Sustainable plastics for electrical & electronics applications

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Safety. Science. Transformation.™

Topics

We deliver

Our solutions span the ESG spectrum to increase safety, security and sustainability

PEOPLE. PLANET. TRUST.

Certification

Verification

Testing

Auditing and inspection

Software

Data insights

Advisory

Learning and development

About UL Solutions

Our mission-driven employees are based in **40+** countries

We work with **68% of Fortune 500**** and **63% of Global 500**** and more than **80,000**** different companies

Our diverse customers are based in **100+** countries

We sit on **1,300+** standards panels and other technical committees

Our sustainability certifications are referenced in **1,000+ sustainable product specifications** or purchasing guidelines around the globe

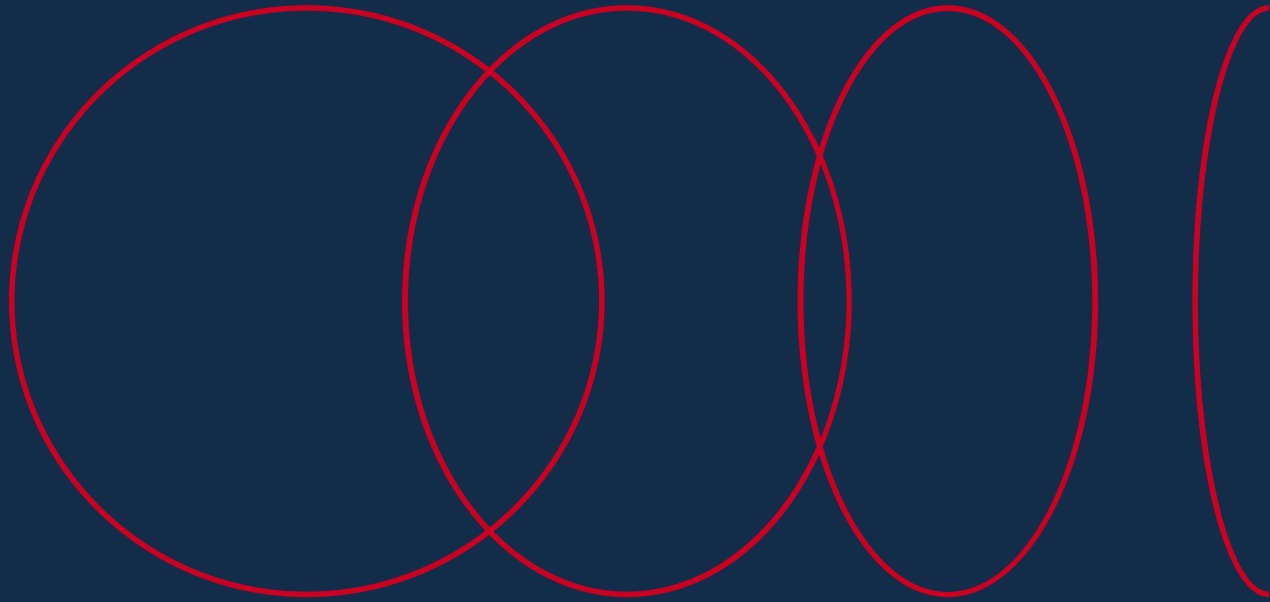
UL Marks appear on **billions** of products globally

UL Solutions ranks **No. 1** globally on brand strength out of the top 11 global TIC and EHS brands per 2,124 decision-makers across 13 countries*

Our software is used by **21,000+** organizations across nearly every industry

*Source: Presciant brand study 2022.
**Data is as of December 2021.

Using recycled plastics in safety-critical applications



UL Solutions safety science and hazard-based safety engineering

Working for a safer world

Electric kettle

(portable unattended device – household)

UL 1082
Standard for Safety

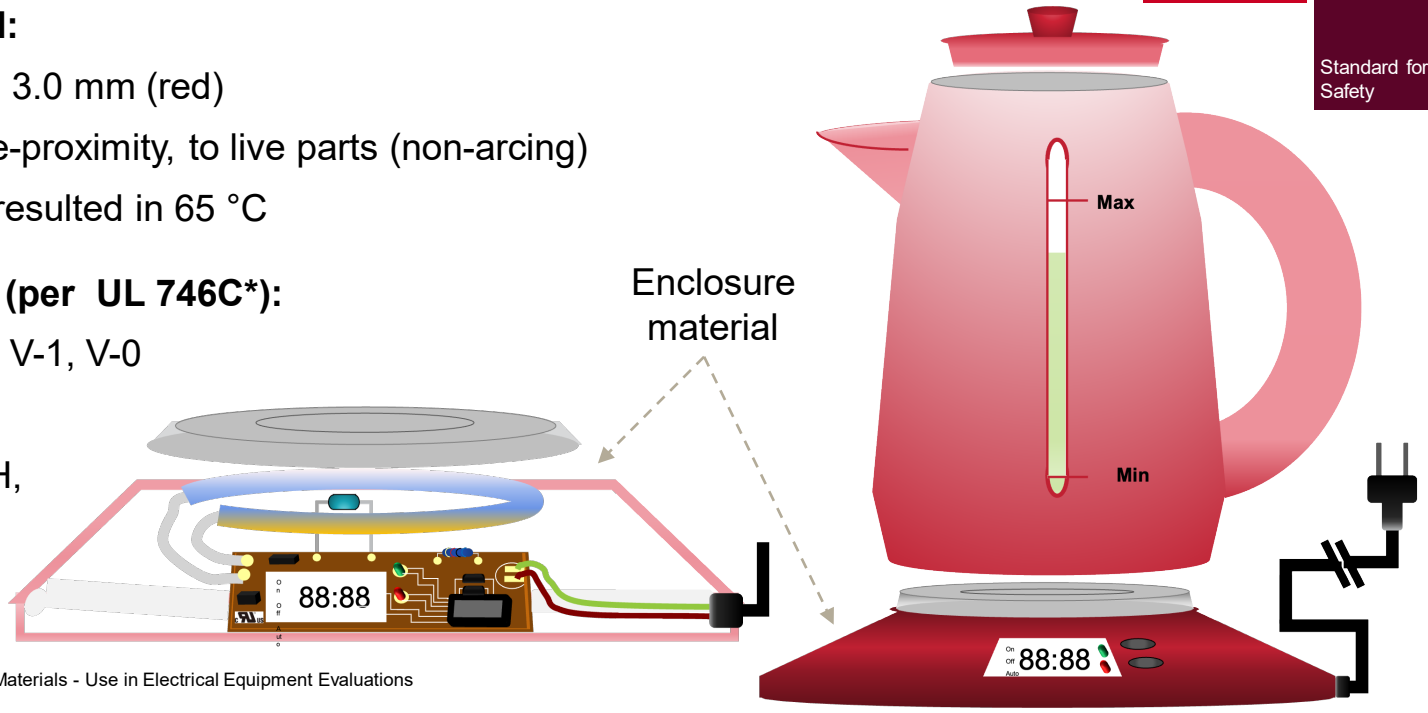
UL 746C
Standard for Safety

Enclosure material:

- Material thickness 3.0 mm (red)
- Material is in close-proximity, to live parts (non-arcing)
- Temperature test resulted in 65 °C

Min. requirements (per UL 746C*):

- Flammability: V-2, V-1, V-0
- HWI: PLC 2, 3, 4
- RTI (ELEC, MECH, MECH with IMPACT): 65 °C



*UL 746C, the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations

What are the safety concerns associated with recycled plastics?

The same as for virgin plastics: The material must perform consistently in the end component or product application.

The challenge:

The feed stream of recycled plastics may come from different sources; therefore, the formulation of the material isn't always identical and can prove more difficult to control.

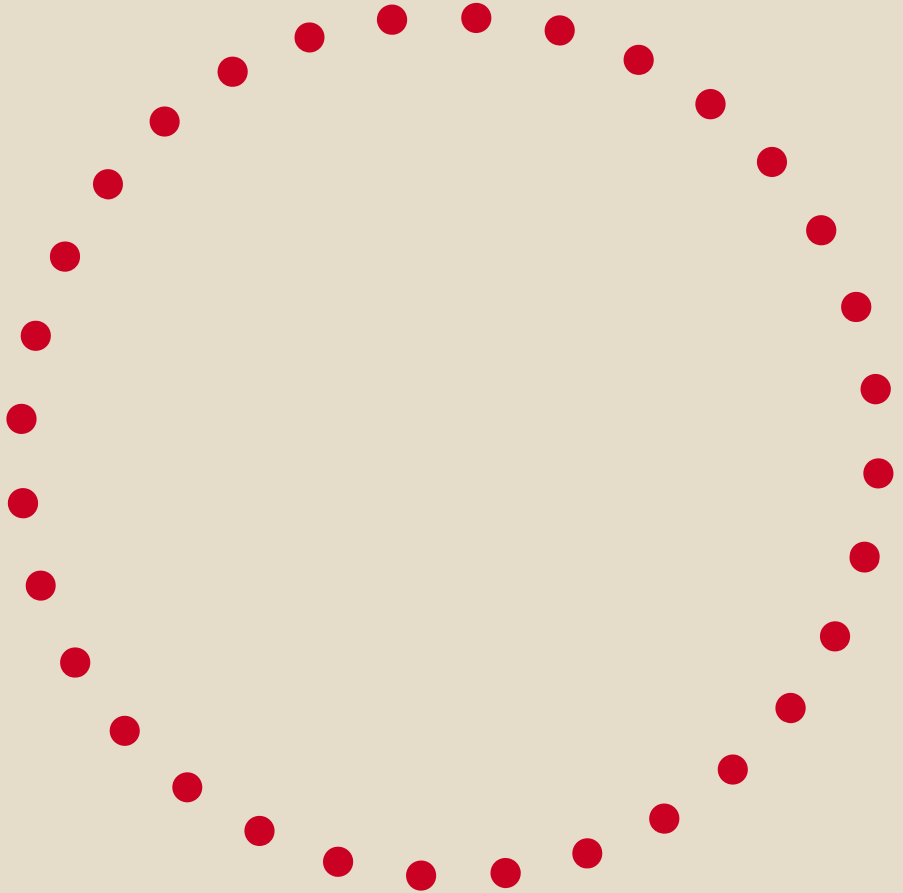
The goal of the recycled plastics program is to ensure consistent performance of the material despite the number of sources, recycled content or any other factors that may cause variation in the formulation of the material.

UL 746D

- The Standard for Polymeric Materials – Fabricated Parts
- Includes operations and requirements at fabricators' (molders) sites, such as:
  - Material traceability
  - Color concentrates
  - Blending
  - Regrind
  - Recycled
- Safety evaluation, preselection, requirements for use in end applications/components

How UL Solutions has addressed concerns:

Evaluating recycled plastics



Safety evaluation – plastics Standards

Virgin:

- UL 94, the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances – HB, V-0, V-1, V-2, 5V, etc.
- UL 746A, the Standard for Polymeric Materials – Short Term Property Evaluations –
  - Performance: HWI, HAI, CTI, GW, DS, etc.
  - Analytical tests: IR, TGA, DSC, etc.
- UL 746B, the Standard for Polymeric Materials – Long Term Property Evaluations – long-term thermal aging: RTI
- UL 746C, the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations – outdoor investigation (f1, f2)

Safety evaluation – plastics Standards

Chemically recycled plastics:

- UL 746A, the Standard for Polymeric Materials – Short Term Property Evaluations
- Table 9.1 and/or section 9.10 defines the program

Mechanically recycled plastics:

UL 746D, the Standard for Polymeric Materials – Fabricated Parts:

- Section 10 defines the program
- Tests refer to UL 94 and UL 746A, B and C

General requirements of recycled plastics safety recognition program

For a recycled plastic to be **recognized**, it must comply with the following:

Perform a test program

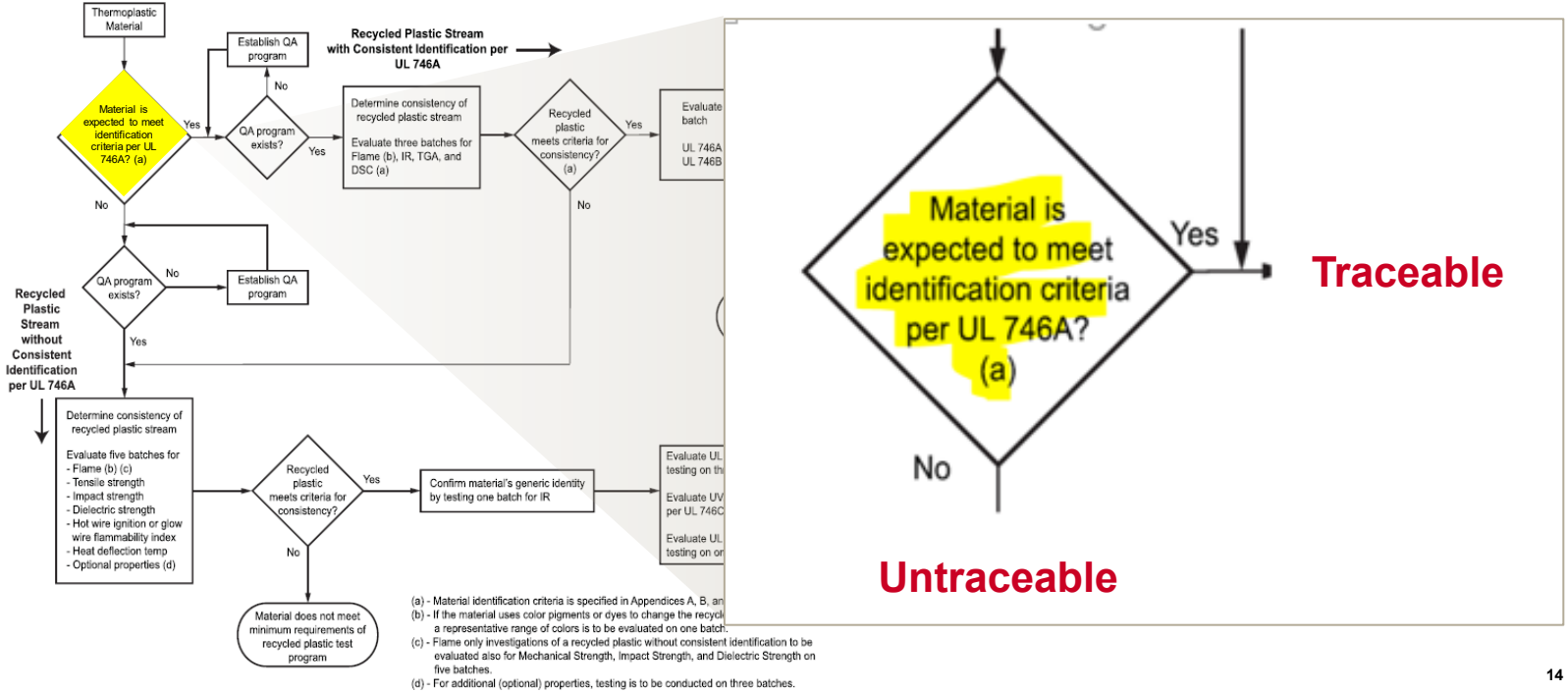
Have a quality assurance program

Have a quality management system

Take part in surveillance / follow-up

Figure 10.1 (UL 746D) – Summary of requirements

Figure 10.1 – Recycled thermoplastic material test program



Program content (Section 10, UL 746D)

Single source (traceable)	Multiple sources (untraceable)
	  
Example: Discarded monitors using the same material for the enclosure, recalled product of same model from the field	**Example:** Post-consumer
Single formulation: • Control is easier • Confirmed by analytical tests (IR, TGA, DSC)	**Multiple formulations:** • Control is more challenging • Analytical tests do not compare
 **Three batches:** Flammability (UL 94), analytical tests (UL 746A: IR, TGA and DSC)	 **Five batches:** Flammability (UL 94), critical short-term properties (UL 746A)
 **One batch:** Short-term properties (UL 746A)	 **Three batches:** All additional short-term properties (UL 746A)
 **One batch:** Outdoor (UL 746C), long-term properties (UL 746B)	 **One batch:** Outdoor (UL 746C), long-term properties (UL 746B)
+ Quality assurance program + Follow-up (flammability, ID)	+ Quality assurance program + Follow-up (flammability, critical short-term properties)

Goal: Consistency in production batches

Insight into UL Recycled Content Claim Validation

Why careful Recycled Content Claims matter

When demand exceeds supply, gray market actors will seek to sell virgin material as recycled content. This disrupts the market and creates distrust of market-facing claims. Consumer concern or confusion in turn draws regulatory attention.

In this environment, careful attention to supplier engagement and market-facing claims that adhere to best practices, national and international guidance help build that trust.

How UL Recycled Content Validation Program can help

Minimize risk

Substantiate claims

Provide confidence and trust

Gain market acceptance

UL 2809, 5th Edition, 2020

- **Recycled processes:** Mechanical and chemical
- **Material source:** Pre-consumer and post-consumer, ocean-bound plastic, ocean plastic, biomass, closed-loop, byproduct synergy, etc.
- **Accounting methods:** Segregated material flows, credit account of mass balance allocation

Delivery process – ECV project

UL Solutions assigns a project manager who is responsible for overseeing all aspects of the project and serving as the primary point of contact for the project. UL Solutions generally completes projects using the following steps. Training and initial audit services are available if needed.

Project kick-off:

- Assign a project manager
- Meet with project leads
- Refine scope, expected outcomes, timelines, roles and responsibilities
- Identify potential risks and issues

Desktop audit/document submission:

- Material handler statements
- Shipping Documents
- Diversion records

On-site audit

- Set date for site audit
- Conduct site audit against desktop review

Issue product environmental claim

- Analyze results
- Submit final report or plan for ongoing support

Ongoing project management, communications

Recycled plastics safety testing (UL 746D) vs. Recycled Content Claim Validation (UL 2809)

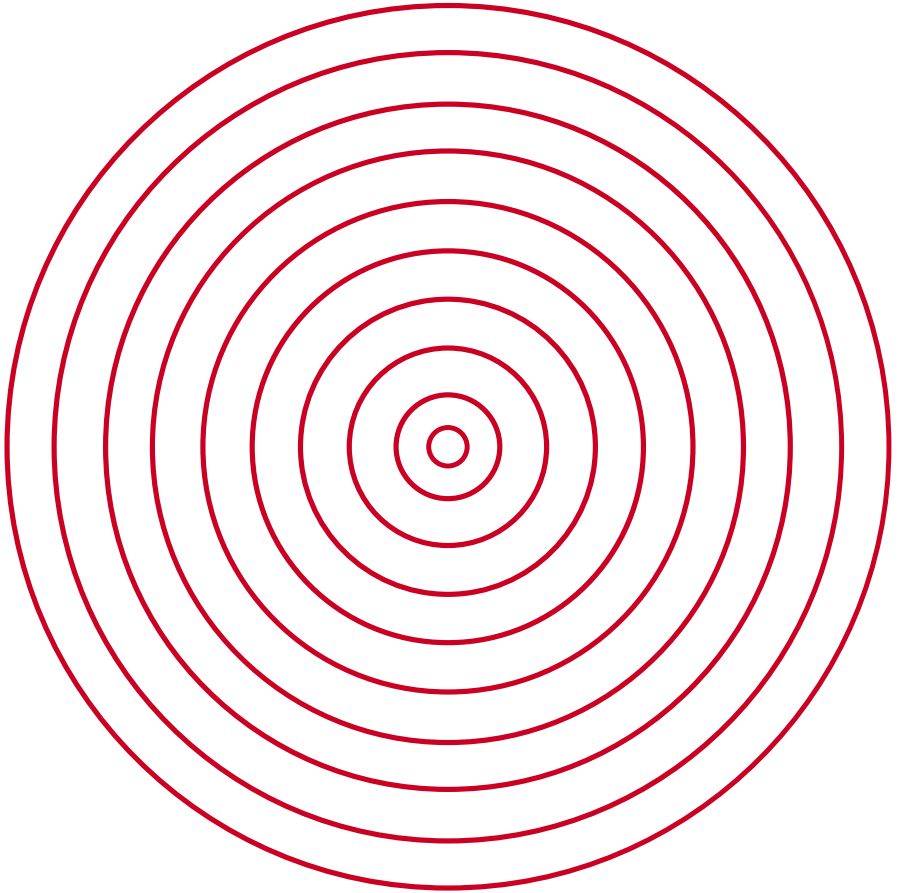
Recycled plastics safety testing

- Testing to rate the material's performance in terms of:
  - Flame
  - Resistance to ignition
  - Durability
  - Electrical properties
  - UV/water exposure
  - Other
- Performance remains consistent in products it is used in

Recycled Content Claim Validation

- Validates the recycled content of material, components, products, packaging
- Validation through documentation and site inspection (no physical test exists to determine recycled content)
- Covers different material sources, e.g., ocean-bound; recycling technologies, e.g., mechanical vs. advanced chemical recycling; and accounting methods, e.g., segregated material flows and mass balance accounting
- Market-facing validation claims adhere to ISO standards and U.S. Federal Trade Commission requirements

Where to find sustainable plastics in the databases of UL Solutions



Publications: Certifications, validations and more

- **UL Product iQ®** – safety certification, recycled content claim validation
- **UL SPOT®** – recycled content claim validation
- **UL Prospector®** – safety datasheets, alternative materials, self-declared technical datasheets

UL Solutions Yellow Card: Sustainability

Component - Plastics E12345

Guide Information

Company ABC

Walt Whitman Road, Melville, NY

FR1234

Polycarbonate (PC), Recycled "Rec", furnished as pellets

Color	Min. Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
ALL	1.5	V-0	-	-	80	80	80
	3.0	V-0	-	-	80	80	80

Comparative Tracking Index (CTI): -
Dielectric Strength (kV/mm): -
High-Voltage Arc Tracking Rate (HVTR): -
Dimensional Change (%): -

Inclined Plane Tracking (IPT) kV: -
Volume Resistivity (10^x ohm-cm): -
Surface Resistivity (10^x ohms/square): -
High Volt, Low Current Arc Resis (D495): -

Rec FR1234 contains an average of 30% post-consumer recycled content.: view SPOT® certificate

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/U
plastic materials used in the components and parts of end-product devices and appliances, wh

Report Date: 2022-02-21
Last Revised: 2022-02-21

SUSTAINABILITY	VALUE	TEST METHOD
Sustainability Attributes	Yes	
Sustainability Statement	Rec FR1234 contains an average of 30% post-consumer recycled content.	UL 2809
SPOT® Certificate	View Certificate	

Thank you

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