EUROPEAN
COMMISSION

Brussels, XXX
[…](2018) XXX draft

ANNEXES 1 to 6

ANNEXES

to the

COMMISSION REGULATION (EU) No …/.. of XXX

implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for servers and data storage products

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) ‘Input/Output (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 (such as Peripheral Component Interconnect, or Peripheral Component Interconnect Express);

(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 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 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 double data rate (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) '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;

(12) "High Performance Computing (HPC) server' means a server which is designed and optimized to execute highly parallel applications, for higher performance computing or deep learning artificial intelligence applications. HPC servers must meet all the following criteria:

(a) they consist of multiple computing nodes, clustered primarily to increase computational capability;

(b) they include high speed inter-processing interconnections between nodes;

(13) '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);

(14) '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;

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

(16) 'single output PSU' means a PSU designed to deliver the majority of its rated output power to one primary DC output for the purpose of powering a server or a data storage product. Single output PSUs may offer one or more standby outputs that remain active whenever connected to an input power source. The total rated power output from any additional PSU outputs that are not primary and standby outputs shall be no greater than 20 Watts. PSUs that offer multiple outputs at the same voltage as the primary output are considered single-output PSUs unless those outputs:

(a) (a) are generated from separate converters or have separate output rectification stages, or

(b) (b) have independent current limits;

(17) ‘multi output PSU’ means a PSU designed to deliver the majority of its rated output power to more than one primary dc output for the purpose of powering a server or a data storage product. Multioutput PSUs may offer one or more standby outputs that remain active whenever connected to an input power source. The total rated power output from any additional PSU outputs that are not primary and standby outputs is greater than or equal to 20 Watts;

(18) 'direct current server' means a server that is designed solely to operate on a DC power source;

(19) 'direct current data storage product' means a data storage product that is designed solely to operate on a DC power source;

(20) ‘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);

(21) 'idle state power' (Pidle) is the power demand, in Watts, in idle state;

(22) ‘low-end performance configuration’ of a server product family means the combination of two data storage devices, processor with the lowest product of core count and frequency (in GHz) and memory capacity (in GB) is equal to the product of the number of memory slots and the lowest capacity DIMM (in GB) offered on the server that represents the lowest performance product model within the product family;

(23) ‘high-end performance configuration’ of a server product family means the combination of two data storage devices, processor with the highest product of core count and frequency and memory capacity (in GB) equal to or greater than 3 times the product of the number of CPUs, cores and hardware threads that represents the highest performance product model within the product family;

(24) '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;

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

(26) '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;

(27) '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);

(28) 'CPU performance (CPU_{perf})' means the number of transactions per unit of time performed by the server under standardised testing of the CPU subsystem;

(29) 'Auxiliary Processing Accelerator' (APA) means a specialized processor and associated subsystem that provide an increase in computing capacity such as graphical processing units or field programmable gate arrays. An APA cannot

operate in a server without a CPU. APAs can be installed in a server either on Graphics or Extension add-in cards installed in general-purpose add-in expansion slots or integrated into a server component such as the motherboard;

(30) 'Expansion APA' means an APA that is on an add-in card installed in an add-in expansion slot. An expansion APA add-in card may include one or more APAs;

(31) 'Integrated APA' means an APA that is integrated into the motherboard or CPU package;

(32) 'product type' means the design of the server or of the data storage product including the chassis (rack, tower or blade), the number of sockets and, for servers, whether it is a resilient server, a blade server, a multi node server, a HPC server, a server with integrated APA, a direct current server or none of the previous categories;

(33) 'disassembly' means a process whereby an item is taken apart in such a way that it could subsequently be reassembled and made operational;

(34) ‘firmware’ means system, hardware, component, or peripheral programming provided with the product to provide basic instructions for hardware to function inclusive of all applicable programming and hardware updates;

(35) ‘secure data deletion’ means the effective erasure of all traces of existing data from a data storage device, overwriting the data completely in such a way that access to the original data, or parts of them, becomes infeasible for a given level of effort;

(36) 'built-in functionality' means a functionality that does not require the installation or usage of additional software or hardware components not already present in the server or data storage product.

ANNEX II
Ecodesign requirements

1. Specific ecodesign requirements for servers and online data storage products

1.1. PSU efficiency and power factor requirements

1.1.1. From 1 March 2020, for servers and online data storage products, with the exception of direct current servers and of direct current data storage products, the internal PSU efficiency at 10%, 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 March 2020

	Minimum PSU efficiency				Minimum power factor
% of rated load	10%	20%	50%	100%	50%
Multi output	-	88%	92%	88%	0.90
Single output	-	90%	94%	91%	0.95

1.1.2. From 1 January 2023, for servers and online data storage products, with the exception of direct current servers and of direct current 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%
Multi output	-	90%	94%	91%	0.95
Single output	90%	94%	96%	91%	0.95

1.1.3. From 1 January 2026, for servers and online data storage products, with the exception of direct current servers and of direct current 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%
Multi output	90%	94%	96%	91%	0.95
Single output	90%	94%	96%	91%	0.95

1.2. Material efficiency requirements

1.2.1. From 1 March 2020, manufacturers shall ensure that joining, fastening or sealing techniques do not prevent the disassembly of the following components, when present:

(a) data storage devices;

(b) memory;

(c) processor (CPU);

(d) motherboard;

(e) expansion card/graphic card;

(f) power supply.

1.2.2. From 1 March 2020, a built-in functionality for secure data deletion shall be made available for the deletion of data contained in all the data storage devices of the product.

1.2.3. From 1 March 2021, the latest available version of the firmware shall be made available for a minimum period of eight years after the placing on the market of the product, at a fair, transparent and non-discriminatory cost.

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

2.1. Idle state power

From 1 March 2020, the idle state power (P_{idle}) of servers, with the exception of resilient servers, HPC servers and servers with integrated APA, 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. For blade servers, P_{idle} is calculated as the total measured power divided by the number of installed blade servers in the tested blade chassis. For multi-node servers, P_{idle} is calculated as the total measured power divided by the number of installed nodes in the tested enclosure.

Table 4 Base idle state power allowances

Product type	Base idle state power allowance, P_{base} (W)
1-socket servers	25
2-socket servers	38
Blade or multi-node servers	40

Table 5 Additional Idle Power Allowances for Extra Components

System characteristics	Applies to	Additional idle power allowance

CPU Performance	All servers	1 socket: $10 \times CPU_{perf}$ W 2 socket: $7 \times CPU_{perf}$ W
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	0.12 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 Gb/s: No Allowance
		= 1 Gb/s: 2.0 W / Active Port
		> 1 Gb/s and < 10 Gb/s: 4.0 W/ Active Port
		≥ 10 Gb/s and <25Gb/s: 15.0 W/Active Port
		≥ 25 Gb/s and <50Gb/s: 20.0 W/Active Port
		≥ 50 Gb/s 26.0 W/Active Port

3. Information to be provided by manufacturers

3.1. From 1 March 2020, 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) PSU rated power output (Watts);

(h) idle state power (Watts);

(i) list of components for additional idle power allowances, if any (additional power supplies, drives, additional memory, additional buffered DDR channels, additional I/O devices);

(j) maximum power demand (Watts);

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

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

(m) the server efficiency and server performance in active state, with the exception of HPC servers and servers with integrated APA;

(n) information on the secure data deletion built-in functionality referred to in point 1.2.2 of this Annex, including instructions on how to use the functionality, the techniques used and the supported secure data deletion standard(s), if any;

(o) 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. From 1 March 2020, the following product information on online 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; it shall also be indicated that 'This product has been tested in order to verify that it will function within the boundaries (such as temperature and humidity) of the declared operating condition class';

(h) information on the data deletions tool(s) referred to in point 1.2.2 of this Annex, including instructions on how to use the functionality, the techniques used and the supported secure data deletion standard(s), if any.

3.3. From 1 March 2020, the following product information on servers and online 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, recycling and upgrading of servers (including brokers, spare parts repairers, spare parts providers, recyclers and third party maintenance) upon registration by the interested third party on a website provided:

(a) weight range (less than 5g, between 5g and 25g, above 25g) at component level, of the following critical raw materials, if any:

(a) Cobalt in the batteries;

(b) Neodymium in the HDDs;

(b) instructions on the disassembly operations referred to in point 1.2.1 of this Annex, including, for each necessary operation and component:

(a) the type of operation;

(b) the type and number of fastening technique(s) to be unlocked;

(c) the tool(s) required.

In the case of servers, if a product model is part of a server product family, the product information required for items a) and b) 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 March 2020, the following product information on servers and online 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.

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 configuration declared for Annex II, point 3.1.(i), which includes both hardware configuration and system settings, unless otherwise specified.

   For servers with expansion APA, the unit under test shall be tested with the expansion APA removed, when measuring the idle state power, the server efficiency and the server performance in active state.

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

   For blade servers, 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.

Where a model has been designed so that a model's performance is automatically altered in test conditions with the objective of reaching a more favourable level for any of the parameters specified in this Regulation or included in the technical documentation provided with the product, the model shall be considered not compliant.

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 2(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 by [OP – please insert the date of entry into force of this Regulation].

The indicative benchmarks for the best available technology on the market for servers and online 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	10	A3
Rack server, 1 socket	50	9	A4
Rack server, 2 socket, low performance	67	11	A4
Rack server, 2 socket, high performance	67	20	A4
Rack server, 4 socket	415	No available data	A4
Blade server, 2 socket	75	15	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%