heat pump clothes dryer. EPA anticipates that ENERGY STAR clothes dryers will need to have control board(s)  
319 to achieve higher levels of efficiency (i.e., using moisture sensing controls and other advanced controls that  
320 optimize energy use, air flow, and drying time) than non-qualified dryers. Similarly, EPA believes it is possible  
321 that heat pump clothes dryers will be introduced in the U.S. and eligible to earn the ENERGY STAR, and that a  
322 minimum warranty requirement could increase consumer confidence and adoption of this new technology and  
323 ensure consumer's expectations for performance and quality continue to be met. To develop the proposed  
324 requirements, EPA researched the length of parts warranties provided with appliances sold in the U.S.

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EPA welcomes comments on the proposed warranty requirements.

- E. Significant Digits and Rounding: All calculations shall be carried out as specified in Appendix D1 to Subpart B of Part 430 and 10 CFR Part 430.23(d).
- F. Model Numbers: Model numbers used for ENERGY STAR qualified product submissions shall be consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.

333 **4) Connected Product Criteria: TBD**

334 **Note:** As noted in the July 2012 launch letter, EPA is planning to consider connected functionality in the Version  
335 1.0 specification. Demand savings for electric dryers can be significant, given they typically draw power on the  
336 order of 5 kW during the drying cycle. For this Draft 1 specification EPA has included a placeholder for optional  
337 connected product criteria. EPA intends to propose specific connected criteria in the Draft 2 Version 1.0 Clothes  
338 Dryer specification and encourages stakeholder feedback on connected functionality relevant to clothes dryers.

339 EPA is in the process of vetting optional connected product criteria for Refrigerators/Freezers (R/F) with  
340 stakeholders, through the Version 5.0 R/F specification revision. Similar to what has been discussed for that  
341 product category, EPA intends to propose connected clothes dryer criteria that enable both near-term consumer  
342 benefits associated with energy management and added convenience features as well as longer-term, societal  
343 benefits associated with smart grid interconnection. EPA plans to leverage the latest R/F connected language and  
344 the recommendations for clothes dryer demand response (DR) functionality provided to EPA and DOE in the  
345 2010 *Joint Petition to ENERGY STAR to Adopt Joint Stakeholder Agreement as It Relates to Smart Appliances*.

346 In addition to this, EPA is interested in stakeholder feedback as to whether price signals and related consumer  
347 feedback are of particular importance for clothes dryers given their schedulable nature. EPA believes there may  
348 be opportunities for electric dryers to offer additional consumer savings and grid benefits through the ability to  
349 receive price signals and provide consumers with feedback that encourages operation during favorable pricing  
350 periods. EPA welcomes suggestions on how to best express this in the specification. More generally, EPA  
351 welcomes feedback on the Agency's plan to include optional connected criteria for clothes dryers in the Version  
352 1.0 specification.

353 **5) Test Requirements:**

- A. One of the following sampling plans shall be used to test energy performance 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 CEF testing per the sampling requirements defined in 10 CFR § 429.21, which references 10 CFR § 429.11.
- B. When testing the energy efficiency of clothes dryers, the following test method shall be used to determine ENERGY STAR qualification:

**Table 3: Test Method for ENERGY STAR Qualification**

ENERGY STAR Requirement	Test Method Reference
CEF	10 CFR § 430, Subpart B, Appendix D1 <sup>1</sup>

<sup>1</sup> 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>

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**Note:** The Draft 1 Version 1.0 specification references the latest DOE residential clothes dryer test procedure found in 10 CFR Part 430, Appendix D1, published in January 2011. There are a number of advantages with using Appendix D1 prior to the compliance date for DOE regulatory purposes. First, it will enable EPA to maintain the Version 1.0 specification change through January 1, 2015, when manufacturers are required to use Appendix D1 to demonstrate compliance with the new DOE standards. Related to this, DOE has also published guidance that allows manufacturers to use Appendix D1 prior to the compliance date requiring its use (January 1, 2015) to rate and certify basic models, as long as certain criteria are met.<sup>1</sup>

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The Appendix D1 test procedure also contains updates to testing conditions that better reflect current usage patterns, including test load size for standard size dryers, initial RMC, updated annual use assumption, and clothes preconditioning. The latest test procedure better represents the product’s total energy consumption since it measures standby and off mode energy consumption, included in the energy performance metric, CEF. Finally, Appendix D1 includes a method for testing ventless dryers, which will allow testing of efficient ventless designs, including, potentially, some heat pump clothes dryers.

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<sup>1</sup> DOE 2012 Guidance “Should an amended test procedure be used to rate and certify products prior to the compliance date?” [http://www1.eere.energy.gov/buildings/appliance\\_standards/pdfs/tp\\_fa\\_q\\_2012-06-29.pdf](http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/tp_fa_q_2012-06-29.pdf)

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C. Assessment of compliance with Drying Time, Automatic Termination, and Warranty criteria shall be in accordance with Table 4.

**Table 4: Test Method for ENERGY STAR Qualification**

ENERGY STAR Criteria	Test Method Reference
Drying Time	ENERGY STAR guidance for measuring drying time during Clothes Dryer Energy Performance Test (Appendix D1)
Automatic Termination Warranty	Examination of product and/or product documentation

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**Note:** Since the current DOE test procedure in Appendix D1 does not measure drying time during the test cycle, DOE is planning to develop ENERGY STAR test method guidance for measuring the duration of the drying cycle during the DOE test (Appendix D1). The Department plans to provide draft guidance for stakeholder review and feedback with the Draft 2 clothes dryer specification.

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EPA proposes manufacturers demonstrate compliance with automatic termination and warranty criteria through examination of product and/or product documentation.

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D. Compliance with Connected functionality, as specified in Section 4, shall be through examination of product and/or product documentation. In addition, demand response functionality shall be certified using the **TBD** ENERGY STAR test method in order to be eligible for the connected allowance.

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**Note:** DOE plans to develop a test method to validate the DR capabilities of residential clothes dryers that will be referenced in this specification. 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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In the meantime (prior to when this new ENERGY STAR test method for demand response is available), qualified clothes dryers with connected features, as specified in the future Section 4, would be highlighted on the ENERGY STAR Qualified Product List.

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EPA and DOE welcome stakeholder comments on the proposed test requirements in Section 5.

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

397 ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of  
398 manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to  
399 be completely assembled.

400 **Note:** EPA anticipates finishing this specification in spring 2013. Since this is a new specification EPA intends for  
401 this specification to take effect immediately after it is finalized. For new ENERGY STAR product categories, EPA  
402 invites manufacturers to qualify and label products as ENERGY STAR as soon as a new specification is finished,  
403 benefiting industry leaders who are first to offer more efficient products to consumers. In contrast, when revising  
404 an existing specification, EPA provides a transition period of nine months between when a final specification is  
405 published and its effective date, to give time for partners to transition any collateral materials to reflect the new  
406 specification.

407 **7) Future Specification Revisions:** EPA reserves the right to change the specification should technological  
408 and/or market changes affect its usefulness to consumers, industry or the environment. In keeping with  
409 current policy, revisions to the specification are arrived at through industry discussions. In the event of a  
410 specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of  
411 a product model.  
412

413 **Note:** Appliance manufacturers are required to comply with new Federal standards for clothes dryers beginning  
414 January 1, 2015. EPA has factored these future requirements into the Draft 1 proposal by citing the new DOE test  
415 procedure Appendix D1 and by using the 2015 DOE standards as a baseline, so that the ENERGY STAR  
416 specification does not need to be revised in advance of these forthcoming changes to the minimum standards.  
417

418 In addition, to support ongoing discussions with stakeholders on possible future clothes dryer savings  
419 opportunities, EPA has developed the below list of topics and questions for consideration as the ENERGY STAR  
420 clothes dryer program evolves in the future.  
421

422 *Commercial clothes dryers:* As noted earlier in the specification, EPA is proposing to exclude commercial clothes  
423 dryers from the scope of this Version 1.0 specification due to the lack of efficiency data for products currently on  
424 the market. However, EPA is interested in further information about the energy efficiency opportunity associated  
425 with commercial clothes dryers. In particular, EPA welcomes feedback on 1) whether there are an industry-  
426 accepted test method(s) to assess the efficiency of commercial clothes dryers; 2) what is the current baseline  
427 efficiency or energy use level for commercial dryers; 3) what efficient technologies can be used with commercial  
428 dryers and their respective energy savings and price; and, 4) market trends in the commercial clothes dryer  
429 market.  
430

431 *Eco mode:* EPA recognizes “eco mode” (also known as “energy saver mode”) as a potentially significant savings  
432 opportunity for clothes dryers. Many manufacturers already employ these modes in dryers available for sale in the  
433 U.S. and have indicated to EPA there has been significant consumer demand for this feature. Eco mode  
434 traditionally saves energy by reducing power output while lengthening the drying cycle, or stopping the cycle  
435 before the clothes are completely dry (leaving them damper than a “normal dryness” cycle). Dryers with an eco  
436 mode may modulate the heater power and fan speed, or employ various algorithms to turn the heater on and off  
437 at various parts of the drying cycle and efficiently utilize the residual heat in the drum. Alternatively, another  
438 possible eco mode approach would be to not employ the heater, and use air flow and tumbling action to dry a  
439 small load of clothes over an extended period of time (possibly overnight). These modes offer savings to users  
440 who are interested in saving energy by extending the drying time or to those who can tolerate higher moisture  
441 content for clothes at the end of the cycle.  
442

443 Often these eco modes are not the highest heat setting for a dryer cycle, and thus are not a cycle that is  
444 measured in the DOE test procedure. The 2012 ENERGY STAR Emerging Technology Award for Advanced  
445 Clothes Dryers includes an eco mode CEF level above the CEF level measured by the highest temperature  
446 setting in the DOE test procedure. For purposes of the Emerging Technology Award specification, EPA requires  
447 eco mode testing using the current DOE test procedure (Appendix D) but with the most energy efficient  
448 temperature setting (drying mode) rather than the maximum temperature setting. EPA believes there may be

449 opportunity to include an eco mode requirement in a future specification revision due to the potentially large  
450 savings potential (an additional 10% or more) available from this mode. EPA welcomes feedback on 1) what  
451 proportion of current dryers on the market employ some form of eco mode; 2) the savings potential available from  
452 these eco modes (using the approach highlighted above from the Emerging Technology Award); 3) consumer  
453 research that shows the demand for these modes or their use in the real world; and 4) how EPA could implement  
454 an eco mode requirement in a future specification revision.  
455

456 *HVAC effects and further research/modeling:* Clothes dryers have an associated heating, ventilation, and air  
457 conditioning (HVAC) impact. Vented dryers take in air from the surrounding room and release heated air through  
458 an outside vent. The HVAC impact can be greater when the dryer is situated in conditioned rooms where the  
459 dryer takes in and vents conditioned air to outside the home. The HVAC system subsequently has to make up this  
460 lost conditioned air from the room. Most ventless dryers use air from the room and release this air at a much  
461 higher temperature back into the room. DOE estimates in the 2011 Final Rule that the impact of home  
462 heating/cooling loads on total clothes dryer energy use is about 6% for vented dryers and 11% for ventless  
463 dryers. The total impact of dryers on home heating/cooling loads will depend on a number of factors (e.g. season,  
464 climate zone, area in home where dryer resides, dryer technology, home insulation, HVAC equipment, etc.). For  
465 example, the impact from ventless dryers may be beneficial in the heating season, but will be detrimental in the  
466 cooling season.  
467

468 EPA is aware of ongoing research looking more into the associated HVAC impacts of clothes dryers, and has  
469 determined that it is too preliminary to address HVAC effects in the Version 1.0 specification. Additionally, the  
470 DOE test procedure does not measure or estimate a clothes dryer's HVAC impact. However, EPA remains  
471 interested in considering this in a future specification revision. One more near-term option could be that EPA  
472 requires reporting of vent airflow rates for vented dryers, allowing consumers and efficiency programs to estimate  
473 the amount of conditioned air leaving the room. EPA is interested in feedback on 1) how the HVAC impacts vary  
474 for different dryer technologies and other factors; 2) any stakeholder research/data that further quantifies a  
475 clothes dryer's HVAC impact, or any models used to estimate a clothes dryers HVAC impact; 3) innovative  
476 designs that are currently being used or are being developed to minimize the HVAC impact of clothes dryers; and,  
477 4) whether any research has been done to estimate the "standby" HVAC effects of vented clothes dryers (i.e.,  
478 standby losses through the vent when the dryer is not actively drying clothes); and 5) the value of including a  
479 reporting requirement of vent airflow rates for vented dryers.  
480

481 *Additional performance considerations:* Fabric care is believed to be important to consumers, demonstrated by  
482 the fact that some withhold clothes from their dryers from fear of damaging their clothes. Because of this,  
483 consumers may be interested in purchasing a clothes dryer that is less likely to damage clothes.<sup>2</sup> EPA believes  
484 that having a minimum drying performance requirement could benefit consumers, but also recognizes that fabric  
485 care is not easily defined, and that integrating it into the ENERGY STAR specification could add test burden to  
486 manufacturers. EPA is proposing a maximum drying time or proposal for Version 1.0, but is also interested  
487 feedback on whether additional performance requirements should be considered for future specifications. EPA is  
488 interested in consumer data that shows the importance of fabric care/dryer performance, and how EPA might  
489 implement this requirement in a future specification.  
490

491 <sup>1</sup> <http://www.hydrocarbonconversions.com/hc-heat-pump-dryers-could-meet-eu-efficiency-standards/>

492 <sup>2</sup> Pescatore, P., and P. Carbone. High Efficiency High Performance Clothes Dryer: Final Report to Department of Energy.  
493 TIAX. March 2005.