

Australian Standard[®]

SAA PACKAGING CODE

Part 16—FLEXIBLE PACKAGING

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The following interests are represented on the committee responsible for this draft Australian standard:

- Adhesives and Sealants Manufacturers Association
- Agricultural and Veterinary Chemicals Association of Australia
- Airline Company
- Australian Institute of Packaging
- Australian Timber Producers Council
- Bureau of Steel Manufacturers of Australia
- Canmakers Institute of Australia
- Confederation of Australian Industry
- Department of Defence
- Department of Primary Industry
- Department of Industry, Technology and Commerce
- Glass Packaging Institute of Australia
- Packaging Council of Australia
- Plastics Institute of Australia Incorporated
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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 2400.16—1986

Packaging

Part 16: Flexible packaging

RECONFIRMATION NOTICE

Technical Committee PK-025 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 11 November 2015.

The following are represented on Technical Committee PK-025:

Australian Maritime Safety Authority
Australian Paint Manufacturers' Federation
Canmakers Institute of Australia
Printing Industries Association of Australia

NOTES

PREFACE

This standard was prepared by the Association's Packaging Code Committee under the direction of the Packaging Standards Board.

The purpose of this standard is to provide information on and assistance with the use of flexible packaging, e.g. regenerated cellulose film, plastics films, aluminium foil and flexible laminates. Since flexible packaging has many and varied applications, no detailed guidance can be given as the individual circumstances will dictate the type of flexible packaging. Companies specializing in this field may be relied upon to assist the prospective user of flexible packaging.

Some plastics will permit fumigation of the contents of a bag (i.e. gas penetration) if a number of bags are placed under a gas-proof sheet. Alternatively, some plastics bags are sufficiently impermeable to permit in-situ fumigation of individual bags, e.g. by placing phosphine-generating tablets inside a bag.

The subject of insect penetration needs to be considered as even aluminium foil packages are not resistant to boring insects such as the lesser grain borer (*Rhyzopertha dominica*). Furthermore, the warehouse beetle (*Trogoderma variabile*) is a pest of packaged foods in the USA and now that it is present in Australia, it could behave in a similar manner (see AS 2400, Part 4).

The wording in this draft standard has been kept relatively simple but the use of some technical terms is unavoidable. Where explanation of these terms is needed, reference should be made to AS 2400, Part 1.

The SAA Packaging Code has been divided into parts dealing with specific subjects, as follows:

Part	Title
1	Glossary of Packaging Terms*
2	Basic Principles of Packaging Practice*
3	Mechanical aids in Package Handling*
4	Protection Against Spoilage of Packages and their contents by Micro-organisms, Insects, Mites and Rodents*
5	Metal Protection
6	Paper and Board, Wrappers and Containers
7	Timber Containers
8	Textile Bags, Sacks and Wrappings
9	Metal Containers
	9.1 Metal Cans and Tubes*
	9.2 Steel Drums
10	Cushioning Materials
11	Cordage
12	Adhesive Closing and Sealing Tapes
13	Tensional Strapping*
14	Adhesives for Packaging*
15	Glass Containers and Closures*
16	Flexible Packaging
17	Packaging in Plastics containers*
18	Use of Desiccants in Packaging*
19	Packaging for Airfreight*
20	Handling of Goods in Freight Containers*
21	Packaging of Dangerous Goods
22	Closures*
23	Shrink and Stretch Wrapping*

During the preparation of the SAA Packaging Code, account was taken of material included in BS 1133, Packaging Code, and the assistance obtained from this source is acknowledged.

* Published.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
SAA PACKAGING CODE

PART 16—FLEXIBLE PACKAGING

1 SCOPE. This standard gives a general description of, and provides information on, nomenclature, availability, properties, end-uses and some methods of test for flexible packaging, e.g. regenerated cellulose film, plastics films and aluminium foil, and gives general guidance on the use of these materials in laminates.

NOTE: Description of some semi-rigid plastics material has been included (to complete the picture) notwithstanding the title of the standard.

2 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1145	Method for Determination of tensile properties of plastics materials.
AS 1326	Polyethylene (Polyethene) Film for Packaging and Allied Purposes
AS 1734	Wrought Aluminium and Aluminium Alloy Flat Sheet, Coiled Sheet and Plate for General Engineering Purposes.
AS 2070	Plastics Materials for Food Contact Use.
AS 2400	SAA Packaging Code Part 1— Glossary of Packaging Terms Part 4— Protection Against Spoilage of Packages and their contents by Microorganisms, Insects, Mites and Rodents Part 23— Shrink and Stretch Wrapping
AS 2609	Materials Used for the Packaging of Food and Beverages Methods for the Assessment of Odour and Taint Part 1—Sensory methods Part 2—Instrumental Methods
ASTM D256	Tests for Impact Resistance of Plastics and Electrical Insulating Materials
ASTM D746	Test for Brittleness Temperature of Plastic and Elastomers by Impact
ASTM E-96	Water Vapour Transmission of Materials
ASTM D882	Tests for Tensile Properties of Thin Plastics Sheeting
ASTM D3985	Oxygen Gas Transmission Rate Through Plastic Film & Sheeting Using a Coulometric Sensor
BS 1763	Thin PVC Sheeting (Calendered, Flexible, Unsupported)
BS 2739	Thick PVC Sheeting (Calendered, Flexible, Unsupported)
BS 2782	Methods of Testing Plastics

BS 3177 Method For Determining the Permeability to Water Vapour of Flexible Sheet Materials Used For Packaging

BS 3757 Specification for Rigid PVC Sheet

ISO 2528 Sheet materials—Determination of water vapour transmission rate—Dish method.

3 DEFINITIONS. For the purpose of this standard, the definitions in AS 2400, Part 1, and the following apply:

3.1 Biaxial orientation—the process of heating and stretching a film in both machine and transverse direction. Film may then be heat-set to provide stability at elevated temperatures. Shrinkable grades are not heat-set. Monoaxially oriented films are also available.

3.2 Copolymer—the product of the polymerization of two or more monomer materials (e.g. ethylene and vinyl acetate to yield EVA).

3.3 Corona discharge—chemical and physical modification of the surface of a film by subjecting it to an electrical discharge which normally increases the surface energy of the film, making it more receptive to inks, adhesives, etc.

3.4 Cross-linked—a polymer may be subjected to a chemical reaction or to ionizing radiation which will cause the polymeric chains to chemically link together at many points along the chain.

3.5 Film—

- (a) Thin sheeting of arbitrarily limited thickness.
- (b) A flat section of plastics material, usually thermoplastic, with a thickness generally less than 500 μ .

3.6 Blown film—film of an extrudable polymer produced by an extrusion-blow method into a continuous tube. The tube is slit in a variety of ways to yield flat film, centrefold film, J-fold film, etc. Gussets may also be formed.

3.7 Cast film—film of an extrudable polymer which is cast in a single continuous sheet onto a chilled roller. Polymer solutions may also be cast into a chemical bath where the polymer is regenerated into a continuous film.

3.8 Coated film—normally a base film which carries a surface coating to provide properties such as sealability, gas barrier, etc.

3.9 Oriented film—film which has been subjected to the process of orientation (see Biaxial orientation).

3.10 Heat set—during the process of orienting a film it may be subjected to a heat treatment while it is held in the stretched form. This treatment relieves the stresses caused by orienting the film and provides heat stability to the film up to the heat-set temperature.

3.11 Homopolymer—the product of the polymerization of just one monomer material.

3.12 Ionomer—an ethylene polymer containing acid groups along the polymer chains which have been reacted to form metallic salts (usually of sodium or zinc).

3.13 Lay-flat tubing—polymer film produced by the extrusion-blow method in which the tube has been collapsed by removal of air and (normally) wound into a roll.

3.14 Melt flow index (MFI)—a quoted property of thermoplastics polymer which is a measure of the mass of polymer which will extrude through a standard orifice under controlled conditions of pressure, time and temperature (typically 2 kg, 190°C, 10 min; however MFI using other conditions is frequently quoted).

3.15 Sheet—A flat section of a plastics material with a thickness generally greater than 500 μ .

3.16 Sheeting—A form of plastic in which the thickness is very small in proportion to length and width.

3.17 Slip—a surface property of a film which is inversely related to coefficient of friction (e.g. a high-slip film has a low surface coefficient of friction).

3.18 Thermoform—the process of forming a container from a flat polymer sheet by applying heat to the sheet and forcing it to stretch into a mould by means of vacuum, air pressure, mechanical ram or a combination of these.

3.19 Treatment—a modification to the surface of a film to increase its surface energy, making it more receptive to inks, adhesives, etc. Normally treatment is achieved by corona discharge and the term refers to that process; however, flame treatment and chemical treatment are also employed.

3.20 Water-vapour transmission rate—The mass of water vapour transmitted (often erroneously termed 'permeability') from one face to the other, under constant conditions of vapour pressure at the two faces, expressed per unit of surface area and during a give time. It is expressed in grams per square metre per 24 h ($\text{g/m}^2\text{d}$) at the conditions of temperature and humidity defined at the two faces of the sheet. This transmission rate depends upon the thickness and permeability of the constituent material or materials and the conditions of temperature and humidity under which the test is carried out.

NOTE: American sources quote transmission in units of $\text{g}/100\text{ inch}^2$. To convert from $\text{g}/100\text{ inch}^2$ to g/m^2 , the value is to be multiplied by the factor 15.5.

4 REGENERATED CELLULOSE FILM.

4.1 General Description. Cellulose film is a thin, flexible, transparent material derived from wood pulp, a natural fibrous form of cellulose. The wood pulp is first converted into an alkaline solution of cellulose xanthate ('viscose'), which is subsequently extruded through a long, thin casting die into an acid bath, where it is regenerated chemically into a continuous transparent web of non-fibrous cellulose. The film may be pigmented or dyed during manufacture.

In addition to cellulose, the regenerated web contains softeners to impart flexibility to a level that is controlled by varying their proportions, in accordance with the specific end-use requirements. The film also contains a small proportion of moisture, the amount of which varies with the relative humidity of the surrounding atmosphere

and which exerts a considerable influence on the film's performance. The film is normally made to be in equilibrium with an atmosphere having a relative humidity of 40 percent to 50 percent and needs to be maintained in this condition for optimum performance, which explains why the manufacturers supply the film in moistureproof wrappings and attach such importance to correct storage.

For the majority of applications, the basic cellulose film has to be further processed to give it the important properties of resistance to moisture permeability and heat-sealability, and for this purpose a thin coating is applied, usually to both sides of the film. A proportion of the film is sold in its original uncoated non-moistureproof form.

Two basic types of coating are in common use, based on nitrocellulose and copolymers of vinylidene chloride. The standard nitrocellulose coating contains paraffin wax, plasticizers and other additives, suitably compounded to give high initial resistance to permeation of moisture, heat-sealing properties, printability and low surface friction. It can be modified slightly to minimize or eliminate the heat-seal properties or to reduce the degree of resistance to permeation of moisture.

The vinylidene chloride copolymer coatings give more permanent resistance to permeation of moisture during use, being more resistant to abrasion, creasing, heat-sealing, printing and the effect of greases and oils, including essential oils, all of which can cause reduction in resistance to permeation of moisture of nitrocellulose coatings. Two separate types of vinylidene chloride copolymer-coated film are produced, distinguished according to whether the coating is applied from an organic solvent solution or from a water dispersion of the copolymer. The latter type has the higher level of resistance to permeation of moisture, because the method of application does not impose solubility limitations and thus enables an inherently more moisture resistant copolymer to be used. Barrier to gas transmission is also greater.

Films coated on one side only, with either nitrocellulose or copolymer, are also produced, mainly for laminating and extrusion-coating applications.

A third type of film has a vinyl chloride copolymer coating, giving the film moisture and gas barrier properties intermediate between the other two main types.

4.2 Nomenclature. The basic coated and uncoated cellulose films described in Clause 4.1 are all available in many grades, which, although superficially very much alike, vary significantly in thickness, base film flexibility and/or coating composition, to satisfy different end-use requirements. A system of nomenclature is used to designate these different types, by means of 'commercial codes' comprising combinations of letters and numbers. The codes vary from one supplier to another and it is advisable to obtain from each supplier a statement of the properties and end-uses of the various films available.

For example, the films from British suppliers are designated by—:

- (a) one or more letters denoting the basic type of film as follows:

P	non-moistureproof.
M	nitrocellulose-coated on both sides.

- QM nitrocellulose-coated on both sides but less moistureproof than M.
 DM nitrocellulose-coated on one side.
 MXXT/A copolymer-coated by aqueous dispersion on both sides.
 MXXT/S copolymer-coated by solvent process on both sides.
 MXDT/A copolymer-coated by aqueous dispersion on one side.
 MXDT/S copolymer-coated by solvent process on one side.

(b) one or more additional letters indicating special characteristics as follows:

- T transparent.
 B opaque.
 C coloured (followed by the name of the colour).
 F for twist-wrapping.
 S heat-sealable.
 U unsized (film for adhesive tape manufacture).
 V high surface slip (uncoated film only).
 W Low seal threshold copolymer coating.

Films from suppliers in Europe, Japan, Korea and North America are designated quite differently, e.g. KHB, Z, XS.

There is also a range of films from North America which are multilayer castings of cellulose and plastics, and in one case foil. These are designated VP, VH, VF and have properties which are quite different from conventional cellulose films.

Most films are identified by a prefix number which indicates the substance of the film. Depending on supplier, the substance is expressed in either grams per 10 square metres or in square inches per pound. For example 320 MXXT/S is 320 grams per 10 square metres and K 210 HB is 21 000 square inches per pound.

4.3 Availability. Cellulose film is available coloured, colourless or white opaque in coated or uncoated form. It is normally supplied in reels or in cut-to-size sheets and, with certain restrictions, in a series of agreed standard substances.

In general, reels up to 1310 mm wide are commercially available, on cores of internal diameter 76 mm or 152 mm, and in standard overall reel diameters of 240 mm and 330 mm. Other sizes are available by arrangement. A few grades of uncoated film are available in reel widths up to 2180 mm.

Sheet sizes normally range up to 1220 mm × 1220 mm. Discs, ovals and other special shapes can usually be supplied to specification.

4.4 Properties. Among the most important properties of cellulose film are its high gloss and transparency. The film is strong for a thin, lightweight material, with high tensile and bursting strengths, but tears, once started, are easily continued.

Cellulose film has high resistance to a wide range of chemicals, is greaseproof, oilproof and dustproof and is impervious to bacteria. Only suitably coated grades are good barriers to water vapour, but under dry conditions all grades are highly impermeable to gases and odours. Coatings, particularly of the copolymer type, ensure that

this property is retained under conditions of high humidity.

Cellulose film does not deteriorate, discolour or perish during normal use or on extended storage under the recommended conditions, but degrades fairly rapidly when buried in the soil, or under typical rubbish tip conditions. All grades can be printed by all common techniques, and at high speeds by flexographic and rotogravure processes.

'Plain' base film is not inherently fusible and joints between uncoated surfaces have to be made with suitable adhesives (normally based on gelatine, dextrin or polyvinyl acetate dispersions) or with pressure-sensitive tape. Heat-sealing grades are obtained by coating, usually both sides, with fusible lacquers, which also confer the desired degree of moisture resistance. Relative rigidity, controllable to a degree, of the infusible base, together with a slippery surface, enables these films to be handled satisfactorily on a wide range of automatic packaging and bag-making machines, and this factor has been largely responsible for their wide acceptance in mechanical wrapping operations on simple machines.

Cellulose film is sensitive to changes in humidity (because of its hygroscopic nature and the presence of hygroscopic softeners) and to changes in temperature. It becomes less durable at low temperatures and humidities, and for this reason it is advisable to avoid temperatures below 20°C and relative humidities under 30 percent when using the film on automatic machines.

Basic properties as described above are inherent in the uncoated film but of comparable importance are those that are obtained through application of standard coatings. In addition to heat-sealing and water-vapour barrier properties, coatings also impart increased stability to changing humidities and some resistance to liquid water, and are formulated to retain gloss, transparency, printability and other surface properties including high surface slip and resistance to blocking. The copolymer coatings increase gas barrier properties significantly.

4.5 Applications. The versatility of cellulose film due to modifications possible to both the base film and coatings to comply with specific requirements, results in a very wide range of uses. Most of these involve coated moistureproof grades, but a substantial volume of uncoated film is nevertheless used.

Main uses for uncoated cellulose film are for manufacture of pressure-sensitive tape, as a carrier backing for pigmented transfer coatings, for twist-wrapping chocolates, as a 'wet-shrink' individual or multiwrap on bottles and jars, and for general wrapping or bagging applications where moisture protection is not required.

Nitrocellulose-coated moistureproof grades are used where heat-sealing is desirable and protection against moisture is required. Major uses are for wrapping cigarettes, sugar confectionery, baked goods, groceries, quick-frozen foods and for general carton overwrapping and multi-wrapping. Modified nitrocellulose-coated grades with reduced resistance to moisture are used for wrapping high-moisture food products such as sausages, meat pies, crumpets and crusty bread, on which some controlled drying of the surface is desirable to avoid premature bacterial spoilage and/or loss of crispness. Another modification of the standard nitrocellulose coating retains full resistance to permeation of moisture but is non-sealing, for use on sweets that are wrapped while still hot.