

**Standard** ECMA-383

1<sup>st</sup> Edition / June 2008

**Measuring Energy  
Consumption,  
Performance and  
Capabilities of ICT and  
CE Products**

**Standard**



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## Introduction

Ecma developed and published the world's first environmentally conscious design standard (ECD) for the ICT & CE industries in 2003 as ECMA-341. This Standard is aimed at the designer and provides pragmatic advice on how to reduce the environmental footprint of a product at the design stage.

ECMA-341 was offered to the IEC (International Electro-technical Committee) for conversion into an IEC standard. IEC TC108 set up a Project Team (PT62075) to complete this work. This Standard is now available as IEC 62075.

Whilst ECMA-341 includes the definitions of low power modes and generic energy saving guidance for designers of ICT & CE products, this Standard complements that guidance by defining a methodology on how to measure the energy efficiency of a product whilst taking into account its performance and capabilities.

Although this Standard's title allows covering all ICT and CE products this initial edition covers desktop and notebook computers only with a media rich and office productivity workload.

Future editions may take into account additional operating systems and workloads for computers and also to broaden in scope to other ICT and CE products.

This Ecma Standard has been adopted by the General Assembly of June 2008.

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## 1 Scope

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Although the title is broader in scope, this edition of the Standard applies to:

- desktop computers
- notebook computers

that are marketed as final products and are hereafter referred to as the Unit Under Test (UUT).

Additionally, this edition of the Standard applies to the following list of workloads

- office productivity
- media rich

defined in [5.2](#) and running under an Operating System that is either principally designed for, or at least configured for, desktop or notebook use.

This Standard defines how to evaluate and report energy consumption, performance and capabilities being the vital factors for the energy efficient performance (EEP) of the UUT. Additionally it provides a standardised results reporting format.

This Standard requires the user to measure and record a set of energy, power, time, and capability results (using a Benchmark), not a single metric of energy efficiency. This Standard does not set any pass/fail criteria for the UUT. Users of the reported results (regulators, customers etc) may define such criteria.

This standard does not provide specifications for a Benchmark.

## 2 Conformance

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The user of this Standard shall meet all “shall” requirements in Clause [6](#).

## 3 Normative references

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None.

## 4 Definitions

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### 4.1 Benchmark

software that exercises the UUT with a Workload to measure energy consumption and performance and that enumerates and reports UUT capabilities

### 4.2 Duty cycle

#### 4.2.1 Benchmark duty cycle

time a UUT spends in each of its [activity modes](#) as measured by the Benchmark

#### 4.2.2 User defined duty cycle

time a UUT spends in each of its [activity modes](#) as defined by the user

### 4.3 Energy use

amount of energy *used by a UUT measured* from the mains power source over a given period of time and measured in kWh

### 4.4 Performance

the speed a UUT can complete a Workload when compared to the Benchmark reference unit

#### 4.5 Workload

defined set of activities

#### 4.6 UUT (Product)

unit under test (also referred to as product)

## 5 Specifications for the UUT

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### 5.1 Computer classifications

#### 5.1.1 Desktop computer

A personal computer where the main unit is intended to be located in a fixed location, often on a desk or on the floor. Desktops are not designed for portability and utilize an integrated or external monitor, keyboard, and mouse.

#### 5.1.2 Notebook computer

A personal computer designed specifically for portability and to be operated for extended periods of time without a direct connection to an ac power source. Notebook computers must utilize an integrated monitor (may be touch sensitive) and be capable of operation off an integrated battery or other notebook power source. In addition, most notebook computers use an external power supply and have an integrated keyboard and pointing device.

### 5.2 Activity Modes

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 UUT is connected to the main electricity supply and used in accordance with the manufacturer's instructions. Off mode is similar to "ACPI state S5".

Sleep Mode: The mode that the UUT is capable of entering automatically after a period of inactivity or by manual selection. A UUT with sleep capability can "wake" in response to network connections or user interface devices or an internally generated condition. Sleep mode is similar to "ACPI state S3".

Idle Mode: The mode in which the operating system and other software have completed loading, and activity is limited to those basic applications that the system starts by default.

Active mode: The mode in which the UUT is executing a workload.

### 5.3 Computer workloads

#### 5.3.1 Office productivity workload

A Workload designed primarily for office (home or business) applications such as word processing, email, web browsing, accounting, etc.

#### 5.3.2 Media rich workload

A Workload designed primarily for entertainment purposes such as listening to music, watching videos, editing audio, pictures, video, etc.

*NOTE*

*Although the Media rich workload could be used on products designed for gaming applications, this workload is not intended to exercise many of the special capabilities of this category of personal computers.*

### 5.4 Core components

The UUT shall at least contain the following components:

- Central Processing Unit (CPU)
- Graphics Processing Unit (GPU)
- Memory (volatile)

- Non-volatile bulk storage (e.g. hard disk)
- Operating System
- Audio
- Primary Network Connection
- Input Devices

## 6 Procedure

### 6.1 Workflow

The user shall follow this workflow:

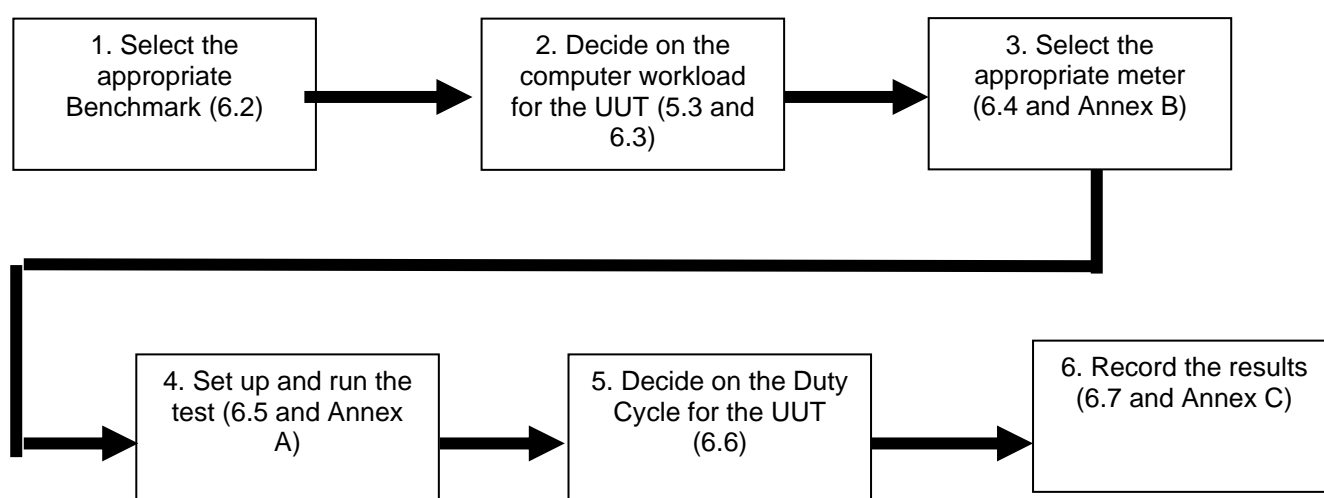


Figure – 6.1: Workflow

### 6.2 Selecting a Benchmark

The User shall select a Benchmark registered at: <http://www.ecma-international.org/publications/standards/Benchmark.htm> suited for intended use of the UUT as specified at: <http://www.ecma-international.org/publications/Standards/Criteria.htm>. The User shall record the name of the selected benchmark per Annex C.

### 6.3 Decide on the UUT Workload

The User shall decide whether the primary use of the UUT is an

- Office productivity workload
- Media rich workload.

### 6.4 Meter requirements

For energy and power measurements, a meter that meets the requirements in Annex B shall be used.

### 6.5 Test system set up

The user shall follow the requirements as detailed in Annex A.

### 6.6 Decide on the Duty Cycle

The User shall determine whether a user defined duty cycle is to be used. He shall report the benchmark duty cycle in a format as described in Annex C together with the user defined duty cycle as appropriate.

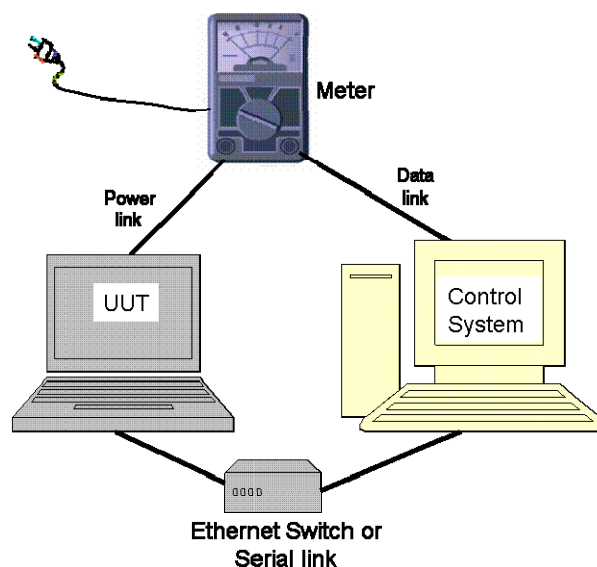
## **6.7 Recording and presenting the results**

All results shall be presented in a manner clearly showing the workload used and in a format as indicated in Annex C.

## Annex A (normative)

### Test set up

The test shall be set up per the example below.



1. The UUT shall be configured in its "as shipped" default state and at a minimum contain all core components as defined in [5.4](#).
2. For notebook computers, the battery shall be either removed or charged to 100 % before test starts.
3. Whether the monitor is switched on or off shall be determined by the user. It is recommended that this decision is carried out in conjunction with an assessment of intended use of the test results.

#### Testing conditions

<b>Supply Voltage:</b>	North America/Taiwan: Europe/Australia/New Zealand: Japan:	115 (± 1 %) Volts AC, 60 Hz (± 1 %) 230 (± 1 %) Volts AC, 50 Hz (± 1 %)  100 (± 1 %) Volts AC, 50 Hz (± 1 %)/60 Hz (± 1 %)  <i>NOTE</i> <i>For products rated for &gt; 1.5 kW maximum power, the voltage range is ± 4 %</i>
<b>Total Harmonic Distortion (THD) (Voltage):</b>	< 2 % THD (< 5 % for products which are rated for > 1.5 kW maximum power)	
<b>Ambient Temperature:</b>	23°C ± 5°C	
<b>Relative Humidity:</b>	10 – 80 %	



## Annex B (normative)

### Meter specifications

The power meter used in conjunction with this Standard shall include the following attributes:

- Power resolution of 1 mW or better
- An available current crest factor of 3 or more at its rated range value; and
- Lower bound on the current range of 10 mA or less.
- Have a frequency response of at least 3 kHz; and
- Be calibrated with a standard that is traceable internationally.
- Be able to average power accurately over any user selected time interval (this is usually done with an internal math's calculation dividing accumulated energy by time within the meter, which is the most accurate approach). Or, alternatively, the meter shall be capable of integrating energy over any user selected time interval with an energy resolution of less than or equal to 0.1 mWh and integrating time displayed with a resolution of 1 second or less.
- Provide a control and logging interface that the Benchmark uses to allow logging of the data onto a control system.

#### Accuracy of power measurement

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

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



## Annex C (normative)

### Results reporting format

Results from this test methodology shall be presented in the following order:

1. Product description
2. Benchmark details
3. Results
  - A. Energy consumption
  - B. Performance score
  - C. Capabilities
4. Test conditions
5. Declaration

Under each of the headings noted above the following minimum set of information shall be reported. The format listed below is an example format only; the user should use the format of his choice.

#### 1. Product description

Manufacturer \_\_\_\_\_

UUT Code / Model Number \_\_\_\_\_

UUT Workload:            Productivity workload             Media rich workload

UUT Type:                            notebook computer             Desktop Computer

Operating System:            Windows             Mac OS

Operating system version details \_\_\_\_\_

Display:                            Off             On

If display on:                    Size \_\_\_\_\_    Brightness \_\_\_ cd/m<sup>2</sup>    Resolution \_\_\_\_\_

Vendor \_\_\_\_\_ HD Ready (Yes/No) \_\_\_\_\_ Refresh rate \_\_\_\_\_

Interface type:    VGA     HDMI     DVI     Other

Operating System Power policy applied during test (e.g. power save, balanced, performance etc) \_\_\_\_\_

BIOS (or equivalent) vendor and version number \_\_\_\_\_

Motherboard model and version number \_\_\_\_\_

## 2. Benchmark details

Benchmark name \_\_\_\_\_

Benchmark version \_\_\_\_\_

## 3. Results

### 3A Energy consumption

Benchmark duty cycle reported results

	Active	Idle	Sleep	Off
Power (W) – Average	n/a			
Energy (Wh)		n/a	n/a	n/a
Measurement Time (s)				

User defined duty cycle calculated results

	Active	Idle	Sleep	Off
Energy (Wh)				
Extrapolated time (h)				

Note: Extrapolated time is Measured time multiplied by a factor defined by the user.

Power supply efficiency levels:

Load (%)	Efficiency (%)

### 3B Performance score results

Performance Score	
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### 3C Capabilities

CPU		Video/Graphics	
Vendor		Vendor	
Name		Model Number / Name	
Model Number		Memory Size	
Number of Cores		Resolution	
Core Frequency		Bus Type	
Bus Frequency		Driver revision number	
L1 Cache			
L2 Cache			
L3 Cache			
Volatile Memory (e.g. DRAM)		Audio	
Size (Mb)			
Array Capacity		Vendor	
Speed		Model	
Family (E.G. DDR2, 3 etc)		Definition	
Number devices			

#### Quantity input devices \_\_\_\_\_

	Mouse	Keyboard	Other
Model Number / Name			
Interface type (USB, PS2, Wireless etc)			

#### Storage

##### Quantity Hard Drives \_\_\_\_\_

	Drive #1	Drive #2	Drive #3	Drive #4
Vendor & Version				
Model				
Capacity				
Speed				
Link Power management supported? If yes, note type				

Quantity Optical Drives \_\_\_\_\_

	Drive #1	Drive #2	Drive #3	Drive #4
Vendor & version				
Model				
Capacity				
Speed				
Link Power management supported? If yes, note type				

Quantity other storage devices \_\_\_\_\_

Device type				
Vendor & Version				
Model				
Capacity				
Speed				

Quantity Network (wired and wireless) devices \_\_\_\_\_

Network type				
Vendor & Version				
Model				
Bus Interface				
Capable speed				
Tested speed				

Other system capabilities

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**4. Test Conditions**

Sample size tested: \_\_\_\_\_

Name of meter used: \_\_\_\_\_

Test Conditions	
Supply Voltage:	
Total Harmonic Distortion (THD) (Voltage):	
Ambient Temperature:	
Relative Humidity:	

**5. Declaration**

Signed \_\_\_\_\_

Date \_\_\_\_\_



## **Annex D (informative)**

### **Bibliography**

IEEE 1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments

IEC 62075: Audio/Video, Information and Communication Technology Equipment - Environmentally Conscious Design

Energy Star V5.0, Draft 1 (February 22, 2008)

ACPI (Advanced Configuration and Power Interface) specification

IEC 62301 Ed 1.0: Measurement of Standby Power

ISO 554-1976: Standard atmospheres for conditioning and/or testing specifications.