

# **BLUE ANGEL**

**The Environmental Label**



**Server and Data Storage Products**

**DE-UZ 213**

**Basic Award Criteria**

**Edition January 2020**

**Version 4**

## The environmental label is underpinned by the following institutions:



Bundesministerium  
für Umwelt, Naturschutz  
und nukleare Sicherheit

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit) is the owner of the label. It regularly provides information on the decisions taken by the Environmental Label Jury.



Umwelt  
Bundesamt

The Federal Environmental Agency (Umweltbundesamt) in the specialist department "Ecodesign, Eco-Labeling and Environmentally friendly Procurement" acts as the office of the Environmental Label Jury and develops the specialist criteria in the form of the Basic Award Criteria for the Blue Angel environmental labels.



Jury  
Umweltzeichen

The Environmental Label Jury is the independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.



**RAL**

gGmbH

RAL gGmbH is the awarding body for the environmental label. It organises the process for developing the relevant award criteria in independent, expert hearings – which involve all relevant interest groups.

If you require further information please contact:

RAL gGmbH

**RAL ENVIRONMENT**

Fränkische Straße 7

53229 Bonn

Tel.: +49 (0) 228 / 6 88 95 - 0

E-mail:

[umweltzeichen@ral.de](mailto:umweltzeichen@ral.de)

Version 1 (01/2020): First edition, term until 31/12/2022

Version 2 (12/2021): Editorial change in section 3.1.2

Version 3 (12/2021): Prolongation without any change for 2 years, until 31.12.2024

Version 4 (01/2024): prolongation without changes, Expiry date: December 31, 2025

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# 1 Introduction

## 1.1 Preface

In cooperation with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the Federal Environmental Agency and considering the results of the expert hearings conducted by RAL gGmbH, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label. RAL gGmbH has been tasked with awarding the Environmental Label.

Upon application to RAL gGmbH and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH, the permission to use the Environmental Label may be granted to all products, provided that they comply with the requirements as specified hereinafter. The product must comply with all the legal requirements in the country in which it is to be marketed. The applicant shall declare that the product meets these conditions.

## 1.2 Background

Servers and data storage products are primarily used in data centers. These product groups are used to process and store data and make it available in a central location. The demand for the central processing and storing of data has increased continuously for many years and has been strengthened by new business processes dealing with digitalisation and the increasing networking of products. This trend is also reflected in the sales figures. According to data from the market research institute IDC, global revenue from the sale of servers doubled between 2009 and 2019 from 10 billion to 20 billion US dollars per quarter. While there were still only about 7 million servers worldwide in 2009, around 12 million servers are sold annually around the world today.<sup>1</sup> According to calculations by the Borderstep Institute, the number of servers in German data centers increased by 18% between 2013 and 2016 to around 1.9 million servers. If those servers that are operated outside of data centers are added to this figure, the number of servers in Germany increased to around 2.3 million servers in 2016.<sup>2</sup> There has also been strong growth in the number of data storage products used in data centers. The market research institute IDC forecasts an annual increase in the storage capacity at cloud data centers of 29 percent between 2018 and 2023 for the economic region of Western Europe.<sup>3</sup> It is anticipated that the importance of servers and data storage devices for the information technology infrastructure will continue to increase substantially over the next few years.

The potential for easing the burden on the environment by developing suitable and ambitious criteria for the server and data storage product group is huge. Two factors will play an important role in this context. The growing sales figures and the fact that this product group is used intensively.

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<sup>1</sup> IDC: Worldwide Server Tracker, [https://www.idc.com/tracker/showproductinfo.jsp?prod\\_id=7](https://www.idc.com/tracker/showproductinfo.jsp?prod_id=7)

<sup>2</sup> Hintemann, R. (2017): Rechenzentren in Deutschland: Eine Studie zur Darstellung der wirtschaftlichen Bedeutung und der Wettbewerbssituation (Data centers in Germany: A study to illustrate their economic importance and the competitive situation). Berlin, Borderstep Institute. Available online at: <https://www.bitkom.org/sites/default/files/pdf/noindex/Publikationen/2017/Studien/2017/Kurzstudie-RZ-Markt-Bitkom-final-20-11-2017.pdf>

<sup>3</sup> Hülskötter, Michael (2019): Multi-Cloud-Bewegung wird den Storage-Markt verändern (The multi-cloud movement will change the storage market). Published by the magazine "speicherguide". Available online at <https://www.speicherguide.de/cloud/multi-cloud-bewegung-wird-den-storage-markt-veraendern-24337.aspx>

Servers and data centers are operated around the clock, every day of the year. Increasing the energy efficiency of servers and data storage products has a huge influence on the energy consumption in data centers because they are responsible for around 60 percent of the total energy requirements in a data center. Saving energy in the operation of servers and storage devices pays off twice. On the one hand, there are the direct energy savings achieved by the devices themselves and, on the other hand, the reduction in the heating load also reduces the required cooling performance by an equal amount and thus saves energy in the cooling of data centers.

### 1.3 Objectives of the environmental label

Climate protection, a reduction in power consumption, the preservation of resources and the avoidance of pollutants are key objectives of environmental protection. The Blue Angel environmental label for Servers and Data Storage Products will contribute to these goals by setting high minimum requirements for the energy efficiency of servers, data storage products and power supply units, as well as for the elimination of pollutants in the plastic materials. In addition, the label will require the early adoption of the ecodesign requirements for servers and data storage products including the guidelines for energy and material efficiency, as well as compliance with the energy efficiency criteria and documentation obligations in the Energy Star label.

The Blue Angel environmental label may be awarded to products featuring the following environmental properties:

- high energy efficiency and its documentation,
- durability due to reparability,
- avoidance of environmentally damaging materials.

The following benefits are stated in the explanatory box:



### 1.4 Definitions

**Server:** A data processing device that provides services and manages networked resources for client devices. Access to a server is primarily achieved via network connections, and not through direct user input devices, such as a keyboard or a mouse.

**Server types:** Server types differ in their design, system architecture and performance capabilities.

Some of the server types and server casings named in the Basic Award Criteria are defined below:

**Blade server:** 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 supply units, cooling) for operation.

- ♦ **Blade chassis:** 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 blade chassis may include power supply units, data storage and hardware for direct current power distribution, thermal management, system management, and network services.
- ♦ **Multi-node server:** A server with two or more independent server nodes that share a single enclosure and one or more power supply units. In a multi-node server, power is distributed to all nodes through shared power supply units.
- ♦ **Resilient server:** A server designed with extensive reliability, availability, serviceability and scalability features integrated in the micro architecture of the system, central processing unit (CPU) and chipset.
- ♦ **High performance computing (HPC) system:** A computing system which is designed and optimized to execute highly parallel applications for high performance, deep learning or artificial intelligence applications. HPC systems feature clustered nodes often featuring high speed inter-processing interconnects as well as high memory capability and bandwidth.
- ♦ **Server with integrated APA:** Servers that have an auxiliary processing accelerator (APA) integrated into the motherboard or the processor module. An APA comprises a specialized processor and associated subsystem that provide an increase in computing capacity such as graphical processing units, field programmable gate arrays (FPGAs) or application specific integrated circuits (ASICs). An APA cannot operate in a server without a CPU.

**Data storage product:** 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 hard 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 center level (e.g. devices required for operation of an external storage area network (SAN)) 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.

## 2 Scope

The Basic Award Criteria for the Blue Angel apply to servers and data storage products that are designed for use in server rooms or data centers (see Paragraph 1.4 Definitions).

Products that fall under the scope of the Blue Angel ecolabel for Computers and Keyboards DE-UZ 78a are excluded from the scope of these Basic Award Criteria.

## 3 Requirements

### 3.1 Basic requirements

#### 3.1.1 Ecodesign regulation

At the time of application, the server and data storage products must already comply with all of the requirements in the ecodesign regulation for servers and data storage products (Regulation (EU) 2019/424, see Appendix A [1]) valid as of 1 March 2020. This also applies even if the products do not fall under the scope of the ecodesign regulation.

The **ecodesign regulation** places minimum requirements on the following areas:

- Requirements relating to the efficiency of the power supply unit (PSU) and the power factor
- Requirements for the material efficiency
- Power output in an idle state
- Efficiency in an active state
- Information to be provided by the manufacturers

#### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract and submit the product information required by the ecodesign regulation for servers and data storage products (Regulation (EU) 2019/424, Annex II, Number 3 "Information to be provided by manufacturers") in Annex 5 to the contract.*

#### 3.1.2 Energy Star requirements

The server and data storage products must comply with the requirements of the energy efficiency label "Energy Star"<sup>4</sup> for the relevant product group, in the current version valid at the time of application.

For **servers**, the *Energy Star Program Requirements for Computer Servers* (see Appendix A [3]) are valid.

In the **Energy Star for computer servers**, minimum requirements are set for, amongst other things, the following areas:

- Energy efficiency of the power supply unit
- Energy management
- Energy efficiency in an active operating state
- Power consumption in an idle state
- Reporting

For **data storage products**, the *Program Requirements for Data Center Storage* (see Appendix A [4]) are valid.

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<sup>4</sup> U.S. Environmental Protection Agency: Energy Star®. Available online at: [https://www.energystar.gov/products/data\\_center\\_equipment](https://www.energystar.gov/products/data_center_equipment).

In the **Energy Star for data storage products**, minimum requirements are set for, amongst other things, the following areas:

- Energy efficiency of the power supply unit
- Power modelling tool
- Energy efficiency features
- Performance data measurement and output requirements
- Reporting

**Exemption:** This requirement does not apply to those servers and data storage products that fall outside of the scope of the relevant Energy Star.

**Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract.*

*If the product is certified with the Energy Star, the applicant shall state the ENERGY STAR Unique ID in Annex 1 to the contract and submit data sheets containing all of the required product information for the Energy Star ("Information Reporting Requirements") in Annex 2 to the contract.*

*If this is not the case, the applicant shall submit a test report from an independent testing laboratory, which is accredited for these types of measurements in accordance with DIN EN ISO/EC 17025, as Annex 2 to the contract. The test report must verify compliance with all of the Energy Star requirements. Test reports completed by the applicant are recognised as being of an equivalent standard when the testing laboratory used for the measurements is accredited by an independent body as an SMT laboratory (supervised manufacturer testing laboratory).<sup>1</sup> In addition, the applicant shall submit data sheets containing all of the required product information for the Energy Star ("Information Reporting Requirements").*

**3.1.3 Operating conditions**

It must be possible to operate the server or data storage product in operating condition class A2 or higher at the classification given in Table 6 "Operating condition classes" from Regulation (EU) 2019/424, see Appendix A **[1]**.

At least the following operating conditions must be allowable: Table 1:

Operating conditions for servers and data storage products

<b>Operating condition classes</b>	<b>A2</b>
Dry bulb temperature	
Allowable range	10 – 35 °C
Recommended range	18 – 27 °C
Humidity range, non-condensing	
Allowable range	– 12 °C Dew Point (DP) and 8% relative humidity (RH) to 21 °C DP and 80% RH
Recommended range	– 9 °C DP to 15 °C DP and 60% RH
Maximum dew point	21 °C
Maximum rate of temperature change	5 °C in 15 minutes and 20 °C in 1 hour

<sup>1</sup> This testing is suspended until further notice until independent testing laboratories are able to perform this testing.



### **Compliance verification**

The applicant shall declare compliance with the requirements in Annex 1 to the contract and state the allowable and recommended values for the operating conditions.

## **3.2 Energy efficiency**

### **3.2.1 Server in an active state**

The energy efficiency of the server in an active state ( $Eff_{ACTIVE}$ ) must be determined according to the *Server Efficiency Rating Tool (SERT)* method (see Appendix A [5]) in the current version valid at the time of application (currently SPEC SERT 2.0.2).

The energy efficiency of the server in an active state ( $Eff_{ACTIVE}$ ) must comply with the following requirements depending on the number of CPU sockets:

- 1-socket server:  $Eff_{ACTIVE} \geq 15$
- 2-socket server:  $Eff_{ACTIVE} \geq 25$
- 4-socket server or more:  $Eff_{ACTIVE} \geq 27$

If individual configurations of the server do not comply with this value, it is not permitted to label the server as a whole with the environmental label but rather only those configurations of the server that comply with these requirements. The labelling and information on compliance with this requirement can also be provided in electronic form (e.g. using an online product configurator).

### **Compliance verification**

The applicant shall declare compliance with the requirements in Annex 1 to the contract and state the number of CPU sockets as well as the energy efficiency in an active state ( $Eff_{ACTIVE}$ ). If the server is supplied in various different configurations, the applicant shall state the minimum value for the energy efficiency in an active state ( $Eff_{ACTIVE}$ ), the maximum value and the value for a typical configuration and provide information on the configuration characteristics in each case.

### **3.2.2 Power supply units**

For all internal and external power supply units for the server and data storage products that are designed to convert AC voltage from the mains power supply to DC voltage for supplying power to the devices, the PSU efficiency and power factor according to the definitions in the ecodesign regulation for servers and data storage products (Regulation (EU) 2019/424, see Appendix A [1]) must be measured. The PSU efficiency and power factor must reach at least the values stated in Table 2 below. This also applies to power supply units contained within casings that are designed to supply power to multiple servers and data storage products, such as power supply units in a blade or multi-node chassis.

Table 2: Minimum values for PSU efficiency and power factor

	Minimum value for PSU efficiency at 230 V AC voltage			Minimum value for the power factor
Load state as percentage of the rated load	20%	50%	100%	50 %

	Minimum value for PSU efficiency at 230 V AC voltage			Minimum value for the power factor
	92%	94%	90%	
Non-redundant power supply unit	92%	94%	90%	0.90
Redundant power supply unit	90%	94%	91%	0.95

### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract and state the values for the PSU efficiency and power factor for the different load states. If the server and data storage products are labelled with the Energy Star, it must be ensured that the measurements for the PSU efficiency and power factor are carried out on power supply units designed for use on the European market or the target market for the environmental label.*

*In addition, the applicant shall submit a test report from an independent testing laboratory, which is accredited for these types of measurements in accordance with DIN EN ISO/EC 17025, as Annex 4 to the contract. Test reports completed by the applicant are recognised as being of an equivalent standard when the testing laboratory used for the measurements is accredited by an independent body as an SMT laboratory (supervised manufacturer testing laboratory). The proof can also be provided by the submission of test protocols confirming that the power supplies may be marked with the 80 PLUS Platinum (230 V) mark. The test report must confirm the stated values for the PSU efficiency and power factor.*

### **3.2.3 Data storage products**

The energy efficiency of the data storage products must be determined in accordance with the SNIA Emerald™ Power Efficiency Measurement Specification (see Appendix A [6]) in the current version valid at the time of application (currently V3.0.3) and stated.

In the case of **block access systems**, the following values must be determined (original descriptions from the SNIA Emerald Measurement Specification):

- Ready Idle Test
  - ♦ Average power consumption (W);
  - ♦ Raw capacity of product under test (GB);
  - ♦ EP<sub>RI</sub> for Ready Idle (GB/W).
- Active Tests
  - ♦ Hot Band: EP<sub>HB</sub> (IO/s/W).
  - ♦ Random Read: EP<sub>RR</sub> (IO/s/W).
  - ♦ Random Write: EP<sub>RW</sub> (IO/s/W).
  - ♦ Sequential Read: EP<sub>SR</sub> (MiB/s/W).
  - ♦ Sequential Write: EP<sub>SW</sub> (MiB/s/W).

In the case of **file access systems**, the following values must be determined:

- Ready Idle Test
  - ♦ Average power consumption (W);
  - ♦ Raw capacity of product under test (GB);
  - ♦ EP<sub>RI</sub> for Ready Idle (GB/W).
- Active Tests

- ♦ Video Data Acquisition: EP<sub>VDA</sub> (MiB/s/W).
- ♦ Database: EP<sub>DB</sub> (MiB/s/W).
- ♦ Virtual Desktop Integration: EP<sub>VDI</sub> (MiB/s/W).
- ♦ Software Build: EP<sub>SWB</sub> (MiB/s/W).

The results of the measurements must be stated in the product documentation (see Paragraph 3.5). The “Information Reporting Requirements” for the Energy Star in accordance with the currently valid version of the *Program Requirements for Data Center Storage* (see Appendix A **[4]**) must also be fulfilled. This information must also be stated even if the product itself is not covered by the scope of the Energy Star.

### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract and submit the measured values in the product documentation in Annex 5 to the contract.*

### **3.3 Monitoring data interface**

The server and data storage products must provide the following data in real time:

- Power consumption [W];
- Inlet temperature of the cooling medium (e.g. air/water) [°C];
- Data transfer via the network interface [Mbit/s];
- In the case of servers: Load state for every logical CPU [%].

This data must be made available in a published or user-accessible format that is readable by third-party, non-proprietary management software via a standard network. The following data formats are, for example, acceptable: SNMP (simple network management protocol), IPMI (intelligent platform management interface) or XML (extensible markup language).

### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract, state the data format and provide a link (Internet link) to the documentation for the monitoring data interface in Annex 5 to the contract.*

### **3.4 Material requirements**

#### **3.4.1 Plastics used in the housing and housing parts**

The plastics used in the housing and housing parts may not contain any substances with the following properties as a constituent components<sup>5</sup>:

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<sup>5</sup> Constituent components are substances added to the product as such or as part of a mixture and remain there unchanged in order to achieve or influence certain product properties. This does not apply to residual monomers that have been reduced to a minimum.

- a) Substances which are identified as particularly alarming under the European Chemicals Regulation REACH (1907/2006/EC) (see Appendix A **[7]**) and which have been incorporated into the list drawn up in accordance with Article 59, Paragraph 1 of the REACH Regulation (so-called "list of candidates").<sup>6</sup>
- b) Substances that according to the CLP Regulation (see Appendix A **[8]**) have been classified in the following hazard categories or which meet the criteria for such classification:<sup>7</sup>
  - ♦ carcinogenic in categories Carc. 1A or Carc. 1B
  - ♦ germ cell mutagenic in categories Muta. 1A or Muta. 1B
  - ♦ reprotoxic (teratogenic) in categories Repr. 1A or Repr. 1B

Halogenated polymers are not permitted in the housing and housing parts. Neither may halogenated organic compounds be added as flame retardants. In addition, no flame retardants classified according to the CLP Regulation as carcinogenic in category Carc. 2 or as hazardous to water in category Aquatic Chronic 1 are permitted.

The hazard statements (H Phrases) that correspond to the hazard categories can be found in Appendix B Assignment of hazard categories and H Phrases.

The following shall be exempt from this rule:

- fluoroorganic additives (e.g. anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed a proportion of 0.5% by mass;
- plastic parts with a mass of less than or equal to 25 g.

### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the Contract and submit a written declaration from the plastics manufacturer or guarantee the provision of these documents to RAL gGmbH. The declaration shall confirm that the excluded substances have not been added to the plastics and provide a chemical description of the flame-retardant materials used including the CAS number and its rating (H Phrases) (Annex P-M to the Contract). When first applying for the Blue Angel environmental label, the submitted declaration must not be older than 6 months. If one applicant submits additional applications for the labelling of products that contain the same plastics, the submitted declarations may be presented unchanged during the term of the Basic Award Criteria. Notwithstanding this, RAL shall be entitled to ask for an updated version of the declarations if the Federal Environmental Agency (Umweltbundesamt) finds that product-relevant substances have been added to the list of candidates.*

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<sup>6</sup> The version of the list of candidates at the time of application is valid. The list of candidates in its relevant version can be found under the following link: <https://echa.europa.eu/candidate-list-table>.

<sup>7</sup> The harmonized classifications and labellings of dangerous substances can be found in Annex VI, Part 3 of the CLP Regulation. Furthermore, a comprehensive classification and labelling inventory, which also includes all of the self-classifications of hazardous substances made by manufacturers, has been made available to the public on the website of the European Chemicals Agency: [ECHA classification and labelling inventory](#).

## **3.5 Durability**

### **3.5.1 Availability of spare parts**

The applicant undertakes to make sure that the provision of spare parts for the repair of the devices is guaranteed for at least 5 years following the termination of production. The spare parts must be available at reasonable prices from the manufacturer themselves or from a third party.

Spare parts are functionally identical or compatible and functionally improved components or modules that may be exchanged during repair in the course of the service life of a server or data storage device to replace defect parts.

The product documentation must include information on the provision of spare parts.

#### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract.*

### **3.5.2 Resetting capability for reuse**

Servers and data storage products must have a function that allows the devices to be reset for reuse. This process must reliably delete all data on the devices and reset the system settings (e.g. BIOS) to the delivered state. This function can also be provided using an external software that is provided free of charge by the manufacturer from the time at which the product is launched on the market until at least 5 years after the termination of production.

#### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract.*

## **3.6 Product documentation**

The product must have product documentation that contains all of the information stipulated in the "Information to be provided by manufacturers" in the ecodesign regulation for servers and data storage products (Regulation (EU) 2019/424, see Appendix A [1]).

In the case of servers, the product information must also include the "Information Reporting Requirements" for the Energy Star according to the *Program Requirements for Computer Servers* (see Appendix A [3]), while for data storage products, the product information must also include the "Information Reporting Requirements" in the *Program Requirements for Data Center Storage* (see Appendix A [4]). This information must also be stated even if the product itself is not covered by the scope of the ecodesign regulation or the Energy Star.

#### **Compliance verification**

*The applicant shall declare compliance with the requirements in Annex 1 to the contract and submit the required product documentation in Annex 5 to the contract.*

## **4 Applicants and parties involved**

Manufacturers or distributors of products according to Paragraph 2 shall be eligible for application.

Parties involved in the award process are:

- RAL gGmbH to award the Blue Angel environmental label,

- the federal state being home to the applicant's production site,
- Umweltbundesamt, (Federal Environmental Agency) which after the signing of the contract receives all data and documents submitted in application for the Blue Angel in order to be able to further develop the Basic Award Criteria.

## **5 Use of the Environmental Label**

The use of the environmental label by the applicant is governed by a contract on the use of the environmental label concluded with RAL gGmbH.

Within the scope of such contract, the applicant undertakes to comply with the requirements under Paragraph 3 while using the environmental label.

Contracts on the Use of the Environmental Label are concluded to fix the terms for the certification of products under Paragraph 2. Such contracts shall run until 31/12/2025.

They shall be extended by periods of one year each, unless terminated in writing by 31/03/2025 or 31 March of the respective year of extension.

After the expiry of the contract, the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

The applicant shall be entitled to apply to RAL gGmbH for an extension of the right to use the ecolabel on the product entitled to the label if it is to be marketed under another brand/trade name and/or other marketing organizations.

The Contract on the Use of the Environmental Label shall specify:

- Applicant (manufacturer/distributor)
- Brand/trade name, product description
- Distributor (Label User), i.e. the marketing organization.

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## Appendix A Quoted laws and standards, literature

- [1]** Commission Regulation (EU) 2019/424 of 15 March 2019 laying down ecodesign requirements for servers and data storage products pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 617/2013. Available online at <https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32019R0424&from=EN>, last checked on 22/05/2019.
- [2]** Commission Regulation (EC) 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. Available online at <https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32013R0617&from=DE>, last checked on 22/05/2019.
- [3]** Energy Star for Computer Servers (2018): ENERGY STAR Program Requirements - Product Specification for Computer Servers - Eligibility Criteria Version 3.0. EPA. Available online at <https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%203.0%20Computer%20Servers%20Program%20Requirements.pdf>, last checked on 22/05/2019.
- [4]** Energy Star for Data Center Storage (2018): ENERGY STAR Program Requirements - Product Specification for Data Center Storage - Eligibility Criteria Version 1.1. EPA. Available online at [https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Storage%20Final%20Version%201.1%20Specification\\_0.pdf](https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Storage%20Final%20Version%201.1%20Specification_0.pdf), last checked on 22/05/2019.
- [5]** Standard Performance Evaluation Corporation (SPEC), Server Efficiency Rating Tool (SERT). Available online at <http://www.spec.org/sert2/>, last checked on 22/05/2019.
- [6]** Storage Networking Industry Association (SNIA), SNIA Emerald™ Power Efficiency Measurement Specification V3.0.3. Available online at [https://www.snia.org/tech\\_activities/standards/curr\\_standards/emerald](https://www.snia.org/tech_activities/standards/curr_standards/emerald), last checked on 22/05/2019.
- [7]** Regulation (EC) No. 1907/2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals; REACH Regulation
- [8]** Regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures, short: CLP (Classification, Labelling and Packing). It replaces the old directives 67/548/EEC (Dangerous Substances Directive) and 1999/45/EC (Dangerous Preparations Directive).
- [9]** Ordinance to limit the use of hazardous substances in electrical and electronic equipment (Material Ordinance for Electrical and Electronic Equipment); ElektroStoffV
- [10]** Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (new version); ROHS Directive
- [11]** Regulation (EC) No. 850/2004 on persistent organic pollutants; POP Regulation

## Appendix B Assignment of hazard categories and H Phrases

The following table assigns the hazard categories for the general exclusion of substances to the corresponding hazard statements (H Phrases).

Table 3: Hazard categories and H Phrases

<b>CLP Regulation (EC) No. 1272/2008</b>		
<b>Hazard category</b>	<b>Hazard statements</b>	
	<b>H Phrases</b>	<b>Wording</b>
<b>Carcinogenic substances</b>		
Carc. 1A Carc. 1B	H350	May cause cancer.
Carc. 1A Carc. 1B	H350i	May cause cancer if inhaled.
Carc. 2	H351	Suspected of causing cancer.
<b>Germ cell mutagenic substances</b>		
Muta. 1A Muta. 1B	H340	May cause genetic defects.
<b>Reprotoxic substances</b>		
Repr. 1A Repr. 1B	H360D	May damage the unborn child.
Repr. 1A Repr. 1B	H360F	May damage fertility.
Repr. 1A Repr. 1B	H360FD	May damage fertility. May damage the unborn child.
Repr. 1A Repr. 1B	H360Df	May damage the unborn child. Suspected of damaging fertility.
Repr. 1A Repr. 1B	H360Fd	May damage fertility. Suspected of damaging the unborn child.
<b>Environmental hazards</b>		
Aquatic Chronic 1	H410	Very toxic to aquatic life with long-lasting effects.