WORKING DOCUMENT FOR THE CONSULTATION FORUM ON

potential ecodesign requirements for servers and data storage products

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products[1], and in particular Article 15(1) thereof,

After consulting the Consultation Forum referred to in Article 18 of Directive 2009/125/EC,

Whereas:

(1) Directive 2009/125/EC requires the Commission to set ecodesign requirements for energy-related products that represent significant volumes of sales and trade, that have a significant environmental impact and that present significant potential for improvement in terms of their environmental impact without entailing excessive costs.

(2) Under Directive 2009/125/EC energy-related products representing significant volumes of sales and trade, having significant environmental impact within the Union and presenting significant potential for improvement in terms of their environmental impact, without entailing excessive costs, are to be covered by an implementing measure or a self-regulation measure regarding ecodesign requirements.

(3) The Commission has carried out a preparatory study to analyse the technical, environmental and economic aspects of servers and data storage products typically used for commercial purposes. The study has been carried out with stakeholders and interested parties from the Union and third countries, and the results have been made publicly available.

(4) The environmental aspects of servers and data storage products that have been identified as significant for the purposes of this Regulation are energy consumption in the use phase and resource efficiency.

(5) The annual energy consumption related to servers directly is expected to be 46 TWh in 2030, which increases to 68 TWh when the annual energy consumption related to infrastructure (e.g. cooling systems and uninterruptible power supply systems) is also included. The annual energy consumption of data storage products is expected to be 29 TWh in 2030, 44 TWh when infrastructure is also included. The preparatory study shows that use-phase energy consumption by servers and data storage products can be significantly reduced.

(6) The effect of the ecodesign requirements set out in this Regulation is estimated to result by 2030 in annual energy savings of approximately 9 TWh. More in detail, the effect of the ecodesign requirements for servers set out in this Regulation is estimated to result by 2030 in direct annual energy savings of approximately 2.4 TWh and indirect (i.e. related to infrastructure) annual energy savings of 3.7 TWh, summing up to a total saving of 6.1 TWh, corresponding to a total of 2.1 Mt of CO2 equivalent. The effect of the ecodesign requirements for data storage products set out in this

[1] OJ L 285, 31.10.2009, p. 10.

Regulation is estimated to result by 2030 in direct annual energy savings of approximately 0.8 TWh and indirect (i.e. related to infrastructure) annual energy savings of 2 TWh, summing up to a total saving of 2.8 TWh, corresponding to 0.9 Mt of CO2 equivalent.

(7) The EU action plan for the Circular Economy[2] calls for cost-effective improvements on resource efficiency, and therefore this Regulation lays down requirements on non-energy related aspects, including extraction of key-components and of critical raw materials, availability of built-in software based data deletion tools and of the latest firmware version.

(8) The energy consumption of servers and data storage products could be reduced by applying existing non-proprietary technologies without an increase in the combined costs of purchasing and operating these products.

(9) Ecodesign requirements should harmonise energy consumption and resource efficiency requirements for servers and data storage products throughout the Union, for the internal market to operate better and in order to improve the environmental performance of those products.

(10) The ecodesign requirements should not affect the functionality or affordability of servers and data storage products from the end-user's perspective and should not negatively affect health, safety or the environment.

(11) The introduction of ecodesign requirements should give manufacturers sufficient time to redesign their products subject to this Regulation. The timing should take into account the impact on manufacturers' costs, in particular for small and medium-sized enterprises, while ensuring timely achievement of the objectives of this Regulation.

(12) Commission Regulation (EU) No 617/2013 of 26 June 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for computers and computer servers should be amended to exclude computer servers from its scope in order to prevent any overlap with the same products in the scope of this Regulation.

(13) Product parameters should be measured and calculated using reliable, accurate and reproducible methods which take into account recognised state-of-the-art measurement and calculation methods, including, where available, harmonised standards adopted by the European standardisation organisations following a request by the Commission, in accordance with the procedures laid down in Regulation (EU) 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation[3].

(14) In accordance with Article 8 of Directive 2009/125/EC, this Regulation specifies which conformity assessment procedures apply.

(15) In order to facilitate compliance checks, manufacturers should provide the information contained in the technical documentation referred to in Annexes IV and V to Directive 2009/125/EC insofar as that information relates to the requirements laid down in this Regulation.

(16) In addition to the legally binding requirements laid down in this Regulation, indicative benchmarks for best available technologies should be determined to ensure that

[2] COM(2015) 614 final

[3] OJ L 316, 14.11.2012, p. 12.

information on the life-cycle environmental performance of servers and data storage products is widely available and easily accessible.

(17) The measures provided for in this Regulation are in accordance with the opinion of the Committee established under Article 19(1) of Directive 2009/125/EC,

HAS ADOPTED THIS REGULATION:

Article 1

Subject matter and scope

1. This Regulation establishes ecodesign requirements for placing on the market and putting into service of servers and online data storage products.

2. This Regulation shall not apply to:

   (a) Servers intended for embedded applications;

   (b) Servers classified as small scale servers in terms of Regulation (EU) No 617/2013;

   (c) Servers with more than four processor sockets;

   (d) Small data storage products;

   (e) Large data storage products.

Article 2

Definitions

In addition to the definitions set out in Article 2 of Directive 2009/125/EC, the following definitions shall apply for the purposes of this Regulation:

1. ‘Server’ means a computing product that provides services and manages networked resources for client devices, such as desktop computers, notebook computers, desktop thin clients, internet protocol (IP) tele-phones, smart phones, tablets, tele-communication, automated systems or other servers. A server is typically placed on the market for use in data centres and office and corporate environments. A server is primarily accessed via network connections, and not through direct user input devices, such as a keyboard or a mouse; A server has the following characteristics:

   (a) is designed to support server operating systems (OS) and/or hypervisors, and targeted to run user-installed enterprise applications;

   (b) supports error-correcting code (ECC) and/or buffered memory (including both buffered dual in-line memory modules (DIMMs) and buffered on board (BOB) configurations);

   (c) is placed on the market with one or more power supply(ies);

   (d) all processors have access to shared system memory and are independently visible to a single OS or hypervisor;

2. ‘Server with more than four processor sockets’ means a server containing more than four interfaces designed for the installation of a processor;

3. 'Embedded application' means a software application that permanently resides in an industrial or consumer device. Providing some type of control function and/or user interface, the software is typically stored in a non-volatile memory such as read-only memory or flash memory;

4. ‘Data storage product' means a fully-functional storage system that supplies data storage services to clients and devices attached directly or through a network. Components and subsystems that are an integral part of the data storage product architecture (e.g., to provide internal communications between controllers and disks) are considered to be part of the data storage product. In contrast, components that are normally associated with a storage environment at the data centre level (e.g. devices required for operation of an external storage area network) are not considered to be part of the data storage product. A data storage product may be composed of integrated storage controllers, data storage devices, embedded network elements, software, and other devices. A data storage product is a unique configuration of one or more stock keeping units, sold and marketed to the end user as a data storage product;

5. 'Hard Drive' (HDD) means the primary computer storage device which reads and writes to one or more rotating magnetic disk platters;

6. 'Solid State Drive' (SSD) means a storage device that uses memory chips instead of rotating magnetic platters for data storage;

7. ‘Data storage device’ means HDDs, SSDs, tapes cartridges, and any other mechanisms providing non-volatile data storage. This definition is specifically intended to exclude aggregating storage elements such as subsystems of redundant arrays of independent disks, robotic tape libraries, filers, and file servers. Also excluded are storage devices which are not directly accessible by end-user application programs, and are instead employed as a form of internal cache;

8. ‘Online data storage product' means a data storage product designed for online, random-access of data. Online data storage devices store user data accessible in a random or sequential pattern. The maximum time required to start receiving data from a storage system to satisfy a read request for arbitrary data (maximum time to first data) of an online data storage product is designed to be less than 80 milliseconds;

9. 'Small data storage product' means a portable data storage product intended for domestic use containing a maximum of one data storage device;

10. 'Large data storage product' means a high end or mainframe data storage product that product that supports more than 400 disks data storage devices in its maximum configuration and with the following required attributes: no single point of failure, non-disruptive serviceability and integrated storage controller.

For the purposes of Annexes II to V, additional definitions are set out in Annex I.

Article 3

Ecodesign requirements and timetable

1. The ecodesign requirements for servers and data storage products are set out in Annex II.

2. Ecodesign requirements shall apply in accordance with the following timetable:

   (a) From 1 January 2019

   Servers shall comply with the requirements set out in points 1.1.1, 1.2, 2.1, 3.1, 3.3 and 3.4 of Annex II

   Data storage products shall comply with the requirements set out in points 1.1.1, 1.2, 3.2, 3.3 and 3.4 of Annex II

(b) From 1 January 2023 servers and data storage products shall comply with the requirements set out in point 1.1.2 of Annex II

(c) From 1 January 2026 servers and data storage products shall comply with the requirements set out in point 1.1.3 of Annex II

3. Compliance with ecodesign requirements shall be measured and calculated in accordance with the methods set out in Annex III.

Article 4

Conformity assessment

1. The conformity assessment procedure referred to in Article 8(2) of Directive 2009/125/EC shall be the internal design control set out in Annex IV to that Directive or the management system set out in Annex V to that Directive.

2. For the purposes of the conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation shall contain the information set out in point 3.4 of Annex II to this Regulation.

Article 5

Verification procedure for market surveillance purposes

Member States shall apply the verification procedure set out in Annex IV to this Regulation when performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC to ensure compliance with the requirements set out in Annex II to this Regulation.

Article 6

Indicative benchmarks

The indicative benchmarks for best-performing servers and data storage products available on the market at the time of entry into force of this Regulation are set out in Annex V.

Article 7

Review

The Commission shall review this Regulation in the light of technological progress and present the result of that review to the Consultation Forum no later than 1 January 2022 (3 years after entry into force first req). In particular, the review shall assess whether:

1. it is appropriate to set specific ecodesign requirements on server efficiency, performance and power demand;
2. it is necessary to update the definitions or the scope of the Regulation;
3. it is appropriate to set specific ecodesign requirements on operating condition class;
4. it is appropriate to set specific ecodesign requirements on the efficiency, performance and power demand of data storage products.

Article 8

Amendment to Regulation (EU) No 617/2013

Regulation (EU) No 617/2013 is amended as follows:

1. Article 1 is amended as follows:

(a) in paragraph 1 the words 'and computer servers' are deleted;

(b) in sub-paragraph (h) of paragraph 2) the words '(h) computer servers' are deleted;

(c) subparagraphs (a), (b), (c) and (d) of paragraph 3 are deleted;

2. Article 2 is amended as follows

   (a) paragraph 2 is deleted;

   (b) in paragraph 4 the words 'or computer server' are deleted;

   (c) in sub paragraph (4)(a) the words 'or computer server' are deleted;

   (d) in subparagraph (4)(c) the words 'or computer server' are deleted;

   (e) paragraphs 11 to 16 are deleted;

   (f) in paragraph 22 the words 'computer server, blade system and components, multi-node server, server appliance,' are deleted.

3. In both the first and second paragraph of Article 3 the words 'and computer servers' are deleted.

4. In the second paragraph of Article 7 the words 'and computer servers' are deleted.

Article 9
Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

The amendments to Regulation (EU) No 617/2013 shall enter into application as of 1 January 2019.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission
The President
Jean-Claude JUNCKER

ANNEX I
Definitions applicable to Annexes II to V

For the purposes of Annexes II to VI the following definitions shall apply:

(1) 'server with one or two processor sockets' means a server containing one or two interfaces designed for the installation of a processor;

(2) ‘I/O Device’ means a device, which provides data input and output capability between a server or a data storage product and other devices. An I/O device may be integral to the server motherboard or may be connected to the motherboard via expansion slots (e.g., PCI, PCIe).

(3) ‘Motherboard’ means the main circuit board of the server. For purposes of this regulation, the motherboard includes connectors for attaching additional boards and typically includes the following components: processor, memory, BIOS, and expansion slots.

(4) ‘Processor’ means the logic circuitry that responds to and processes the basic instructions that drive a server. For purposes of this regulation, the processor is the central processing unit (CPU) of the server. A typical CPU is a physical package to be installed on the server motherboard via a socket or direct solder attachment. The CPU package may include one or more processor cores.

(5) ‘Memory’ means a part of a server external to the processor in which information is stored for immediate use by the processor.

(6) 'Expansion card' means an internal component connected by an edge connection over a common/standard interface such as PCIe (Peripheral Component Interconnect Express) providing additional functionality. It does not include CPUs, random access memory (RAM) or storage modules.

(7) 'Graphics card' means an expansion card containing one or more graphics processing units with a local memory controller interface and local graphics-specific memory

(8) 'Buffered DDR channel' means a channel or memory port connecting a memory controller to a defined number of memory devices in a server. A typical server may contain multiple memory controllers, which may in turn support one or more buffered DDR channels. As such, each buffered DDR channel serves only a fraction of the total addressable memory space in a server.

(9) 'Blade server' means a server that is designed for use in a blade chassis. A blade server is a high-density device that functions as an independent server and includes at least one processor and system memory, but is dependent upon shared blade chassis resources (e.g., power supplies, cooling) for operation. A processor or memory module that is intended to scale up a standalone server is not considered a blade server.

(10) 'Blade chassis' means an enclosure that contains shared resources for the operation of blade servers, blade storage, and other blade form-factor devices. Shared resources provided by a chassis may include power supplies, data storage, and hardware for direct current power distribution, thermal management, system management, and network services.

(11) 'Resilient server' means a server designed with extensive reliability, availability, serviceability and scalability features integrated in the micro architecture of the system, CPU and chipset.

(12) 'Multi-node server' means a server that is designed with two or more independent server nodes that share a single enclosure and one or more power supplies. In a multi-node server, power is distributed to all nodes through shared power supplies. Server nodes in a multi-node server are not designed to be hot-swappable.

(13) 'Server appliance' means a server that is bundled with a pre-installed OS and application software that is used to perform a dedicated function or set of tightly coupled functions. Server appliances deliver services through one or more networks (e.g., IP or storage area network), and are typically managed through a web or command line interface. Server appliance hardware and software configurations are customized by the vendor to perform a specific task (e.g., name services, firewall services, authentication services, encryption services, and voice-over-IP services), and are not intended to execute user-supplied software.

(14) 'Server product family' means a high-level description referring to a group of servers sharing one chassis and motherboard combination that may contain more hardware and software configurations. All configurations within a family must share the following common attributes:

(a) be from the same model line or machine type;

(b) either share the same form factor (i.e., rack-mounted, blade, pedestal) or share the same mechanical and electrical designs with only superficial mechanical differences to enable a design to support multiple form factors;

(c) either share processors from a single defined processor series or share processors that plug into a common socket type;

(d) share the power supply unit(s).

(15) 'Power supply unit' (PSU) means a device that converts alternate current (AC) or direct current (DC) input power to one or more DC power outputs for the purpose of powering a server or a data storage product. A server or data storage product PSU must be self-contained and physically separable from the motherboard and must connect to the system via a removable or hard-wired electrical connection.

(16) ‘Power factor’ means the ratio of the real power consumed in Watts to the apparent, or reactive, power drawn in volt amperes.

(17) ‘Non-redundant PSU’ means a PSU intended to be used in a server or in a data storage product that is not designed for a redundant configuration

(18) ‘Redundant PSU’ means a PSU designed and installed in a configuration capable of two or more PSUs, which provide alternative power routes to increase reliability.

(19) ‘Idle state’ means the operational state in which the OS and other software have completed loading, the server is capable of completing workload

transactions, but no active workload transactions are requested or pending by the system (i.e., the server is operational, but not performing any useful work).

(20) 'Idle state power' (Pidle) is the power demand, in Watts, in idle state.

(21) ‘Low-end performance configuration’ of a server product family means the combination of two 10,000 rpm HDDs, processor with the lowest product of core count and frequency and memory capacity (in GB) equal to 0.5 to 0.75 times the product of the number of CPUs, cores and hardware threads that represents the lowest performance product model within the product family.

(22) ‘High-end performance configuration’ of a server product family means the combination of two SSDs, processor with the highest product of core count and frequency and memory capacity (inGB) equal to 1.0 to 2.0 times the product of the number of CPUs, cores and hardware threads that represents the highest performance product model within the product family.

(23) 'Hardware thread': means the hardware resources in a CPU core to execute a stream of software instructions. A CPU core may have the resources to execute more than one thread simultaneously.

(24) 'Server efficiency' means the ratio between server performance and server power demand in active state

(25) 'Active state' means the operational state in which the server is carrying out work in response to prior or concurrent external requests (e.g., instruction over the network). Active state includes both active processing and data seeking/retrieval from memory, cache, or internal/external storage while awaiting further input over the network.

(26) 'Server performance' means the number of transactions per unit of time performed by the server under standardised testing of discrete system components (e.g. processors, memory and storage) and subsystems (e.g. RAM and CPU).

ANNEX II
Ecodesign requirements

1. Specific ecodesign requirements for servers and data storage products

1.1. PSU efficiency and power factor requirements

1.1.1. From 1 January 2019, for servers and data storage products the internal PSU efficiency at 20%, 50% and 100% rated load level and the power factor at 50% rated load level shall not be less than the values reported in Table 1.

Table 1 Minimum PSU efficiency and power factor requirements from 1 January 2019

	Minimum PSU efficiency				Minimum power factor
% of rated load	10%	20%	50%	100%	50%
Non redundant	-	90%	92%	89%	0.90
Redundant	-	88%	92%	88%	0.90

1.1.2. From 1 January 2023, for servers and data storage products the internal PSU efficiency at 20%, 50% and 100% rated load level and the power factor at 50% rated load level shall not be less than the values reported in Table 2.

Table 2 Minimum PSU efficiency and power factor requirements from 1 January 2023

	Minimum PSU efficiency				Minimum power factor
% of rated load	10%	20%	50%	100%	50%
Non redundant	-	92%	94%	90%	0.90
Redundant	-	90%	94%	91%	0.95

1.1.3. From 1 January 2026, for servers and data storage products the internal PSU efficiency at 20%, 50% and 100% rated load level and the power factor at 50% rated load level shall not be less than the values reported in Table 3:

Table 3 Minimum PSU efficiency and power factor requirements from 1 January 2026

	Minimum PSU efficiency				Minimum power factor
% of rated load	10%	20%	50%	100%	20%
Non redundant	90%	94%	96%	94%	0,95
Redundant	90%	94%	96%	91%	0,95

1.2. Material efficiency requirements

1.2.1. From 1 January 2019, manufacturers shall ensure that welding or firm gluing is not used as joining or sealing technique for the following types of components, when present:

(a) HDD and SSD

(b) Memory

(c) Processor (CPUs)

(d) Motherboard

(e) Chassis

(f) Expansion cards/graphic cards

(g) Power supply

Accessing components shall be ensured by documenting the sequence of dismantling operations needed to access the targeted components, including for each of these operations: type of operation, type and number of fastening technique(s) to be unlocked, and tool(s) required;

1.2.2. From 1 January 2019, data deletion of potentially reusable data storage equipment (i.e. hard drives and solid state drives) shall be made possible by securing availability of built-in software based data deletion tool(s).

1.2.3. From 1 January 2019, the latest version of firmware necessary for upgrading and to test the functionality and compatibility of different components in the server shall be made available.

2. Specific ecodesign requirements only for servers with one or two processor sockets

2.1. Idle state power

From 1 January 2019, the idle state power (Pidle) of servers shall not exceed the value calculated using the following equation:

$P_{idle} = P_{base} + P_{add\_i}$

where P_{base} is the basic idle state power allowance in Table 4, and Padd_i is the idle state power allowance for additional components, as determined per Table 5.

Table 4 Base idle state power allowances

Product type	Base idle state power allowance, P_{base} (W)
1-socket servers	37
1-socket resilient servers	130
2-socket servers	85
2-socket resilient servers	297
Blade or multi-node servers	105

Table 5 Additional Idle Power Allowances for Extra Components

System characteristics	Applies to	Additional idle power allowance
Additional power supplies	Power supplies installed explicitly for power redundancy	10 W per power supply
Drives (HDD or SSD)	Per installed HDD and SSD	4.0 W per HDD and SSD
Additional memory	Installed memory greater than 4 GB	0.25 W per GB
Additional buffered DDR channel	Installed buffered DDR channels greater than 8 channels	4.0 W per buffered DDR channel
Additional I/O devices	Installed devices greater than two ports of ≥ 1 Gbit, onboard Ethernet	< 1 Gbit: No Allowance
		= 1 Gbit: 2.0 W / Active Port
		> 1 Gbit and < 10 Gbit: 4.0 W/ Active Port
		≥ 10 Gbit: 8.0 W/Active Port

3. Information to be provided by manufacturers

3.1. 3.1. From 1 January 2019, the following product information on servers shall be provided in the instruction manuals for installers and end-users, and on the free-access websites of manufacturers, their authorised representatives and importers:

(a) product type;

(b) manufacturer’s name, registered trade name and registered trade address at which they can be contacted;

(c) product model number;

(d) year of manufacture;

(e) internal power supply efficiency at 10 %, 20 %, 50 % and 100 % of rated output power;

(f) power factor at 50% of rated load level, power factor at 20% of rated load level from 1 January 2026

(g) idle state power (Watts) and the list of components, such as additional power supplies, drives, additional memory, additional buffered DDR channels, additional I/O devices, in case they are present;

(h) maximum power demand (Watts);

(i) declared operating condition class, as detailed in Table 6;

(j) idle state power (Watts) at the higher boundary temperature of the declared operating condition class;

(k) the server efficiency, server performance and server power demand in active state;

(l) information relevant to disassembly, recycling and disposal at end-of-life;

(m) information on the data deletions tool(s) referred to in point 1.2.2 of this Annex;

(n) if a product model is part of a server product family, a list of all model configurations that are represented by the model can be supplied.

If a product model is part of a server product family, the product information required for items g) to k) under point 3.1 shall be reported either for the product model or, alternatively, for the low-end and high-end configurations of the server product family.

3.2. 3.2. From 1 January 2019, the following product information on data storage products shall be provided in the instruction manuals for installers and end-users, and on the free-access websites of manufacturers, their authorised representatives and importers:

(a) product type;

(b) manufacturer's name, registered trade name and registered trade address at which they can be contacted;

(c) product model number;

(d) year of manufacture;

(e) internal power supply efficiency at 10 %, 20 %, 50 % and 100 % of rated output power;

(f) power factor at 50% of rated load level, power factor at 20% of rated load level from 1 January 2026

(g) declared operating condition class, as detailed in Table 6;

(h) information relevant to disassembly, recycling and disposal at end-of-life;

(i) information on the data deletions tool(s) referred to in point 1.2.2 of this Annex.

3.3. From 1 January 2019, the following product information on servers and data storage products shall be made available free of charge by manufacturers, their authorised representatives and importers to third parties dealing with maintenance, repair, reuse and upgrading of servers (including brokers, spare parts repairer, spare parts provider and third party maintenance) upon registration by the interested third party on a website provided:

(a) total weight per product of the following critical raw materials, if any, and indication of the components in which the following critical raw materials are present:

(a) Cobalt, expressed in grams rounded to the nearest integer;

(b) Neodymium, expressed in grams rounded to the nearest integer;

(c) Palladium, expressed in grams to one decimal place;

(b) instructions on the sequence of operations needed to remove the components referred to in point 1.2.1 of this Annex, including type and number of fastening techniques to be unlocked and tool(s) required;

(c) the latest firmware version referred to in point 1.2.3 of this Annex.

In the case of servers, if a product model is part of a server product family, the product information required for item a) under point 3.3 shall be reported either for the product model or, alternatively, for the low-end and high-end configurations of the server product family

3.4. From 1 January 2019, the following product information on servers and data storage products shall be provided in the technical documentation for the purposes of conformity assessment pursuant to Article 4:

(a) Information listed in points 3.1 and 3.3, in the case of servers

(b) Information listed in point 3.2 and 3.3, in the case of data storage products.

The information referred to in point 3.4 may be merged with the technical documentation provided in accordance with measures under Directive 2010/30/EU.

Table 6 Operating condition classes

Operating condition class	Dry bulb temp °C	Humidity range, non-condensing	Max dew point (°C)	Maximum rate of change (°C/hr)
A1	15- 32	–12°C DP and 8% RH to 17°C DP and 80% RH	17	5/20
A2	10-35	20% - 80% RH	21	5/20
A3	5-40	-12°C DP and 8% RH to 85% RH	24	5/20
A4	5-45	–12°C DP and 8% RH to 24°C DP and 90% RH	24	5/20

ANNEX III
Measurements and calculations

1. For the purposes of compliance and verification of compliance with the applicable requirements of this Regulation, measurements and calculations shall be made using harmonised standards, the reference numbers of which have been published in the Official Journal of the European Union, or using other reliable, accurate and reproducible methods which take into account the generally recognised state of the art, and produce results deemed to be of low uncertainty.

2. Servers shall be tested in their 'as-shipped' configuration, which includes both hardware configuration and system settings, unless otherwise specified.

   For multi-node systems, the unit under test shall be tested for per node power consumption in the fully-populated chassis configuration.

   For blade systems, the unit under test shall be tested for blade server power consumption in the half-populated chassis configuration, and the chassis shall be populated as follows:

   (1) Individual blade server configuration

      (a) All individual blade servers installed in the chassis shall be identical, sharing the same configuration

   (2) Half chassis population

      (a) The number of blade servers required to populate half the number of single-wide blade server slots available in the blade chassis shall be calculated.

      (b) For blade chassis having multiple power domains, the number of power domains that is closest to filling half of the chassis shall be chosen. If there are two choices that are equally close to filling half of the chassis, the test shall be performed with the domain or combination of domains which use a higher number of blade servers.

      (c) All user manual or manufacturer recommendations for partially populating the chassis, which may include disconnecting some of the power supplies and cooling fans for the unpopulated power domains, should be followed.

      (d) If user manual recommendations are not available or are incomplete, then the following guidance shall be used:

         i. Completely populate the power domains;

         ii. If possible, disconnect the power supplies and cooling fans for unpopulated power domains;

         iii. Fill all empty bays with blanking panels or an equivalent airflow restriction for the duration of testing.

ANNEX IV
Verification procedure for market surveillance purposes

The verification tolerances defined in this Annex relate only to the verification of the measured parameters by Member State authorities and shall not be used by the manufacturer or importer as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.

When verifying the compliance of a product model with the requirements laid down in this Regulation pursuant to Article 3(2) of Directive 2009/125/EC, for the requirements referred to in this Annex, the authorities of the Member States shall apply the following procedure:

1. The Member State authorities shall verify one single unit of the model or model configuration.

2. The model or model configuration shall be considered to comply with the applicable requirements if:

   (a) the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC (declared values), and, where applicable, the values used to calculate these values, are not more favourable for the manufacturer or importer than the results of the corresponding measurements carried out pursuant to paragraph (g) thereof; and

   (b) the declared values meet any requirements laid down in this Regulation, and any required product information published by the manufacturer or importer does not contain values that are more favourable for the manufacturer or importer than the declared values; and

   (c) when the Member State authorities test the unit of the model or model configuration, the determined values (the values of the relevant parameters as measured in testing and the values calculated from these measurements) comply with the respective verification tolerances as given in Table 7.

3. If the results referred to in points 2(a) or (b) are not achieved, the model and all model configurations that are covered by the same product information (according to Annex II point 3.1(n)) shall be considered not to comply with this Regulation.

4. If the result referred to in point 2(c) is not achieved:

   (a) for models that are produced in quantities of less than five per year, the model and all model configurations that are covered by the same product information (according to Annex II point 3.1(n)) shall be considered not to comply with this Regulation;

   (b) for models that are produced in quantities of five or more per year, the Member State authorities shall select three additional units of the same model or model configuration for testing.

5. The model or model configuration shall be considered to comply with the applicable requirements if, for these three units, the arithmetical mean of the determined values complies with the respective verification tolerances given in Table 7

6. If the result referred to in point 4(b) is not achieved, the model and all model configurations that are covered by the same product information (according to Annex II point 3.1(n)) shall be considered not to comply with this Regulation.

7. The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3 and 6.

The Member State authorities shall use the measurement and calculation methods set out in Annex III.

The Member State authorities shall only apply the verification tolerances that are set out in Table 7 of this Annex and shall only use the procedure described in points 1 to 7 for the requirements referred to in this Annex. No other tolerances shall be applied.

Table 7— Verification tolerances

Parameters	*Verification tolerances*
PSU efficiency (%)	The determined value shall not be lower than the declared value by more than 2 %.
Power factor	The determined value shall not be lower than the declared value by more than 10 %.
Idle state power, P_{idle} (W)	The determined value shall not exceed the declared value by more than 10 %.
Server efficiency	The determined value shall not be lower than the declared value by more than 10 %.

ANNEX V
Indicative benchmarks referred to in Article 6

The following indicative benchmarks are identified for the purpose of Part 3, point 2 of Annex I to Directive 2009/125/EC.

They refer to the best available technology at the time of drafting this Regulation.

The indicative benchmarks for the best available technology on the market for servers and data storage products are as follows.

Table 8 Benchmark for idle state power, server efficiency and operating condition

Product type	Idle power, W	Server efficiency	Operating condition class
Tower server, 1 socket	24	57	A3
Rack server, 1 socket	50	42	A4
Rack server, 2 socket, low performance	67	56	A4
Rack server, 2 socket, high performance	67	92	A4
Rack server, 4 socket	415	89	A4
Blade server, 2 socket	75	No available data	A3
Blade server, 4 socket	127	No available data	A3
Resilient server, 2 socket	234	No available data	A3
Data storage products	Not applicable	Not applicable	A3

Table 9 Benchmark for PSU efficiency at 10%, 20%, 50% and 100% load level and power factor at 50% load level

PSU nameplate power	10%	20%	50%	100%
< 750W	91.17%	93.76%	94.72% Power factor >0.95	94.14%
≥ 750W	95.02%	95.99% Power factor >0.95	96.09%	94.69%

ANNEX VI
Amendments to the Annexes to Regulation (EU) No 617/2013

Amendments to the Annexes to Regulation (EU) No 617/2013

1. Annex II is amended as follows:

(a) point 5.2 is deleted;

(b) in point 7.3 the words 'and computer server' are deleted.