UL 746S

STANDARD FOR SAFETY

Evaluation of Sustainable Polymeric Materials for Use in Electrical Equipment

UL Standard for Safety for Evaluation of Sustainable Polymeric Materials for Use in Electrical Equipment, UL 746S

First Edition, Dated August 30, 2023

Summary of Topics

This revision of ANSI/UL 746S dated December 5, 2023, includes a correction to Figure 6.1.

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated September 29, 2023.

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AUGUST 30, 2023
(Title Page Reprinted: December 5, 2023)

ANSI/UL 746S-2023

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Standard for Evaluation of Sustainable Polymeric Materials for Use in Electrical Equipment

First Edition

August 30, 2023

This ANSI/UL Standard for Safety consists of the First Edition including revisions through December 5, 2023.

The most recent designation of ANSI/UL 746S as an American National Standard (ANSI) occurred on December 5, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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.

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INTRODUCTION

1 Scope

1.1 This standard establishes program requirements for the evaluation of sustainable polymeric materials for use in electrical equipment. The test program is intended to ensure acceptable material performance with respect to flammability, electrical, mechanical, and other related safety properties.

1.2 This Standard will cover the requirements for using Mechanically Recycled Plastic in various proportions with the virgin material.

2 Units of Measurements

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

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.

3.2 The following publications are referenced in this Standard:

IEC 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*

UL 94, *Standard Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746B, *Polymeric Materials – Long Term Property Evaluations*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 746D, *Polymeric Materials – Fabricated Parts*

4 Glossary

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

4.2 MECHANICALLY RECYCLED PLASTIC BASE COLOR – The color of the mechanically recycled resin arising from pigments and dyes that are in the as received resin and prior to any further addition of pigments or dyes. For example, the base color of a mechanically recycled plastics resin can be gray or black with the actual color depending on the distribution of pigments and dyes given the multiple plastics being recycled in the recycled plastics stream.

4.3 MECHANICALLY RECYCLED PLASTICS – Those plastics composed of post-consumer material or post-industrial material only, or both, that may or may not have been subjected to additional processing steps of the types used to make products such as mechanically recycled-regrind, or reprocessed plastic.

4.4 POLYMERIC MATERIAL – A compound formed by chemical reaction that results in large molecules whose molecular weight is a multiple of that of the original substance (monomer). Includes thermoplastic, thermoset, and elastomeric materials.

4.5 RECYCLED PLASTICS STREAM – Plastic pellets incorporating one or more grades of the plastic material that has been mechanically recovered from post-consumer or post-industrial sources.

4.6 REPROCESSED PLASTIC – Regrind or mechanically recycled-regrind material that has been processed for reuse by extruding and forming into pellets or by other appropriate treatment.

5 Related Standards

5.1 The following is a summary of the requirements provided in UL 94, UL 746A, UL 746B, UL 746C, and UL 746D:

a) UL 94 cover flammability of polymeric materials used for parts in devices and appliances.

b) UL 746A contains short-term test procedures to be used for the evaluation of materials used for parts intended for specific applications in electrical end products.

c) UL 746B contains long-term test procedures to be used for the evaluation of materials used for parts intended for specific applications in end products.

d) UL 746C contain test procedures for the evaluation of polymeric materials in specific applications in end products. The test procedures include reference to the data obtained from the standard property tests in UL 746A, as well as other practical means of evaluation.

e) UL 746D covers requirements for materials that have been modified to match the requirements of a specific application, including the use of additives and colorants and the blending of two or more materials.

5.2 Requirements for the evaluation of recycled plastic materials are described in this Standard.

EVALUATION OF MECHANICALLY RECYCLED PLASTICS

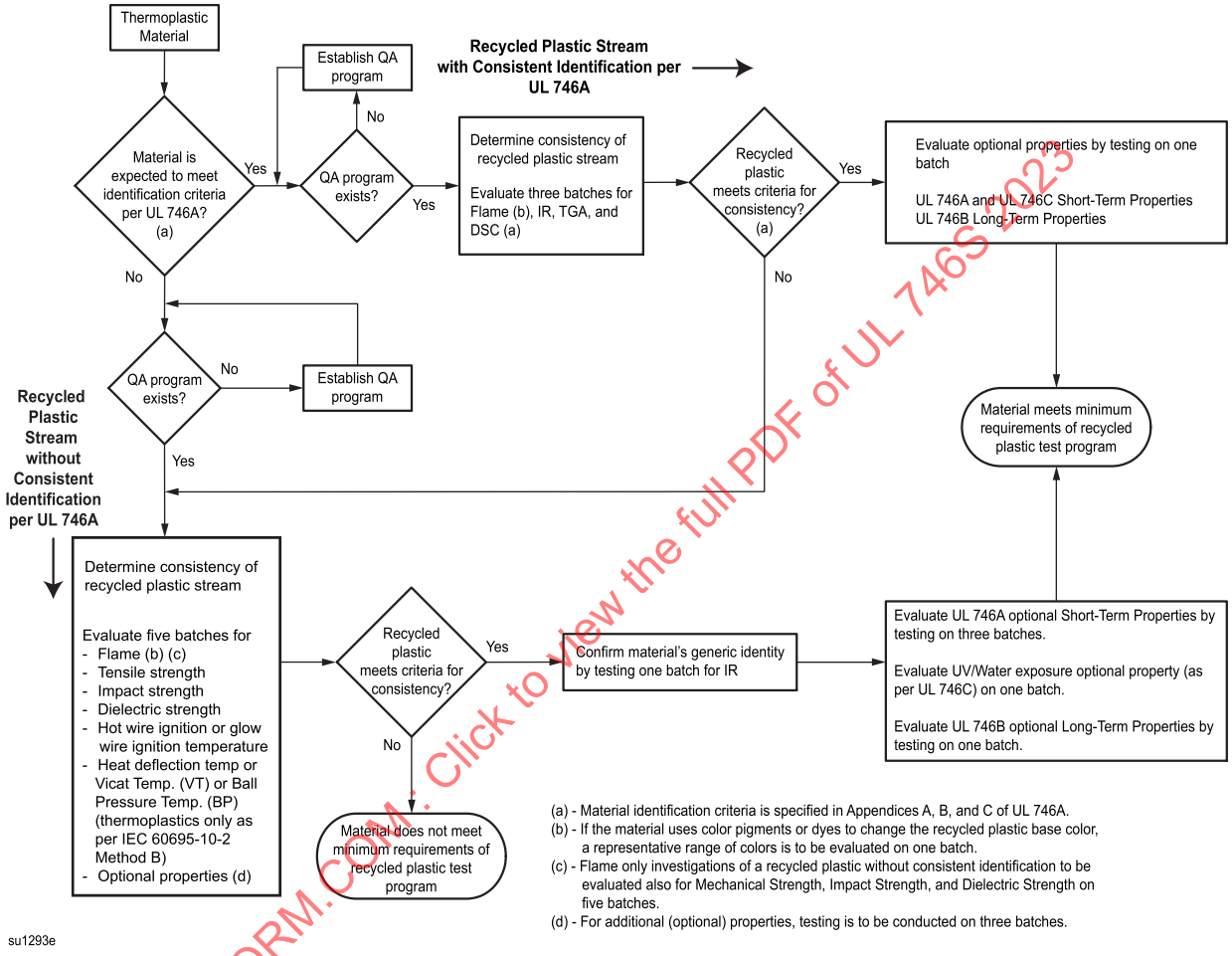
6 Mechanically Recycled Plastic

6.1 General

6.1.1 Mechanically recycled plastics shall be evaluated to determine whether the variations between production batches have significantly affected critical material properties. Figure 6.1 illustrates the test program for recycled thermoplastic materials and the following paragraphs describe the test requirements and acceptability criteria.

Figure 6.1

Mechanically Recycled Thermoplastic Material Test Program



(a) - Material identification criteria is specified in Appendices A, B, and C of UL 746A.
(b) - If the material uses color pigments or dyes to change the recycled plastic base color, a representative range of colors is to be evaluated on one batch.
(c) - Flame only investigations of a recycled plastic without consistent identification to be evaluated also for Mechanical Strength, Impact Strength, and Dielectric Strength on five batches.
(d) - For additional (optional) properties, testing is to be conducted on three batches.

6.2 Mechanically recycled plastics with consistent identification

6.2.1 Mechanically recycled plastics, as described in 4.3 meeting the identification comparison criteria in UL 746A are to be categorized as recycled plastics with consistent identification.

6.2.2 Mechanically recycled plastics, as described in 4.3 that are expected to meet the identification criteria in UL 746A between different batches are to have a complete series of UL 94 flammability and UL 746A identification tests, conducted on specimens for three production batches.

6.2.3 Results of tests for the three production batches are expected to meet the following requirements:

a) The identification tests per UL 746A are to be comparable between batches.

b) The same flammability rating is to be maintained for all tested production batches in the mechanically recycled plastic base color or if base color is not part of the evaluation, a commonly produced color that is part of the evaluation can be considered for complete series of UL 94 flammability and UL 746A identification tests, on three production batches.

c) For additional colors, only one production batch is required for flammability testing in compliance with requirements from test specimens for the:

1) Horizontal Burning Test;

2) 50W (20 mm) Vertical Burning Test; V-0, V-1, or V-2; and

3) 500 W (125 mm) Vertical Burning Test; 5VA or 5VB

of UL 94, as applicable, and the rating of this one batch shall be the same as the rating of the recycled plastic color that was evaluated for three production batches.

6.2.4 For evaluation of additional short and long-term properties, testing of specimens from one production batch is to be conducted.

a) Shot-term properties include ignition (HWI, HAI, GWFI, GWIT), tracking (CTI, IPT, HVTR, D495), outdoor exposure (UV, Water), mechanical (Tensile, Impact), electrical (Dielectric), as referenced in UL 746A; and

b) Long-term properties include Tensile Strength, Electrical Strength, or Impact Strength evaluated through heat aging per UL 746B.

6.2.5 A generic relative thermal index (RTI), per UL 746B, shall be assigned according to the generic identity of the recycled plastic ascertained through Infrared Analysis per UL 746A.

6.2.6 Table 6.1 indicates the criteria for assigning Relative Thermal Index (RTI) to an existing plastic material with elevated RTIs for cases pertaining to addition, deletion and change-in-level of recycled resin with consistent identification. If the identification test results of the recycled plastics do not compare favorably to a related virgin resin with an elevated RTI, the recycled plastic shall obtain an elevated RTI through a 4-point Long Term Thermal Aging program described in UL 746B. In that case the recycle material evaluated shall be a new designation.

6.2.7 Table 6.1 indicates the criteria for assigning UV/water resistance rating to an existing plastic material having UV/water resistance rating for cases pertaining to addition, deletion and change-in-level of recycled resin with consistent identification. UV/Water resistance properties described in UL 746C are to be evaluated on one batch for each representative color. If the identification test results of the recycled plastic do not compare favorably to a related virgin resin with UV/Water resistance rating, the recycled material evaluated shall be a new designation.