



ENERGY STAR® Product Specification for Imaging Equipment

Eligibility Criteria Final Draft Version 2.0

1 Following is the Version 2.0 ENERGY STAR Product Specification for Imaging Equipment. A product shall
2 meet all of the identified criteria if it is to earn the ENERGY STAR.

3 **1 DEFINITIONS**

4 A) Product Types:

- 5 1) Printer: A product whose primary function is to generate paper output from electronic input. A
6 printer is capable of receiving information from single-user or networked computers, or other input
7 devices (e.g., digital cameras). This definition is intended to cover products that are marketed as
8 printers, and printers that can be field-upgraded to meet the definition of an MFD.
- 9 2) Scanner: A product whose primary function is to convert paper originals into electronic images
10 that can be stored, edited, converted, or transmitted, primarily in a personal computing
11 environment. This definition is intended to cover products that are marketed as scanners.
- 12 3) Copier: A product whose sole function is to produce paper duplicates from paper originals. This
13 definition is intended to cover products that are marketed as copiers, and upgradeable digital
14 copiers (UDCs).
- 15 4) Facsimile (Fax) Machine: A product whose primary functions are (1) to scan paper originals for
16 electronic transmission to remote units, and (2) to receive electronic transmissions for conversion
17 to paper output. A fax machine may also be capable of producing paper duplicates. Electronic
18 transmission is primarily over a public telephone system, but may also be via a computer network
19 or the Internet. This definition is intended to cover products that are marketed as fax machines.
- 20 5) Multifunction Device (MFD): A product that performs two or more of the core functions of a Printer,
21 Scanner, Copier, or Fax Machine. An MFD may have a physically integrated form factor, or it may
22 consist of a combination of functionally integrated components. MFD copy functionality is
23 considered to be distinct from single-sheet convenience copying functionality sometimes offered
24 by fax machines. This definition includes products marketed as MFDs, and "multi-function
25 products" (MFPs).
- 26 6) Digital Duplicator: A product sold as a fully-automated duplicator system through the method of
27 stencil duplicating with digital reproduction functionality. This definition is intended to cover
28 products that are marketed as digital duplicators.
- 29 7) Mailing Machine: A product whose primary function is to print postage onto mail pieces. This
30 definition is intended to cover products that are marketed as mailing machines.

31 B) Marking Technologies:

- 32 1) Direct Thermal (DT): A marking technology characterized by the burning of dots onto coated print
33 media that is passed over a heated print head. DT products do not use ribbons.
- 34 2) Dye Sublimation (DS): A marking technology characterized by the deposition (sublimation) of dye
35 onto print media as energy is supplied to heating elements.

- 36 3) Electro-photographic (EP): A marking technology characterized by the illumination of a
37 photoconductor in a pattern representing the desired output image via a light source, development
38 of the image with particles of toner using the latent image on the photoconductor to define the
39 presence or absence of toner at a given location, transfer of the toner to the final print media, and
40 fusing to cause the output to become durable. For purposes of this specification, Color EP
41 products simultaneously offer three or more unique toner colors, while Monochrome EP products
42 simultaneously offer one or two unique toner colors. This definition includes Laser, Light Emitting
43 Diode (LED), and Liquid Crystal Display (LCD) illumination technologies.
- 44 4) Impact: A marking technology characterized by the formation of the desired output image by
45 transferring colorant from a “ribbon” to the print media via an impact process. This definition
46 includes Dot Formed Impact and Fully Formed Impact.
- 47 5) Ink Jet (IJ): A marking technology characterized by the deposition of colorant in small drops
48 directly to the print media in a matrix manner. For purposes of this specification, Color IJ products
49 offer two or more unique colorants at one time, while Monochrome IJ products offer one colorant
50 at a time. This definition includes Piezo-electric (PE) IJ, IJ Sublimation, and Thermal IJ. This
51 definition does not include High Performance IJ.
- 52 6) High Performance IJ: An IJ marking technology that includes nozzle arrays that span the width of
53 a page and/or the ability to dry ink on the print media via supplemental media heating
54 mechanisms. High-performance IJ products are used in business applications usually served by
55 electro-photographic marking products.
- 56 7) Solid Ink (SI): A marking technology characterized by ink that is solid at room temperature and
57 liquid when heated to the jetting temperature. This definition includes both direct transfer and
58 offset transfer via an intermediate drum or belt.
- 59 8) Stencil: A marking technology characterized by the transfer of images onto print media from a
60 stencil that is fitted around an inked drum.
- 61 9) Thermal Transfer (TT): A marking technology characterized by the deposition of small drops of
62 solid colorant (usually colored waxes) in a melted/fluid state directly to print media in a matrix
63 manner. TT is distinguished from IJ in that the ink is solid at room temperature and is made fluid
64 by heat.

65 C) Operational Modes:

66 1) On Mode:

- 67 a) Active State: The power state in which a product is connected to a power source and is
68 actively producing output, as well as performing any of its other primary functions.
- 69 b) Ready State: The power state in which a product is not producing output, has reached
70 operating conditions, has not yet entered into any lower-power Modes, and can enter Active
71 State with minimal delay. All product features can be enabled in this state, and the product is
72 able to return to Active State by responding to any potential inputs, including external
73 electrical stimulus (e.g., network stimulus, fax call, or remote control) and direct physical
74 intervention (e.g., activating a physical switch or button).

75 2) Off Mode: The power state that the product enters when it has been manually or automatically
76 switched off but is still plugged in and connected to the mains. This mode is exited when
77 stimulated by an input, such as a manual power switch or clock timer to bring the unit into Ready
78 State. When this state is resultant from a manual intervention by a user, it is often referred to as
79 Manual Off, and when it is resultant from an automatic or predetermined stimuli (e.g., a delay time
80 or clock), it is often referred to as Auto-off.¹

81 3) Sleep Mode: A reduced power state that a product enters either automatically after a period of
82 inactivity (i.e., Default Delay Time), in response to user manual action (e.g., at a user-set time of
83 day, in response to a user activation of a physical switch or button), or in response to external
84 electrical stimulus (e.g., network stimulus, fax call, remote control). For products evaluated under
85 the TEC test method, Sleep Mode permits operation of all product features (including
86 maintenance of network connectivity), albeit with a possible delay to transition into Active State.
87 For products evaluated under the OM test method, Sleep Mode permits operation of a single
88 active network interface, as well as a fax connection if applicable, albeit with a possible delay to
89 transition into Active State.

90 4) Standby: The lowest power consumption state which cannot be switched off (influenced) by the
91 user and that may persist for an indefinite time when the product is connected to the main
92 electricity supply and used in accordance with the manufacturer's instructions.^{1,2} Standby is the
93 product's minimum power state. For Imaging Equipment products addressed by this specification,
94 the "Standby" Mode usually corresponds to Off Mode, but may correspond to Ready State or
95 Sleep Mode. A product cannot exit Standby and reach a lower power state unless it is physically
96 disconnected from the main electricity supply as a result of manual manipulation.

97 D) Media Format:

98 1) Large Format: Products designed for A2 media and larger, including those designed to
99 accommodate continuous-form media greater than or equal to 406 mm wide. Large-format
100 products may also be capable of printing on standard-size or small-format media.

101 2) Standard Format: Products designed for standard-sized media (e.g., Letter, Legal, Ledger, A3,
102 A4, B4), including those designed to accommodate continuous-form media between 210 mm and
103 406 mm wide. Standard-size products may also be capable of printing on small-format media.

104 3) Small Format: Products designed for media sizes smaller than those defined as Standard (e.g.,
105 A6, 4"x6", microfilm), including those designed to accommodate continuous-form media less than
106 210 mm wide.

107 4) Continuous Form: Products that do not use a cut-sheet media format and that are designed for
108 applications such as printing of bar codes, labels, receipts, banners, and engineering drawings.
109 Continuous form products can be of small, standard, or large format.

110 E) Additional Terms:

111 1) Automatic Duplexing: The capability of a copier, fax machine, MFD, or printer to produce images
112 on both sides of an output sheet, without manual manipulation of output as an intermediate step.
113 A product is considered to have automatic duplexing capability only if all accessories needed to
114 produce duplex output are included with the product upon shipment.

115 2) Data Connection: A connection that permits the exchange of information between the imaging
116 product and one external powered device or storage medium.

1 For the purposes of this specification "mains" or the "main electricity supply" refers to the input power source, including a dc power supply for products that operate solely off dc power.

2 IEC 62301 Ed. 1.0 – Household electrical appliances – Measurement of standby power.

117 3) Default Delay Time: The time set by the manufacturer prior to shipping that determines when the
118 product will enter a lower-power Mode (e.g., Sleep, Auto-off) following completion of its primary
119 function.

120 4) Digital Front-end (DFE): A functionally-integrated server that hosts other computers and
121 applications and acts as an interface to imaging equipment. A DFE provides greater functionality
122 to the imaging product.

123 a) A DFE offers three or more of the following advanced features:

- 124 i. Network connectivity in various environments;
- 125 ii. Mailbox functionality;
- 126 iii. Job queue management;
- 127 iv. Machine management (e.g., waking the imaging equipment from a reduced power
128 state);
- 129 v. Advanced graphic user-interface (UI);
- 130 vi. Ability to initiate communication with other host servers and client computers (e.g.,
131 scanning to email, polling remote mailboxes for jobs); or
- 132 vii. Ability to post-process pages (e.g., reformatting pages prior to printing).

133 b) Type 1 DFE: A DFE that draws its dc power from its own ac power supply (internal or
134 external), which is separate from the power supply that powers the imaging equipment. This
135 DFE may draw its ac power directly from a wall outlet, or it may draw it from the ac power
136 associated with the imaging product's internal power supply. A Type 1 DFE may be sold
137 standard with the Imaging Equipment product, or as an optional accessory.

138 **Note:** EPA has clarified the Type 1 definition to indicate that Type 1 DFEs sold with or as an option with
139 the Imaging Equipment product at the time of purchase must meet DFE_{TEC} requirements in order for the
140 associated Imaging Equipment product to qualify.

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142 c) Type 2 DFE: A DFE that draws its dc power from the same power supply as the imaging
143 equipment with which it operates. Type 2 DFEs must have a board or assembly with a
144 separate processing unit that is capable of initiating activity over the network and can be
145 physically removed, isolated, or disabled using common engineering practices to allow power
146 measurements to be made.

147 d) Auxiliary Processing Accelerator (APA): A computing expansion add-in card installed in a
148 general-purpose add-in expansion slot of the DFE (e.g., GPGPU installed in a PCI slot).

149 **Note:** In response to stakeholder comments in Draft 2, EPA has provided a definition for APAs as a more
150 general categorization variable than Graphics Processing Units (GPUs) for the TEC_{DFE} requirements in
151 Table 2. This definition is based on the APA definition in the Version 2.0 Computer Servers specification,
152 currently under development.

153 5) Network Connection: A connection that permits the exchange of information between the imaging
154 product and one or more external powered devices.

155 6) Functional Adder: A data or network interface or other component that adds functionality to the
156 marking engine of an imaging equipment product and provides a power allowance when qualifying
157 products according to the OM method.

158 7) Operational Mode (OM): For the purposes of this specification, a method of comparing product
159 energy performance via an evaluation of power (measured in watts) in various operating states, as
160 specified in Section 9 of the ENERGY STAR Imaging Equipment test method.

- 161 8) Typical Electricity Consumption (TEC): For the purposes of this specification, a method of
162 comparing product energy performance via an evaluation of typical electricity consumption
163 (measured in kilowatt-hours) during normal operation over a specified period of time, as specified
164 in Section 8 of the ENERGY STAR Imaging Equipment test method.
- 165 9) Marking Engine: The fundamental engine of an imaging product that drives image production. A
166 marking engine relies upon functional adders for communication ability and image processing.
167 Without functional adders and other components, a marking engine cannot acquire image data for
168 processing and is non-functional.
- 169 10) Base Product: The most fundamental configuration of a particular Product Model, which
170 possesses the minimum number of functional adders available. Optional components and
171 accessories are not considered part of a base product.
- 172 11) Accessory: A piece of peripheral equipment that is not necessary for the operation of the Base
173 Product, but that may be added before or after shipment in order to add functionality. An
174 accessory may be sold separately under its own model number, or sold with a base product as
175 part of a package or configuration.
- 176 12) Product Model: An imaging equipment product that is sold or marketed under a unique model
177 number or marketing name. A product model may be comprised of a base product or a base
178 product plus accessories.
- 179 13) Product Family: A group of product models that are (1) made by the same manufacturer, (2)
180 subject to the same ENERGY STAR qualification criteria, and (3) of a common basic design.
181 Product models within a family differ from each other according to one or more characteristics or
182 features that either (1) have no impact on product performance with regard to ENERGY STAR
183 qualification criteria, or (2) are specified herein as acceptable variations within a product family.
184 For Imaging Equipment, acceptable variations within a product family include:
- 185 a) Color,
186 b) Housing,
187 c) Input or output paper-handling accessories,
188 d) Electronic components not associated with the marking engine of the Imaging Equipment
189 product.

190 **Note:** EPA received comments that EPA should retain “input voltage and frequency” on the list of
191 allowable family variations even though doing so would increase testing and certification burden for
192 products sold internationally. Since only products sold in the US are required to be third party certified,
193 testing should not increase for these products. If products are sold in the US with different frequencies and
194 voltages, the energy performance of these products is expected to change and thus they should be tested
195 and qualified separately.

196
197 As was noted in Draft 2, EPA has expanded the scope of allowable variation within a product family to
198 include electronic components that are not associated with the marking engine of the Imaging Equipment
199 product. Products are tested and qualified with the most featured and highest energy using configuration
200 within a family and any changes or additions of electronic components in the system that lead to greater
201 power consumption than the qualified representative model will require requalification.

202 **2 SCOPE**

203 **2.1 Included Products**

204 2.1.1 Commercially-available products that meet one of the Imaging Equipment definitions in
 205 Section 1.A) and are capable of being powered from (1) a wall outlet, (2) a data or network
 206 connection, or (3) both a wall outlet and a data or network connection, are eligible for ENERGY
 207 STAR qualification, with the exception of products listed in Section 2.2.

208 2.1.2 An imaging equipment product must further be classified as either “TEC” or “OM” in Table 1,
 209 below, depending on the method of ENERGY STAR evaluation.

210 **Table 1: Evaluation Methods for Imaging Equipment**

Equipment Type	Media Format	Marking Technology	ENERGY STAR Evaluation Method
Copier	Standard	DT, DS, EP, SI, TT	TEC
	Large	DT, DS, EP, SI, TT	OM
Digital Duplicator	Standard	Stencil	TEC
Fax Machine	Standard	DT, DS, EP, SI, TT	TEC
		IJ	OM
Mailing Machine	All	DT, EP, IJ, TT	OM
Multifunction Device (MFD)	Standard	High Performance IJ, DT, DS, EP, SI, TT	TEC
		IJ, Impact	OM
	Large	DT, DS, EP, IJ, SI, TT	OM
Printer	Standard	High Performance IJ, DT, DS, EP, SI, TT	TEC
		IJ, Impact	OM
	Large or Small	DT, DS, EP, Impact, IJ, SI, TT	OM
	Small	High Performance IJ	TEC
Scanner	All	N/A	OM

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212 **2.2 Excluded Products**

213 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for
 214 qualification under this specification. The list of specifications currently in effect can be found at
 215 www.energystar.gov/products.

216 2.2.2 Products that satisfy one or more of the following conditions are not eligible for ENERGY STAR
 217 qualification under this specification:

- 218 i. Products that are designed to operate directly on three-phase power.
- 219 ii. Products sold with multiple DFEs.

220 **Note:** Based on stakeholder comments, EPA has excluded Imaging Equipment products sold with multiple
 221 DFEs from the scope due to a lack of information on the prevalence of these products in the marketplace
 222 and clear understanding of the effect of using two DFEs on energy consumption. EPA is interested
 223 information on the prevalence of products in the market and the energy performance of this configuration
 224 to determine if they should be included in scope in future specifications.

225 **3 QUALIFICATION CRITERIA**

226 **3.1 Significant Digits and Rounding**

- 227 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.
- 228 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using directly
229 measured or calculated values without any benefit from rounding.
- 230 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
231 website shall be rounded to the nearest significant digit as expressed in the corresponding
232 specification limit.

233 **3.2 General Requirements**

234 3.2.1 External Power Supply (EPS):

- 235 i. If the product is shipped with a single-voltage EPS, the EPS shall meet the level V
236 performance requirements under the International Efficiency Marking Protocol and include the
237 level V marking. Additional information on the Marking Protocol is available at
238 www.energystar.gov/powersupplies.
239
- 240 • Single-output EPS shall meet level V requirements when tested using the *Test Method for*
241 *Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power*
242 *Supplies*, Aug. 11, 2004.
243
 - 244 • Multi-output EPS shall meet the level V requirements when tested using the *EPRI 306*
245 *Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.6*. Power Supply data
246 generated using Rev. 6.4.2 (as required in Version 1.2) is acceptable provided the test
247 was conducted prior to the effective date of Version 2.0.

248 3.2.2 Additional Cordless Handset: Fax machines and MFDs with fax capability that are sold with
249 additional cordless handsets shall use an ENERGY STAR qualified handset, or one that meets
250 the ENERGY STAR Telephony specification when tested to the ENERGY STAR test method on
251 the date the imaging product is qualified as ENERGY STAR. The ENERGY STAR specification
252 and test method for telephony products may be found at www.energystar.gov/products.

253 3.2.3 Functionally Integrated MFD: If an MFD consists of a set of functionally integrated components
254 (i.e., the MFD is not a single physical device), the sum of the measured energy or power
255 consumption for all components shall be less than the relevant MFD energy or power
256 consumption requirements for ENERGY STAR qualification.

257 3.2.4 DFE Requirements: The Typical Electricity Consumption of a Type 1 or Type 2 DFE sold with an
258 Imaging Equipment product (TEC_{DFE}) shall be calculated using Equation 1 for a DFE without sleep
259 mode or Equation 2 for a DFE with sleep mode. The resulting TEC_{DFE} value shall be less than or
260 equal to the maximum TEC_{DFE} requirement specified in Table 2 for the given DFE type.

- 261 i. The TEC value or ready mode power of a DFE that meets the maximum TEC_{DFE} requirements
262 should be excluded or subtracted from the TEC energy and OM power measurements of the
263 Imaging Equipment product as appropriate.
- 264 ii. Section 3.3.2i provides further detail on subtracting TEC_{DFE} values from TEC products;
- 265 iii. Section 3.4.2 provides further detail for excluding DFEs from OM Sleep and Standby levels.

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Equation 1: TEC_{DFE} Calculation for Digital Front Ends without Sleep Mode

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$$TEC_{DFE} = \frac{168 \times P_{DFE_READY}}{1000}$$

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Where:

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- *TEC_{DFE} is the typical weekly energy consumption for DFEs, expressed in kilowatt-hours (kWh) and rounded to the nearest 0.1 kWh;*

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- *P_{DFE_READY} is ready mode power measured in the test procedure in watts.*

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Equation 2: TEC_{DFE} Calculation for Digital Front Ends with Sleep Mode

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$$TEC_{DFE} = \frac{(45 \times P_{DFE_READY}) + (123 \times P_{DFE_SLEEP})}{1000}$$

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Where:

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- *TEC_{DFE} is the typical weekly energy consumption for DFEs, expressed in kilowatt-hours (kWh) and rounded to the nearest 0.1 kWh;*

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- *P_{DFE_READY} is ready mode power measured in the test procedure in watts.*

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- *P_{DFE_SLEEP} is sleep mode power measured in the test procedure in watts.*

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Table 2: Maximum TEC_{DFE} Requirements for Type 1 and Type 2 DFEs

DFE Category	Category Description	Maximum TEC _{DFE} (kWh/week, rounded to the nearest 0.1 kWh/week for reporting)	
		Type 1 DFE	Type 2 DFE
A	All DFEs that do not meet the definition of Category B will be considered under Category A for ENERGY STAR qualification.	10.9	8.7
B	To qualify under Category B DFEs must have: 2 or more physical CPUs or 1 CPU and ≥ 1 discrete Auxiliary Processing Accelerators (APAs)	22.7	18.2

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Note: Based on analysis of data received from stakeholders, EPA is proposing to use an 80% power supply efficiency assumption for the calculation of Type 2 DFE TEC_{DFE} requirements in the Final Draft. When DFE Ready Mode is measured in the test method, the Imaging Equipment product is required to be in Ready Mode as well. Stakeholder submitted data shows that power supplies operate at or slightly above 80% efficiency when both the DFE and Imaging Equipment product are in Ready Mode. The revised Type 2 DFE TEC_{DFE} values, calculated using this revised efficiency assumption, are shown in Table 2 above.

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3.3 Requirements for Typical Electricity Consumption (TEC) Products

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3.3.1 Automatic Duplexing Capability:

- 292 i. For all copiers, MFDs, and printers subject to the TEC test method, automatic duplexing
 293 capability shall be present at the time of purchase as specified in Table 3 and Table 4.
 294 Printers whose intended function is to print on special single-sided media for the purpose of
 295 single sided printing (e.g. release coated paper for labels, direct thermal media, etc.) are
 296 exempt from 3.3.1.

297 **Table 3: Automatic Duplexing Requirements for**
 298 **all Monochrome TEC Copiers, MFDs, and Printers**

Monochrome Product Speed, s , as Calculated in the Test Method (ipm)	Automatic Duplexing Requirement
$s \leq 19$	None
$19 < s < 35$	Integral to the base product or optional accessory
$s \geq 35$	Integral to the base product

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300 **Table 4: Automatic Duplexing Requirements for**
 301 **all Color TEC Copiers, MFDs, and Printers**

Monochrome Product Speed, s , as Calculated in the Test Method (ipm)	Automatic Duplexing Requirement
$s \leq 24$	None
$24 < s < 37$	Integral to the base product or optional accessory
$s \geq 37$	Integral to the base product

303

- 304 ii. If a product is not certain to be bundled with an automatic duplex tray, the partner must make
 305 clear in their product literature, on their Web site, and in institutional sales literature that
 306 although the product meets the ENERGY STAR energy efficiency requirements, the product
 307 only fully qualifies for ENERGY STAR when bundled with or used with a duplex tray. EPA
 308 asks that partners use the following language to convey this message to customers:
 309 "Achieves ENERGY STAR energy savings; product fully qualifies when packaged with (or
 310 used with) a duplex tray."

311 **Note:** In Draft 2, EPA attempted to unify the automatic duplexing requirements for color and monochrome
 312 imaging devices. Stakeholders commented that for some lower speed products, automatic duplexing is not
 313 practical and may have the potential effect of discouraging lower-cost ENERGY STAR qualified printers.
 314 Stakeholders also noted that removal of the optional accessory requirement for middle speed range
 315 products was a cost issue and consumers should have the option to select this price impacting
 316 functionality. EPA recognizes these concerns and as such has revised the proposed automatic duplexing
 317 requirement to revert back to providing separate automatic duplexing requirements based on color
 318 capability and speed. Based on input from stakeholders, EPA has however increased the stringency of
 319 the requirements (compared to Version 1.2) to reflect improvements in products in the market.

320

321 EPA recognizes there are circumstances in the manufacture and distribution of base products and duplex
 322 accessories that present challenges to the ENERGY STAR labeling requirements. As such, under Version
 323 2.0, EPA proposing to continue the allowance for ENERGY STAR labeled products to be sold without the
 324 duplex tray. The partner must, in this case, make clear in their product literature, on their Web site, and in
 325 institutional sales literature that although the product meets the ENERGY STAR energy efficiency
 326 requirements, the product only fully qualifies for ENERGY STAR when bundled with or used with a
 327 duplex tray.

328 3.3.2 **Typical Electricity Consumption:** Calculated Typical Electricity Consumption (TEC) per Equation 3
 329 or Equation 4 shall be less than or equal to the Maximum TEC Requirement (TEC_{MAX}) specified in
 330 Equation 6 to the nearest 0.1 kilowatt-hour.

331 i. For imaging products with a Type 2 DFE that meet the Type 2 DFE maximum TEC_{DFE}
 332 requirement found in Table 2, the measured energy consumption of the DFE, shall be divided
 333 by 0.80 to account for internal power supply losses, and then be excluded when comparing
 334 the product's measured TEC value to TEC_{MAX}. The DFE shall not interfere with the ability of
 335 the imaging product to enter or exit its lower-power modes. The energy use of a DFE can only
 336 be excluded if it meets the DFE definition in Section 1 and that has a separate processing unit
 337 that is capable of initiating activity over the network, may be subtracted from the measured
 338 DFE.

339 **Example:** A printer's total TEC result is 24.50 kWh/wk and its Type 2 TEC_{DFE} value calculated in Section
 340 3.2.4 is 9.0 kWh/wk. The TEC_{DFE} value is then divided by 0.80 to account for internal power supply losses
 341 with the Imaging Equipment in Ready Mode, resulting in 11.25 kWh/wk. The power supply adjusted value
 342 is subtracted from the tested TEC value: 24.50 kWh/wk – 11.25 kWh/wk = 13.25 kWh/wk. This
 343 13.25 kWh/wk result is then compared to the relevant TEC_{MAX} to determine qualification

344
 345 **Note:** EPA received stakeholder feedback that dc power measured at the DFE in TEC products cannot be
 346 subtracted from the ac power at the ac mains without accounting for losses in the Imaging Equipment
 347 product's internal power supply. Applying the same assumption regarding typical internal power supply
 348 efficiency in Table 2, above, EPA proposes to divide the measured TEC_{DFE} value by 0.80 to account for
 349 internal power supply losses. EPA has revised the language in section 3.3.2 as well as the example
 350 notebbox to reflect this addition.

351 ii. For printers, fax machines, digital duplicators with print capability, and MFDs with print
 352 capability, TEC shall be calculated per Equation 3.

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**Equation 3: TEC Calculation for Printers, Fax Machines, Digital Duplicators
 with Print Capability, and MFDs with Print Capability**

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$$TEC = 5 \times \left[E_{JOB_DAILY} + (2 \times E_{FINAL}) + [24 - (N_{JOBS} \times 0.25) - (2 \times t_{FINAL})] \times \frac{E_{SLEEP}}{t_{SLEEP}} \right] + 48 \times \frac{E_{SLEEP}}{t_{SLEEP}},$$

357

358 *Where:*

- 359 • TEC is the typical weekly energy consumption for printers, fax machines,
 360 digital duplicators with print capability, and MFDs with print capability,
 361 expressed in kilowatt-hours (kWh) and rounded to the nearest 0.1 kWh;
- 362 • E_{JOB_DAILY} is the daily job energy, as calculated per Equation 5, in kWh;
- 363 • E_{FINAL} is the final energy, as measured in the test procedure, converted to
 364 kWh;
- 365 • N_{JOBS} is the number of jobs per day, as calculated in the test procedure,
- 366 • t_{FINAL} is the final time to Sleep, as measured in the test procedure, converted
 367 to hours;
- 368 • E_{SLEEP} is the Sleep energy, as measured in the test procedure, converted to
 369 kWh; and
- 370 • t_{SLEEP} is the Sleep time, as measured in the test procedure, converted to hours.

371 iii. For copiers, digital duplicators without print capability, and MFDs without print capability, TEC
 372 shall be calculated per Equation 4.

373 **Equation 4: TEC Calculation for Copiers, Digital Duplicators without Print Capability,**
 374 **and MFDs without Print Capability**

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$$TEC = 5 \times \left[E_{JOB_DAILY} + (2 \times E_{FINAL}) + [24 - (N_{JOBS} \times 0.25) - (2 \times t_{FINAL})] \times \frac{E_{AUTO}}{t_{AUTO}} \right] + 48 \times \frac{E_{AUTO}}{t_{AUTO}},$$

376 *Where:*

- 377 • *TEC is the typical weekly energy consumption for copiers, digital duplicators*
- 378 *without print capability, and MFDs without print capability, expressed in*
- 379 *kilowatt-hours (kWh) and rounded to the nearest 0.1 kWh;*
- 380 • *E_{JOB_DAILY} is the daily job energy, as calculated per Equation 5, in kWh;*
- 381 • *E_{FINAL} is the final energy, as measured in the test procedure, converted to*
- 382 *kWh;*
- 383 • *N_{JOBS} is the number of jobs per day, as calculated in the test procedure;*
- 384 • *t_{FINAL} is the final time to Sleep, as measured in the test procedure, converted*
- 385 *to hours;*
- 386 • *E_{AUTO} is the Auto-off energy, as measured in the test procedure, converted to*
- 387 *kWh; and*
- 388 • *t_{AUTO} is the Auto-off time, as measured in the test procedure, converted to*
- 389 *hours.*

390 iv. Daily Job Energy shall be calculated per Equation 5.

391 **Equation 5: Daily Job Energy Calculation for TEC Products**

392
$$E_{JOB_DAILY} = (2 \times E_{JOB1}) + \left((N_{JOBS} - 2) \times \frac{E_{JOB2} + E_{JOB3} + E_{JOB4}}{3} \right),$$

393 *Where:*

- 394 • *E_{JOB_DAILY} is the daily job energy, expressed in kilowatt-hours (kWh);*
- 395 • *E_{JOBi} is the energy of the ith job, as measured in the test procedure, converted*
- 396 *to kWh; and*
- 397 • *N_{JOBS} is the number of jobs per day, as calculated in the test procedure.*

399 **Equation 6: Maximum TEC Requirement Calculation**

400
$$TEC_{MAX} = TEC_{REQ} + Adder_{A3},$$

401 *Where:*

- 402 • *TEC_{MAX} is the maximum TEC requirement in kilowatt-hours per week*
- 403 *(kWh/wk);*
- 404 • *TEC_{REQ} is the TEC requirement specified in Table 5, in kWh; and*
- 405 • *Adder_{A3} is a 0.02 kWh/wk allowance provided for A3 products with a paper*
- 406 *path width equal to or greater than 11 inches.*

407 **Note:** Based on stakeholder feedback, EPA conducted an analysis on the impact of A3 versus A4 paper
 408 width on printers qualification rates. EPA did find a lower qualification rate among products using A3
 409 paper. As such, EPA is proposing an adder of 0.20 kWh/week for A3 paper width products to ensure
 410 adequate selection.

Table 5: TEC Requirement Before A3 Allowance (If Applicable)

Color Capability	Monochrome Product Speed, s , as Calculated in the Test Method (ipm)	TEC _{REQ} (kWh/week, to the nearest 0.1 kWh/week for reporting)
Monochrome Non-MFD	$s \leq 5$	0.3
	$5 < s \leq 20$	$(s \times 0.04) + 0.1$
	$20 < s \leq 30$	$(s \times 0.06) - 0.3$
	$30 < s \leq 40$	$(s \times 0.11) - 1.8$
	$40 < s \leq 65$	$(s \times 0.16) - 3.8$
	$65 < s \leq 90$	$(s \times 0.2) - 6.4$
	$s > 90$	$(s \times 0.55) - 37.9$
Monochrome MFD	$s \leq 5$	0.4
	$5 < s \leq 30$	$(s \times 0.07) + 0.05$
	$30 < s \leq 50$	$(s \times 0.11) - 1.15$
	$50 < s \leq 80$	$(s \times 0.25) - 8.15$
	$s > 80$	$(s \times 0.6) - 36.15$
Color Non-MFD	$s \leq 10$	1.3
	$10 < s \leq 15$	$(s \times 0.06) + 0.7$
	$15 < s \leq 30$	$(s \times 0.15) - 0.65$
	$30 < s \leq 75$	$(s \times 0.2) - 2.15$
	$s > 75$	$(s \times 0.7) - 39.65$
Color MFD	$s \leq 10$	1.5
	$10 < s \leq 15$	$(s \times 0.1) + 0.5$
	$15 < s \leq 30$	$(s \times 0.13) + 0.05$
	$30 < s \leq 70$	$(s \times 0.2) - 2.05$
	$70 < s \leq 80$	$(s \times 0.7) - 37.05$
	$s > 80$	$(s \times 0.75) - 41.05$

413

414 **Note:** Based on stakeholder feedback, EPA has reviewed the data set and removed duplicates and data
415 with errors to ensure we are using the most accurate information to create the appropriate efficiency
416 criteria across all product categories. The resulting data set did not significantly alter the qualification rate
417 using the Draft 2 proposed TEC max but EPA made some minor adjustments to the monochrome non-
418 MFD lower speed products to allow a modest increase in the products eligible for certification. The
419 adjustments to proposed levels reflect qualified data up through September 20, 2012. EPA analyzed the
420 impact of these new levels on each TEC category.

421

422 At the proposed TEC levels for the four product classes, EPA expects a broad selection of models from
423 multiple manufacturers to be eligible for the ENERGY STAR. EPA is proposing levels that recognize
424 uncertainty around the revised test method.

425

426

427 3.3.3 Additional Test Results Reporting Requirements: Recovery times from various modes (Active 0,
428 Active 1, Active 2 times) and Default Delay Time shall be reported for all products tested using the
429 TEC test method.

430

431 **Note:** Since recovery time and Default Delay Time to Sleep are useful to consumers and potentially a
432 useful parameter for evaluating the impact of the Version 2.0 requirements on usability, EPA proposes to
433 require reporting them for all TEC products. To provide a recovery time metric that is meaningful to the
434 user, EPA proposes averaging Active 0, Active 1, and Active 2 times, and reporting their unweighted
435 arithmetic mean on the Version 2.0 Qualified Product List (QPL). Although EPA considered weighting the
436 Active times according to the frequency with which they are encountered throughout the day, doing so
437 could obscure the importance that users attach to shorter recovery times from low-power modes (Active 0
438 and Active 1 times). The unweighted average gives these recovery times equal prominence and is a
439 simple, easy-to-understand calculation.

440

441 3.4 Requirements for Operational Mode (OM) Products

442 3.4.1 Multiple Sleep Modes: If a product is capable of automatically entering multiple successive Sleep
443 Modes, the same Sleep Mode shall be used to determine qualification under the default delay time
444 to sleep requirements specified in Section 3.4.2 and the Sleep Mode power consumption
445 requirements specified in Section 3.4.3.

446 3.4.2 DFE Requirements: For imaging products with a functionally-integrated DFE that relies on the
447 imaging product for its power, and that meets the appropriate maximum TEC_{DFE} requirement
448 found in Table 2, the ready mode power of the DFE, measured in the test method, should be
449 divided by 0.60 to account for internal power supply losses, and then excluded when comparing
450 the product's measured Sleep Mode power to the combined marking-engine and functional-adder
451 criteria limits below and when comparing the measured Standby Mode power to the Standby
452 criteria limits below.

- 453 i. The DFE must not interfere with the ability of the imaging product to enter or exit its lower-
454 power modes.
455 ii. In order to take advantage of this exclusion, the DFE must meet the definition in Section 1
456 and be a separate processing unit that is capable of initiating activity over the network.
457

458 **Note:** Stakeholders noted that the Draft 2 assumption of 85% power supply efficiency for the Type 2 DFE
459 used in large format OM products was too high. No products currently in the market would be able to meet
460 both the marking engine sleep values and the maximum TEC_{DFE} requirements. Stakeholders stated that
461 power supplies operate at a significantly lower efficiency when the Imaging Equipment product is in Sleep
462 Mode, which is the case during OM testing.

463
464 EPA has received additional feedback from stakeholders and is proposing a lower power supply efficiency
465 assumption for OM products sold with Type 2 DFEs. When an Imaging Equipment product is in Sleep
466 Mode, the internal power supply is operating at a significantly lower load point, resulting in power supply
467 efficiency of approximately 60%. EPA proposes to divide the measured TEC_{DFE} value in Section 3.4.2 by
468 0.60, reflecting this assumption of 60% power supply efficiency with the Imaging Equipment in Sleep
469 Mode.

470 3.4.2 Default Delay Time: Measured Default Delay Time to Sleep (t_{SLEEP}) shall be less than or equal to
471 the Required Default Delay Time to Sleep (t_{SLEEP_REQ}) requirement specified in Table 6, subject to
472 the following conditions:

- 473 i. The Default Delay Time to Sleep may not be adjusted by the user to be greater than the
474 Maximum Machine Delay Time. This Maximum Machine Delay Time shall be set by the
475 manufacturer at less than or equal to 4 hours.

476 **Note:** EPA received stakeholder comments that the terms associated with Default Delay Time are
477 confusing and that some are used interchangeably in the specification. EPA has clarified the Default Delay
478 Time to Sleep Requirement as follows:
479 - Default Delay Time is the measured parameter of the UUT in its as-shipped state,

- 480 - Required Default Delay Time (formerly Maximum Default Delay Time) is the value listed in Table 66
- 481 against which the measured parameter is compared to for purposes of qualification, and
- 482 - Maximum Machine Delay Time is the value also listed in the specification (4 hours for all products)
- 483 beyond which the Default Delay Time cannot be extended by the end-user.

- 484 ii. When reporting data and qualifying products that can enter Sleep Mode in multiple ways,
- 485 partners should reference a Sleep level that can be reached automatically. If the product is
- 486 capable of automatically entering multiple, successive Sleep levels, it is at the manufacturer's
- 487 discretion which of these levels is used for qualification purposes; however, the default-delay
- 488 time provided must correspond with whichever level is used.
- 489 iii. Default Delay Time does not apply to OM products that can meet sleep mode requirements in
- 490 ready mode.

491 **Table 6: Required Default Delay Time to Sleep for OM Products**

492

Product Type	Media Format	Monochrome Product Speed, s , as Calculated in the Test Method (ipm or mppm)	Required Default Delay Time to Sleep, t_{SLEEP_REQ} (minutes)
Copier	Large	$s \leq 30$	30
		$s > 30$	60
Fax Machine	Small or Standard	All	5
MFD	Small or Standard	$s \leq 10$	15
		$10 < s \leq 20$	30
		$s > 20$	60
	Large	$s \leq 30$	30
$s > 30$		60	
Printer	Small or Standard	$s \leq 10$	5
		$10 < s \leq 20$	15
		$20 < s \leq 30$	30
		$s > 30$	60
	Large	$s \leq 30$	30
$s > 30$		60	
Scanner	All	All	15
Mailing Machine	All	$s \leq 50$	20
		$50 < s \leq 100$	30
		$100 < s \leq 150$	40
		$s > 150$	60

493 3.4.3 Sleep Mode Power Consumption: Measured Sleep Mode power consumption (P_{SLEEP}) shall be
494 less than or equal to the maximum Sleep Mode power consumption requirement (P_{SLEEP_MAX})
495 determined per Equation 7, subject to the following conditions:

- 496 i. Only those interfaces that are present and used during the test, including any fax interface,
497 may be considered functional adders.
498 ii. Product functionality offered through a DFE shall not be considered a functional adder.
499 iii. A single interface that performs multiple functions may be counted only once.
500 iv. Any interface that meets more than one interface type definition shall be classified according
501 to the functionality used during the test.
502 v. For products that meet the Sleep Mode power requirement in Ready State, no further
503 automatic power reductions are required to meet Sleep Mode requirements.

504
505
506

**Equation 7: Calculation of Maximum Sleep Mode Power
Consumption Requirement for OM products**

507
$$P_{SLEEP_MAX} = P_{MAX_BASE} + \sum_1^n Adder_{INTERFACE} + \sum_1^m Adder_{OTHER}$$

508 *Where:*

- 509 • P_{SLEEP_MAX} is the maximum Sleep Mode power consumption requirement,
510 expressed in watts (W), and rounded to the nearest 0.1 watt;
511 • P_{MAX_BASE} is the maximum Sleep Mode power allowance for the base marking
512 engine, as determined per Table 7, in watts;
513 • $Adder_{INTERFACE}$ is the power allowance for the interface functional adders used during
514 the test, including any fax capability and as selected by the manufacturer from Table 8,
515 in watts;
516 • n is the number of allowances claimed for interface functional adders used
517 during the test, including any fax capability and is less than or equal to 2
518 • $Adder_{OTHER}$ is the power allowance for any non-interface functional adders in
519 use during the test, as selected by the manufacturer from Table 8., in watts;
520 and
521 • m is the number of allowances claimed for any non-interface functional
522 adders in use during the test.

523

524

525

Table 7: Sleep Mode Power Allowance for Base Marking Engine

Product Type	Media Format	Marking Technology				P _{MAX_BASE} (watts)
		Impact	Ink Jet	All Other	Not Applicable	
Copier	Large			x		8.2
Fax Machine	Standard		x			0.6
Mailing Machine	N/A		x	x		5.0
MFD	Standard	x	x			0.6
	Large		x			4.9
				x		8.2
Printer	Small	x	x	x		4.0
	Standard	x	x			0.6
	Large	x		x		2.5
			x			4.9
Scanner	Any				x	2.5

526

527

528

Table 8: Sleep Mode Power Allowances for Functional Adders

Adder Type	Connection Type	Max. Data Rate, r (Mbit/second)	Details	Functional Adder Allowance (watts)
Interface	Wired	$r < 20$	Includes: USB 1.x, IEEE 488, IEEE 1284/Parallel/ Centronics, RS232	0.2
		$20 \leq r < 500$	Includes: USB 2.x, IEEE 1394/ FireWire/i.LINK, 100Mb Ethernet	0.4
		$r \geq 500$	Includes: USB 3.x, 1G Ethernet	0.5
		Any	Includes: Flash memory-card/smart-card readers, camera interfaces, PictBridge	0.2
	Fax Modem	Any	<u>Applies to Fax Machines and MFDs only.</u>	0.2
	Wireless, Radio-frequency (RF)	Any	Includes: Bluetooth, 802.11	2.0
	Wireless, Infrared (IR)	Any	Includes: IrDA.	0.1
Cordless Handset	N/A	N/A	Capability of the imaging product to communicate with a cordless handset. Applied only once, regardless of the number of cordless handsets the product is designed to handle. Does not address the power requirements of the cordless handset itself.	0.8

Adder Type	Connection Type	Max. Data Rate, <i>r</i> (Mbit/second)	Details	Functional Adder Allowance (watts)
Memory	N/A	N/A	Applies to the internal capacity available in the imaging product for storing data. Applies to all volumes of internal memory and should be scaled accordingly for RAM. This adder does not apply to hard disk or flash memory.	0.5/GB
Scanner	N/A	N/A	<u>Applies to MFDs and Copiers only.</u> Includes: Cold Cathode Fluorescent Lamp (CCFL) or a technology other than CCFL, such as Light-Emitting Diode (LED), Halogen, Hot-Cathode Fluorescent Tube (HCFT), Xenon, or Tubular Fluorescent (TL) technologies. (Applied only once, regardless of the lamp size or the number of lamps/bulbs employed.)	0.5
Power Supply	N/A	N/A	Applies to both internal and external power supplies of Mailing Machines and Standard Format products using Inkjet and Impact marking technologies with nameplate output power (P_{OUT}) greater than 10 watts.	$0.02 \times (P_{OUT} - 10.0)$
Touch Panel Display	N/A	N/A	Applies to both monochrome and color touch panel displays.	0.2
Internal Disk Drives	N/A	N/A	Includes any high-capacity storage product, including hard-disk and solid-state drives. Does not cover interfaces to external drives.	0.15

529

530 **Note:** EPA has further modified Table 8 to permit the application of the Power Supply adder to Mailing
531 Machines, which, like Ink Jet printers and MFDs have higher speed and functionality correlated with the
532 rating of the power supply.

533
534 A notebox in the Draft 2 specification made clear that the touch-panel adder would be limited to small
535 capacitive touch panels; however, stakeholders commented that the adder should apply to all touch panel
536 technologies and sizes. EPA does not wish to constrain this functionality, and wishes to clarify that the
537 adder may be applied to all touch panel technologies and sizes. Additionally, EPA is requesting that touch
538 panel type and size be reported during testing.

539

540 3.4.4 **Standby Power Consumption:** Standby Mode power, which is the lesser of the Ready Mode
541 Power, Sleep Mode Power, and Off Mode Power, as measured in the test procedure, shall be less
542 than or equal to the Maximum Standby Power specified in Table 9, subject to the following
543 condition.

544 i. The Imaging Equipment shall meet the Standby Power requirement independent of the state
545 of any other devices (e.g., a host PC) connected to it.

546

Table 9: Maximum Standby Power Requirement

Product Type	Maximum Standby Power (watts)
All OM Products	0.5

547

548

549

550

551

Note: Products intended for sale in the US market are subject to minimum toxicity and recyclability requirements. Please see ENERGY STAR Program Requirements for Imaging Equipment: Partner Commitments for details.

552

4 TESTING

553

4.1 Test Methods

554

555

4.1.1 When testing Imaging Equipment products, the test methods identified in Table 10 shall be used to determine qualification for ENERGY STAR.

556

Table 10: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
All Products	ENERGY STAR Imaging Equipment Test Method, Rev. May-2012

557

558

4.2 Number of Units Required for Testing

559

4.2.1 Representative Models shall be selected for testing per the following requirements:

560

561

562

i. For qualification of an individual product model, a product configuration equivalent to that which is intended to be marketed and labeled as ENERGY STAR is considered the Representative Model;

563

564

565

566

ii. For qualification of a product family, the highest energy using configuration within the family shall be considered the Representative Model. When submitting product families, manufacturers continue to be held accountable for any efficiency claims made about their imaging products, including those not tested or for which data was not reported.

567

4.2.2 A single unit of each Representative Model shall be selected for testing.

568 **4.3 International Market Qualification**

569 4.3.1 Products shall be tested for qualification at the relevant input voltage/frequency combination for
570 each market in which they will be sold and promoted as ENERGY STAR.

571 **5 USER INTERFACE**

572 5.1.1 Manufacturers are encouraged to design products in accordance with the user interface standard
573 IEEE 1621: Standard for User Interface Elements in Power Control of Electronic Devices
574 Employed in Office/Consumer Environments. For details, see <http://eetd.LBL.gov/Controls>.

575 **6 EFFECTIVE DATE**

576 6.1.1 Effective Date: The Version 2.0 ENERGY STAR Imaging Equipment specification shall take effect
577 on **October 1, 2013**. To qualify for ENERGY STAR, a product model shall meet the ENERGY
578 STAR specification in effect on its date of manufacture. The date of manufacture is specific to
579 each unit and is the date on which a unit is considered to be completely assembled.

580 **Note:** Due to extensive feedback from stakeholders following the publication of Draft 2, EPA expects to
581 finalize the specification in January 2013, with an effective date of October 1, 2013.

582 6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should
583 technological and/or market changes affect its usefulness to consumers, industry, or the
584 environment. In keeping with current policy, revisions to the specification are arrived at through
585 stakeholder discussions. In the event of a specification revision, please note that the ENERGY
586 STAR qualification is not automatically granted for the life of a product model.

587 6.1.3 Items for Consideration in Future Revision:

- 588 i. **Network Proxy**: EPA will continue to monitor the implementation of proxying capability in
589 imaging equipment hardware and consider the development of a test method to determine the
590 presence of a network proxy (e.g. one compliant with ECMA-393 ProxZzy for Sleeping
591 Hosts).
592
- 593 ii. **Draft Mode**: Stakeholders raised concerns with the current method of qualifying TEC
594 products. Specifically, assigning TEC limits based on the maximum claimed speed while
595 testing using the default speed. EPA and DOE have clarified the test method to avoid the
596 confusion between the two potentially different speeds and will continue to monitor qualifying
597 products to assess the impacts of these differences and potential test method changes in
598 future revisions.
599
- 600 iii. **Recovery Time for OM Products**: EPA is interested in a recovery time requirement for OM
601 devices and welcomes stakeholder input on the benefits of providing this data to consumers
602 on the qualified product list. If substantial benefits exist, EPA and DOE may include a
603 recovery time measurement for OM products in the next version of the test method.
604
- 605 iv. **TEC Requirements in Kilowatt-hours per Year**: EPA has added columns to the TEC Tables
606 expressing the requirements in kilowatt-hours per year in addition to the currently-used
607 kilowatt-hours per week. Although this is purely informative, EPA will consider making this unit
608 the only way to express TEC in a future specification revision as a way to address issues with
609 reporting accuracy and comparisons between other ENERGY STAR products (which typically
610 report in kilowatt-hours/year).
611

- 612 v. **Consistency of speed values:** While the maximum claimed print speed is used for purposes
613 of calculation and qualification, the as-shipped speed is used within testing to emulate the end
614 user's expected performance. EPA is interested in measuring as-shipped speed within the
615 test method, and using this value for qualification purposes. Possible test methods for
616 consideration include ISO/IEC 24734:2009 Method for measuring digital printing productivity
617 and ISO/IEC 24735:2012 Method for measuring digital copying productivity.
618
- 619 vi. **Wake Up Test Method:** EPA's intent is that ENERGY STAR qualified products use power
620 management features, in the as-shipped condition, without requiring special configurations for
621 use on the local network. If a fully networked machine is awoken by common network events,
622 the energy associated with these events should be captured while testing for ENERGY STAR
623 qualification. EPA and DOE are interested in working with stakeholders to develop a test
624 method to standardize the wake up testing of units to capture this real world condition.
625
- 626 vii. **Equipment for Printing and Scanning Media Other Than Paper:** EPA often receives
627 questions about qualifying products that print or scan media other than paper (e.g., cloth,
628 microfilm, etc.) and welcomes data on their energy consumption. Such data would support
629 development of requirements for these products in a future version of the specification.
630
- 631 viii. **Professional Products (High-speed TEC Products for Printing on Heavier, Larger
632 Paper):** EPA has learned that some high-speed TEC products have additional requirements
633 for handling larger and heavier paper. EPA will consider separating these into a separate
634 category in a future version of the specification.
635
- 636 ix. **Decoupled Requirements for TEC Categories:** In Version 1 and 2 Imaging Equipment
637 specifications, EPA has assumed that color products would have higher TEC than
638 monochrome products due to their additional complexity, and multi-function higher than
639 single-function. The TEC requirements were structured to reflect this relationship. However,
640 EPA has recently learned that color MFDs—a premium product—can incorporate energy
641 saving features that decrease their energy consumption below that for monochrome non-
642 MFDs. EPA will therefore consider decoupling the TEC requirements in the future to
643 recognize the highest performers among all TEC categories.
644
645
646