

ENERGY STAR® Qualified Imaging Equipment
Final Draft Test Procedure
Operational Mode Approach
August 31, 2005

*This document presents a final draft test procedure for evaluating the energy performance of products addressed by the **Operational Mode (OM)** approach in the Version 1.0 ENERGY STAR Imaging Equipment specification. This test procedure is to be used to quantify the power consumption of imaging products that do not utilize the Typical Electricity Consumption (TEC) method. Examples of products that will be tested with this OM method include those that use marking technologies such as Ink Jet, Dot Matrix or Impact, as well as scanners and all large-format devices. The key results of this test procedure are power values for ready, sleep, low-power, and off modes.*

This test procedure document includes the following sections:

1. Test Parameters;
2. Power Measurement Method;
3. ENERGY STAR OM Measurement Procedure;
4. Reporting; and
5. References.

The full OM test procedure consists of this narrative document and the accompanying test conditions, entitled **Test Conditions and Equipment for Determining the ENERGY STAR® Qualification Status of Imaging Equipment Products**. The Test Conditions document provides the ambient test conditions and equipment requirements that should be established when performing the energy or power measurements to determine a product's ENERGY STAR qualification status. These test conditions are common to both the TEC and the OM test procedures.

1. Test Parameters

This section describes the test parameters to use when measuring a product's power consumption under the OM test procedure.

Note to industry: Because of changes to the way speed is characterized in this test procedure, the reference to a standard test pattern proposed in the first draft OM test procedure has been removed. The standard test pattern was suggested for use in the ENERGY STAR speed test for Ink Jet products; however, this speed test has since been removed due to stakeholder feedback and additional consideration on how best to differentiate Ink Jet products in the specification.

Network Connectivity

Products that are capable of being network-connected as-shipped¹ shall be connected to at least one network during the test procedure. The type of network connection that is active is at the discretion of the manufacturer, and the type used shall be reported.

The product shall not receive operating power over the network connection (e.g., via Power over Ethernet, USB PlusPower, or IEEE 1394) unless that is the only source of power for the product (i.e., no AC power source is present).

¹ The type of network connection shall be reported. Common network types are Ethernet, WiFi (802.11), and Bluetooth. Other (non-network) data connection types are USB, serial, and parallel.

Product Configuration

The product shall be configured **as shipped and recommended for use**, particularly for key parameters such as power management default-delay times, print quality, and resolution. In addition:

- Paper source and finishing hardware shall be present and configured as-shipped; however, use of these features in the test is at the manufacturer's discretion (e.g., any paper source may be used).
- Anti-humidity features may be turned off if they are user-controllable.
- If a product includes communications ports other than those needed for performing the test (e.g., USB), or convenient memory connections (e.g., for digital camera memory devices), these devices do not need to be connected during the test procedure.
- For Ink Jet fax machines, a page shall be fed into the unit's document feeder for convenience copying, and may be placed in the document feeder before the test begins. The unit need not be connected to a telephone line unless the telephone line is necessary for performing the test. For example, if the fax machine lacks convenience copying capability, then the job performed in Step 2 shall be sent via phone line. On fax machines without a document feeder, the page should be placed on the platen.
- If a product has an auto-off mode enabled as shipped, it shall be enabled prior to performing the test.

Speed

When conducting power measurements under this test procedure, the product shall produce images at the speed resultant from its default settings as shipped.

2. Power Measurement Method

All power measurements are to be made in accordance with IEC 62301 with the following exceptions:

- To determine the voltage/frequency combinations to be used during testing, reference the ENERGY STAR Imaging Equipment (IE) Test Conditions document, entitled **Test Conditions and Equipment for Determining the ENERGY STAR® Qualification Status of Imaging Equipment Products**.
- The harmonics requirement used during testing is that specified in the IE Test Conditions document, which is more stringent than that required by IEC 62301.
- The accuracy requirement for this OM test procedure is 2% for all measurements except for ready power. The accuracy requirement for measuring ready power remains at 5%, as provided in the IE Test Conditions document. The 2% figure is consistent with IEC 62301, although the IEC standard expresses it as a confidence level.
- For products designed to operate using batteries when not connected to the mains, the battery shall be left in place for the test; however, the measurement should not reflect active battery charging beyond maintenance charging (i.e., the battery should be fully charged before beginning the test).
- Products with external power supplies shall be tested with the product connected to the external power supply.
- Products powered by a standard low voltage DC supply (e.g., USB, USB PlusPower, and Power Over Ethernet) shall utilize a suitable AC-powered source of the DC power. This AC-powered source's energy consumption also shall be measured and reported for the imaging equipment product under test. For imaging equipment powered by USB, a powered hub serving only the imaging equipment being tested shall be used. For imaging equipment powered by Power Over Ethernet or USB PlusPower, it is acceptable to measure the power distribution device with and without the imaging product connected, and use this difference as the imaging product's consumption. It should be shown that this reasonably reflects the unit's DC consumption plus some allowance for power supply and distribution inefficiency.

Note to industry: When commenting on the first draft OM test procedure, several stakeholders expressed concern that IEC 62301 was not yet final. This standard was since finalized on June 13, 2005 and is referenced in Section 5 of this test procedure.

3. ENERGY STAR OM Measurement Procedure

To measure time, an ordinary stopwatch and timing to a resolution of one second is sufficient. All power figures are to be recorded in Watts (W). Table 1 below outlines the steps of the OM test procedure.

Service/maintenance modes (including calibration) generally should not be included in measurements. Any adaptation of the procedure needed to exclude such modes that occur during the test shall be noted.

As stated above, all power measurements are to be made in accordance with IEC 62301. Depending on the nature of the mode, IEC 62301 provides for instantaneous power measurements, five-minute accumulated energy measurements, or accumulated energy measurements over periods long enough to properly assess cyclical consumption patterns. Regardless of the method, only measurements of power should be reported.

Note to industry: For the purposes of simplicity, the formerly separate Tables 1 and 2 have been combined in Table 1 in this final draft test procedure. Since various products may be lacking low-power or auto-off modes, guidance has been provided in the notes beneath the table for addressing these products.

Table 1. The OM Test Procedure

Step	Initial State	Action	Record
1	Off	Plug the unit into meter. Turn on unit. Wait until unit indicates it is in Ready mode.	-
2	Ready	Print, copy, or scan a single image.	-
3	Ready	Measure Ready power.	Ready <i>power</i>
4	Ready	Wait default delay-time to Low-power.	Low-power default-delay <i>time</i>
5	Low-power	Measure Low-power power.	Low-power <i>power</i>
6	Low-power	Wait default delay-time to Sleep.	Sleep default-delay <i>time</i>
7	Sleep	Measure Sleep power.	Sleep <i>power</i>
8	Sleep	Wait default delay time to Auto-off.	Auto-off default-delay <i>time</i>
9	Auto-off	Measure Auto-off power.	Auto-off <i>power</i>
10	Off/Standby	Manually turn device off. Wait until unit is off.	-
11	Off/Standby	Measure Off/Standby power.	Off/Standby <i>power</i>

Notes:

- Before beginning the test, it is helpful to check the power management default-delay times to ensure they are as-shipped.

- Step 1 – If the unit has no ready indicator, use the time at which the power consumption level stabilizes to the ready level, and note this detail when reporting the product test data.
- Steps 4 and 5 – Some products do not have a distinct low-power mode. This mode is typically designed into large-format copiers and MFDs that use high-heat marking technologies as an initial power reduction preceding sleep. For products lacking this mode, disregard Steps 4 and 5 and note this detail when reporting the product test data.
- Steps 4, 6, and 8 – Default-delay time measurements are to be measured in parallel fashion, meaning cumulative from the start of Step 4. E.g., a product set to enter low-power mode in 15 minutes and enter sleep mode 30 minutes after entering low-power mode will have a low-power default-delay time of 15 minutes and a sleep default-delay time of 45 minutes.
- Steps 8 and 9 – Some products do not have a distinct auto-off mode. For products lacking this mode, disregard Steps 8 and 9 and note this detail when reporting the product test data.
- Step 10 – If the unit has no power switch, wait until it enters its lowest power mode and note this detail when reporting the product test data.

Note to industry: Some stakeholders have suggested that EPA should not include a ready-mode measurement in the OM test procedure if EPA does not plan to include ready-mode criteria in the specification. While EPA does not intend to include ready-mode limits in the Version 1.0 specification, EPA has retained the measurement of ready mode in this Final Draft test procedure because:

1. *EPA remains interested in the ready-mode power consumption of these products, and may consider specifying ready-mode power limits in future specification revisions if data indicates that addressing sleep modes is no longer sufficient; and*
2. *measuring ready-mode power does not add significant complexity or time to the test procedure.*

Note to industry: In response to stakeholder feedback, a separate step has been incorporated into the OM test procedure to measure low-power mode. This step may be disregarded if a product does not possess this power-reduction level. Additionally, this mode may also be renamed from “low power” in the final version if the need for further clarity warrants it.

Note to industry: To improve consistency with the Draft 1 (Version 1.0) specification, the mode measured in Step 11 has been named “Off/Standby” rather than “Off” in this final draft. This term is provided for products that do not have a manual-off switch but are able to meet the standby levels called for in the specification while in low-power or sleep.

Note to industry: The former Section 4, which outlined the ENERGY STAR Speed test for Ink Jet products, has been removed from this draft test procedure. Due to the variables that influence product speed, as well as the lack of sufficient data thus far to support the differentiation of Ink Jet products based on speed, EPA has proposed in the Draft 1 specification to differentiate these products independent of speed. The exact nature of this differentiation has yet to be finalized, and it is still possible that speed will be addressed in some way. If it is determined that Ink Jet products do need to be differentiated in the specification based on speed, manufacturer claimed speed will be used, rather than a measured “ENERGY STAR speed.”

4. Reporting

To qualify products under the Version 1.0 ENERGY STAR specification for imaging equipment, partners will be required to submit qualifying product data using the ENERGY STAR Online Product Submittal (OPS) tool. This tool will collect product data that is pertinent to confirming product qualification in addition to general product information. The applicable fields will be provided upon the finalization of the OM Test Procedure and Imaging Equipment specification.

Speed

Product speed shall be reported to EPA as follows:

Standard-size Products

The speed of the product as reported to ENERGY STAR shall be the manufacturer's reported maximum claimed simplex speed for producing copies or prints (or scans, if a scanner) on standard-sized paper (8.5" x 11" or A4), rounded to the nearest integer. For Standard-size products, a single A4 or 8.5" x 11" sheet printed/copied/scanned on one side in a minute is equal to one image-per-minute (ipm). If the maximum claimed speeds differ when producing images on 8.5" x 11" or A4 paper, the higher of the two shall be used.

Continuous Form Products

For continuous-form products designed to handle primarily roll-form paper, from a width of 2-inches (50.8 mm) or larger, the product speed shall be converted into Standard-size imaging speeds based on total paper area. For example, for a point-of-sale (POS) printer designed to print sales receipts, the maximum claimed speed for this product, as marketed in lines per second (lps), would be converted to Standard-size ipm based on the area of a typical receipt (e.g., 2.76" x 5.9") printed in seconds held in comparison to the area of a Standard-size image (e.g., 8.5" x 11") in minutes.

Note to industry: Because continuous-form products vary widely in size and purpose (e.g., point-of-sale printers, thermal label printers) as well as by marketed speed (e.g., lps, inches per minute), the comparison method in this final draft test procedure is provided as a guideline. EPA would appreciate feedback from stakeholders on whether additional clarification is needed.

Large-format Products

For large-format products designed to handle primarily paper sizes of 17" x 22", A2, or larger, the product speed shall be converted into Standard-size imaging speeds as follows: (a) One A2 image per minute is equivalent to four A4 images per minute, and (b) One A0 image per minute is equivalent to 16 A4 images per minute. Other page sizes can be converted similarly.

Mailing Machines

A piece of mail processed in a minute is equal to one mail-piece-per-minute (mppm).

Small-format Products

A single A6 or 4" x 6" sheet printed/copied/scanned on one side in a minute is equal to 0.25 ipm.

5. References

- IEC 62301:2005. Household Electrical Appliances – Measurement of Standby Power

Note to industry: IEC 62301 went into effect on June 13, 2005. It is available for purchase online at <http://domino.iec.ch/webstore/webstore.nsf/artnum/034231>.