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**February 25, 1991**

**Reprinted title page for**

**STANDARD FOR**

**POLYMERIC MATERIALS — FABRICATED PARTS**

**UL 746D, FOURTH EDITION**

Attached is a reprinted title page for the fourth edition of UL 746D.

As indicated on the reprinted title page, this standard is an American National Standard.

Attention is directed to the note on the title page of this standard outlining the procedure to be followed to retain the approved text of ANSI/UL 746D—1990.

Revised and/or additional pages may be issued from time to time.

May 12, 1983  
(Title Page Reprinted: February 25, 1991)



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**UL 746D**

**STANDARD FOR**

**POLYMERIC MATERIALS — FABRICATED PARTS**

First Edition — August, 1974  
Second Edition — March, 1978  
Third Edition — March 1980

The first edition was titled Molded Plastic Parts for Use in Devices and Equipment and numbered UL 746.4.

**FOURTH EDITION**

**MAY 12, 1983**

Approval as an American National Standard covers the numbered paragraphs on pages dated May 12, 1983 and November 20, 1984. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI/UL 746D—1985, March 29, 1985  
Approved as ANSI/UL 746D—1990, November 16, 1990

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

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(2 — 05/28/85)



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**March 6, 1990**

**STANDARD FOR**

**POLYMERIC MATERIALS — FABRICATED PARTS**

**UL 746D, FOURTH EDITION**

Attached is a reprint of the fourth edition of UL 746D, including DoD Adoption Notice dated November 3, 1988.

**THIS EDITION OF THE STANDARD IS NOW IN EFFECT.**

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May 12, 1983  
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ANSI/UL 746D—1985

1

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## FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

## GENERAL

### 1. Scope

1.1 These requirements cover a program applicable to parts that have been molded or fabricated from polymeric material and describe the material-identity control system intended to provide traceability of the material used for the polymeric parts through the handling, molding or fabrication, and shipping operations. Guidelines are also provided for acceptable blending or simple compounding operations that may affect risk of fire, electrical shock, or injury to persons.

1.2 This program is intended to provide quick verification of material identification by means of an identification marking on the part, or on the carton in which the part is shipped, or in a specification sheet placed within the shipping carton with the part. This program is intended to eliminate the uncertainty of the polymeric material identity in the end-use product and to reduce the possibility of field problems caused by the use of incorrect compounds.

1.3 The polymeric-material identity program covered by this standard is intended to provide traceability for parts that are to be factory-installed components of other equipment where the acceptability of the combination is to be determined.

1.4 This program is not intended to provide traceability for polymeric materials that are intended for field installation.

1.5 This standard does not cover performance requirements for a given part. Requirements and methods for the evaluation of metallized or painted parts are contained in the requirements for polymeric materials — use in electrical equipment evaluations, UL 746C, and the requirements for polymeric materials — short term property evaluations, UL 746A. Reference should be made to the applicable individual product standard for performance requirements covering the part or assembly.

## 2. Glossary

2.1 For the purposes of this standard the following definitions apply.

2.2 **CO-MOLDING** — The process of injecting or extruding two or more materials into a single mold using two or more plasticizing cylinders or through a single dye being fed by separate extruders either simultaneously or in sequence.

Paragraph 2.2 renumbered and relocated as paragraph 2.3 November 20, 1984

Paragraph 2.8 renumbered and relocated as paragraph 2.2 November 20, 1984

2.3 **FABRICATOR** — Performs such finishing operations as machining, drilling, painting, plating, assembly, hot stamping, and the like.

Paragraph 2.3 renumbered and relocated as paragraph 2.4 November 20, 1984

Paragraph 2.2 renumbered and relocated as paragraph 2.3 November 20, 1984

2.4 **GENERICALLY-SIMILAR HOMOPOLYMER MATERIALS** — Materials having the same basic chemical constituents and structure but differing in the amounts of fillers, modifiers, and/or reinforcements.

Paragraph 2.4 renumbered and relocated as paragraph 2.6 November 20, 1984

Paragraph 2.3 renumbered and relocated as paragraph 2.4 November 20, 1984

2.5 **LET-DOWN RATIO** — The proportion by weight of additive or concentrate to the base resin material. The maximum let-down ratio is the highest permissible proportion by weight of the additive or concentrate to the base resin material. The minimum let-down ratio is the lowest permissible proportion by weight of the additive or concentrate to the base resin material.

Paragraph 2.5 renumbered and relocated as paragraph 2.7 November 20, 1984

Paragraph 2.5 revised November 20, 1984

2.6 **MOLDER** — Performs injection, extrusion, transfer, compression, rotational, co-molding, thermoforming, reaction injection molding, pultrusion, open mold or hand lay-up processes.

Paragraph 2.6 renumbered and relocated as paragraph 2.9 November 20, 1984

Paragraph 2.4 renumbered and relocated as paragraph 2.6 November 20, 1984

*\*Replaces page 5 dated May 12, 1983*

**2.7 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.

Paragraph 2.7 renumbered and relocated as paragraph 2.8 November 20, 1984

Paragraph 2.5 renumbered and relocated as paragraph 2.7 November 20, 1984

**2.8 RECYCLED PLASTICS** — Refers to rejected and scrap parts that are reground, then repolymerized or reconstituted with virgin materials, additives, fillers, plasticizers, stabilizers or pigments.

Paragraph 2.8 renumbered and relocated as paragraph 2.2 November 20, 1984

Paragraph 2.7 renumbered and relocated as paragraph 2.8 November 20, 1984

**2.9 REGRIND** — Refers to flash, runners, and noncontaminated rejected parts from the molders own production that are reground, or pelletized, and that

may be dry blended by the molder with the same grade of virgin material.

Paragraph 2.9 added November 20, 1984

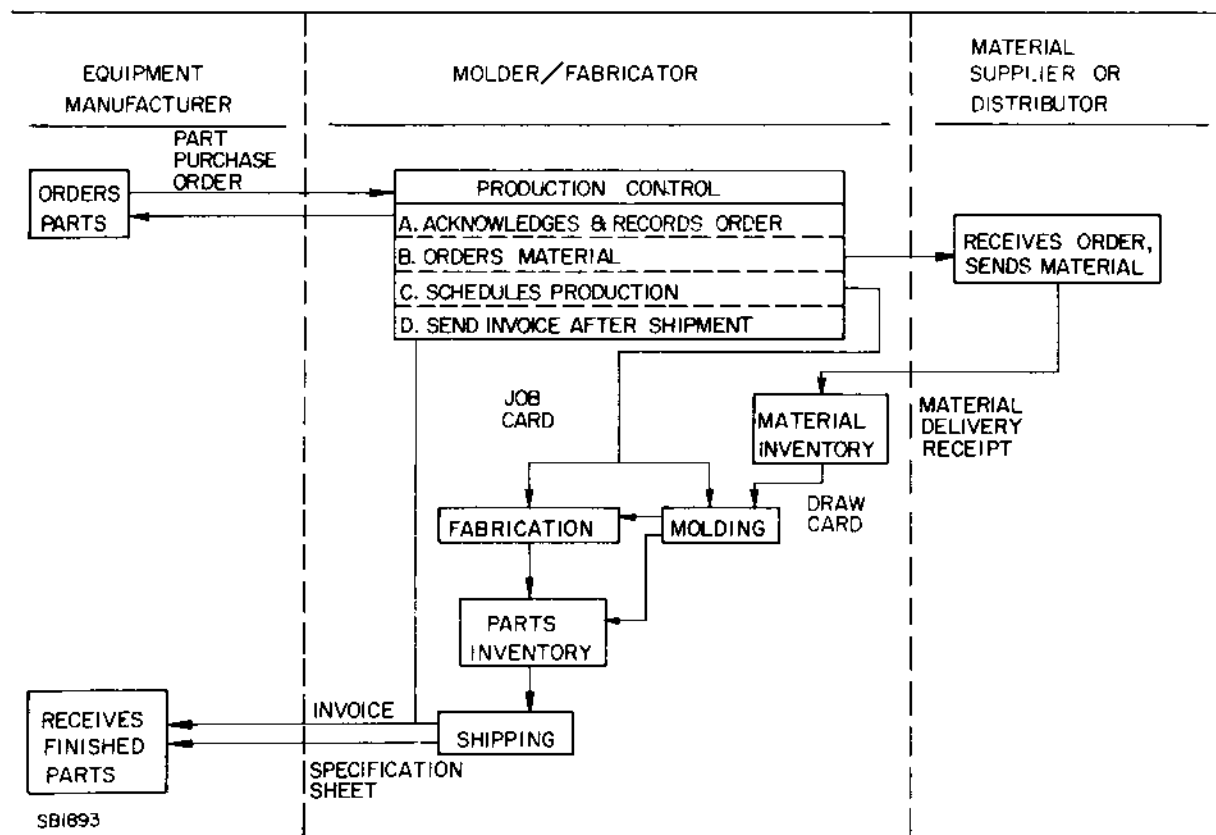
## RECORDS

### 3. Details

3.1 The molder/fabricator of the polymeric material parts shall maintain records that facilitate tracing the identity of the polymeric material used in the molding/fabrication of the parts from its receipt from the material supplier, through storage, handling, molding, finishing operations, and shipping. See Figure 3.1.

Exception: Records covering subcontracted fabrication processes are not required if the markings described in Section 9 are permanently molded into, or applied to the part, and the integrity of the marking is intact after all fabrication processes.

FIGURE 3.1  
EXAMPLE OF A MATERIAL-IDENTITY CONTROL  
SYSTEM AS DESCRIBED IN SECTION 3



\*Replaces page 6 dated May 12, 1983



3.2 The following is an example of the records that may be maintained by the molder/fabricator to comply with the requirements in paragraph 3.1.

A. Purchase Order — Orders part or assembly from a molder/fabricator. This form generally is to include the following entries:

1. Name of end-product manufacturer or designated party (consignee).
2. Purchase order number.
3. Part (assembly or drawing) number and/or name. This item is to specify the material to be used for production of the component.
4. Quantity ordered.
5. Date.

† *Additional page*

B. Internal Record of Purchase Order — Transfers information from purchase order to molder's/fabricator's in-house records. This form is to include the following entries:

1. Name of end-product manufacturer or designated party.
2. Purchase order number.
3. Internal work order number. See paragraph 3.3
4. Part (assembly or drawing) number and/or name.
5. Quantity ordered.
6. Date.

C. Material Delivery Receipt — Records receipt of material from which finished parts are molded/fabricated. The following entries are to correlate with like entries on the Material Inventory:

1. Material manufacturer's name or trade name.
2. Material designation.
3. Quantity delivered.
4. Date delivered.

D. Material Inventory (See Paragraph 3.6) — Records quantity of material in storage as well as receipts and withdrawals. The following entries are to correlate with like entries on the Material Delivery Receipt and Material Draw:

1. Material manufacturer's name or trade name.
2. Material designation.
3. Quantity delivered.

4. Date delivered.
5. Quantity withdrawn.
6. Date withdrawn.

E. Material Draw — Records withdrawal of material from inventory for part molding/fabrication. The following entries are to correlate with like entries on the Material Inventory. The date of withdrawal is to approximate the molding/fabrication date on the Parts Identification.

1. Material manufacturer's name or trade name.
2. Material designation.
3. Quantity withdrawn.
4. Date withdrawn.

F. Job Card — Records details regarding molding/fabrication of finished parts. The following entries are to correlate with like entries on the Purchase Order, Internal Record of Purchase Order, and Parts Inventory. The date of molding/fabrication is to approximate the molding/fabrication date on the Parts Identification.

1. Part (assembly or drawing) number and/or name.
2. Internal work order number. See paragraph 3.3.
3. Material manufacturer's name or trade name.
4. Material designation.
5. Quantity of parts produced.
6. Date produced.

G. PARTS INVENTORY — Records quantity of finished parts in storage as well as additions and shipments. The following entries are to correlate with like entries on the Job Card (additions) and Invoice (shipments). The added date is to approximate the molding/fabrication date on the Parts Identification:

1. Part (assembly or drawing) number and/or name.
2. Internal work order number. See paragraph 3.3.
3. Quantity added.
4. Date added.
5. Quantity withdrawn.
6. Date withdrawn.

H. Invoice — Records shipment of finished parts. The following entries are to correlate with like entries on the Purchase Order, Internal Record of Purchase Order, Job Card, and Parts Inventory:

1. Name of end-product manufacturer or designated party.
2. Part (assembly or drawing) name and/or number.
3. Quantity shipped.
4. Date shipped.

I. Parts Identification — See Marking, Section 9, and paragraph 3.4.

1. Molder's/fabricator's name.
2. Assigned designation. See paragraph 3.5.
3. Part (assembly or drawing) number and/or name.

4. Molding/fabrication date.

5. Material manufacturer's name or trade name.

6. Material designation.

Paragraph 3.2, item 1 revised November 20, 1984

3.3 The molder/fabricator may elect to represent the name of the end-product manufacturer or designated party; purchase order number; assembly, part or drawing number; and/or part name, by an internal code or work-order number on the molder/fabricator in-house records.

3.4 When an assembly consists of two or more polymeric parts, complete material identification is to be provided for each component part.

3.5 If subassemblies of the complete device are manufactured at locations where traceability cannot be evaluated, the assigned designation shall not be used (see paragraph 9.1).

Paragraph 3.5 revised November 20, 1984

3.6 A material may be used for products not covered by the material-identity traceability system as well. The quantities necessary for these products may be ordered or withdrawn on the same records as the material necessary for the products that do fall under the traceability system.

3.7 The records indicated in paragraph 3.1 are to be maintained on a ready-access basis for at least 3 months and in storage for at least 2 years.

## BLENDING

### 4. Additives

4.1 The molder/fabricator shall not employ colorants, flame retardants, fillers, mold-release lubricants, color concentrates, dyestuff, chemical blowing agents or reinforcements or any combination in conjunction with the polymeric material unless the additive or concentrate is tested and found not to adversely affect the critical properties of the material. If an additive or concentrate of unknown performance is employed, the assigned designation mentioned in paragraph 9.1 shall not be used.

*\*Replaces page 8 dated May 12, 1983*

Exception No. 1: Mold-release lubricants that are applied directly to the mold die may be employed without additional tests for materials that have been classed 94HB in accordance with the Standard for Tests for Flammability of Plastic Materials — For Parts in Devices and Appliances, UL 94. A mold-release lubricant may be used with a material classed 94V-2 or better provided that the results of testing indicate that the UL 94 flammability classification remains unchanged when the lubricant is applied to either molded bar specimens or molded parts of material from the same generic material type.

Exception No. 2: Chemical blowing agents may be employed to eliminate sink marks on finished parts if the specific gravity of the finished part is not less than 95 percent of the specific gravity of the unfoamed material. This exception does not apply to rigid foamed materials that generally result in a much lower density than the unfoamed material.

Exception No. 3: Dyestuff that is suspended in water may be used by a molder/fabricator to apply color to the outer surface of a molded part made from materials classed 94HB or from unpigmented nylon that has been classed 94HB or 94V-2 in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

Exception No. 4: Color concentrates, colorants and dyestuff that have been classed 94HB or better when used in a generic material category, may be dry-blended without additional tests with polymeric materials that have been classed 94HB from the same generic material category. The molder/fabricator may dry-blend a color concentrate, colorant or dyestuff with a material classed 94V-2 or better provided that the UL 94 flammability classification remains unchanged when the color concentrate, colorant or dyestuff is let-down into the specific grade of base resin material. The molder/fabricator may dry-blend color concentrate, colorant or dyestuff in a let-down ratio that is equal to or less than the maximum let-down ratio maintained and reported for the pigmented molded bar specimens or parts that are subjected to the UL 94 flammability test.

Exception No. 5: The molder/fabricator may dry-blend a flame retardant concentrate into a specific grade of base resin material in a let-down ratio that is equal to or greater than the minimum let-down ratio maintained and reported for the samples that were subjected to the UL 94 flammability test to obtain the indicated flammability classification.

Revised paragraph 4.1 effective July 1, 1985

†Additional page

4.2 If acceptable additives are employed, the job card described in item F of paragraph 3.2 shall describe the nature and quantity of the additive or concentrate.

### 5. Combined Resins

5.1 Materials can be formulated to match the requirements of a specific application. Tumble blending of two materials of the same approximate particle size is a method that a molder/fabricator may employ to customize the compound for the specific application. The requirements of this section cover particulate blending of molding powders and pellets by dry, cold compounding techniques. Figure 5.1 illustrates the requirements described in paragraphs 5.4—5.6.

5.2 These requirements do not apply to co-molding materials. Section 7 describes requirements for co-molding operations.

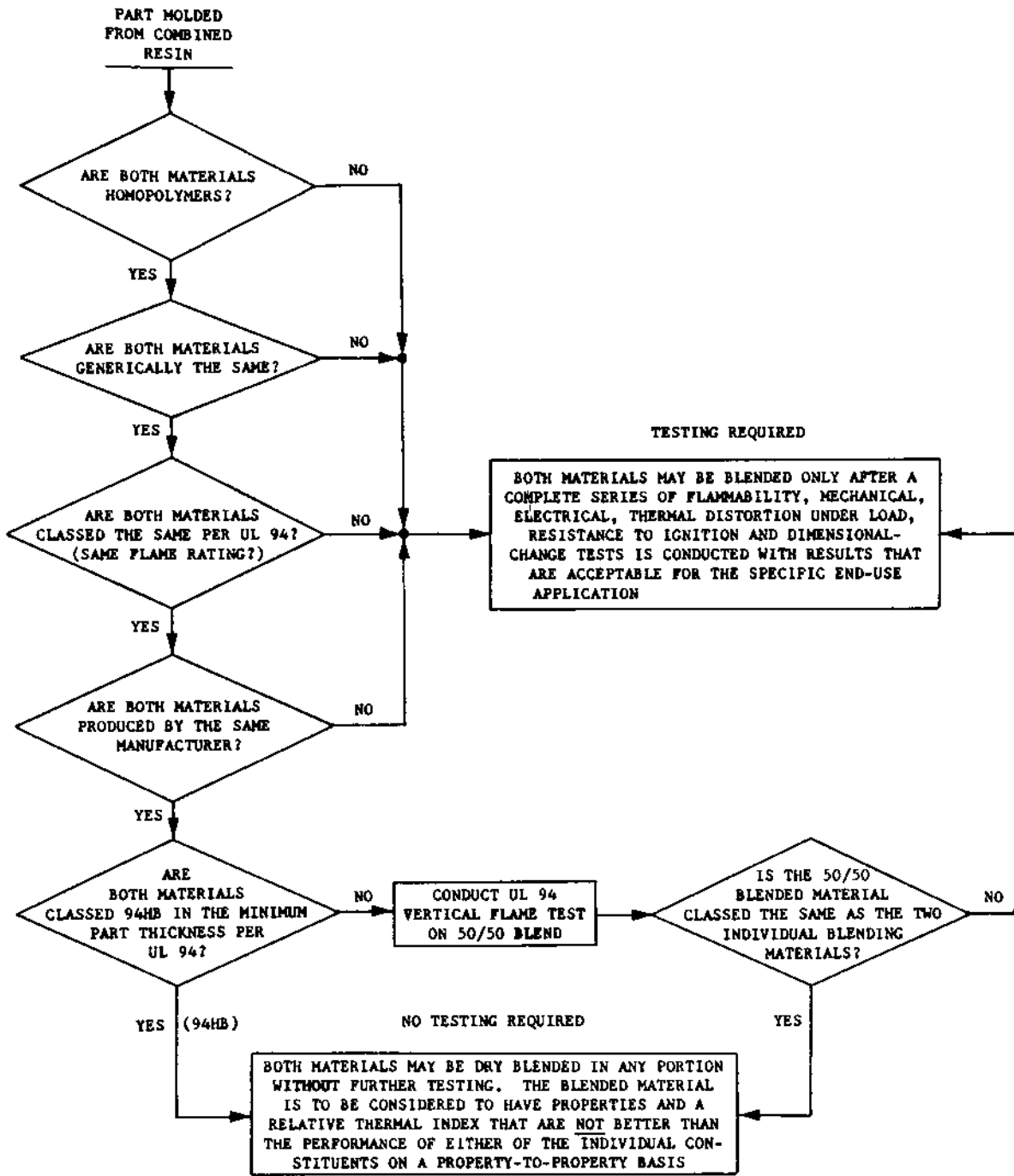
5.3 This section provides guidelines on the development of criteria that may be used to evaluate combined materials if small-scale-test data is available using the methods described in the requirements for polymeric materials — short term property evaluations, UL 746A. The finished part shall possess minimum property levels and a relative thermal index that is considered acceptable for the application as described in the requirements for polymeric materials — use in electrical equipment evaluations, UL 746C; polymeric materials — long term property evaluations, UL 746B; or as described in the specific product standard.

5.4 Two generically similar homopolymer materials produced by the same manufacturer that are classed 94HB in the minimum part thickness when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, may be dry blended in any portion by the molder/fabricator without further testing. The blended material is to be considered to have properties and a relative thermal index that are not better than the performance of either of the individual constituents on a property-to-property basis.

5.5 Two generically similar homopolymer materials produced by the same manufacturer, each classed 94V-0, or 94V-1, or 94V-2 in the minimum part thickness when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, may be dry blended in any proportion by the molder/fabricator provided that the results of testing the 50/50 percent by volume blend indicate that the UL 94 flammability classification remains unchanged. The blended material is to be considered to have properties and a relative thermal index that are not better than the performance of either of the individual constituents on a property-to-property basis.

*\*Replaces page 9 dated May 12, 1983*

FIGURE 5.1  
TEST CONSIDERATIONS FOR COMBINED RESINS



S2310

**EXCEPTION:** TWO GENERICALLY SIMILAR HOMOPOLYMER MATERIALS OR HOMOPOLYMER POLYSTYRENE AND STYRENE/BUTADIENE COPOLYMER BLENDS CLASSED 94HB THAT ARE PRODUCED BY DIFFERENT MANUFACTURERS MAY BE DRY BLENDED IN ANY PORTION WITHOUT FURTHER TESTING. THE BLENDED MATERIAL IS CONSIDERED TO HAVE PROPERTIES NOT BETTER THAN THE INDIVIDUAL CONSTITUENTS.

5.6 Two materials that are generically different (this includes the blending of materials where one or both components are copolymers, alloys, terpolymers, and the like), or have different UL 94 flammability classifications, or have the same UL 94 flammability classification but are produced by different manufacturers, may be blended by a molder/fabricator only after a complete series of flammability, mechanical, electrical, thermal distortion under load, resistance to ignition, and dimensional-change tests is conducted with results that are acceptable for the specific end-use application.

Exception: Two generically similar homopolymer materials or homopolymer polystyrene and styrene/butadiene copolymer blends classed 94HB that may be produced by different manufacturers are to be evaluated in accordance with the requirements in paragraph 5.4.

5.7 The material identity required in item C of paragraph 9.2 shall include each material manufacturer's name or trade name, material designation, and approximate percentage or ratio of each component material.

## 6. Regrinds

6.1 Thermoset regrind shall not be employed in the molding/fabrication of parts, unless the results of a separate investigation indicate acceptable performance for the specific part that contains regrind.

6.2 Parts shall not be molded from material that contains more than 25-percent thermoplastic regrind by weight, unless the results of a separate investigation indicate acceptable performance for the specific part.

6.3 Any increase in the amount or change of the type of regrind shall require a separate investigation to determine the effects of the modification.

6.4 The material identity required in item C of paragraph 9.2 shall include the maximum amount of regrind that the parts contain in situations where the regrind content exceeds 25 percent by weight.

6.5 The separate investigation mentioned in paragraphs 6.2 and 6.3 shall include an analysis of the part function; establishment of minimum performance levels for characteristics involving risk of fire, electric shock, or injury to persons; determination of the need for thermal aging and the establishment of a manufacturer's production control plan to maintain a minimum performance level. Specimens of the part shall be made from repeated blending of virgin and reground materials of the specified percentages until the residue of the material used in the first molding cycle is less than 1 percent of the total material in the part being tested (or the 20th molding cycle whichever comes first).

Exception: Specimens of the part may be made from only one blending of virgin and reground materials of the specified percentages.

## 7. Co-Molding

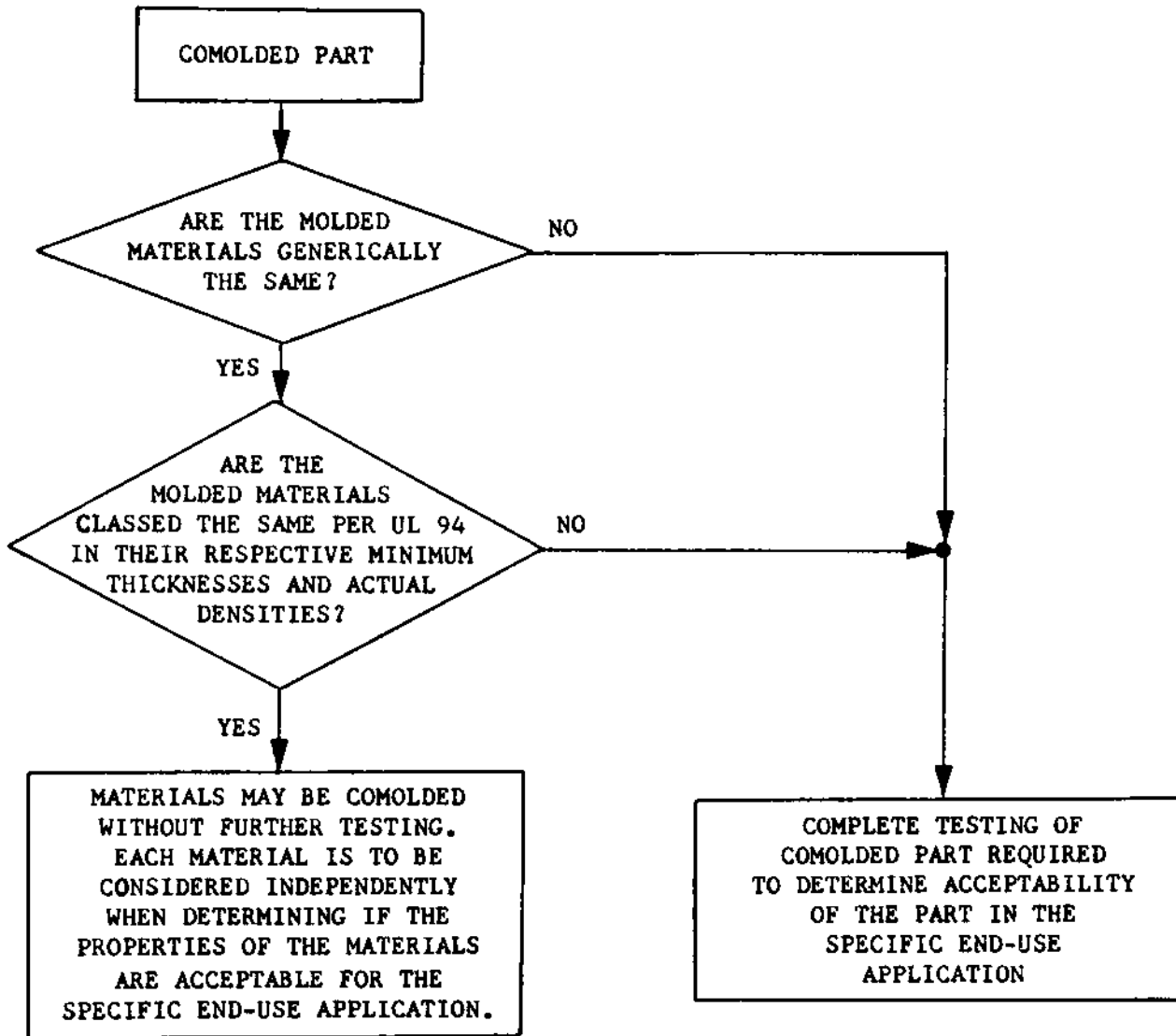
7.1 Co-molded parts that are produced on a molding machine are to be evaluated with respect to the test considerations indicated in Figure 7.1.

## 8. Recycled Plastic

8.1 Recycled plastic shall be evaluated to determine whether the variations between production batches have significantly affected critical material properties. A complete series of flammability, mechanical, electrical, thermal distortion under load, thermal endurance (aging), resistance to ignition, and dimensional-change tests shall be conducted on specimens from a minimum of 5 production batches.

8.2 The manufacturer shall establish a production control plan to maintain a minimum performance level for recycled plastic material. This production control plan shall include identification tests (such as ash content and specific gravity), electrical property tests (such as dielectric strength), and physical property tests (such as tensile strength, elongation and impact strength) as appropriate.

FIGURE 7.1  
TEST CONSIDERATIONS FOR CO-MOLDING OPERATIONS



S2311



## MARKING

### 9. Details

9.1 Polymeric-material parts that comply with these requirements are to be identified by a designation that is assigned to the molder/fabricator.

Paragraph 9.1 revised November 20, 1984

9.2 The required markings shall consist of all of the following:

A. Part identification — end-product-manufacturer or designated-party part number or name or both.

B. Date of molding or fabrication — may be approximate to the nearest month. A date code repetition time cycle shall not be less than 10 years.

C. Material identity — material manufacturer's name or trade name and material designation. See also paragraph 5.7 for combined resins, paragraph 3.4 for assemblies consisting of two or more polymeric parts, and paragraph 6.4 for parts containing regrind.

D. Molder's/fabricator's name or trade name.

E. Assigned designation.

F. Molder/fabricator factory location — distinctive marking, which may be in code, used to identify the part as a product of a particular factory. The factory identification is to be marked in close proximity to the assigned designation.

Exception No. 1: The material identity may be in a traceable code (1) if the material is identified by the name, brand name or trademark of a private labeler; or (2) if the code is mutually agreed upon between the end-product or designated-party manufacturer and the molder/fabricator.

Exception No. 2: The date of manufacture may be abbreviated, or in a nationally accepted conventional code, or a date code affirmed and used by the manufacturer.

Exception No. 3: The molder/fabricator factory location is not required if the part is molded or fabricated or both in one location.

Exception No. 4: The markings are not required to be applied at subcontracted factory locations that perform fabrication operations on parts if the required markings are permanently molded into, or applied to the part, and the integrity of the marking is intact after all fabrication processes.

Paragraph 9.2 revised November 20, 1984

9.3 The required information described in paragraph 9.2 shall be displayed in one or more of the following locations:

A. On the part.

B. On each carton in which the parts are shipped.

C. On a specification sheet or invoice placed in each shipping carton with the parts.

*\*Replaces page 13 dated May 12, 1984*