ENERGY STAR® Qualified Imaging Equipment

Draft Test Procedure

Typical Electricity Consumption

August 31, 2004

*This document presents a draft test procedure to facilitate evaluation of the **Typical Electricity Consumption (TEC)** approach proposed in the February 10 ENERGY STAR Imaging Equipment Directional Draft. This paper and accompanying spreadsheet outline a test procedure, which may be used to evaluate the TEC of Imaging Equipment (IE) products such as copiers, printers, multi-function devices (MFDs), scanners, and fax machines. This TEC test procedure consists of test conditions, a measurement procedure, and a calculation method. The key result is a figure for typical daily electricity consumption.*

Test Conditions

The voltage shall be appropriate for the market the product is intended for, and shall be reported in the test results. The product shall be configured as shipped and recommended for use.

If a machine has a duplexing mode, it shall be tested in duplex mode. If it does not have duplexing mode, it shall be tested in simplex mode.

The standard test image is yet to be determined. For copiers and fax machines, it shall be rendered on a 8.5" x 11" sheet of paper (except for large format products). For printers and MFDs, images shall be sent to the product in a page description language (e.g. PCL or Postscript) if the product is capable of that.

The product shall be configured as-shipped, particularly for key parameters such as power management delay times and resolution (except as noted below). Printers and MFDs shall be connected to a network if capable of being network-connected as-shipped[1]. While the type of network connection (or other data connection if not capable of being networked) is at the discretion of the manufacturer, the type used shall be reported.

[1] The type of network connection shall be reported. Common types are Ethernet and 802.11. Other data connection types are USB, serial, parallel, and Bluetooth.

Measurement Procedure

Table 1. The TEC Test Procedure in Brief

Step	Initial State	Action	Record (at end of test period)
1	Off	Plug the unit into meter for at least one hour. Zero the meter; wait test period (five minutes).	Auto-Off or Off *energy*
2	Off	Zero meter; turn on unit. Measure the time it takes for unit to indicate Ready mode.	Recovery from Auto-Off or Off *time*
			Recovery from Auto-Off or Off *energy*
3	Ready	Zero meter; wait test period (Sleep delay time).	Ready *energy*
4	Sleep	Zero meter; wait test period (choice of Auto Off delay time or 10 minutes).	Sleep *energy*
5	Sleep	Zero meter; wake unit. Measure the time it takes for unit to indicate Ready mode.	Recovery from Sleep *time*
			Recovery from Sleep *energy*
6	Ready	Zero meter; perform one job per Job Table; wait test period (job interval, always 15 minutes).	Job *energy*

Notes:
(3) The manufacturer has the option of basing the test period on the observed transition from Ready to Sleep, rather than strictly on the basis of timing.
(4) The manufacturer may want to wait the entire Sleep period rather than stop at 10 minutes, to be able to capture more than one Sleep mode if present.
(5) Recovery from Sleep energy is not presently used in any of the calculations, but is easy to collect and may be useful in future.

The procedure assumes the use of an electricity meter capable of accumulating electricity consumption in Wh accurate to the greater of 0.5% or one hundredth of a Wh. For measuring time, an ordinary stopwatch is sufficient. All energy figures are to be recorded as Wh and all time in seconds. “Zero meter” references are to the "hours/Watt-hours" readout of the meter. Table 1 outlines the TEC procedure.

The number of images for the imaging job performed in Step 6 is as specified in Table 2, calculated according to the formulas listed, based on the manufacturers reported speed. Fractional images per job that result from the calculation should be ignored (truncated). For example, a figure of 15.8 indicates that 15 images should be made, not rounded to 16 images.

For copiers and fax machines, originals can be placed in the document feeder before the test begins and may be single or double-sided. Products without a document feeder can make all images off of a single original placed on the platen. Finishing options (e.g. stapling, collating) selected are at the discretion of the manufacturer.

For printers or MFDs, each image shall be sent separately; they can be all part of the same document, but not specified in the document as multiple copies of a single original image.

For fax machines, individual pages shall be fed into product’s document feeder for convenience copying. The unit need not be connected to a phone line.

If the job size called for by Table 2 is more than the document feeder can handle, the test can be done by a succession of imaging jobs.

Table 2. Imaging Equipment Job Table

Product type	Rating to use	Speed	Images per (test) job
Copier, monochrome	multicopy speed	< 10 ipm	1
		10-50 ipm	(speed x 0.4) - 3
		> 50 ipm	(speed x 1.6) - 63
Printer, inkjet and MFD, inkjet	(monochrome speed)	all	1
Printer, non-inkjet, color	monochrome speed	all	(speed x 0.6) + 6
Printer, non-inkjet, mono	monochrome speed	≤ 25 ipm	1
		> 25 ipm	(speed x 1.2) - 30
MFD, copier-based, color	(monochrome speed)	all	(speed x 0.6)
MFD, copier-based, mono	monochrome speed	< 15 ipm	1
		≥ 15 ipm	(speed x 1.2) – 16
Fax machine	(monochrome speed)	all	1

Note: Derived from on Buyers Laboratory Inc. ratings for recently-introduced equipment (2003-04)

Calculation Method

The total daily consumption is derived from assumptions about how many hours a day the product is in general use, the pattern of use during those hours, and the delay times that the product uses to transition to lower power modes. Please refer to the attached spreadsheet for any specifics not covered here. For example, all electricity measurements are made as accumulated energy over time, then converted to power by dividing by the length of the time period.

The calculation method for **copiers** is summarized in the following three equations. Final Ready Time and Final Sleep Time are net of the 15 minute job interval and ignore the length of the copying time. Final Ready Time is the Sleep Delay time less the 15 minute job interval. Final Sleep Time is the Auto-Off Delay Time less any Sleep time that occurs in the 15 minute job interval.

Daily Consumption =
*Recovery from Auto-off Energy + (8 hours * (Job Energy * 4)) + Final Ready Energy + Final Sleep Energy + Daily Auto-Off Energy*
*Daily Auto-Off Energy = (16 hours – Final Ready Time – Final Sleep Time) * Auto-Off Power*
*Final Ready Energy = Final Ready Time * Ready Power*

The calculation method for **printers, MFDs, and fax machines** is summarized in the following two equations. Final Ready Time is net of the 15 minute job interval and ignores the length of the imaging time. Final Ready Time is the Sleep Delay time less the 15 minute job interval.

Daily Consumption =
*Recovery from Sleep Energy + (8 hours * (Job Energy * 4)) + Final Ready Energy + Daily Sleep Energy*
*Daily Sleep Energy = (16 hours – Final Ready Time) * Sleep Power*