ENERGY STAR®
Product Specification for Imaging Equipment

Eligibility Criteria
Draft 1 Version 2.0

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

1 DEFINITIONS

A) Product Types:

1) Printer: A product whose primary function is to generate paper output from electronic input. A printer is capable of receiving information from single-user or networked computers, or other input devices (e.g., digital cameras). This definition is intended to cover products that are marketed as printers, and printers that can be field-upgraded to meet the definition of an MFD.

2) Scanner: A product whose primary function is to convert paper originals into electronic images that can be stored, edited, converted, or transmitted, primarily in a personal computing environment. This definition is intended to cover products that are marketed as scanners.

3) Copier: A product whose sole function is to produce paper duplicates from paper originals. This definition is intended to cover products that are marketed as copiers, and upgradeable digital copiers (UDCs).

4) Facsimile (Fax) Machine: A product whose primary functions are (1) to scan paper originals for electronic transmission to remote units, and (2) to receive electronic transmissions for conversion to paper output. A fax machine may also be capable of producing paper duplicates. Electronic transmission is primarily over a public telephone system, but may also be via a computer network or the Internet. This definition is intended to cover products that are marketed as fax machines.

5) Multifunction Device (MFD): A product that performs two or more of the core functions of a Printer, Scanner, Copier, or Fax Machine. An MFD may have a physically integrated form factor, or it may consist of a combination of functionally integrated components. MFD copy functionality is considered to be distinct from single-sheet convenience copying functionality sometimes offered by fax machines. This definition includes products marketed as MFDs, and “multi-function products” (MFPs).

6) Digital Duplicator: A product sold as a fully-automated duplicator system through the method of stencil duplicating with digital reproduction functionality. This definition is intended to cover products that are marketed as digital duplicators.

7) Mailing Machine: A product whose primary function is to print postage onto mail pieces. This definition is intended to cover products that are marketed as mailing machines.

B) Marking Technologies:

1) Direct Thermal (DT): A marking technology characterized by the burning of dots onto coated print media that is passed over a heated print head. DT products do not use ribbons.

2) Dye Sublimation (DS): A marking technology characterized by the deposition (sublimation) of dye onto print media as energy is supplied to heating elements.

3) Electro-photographic (EP): A marking technology characterized by the illumination of a photoconductor in a pattern representing the desired output image via a light source, development of the image with particles of toner using the latent image on the photoconductor to define the presence or absence of toner at a given location, transfer of the toner to the final print media, and fusing to cause the output to become durable. For purposes of this specification, Color EP products simultaneously offer three or more unique toner colors, while Monochrome EP products simultaneously offer one or two unique toner colors. This definition includes Laser, Light Emitting Diode (LED), and Liquid Crystal Display (LCD) illumination technologies.

4) Impact: A marking technology characterized by the formation of the desired output image by transferring colorant from a "ribbon" to the print media via an impact process. This definition includes Dot Formed Impact and Fully Formed Impact.

5) Ink Jet (IJ): A marking technology characterized by the deposition of colorant in small drops directly to the print media in a matrix manner. For purposes of this specification, Color IJ products offer two or more unique colorants at one time, while Monochrome IJ products offer one colorant at a time. This definition includes Piezo-electric (PE) IJ, IJ Sublimation, and Thermal IJ. This definition does not include High Performance IJ.

6) High Performance IJ: An IJ marking technology that includes nozzle arrays that span the width of a page and/or the ability to dry ink on the print media via supplemental media heating mechanisms. High-performance IJ products are used in business applications usually served by electro-photographic marking products.

7) Solid Ink (SI): A marking technology characterized by ink that is solid at room temperature and liquid when heated to the jetting temperature. This definition includes both direct transfer and offset transfer via an intermediate drum or belt.

8) Stencil: A marking technology characterized by the transfer of images onto print media from a stencil that is fitted around an inked drum.

9) Thermal Transfer (TT): A marking technology characterized by the deposition of small drops of solid colorant (usually colored waxes) in a melted/fluid state directly to print media in a matrix manner. TT is distinguished from IJ in that the ink is solid at room temperature and is made fluid by heat.

C) Operational Modes:

1) On Mode:

a) Active State: The power state in which a product is connected to a power source and is actively producing output, as well as performing any of its other primary functions.

b) Ready State: The power state in which a product is not producing output, has reached operating conditions, has not yet entered into any lower-power Modes, and can enter Active State with minimal delay. All product features can be enabled in this state, and the product is able to return to Active State by responding to any potential inputs, including external electrical stimulus (e.g., network stimulus, fax call, or remote control) and direct physical intervention (e.g., activating a physical switch or button).

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

3) Sleep Mode: A reduced power state that a product enters either automatically after a period of inactivity (i.e., Default Delay Time), in response to user manual action (e.g., at a user-set time of day, in response to a user activation of a physical switch or button), or in response to external electrical stimulus (e.g., network stimulus, fax call, remote control). For products evaluated under the TEC test method, Sleep Mode permits operation of all product features (including maintenance of network connectivity), albeit with a possible delay to transition into Active State. For products evaluated under the OM test method, Sleep Mode permits operation of all product features considered Primary Function adders, albeit with a possible delay to transition into Active State.

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

D) Media Format:

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

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

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

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

E) Additional Terms:

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

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

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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.

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

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

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

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

b) Type 1 DFE: A DFE that draws its dc power from its own ac power supply (internal or external), which is separate from the power supply that powers the imaging equipment. This DFE may draw its ac power directly from a wall outlet, or it may draw it from the ac power associated with the imaging product's internal power supply

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

d) Type 3 DFE: A DFE that is not shipped with the imaging product it supports. This DFE draws its dc power from its own external ac power supply, which is separate from the power supply that powers the imaging equipment.

Note: EPA is interested in stakeholder feedback on the proposed restructured definitions for imaging products with DFEs.

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

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

Note: In a July 8 memo to stakeholders, EPA proposed a new approach to functional adders for OM products. The current Version 1.2 Imaging Equipment Specification provides Primary and Secondary Functional Adder allowances to accommodate the power consumption in Sleep Mode of additional capabilities such as data and network interfaces. The proposed new adder approach better reflects advances in technology and the way that Imaging products are used. Our proposal and the data analysis are described in the accompanying "Explanation of the Draft 1 Levels for Operational Mode (OM) Products and Functional Adder Allowances." EPA is interested in stakeholder feedback on these proposed updates.

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

8) Typical Electricity Consumption (TEC): For the purposes of this specification, a method of comparing product energy performance via an evaluation of typical electricity consumption (measured in kilowatt-hours) during normal operation over a specified period of time, as specified in Section 8 of the ENERGY STAR Imaging Equipment test method.

9) Marking Engine: The fundamental engine of an imaging product that drives image production. A marking engine relies upon functional adders for communication ability and image processing. Without functional adders and other components, a marking engine cannot acquire image data for processing and is non-functional.

10) Base Product: The most fundamental configuration of a particular Product Model, which possesses the minimum number of functional adders available. Optional components and accessories are not considered part of a base product.

11) Accessory: A piece of peripheral equipment that is not necessary for the operation of the Base Product, but that may be added before or after shipment in order to add functionality. An accessory may be sold separately under its own model number, or sold with a base product as part of a package or configuration.

12) Product Model: An imaging equipment product that is sold or marketed under a unique model number or marketing name. A product model may be comprised of a base product or a base product plus accessories.

13) Representative Model: An imaging equipment product that is defined by (1) a product configuration equivalent to that which is intended to be marketed and labeled as ENERGY STAR and (2) the highest energy using configuration within a product family if more than one model is qualified under a common basic design.

Note: The above definition is proposed for addition to clarify the testing requirements in Section 4.2. EPA seeks comments on the proposed definition.

14) Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR qualification criteria, and (3) of a common basic design. Product models within a family differ from each other according to one or more characteristics or features that either (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2) are specified herein as acceptable variations within a product family. For Imaging Equipment, acceptable variations within a product family include:

a) Color,

b) Housing,

c) Input voltage and frequency,

d) Input or output paper-handling accessories,

e) Internal storage drive (hard disk drives (HDD) or solid state drives (SDD)), or

f) Any of the functional adders specified in Table 7.

2 SCOPE

2.1 Included Products

2.1.1 Commercially-available products that meet one of the Imaging Equipment definitions in Section 1

and are capable of being powered from (1) a wall outlet, (2) a data or network connection, or (3) both a wall outlet and a data or network connection, are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2.

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

Note: Despite diminishing shipments, based on stakeholder input, EPA is proposing to retain scanners within the scope while increasing the stringency of the specification, with different specification levels for different product speeds. Also, despite diminishing sales, EPA is proposing to retain fax machines within the scope of the specification, also based on stakeholder feedback on the importance of continuing to provide product differentiation for institutional purchasers.

EPA is interested in stakeholder feedback on the proposal to retain these product categories within the scope of the specification.

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

Note: Stakeholders have proposed adding Standard-format impact MFDs and Small-format high performance Inkjet printers. Standard-format impact MFDs have been added as a new OM category in the table above, while small-format high-performance ink jet printers have been added as a new TEC category. EPA welcomes comments on the proposed changes. These additions and their classification as either OM or TEC have been made based on EPA's approach of categorizing products based on their known usage patterns.

EPA is not proposing to reclassify any current OM products as TEC nor test OM products in Active Mode.

2.2 Excluded Products

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

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

i. Products that are designed to operate directly on three-phase power.

3 QUALIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.

3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.2 General Requirements

3.2.1 External Power Supply (EPS):

i. If the product is shipped with a single-voltage EPS, the EPS shall meet the level V performance requirements under the International Efficiency Marking Protocol and include the level V marking. Additional information on the Marking Protocol is available at www.energystar.gov/powersupplies.
ii. External Power Supplies shall meet level V requirements when tested using the Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies, Aug. 11, 2004.

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

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

3.2.4 Wakeup: UUT shall not wake for common network traffic unless the traffic is designated for the unit to perform a user requested service. Common traffic including ARP and NS Simple Network Management Protocol (SNMP) packets should not wake the device.

Note: EPA's intent is that ENERGY STAR qualified imaging equipment will use power management features "out of the box", saving energy, without requiring special configuration of the imaging device or other devices (such as PCs) on the local network. If fully-networked machines are awakened by ordinary network events while in sleep, these disturbances and energy consumption should be captured when testing for ENERGY STAR qualification.

3.2.5 DFE Requirements: The DFE ready mode power of an imaging equipment product that is sold with a Type 1 or Type 2 DFE shall be less than or equal to the Maximum Ready Mode Power, as specified in Table 2 for the given DFE type.

i. The ready mode power of a DFE that meets the Maximum Ready Mode Power should be excluded or subtracted from the TEC energy and OM power measurements.
ii. Section 3.3.2i provides further detail on subtracting TEC values for DFEs for TEC products;
iii. Section 3.4.2 provides further detail for excluding DFEs from OM Sleep and Standby levels.
iv. No requirements shall apply to Type 3 DFEs.

Table 2: Maximum Ready Mode Power Requirement for Type 1 and Type 2 DFEs

DFE Category	Category Description (From Small-Scale Servers)	Maximum Ready Mode Power (W)	
		Type 1 DFE	Type 2 DFE
A	All DFEs that do meet the definition of Category B will be considered under Category A for ENERGY STAR qualification.	50	42.5
B	To qualify under Category B DFEs must have: Processor(s) with greater than 1 physical core or greater than 1 discrete processor; and Minimum of 1 gigabyte of system memory.	65	55

Note: EPA intends to treat DFEs similarly to small scale servers in the ENERGY STAR 5.2 Computer specification, as they have similar hardware and software functionality. Type 1 DFE values are pulled directly from the computer specification, while Type 2 DFE values are a reduced value to compensate for added efficiency from using in the internal imaging product power supply. For a more detailed explanation of the values shown in Table 2, please refer to the DFE Ready Mode Power Requirements supporting document.

EPA is interested in stakeholder feedback on the proposed approach and maximum ready mode power requirements for imaging products with DFEs.

3.3 Requirements for Typical Electricity Consumption (TEC) Products

Note: Without the availability of appropriate test data, EPA has decided not to propose a recovery time requirement for TEC products but is interested in providing this data to consumers on the qualified product listing. EPA is interested in stakeholder feedback on this proposed approach.

3.3.1 Automatic Duplexing Capability:

i. For all copiers, MFDs, and printers subject to the TEC test method, automatic duplexing capability shall be present at the time of purchase as specified in Table 3.

Table 3: Automatic Duplexing Requirements for all TEC Copiers, MFDs, and Printers

Monochrome Product Speed, *s*, as Calculated in the Test Method (ipm)	Automatic Duplexing Requirement
$s \leq 19$	None
$s > 19$	Integral to the base product

Note: Based on analysis of the currently qualified products list, the majority of ENERGY STAR-qualified monochrome products with speed greater than 19 ipm already offer automatic duplexing. However, as similar duplexing technology is available for color products, monochrome and color products have been combined into one category for simplicity. EPA welcomes comments on this proposal as well as further comments on the inclusion of automatic duplexing on OM product categories where it is applicable.

Note: EPA has recently received information from a Partner about a product that operates faster in duplex mode than simplex: because it prints on both sides of the page simultaneously, it can output two duplex images in the same time as a single simplex image.

As testing these products in simplex mode would double the printing time of a job, thereby doubling the energy consumption due to the fixed power losses such as the fuser, the current (Version 1.2) test method would put these products at a disadvantage. Since the ENERGY STAR program is interested in promoting duplexing, EPA and DOE have amended the associated Version 2.0 test method to test these products in duplex mode—their faster and less consumptive mode. EPA welcomes comments on this proposal and whether this difference in testing would impact end-users' ability to equitably compare the TEC between products.

3.3.2 Typical Electricity Consumption: Calculated Typical Electricity Consumption (TEC) per Equation 1 or Equation 2 shall be less than or equal to the Maximum TEC Requirement (TEC_{MAX}) specified in Table 4, to the nearest 0.1 kilowatt-hour.

i. For imaging products with a Type 2 DFE that meet the Type 2 DFE maximum ready mode power allowance values found in Table 2, the energy consumption of the DFE, calculated per the example below, should be excluded when comparing the product's measured TEC value to TEC_{MAX}. The DFE shall not interfere with the ability of the imaging product to enter or exit its lower-power modes. In order to take advantage of this exclusion, the DFE must meet the definition in Section 1 and be a separate processing unit that is capable of initiating activity over the network.

Example: A printer's total TEC result is 24.5 kWh/week and its internal DFE consumes 40 W in Ready mode. 40 W x 168 hours/week = 6.72 kWh/week, which is then subtracted from the tested TEC value: 24.5 kWh/week – 6.72 kWh/week = 17.78 kWh/week. 17.78 kWh/week is then compared to the following criteria.

ii. For printers, fax machines, digital duplicators with print capability, and MFDs with print capability, TEC shall be calculated per Equation 1.

Equation 1: TEC Calculation for Printers, Fax Machines, Digital Duplicators with Print Capability, and MFDs with Print Capability

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

Where:

- *TEC is the typical weekly energy consumption for printers, fax machines, digital duplicators with print capability, and MFDs with print capability, expressed in kilowatt-hours (kWh) and rounded to the nearest 0.1 kWh;*
- *E_{JOB_DAILY} is the daily job energy, as calculated per Equation 3, in kWh;*
- *E_{FINAL} is the final energy, as measured in the test procedure, converted to kWh;*
- *N_{JOBS} is the number of jobs per day, as calculated in the test procedure,*
- *t_{FINAL} is the final time to Sleep, as measured in the test procedure, converted to hours;*
- *E_{SLEEP} is the Sleep energy, as measured in the test procedure, converted to kWh; and*
- *t_{SLEEP} is the Sleep time, as measured in the test procedure, converted to hours.*

iii. For copiers, digital duplicators without print capability, and MFDs without print capability, TEC shall be calculated per Equation 2.

Equation 2: TEC Calculation for Copiers, Digital Duplicators without Print Capability, and MFDs without Print Capability

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

Where:

- *TEC is the typical weekly energy consumption for copiers, digital duplicators without print capability, and MFDs without print capability, expressed in kilowatt-hours (kWh) and rounded to the nearest 0.1 kWh;*
- *E_{JOB_DAILY} is the daily job energy, as calculated per Equation 3, in kWh;*
- *E_{FINAL} is the final energy, as measured in the test procedure, converted to kWh;*
- *N_{JOBS} is the number of jobs per day, as calculated in the test procedure;*
- *t_{FINAL} is the final time to Sleep, as measured in the test procedure, converted to hours;*
- *E_{AUTO} is the Auto-off energy, as measured in the test procedure, converted to kWh; and*
- *t_{AUTO} is the Auto-off time, as measured in the test procedure, converted to hours.*

iv. Daily Job Energy shall be calculated per Equation 3.

Equation 3: Daily Job Energy Calculation for TEC Products

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

Where:

- *E_{JOB_DAILY} is the daily job energy, expressed in kilowatt-hours (kWh);*

- *E_{JOBi} is the energy of the i^{th} job, as measured in the test procedure, converted to kWh; and*
- *N_{JOBS} is the number of jobs per day, as calculated in the test procedure.*

Note: EPA proposes to maintain the TEC test procedure usage profiles as we believe the current profiles fairly reflect the way products are used. EPA has no test or qualification data to support that the TEC usage assumptions result in an artificially high paper and energy consumption.

Table 4: Maximum TEC Requirement

Color Capability	Monochrome Product Speed, *s*, as Calculated in the Test Method (ipm)	TEC_{MAX} (kWh, to the nearest 0.1 kWh)
Monochrome	$s \leq 7$	0.5
	$7 < s \leq 44$	(s x 0.07)
	$44 < s \leq 74$	(s x 0.20) – 5.7
	$s > 74$	(s x 0.70) – 42.7
Color	$s \leq 45$	(s x 0.07) + 1.4
	$45 < s \leq 70$	(s x 0.2) – 4.5
	$s > 70$	(s x 0.70) – 39.5

Note: EPA is proposing to treat MFD and non MFD products the same for the purposes of maximum TEC requirements. Current qualified product data show that many MFD products can perform as well, if not better than, printer products of the same color capability and speed, and therefore do not require a higher power consumption limit.

Note: EPA is not proposing a default-delay time requirement for TEC products because the TEC metric already accounts for the time that a product remains in ready mode following a print job and there is lack of available test data to allow setting requirements. EPA is interested in stakeholders' input on the benefits of providing this data to consumers on the qualified product listing.

EPA continues to welcome any information on the typical use of TEC products and the expected benefit of default-delay time requirements.

3.4 Requirements for Operational Mode (OM) Products

Note: Without the availability of appropriate test data, EPA has decided not to propose a recovery time requirement for OM products but is interested in stakeholders input on the benefits of providing this data to consumers on the qualified product listing.

EPA is interested in stakeholder feedback on this proposed approach and appreciates any information on the typical use of OM devices, and the expected benefit of recovery time requirements.

3.4.1 Multiple Sleep Modes: If a product is capable of automatically entering multiple successive Sleep Modes, the same Sleep Mode shall be used to determine qualification under the default delay time to sleep requirements specified in Section 3.4.3 and the Sleep Mode power consumption requirements specified in Section 3.4.4.

3.4.2 DFE Requirements: For imaging products with a functionally-integrated DFE that relies on the imaging product for its power, and that meets the appropriate maximum ready mode power allowance found in Table 2, the power consumption of the DFE should be excluded when comparing the product's measured Sleep Mode power to the combined marking-engine and functional-adder criteria limits below and when comparing the measured Standby Mode power to the Standby criteria limits below.

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

3.4.3 Default Delay Time: Measured Default Delay Time to Sleep (t_{SLEEP}) shall be less than or equal to the Maximum Default Delay Time to Sleep (t_{SLEEP_MAX}) requirement specified in Table 5, subject to the following conditions:

i. The maximum machine delay time shall be less than or equal to 4 hours, which is only adjustable by the manufacturer. This maximum machine delay time cannot be influenced by the user and typically cannot be modified without internal, invasive product manipulation.
ii. When reporting data and qualifying products that can enter Sleep mode in multiple ways, partners should reference a Sleep level that can be reached automatically. If the product is capable of automatically entering multiple, successive Sleep levels, it is at the manufacturer's discretion which of these levels is used for qualification purposes; however, the default-delay time provided must correspond with whichever level is used.
iii. Default delay time does not apply to OM products that can meet sleep mode requirements in ready mode.

Note: EPA is interested in stakeholder feedback on the proposed approach of qualifying OM products that have no distinct sleep mode but meet the maximum standby requirements.

437 **Table 5: Maximum Default Delay Time to Sleep for OM Products**

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Product Type	Media Format	Monochrome Product Speed, *s*, as Calculated in the Test Method (ipm or mppm)	Default Delay Time to Sleep (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

3.4.4 Sleep Mode Power Consumption: Measured Sleep Mode power consumption (P_{SLEEP}) shall be less than or equal to the maximum Sleep Mode power consumption requirement (P_{SLEEP_MAX}) determined per Equation 4, subject to the following conditions:

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

Equation 4: Calculation of Maximum Sleep Mode Power Consumption Requirement for OM products

$$P_{SLEEP\_MAX} = P_{MAX\_BASE} + \sum_{1}^{n} Adder_{INTERFACE} + \sum_{1}^{m} Adder_{OTHER}$$

Where:

- P_{SLEEP_MAX} *is the maximum Sleep Mode power consumption requirement, expressed in watts (W), and rounded to the nearest 0.1 watt;*
- P_{MAX_BASE} *is the maximum Sleep Mode power allowance for the base marking engine, as determined per Table 6 , in watts;*
- $Adder_{INTERFACE}$ *is the power allowance for the interface functional adders used during the test, including any fax capability and as selected by the manufacturer from Table 7, in watts;*
- *n is the number of allowances claimed for interface functional adders used during the test, including any fax capability and is less than or equal to 2*
- $Adder_{OTHER}$ *is the power allowance for any non-interface functional adders in use during the test, as selected by the manufacturer from Table 7, in watts; and*
- *m is the number of allowances claimed for any non-interface functional adders in use during the test.*

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471 **Table 6: 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		7.4
Fax Machine	Standard		x			0.6
Mailing Machine	N/A		x	x		5.6
MFD	Standard	x				2.3
			x			0.6
	Large		x			4.9
				x		7.4
Printer	Small	x	x	x		9.0
	Standard	x				2.3
			x			0.6
	Large	x		x		2.5
			x			4.9
Scanner	Any				x	2.7

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474 **Table 7: Sleep Mode Power Allowances for Functional Adders**

Adder Type	Connection Type	Max. Data Rate, *r* (Mbit/ second)	Details	Functional Adder Allowance (watts)
Data or Network Connec-tion	Wired	r < 20	Includes: USB 1.x, IEEE 488, IEEE 1284/Parallel/ Centronics, RS232, Fax Modem	0.2
		20 ≤ r < 500	Includes: USB 2.x, IEEE 1394/ FireWire/i.LINK, 100Mb Ethernet	0.4
		r ≥ 500	Includes: USB 3.x,1G Ethernet	0.5
		Any	Includes: Flash memory-card/smart-card readers, camera interfaces, PictBridge	0.2
	Wireless, Radio-frequency (RF)	Any	Includes: Bluetooth, 802.11	2.0
	Wireless, Infrared (IR)	Any	Includes: IrDA.	0.1

Adder Type	Connection Type	Max. Data Rate, *r* (Mbit/ second)	Details	Functional Adder Allowance (watts)
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.	0.5
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.	0.5
Scanner	N/A	N/A	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

Note: In a July 8 memo to stakeholders, EPA proposed a new approach to functional adders for OM products. The current Version 1.2 Imaging Equipment Specification provides Primary and Secondary Functional Adder allowances to accommodate the power consumption in Sleep Mode of additional capabilities such as data and network interfaces. The Draft Test Method has since been amended to allow the use of only one interface (down from three previously), to be selected from a list ordered by typical use. In this Draft 1 specification, EPA proposes to revise the adder approach to better reflect advances in technology and the way that Imaging products are used. EPA has updated the OM requirements in Section 3.4 of this Specification to reflect this proposed approach to Functional Adders. Our proposal and the data analysis are further described in depth in the accompanying "Explanation of the Draft 1 Levels for Operational Mode (OM) Products and Functional Adder Allowances." EPA is interested in stakeholder feedback on these proposed updates.

EPA believes that this would more closely reflect the actual use of these products, reward greater efficiency and highlight those products that power down non-essential functions while in sleep mode. The base allowances proposed in Table 6 reflect this new approach. EPA believes that the proposed approach and performance requirements will differentiate top performers while allowing for a good selection of products across speeds at a price that remains cost effective.

First, in recognition of advances made in technology, EPA proposes to decrease many of the allowances and eliminate others—allowances that have remained unchanged since the Version 1.0 specification was finalized 5 years ago. Following discussions and correspondence with industry leaders, EPA has revised the allowance levels proposed on July 8 based on stakeholder feedback to best reflect the current state of technology.

The following adders have been removed from Table 7 for simplicity or to reflect improvements in technology:

- Internal storage drive: EPA eliminated the internal storage drive adder because hard drives are not typically active during Sleep Mode. Furthermore, both solid state and hard disk drives have low sleep power, with the controller the only component active.
- Power supplies: EPA eliminated the power supply adder because of significant decreases in power supply no-load and low-load power achieved through mandatory standards. The Federal standard for EPSs require a no-load power of 0.5 W and it is common to find EPSs with no-load power as low as 0.1 W.
- PC systems: EPA eliminated the PC system adder because rather than a distinct component that is either present or absent in the device, the PC system adder is currently applied to products that "rely on an external computer for significant resources."

Second, EPA proposes to limit allowances to those features/functionalities that remain active during sleep mode to better reflect product use. For Primary Functional Adders, this means providing allowances only to the interface used during the test, while for Secondary Functional Adders, it means providing allowances only for those functions that provide value by remaining active in sleep.

EPA welcomes comment on whether the removal of any of these adders will impact the qualification of child models under Section 1, E, 14, above. So far, EPA has added internal storage drives to the list of variations specifically allowed under the Product Family definition, but welcomes additional suggestions.

3.4.5 Standby Power Consumption: Standby Mode power, which is the lesser of the Ready Mode Power, Sleep Mode Power, and Off Mode Power, as measured in the test procedure, shall be less than or equal to the Maximum Standby Power specified in Table 8..

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

Table 8: Maximum Standby Power Requirement

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

Note: Based on analysis of currently qualified products and data submitted, the majority of ENERGY STAR qualified imaging products that have an Off Mode already meet the 0.5 W limit. EPA has therefore decided to retain the proposal of the 0.5 W limit in Standby, harmonizing with the Standby Mode requirement in the European Commission (EC) Ecodesign Regulation No 1275/2008.

EPA has further clarified that the Standby Power requirement applies independent of the state of other devices connected to the Imaging Equipment during the test. This, together with edits to the test method, should resolve recurring questions with testing USB-connected products. EPA welcomes comments on this topic as well as suggestions of further issues for clarification.

3.5 Digital Front End Power Supply Efficiency Requirements

Note: EPA is proposing to remove the DFE power supply efficiency requirements present in the Version 1.2 specification as the power supply efficiency will now be accounted for by the ready mode requirements in Section 3.2.5. EPA welcomes comment on this proposal.

3.6 Toxicity and Recyclability Requirements

3.6.1 Imaging Equipment products shall contain restricted levels of the following materials, where the maximum concentration values tolerated by weight in homogeneous materials are: lead (0.1%), mercury (0.1%), cadmium (0.01%), hexavalent chromium (0.1%), polybrominated biphenyls (PBB) (0.1%), or polybrominated diphenyl ethers (PBDE) (0.1%). Batteries are exempt. The following exemptions are granted for components in Imaging Equipment:

i. Lead in glass of fluorescent tubes not exceeding 0.2% by weight.
ii. Copper alloy containing up to 4% lead by weight.
iii. Electrical or electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix.
iv. Lead in dielectric ceramic in capacitors for a rated voltage of 125V AC or 250 V DC or higher.

3.6.2 Imaging Equipment products shall be designed for ease of disassembly and recyclability where external enclosures, sub-enclosures, chassis and electronic subassemblies are easily removable with commonly available tools, by hand, or by a recycler's automated processes. Products shall identify and provide ease of access to, and removal of, materials with special handling needs.

3.6.3 For purposes of third-party certification, toxicity and recyclability requirements shall not be reviewed when products are initially qualified or during subsequent verification testing. Instead, consistent with the RoHS Directive (for toxicity) and IEEE 1680 standard (for design for recyclability), manufacturers shall maintain documentation on file that products meet these requirements. EPA reserves the right to request this documentation at any time.

3.6.4 To the extent product models are sold in countries other than the U.S., they are not subject to requirements in 3.6.1, 3.6.2 and 3.6.3.

Note:
While energy efficiency remains the basis upon which top performers are selected, EPA has a longstanding practice of including criteria related to other aspects of product performance in ENERGY STAR specifications to ensure that overall product performance is maintained relative to a non-qualifying product. To the extent these types of requirements are included, the Agency leverages existing standards and looks to achieve a minimally acceptable level of performance (i.e. not one that is overly stringent/difficult to achieve). By including additional criteria, the ENERGY STAR program seeks to avoid associating the label with poor quality or otherwise undesirable product models, thereby preserving the influence of the label in the market.

For these requirements, EPA drew from existing standards for toxicity and design for recyclability. EPA looked to the RoHS Directive for a toxicity limit because Imaging products manufacturers have extensive experience with designing products free from certain toxic materials in compliance with the RoHS Directive. The RoHS Directive, formally known as Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment, was amended by 2005/618/EC and went into effect in 2006. Most global manufacturers have been in compliance with RoHS since 2006, when the directive first took effect. Products that currently meet the EU RoHS Directive would satisfy this toxicity requirement. In some cases, the RoHS Directive allows for specific, limited exemptions for specific materials and provides expiration dates for these exemptions. EPA intends to harmonize with the RoHS Directive by adding language in Section 3.6 allowing the same exemptions as those outlined in the current RoHS Directive. EPA welcomes feedback from stakeholders to understand if any materials exempted for a given period of time under the RoHS Directive currently apply to components typically found in imaging products. EPA does not intend to require documentation of the need for exemption beyond what is needed by the Partner to demonstrate compliance with the RoHS Directive.

The proposed design for ease of disassembly and recyclability is harmonized with the existing IEEE 1680.1 standard and those proposed under the draft 1680.2. EPA believes that many manufacturers in the marketplace already meet this requirement.

EPA has clarified (Section 3.6.4) that these requirements are exempt from the ENERGY STAR third-party certification process. Further, EPA added language making clear that the non-energy requirements proposed here are not intended for international adoption. EPA continues to anticipate that existing reporting efforts and maintenance of relevant quality assurance documentation would be sufficient to demonstrate compliance with these requirements.

4 TESTING

4.1 Test Methods

4.1.1 When testing Imaging Equipment products, the test methods identified in Table 9 shall be used to determine qualification for ENERGY STAR.

Table 9: Test Methods for ENERGY STAR Qualification

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

4.2 Number of Units Required for Testing

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

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;

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.

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

Note: EPA has clarified that for qualification purposes, the product configuration that represents the highest as-shipped power consumption for each product category within the product family will be considered the Representative Model. Because of verification testing performed by certification bodies, EPA believes the existing requirements for additional testing of units near the limit of eligibility criteria is no longer necessary.

4.3 International Market Qualification

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

5 USER INTERFACE

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

6 EFFECTIVE DATE

6.1.1 Effective Date: The Version 2.0 ENERGY STAR Imaging Equipment specification shall take effect on March 1, 2013. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

Note: EPA anticipates releasing a Final Version 2.0 specification by June 2012. As such, the effective date provided above allows manufacturers time to work with certification bodies and update product literature as needed to comply with the new requirements. As of February 28, 2013 only those models that have been third-party certified by an EPA recognized Certification Body will remain on the ENERGY STAR Qualified Product List. For information on third-party certification visit: www.energystar.gov/3rdpartycert**.**

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