File Copy

A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

DO NOT REMOVE LAST COPY

NBS Voluntary Product Standard

WITHDRAWN

PS 29-70

U.S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Voluntary Product Standard
(PS 29-70)
Plastic Heat-Shrinkable Film

Technical Standards Coordinator: L. H. Breden

Abstract

This Voluntary Product Standard covers plastic film which, within its useful temperature range, will shrink at least 20 percent in either or both the machine and the transverse directions. Included are requirements and methods of test for shrink properties, dimensions, yield, weight, and slip.

Key words: Balanced and unbalanced film; film, plastic; orientation release stress; plastic heat-shrinkable film; retraction ratio; shrink film, plastic.

Nat. Bur. Stand. (U.S.), Prod. Stand. 29–70, 16 pages (Jan. 1971)
CODEN: XNPSA

Contents

	Page
1. Purpose	1
2. Scope and Classification	1
2.1. Scope	1
2.2. Classification	1
3. Requirements	2
3.1. General	2
3.2. Material	2
3.3. Shrink properties	2
3.4. Thickness	2
3.5. Length	2
3.6. Width	2
3.7. Weight	2
3.8. Yield	2
3.9. Slip	2
3.10. Workmanship	4
4. Inspection and Test Procedures	4
4.1. General	4
4.2. Conditioning and test conditions	4
4.3. Shrink properties	4
4.3.1. Unrestrained linear shrinkage	4
4.3.2. Orientation release stress	4
4.3.3. Retraction ratio	4
4.4. Thickness	4
4.4.1. Apparatus	4
4.4.2. Procedure	5
4.5. Length	5
4.6. Width	5
4.7. Weight	5
4.8. Yield	5
4.9. Slip	6
5. Definitions	6
5.1. General	6
5.2. Unrestrained linear shrinkage	6
5.3. Orientation release stress	6
5.4. Retraction ratio	7
5.5. Balanced shrink film	7
5.6. Unbalanced shrink film	7
5.7. Yield	7
6. Identification	7
7. Effective Date	8
8. History of Project	8
9. Standing Committee	8
10. Acceptors	9

VOLUNTARY PRODUCT STANDARDS

Voluntary Product Standards are standards developed under procedures established by the Department of Commerce (15 CFR Part 10, as amended, May 28, 1970). The standards may include (1) dimensional requirements for standard sizes and types of various products, (2) technical requirements, and (3) methods of testing, grading, and marking. The objective of a *Voluntary Product Standard* is to establish requirements which are in accordance with the principal demands of the industry, and, at the same time, are not contrary to the public interest.

Development of a VOLUNTARY PRODUCT STANDARD

The Office of Engineering Standards Services of the National Bureau of Standards has been assigned by the Department of Commerce the responsibility to work closely with scientific and trade associations and organizations, business firms, testing laboratories, and other appropriate groups to develop *Voluntary Product Standards*. The Bureau has the following role in the development process: It (1) provides editorial assistance in the preparation of the standard; (2) supplies such assistance and review as is required to assure the technical soundness of the standard; (3) acts as an unbiased coordinator in the development of the standard; (4) sees that the standard is representative of the views of producers, distributors, and users or consumers; (5) seeks satisfactory adjustment of valid points of disagreement; (6) determines the compliance with the criteria established in the Department's procedures cited above; and (7) publishes the standard.

Industry customarily (1) initiates and participates in the development of a standard; (2) provides technical counsel on a standard; and (3) promotes the use of, and support for, the standard. (A group interested in developing a *Voluntary Product Standard* may submit a written request to the Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234.)

A draft of a proposed standard is developed in consultation with interested trade groups. Subsequently, a Standard Review Committee is established to review the proposed standard. The committee, appropriately balanced, includes qualified representatives of producers, distributors, and users or consumers of the product being standardized. When the committee approves a proposal, copies are distributed for industry consideration and acceptance. When the acceptances show general industry agreement, and when there is no substantive objection deemed valid by the Bureau, the Bureau announces approval of the *Voluntary Product Standard* and proceeds with its publication.

Use of a VOLUNTARY PRODUCT STANDARD

The adoption and use of a *Voluntary Product Standard* is completely voluntary. *Voluntary Product Standards* have been used most effectively in conjunction with legal documents such as sales contracts, purchase orders, and building codes. When a standard is made part of such a document, compliance with the standard is enforceable by the purchaser or the seller along with other provisions of the document.

Voluntary Product Standards are useful and helpful to purchasers, manufacturers, and distributors. Purchasers may order products that comply with *Voluntary Product Standards* and determine for themselves that their requirements are met. Manufacturers and distributors may refer to the standards in sales catalogs, advertising, invoices, and labels on their product. Commercial inspection and testing programs may also be employed, together with grade labels and certificates assuring compliance, to promote even greater public confidence. Such assurance of compliance promotes better understanding between purchasers and sellers.

Plastic Heat-Shrinkable Film

Effective July 15, 1970 (See section 7.)

(This voluntary Standard, initiated by The Society of the Plastics Industry, Inc., has been developed under the *Procedures for the Development of Voluntary Product Standards*, published by the Department of Commerce. See Section 8, *History of Project*, for further information.)

1. PURPOSE

The purpose of this Voluntary Product Standard is to establish nationally recognized shrinkage criteria and significant quality requirements for commercially available plastic heat-shrinkable film. This Standard is intended to provide producers, distributors, and users with a basis for common understanding of the characteristics of this product.

2. SCOPE AND CLASSIFICATION

2.1. **Scope**—This Voluntary Product Standard covers plastic film [1] which, within its useful temperature range, will shrink at least 20 percent in either or both the machine and the transverse directions. Included are requirements and methods of test for shrink properties, dimensions, yield, weight, and slip. Methods of marking and labeling to identify products conforming to this Standard and a definitions section are provided.

2.2. **Classification**—The plastic film covered by this Voluntary Product Standard is classified by the following types, grades, classes, and styles.

Types

Type I—Balanced shrinkage

Type II—Unbalanced shrinkage

Grades (apply only to Type II)

Grade M—Greatest shrinkage in the machine direction

Grade T—Greatest shrinkage in the transverse direction

Classes (apply to Type I and Type II)

Class 1—Orientation release stress of 50 psi or greater in both the machine direction and the transverse direction.

Class 2—Orientation release stress of less than 50 psi in both the machine direction and the transverse direction.

Class 3—Orientation release stress of less than 50 psi in the transverse direction and 50 psi or greater in the machine direction (not applicable to Grade T).

Class 4—Orientation release stress of less than 50 psi in the machine direction and 50 psi or greater in the transverse direction (not applicable to Grade M).

[1] This Standard is not necessarily intended to cover films which are to be used for wrapping pallets. However, if such films meet all of the specified requirements they may be so identified and used for such applications.

Styles (apply to Type I and Type II)

Style 1—Low slip
Style 2—Medium slip
Style 3—High slip

3. REQUIREMENTS

3.1. General—All plastic film represented as complying with this Voluntary Product Standard shall meet all of the requirements specified herein.[2] The nominal thickness, yield, length, width, and net weight of the film shall be as agreed upon between buyer and seller. The tolerances for these nominal values shall be as stated herein.

3.2. Material—The film may be made of any polymer such as polyethylene, polypropylene, polyolefin copolymers, polyester, polytetrafluoroethylene, fluorinated ethylene-propylene, polystyrene, or poly (vinyl chloride) homopolymer and copolymers.

3.3. Shrink properties—The film shall have the shrink properties specified in table 1 when tested in accordance with 4.3.

3.4. Thickness—When measured in accordance with 4.4., the tolerance for the nominal thickness shall be as follows:

Nominal thickness below 0.001 inch..... ±25 percent
Nominal thickness 0.001 inch and above..... ±20 percent

3.5. Length—The tolerance for the nominal length of the film shall be between plus 3 percent and minus 1 percent when measured in accordance with 4.5.

3.6. Width—The tolerance for the nominal width shall be as follows when measured in accordance with 4.6:

Width	*Tolerance*
inch	inch
12 or less	±1/8
over 12 to 30 inclusive	±3/16
over 30 to 50 inclusive	±3/8
over 50 to 60 inclusive	±1/2

3.7. Weight—The actual net weight of each package or roll of film shall not be less than the nominal net weight as determined in accordance with 4.7. The actual net weight shall be the labeled net weight.

3.8. Yield—The actual yield of the film shall be within ±10 percent of the nominal yield when determined in accordance with 4.8.

3.9. Slip—The slip (kinetic coefficient of friction) of the film shall be classified as one of the following when tested in accordance with 4.9:

Style 1—greater than 0.500 (low slip)
Style 2—from 0.201 to 0.500 inclusive (medium slip)
Style 3—not greater than 0.200 (high slip)

[2] Films intended for packaging foods, drugs, and cosmetics are subject to the Food, Drug, and Cosmetic Law, administered by the Food and Drug Administration, Department of Health, Education, and Welfare, Washington, D.C. 20201.

TABLE 1. *Shrink properties*

	Type I Balanced shrinkage				Type II Unbalanced shrinkage							
					Grade M Shrinkage greatest in machine direction				Grade T Shrinkage greatest in transverse direction			
Unrestrained linear shrinkage percent	Equal to or greater than 20%				Equal to or greater than 20%				Equal to or greater than 20%			
Retraction ratio	Equal to or less than 1.5				Greater than 1.5				Greater than 1.5			
	Class				Class				Class			
	1	2	3	4	1	2	3	4	1	2	3	4
Orientation release stress machine direction psi	50 or more	less than 50	50 or more	less than 50	50 or more	less than 50	50 or more	not applicable	50 or more	less than 50	not applicable	less than 50
Orientation release stress transverse direction psi	50 or more	less than 50	less than 50	50 or more	50 or more	less than 50	less than 50	not applicable	50 or more	less than 50	not applicable	50 or more

3.10. Workmanship—The film shall be as free as commercially possible of gels, streaks, pin holes, or particles of foreign matter. There shall be no tears, blisters, nicks, or cuts visible to the unaided eye.

4. INSPECTION AND TEST PROCEDURES

4.1. General—The inspection and test procedures contained in this section are to be used to determine the conformance of plastic heat-shrinkable film to the requirements of this Voluntary Product Standard. Each producer or distributor who represents his products as conforming to this Standard may utilize statistically based sampling plans which are appropriate for each particular manufacturing process but shall keep such essential records as are necessary to document with a high degree of assurance his claim that all of the requirements of this Standard have been met. Additional sampling and testing of the product, as may be agreed upon between purchaser and seller, is not precluded by this section.

4.2. Conditioning and test conditions—The test specimens shall be conditioned and tested in accordance with Procedure A of American Society for Testing and Materials (ASTM) D 618–61, *Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing.*[3]

4.3. Shrink properties—

4.3.1. Unrestrained linear shrinkage—The unrestrained linear shrinkage shall be determined in accordance with ASTM D 2732–68T, *Tentative Method of Test for Unrestrained Linear Shrinkage of Plastic Film and Sheeting of 0.76 mm (0.030 in.) in Thickness or Less.*[3]

4.3.2. Orientation release stress—The orientation release stress shall be determined in accordance with ASTM D 2838–69, *Standard Method for Determination of Shrink Tension and Orientation Release Stress of Plastic Film and Sheeting.*[3]

4.3.3. Retraction ratio—The retraction ratio shall be calculated according to the equation given in 5.4 using the unrestrained linear shrinkage determined in both the machine and transverse directions of the film at the same temperature. (See 4.3.1.).

4.4. Thickness—The thickness shall be determined by using the apparatus and procedure described in 4.4.1 and 4.4.2. The apparatus shall be installed and operated according to the procedure recommended by its manufacturer.

4.4.1. Apparatus—A deadweight dial micrometer, with a flat anvil of ¼-inch diameter or larger in area and a 3/16-inch diameter flat surface on the head of the spindle, shall be used. The micrometer shall meet the requirements of the apparatus in Method C of ASTM D 374–68, *Standard Methods of Test for Thickness of Solid Electrical Insulation,*[3] and be capable of measuring thickness to ±0.00005 inch.

[3] Later issues of all ASTM publications referenced in this Standard may be used providing the requirements are applicable and consistent with the issue designated. Copies of ASTM publications are obtainable from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

4.4.2. **Procedure**—The procedure shall be in accordance with Method C of ASTM D 374–68. A set of five specimens shall be tested, each at least 2 inches by 2 inches taken uniformly across the width of the roll being tested. The surfaces of the anvil, the spindlehead, and the specimen shall be clean and dry. Place the specimen on the anvil, and lower the spindlehead onto it slowly. The readings shall be taken at least 2 seconds but not more than 2 minutes after the load is applied. The total load applied to the spindle shall not be greater than 650 grams (22.93 ounces), and not less than 500 grams (17.64 ounces). The thickness measurements shall be made on each specimen.

4.5. **Length**—Measurements shall be made with a calibrated steel tape graduated at intervals of 1/8 inch. The roll shall be extended to its full length on a flat surface, and all creases and buckles shall be removed, insofar as practical, without applying stresses that cause significant flow. Measurement of length shall be rounded to the nearest inch. Alternate methods of measuring length shall be as agreed upon between buyer and seller.

4.6. **Width**—Measurements shall be made with a calibrated steel tape graduated at intervals of 1/16 inch. Width shall be measured to the nearest 1/16 inch at not less than 10 locations uniformly distributed along the length of the roll.

4.7. **Weight**—The actual net weight shall be determined by weighing on a scale which conforms to the tolerances specified in the National Bureau of Standards Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices.*[4] The nominal net weight shall be calculated to the nearest 0.1 pound as follows:

$$Wn = T \times A \times 0.03613d$$

Where: Wn = nominal net weight in pounds

T = nominal thickness in inches

A = nominal length in inches times nominal width in inches

d = numerical value of the density in grams per cubic centimeter as determined by ASTM D 1505–68, *Standard Method of Test for Density of Plastics by the Density-Gradient Technique,*[5] using three specimens

0.03613 = factor for converting g/cm ^{3} to lb/in ^{3}.

4.8. **Yield**—The actual yield shall be calculated as follows:

$$Ya = \frac{A}{W}$$

Where: Ya = actual yield in square inches per pound

A = area in square inches

W = weight in pounds.

[4] Copies of NBS publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

[5] See footnote 3, page 4.

The area shall be calculated from the actual length when measured in accordance with 4.5 and the actual width when measured in accordance with 4.6. The weight shall be the actual weight of the film determined in accordance with 4.7. The nominal yield shall be calculated as follows:

$$Yn = \frac{1}{d \times T}$$

Where: Yn = nominal yield
d = density
T = thickness

If density is expressed in g/cm^3 and thickness in inches, the final nominal yield equation becomes:

$$Yn = \frac{27.68}{d \times T}$$

Where: Yn = nominal yield in square inches per pound
d = density (g/cm^3) as determined by ASTM D 1505–68
T = numerical value for thickness in inches
27.68 = conversion factor for $\frac{1}{\text{g/cm}^3 \times \text{in}}$ to sq in/lb.

The deviation of the actual yield from the nominal yield shall be calculated as follows:

$$\text{Dev} = \frac{100\ (Ya - Yn)}{Yn}$$

Where: Dev = the deviation from the nominal yield in percent
Ya = actual yield in square inches per pound
Yn = nominal yield in square inches per pound.

4.9. Slip—The slip (kinetic coefficient of friction) shall be measured in accordance with ASTM D 1894–63, *Standard Method of Test for Coefficients of Friction of Plastic Film.*[6]

5. DEFINITIONS

5.1. General—The plastics terminology used in this Standard is in accordance with the definitions given in ASTM D 883–69, *Standard Nomenclature Relating to Plastics.*[6]

5.2. Unrestrained linear shrinkage—The unrestrained linear shrinkage is the irreversible and rapid reduction in linear dimension in a specified direction occurring in film subjected to appropriate elevated temperatures under conditions where negligible or no restraints are present to inhibit shrinkage. Unrestrained linear shrinkage (free shrink) is expressed as a percentage of the original dimension.

5.3. Orientation release stress—The orientation release stress is equal to the maximum force per original average cross sectional

[6] See footnote 3, page 4.

area developed by a film in the machine direction or the transverse direction, throughout its range of shrink temperatures, while totally restrained from shrinking.

5.4. **Retraction ratio**—The retraction ratio is the ratio of greater to lesser shrinkage in perpendicular directions at the same temperature, and is determined as follows:

$$R = \frac{S_2}{S_1} = \frac{(LO)_1 \times (\Delta L)_2}{(LO)_2 \times (\Delta L)_1}.$$

Where R = Retraction ratio

S_1 = Shrinkage in the machine or transverse direction

S_2 = Shrinkage perpendicular to S_1

$(LO)_1$ = Initial length in the machine or transverse direction

$(LF)_1$ = Final length in the machine or transverse direction

$(\Delta L)_1 = (LO)_1 - (LF)_1$

$(LO)_2$ = Initial length in the machine or transverse direction perpendicular to $(LO)_1$

$(LF)_2$ = Final length in the machine or transverse direction perpendicular to $(LF)_1$

$(\Delta L)_2 = (LO)_2 - (LF)_2$.

5.5. **Balanced shrink film**—A balanced shrink film is capable of retraction at an elevated temperature such that the ratio of greater to lesser shrinkage, in the machine direction and the transverse direction, is no greater than 1.5 at temperatures causing a 20 percent or greater unrestrained shrinkage. These temperatures should be below the temperature at which the polymer decomposes or melts.

5.6. **Unbalanced shrink film**—An unbalanced shrink film is capable of retraction at an elevated temperature such that the ratio of greater to lesser shrinkage, in the machine direction and the transverse direction, is greater than 1.5 at temperatures causing 20 percent or greater unrestrained shrinkage. These temperatures should be below the temperature at which the polymer decomposes or melts.

5.7. **Yield**—Yield is the amount of area provided by a given weight of a film at a specified thickness.

6. IDENTIFICATION

In order that purchasers may identify products conforming to all requirements of this Voluntary Product Standard, producers and distributors may include a statement of compliance in conjunction with their name and address on product labels, invoices, sales literature, and the like. The following statement is suggested when sufficient space is available:

> This plastic heat-shrinkable film conforms to all of the requirements established in Voluntary Product Standard PS 29–70, developed cooperatively with the industry and published by the National Bureau of Standards under the *Procedures for the Development of Voluntary Product Standards* of the U. S. Department of Commerce. Full

responsibility for the conformance of this product to the standard is assumed by (name and address of producer or distributor).

The following abbreviated statement is suggested when available space on labels is insufficient for the full statement:

Conforms to PS 29–70, (name and address of producer or distributor).

7. EFFECTIVE DATE

The effective date of this Voluntary Product Standard is the date upon which reference to the Standard may be made by producers, distributors, users and consumers, and other interested parties. Compliance by producers with all of the requirements of this Voluntary Product Standard may not actually occur until some time after its effective date. Products shall not be represented as conforming to this Voluntary Product Standard until such time as all requirements established in the Standard are met. The effective date of this Standard is July 15, 1970.

8. HISTORY OF PROJECT

In December 1967, The Society of the Plastics Industry, Inc., requested the assistance of the Department of Commerce in establishing a Voluntary Product Standard for plastic heat-shrinkable film. A proposed draft of the Standard was developed, and in October 1969, the proposed Voluntary Product Standard was approved by the Standard Review Committee. In January 1970, public announcement was made, and the recommended Voluntary Product Standard was widely circulated to the industry for acceptance. The response to this circulation indicated a consensus of acceptability within the industry, as defined in the *Procedures for the Development of Voluntary Product Standards*. Accordingly, the Standard, designated PS 29–70, *Plastic Heat-Shrinkable Film*, was approved for publication by the National Bureau of Standards to be effective July 15, 1970.

Technical Standards Coordinator:

Leslie H. Breden, Product Standards Section
Office of Engineering Standards Services
National Bureau of Standards, Washington, D.C. 20234

9. STANDING COMMITTEE

The individuals whose names are listed below constitute the membership of the Standing Committee for this Standard. The function of the committee is to review all proposed revisions and amendments in order to keep this Standard up to date. Comments concerning this Standard and suggestions for its revision may be addressed to any member of the committee or to the Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234, which acts as secretary for the committee.

Representing Producers

Mr. Fred F. Weiss, Favorite Plastic Corporation, 1467 Utica Avenue, Brooklyn, New York 11203
Mr. William E. Kelly, Reynolds Metals Company, 6601 West Broad Street, Richmond, Virginia 23218
Mr. Allen J. Seckner, E. I. DuPont de Nemours & Co., Inc., Film Department N 9025, 10007 Marleet Street, Wilmington, Delaware 19898
Mr. Norman Bornstein, W. R. Grace & Co., Cryovac Division, P. O. Box 464, Duncan, South Carolina 29334

Representing Distributors

Mr. Manuel Zinman, Kaufman Glass Co., 1215 French Street, Wilmington, Delaware 19899
Mr. Walter Haller, Almac Plastics, Inc., 6602 Landay Avenue, Baltimore, Maryland 21206
Mr. Frank E. Manning, National Plastics Distributors Assn., 2217 Tribune Tower, Chicago, Illinois 60611
Mr. Harry R. Greenwald, Central Plastics Distribution, 527 South Wells Street, Chicago, Illinois 60607

Representing Users

Mr. William K. Eagle, Fisher-Price Toys, Inc., 606 Girard Avenue, East Aurora, New York 14052
Mr. J. B. Craine, Swift & Company, 1919 Swift Drive, Oak Brook, Illinois 60521
Dr. John M. Jackson (Chairman) Green Giant Company, Le Seuer, Minnesota 56058
Mr. Jesse Sifuentes, Capitol Records, Inc., 2061 Fletcher Drive, Los Angeles, California 90065

10. ACCEPTORS

The producers, distributors, users, and others listed below have individually indicated in writing their acceptance of this Voluntary Product Standard prior to its publication. The acceptors have indicated their intention to use this Standard as far as practicable but reserve the right to depart from it when necessary. The list is published to show the extent of recorded public support for this Standard.

ASSOCIATIONS

(General Support)

American Society of Agricultural Engineers, Naperville, Illinois
Ashrae, New York, New York
National Association of Home Builders, Washington, D.C.
Society of the Plastics Industry, Inc., The, New York, New York

PRODUCERS

Allied Chemical Corporation, Morristown, New Jersey
American Can Company, Fair Lawn, New Jersey
Athens Papermill, The, Athens, Greece
Better Containers Manufacturing Company, Inc., Hillside, Illinois
Canadian Industries Limited, Montreal, Quebec, Canada
Chase Bag Company, Greenwich, Connecticut
Consolidated Thermoplastics Company, Odessa, Texas
Dayco Corporation, Howell, Michigan
Dow Chemical Company, Midland, Michigan
DuPont, E. I., de Nemours & Company Inc., Wilmington, Delaware
Ethyl Corporation, Baton Rouge, Louisiana
Extrudo Film Corporation, Lake Zurich, Illinois
Favorite Plastic Corporation, Brooklyn, New York
Film and Allied Products Division, 3 M Company, St. Paul, Minnesota
Filmco Division of Archer Products, Inc., Aurora, Ohio
Fortune Plastics, Inc., Old Saybrook, Connecticut
Goodyear Tire & Rubber Company, The, Akron, Ohio
Grace, W. R., & Company, Duncan, South Carolina
Great Plains Bag Company, Des Moines, Iowa
Gulf Oil Company, Houston, Texas
Gulf Plastic Products Company, Totowa, New Jersey
Hercules, Inc., Wilmington, Delaware
Interpak Corporation, San Juan, Puerto Rico
Keystone Packaging Service, Inc., Phillipsburg, New Jersey
Leco Industries, Ltd., Montreal, Quebec
Milprint, Inc., Milwaukee, Wisconsin
Mobil Chemical Company, Jacksonville, Illinois
Monsanto Company, St. Louis, Missouri
Pantasote Company, Inc., The Passaic, N. J.
Phillips Films Company, Inc., Auburn, Pennsylvania
Pierson Industries, Inc., Palmer, Massachusetts
Plasti Form, Inc., Phillipsburg, New Jersey
Polymer Processing, Inc., Lenoir, North Carolina
Protective Lining Corporation, Brooklyn, New York
Reynolds Metals Company, Richmond, Virginia
Sinclair-Koppers Company, Pittsburgh, Pennsylvania
Stauffer Hoechst Polymer Corporation, Delaware City, Delaware
Texas Plastics, Inc., Elsa, Texas
Union Carbide Canada Limited, Toronto, Ontario
Union Carbide Canada Limited, Pte. Aux Trembles, Quebec
Union Carbide Corporation, Chicago, Illinois
USI Film Products, New York, New York
U. S. Industrial Chemicals Company, Tuscola, Illinois
Vision-Wrap Industries, Inc., Palatine, Illinois

DISTRIBUTORS, USERS, AND GENERAL INTEREST

Almac Plastics of Maryland, Inc., Baltimore, Maryland
Aluminum Company of America, Pittsburgh, Pennsylvania
American Institute of Supply Association, Washington, D.C.
American Standards Testing Bureau, New York, New York
American Zinc Sales Company, St. Louis, Missouri
Amoco Chemicals Corporation, Naperville, Illinois
Bell Telephone Laboratories, Murray Hill, New Jersey
Better Containers Manufacturing Company, Inc., Hillside, Illinois
Big Bear Stores Company, Columbus, Ohio
Brentwood Plastic Films, Brentwood, Missouri
California Testing Laboratories, Los Angeles, California
Callery Chemical Company, Callery, Pennsylvania
Calmar, Inc., Clark, New Jersey
Camlet, J. Thomas & Son, Clifton, New Jersey
Canada Dry Limited, Downsview, Ontario
Capitol Records, Inc., Los Angeles, California
Celanese Plastics Company, Hilliard, Ohio
Central Plastics Distributors, Chicago, Illinois
Chastain & Tindel, Inc., Atlanta, Georgia
Cities Service Research & Development Company, Cranbury, New Jersey
Dollar, Banner & Funk, Architects, Wilmington, Delaware
Eastman Chemical Products, Inc., Kingsport, Tennessee
Equitable Bag Company, Inc., Long Island City, New York
Fisher-Price Toys, Inc., East Aurora, New York
Froehling & Robertson, Inc., Richmond Virginia
Geigy Agricultural Chemicals, Ardsley, New York
Glyco Chemicals, Inc., Greenwich, Connecticut
Green Giant Company, Le Sueur, Minnesota
Hamilton Manufacturing Company, Richmond, Virginia
Hawaii, State of, Department of Accounting, Honolulu, Hawaii
Inmont Corporation, Clifton, New Jersey
Interlake Steel Corporation, Chicago, Illinois
International Minerals & Chemical Corporation, Skokie, Illinois
Kaufman Glass Company, Wilmington, Delaware
Kay-Fries Chemicals, Inc., West Haverstraw, New York
KCL Corporation, Shelbyville, Indiana
Kleartone Transparent Products, Westbury, New York
Langhan, David, East Providence, Rhode Island
National Lead Company, St. Louis, Missouri
National Plastics Distributors Association, Chicago, Illinois
Omaha Testing Laboratories, Inc., Omaha, Nebraska
Penntube Plastics Company, Clifton Heights, Pennsylvania
Pennwalt Corporation, Philadelphia, Pennsylvania
Phillips Films Company, Inc., Cincinnati, Ohio
Procter & Gamble Company, Cincinnati, Ohio
Reliance Electric Company, Cleveland, Ohio
Research & Library Service, Swarthmore, Pennsylvania
Richardson Company, Kearny, New Jersey
Sears, Roebuck & Company, Chicago, Illinois
Small, P. A. & S., York, Pennsylvania
Swift & Company, Oak Brook, Illinois
Thielex Plastics Corporation, Piscataway, New Jersey
United Co-Operatives, Inc., Alliance, Ohio
United Engineers & Constructors, Philadelphia, Pa.
Wank, Adams & Slavin, New York, New York
Woodward, Wight & Company, Ltd., New Orleans, Louisiana

FEDERAL GOVERNMENT

General Services Administration, Washington, D.C.
Health, Education, and Welfare, Department of, Washington, D.C.
Indian Affairs, Bureau of, Albuquerque, New Mexico
National Park Service, Washington, D.C.
Post Office Department, Washington, D.C.

☆U.S. GOVERNMENT PRINTING OFFICE: 1971 O—407-816