भारतीय मानक

वल्कनीकृत रबड़ के पैकेजबन्दी और संग्रहण की रीति संहिता

(पहला पुनरीक्षण)

Indian Standard

CODE OF PRACTICE FOR PACKAGING AND STORAGE OF VULCANIZED RUBBER

(First Revision)

ICS 83.060

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 3

Rubber Products Sectional Committee, PCD 13

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was initially published in 1972 based on ISO 2230 'Vulcanized rubber — Guide to storage'. The Committee responsible for its preparation decided to enlarge its scope and update the standard based on BS 3574 : 1989 'Controlled storage and packaging of vulcanized rubber and rubber products' issued by British Standards Institution and in the light of experience gained over the years.

In this revision the definitions, classification, packaging, packaging materials, marking, storage, storage conditions, rotation of stocks, inspection, testing and recording have been included based on BS 3574 : 1989. Recommendations for inspection and testing of some of the specific products have been included in Annex A.

Most vulcanized rubbers change in physical properties during storage and ultimately may become unserviceable, for example, because of excessive hardening, softening, cracking, creasing or other types of degradation. These changes may be the result of one particular factor or a combination of factors, namely, the action of oxygen, ozone, light, heat and humidity. The deleterious effect of these factors may, however, be minimized by careful choice of storage conditions. The standard indicates the most suitable conditions for storage.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CODE OF PRACTICE FOR PACKAGING AND STORAGE OF VULCANIZED RUBBER

(First Revision)

1 SCOPE

This standard specifies requirements for the inspection, recording procedures, packaging and storage of vulcanized rubber and/or products, assemblies or components containing rubber made from vulcanized or thermoplastic rubbers, prior to these being put into circulation. It is applicable to both solid and cellular rubber. The requirements for packaging form an integral part of the controlled storage procedure, as well as providing means of identifying the material or product.

2 DEFINITIONS

For the purpose of this Indian Standard the following definitions apply.

2.1 Rubber

A generic term for rubber that has undergone vulcanization and/or conversion into a finished product.

NOTE — This standard is not intended to cover raw rubber in bale, liquid or particulate form.

2.2 Initial Storage Period

The maximum period, starting from the time of manufacture, for which a vulcanized rubber or rubber product, appropriately packaged, may be stored under specified conditions before a sample needs to be inspected or retested. For vulcanized rubber and vulcanized rubber products the time of manufacture is the time of cure.

2.3 Extension Storage Period

The period for which a vulcanized rubber or rubber product, appropriately packaged, may be stored after the initial storage period before further inspection and retesting is necessary.

2.4 Storage Life

The maximum period of time that is vulcanized rubber or rubber product, appropriately packaged, may be stored, after which time it is regarded as unserviceable for the purposes for which it was originally manufactured.

NOTE — The storage life of a rubber product is influenced by its shape and size as well as by its composition, with thick products usually undergoing less change due to degradation than thinner ones.

2.5 Assembly

Any product or component containing more than one element, one or more of which is made of rubber.

3 CLASSIFICATION OF RUBBER TYPES ACCORDING TO THEIR RELATIVE SUSCEPTIBILITY TO DETERIORATION

3.1 General

Unless otherwise specified in the product specification, rubber and rubber products shall be classified (for the purposes of storage) in terms of their relative susceptibility to deterioration as follows:

a) **Group A :** Rubbers with moderate susceptibility to deterioration by ageing, as listed in Table 1.

The following additional rubbers shall be classified as Group A:

i) All new rubbers until their storage capabilities have been established.

ii) All thermoplastic rubbers until their storage capabilities have been established.

iii) Any products that cannot be classified.

b) **Group B :** Rubbers with low susceptibility to deterioration by ageing as listed in Table 2

c) **Group C :** Rubbers which are highly resistant to deterioration by ageing, as listed in Table 3.

NOTE — In adopting this classification attention is drawn to the following:

a) Resistance to deterioration can be influenced by compounding ingredients other than the type of base rubber.

b) Products can undergo changes during storage other than those caused by ageing of the rubber.

Table 1 Group A Rubbers
(*Clause* 3.1)

Abbreviation	Chemical Name	Common Name
NR	Isoprene rubber, natural	Natural rubber
IR	Isoprene rubber, synthetic	Polyisoprene
BR	Butadiene rubber	Polybutadiene
AU	Polyester urethane rubber	Polyurethane
EU	Polyether urethane rubber	Polyurethane
SBR	Styrene-butadiene rubber	SBR

3.2 Blends and Composites

A blend of two or more rubbers of different groups shall be classified as the group of the rubber(s) forming more than 50% of the blend. If two rubbers are in equal proportions the blend shall belong to the group having the higher susceptibility to deterioration. A composite article containing components made out of different rubbers shall be also regarded as belonging to the group of the rubber considered most susceptible to deterioration.

4 PACKAGING

4.1 General

Unless otherwise specified in the appropriate product specification, vulcanized rubber or rubber products shall be enclosed:

a) either in individual sealed envelopes o

Table 2 Group B Rubbers
(*Clause* 3.1)

Abbreviation	Chemical Name	Common Name
NBR	Acrylonitrile-butadiene rubber	Nitrile
NBR/PVC	Blend or acrylonitrile-butadiene rubber and polyvinylchloride	Nitrile PVC
CO	Polychloromethyloxiran	Epichlorhydrin
ACM	Copolymer or ethyl acrylate(or other acrylates) and a small amount of a monomer which facilitates vulcanization	Polyacrylate
CR	Chloroprene rubber	Neoprene
IIR	Isobutene-isoprene rubber	Butyl
XNBR	Carboxylic-acrylonitrile-butadiene rubbers	Carboxylated nitrile
BIIR	Bromo-isobutene-isoprene rubbers	Bromobutyl
CIIR	Chloro-isobutene-isoprene rubber	Chlorobutyl

Table 3 Group C Rubbers
(*Clauses* 3.1 *and* 4.1)

Abbreviation	Chemical Name	Common Name
CM	Chloropolyethylene	Chlorinated polyethylene
CSM	Chlorosulphonylpolyethylene	Chlorosulphonated polyethylene
EPM	Ethylene propylene copolymers	EPM, EPR
EPDM	Terpolymer of ethylene propylene and a diene with the residual unsaturated portion of the diene in the side chain	EPDM
FPM	Rubber having fluoro and fluoroalkyl or fluoroalkoxy substituent groups on the polymer chain	Fluorocarbon
Q Group	Silicone rubber	Silicone
FMQ	Silicone rubber having both methyl and fluorine substituent groups on the polymer chain	
PMQ	Silicone rubber having both methyl and phenyl substituent groups on the polymer chain	
PVMQ	Silicone rubber having methyl, phenyl and vinyl substituent groups on the polymer chain	
MQ	Silicone rubber having only methyl substituent groups on the polymer chain, such as dimethyl polysiloxane	
VMQ	Silicone rubber having both methyl and vinyl substituent groups on the polymer chain	

b) in individual sealed pockets in a multiple envelope provided that they can be removed without affecting the sealing of the remainder of the items in the package or;

c) if it is not possible to package the items in this manner, they shall be suitably enclosed or wrapped so as to prevent free access of air.

NOTES

1 Under certain conditions Q group polymers listed in Group C in Table 3, deteriorate if totally enclosed and in these cases free access of air is advisable. The avoidance of other deteriorating agencies (*see* 5.2) is however necessary.

2 Packaging should be completed as soon as is reasonably practicable after curing in the case of vulcanized rubber or as soon as reasonably practicable after manufacture in the case of thermoplastic rubber products.

The packaging shall be carried out in an atmosphere in which the relative humidity is not greater than 65 percent (*see* 5.2.2). Contamination by dust, oil, grease, etc, shall be avoided.

If it is necessary for rubber components to be packed in assembly sets, the components shall be retained in their original identifying envelopes within the main package.

No part shall be tied or tagged in such a way as to cause damage.

4.2 Packaging Materials

All material of any containers, covering or wrapping shall be free from substances such as copper naphthenates or creosote preservatives which degrade rubber or which will degrade rubber.

Heat-sealable opaque materials shall be used unless it can be demonstrated that this is not practical in the circumstances or would distort the packaged component.

NOTE — Some suitable materials are polyethylene-coated kraft paper, aluminium foil/paper/polyethylene laminates and opaque polyethylene film.

Plasticized polyvinylchloride (PVC) film, or any other film containing plasticizer shall not be used in direct contact with the rubber. If for any reason a transparent or translucent material is used, it shall be over-wrapped with an opaque material.

If polyethylene is used as a single wrapping it shall be not less than 0.075 mm thick.

Where there is a serious risk of ingress of moisture (*see* **5.2.2**) aluminium foil/paper/polyethylene laminate or other similar means of protection shall be used to ensure protection from ingress of moisture.

4.3 Labelling

Every package or container shall be labelled with the following information which shall be visible from the outside of the package without breaking the seal:

a) Manufacturer's part number;
b) Specification number of product or component (where applicable) and/or polymer description;
c) Quarter and year of cure or manufacture of the rubber component (for example July to September 1995 = 3Q95);
d) The classification of the rubber in accordance with 3;
e) Quantity in package;
f) Manufacturer's identity or trade-mark; and
g) Manufacturer's batch number or similar means of production identity.

5 STORAGE

5.1 General

Materials, unassembled components and assemblies containing rubber components packaged in accordance with 4 shall be stored indoors under the conditions specified in 5.2.

NOTE — The physical environment in which rubber is stored shall be given due consideration, as thermoplastics tiles and painted surfaces may become permanently stained through migration or volatilization of compounding ingredients such as antidegradants or process oil.

5.2 Storage Conditions

5.2.1 *Temperature*

The storage temperature shall be below 25°C and articles shall be stored away from direct sources of heat such as boilers, radiators and direct sunlight.

NOTE — If the storage temperature is below 15°C care shall be exercised during the handling of stored articles as they may have stiffened and become susceptible to distortion if not handled carefully.

The temperature of articles stored below 15°C shall be raised to approximately 30°C throughout their mass, before being put into circulation.

5.2.2 *Humidity*

The relative humidity shall be such that given the variations of temperature in storage, condensation does not occur. In any event the relative humidity of the atmosphere in storage shall be less than 75% r.h. or, if polyurethanes are being stored, shall be less than 65% r.h.

NOTE — Air with 75% r.h. at 15°C will have a dew point of approximately 11°C.

Air with 75% r.h. at 20°C will have a dew point of approximately 16°C.

Air with 65% r.h. at 15°C will have a dew point of approximately 9°C.

Air with 65% r.h. at 20°C will have a dew point of approximately 13°C.

Air with 50% r.h. at 10°C will have a dew point of approximately 0°C.

5.2.3 *Light*

Rubber shall be protected from light sources in particular direct sunlight or intense artificial light having a high ultraviolet content.

NOTE — It is advisable that windows of storage rooms be covered with a red or orange coating or screen.

5.2.4 *Radiation*

Precautions shall be taken to protect stored articles from all sources of ionizing radiation likely to cause damage to stored articles.

5.2.5 *Ozone*

As ozone is particularly deleterious to rubber, storage rooms shall not contain any equipment that is capable of generating ozone, such as mercury vapour lamps, high voltage electrical equipment giving rise to electric sparks or silent electrical discharge. Combustion gases and organic vapour shall be excluded from storage rooms, as they may give rise to ozone via photochemical processes.

5.2.6 *Deformation*

Rubber shall be stored free from superimposed tensions and compressive stresses or other causes of deformation. Where articles are packaged in a strain free condition they shall be stored in their original packaging. In case of doubt the manufacturer's advice shall be sought.

Rings of large internal diameter shall be formed into three equal superimposed loops so as to avoid creasing or twisting.

NOTE — It is not possible to achieve this condition by forming just two loops.

5.2.7 *Contact with Liquid and Semi-Solid Materials*

Rubber shall not be allowed to come into contact with liquid or semi-solid materials (for example, petrol, greases, acids, disinfectants, cleaning fluids) or their vapours at any time during storage, unless these materials are by design and integral part of the component or the manufacturer's packaging. When rubber parts are received coated with their operational media, they shall be stored in this condition.

5.2.8 *Contact with Metals*

Certain metals and their alloys (in particular, copper, manganese and iron) are known to have deleterious effects on some rubbers. Rubbers shall not be stored in contact with such metals (except when bonded to them) but shall be protected by wrapping or by separation with a layer of suitable material, for example, paper or polyethylene, as specified in **4**.

5.2.9 *Contact with Dusting Powder*

Dusting powders shall only be used for the packaging of rubber items in order to prevent blocking. In such instances the minimum quantity of powder to prevent adhesion shall be used.

NOTE — Any powder used shall be free from any constituent having a deleterious effect on the rubber or the subsequent application of the rubber.

5.2.10 *Contact Between Different Rubbers*

Contact between rubbers of different compositions and colours shall be avoided.

5.2.11 *Article with Rubber-to-Metal Bonds*

The metal part of bonded metal items shall not come into contact with the rubber of other articles. Any preservative used on the metal shall be such that it will not affect the rubber or the bond to such an extent that it does not comply with the product specification.

5.2.12 *Proofed Fabrics and Rubber Sheeting*

Proofed fabrics and rubber sheeting having areas of approximately 1 m^2 or less than 2 m in length, shall be stored flat, with the layers interleaved with a suitable material as specified in **4.2**. Larger areas and longer lengths of material shall be rolled, with the layers interleaved with a suitable material as specified in **4.2**.

5.3 Rotation of Stocks

Articles shall be issued from stores in strict rotation so that the articles remaining in store are those of most recent manufacture or delivery.

6 INSPECTION, TESTING AND RECORDING OF DATA DURING STORAGE

6.1 Recording

A record shall be kept of the test characteristics of items or components stored. Such records shall include details of the confidence interval of the mean for each parameter tested where the test conducted provides a numerical result.

A record shall also be kept of the following:

a) The quantity of each item or component stored, the date of initial packaging, the date it was placed into store;
b) The date of any subsequent repackaging (*see* **6.4**);
c) The manufacturer's batch number [*see* **4.3** (g)];
d) The quantity of items or components that are a representative sample of those items or components.

6.2 Inspection

6.2.1 *Inspection Before Extension Storage*

Before any item or component is to be stored for any extension storage period (*see* **6.3.2**),

representative samples of each type of item or component shall be selected for inspection at the end of the appropriate initial storage period. Items shall not be laid on concrete floors or other rough surfaces or in areas susceptible to contamination by grit. Inspection shall be in accordance with the relevant product specification, or, where the relevant product specification does not make such provision, the following minimum visual inspection procedures shall apply.

6.2.2 *Visual Inspection*

Inspect each of the items or components in the representative sample for the following:

a) Parmanent distortions, such as creases or flats;
b) Mechanical damage, such as cuts, tears, abraded areas of delaminated plies;
c) Surface cracking when viewed under a magnification of x 10;
d) Changes in surface condition such as hardening, softening or tackiness.

6.2.3 *Testing*

Providing that the items or components inspected at **6.2.1** or **6.2.2** are satisfactory, they shall be tested to ascertain that their relevant performance characteristics are within the confidence limits recorded at **6.1**.

NOTE — Testing to demonstrate that the material or component is serviceable should be carried out according to the appropriate product specification for the particular item concerned.

6.3 Storage Periods

6.3.1 *Assessment at the End of the Initial Storage Period*

If, following the visual inspection procedure at **6.2.1** or **6.2.2** or following the test procedures at **6.2.3**, the items or components are not satisfactory they shall not be released into any extension storage period. If the items are satisfactory and are placed into an extension storage period, the provisions of **6.1** shall apply and in addition, a record shall be kept of the date of commencement of the initial storage as well as the date of commencement of the extension storage period.

6.3.2 *Extension Storage Periods*

Items or components admitted into an extension storage period (*see* **2.3** and Table 4) shall be inspected and tested according to **6.2.1** and **6.2.3** at or before the expiry of the extension storage period before they are put into circulation or admitted to any further extension storage period.

NOTE — The duration of the storage periods, both initial and extension, shall also be specified in the appropriate product specification.

6.3.3 Duration of Storage

Unless otherwise specified in the product specification, the initial storage period and extension storage periods shall be those described in Table 4.

Table 4 Initial and Extension Storage Periods for Unassembled Components
(*Clauses* 6.3.2 *and* 6.3.3)

Classification of Group	Initial Storage Period (*see* 2.2 and 6)	Extension Storage Periods (*see* 2.3 and 6)
Group A rubbers	5 Years	2 Years
Group B rubbers	7 Years	3 Years
Group C rubbers	10 Years	5 Years

NOTES

1 The initial storage periods and extension storage periods for the rubber types classified according to the grouping in 3 are tabulated in Table 4. It is pointed out that these periods apply to unassembled rubber components packaged in accordance with the requirements of 4 and 5.

2 Shorter storage periods than those tabulated in Table 4 may be advisable for some items of Group A rubbers of less than 1.5 mm thickness or Group A cellular rubbers (and for items packaged and/or stored under conditions other than those specified in 4 and 5).

6.4 Repackaging

If materials are removed from storage for inspection or testing or any other purpose and are subsequently to be returned to storage for a further period, they shall be repackaged in accordance with 4 and the date of repackaging recorded on the container.

ANNEX A

(*Foreword*)

RECOMMENDATIONS FOR INSPECTION AND TESTING OF SPECIFIC PRODUCTS

A-1 FLEXIBLE TANKS AND CONTAINERS

Flexible tanks and containers shall be inspected in accordance with **6.2** by laying out flat on clean cellular rubber sheeting or other suitable surface.

A-2 INFLATABLE ITEMS

Inflatable items including dinghies shall be inspected in accordance with **6.2** and shall be subjected to any pressure maintenance test specified in the relevant product specification.

A-3 SEALS, EXTRUSIONS AND LARGE COMPONENTS

Seals, extrusion and large components shall be inspected in accordance with **6.2**. Special attention shall be given to the condition of the lip or sealing surface of seals and the edges of the extrusions and components.

A-4 BRAIDED RUBBER CORDS

Braided rubber cords shall be visually inspected for damage to the braid and the mechanical properties of the finished cords tested in accordance with relevant specification. A sample cord shall be stripped of braid and the rubber strands inspected in accordance with **6.2**.

A-5 RUBBER TO METAL BONDED COMPONENTS

A-5.1 The rubber parts of rubber-to-metal bonded components shall be inspected in accordance with **6.2**.

A-5.2 The edge of the bond shall be inspected, where this is practicable, the inspection being carried out with the rubber in slight tension.

A-6 PROOFED FABRICS AND RUBBER SHEETING

Proofed fabrics and rubber sheeting shall be inspected in accordance with **6.2**. Special attention shall be given to regions where folding may have been necessary for storage. The material shall be inspected by laying out flat on clean cellular rubber sheeting or other smooth surface free from grit or other contamination.

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