

## ANNEX I: Battery testing according to EC EN 61960-3:2017

Parameter	Description	Acceptance Criteria Battery
Discharge performance at 20 °C (Rated Capacity)	This test verifies the rated capacity of the battery.	100% of the rated capacity (C5 Ah) <sup>5</sup>
Discharge performance at –20 °C (Rated Capacity)	This test determines the capacity of the battery at low temperatures.	30% of the rated capacity (C5 Ah)
High rate discharge performance at 20 C	This test determines the capacity of the battery when discharged at high rate. This test is not required if the battery is not designed to be used at this rate (1 ItA).	60% of the rated capacity (C5 Ah)
Charge (capacity) retention and recovery	This test determines, firstly, the capacity which a battery retains after storage for an extended period of time (28 days) and, secondly, the capacity that can be recovered by a subsequent recharge.	60% of the rated capacity (C5 Ah)
Charge (capacity) retention after long-term storage	This test determines the capacity of a battery after extended storage (90 days) at 50% state of charge, followed by a subsequent charge.	85% of the rated capacity (C5 Ah)
Endurance in cycles	This test determines the number of charge/discharge cycles which a battery can endure before its capacity has been significantly depleted.	60% of the rated capacity (C5 Ah) after 300 cycles
Electrostatic discharge	This test is to evaluate the ability of a battery to withstand electrostatic discharge.	Operational

<sup>5</sup> Amount of electricity declared by the manufacturer that a cell can deliver in a 5-hour period.

## ANNEX II: Durability tests for mobile equipment

Test	Test method	Minimum thresholds		Functional performance requirements
Accidental drop	IEC 60068 Part 2-31: Ec (Freefall, procedure 1) or MIL-STD-810G w/CHANGE 1 Drop test: Method 516.7 - Shock (procedure IV) or MIL-STD-810H Method 516.8 – Shock (Procedure IV)	<b>CORE CRITERIA</b>  The notebook or tablet must be dropped from: a minimum of 45 cm (modified drop test height) of height onto a non-yielding surface. A minimum of one drop must be made on each bottom side and each bottom corner.	<b>AWARD CRITERIA</b>  The notebook or tablet must be dropped from: a minimum of 76 cm (30 inches <sup>6</sup> ) of height onto a non-yielding surface. A minimum of one drop must be made on each bottom side and each bottom corner.	After exposure to any of the specified stress tests, the product should be able to:  1. Boot up and operate normally <ul style="list-style-type: none"> <li>• Booting up or resuming should not exceed 50% more time as a result of the test.</li> <li>• No noticeable operational faults when using standard software applications.</li> <li>• No major damage to the product that does not allow for standard usage.</li> </ul>
Temperature stress	IEC 60068 Part 2-1: A Cold Part 2-2: B Dry Heat or MIL-STD-810G w/CHANGE 1 High temperature: Method 501.6 - Basic Hot (A2) Low temperature: Method	The mobile equipment must be subjected to test cycles of a minimum of 48 hours exposure for storage temperature at: <ul style="list-style-type: none"> <li>• High temperature storage <math>\geq 60^{\circ}\text{C}</math></li> <li>• Low temperature storage <math>\leq -30^{\circ}\text{C}</math></li> </ul> The mobile equipment must be subjected to test cycles of a minimum of 4 hours for operational temperature at: <ul style="list-style-type: none"> <li>• Operational temperature <math>\geq 40^{\circ}\text{C}</math></li> <li>• Operational temperature <math>\leq -20^{\circ}\text{C}</math></li> </ul>		2. Not create hazards to the end-user <ul style="list-style-type: none"> <li>• No case or display cracking or other sharp points created from failures that could injure a user.</li> <li>• No electrical component failures or access that could result in a user safety issue.</li> </ul>

<sup>6</sup> US Department of Defence standard MIL-STD-810G Method 516.6 Specification VI 'Transit drop test'.

Test	Test method	Minimum thresholds		Functional performance requirements
	502.6 - Basic Cold (C1) or MIL-STD-810H Method 501.7 - High temperature - Basic Hot (A2) Method 502.7 - Low temperature - Basic Cold (C1)			
Screen resilience	<p>The test equipment and set-up used must be confirmed by the tenderer.</p> <p>Applicable test standards include:</p> <p>ISO 1518-1:2019 Paints and varnishes - Determination of scratch resistance - Part 1: Constant-loading method</p> <p>ISO 1518-2:2019 Paints and varnishes - Determination of scratch resistance - Part 2: Variable-loading method</p> <p>ASTM C1895 - 19 using a hardness test pencil equipped with a spiral spring and a carbide ball tip of 1 mm diameter (in accordance with ISO</p>		<p>With the product placed on a flat surface, two loading tests must be carried out:</p> <ul style="list-style-type: none"> <li>• A minimum load of 50kg must be evenly applied to the screen lid (for notebooks) or screen (for tablets).</li> <li>• A minimum load of 25kg must be applied to a point at the centre of screen with a diameter of approximately 3cm.</li> </ul>	

Test	Test method	Minimum thresholds		Functional performance requirements
	1518)			
Resistance to shock	IEC 60068 Part 2-27: Test Ea and guidance: Shock  Part 2-47: Test - Mounting of specimens for vibration, impact and similar dynamic tests		A minimum of a 40G peak half-sine wave pulse must be applied three times for a duration of a minimum of 6 ms to the top, bottom, right, left, front and rear side of the product.	
Resistance to vibration	IEC 60068 Part 2-6: Test Fc: Vibration (sinusoidal)  Part 2-47: Test - Mounting of specimens for vibration, impact and similar dynamic tests		Minimum specification:  Randomised sinusoidal vibrations in the frequency range 5Hz up to a minimum of 250Hz must be applied for a minimum of one sweep cycle to the end of each axis of the top, bottom, right, left, front and back of the product.	
Dust ingress protection	IEC 60529, Degree of protection provided by enclosures  or  MIL-STD-810G Method 510.5, Procedure I Sand and dust - Blowing dust  or  MIL-STD-810H 510.7 – Procedure I - Sand and Dust – Blowing Dust		IP-6x - No ingress of dust; complete protection against contact.	

Test	Test method	Minimum thresholds		Functional performance requirements
Water ingress protection	IEC 60529, Degree of protection provided by enclosures  or  MIL-STD-810G, Method 506.5 Procedure I Rain and blowing rain  or  MIL-STD-810H 506.6 – Procedure I Rain		IP-x5 - Water is projected in jets against the enclosure from any direction with no harmful effects.	

### ANNEX III: Minimum energy performance for computers (based on Energy Star for Computers, Specifications 7.1)

Calculated Typical Energy Consumption ( $E_{TEC}$ ) for Desktop, Integrated Desktop, and Notebook Computers per shall be less than or equal to the maximum TEC ( $E_{TEC\_MAX}$ ) as calculated below:

( $E_{TEC\_MAX}$ ) per Equation below:

$$E_{TEC\_MAX} = (1 + ALLOWANCE_{PSU}) \times (TEC_{BASE} + TEC_{MEMORY} + TEC_{GRAPHICS} + TEC_{STORAGE} + TEC_{INT\_DISPLAY} + TEC_{SWITCHABLE} + TEC_{EEE} + TEC_{MOBILEWORKSTATIONS})$$

Where:

- $ALLOWANCE_{PSU}$  is an allowance provided to power supplies that meet the optional more stringent efficiency levels specified in Table 1; power supplies that do not meet the requirements receive an allowance of 0;
- $TEC_{BASE}$  is the base allowance specified in Table 2; and,
- $TEC_{GRAPHICS}$  is the discrete graphics allowance as specified in Table 2, with the exception of systems with integrated graphics, which do not receive an allowance, or Desktops and Integrated Desktops with switchable graphics enabled by default, which receive an allowance through  $TEC_{SWITCHABLE}$ ; and
- $TEC_{MEMORY}$ ,  $TEC_{STORAGE}$ ,  $TEC_{INT\_DISPLAY}$ ,  $TEC_{SWITCHABLE}$ ,  $TEC_{EEE}$  and  $TEC_{MOBILEWORKSTATIONS}$  are adder allowances as specified in Table 3.

**Table 1: Power Supply Efficiency Allowance**

Power Supply Type	Computer Type	Minimum Efficiency at Specified Proportion of Rated Output Current				Minimum Average Efficiency	Allowance <sub>PSU</sub>
		10%	20%	50%	100%		

IPS	Desktop	0.86	0.90	0.92	0.89	-	0.015
		0.90	0.92	0.94	0.90	-	0.03
	Integrated Desktop	0.86	0.90	0.92	0.89	-	0.015
		0.90	0.92	0.94	0.90	-	0.04

**Table 2: Base TEC ( $TEC_{BASE}$ ) Allowances for Desktop or Integrated Desktops and Notebooks**

Category Name	Graphic Capability	Desktop or Integrated Desktop	
		Performance Score, P	Base Allowance
0	Any Graphics dGfx≤G7	P≤3	69.0
I1	Integrated or Switchable Graphics	3<P≤6	112.0
I2		6<P≤7	120.0
I3		P>7	135.0
D1	Discrete Graphics dGfx≤G7	3<P≤9	115.0
D2		P>9	135.0
Category Name		Notebooks	
		Performance Score, PV	Base Allowance
0		P≤2	6.5
I1		2<P≤5.2	22.0

I2	$5.2 < P \leq 8$	8.0
I3	$P > 8$	14.0

**Table 3: Functional Adder Allowances for Desktop, Integrated Desktop, Thin Client and Notebook Computers**

Function			Desktop	Integrated Desktop	Notebook
TEC <sub>MEMORY</sub> (kWh) vi			0.8		2.4 + (0.294 x GB)
TEC <sub>GRAPHICS</sub> (kWh) vii	Graphics Category Viii	G1 (FB_BW ≤ 16)	36		29.3 x tanh (0.0038 x FB_BW – 0.137) + 13.4
		G2 (16< FB_BW ≤ 32)	51		
		G3 (32 < FB_BW ≤ 64)	64		
		G4 (64 < FB_BW ≤ 96)	83		
		G5 (96 < FB_BW ≤ 128)	105		
		G6 (FB_BW > 128; Frame Buffer Data Width < 192 bits)	115		
		G7 (FB_BW > 128;	130		



		Frame Buffer Data Width $\geq 192$ bits		
TEC <sub>SWITCHABLE</sub> (kWh)			0.5 x G1	N/A
TEC <sub>EEE</sub> (kWh) x			8.76 x 0.2 x (0.15 + 0.35)	8.76 x 0.2 x (0.10 + 0.30)
TEC <sub>STORAGE</sub> (kWh) xi			26	2.6
TEC <sub>INT_DISPLAY</sub> (kWh) xii			N/A	8.76 x 0.35 x (1+EP) x (4xr + 0.05 x A)
TEC <sub>MOBILEWORKSTATION</sub> (kWh) xii			N/A	8.76 x 0.30 x (1+EP) x (2 x r + 0.02 x A)
				4.0

### Equation 1: Calculation of Allowance for Enhanced Performance Integrated Displays

$$EP = \begin{cases} 0, & \text{No Enhanced Power Displays} \\ 0.3 & \text{Enhanced Performance Display } d < 27 \\ 0.75 & \text{Enhanced Performance Display } d \geq 27 \end{cases}$$

Where

- vi TEC<sub>MEMORY</sub> Adder: Applies per GB installed in the system.
- vii TEC<sub>GRAPHICS</sub> Adder: Applies to only the first dGfx installed in the system, but not Switchable Graphics.
- viii FB\_BW: Is the display frame buffer bandwidth in gigabytes per second (GB/s). This is a manufacturer declared parameter and should be calculated as follows: (Data Rate [Mhz]  $\times$  Frame Buffer Data Width [bits]) / (8  $\times$  1000).

- ix  $TEC_{SWITCHABLE}$  Incentive: Applies to automated switching that is enabled by default in Desktops and Integrated Desktops.
- x  $TEC_{EEE}$ : Applies per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port.
- xi  $TEC_{STORAGE}$  Adder: Applies once if system has more than one Additional Internal Storage element.
- xii  $TEC_{INT\_DISPLAY}$  Adder: EP is the Enhanced Performance Display allowance calculated per Table 28; r is the Screen resolution in megapixels; and A is viewable screen area in square inches.

### Calculation of $E_{TEC\_MAX}$ for Thin Clients

- $E_{TEC\_MAX} = TEC_{BASE} + TEC_{GRAPHICS} + TEC_{WOL} + TEC_{INT\_DISPLAY} + TEC_{EEE}$
- Where:
- $TEC_{BASE}$  is the Base Allowance specified in Table 4;
- $TEC_{GRAPHICS}$  is the Discrete Graphics allowance specified in Table 4, if applicable;
- $TEC_{WOL}$  is the Wake-on-LAN allowance specified in Table 4, if applicable;
- $TEC_{INT\_DISPLAY}$  is the Integrated Display allowance for Integrated Desktops specified in Table 3, if applicable; and
- $TEC_{EEE}$  is the Energy Efficiency Ethernet incentive for Desktops specified in Table 3, if applicable, per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port.

**Table 4: Adder allowances for Thin Clients**

Adder	Allowance (kWh)
TEC <sub>BASE</sub>	31
TEC <sub>GRAPHICS</sub>	36
TEC <sub>WOL</sub>	2