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International Telecommunication Union
Standardization Sector

Recommendation

ITU-T L.1027 (08/2023)

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E-waste and circular economy

Assessment of material efficiency of ICT network infrastructure goods (circular economy) – Server and data storage product disassembly and disassembly instruction

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Recommendation ITU-T L.1027

Assessment of material efficiency of ICT network infrastructure goods (circular economy) – Server and data storage product disassembly and disassembly instruction

Summary

Recommendation ITU-T L.1027 contains methods to assess the ability to disassemble certain key components of servers and data storage products, and the provision of information on these disassembly operations. It places a special emphasis on aspects relevant to the circular economy, such as fostering durability and reparability, in particular by third parties.

History*

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T L.1027	2023-08-13	5	11.1002/1000/15597

Keywords

Circular economy, data storage product, disassembly, environment, E-waste management, KPI, server, waste management.

* To access the Recommendation, type the URL https://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID.

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Introduction

This Recommendation contains methods to assess the ability to disassemble certain key components of servers and data storage products, and the provision of information on these disassembly operations. This Recommendation places a special emphasis on aspects relevant to the circular economy, such as fostering durability and reparability, in particular by third parties (such as spare parts repairers and maintenance).

The present document was developed jointly by ETSI TC EE and ITU-T Study Group 5. It is published respectively by ITU and ETSI as Recommendation ITU-T L.1027 and [b-ETSI EN 303 800-5], which are technically equivalent.

Recommendation ITU-T L.1027

Assessment of material efficiency of ICT network infrastructure goods (circular economy) – Server and data storage product disassembly and disassembly instruction

1 Scope

This Recommendation specifies methods to measure the ability of the following products to be disassembled:

1) Servers;

2) Data storage equipment.

The Recommendation covers demonstration of compliance with the following requirements of EU Regulation 2019/424:

i) The ability to disassemble, with particular regard to assessing that joining, fastening or sealing techniques do not prevent disassembly for repair or reuse purposes.

ii) The provision of instructions on disassembly operations, including the type of operation, the type and number of fastening technique(s) to be unlocked and the tool(s) required.

The following products are out of scope of this Recommendation:

- Servers that are used in means of transport for persons or goods;
- Servers intended for embedded applications;
- Servers classified as small scale servers in terms of [b-EC 617/2013];
- Servers with more than four processor sockets;
- Server appliances;
- Large servers;
- Fully fault tolerant servers;
- Network servers;
- Small data storage products;
- Large data storage products.

The decision whether a product should be repaired, reused or upgraded is out of scope. This is dependent on a range of factors including various environmental aspects and other relevant considerations, such as safety and health, technical requirements for functionality, quality and the performance of the server or storage product.

NOTE – See Directive [b-2009/125/EC].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 battery [b-EU 2023/1542]: Any source of electrical energy generated by direct conversion of chemical energy and consisting of one or more non-rechargeable or rechargeable battery cells or of groups of them.

3.1.2 blade chassis [b-EU 2019/424]: Enclosure that contains shared resources for the operation of blade servers, blade storage, and other blade form-factor devices.

3.1.3 data storage product [b-EU 2019/424]: Fully-functional storage system that supplies data storage services to clients and devices attached directly or through a network.

NOTE – Parts 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, parts 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.

3.1.4 data storage device [b-EU 2019/424]: Device providing non-volatile data storage, with the exception of aggregating storage elements such as subsystems of redundant arrays of independent disks, robotic tape libraries, filers, and file servers and storage devices which are not directly accessible by end-user application programs, and are instead employed as a form of internal cache.

3.1.5 disassembly [b-EU 2019/424] [b-EN 45550]: Process whereby an item is taken apart in such a way that it can subsequently be reassembled and made operational.

3.1.6 expansion card [b-EU 2019/424]: Internal component connected by an edge connection over a common/standard interface such as Peripheral Component Interconnect Express providing additional functionality.

3.1.7 graphics card [b-EU 2019/424]: Expansion card containing one or more graphics processing units with a local memory controller interface and local graphics-specific memory.

3.1.8 manufacturer [b-EC 2016/C 272/01]: Any natural or legal person who manufactures a product or has a product designed or manufactured, and places it on the market under his own name or trademark.

3.1.9 memory [b-EU 2021/341]: Part of a server or a data storage product external to the processor in which information is stored for immediate use by the processor, expressed in gigabyte (GB).

3.1.10 motherboard [b-EU 2021/341]: Main circuit board of a server or a data storage product. The motherboard includes connectors for attaching additional boards and typically includes the following components: processor, memory, BIOS, and expansion slots.

3.1.11 part [b-EN 45447]: Hardware, firmware or software constituent of a product.

NOTE – Firmware and software are not relevant for the purpose of this Recommendation.

3.1.12 power supply unit (PSU) [b-EU 2019/424]: 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.

3.1.13 processor [b-EU 2021/341]: Logic circuitry that responds to and processes the basic instructions that drive a server or a data storage product.

NOTE 1 – 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.

NOTE 2 – For some soldered processors to function properly after reassembly, the tools used and skills of the disassembly personnel need to be of the highest class level.

3.1.14 server [b-EU 2019/424]: Computing product that provides services and manages networked resources for client devices, such as desktop computers, notebook computers, desktop thin clients, internet protocol telephones, smartphones, tablets, tele-communication, automated systems or other servers, primarily accessed via network connections, and not through direct user input devices, such as a keyboard or a mouse and with the following characteristics:

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

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

c) all processors have access to shared system memory and are independently visible to a single OS or hypervisor.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 next-level subassembly: Subassembly comprising up to three of the key parts b) to d) listed in clause 6.1.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AC	Alternate Current
ATEX	Atmosphere Explosible
BIOS	Basic Input Output Systems
CPU	Central Processing Unit
DC	Direct Current
OS	Operating System
PSU	Power Supply Unit
SoC	Systems on Chip

5 Conventions

None.

6 Assessment of ability to disassemble

6.1 Scope of the assessment

The core intent of this Recommendation is to demonstrate the ability to disassemble based on criteria it lays down. The disassembly is limited to the following key parts which shall be included in the assessment, when present:

a) data storage devices;

b) memory;

c) processor (CPU);

d) motherboard;

e) expansion card/graphic card;

f) power supply unit (PSU);

g) chassis;

h) batteries.

It shall be ensured and demonstrated that the server and data storage product can be disassembled to access the above parts irrespective of the joining, sealing and fastening techniques used, for purposes of repair or reuse.

NOTE 1 – See [b-EU 2019/424].

At the product design stage, the ability to disassemble the server and data storage product will take into account the reasonable balance between the various environmental aspects and other relevant considerations, such as safety and health, technical requirements for the functionality, quality and performance of the server or data storage product.

NOTE 2 – See [b-2009/125/EC].

The availability of guideline instructions for disassembly to access the above parts for repair or reuse purposes shall be ensured. (See Table 1 Class B and clause 6.2.)

Furthermore, information availability is subject to registration if requested by the manufacturer, their authorized representatives or importers.

NOTE 3 – See [b-2009/125/EC].

Table 1 classifies to whom the information shall be made available.

Table 1 – Classification of information availability for servers and data storage products by target groups

Category	Class
Publicly available: A disassembly process, for which the relevant information is available to all interested parties.	A
Available to independent repair service providers/operators: A disassembly process, for which the relevant information is not publicly available as described above (Class A), but is available to any self-employed professional, as well as any legally established organization, providing repair services. NOTE – This includes third parties dealing with the maintenance, repair, reuse, recycling and upgrading of servers (including brokers, spare parts repairers, spare parts manufacturers, their authorized representatives and importers, recyclers and third party maintenance) upon registration by the interested third party on a website (see clause 6.2.1).	B

NOTE – See [b-EN 45554], Table A.11.

6.2 Provision of instructions on disassembly operations

6.2.1 Instruction content and availability

The availability of guideline instructions for disassembly to access the parts listed in clause 6.1 for repair or reuse purposes of the products in scope shall be ensured on a free access website of the manufacturer, importer or authorized representative. The instructions shall be made available 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.

The instructions may include:

- a disassembly map or exploded view;

- information on how to access professional repair (internet webpages, addresses, contact details).

NOTE 1 – Installation manuals could serve as purpose for disassembly/assembly instructions.

For each necessary operation and part the instructions shall contain:

- the type of disassembly operation,
- the type and number of fastening technique(s) to be unlocked,
- the exact tools needed to unlock any fastening technique as deployed.

NOTE 2 – Visual representation of the procedure to be followed should be added to the instruction to clarify the operation.

These instructions shall be provided upon request to third parties dealing with maintenance, repair, reuse, recycling and upgrading of servers (including brokers, spare parts repairers, spare parts manufacturers, their authorized representatives and importers, recyclers and third party maintenance) upon registration by the interested third party on a website provided.

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

6.3 Ensuring joining, fastening and sealing techniques do not prevent disassembly for repair or reuse purposes

As shown in Table 2, joining, fastening and sealing techniques can be categorized into four groups.

Table 2 – Classification of joining, fastening and sealing techniques for servers and data storage products

Category	Class
Reusable technique/system: An original joining, fastening or sealing technique/system that can be completely reused.	A
Semi-reusable technique/system: An original joining, fastening or sealing technique/system where elements of the fastening system that need to be replaced are supplied with the new part (specified in clause 6.1) for the repair.	B
Removable technique: An original joining, fastening or sealing technique/system that cannot be reused, but can be removed without causing damage or leaving residue which precludes reassembly of the product for the repair or reuse operation or reuse of the removed part.	C
Neither removable nor reusable technique: An original joining, fastening or sealing technique/system which is neither removable nor reusable without causing damage to the removed part or the remaining product that precludes reassembly or reuse of the parts.	D

NOTE – Categories have been expanded from [b-EN 45554], Table A.1. See also Commission Regulation (EU) 2019/424 [b-EU 2019/424].

Joining, fastening or sealing techniques involved in the disassembly/assembly of the parts in scope of this assessment (clause 6.1) shall be either reusable, semi-reusable or removable in order not to prevent the disassembly for repair or reuse purposes of the parts.

As shown in Table 3, the tools necessary for disassembly can be categorized into four groups.

Table 3 – Classification of tools for servers and data storage products

Category	Class
Feasible with basic tools: A disassembly process which can be carried out without the use of any tools, or with a tool or set of tools that is supplied with the product or spare part, or with basic tools as listed in [b-EN 45554], Table A.3.	A
Feasible with other commercially available tools: A disassembly process which cannot be carried out with basic tools as defined above (Class A), but can be carried out without the use of any proprietary tools.	B
Feasible with proprietary tools: A disassembly process which can be carried out only with one or more proprietary tools. These are tools that are not available for purchase by the general public or for which any applicable patents are not available to license under fair, reasonable and non-discriminatory terms.	C
Not feasible with any existing tool: A disassembly process which cannot be carried out with any existing tool.	D

Appendix I

Identified considerations for servers and storage products

(This appendix does not form an integral part of this Recommendation.)

There are some special considerations which were identified by participants when developing the present Recommendation. These considerations and reflections may be useful for review and preparation of the next standard.

I.1 Scope

The following servers or data storage products being addressed by other Directives and which have special demands on the reliability of the disassembled products need special consideration when applying this present document:

Those which:

- are subject to Directive 2014/34/EU, Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) [b-EU 2014/34/EU];
- are subject to Council Directive [93/42/EEC] Medical Devices [b-EU 93/42/EEC];
- are subject to Directive 90/385/EEC, Active Implantable Medical Devices [b-EU 90/385/EEC];
- are subject to Directive 98/79/EC, In Vitro Diagnostic Medical Devices [b-EU 98/79/EC];
- are subject to Directive 2014/32/EU, Measuring Instruments [b-EU 2014/32/EU].

NOTE – See Commission Regulation (EU) No 617/2013 [b-EC 617/2013].

I.2 Futureproofness and next-level subassembly

Generally, 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.

The technological development regarding the manner in which the parts in clause 6.1 are assembled is far from static.

Where a part cannot be repaired or reused without:

a) significant negative impact on the functionality of the product, from the perspective of the user or;

b) adverse effects to health, safety and the environment or;

c) adversely affecting health, safety or the environment or;

d) significant negative impact on consumers in particular as regards the affordability and the life cycle cost of the product;

the manufacturer may either

a) provide for repair and reuse in an alternative manner than described in this Recommendation.

For example:

Microsystems packaging concepts such as systems-on-chip (SoC) integrate e.g., the memory and the processor in one integrated circuit. SoC disassembly is not practical. Therefore, categorical requirements of disassembly of memories and processers using SoC technology is very challenging.

Seen in the light of this trend, if the part cannot be repaired and reused without the adverse effects listed above, disassembly should allow the repair and reuse of the next-level subassembly the part is affixed to, or in which it is integrated.

The disassembly operations should demonstrate that each key part – or next-level subassembly – can be removed and replaced such that the product can be restored to a normal operating state, including meeting product safety and product quality requirements or where a) is not practical or possible, not provide for the repair. Moreover, remanufacturing and repair of PCBAs may be difficult in practice. Surface mounted resistors, capacitors, etc. may be damaged by the heat required to unsolder processors. The entire motherboard has to be heated to be able to remove the targeted processors.

I.3 Traceability

Traceability of repairers is important for manufacturers.

The product traceability may be ensured including the identity of the repairer as appropriate. The information may be made available from the time a product model is placed on the market until at least eight years after the placing on the market of the last product of a certain product model, free of charge by manufacturers, their authorized representatives and importers.

After repair or refurbish a product may

a) be a new product, in which case a natural or legal person different from the original manufacturer becomes the manufacturer with the corresponding obligations;

b) not be a new product, in which case the original manufacturer remains the manufacturer. The manufacturer should be permitted means to able to confirm the repair process and materials are sufficient to ensure the product continues to meet compliance requirements.

For these reasons, traceability of repairers is important for manufacturers.

I.4 Registration of repairers

In the case of Class B (Table 1) information availability by target group, manufacturers – or their authorized representatives and importers – may request the third party to qualify that it is dealing with maintenance, repair, reuse, recycling and upgrading of servers.

The manufacturer's, importer's or authorized representative's website may indicate the process for professional repairers to register for access to information.

To accept such a request, the manufacturers, importers or authorized representatives may require the professional repairer to demonstrate that:

i) The professional repairer has the technical competence to repair servers and data storage products and complies with the applicable regulations for repairers of electrical equipment in the Member States where it operates. Reference to an official registration system as professional repairer, where such system exists in the Member States concerned, should be accepted as proof of compliance with this point;

ii) The professional repairer is covered by insurance covering liabilities resulting from its activity regardless of whether this is required by the Member State.

The registration to access the website may contain confidentiality clauses.

Manufacturers – or their authorized representatives and importers – are able to reject an application based e.g., on the following conditions:

- If the third party is on the counterfeit watchlist, or if the third party is located in a country under embargo or if the third party has been convicted of counterfeiting in the past.
- If the third party is a direct competitor.

The third party rejected need to be informed of the reasons for rejection.

Moreover, manufacturers should not be required to divulge trade secrets.

I.5 Exemptions

During the development of the next Recommendation, the following exemptions may be discussed.

1 Joining, fastening and sealing techniques intended to provide for compliance to Directive 2014/35/EU (Low Voltage Directive) [b-EU 2014/35/EU] or Directive 2001/95/EC (General Product Safety Directive) [b-EU 2001/95/EC].

2 Cases in which there would be:

a) Significant negative impact on the functionality of the product, from the perspective of the user;

b) Adverse effect on health, safety and the environment;

c) Significant negative impact on consumers, in particular as regards the affordability and the life cycle cost of the product;

d) Significant negative impact on the industry's competitiveness;

e) The consequence of imposing proprietary technology on manufacturers; and [b-2009/125/EC] (Article 15 Paragraph 5).

The manufacturer – or their authorized representatives and importers – should provide evidence to support exemptions 1 and 2.

Bibliography

[b-2009/125/EC] 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 (recast).

[b-EC 2016/C 272/01] European Commission Notice 2016/C 272/01 (2016), *The 'Blue Guide' on the implementation of EU products rules*, p. 28.
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016XC0726(02)&from=BG

[b-EC 617/2013] 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.

[b-EN 45550] CENELEC EN 45550:2020, *Definitions related to material efficiency*.

[b-EN 45554] CENELEC EN 45554:2020, *General method for the assessment of the ability to repair, reuse and upgrade energy-related products*.

[b-ETSI EN 303 800-5] ETSI EN 303 800-5, *Assessment of material efficiency of ICT network infrastructure goods (circular economy) part 5 – server and data storage product disassembly and disassembly instruction*.

[b-EU 2001/95/EC] Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety.

[b-EU 2014/32/EU] Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (recast) Text with EEA relevance.

[b-EU 2014/34/EU] Directive 2014/34/EU, *Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)*.

[b-EU 2014/35/EU] Directive 2014/35/EU Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.

[b-EU 2019/424] 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.

[b-EU 2021/341] Commission Regulation (EU) 2021/341 of 23 February 2021 amending Regulations (EU) 2019/424, (EU) 2019/1781, (EU) 2019/2019, (EU) 2019/2020, (EU) 2019/2021, (EU) 2019/2022, (EU) 2019/2023 and (EU) 2019/2024 with regard to ecodesign requirements for servers and data storage products, electric motors and variable speed drives, refrigerating appliances, light sources and separate control gears, electronic displays, household dishwashers, household washing machines and household washer-dryers and refrigerating appliances with a direct sales function (Text with EEA relevance) C/2021/923.

[b-EU 2023/1542] Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC.

[b-EU 90/385/EEC] Directive 90/385/EEC of 20 June 1990 on the approximation of the laws of the Member States relating to active implantable medical devices.

[b-EU 98/79/EC] Directive 98/79/EC of the European Parliament and of the Council of 27 October 1998 on in vitro diagnostic medical devices.

[b-EU 93/42/EEC] Council Directive 93/42/EEC of 14 June 1993 concerning medical devices.

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Published in Switzerland
Geneva, 2023