



UL 3602

STANDARD FOR

Measuring and Reporting Circularity
and End-of-Life Management for
Electrification Products – General
Sustainability Requirements and
Practices

Standard for Measuring and Reporting Circularity and End-of-Life Management for Electrification Products
– General Sustainability Requirements and Practices, UL 3602

First Edition, Dated April 18, 2025

Summary of Topics

This is the First Edition of UL 3602, Standard for Measuring and Reporting Circularity and End-of-Life Management for Electrification Products – General Sustainability Requirements and Practices, dated April 18, 2025.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of ULSE Inc. (ULSE).

ULSE provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will ULSE be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if ULSE or an authorized ULSE representative has been advised of the possibility of such damage. In no event shall ULSE's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold ULSE harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

No Text on This Page

APRIL 18, 2025

1

UL 3602

**Standard for Measuring and Reporting Circularity and End-of-Life
Management for Electrification Products – General Sustainability
Requirements and Practices**

First Edition

April 18, 2025

This UL Standard for Safety consists of the First Edition.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

Our Standards for Safety are copyrighted by ULSE Inc. Neither a printed nor electronic copy of a Standard should be altered in any way. All of our Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of ULSE Inc.

© 2025 ULSE Inc. All rights reserved.

No Text on This Page

CONTENTS

INTRODUCTION

1	General	5
2	Scope	5
3	Referenced Publications	5
4	Glossary	8

COMPLIANCE, EVALUATION, AND ASSESSMENT CRITERIA

5	Evaluation and Assessment Criteria	13
5.1	General	13
5.2	Levels of achievement	13
6	Evaluating Circularity Potential	14
6.1	Required – Circularity evaluation	14
6.2	Required – Life-cycle assessment (LCA)	14
7	Materials	15
7.1	Optional – Integration of recycled content	15
7.2	Required – Declaration of recycled content	16
7.3	Optional – Substances of concern	16
7.4	Optional – Substitution assessment	18
7.5	Optional – Material management and traceability	19
8	Supply Chain Management of Materials	19
8.1	Required – Sourcing of critical raw materials and conflict minerals	19
8.2	Optional – Supplier risk assessment	20
8.3	Required – Human rights and social impacts	21
8.4	Optional – Community engagement and social responsibility	21
9	Manufacturing and Operations	22
9.1	Required – Criteria for environmental management systems	22
9.2	Optional – Production quality	22
9.3	Optional – Operational waste reduction and diversion	22
10	Packaging	22
10.1	Material selection	22
11	Extension of Useful Life	25
11.1	Required – Product repair	25
11.2	Required – Specialized tools	25
11.3	Required – Instructions for repair and disassembly	26
11.4	Optional – Product durability	26
11.5	Optional – Product upgradeability	26
11.6	Required – Remanufacturing	27
12	End-of-Life Management	27
12.1	Required – Product recyclability	27
12.2	Required – Take-back programs	29
12.3	Required – Third-party evaluation – primary recyclers	30
12.4	Optional – Closed-loop systems	30
12.5	Required – Disposal	31
13	Digital Product Passports	31
13.1	Optional – Digital Product Passport	31

ANNEX A (Informative) ACHIEVEMENT MATRIX

No Text on This Page

INTRODUCTION

1 General

1.1 While existing Standards address various aspects of circularity for electrification products – through circularity strategies, design requirements, or specific product categories – this Standard establishes a general framework of requirements and best practices that current and future standards can use as a foundation for product-specific requirements.

2 Scope

2.1 This Standard provides a framework for evaluating and reporting the circularity and end-of-life management practices for electrification products.

2.2 This Standard applies to organizations responsible for the design, manufacture, and end-of-life management of electrification products, including but not limited to manufacturers, recyclers, and waste management facilities.

2.3 This Standard covers the circularity evaluation, material selection, supply chain management, manufacturing and operations, packaging, extension of useful life, end-of-life management, and digital product passports of electrification products.

2.4 The scope includes electrification products such as:

- a) Energy generation equipment (e.g., photovoltaic modules, wind turbines);
- b) Energy storage systems and components;
- c) Electric vehicle charging infrastructure; and
- d) Micromobility devices and related charging equipment.

2.5 While this Standard identifies key elements and considerations for circularity and end-of-life management, it does not stipulate specific methods or techniques. The Standard covers products ranging from individual components to complete systems, intended for both industrial and consumer applications.

2.6 This Standard does not cover topics not associated with circularity, including, but not limited to product safety.

3 Referenced Publications

3.1 Any undated reference to a code or standard appearing in the requirements of this Standard shall be interpreted as referring to the latest edition of that code or standard.

3.1 The following publications are referenced in this Standard:

29 CFR 1910.1200, *Occupational Safety and Health Standards – Hazard Communication*

48, 49 and 50, EU Regulation 2023/1542

49 CFR 100 – 185, *Pipeline and Hazardous Materials Safety Administration, Department of Transportation*

RIC001.2, *Specifications for the Process of Remanufacturing*

APR Design® Guide for Plastics Recyclability

ASTM D6400, *Standard Specification for Labeling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities*

ASTM D6868, *Standard Specification for Labeling of End Items that Incorporate Plastics and Polymers as Coatings or Additives with Paper and Other Substrates Designed to be Aerobically Composted in Municipal or Industrial Facilities*

ASTM D7611/D7611M, *Standard Practice for Coding Plastic Manufactured Articles for Resin Identification*

ASTM D8410, *Standard Specification for Evaluation of Cellulosic-Fiber-Based Packaging Materials and Products for Compostability in Municipal or Industrial Aerobic Composting Facilities*

ASTM D996, *Standard for Packaging Definitions California Health and Safety Code Safe Drinking Water and Toxic Enforcement Act of 1986, Sections 25249.5 – 25249.14*

DIRECTIVE 2011/65/EU, *Restriction of the use of certain hazardous substances in electrical and electronic equipment*

Directive 2012/19/EU, *Waste electrical and electronic equipment (WEEE)*

Directive (EU) 2024/1760, *Corporate Sustainability Due Diligence*

DOE-HDBK-1100, *Department of Energy (DOE) Handbook on Chemical Process Hazards Analysis*

Electronic Industry Citizenship Coalition® (EICC®) Code of Conduct

EN 45552, *General method for the assessment of the durability of energy-related products*

EN 45554, *General methods for the assessment of the ability to repair, reuse and upgrade energy-related products*

EN 50625-1, *Collection, logistics & Treatment requirements for WEEE -- Part 1: General treatment requirements*

e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment GreenCircle waste diversion from landfill certification

IEC 62474, *Material Declaration for Products of and for the Electrotechnical Industry*

IEC 63000, *Amendment 1 – Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*

ILO Multinational Enterprises and Social Policy (MNE) Declaration

IRMA, Standard for Responsible Mining IRMA-STD-001

ISO 9000, *Quality Management Systems*

ISO 9001, *Quality management systems – Requirements*

ISO 11469/1043, *Plastics – Generic identification and marking of plastics products*

ISO 14001, *Environmental Management Systems*

ISO 14004, *Environmental Management Systems*

ISO 14040, *Environmental Management – Life cycle assessment principles and frameworks*

ISO 14044, *Environmental Management – Life cycle assessment*

ISO 16103, *Packaging – Transport packaging for dangerous goods – Recycled plastics material*

ISO/IEC 17020, *Conformity assessment – Requirements for the operation of various types of bodies performing inspection*

ISO 17088, *Plastics – Organic recycling*

ISO/IEC 18004, *Information technology – Automatic identification and data capture technology – QR code barcode symbology specification*

ISO 18602, *Packaging and the environment – Optimization of the packaging system*

ISO 18603, *Packaging and the environment – Reuse*

ISO 18606, *Packaging and the environment – Organic recycling*

ISO 28219, *Packaging – Labelling and direct product marking with linear bar code and two-dimensional symbols*

ISO 31000, *Risk Management*

NSF 457, *Sustainability Leadership Standard for Photovoltaic Modules and Photovoltaic Inverters*

NSF Landfill Free certification

OECD *Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas*

Recycling Industry Operating Standard (RIOS)[™]

Regulation (EC) No 1907/2006, *Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)*

Regulation (EU) 2024/1252, *Establishing a Framework for Ensuring a Secure and Sustainable Supply of Critical Raw Materials*

Regulation (EU) 2024/1781, *Establishing a Framework for the Setting of Ecodesign Requirements for Sustainable Products*

Responsible Recycling (“R2”) *Standard for Electronics Recyclers*

SAI SA8000, *Social Accountability*

SEDEX Members Ethical Trading Audit

True Rating System certification

United Nations Guiding Principles on Business and Human Rights

U.S. Dodd-Frank Wall Street Reform and Consumer Protection Act

U.S. EPA 15 USC Section 2601, *Findings, policy, and intent*

U.S. EPA 15 USC Section 2603, *Testing of chemical substances and mixtures*

U.S. EPA 15 USC Section 2604, *Manufacturing and processing notices*

U.S. EPA 15 USC Section 2605, *Prioritization, risk evaluation, and regulation of chemical substances and mixtures*

U.S. EPA 15 USC Section 2611, *Exports*

U.S. EPA 15 U.S.C. Section 2612, *Entry into customs territory of the United States*

U.S. Environmental Protection Agency (EPA) Design for the Environment Program Alternatives Assessment Criteria for Hazard Evaluation

UL 969, *Marking and Labeling Systems*

UL 1497, *Biodegradability and Compostability Validation*

UL 3600, *Measuring and Reporting Circular Economy Aspects of Products, Sites and Organizations*

UL 5500, *Remote Software Updated*

4 Glossary

4.1 For the purpose of this Standard the following definitions apply.

4.2 AUTHORIZED REPAIR SERVICE PROVIDERS – A service provider is an entity or facility that has been provided permission directly by the manufacturer to provide repair services. Manufacturer authorized service centers are entities or facilities approved by the manufacturer to perform service on the product, including partnerships with local 3PLs (third-party logistic providers).

4.3 BY-PRODUCT – A secondary product made during the manufacture of another product. A production residue may be considered a by-product if it possesses characteristics that make it ready for further use in the economy; its further use must be a certainty without any further processing, and as part of a continuing process of production.

4.4 CHEMICAL HAZARD ANALYSIS – Process of identifying hazards and analyzing their causes, and the derivation of requirements to limit the likelihood and consequences of hazards to a tolerable level.

4.5 CHIPBOARD – A type of paperboard, generally made from recycled paper, that is used in packaging and other applications where strength and durability are not critical.