ENERGY STAR® Qualified Imaging Equipment

First Draft Test Procedure

Operational Mode Approach

May 17, 2005

*This document presents a first draft test procedure for evaluating the energy performance of products addressed by the **Operational Mode (OM)** approach in the revised 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 Energy 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 all large format devices and scanners. The key results of this test procedure are power values for sleep 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. Speed Measurement Procedure for Standard- and Smaller-size Ink Jet Products;
5. Reporting; and
6. References.

The full OM test procedure consists of this narrative document and 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 were previously distributed with the TEC test procedure as they 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.

Test Pattern for Measuring the Speed of Standard- and Smaller-size Ink Jet Products

The test pattern is comprised of a set of four images from the current draft of ISO/IEC 24712, which is currently in development. The pattern shall be rendered on an 8.5" x 11" or A4 sheet of paper, as appropriate for the primary intended market. For products with a maximum paper size less than the standard sheet, the pattern shall be appropriately reduced for the normal maximum width of the unit.

Auto-off

If a product has an auto-off mode enabled as shipped, it shall be enabled prior to performing the test.

Network Connectivity

Products that are capable of being network-connected as-shipped[1] shall be connected to a 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. Fax machines need not be connected to a telephone line unless the telephone line is necessary for performing the test, e.g., if the fax machine lacks convenience copying capability, then the job performed in Step 2 shall be sent via phone line.

[1] The type of network connection shall be reported. Common types are Ethernet, 802.11, and Bluetooth. Other 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. 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 user-controllable.

"ENERGY STAR Speed"

It is expected that the final ENERGY STAR specification for imaging equipment will contain power consumption criteria that are correlated to product speed for some categories. For this reason, manufacturers must report (and in some cases, measure) a speed that may be used as a basis for comparison of energy efficiency. This speed will be referred to as the product's "ENERGY STAR speed" for the purposes of this procedure. The "ENERGY STAR speed" may differ from the speed at which the product is marketed. The "ENERGY STAR speed" is simply one speed at which the product is capable of performing, and the speed used to qualify the product for ENERGY STAR. The methods for measuring or deriving "ENERGY STAR speed" are described below.

For all product types (except mailing machines) the "ENERGY STAR speed" is expressed in images per minute (ipm) of standard-size images.

"ENERGY STAR Speed" for Standard- and Smaller-size Ink Jet Products

The "ENERGY STAR speed" for standard and smaller-size Ink Jet products must be measured as part of this OM test procedure. This measurement procedure is outlined in Section 4.

For all other product categories, the "ENERGY STAR speed" is derived from manufacturer claims. 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.

"ENERGY STAR Speed" for Standard- and Smaller-size Scanners

The "ENERGY STAR speed" for scanners shall be the maximum claimed speed for monochrome scans of a single sheet. A single sheet scanned on one side in one minute is equal to 1 ipm.

"ENERGY STAR Speed" for Large Format Products

The "ENERGY STAR speed" for large format products shall be the maximum claimed speed for making monochrome images, or scans if the product is a scanner. 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 sizes can be converted similarly.

"ENERGY STAR Speed" for Mailing Machines

For mailing machines, the "ENERGY STAR speed" is the speed that is used in product marketing, in mail pieces per minute.

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 will not reflect active battery charging beyond maintenance charging.
- 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.

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.

There are two different methods to test imaging equipment products in this ENERGY STAR OM test procedure, as detailed in Tables 1 and 2 below. Table 1 outlines the procedure for products that do not have an auto-off feature, and Table 2 outlines the procedure for products that do have an auto-off feature.

Table 1. The OM Test Procedure — Products without Auto-off

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. Wait until unit indicates it is again in Ready mode. Wait one minute.	-
3	Ready	Measure Ready power.	Ready *power*
4	Ready	Wait default delay-time to Sleep.	-
5	Sleep	Measure Sleep power.	Sleep *power*
6	Off	Manually turn device off. Wait until unit is off.	-
7	Off	Measure Off power.	Off *power*

Notes:

- Before beginning the test, it is helpful to check the power management default-delay times to ensure they are as-shipped.
- Steps 1 and 2 – 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.

- Step 4 – Some products do not have distinct ready and sleep modes. For these products, simply wait one minute.
- Step 6 – 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.

Table 2. The OM Test Procedure — Products with Auto-off

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. Wait until unit indicates it is again in Ready mode. Wait one minute.	-
3	Ready	Measure Ready power.	Ready *power*
4	Ready	Wait default delay-time to Sleep.	-
5	Sleep	Measure Sleep power.	Sleep *power*
6	Sleep	Wait default delay time to Auto-off.	-
7	Auto-off	Measure Auto-off power.	Auto-off *power*
8	Off	Manually turn device off. Wait until unit is off.	-
9	Off	Measure Off power.	Off *power*

Notes:
- Before beginning the test, it is helpful to check the power management default-delay times to ensure they are as-shipped.
- Steps 1 and 2 – 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.
- Step 4 – Some products do not have distinct ready and sleep modes. For these products, simply wait one minute.
- Step 8 – If the unit has no power switch/button, wait until it enters its lowest power mode and note this detail when reporting the product test data.

4. Speed Measurement Procedure for Standard- and Smaller-size Ink Jet Products

This measurement only applies to standard- and smaller-size Ink Jet products. The same test conditions utilized for measuring the imaging equipment product's OM power consumption shall be utilized for this procedure. For time measurements, an ordinary stopwatch accurate to one second is sufficient. There is no requirement about how the computer generates or sends the images to the product (e.g., number of separate print jobs, file format, etc.); however, if the product can interpret a page description language (PDL) (e.g., PCL or Postscript), images shall be sent to the product in a PDL.

Table 3. Procedure to Determine Standard- and Smaller-size Ink Jet Product Speed

Step	Initial State	Action	Record
1	Off	Turn on unit. Wait until unit indicates it is in Ready mode.	-
2	Ready	Send six sets of the four test-images to the printer. Wait until the last of the four images from of the first set exits the printer. Zero the stopwatch.	-
3	Active	Wait until the last of the final set of images exits the printer.	*Total Print Time (seconds)*

Notes:
- Before beginning the test, check to make sure that there is sufficient paper supplied.
- Step 1 – If the unit has no ready indicator, wait a sufficient time for the unit to become ready.

- Step 2 – In all cases, to ensure measurement accuracy, the Total Print Time shall be no less than 60 seconds. If necessary, increase the number of test image sets to ensure a 60-second test interval. Alternatively, for relatively slow printers, the number of sets can be reduced from five as long as the Total Print Time does not drop below three minutes. If the number of image sets is changed in this case, adjust the formula accordingly.

Total Print Time covers five of the sets of four images or a total of 20 images. Calculate the product's "ENERGY STAR speed" in Images per Minute (ipm) using the following equation:

"*ENERGY STAR speed"* (ipm) = *60* (seconds/minute) *x 20* (images) / *Total Print Time* (seconds)

Which is equivalent to:

"ENERGY STAR" speed (ipm) = *60 x 20 / Total Print Time*

The result shall be rounded to the nearest integer (results under 0.5 ipm should be reported as 1).

5. Reporting

Once the ENERGY STAR OM test procedure and Imaging Equipment specification are finalized and become effective, partners will be asked to report 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.

6. References

- IEC 62301: Household Electrical Appliances – Measurement of Standby Power
- ISO/IEC 10561:1999. Information technology — Office equipment — Printing devices — Method for measuring throughput — Class 1 and Class 2 printers (available in English only)
- ISO/IEC 24712: Color Test pages for Measurement of Office Equipment Consumable Yield, ISO/IEC JTC1, SC 28/WG 2