



# ENERGY STAR® Program Requirements for Computers

DRAFT 3

## Table of Contents

6		
7		
8		
9		
10		
11		
12	<b>Partner Commitments</b>	2
13		
14	<i>Commitments</i>	2
15		
16	<i>Performance for Special Distinction</i>	3
17		
18	<b>Eligibility Criteria</b>	5
19		
20	<i>Section 1: Definitions</i>	5
21		
22		
23	<i>Section 2: Qualifying Products</i>	8
24		
25		
26	<i>Section 3: Energy Efficiency and Power Management Criteria</i>	9
27		
28	<i>Tier 1 Requirements</i>	9
29		
30	<i>Tier 2 Requirements</i>	14
31		
32		
33	<i>Section 4: Test Procedures</i>	14
34		
35		
36	<i>Section 5: Effective Date</i>	16
37		
38		
39	<i>Section 6: Future Specification Revisions</i>	16
40		
41		
42	<b>Appendix A: ENERGY STAR Draft Test Procedure for Determining the Power Use of Computers in Standby,</b>	
43	<b>    Sleep, and Idle</b>	
44		
45		



# ENERGY STAR<sup>®</sup> Program Requirements for Computers

## Partner Commitments DRAFT 3

51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95

### Commitments

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacturing of ENERGY STAR qualified computers. The ENERGY STAR Partner must adhere to the following program requirements:

- comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must be met for use of the ENERGY STAR certification mark on computers and specifying the testing criteria for computers. EPA may, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at EPA's request;
- comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR marks and name may be used. Partner is responsible for adhering to these guidelines and for ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance;
- qualify at least one ENERGY STAR computer model within one year of activating the computers portion of the agreement. When Partner qualifies the product, it must meet the specification (e.g., Tier 1 or 2) in effect at that time;
- provide clear and consistent labeling of ENERGY STAR qualified computers. The ENERGY STAR mark must be clearly displayed:

1. On the top/front of the product. Labeling on the top/front of product may be permanent or temporary. All temporary labeling must be affixed to the top/front of product with an adhesive or cling-type application;

Electronic Labeling Option: Manufacturers have the option of using an alternative electronic labeling approach in place of this product labeling requirement, as long it meets the following requirements:

- The ENERGY STAR mark in cyan, black, or white (as described in "The ENERGY STAR Identity Guidelines" available at [www.energystar.gov/logos](http://www.energystar.gov/logos)) appears at system start-up. The electronic mark will display for a minimum of 10 seconds, unless the product turn-on process does not allow this. In this case the mark should show for as much time as possible, but for no less than 5 seconds;
- The ENERGY STAR mark must be at least 10% of the screen by area, may not be smaller than 76 pixels x 78 pixels, and must be legible.

EPA will consider alternative proposals for electronic labeling on a case-by-case basis.

2. In product literature (i.e., user manuals, spec sheets, etc.);
3. On product packaging for products sold at retail; and

- 96 4. On the manufacturer's Internet site where information about ENERGY STAR qualified models is  
97 displayed:
- 98 – If information concerning ENERGY STAR is provided on the Partner Web site, as specified by  
99 the ENERGY STAR Web Linking Policy (this document can be found in the Partner  
100 Resources section on the ENERGY STAR Web site at [www.energystar.gov](http://www.energystar.gov)), EPA may  
101 provide links where appropriate to the Partner Web site;

**Note:** The packaging requirement is meant to distinguish qualified products to consumers in retail settings. Thus, the labeling requirements have been changed to allow manufacturers preparing products not destined for a retail setting to choose whether they wish to label the packaging of these products. Clarifying language regarding the physical labeling of products has also been added.

- 103  
104
- 105 • provide to EPA, on an annual basis, an updated list of ENERGY STAR qualified computer models.  
106 Once the Partner submits its first list of ENERGY STAR qualified computer models, the Partner will be  
107 listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the  
108 list of participating product manufacturers;
  - 109 • provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in  
110 determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total  
111 number of ENERGY STAR qualified computers shipped (in units by model) or an equivalent  
112 measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide  
113 ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g.,  
114 capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and  
115 percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year  
116 should be submitted to EPA, preferably in electronic format, no later than the following March and may  
117 be provided directly from the Partner or through a third party. The data will be used by EPA only for  
118 program evaluation purposes and will be closely controlled. Any information used will be masked by  
119 EPA so as to protect the confidentiality of the Partner;
  - 120 • notify EPA of a change in the designated responsible party or contacts for computers within 30 days.

## 121 122 123 124 125 **Performance for Special Distinction**

126 In order to receive additional recognition and/or support from EPA for its efforts within the  
127 Partnership, the ENERGY STAR Partner may consider the following voluntary measures and should keep  
128 EPA informed on the progress of these efforts:

- 129 • consider energy efficiency improvements in company facilities and pursue the ENERGY STAR mark  
130 for buildings;
- 131 • purchase ENERGY STAR qualified products. Revise the company purchasing or procurement  
132 specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA  
133 for periodic updates and coordination. Circulate general ENERGY STAR qualified product information  
134 to employees for use when purchasing products for their homes;
- 135 • ensure the power management feature is enabled on all ENERGY STAR qualified monitors and  
136 computers in use in company facilities, particularly upon installation and after service is performed;
- 137 • provide general information about the ENERGY STAR program to employees whose jobs are relevant  
138 to the development, marketing, sales, and service of current ENERGY STAR qualified product  
139 models;
- 140 • provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the  
141  
142  
143  
144  
145

146 program requirements listed above. By doing so, EPA may be able to coordinate, communicate,  
147 and/or promote Partner's activities, provide an EPA representative, or include news about the event in  
148 the ENERGY STAR newsletter, on the ENERGY STAR Web pages, etc. The plan may be as simple  
149 as providing a list of planned activities or planned milestones that Partner would like EPA to be aware  
150 of. For example, activities may include: (1) increase the availability of ENERGY STAR qualified  
151 products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2)  
152 demonstrate the economic and environmental benefits of energy efficiency through special in-store  
153 displays twice a year; (3) provide information to users (via the Web site and user's manual) about  
154 energy-saving features and operating characteristics of ENERGY STAR qualified products: and (4)  
155 build awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on  
156 one print advertorial and one live press event;

- 157
- 158 • provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase  
159 availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and  
160 its message.



# ENERGY STAR® Program Requirements for Computers

## Eligibility Criteria DRAFT 3

166

167

168

Below is the **DRAFT 3** Version 4.0 product specification for ENERGY STAR qualified computers. A product must meet all of the identified criteria to earn the ENERGY STAR.

169

170

171

1) **Definitions:** Below are the definitions of the relevant terms in this document.

172

173

- A. **Computer:** A device which performs logical operations and processes data. Computers are composed of, at a minimum: (1) a central processing unit (CPU) to perform operations; (2) user input devices such as a keyboard, mouse, digitizer or game controller; and (3) a display screen to output information. For the purposes of this specification, computers include both stationary and portable units, including desktop computers, gaming consoles, integrated computers, notebook computers, tablet PCs, desktop-derived servers and workstations.

174

175

176

177

178

179

### Components

180

181

- B. **Display:** A commercially-available, electronic product with a display screen and its associated electronics encased in a single housing, or within the computer housing (e.g., notebook or integrated computer), that is capable of displaying output information from a computer via one or more inputs, such as a VGA, DVI, and/or IEEE 1394. Examples of display technologies are the cathode-ray tube (CRT) and liquid crystal display (LCD).

182

183

184

185

186

187

- C. **External Power Supply:** A component contained in a separate physical enclosure external to the computer casing and designed to convert line voltage ac input from the mains to lower dc voltage(s) for the purpose of powering the computer. An external power supply must connect to the computer via a removable or hard-wired male/female electrical connection, cable, cord or other wiring and have a nameplate output power less than or equal to 250 watts.

188

189

190

191

192

193

- D. **Internal Power Supply:** A component internal to the computer casing and designed to convert ac voltage from the mains to dc voltage(s) for the purpose of powering the computer components. For the purposes of this specification, an internal power supply must be contained within the computer casing but be separate from the main computer board. The power supply must connect to the mains through a single cable with no intermediate circuitry between the power supply and the mains power. In addition, all power connections from the power supply to the computer components must be internal to the computer casing (i.e., no external cables running from the power supply to the computer or individual components). Internal dc to dc converters used to convert a single dc voltage from an external power supply into multiple voltages for use by the computer are not considered internal power supplies.

194

195

196

197

198

199

200

201

202

203

204

### Computer Types

205

206

- E. **Desktop Computer:** A computer where the main unit is intended to be located in a permanent location, often on a desk or on the floor. Desktops are not designed for portability and utilize an external monitor, keyboard, and mouse. Desktops are designed for a broad range of home and office applications including, email, web browsing, word processing, standard graphics applications, gaming, etc.

207

208

209

210

211

212

213

214 F. Desktop-Derived Server: A desktop-derived server is a computer that typically uses desktop  
215 components in a tower form factor, but is designed explicitly to be a host for other computers or  
216 applications. For the purposes of this specification, a computer must be marketed as a server and  
217 have the following characteristics to be considered a desktop-derived server:

- 218
- 219 • Designed and placed on the market as a Class B product per EuroNorm EN55022:1998 under  
220 the EMC Directive 89/336/EEC and has no more than single processor capability (1 socket on  
221 board);
- 222
- 223 • Designed in a pedestal, tower, or other form factor similar to those of desktop computers such  
224 that all data processing, storage, and network interfacing is contained within one box/product;
- 225
- 226 • Designed to operate in a high-reliability, high-availability application environment where the  
227 computer must be operational 24 hours/day and 7 days/week, and unscheduled downtime is  
228 extremely low (on the order of hours/year);
- 229
- 230 • Capable of operating in a simultaneous multi-user environment serving several users through  
231 networked client units; and
- 232
- 233 • Shipped with an industry accepted operating system for standard server applications (e.g.,  
234 Windows NT, Windows 2003 Server, Mac OS X Server, OS/400, OS/390, Linux, Unix and  
235 Solaris).
- 236

237 Desktop-derived servers are designed to perform functions such as processing information for  
238 other systems, providing network infrastructure services (e.g., archiving), data hosting and running  
239 web servers.

240 This specification does not cover mid-range or large servers, defined for purposes of this  
241 specification as:

- 242
- 243
- 244 • Designed and placed on the market as a Class A product per EuroNorm EN55022:1998 under  
245 the EMC Directive 89/336/EEC and designed and capable of having a single or dual  
246 processor capability (1 or greater sockets on board); and
- 247
- 248 • Designed and placed on the market as a Class B product per EuroNorm EN55022:1998 under  
249 the EMC Directive 89/336/EEC and designed and capable of having a *minimum* dual  
250 processor capability (2 sockets on board).
- 251

252 G. Game Consoles: Stand alone computers whose primary use is to play video games. For the  
253 purposes of this specification, game consoles must use a hardware architecture based on typical  
254 computer components (e.g., processors, system memory, video architecture, optical and/or hard  
255 drives, etc.). The primary input for game consoles are special hand held controllers rather than  
256 the mouse and keyboard used by conventional computer types. Game consoles are also  
257 equipped with audio visual outputs for use with televisions as the primary display, rather than an  
258 external monitor or integrated display. These devices do not typically use a conventional  
259 operating system, but often perform a variety of multimedia functions such as: DVD/CD playback,  
260 digital picture viewing, and digital music playback.

261

262 H. Integrated Computer: A desktop system in which the computer and display function as a single  
263 unit which receives its ac power through a single cable. Integrated computers come in one of two  
264 possible forms: (1) a system where the display and computer are physically combined into a  
265 single unit; or (2) a system packaged as a single system where the display is separate but is  
266 connected to the main chassis by a dc power cord and both the computer and display are  
267 powered from a single power supply. As a subset of desktop computers, integrated computers  
268 are typically designed to provide similar functionality as desktop systems.

**Note:** Some stakeholders expressed concern about how to qualify computers packaged with dedicated monitors that connect to the main computer with a dc power cord. After researching this issue, EPA modified the definition of integrated computers to include computers with displays powered by a dc power cord off of the main unit's power supply. EPA believes that these products should fit the definition of integrated computers even though they do not share a single housing because these products share a single power supply and are therefore, technically equivalent to integrated computers though in a slightly different form.

270

271

272

273

274

275

276

277

278

279

280

281

282

- I. Notebook and Tablet Computers: A computer designed specifically for portability and to be operated for extended periods of time without a direct connection to an ac power source. Notebooks and tablets must utilize an integrated monitor and be capable of operation off an integrated battery or other portable power source. In addition, most notebooks and tablets use an external power supply and have an integrated keyboard and pointing device, though tablets use touch sensitive screens. Notebook and tablet computers are typically designed to provide similar functionality to desktops except within a portable device. For the purposes of this specification, docking stations are considered accessories and therefore, the performance levels associated with notebooks presented in Table 1 of section 3, below, do not include them.

283

- J. Workstation: For the purposes of this specification, to qualify as a workstation, a computer must:

- Be marketed as a workstation;
- Have a mean time between failures (MTBF) of at least 15,000 hours based on Bellcore TR-NWT-000332, issue 6, 12/97; and
- Support error-correcting code (ECC) and/or buffered memory.

287

288

In addition, a workstation must meet three of the following six optional characteristics:

289

290

291

292

293

294

295

296

297

298

299

300

- Have supplemental power support for high end graphics (i.e., PCI-E 6-pin 12V supplemental power feed);
- System is wired for 4x or 8x PCI-E on motherboard in addition to graphics slot(s) and/or PCI-X support;
- Does not support Uniform Memory Access (UMA) graphics;
- Includes 5 or more PCI, PCIe, PCI-X slots;
- Capable of multi-processor support for two or more processors (must support physically separate processor packages/sockets, i.e., not met with support for a single multi core processor); and/or
- Be qualified by at least 2 Independent Software Vendor (ISV) product certifications; these certifications can be in process, but must be completed within 3 months of qualification.

**Notes:** Definitions for the terms included in the workstation definition will be included in the Final Draft. Some stakeholders felt that EPA's proposed workstation definition relied too heavily on the specific configuration of the system, and that a simpler definition could be created that accurately differentiates a workstation based on its inherent capabilities. EPA and industry have worked through several iterations to develop this new definition which EPA believes meets these goals of accuracy and simplicity. This definition was released to stakeholders in the 6/12/06 Computer Specification Progress Update, and the Draft 3 version reflects changes based on comments received in response to that release. EPA feels that this definition is close to the definition that will be used in the final specification. However, EPA would like feedback on a few points raised just prior to the release of this draft. These points are as follows: (1) Is 5 PCI/ PCIe/PCI-X slots adequate to differentiate workstations from desktops; (2) Would substituting greater than four cores for symmetric multiprocessing (SMP) support further EPA's goal of distinguishing workstations from desktops; and (3) EPA intends for all PCIe slots to be wired for high bandwidth - are there compatibility issues associated with this line item, and would aggregated I/O simplify this optional requirement? EPA will evaluate all feedback received in the development of the Final Draft.

301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339

### **Operational Modes**

- K. Idle State: For purposes of testing and qualifying computers under this specification, this is the state in which the operating system and other software have completed loading, the machine is not asleep, and activity is limited to those basic applications that the system starts by default.
- L. Sleep Mode: A low power state that the computer is capable of entering automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices. For the purposes of this specification, Sleep mode correlates to ACPI System Level S3 (suspend to RAM) state, where applicable.
- M. Standby Level (Off Mode): The power consumption level in the lowest power mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when the appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions. For purposes of this specification, Standby correlates to ACPI System Level S4 or S5 states, where applicable.

### **Networking and Power Management**

- N. Network Interface: The components (hardware and software) whose primary function is to make the computer capable of communicating over one or more network technologies. For purposes of testing to this specification, Network Interface refers to the IEEE 802.3 wired Ethernet interface.
- O. Wake Event: A user, programmed, or external event or stimulus that causes the computer to transition from Sleep or Standby to active mode of operation. Examples of wake events include, but are not limited to: movement of the mouse, keyboard activity, or a button press on the chassis, and in the case of external events, stimulus conveyed via a remote control, network, modem, etc.
- P. Wake-On LAN (WOL): Functionality which allows a computer to wake from Sleep or Standby when directed by a network request.

- 2) **Qualifying Products**: Computers must meet the computer definition as well as one of the product type definitions provided in Section 1, above, to qualify as ENERGY STAR. **Please note that EPA will explore additional computer types, such as thin clients, for potential Tier 2 requirements.** The following table provides a list of the types of computers that are (and are not) eligible for ENERGY STAR.

Products Covered by Version 4.0 Specification	Products Not Covered by Version 4.0 Specification
<ul style="list-style-type: none"> <li>• Desktop Computers</li> <li>• Game Consoles</li> <li>• Integrated Computer Systems</li> <li>• Notebook Computers/Tablet PCs</li> <li>• Desktop-Derived Servers</li> <li>• Workstations</li> </ul>	<ul style="list-style-type: none"> <li>• Mid-Range and Large Servers (as defined in Section 1F)</li> <li>• Thin Clients/Blade PCs</li> <li>• Handhelds and PDAs</li> </ul>

340

341

3) **Energy Efficiency and Power Management Criteria:** Computers must meet the requirements below to qualify as ENERGY STAR. Proposed effective dates for Tier 1 and Tier 2 are covered in Section 5 of this specification.

342

343

344

345

**A) Tier 1 Requirements - Effective July 1, 2007**

346

347

**(1) Power Supply Efficiency Requirements**

348

**Computers Using an Internal Power Supply:** 80% minimum efficiency at 20%, 50%, and 100% of rated output and Power Factor  $\geq$  0.9 at 100% of rated output.

349

350

351

**Computers Using an External Power Supply:** Must be ENERGY STAR qualified or meet the no-load and active mode efficiency levels provided in the ENERGY STAR Program Requirements for Single Voltage Ac-Ac and Ac-Dc External Power Supplies. The ENERGY STAR specification and qualified product list can be found at [www.energystar.gov/powersupplies](http://www.energystar.gov/powersupplies). Note: This performance requirement also applies to multiple voltage output external power supplies as tested in accordance to the Internal Power Supply test method referenced in Section 4, below.

352

353

354

355

356

357

358

**(2) Operational Mode Efficiency Requirements**

359

360

**Desktop Differentiation:**

For the purposes of determining Idle state levels, desktops and integrated computers must qualify under Categories A, B, or C as defined below:

361

362

363

364

**Category A:** All desktop computers that do not meet the definition of either Category B or Category C below are considered under Category A for ENERGY STAR qualification.

365

366

367

**Category B:** To qualify under Category B desktops must have:

368

- Multi-core processor(s) or greater than 1 discrete processor; and
- Minimum of 1 gigabyte of system memory.

369

370

371

**Category C:** To qualify under Category C desktops must have:

372

- Multi-core processor(s) or greater than 1 discrete processor; and
- A GPU with greater than 128 megabytes of dedicated, non-shared memory.

373

374

375

In addition to the requirements above, models qualifying under Category C must be configured with a minimum of 2 of the following three characteristics:

376

377

- Minimum of 2 gigabytes of system memory;
- TV tuner and/or video capture capability with high definition support; and/or
- Minimum of 2 hard disk drives.

378

379

380

381

**Note:** After extensive discussions with stakeholders, the category system for desktops has been revised to allow for greater differentiation between desktops for the purposes of Idle allowances. This change was made to better reflect the range of capabilities of desktops currently in the marketplace. However, if data provided in August is not robust enough for EPA to set levels for each of the three categories, EPA may return to its initial two category proposal.

**Notebook Differentiation:** A couple of stakeholders submitted comments and data indicating the need to differentiate notebooks based on performance, similar to what EPA did with desktops. This data shows that some notebooks with advanced graphics capability use additional energy in Idle. EPA continues to believe that notebooks with advanced graphics occupy a relatively small niche market. EPA also believes that the advanced power management available for these products makes a flat line Idle requirement achievable for all notebooks, an approach supported by EPA's initial data collection efforts. EPA may consider a differentiation for notebooks based solely on discrete graphics if the data provided in August supports this conclusion. Absent data from industry, EPA will continue to move forward with a single Idle level for notebooks.

382

383

384

**Workstation Levels:**

385

Workstation levels will be determined using a simplified Typical Electricity Consumption (TEC) approach to allow manufacturers energy trade offs between different operating modes, based on a given weighting factor for each mode. The final level will be based on the TEC power level ( $P_{TEC}$ ) which will be determined by the following formula:

386

387

388

$$P_{TEC} = A * P_{Off} + B * P_{Sleep} + C * P_{Idle}$$

389

390

where,  $P_{Off}$  is the power measured in Off,  $P_{Sleep}$  is the power measured in Sleep and in  $P_{Idle}$  is the power measured in Idle (Note – A, B and C represent the weighting factor for each operational mode and are TBD based on industry submitted data). This simplified TEC approach will be used in combination with a scalable classifier to scale the power allowance according to the capability of the system.

391

392

393

394

395

**Workstation Scalable Classifier:** TBD

396

397

**Note:** EPA has included the simplified TEC approach as discussed with stakeholders at the May stakeholder meeting. This approach has been added to give manufacturers the ability to use alternative approaches to energy savings in workstations, since workstations often use advanced technology which warrants special consideration. Though EPA has not gone in this direction for desktops and notebooks, EPA is willing to try this approach for workstations because of their unique characteristics and relatively small market share.

EPA also agreed in concept to a scalable classifier for workstations, and has been working with stakeholders to gather the necessary information and data to determine the effectiveness of such an approach. EPA appreciates all data submitted to support this effort, but due to a low volume of data and gaps in the data initially submitted, EPA has not been able to properly assess if a scalable classifier based on percentage of maximum power is achievable. In email communications dated June 23 and 26, 2006, EPA provided feedback on what further data is needed to continue to pursue this approach. In a revised timeline shared on June 23, 2006 EPA asked that all appropriate data be submitted by July 10, 2006. After the data is collected, EPA will conduct a call on July 13, 2006 to discuss the proposed approach followed by an announcement of the final approach on July 17, 2006.

Although EPA remains committed to these approaches for workstations, without an adequate data set EPA will return to the Draft 2 approach.

398

399

400  
 401  
 402  
 403  
 404  
 405  
 406  
 407  
 408

**Power Level Requirements:**

The following tables indicate the required power allowances for the Tier 1 specification. Table 1 gives the baseline requirements, while Table 2 gives additional power allowances for WOL and increased system memory. For those products that meet the WOL and memory requirements, a model must meet the energy level provided in Table 1 summed with the appropriate allowances from Table 2.

**Note: Products whose Sleep levels meet the Standby power requirements do not need to have a distinct Off mode, and may qualify for this specification using only Sleep mode.**

**Table 1: Tier 1 Energy Efficiency Requirements**

Product Type	Tier 1 Requirements
Desktops, Integrated Computers and Gaming Consoles	<b>Standby (Off Mode):</b> ≤ TBD W  <b>Sleep Mode:</b> ≤ TBD W  <b>Idle State:</b> <b>Category A:</b> ≤ TBD W <b>Category B:</b> ≤ TBD W <b>Category C:</b> ≤ TBD W
Desktop-Derived Servers	<b>Standby (Off Mode):</b> ≤ TBD W  <b>Sleep Mode:</b> N/A  <b>Idle State:</b> ≤ TBD W
Notebooks	<b>Standby (Off Mode):</b> ≤ TBD W  <b>Sleep Mode:</b> ≤ TBD W  <b>Idle State:</b> ≤ TBD W
Workstations	<b>TEC Power (<math>P_{TEC}</math>):</b> ≤ TBD W

409

**Table 2: Tier 1 Capability Adders for Sleep and Standby**

Capability	Power Allowance
WOL	TBD watts for Sleep and/or Standby
System Memory	TBD watts for Sleep per memory module greater than two

410  
 411

**Note:** There was industry concern that the data used to inform the proposed performance levels reflected in Draft 2 of the Computer Specification were not representative of new technologies and platforms that would be in production when the specification is finalized. According to some manufacturers, these new technologies could require additional energy budgets and would be more representative of products available when the specification takes effect on July 1, 2007. In response to this concern, EPA is allowing manufacturers additional time to test and report all models available when this specification is finalized. Therefore, all levels in this Draft 3 specification are denoted as “TBD” and will be based on data submitted by industry in August. EPA is taking this approach to ensure that the levels included in this specification are representative of the products that will actually be available when the specification is finalized in September, 2006. The attached final data sheet must be completed and returned to EPA **no later than August 4, 2006**, to have data considered in this final analysis. **It is important that the data points submitted are reflective of both varied configurations of the same model as well as a range of different models, so that EPA has a solid data set on which to base the specification lines.** Absent a sufficiently robust and varied data set, EPA will use data collected to date to set all levels.

**Integrated Computers:** Some stakeholders commented that integrated computers should be allowed additional power over desktops. EPA believes there is no technical justification for why these systems need additional power, most notably because they only have losses through a single power supply for low power modes. Furthermore, the power used by the monitor is not accounted for under the Idle test procedure since the monitor remains off during testing. Lastly, the data collected by EPA to date supports the conclusion that additional power allowances are not needed for integrated computers. Thus, EPA plans to keep these requirements unless data submitted in August justifies a higher power allowance.

**Game Consoles:** Game consoles will now be treated as desktops for the purposes of this specification. To earn the ENERGY STAR mark, game consoles will now have to meet all the same definitions and levels as desktops, which will include the necessity of a low power sleep requirement. This change was made because EPA has received very little feedback on game console systems, and with the new differentiation approach for desktops it is difficult to classify these products in a single category, as was proposed in the Draft 2 specification. Game consoles may now qualify in any desktop category for which they meet the definition. The Sleep mode requirement was added, because many of these systems use a substantial amount of energy in Idle and are often left on and unused for long periods of time. EPA believes there is large savings potential for game consoles automatically entering low power modes and hopes that this requirement will encourage manufacturers to include low power modes in future designs.

**Desktop-Derived Servers:** EPA received feedback from a number of stakeholders and has concluded that the definition for desktop-derived servers is sufficient and therefore, plans to provide these products with levels separate from desktops in the final specification. EPA needs to receive data by the August 4<sup>th</sup> deadline that supports a separate category with separate levels for these products. Absent a robust data set, EPA will fold these systems back in with desktops and the definition will be removed.

412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428

**Qualifying Computers With or Without WOL Enabled:**

The following requirements should be followed when determining whether models should be qualified with or without WOL:

**Standby:** Computers should be tested and reported as shipped for Standby. Models which will be shipped with WOL enabled should be tested with WOL enabled and will qualify using the extra allowance for Standby found in Table 2.

**Sleep:** Computers should be tested and reported as shipped for Sleep. Models sold through enterprise channels, as defined in the Tier 1 Power Management Requirements (Section 3.A.3), shall be tested, qualified, and shipped WOL enabled. Products going directly to consumers through normal retail channels may be tested, qualified, and shipped with WOL disabled. Those models sold both through enterprise channels and directly to consumers must test and meet both the levels with and without WOL.

429 **(3) Power Management Requirements**

430

431 **Shipment Requirement:**

432 Products must be shipped with the display's Sleep mode set to activate within 15 minutes of user  
433 inactivity. Products must be shipped with the computer's Sleep mode set to activate within 30 minutes  
434 of user inactivity. Products may have more than one low power mode but these proposed criteria  
435 address Sleep mode as defined in this specification. Computers shall reduce the speed of any active  
436 Ethernet network links to the lowest speed supported by both ends of the link when transitioning to  
437 Sleep or Standby.

438

439 All computers, regardless of distribution channel, shall have the ability to enable and disable WOL for  
440 Sleep mode. Systems shipped through enterprise channels must have Wake On LAN (WOL) enabled  
441 from the Sleep mode. For the purpose of this specification, "enterprise channels" are defined as sales  
442 channels normally used by large and medium-sized business, government organizations, and  
443 educational institutions, with the intent of identifying machines that will be used in managed client/  
444 server environments. With WOL enabled, any directed packet filters shall be enabled and set to an  
445 industry standard default configuration.

446

447 All machines shipped to enterprise customers shall be capable of both remote and scheduled wake  
448 events from Sleep mode and manufacturers shall ensure that these settings, where the manufacturer  
449 has control (i.e., configured through hardware settings rather than software settings), can be managed  
450 centrally with tools provided by the manufacturer.

451

452 **User Education Requirement:**

453 In order to ensure that purchasers/users are properly educated on the benefits of power management,  
454 the manufacturer will include with each computer, one of the following:

455

- 456 • Information on ENERGY STAR and the benefits of power management in either a hard copy or  
457 electronic copy of the user manual. This information should be near the front of the user guide; or
- 458 • A package or box insert on ENERGY STAR and the benefits of power management.

459

460 Either option must include the following information:

461

- 462 • Notice that the computer has been shipped enabled for power management and what the time  
463 settings are;
- 464 • How to properly wake the computer from Sleep mode;
- 465 • Energy saving benefits;
- 466 • Money saving benefits;
- 467 • Environmental benefits
- 468 • Some information on ENERGY STAR and a link to [www.energystar.gov](http://www.energystar.gov); and
- 469 • ENERGY STAR logo (used in accordance with "The ENERGY STAR Identity Guidelines"  
470 available at [www.energystar.gov/logos](http://www.energystar.gov/logos)).

471

472 In addition, the manufacturer will have similar information with a link to  
473 [www.energystar.gov/powermanagement](http://www.energystar.gov/powermanagement) on the company Web site, readily accessible from computer  
474 product pages, product specifications, and related content pages.

475

476 At the manufacturer's request, EPA will supply suggested facts and figures related to the above  
477 criteria, template elements, or a complete template suitable for use in user guides or box inserts.

478

479 EPA's goal is to achieve a 40% enabling rate nationally by 2010; 60% by 2012; and  $\geq$  80% by 2014.  
480 EPA recognizes the importance of documenting enabling rates and encourages industry to develop a  
481 collective strategy for securing and funding this research, and sharing findings with EPA and the  
482 public.

483

484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538

**(B) Tier 2 Requirements - Effective January 1, 2009**

**(1a) Tier 2 Capability Benchmark:** All computers will be required to meet the following minimum performance per unit energy metric.

Performance Benchmarking Software and Associated Levels: **TBD**

- OR -

**(1b) Provisional Tier 2 Idle State Requirements:** If an energy efficiency performance or capability benchmark, and associated performance levels, are not ready to go into effect **by January 1, 2009**, a provisional Tier 2 specification will automatically go into effect and will remain in effect until such a benchmark is established. This provisional Tier 2 will include revised Idle state levels for all computer types (those included in Tier 1 as well as others as appropriate [e.g., thin clients]) with the intention of capturing the top 25% performers in energy efficiency.

Additional topics, including the following, will also be re-examined under a provisional Tier 2:

- Idle levels for notebooks and integrated computers that incorporate the energy use of the displays;
- Quantitative distinctions between desktop categories (e.g., Mb of video memory, number of processor cores, Mb of system memory) to make sure these distinctions remain current;
- Sleep levels for desktop-derived servers; and
- Allowances for Out-Of-Bound (OOB) client management tools, such as service processors in Sleep and Standby, which may aid in the adoption of computer power management.

In the case of the implementation of a provisional Tier 2, EPA will re-examine these new topics and finalize new levels at least six months prior to the effective date for Tier 2.

**(2) Power Management Requirements:** In addition to the requirements provided under Tier 1, above, ENERGY STAR qualified computers must retain full network connectivity while in Sleep mode, according to a platform-independent industry standard. All computers shall reduce their network link speeds during times of *low data traffic* levels in accordance with any industry standards that provides for quick transitions among link rates.

**C) Voluntary Requirements**

**User Interface:** Although not mandatory, manufacturers are strongly recommended to design products in accordance with the Power Control User Interface Standard — IEEE 1621 (formally known as “Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments”). Compliance with IEEE 1621 will make power controls more consistent and intuitive across all electronic devices. For more information on the standard see <http://eetd.LBL.gov/Controls>.

**4) Test Procedures:** Manufacturers are required to perform tests and self-certify those models that meet the ENERGY STAR guidelines.

- In performing these tests, partner agrees to use the test procedures provided in Table 3, below.
- The test results must be reported to EPA using the Computer Version 4.0 Qualifying Product Information (QPI) Form.

539 **Models Capable of Operating at Multiple Voltage/Frequency Combinations:** Manufacturers shall  
 540 test their products based on the market(s) in which the models will be sold and promoted as ENERGY  
 541 STAR qualified. For products that are sold as ENERGY STAR in multiple international markets and,  
 542 therefore, rated at multiple input voltages, the manufacturer must test at and report the required power  
 543 consumption or efficiency values at all relevant voltage/frequency combinations. For example, a  
 544 manufacturer that is shipping the same model to the United States and Europe must measure, meet  
 545 the specification, and report test values at both 115 Volts/60 Hz and 230 Volts/50 Hz in order to qualify  
 546 the model as ENERGY STAR in both markets. If a model qualifies as ENERGY STAR at only one  
 547 voltage/frequency combination (e.g., 115 Volts/60 Hz), then it may only be qualified and promoted as  
 548 ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g., North  
 549 America and Taiwan).  
 550

**Table 3: Test Procedures for Measuring Operational Modes**

Specification Requirement	Test Protocol	Source
Standby (Off Mode), Sleep Mode, Idle State	ENERGY STAR Computer Test Method (Version 4.0)	Appendix A
Power Supply Efficiency	IPS: Internal Power Supply Efficiency Protocol EPS: ENERGY STAR Test Method for External Power Supplies	IPS: <a href="http://www.efficientpowersupplies.org">www.efficientpowersupplies.org</a> EPS: <a href="http://www.energystar.gov/powersupplies">www.energystar.gov/powersupplies</a>

551 **Qualifying Families of Products**  
 552 Models that are unchanged or that differ only in finish from those sold in a previous year may remain  
 553 qualified without the submission of new test data assuming the specification remains unchanged. If a  
 554 product model is offered in the market in multiple configurations or styles, as a product “family” or  
 555 series, the partner may report and qualify the product under a single model number, as long as all of  
 556 the models within that family or series meet either of the following requirements:  
 557  
 558

- Computers that are built on the same platform and are identical in every respect except for housing and color may be qualified through submission of test data for a single, representative model.
- If a product model is offered in the market in multiple configurations, the partner may report and qualify the product under a single model number that represents the highest power configuration available in the family, rather than reporting each and every individual model in the family. In this case, the highest configuration would consist of: the highest power processor, the maximum memory configuration, the most advanced GPU, etc. For desktop systems which meet the definition for multiple desktop categories (as defined in section 3.A.2) depending on the specific configuration, manufacturers will have to submit the highest power configuration for each category under which they would like the system to qualify. For example, a system that could be configured either as a Category A or a Category B desktop would require a submittal of the highest power configuration for both categories in order to qualify as ENERGY STAR. If a product could be configured to meet all three categories, it would then have to submit data for the highest power configuration in all categories.

570 When submitting model families, manufacturers must confirm that every tested configuration meets  
 571  
 572  
 573  
 574  
 575  
 576

577 the specification, but also will be held accountable for any efficiency claims made about all other  
578 models in the family, including those not tested or for which data was not reported.  
579

**Note:** EPA has included language that explains how models with multiple configurations may qualify for ENERGY STAR. The proposed approach is intended to reduce manufacturer reporting while ensuring all configurations of a given model meet the specification. Similarly, EPA is also asking manufacturers qualifying Imaging Products to submit the highest power configuration as well in response to partners' requests. For desktops, to ensure that products meet the specification under all configurations, EPA proposes that manufacturers submit data for the highest configuration for each category (e.g., A, B, and/or C) in which they want to qualify in the desktop space. EPA intends to collaborate with partners on revising the Online Product Submittal (OPS) tool to accommodate revisions to the computer specification in a way that is acceptable to both partners and EPA.

580  
581  
582

583 **5) Effective Date:** The date that manufacturers may begin to qualify products as ENERGY STAR,  
584 under this Version 4.0 specification, will be defined as the *effective date* of the agreement. Any  
585 previously executed agreement on the subject of ENERGY STAR qualified computers shall be  
586 terminated effective June 30, 2007.  
587

- 588 1. Qualifying Products Under Tier 1 of the Version 4.0 Specification: The first phase of this  
589 specification will commence on **July 1, 2007**. All products, including models originally qualified  
590 under Version 3.0, with a **date of manufacture** on or after **July 1, 2007**, must meet the new  
591 (Version 4.0) requirements in order to qualify for ENERGY STAR. The **date of manufacture** is  
592 specific to each unit and is the date (e.g., month and year) of which a unit is considered to be  
593 completely assembled.  
594
- 595 2. Qualifying Products Under Tier 2 of the Version 4.0 Specification: The second phase of this  
596 specification, Tier 2, will commence on **January 1, 2009**. All products, including models originally  
597 qualified under Tier 1, with a **date of manufacture** on or after **January 1, 2009**, must meet the  
598 Tier 2 requirements in order to qualify for ENERGY STAR.  
599
- 600 3. Elimination of Grandfathering: EPA will not allow grandfathering under this Version 4.0 ENERGY  
601 STAR specification. **ENERGY STAR qualification under previous versions is not**  
602 **automatically granted for the life of the product model.** Therefore, any product sold,  
603 marketed, or identified by the manufacturing partner as ENERGY STAR must meet the current  
604 specification in effect at the time of manufacture of the product.  
605

606 **6) Future Specification Revisions:** EPA reserves the right to revise the specification should  
607 technological and/or market changes affect its usefulness to consumers or industry or its impact on  
608 the environment. In keeping with current policy, revisions to the specification will be discussed with  
609 stakeholders. In the event of a specification revision, please note that ENERGY STAR qualification is  
610 not automatically granted for the life of a product model. To qualify as ENERGY STAR, a product  
611 model must meet the ENERGY STAR specification in effect on the model's date of manufacture.

612  
613  
614  
615

## APPENDIX A

### ENERGY STAR Test Procedure for Determining the Power Use of Computers in Standby, Sleep, and Idle

616 The following protocol should be followed when measuring power consumption levels of computers for  
617 compliance with the Standby, Sleep, and Idle levels provided in the ENERGY STAR Version 4.0  
618 Computer Specification. Partners must measure a representative sample of the configuration as shipped  
619 to the customer. However, the Partner does not need to consider power consumption changes that may  
620 result from component additions made by the computer user after sale of product. *This procedure is*  
621 *intended to be followed in order and the mode being tested is labeled where appropriate.*  
622

#### 623 I. Definitions

624  
625 Unless otherwise specified, all terms used in this document are consistent with the definitions  
626 contained in the Version 4.0 ENERGY STAR Eligibility Criteria for Computers.

##### 627 **UUT**

628 UUT is an acronym for “unit under test,” which in this case refers to the computer being tested.  
629

##### 630 **UPS**

631 UPS is an acronym for “Uninterruptible Power System,” which refers to a combination of converters,  
632 switches and energy storage means, for example batteries, constituting a power system for  
633 maintaining continuity of load power in case of input power failure.  
634  
635  
636

#### 637 II. Testing Requirements

##### 638 **Approved Meter**

639 Approved meters will include the following attributes<sup>1</sup>:

- 640 • Power resolution of 1 mW or better;
- 641 • An available current crest factor of 3 or more at its rated range value; and
- 642 • Lower bound on the current range of 10mA or less.

643  
644  
645 EPA also suggests the following attributes in addition to those above:

- 646 • Frequency response of at least 3 kHz; and
- 647 • Calibration with a standard that is traceable to the U.S. National Institute of Standards and  
648 Technology (NIST).

649  
650  
651 It is also desirable for measurement instruments to be able to average power accurately over any user  
652 selected time interval (this is usually done with an internal math’s calculation dividing accumulated  
653 energy by time within the meter, which is the most accurate approach). As an alternative, the  
654 measurement instrument would have to be capable of integrating energy over any user selected time  
655 interval with an energy resolution of less than or equal to 0.1 mWh and integrating time displayed with  
656 a resolution of 1 second or less.  
657  
658

##### 659 **Accuracy**

660 Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to  
661 2% at the 95% confidence level. Measurements of power of less than 0.5 W shall be made with an  
662 uncertainty of less than or equal to 0.01 W at the 95% confidence level. The power measurement  
663 instrument shall have a resolution of:

<sup>1</sup> Characteristics of approved meters taken from IEC 62301 Ed 1.0: Measurement of Standby Power

664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688

- 0.01 W or better for power measurements of 10 W or less;
- 0.1 W or better for power measurements of greater than 10 W up to 100 W; and
- 1 W or better for power measurements of greater than 100 W.

All power figures should be in watts and rounded to the second decimal place. For loads greater than or equal to 10 W, three significant figures shall be reported.

#### Test Conditions

- Line Impedance: < 0.25 ohm
- Total Harmonic Distortion: < 5%
- Ambient Temperature: 25 degrees C +/- 3 degrees C
- For products to be qualified in markets using 100V / 120V input:
  - Input AC Voltage: 115 VAC RMS +/- 5 V RMS
  - Input AC Frequency: 60 Hz +/- 3 Hz
- For products to be qualified in markets using 230 V input:
  - Input AC Voltage: 230 VAC RMS +/- 5V RMS
  - Input AC Frequency: 50 Hz +/- 3 Hz

#### Test Configuration

Power consumption of a computer shall be measured and tested from an ac source to the UUT.

The UUT must be connected to an Ethernet network switch capable of the UUT's highest and lowest network speeds. The network connection must be live during all tests.

**Note:** Based on stakeholder comments, the Ethernet network switch is now specified to be capable of the highest and lowest network speed of the UUT. This will allow for increased repeatability as all systems will be able to drop to the lowest link speed during the tests.

689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710

### III. Test Procedure

Measurement of ac power consumption of a computer should be conducted as follows:

#### UUT Preparation

1. Record the manufacturer and model name of the UUT.
2. Ensure that the UUT is connected to a live Ethernet (IEEE 802.3) network switch as specified in Section II., "Test Configuration," above, and that the connection is live. The computer must maintain this live connection to the switch for the duration of testing, disregarding brief lapses when transitioning between link speeds.
3. Connect an approved meter capable of measuring true power to an ac line voltage source set to the appropriate voltage/frequency combination for the test.
4. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units should be connected between the meter and the UUT. For a valid test to take place the meter should remain in place until all Standby, Sleep, and Idle power data is recorded.
5. Record the ac voltage.
6. Boot computer and wait until the operating system has fully loaded.
7. Record basic information about the computer's configuration – computer type, operating system name and version, processor type and speed, and total and available physical memory, etc.<sup>2</sup>
8. Record basic information about the video card - video card name, resolution, amount of onboard memory, and bits per pixel.<sup>3</sup>

<sup>2</sup> On Windows-based machines, much of this can be found by selecting the following window: Start / Programs / Accessories / System Tools / System Information.

- 711 9. Ensure that the UUT is configured as shipped including all accessories, power management  
712 settings, WOL enabling and software shipped by default. UUT should also be configured using  
713 the following requirements for all tests:  
714 a. Desktop systems (including workstations and desktop-derived servers) shipped without  
715 accessories should be configured with a standard mouse, keyboard and external monitor.  
716 b. Notebooks and tablets should include all accessories shipped with the system, and need  
717 not include a separate keyboard or mouse when equipped with an integrated pointing  
718 device or digitizer.  
719 c. Notebooks and tablets should have the batteries removed for all tests.  
720 d. Power to wireless radios should remain configured as shipped. Systems shipped with  
721 wireless radios enabled should ensure that the adapters remain enabled, but the system  
722 should not be connected to an active wireless link for testing. This requirement applies to  
723 wireless network adapters (e.g., 802.11) or device to device wireless protocols.  
724 10. For computers with integrated monitors (notebooks, tablets and integrated systems), use the  
725 power management settings to set the monitor to power down after 1 minute (adjust no other  
726 power management settings).  
727 11. Shut down the computer.  
728

**Note:** Some stakeholders commented that the test procedure should explicitly state that wireless adapters should be turned off for all tests. EPA believes it is important to capture the power consumption of these devices, but has specified that these wireless devices should not be actively connected to a network or device during testing.

729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744

#### **Standby (Off Mode) Testing**

12. With the UUT shut down and in Standby, set the meter to begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.<sup>4</sup>

#### **Idle Mode Testing**

13. Switch on the computer and begin recording elapsed time, starting either when the computer is initially switched on, or after completing any log in activity necessary to fully boot the system. Once logged in with the operating system fully loaded and ready, close any open windows so that the standard operational desktop screen or equivalent ready screen is displayed. Exactly 10 minutes after the initial boot or log in, set the meter to begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.

**Note:** Based on stakeholder comment, the Idle test procedure has been modified to begin Idle measurements from either the initial switching on of the UUT or from the completion of any necessary log in procedures. This change was made to increase repeatability for computers with required log in. To minimize the impact of the difference between these two start points, and to ensure all computers have fully loaded and settled into the Idle state, measurement will now begin after a 10 minute wait interval. The language has also been clarified to indicate more clearly that all windows must be closed after the user has logged in, to display the standard desktop screen or ready screen.

745  
746  
747  
748

<sup>3</sup> On Windows-based machines, this can be found by selecting the following window: Start / Programs / Accessories / System Tools / Components / Display.

<sup>4</sup> Laboratory-grade, full-function meters can integrate values over time and report the average value automatically. Other meters would require the user to capture a series of changing values every 5 seconds for a five minute period and then compute the average manually.

749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768

**Sleep Mode Testing**

14. After completing the Idle measurements, place the computer in Sleep mode. Reset the meter (if necessary) and begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.
15. If testing both WOL enabled and WOL disabled for Sleep, wake the computer and change the WOL from Sleep setting through the operating system settings or by other means. Place the computer back in Sleep mode and repeat step 14, recording Standby power for this alternate configuration.

**Reporting Test Results**

16. The test results must be reported to EPA using the Online Product Submittal (OPS) Tool, taking care to ensure that all required information has been included.

**IV. Continuing Verification**

This testing procedure describes the method by which a single unit may be tested for compliance. An ongoing testing process is highly recommended to ensure that products from different production runs are in compliance with ENERGY STAR.