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**Film for wrapping rubber bales —**

Part 3:

**Ethylene-propylene-diene rubber (EPDM),  
acrylonitrile-butadiene rubber (NBR),  
hydrogenated nitrile-butadiene rubber  
(HNBR), acrylic-ethylene rubber (AEM)  
and acrylic rubber (ACM)**

*Emballage des balles en caoutchouc —*

*Partie 3: Caoutchouc éthylène-propylène-diène (EPDM), caoutchouc  
butadiène-acrylonitrile (NBR), caoutchouc butadiène-nitrile hydrogéné  
(HNBR), caoutchouc éthylène acrylique (AEM) et caoutchouc acrylique  
(ACM)*

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20299-3 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 3, *Raw materials (including latex) for use in the rubber industry*.

ISO 20299 consists of the following parts, under the general title *Film for wrapping rubber bales*:

- *Part 1: Butadiene rubber (BR) and styrene-butadiene rubber (SBR)*
- *Part 2: Natural rubber*
- *Part 3: Ethylene-propylene-diene rubber (EPDM), acrylonitrile-butadiene rubber (NBR), hydrogenated nitrile-butadiene rubber (HNBR), acrylic-ethylene rubber (AEM) and acrylic rubber (ACM)*

## Introduction

Considerable quantities of synthetic rubber are prepared in crumb form. The crumbs are dried and then pressed into bales whilst still warm, at approximately 60 °C. The bales are then wrapped in a film and packed, often automatically, into crates.

The wrapping film should be strong enough to withstand the stresses encountered during the wrapping and packing operations. It should not adhere to the film on the other bales under the combined effects of the heat from the rubber and the weight of the bales. During storage, the rubber will flow and the film should be able to withstand the stresses generated. Any failure of the film causes rubber-to-rubber adhesion, which in a 30-bale crate leads to a “one-tonne bale”.

The prime purpose of the film is to keep the bales separate at all times, so that they may be easily removed from their packaging for use. However, because it is difficult and uneconomic to strip the film from each bale, an essential feature is that the film should disperse in the rubber compound during mixing. This means that its melting point has to be lower than the temperatures attained in internal mixing cycles, typically 120 °C to 160 °C.

Unfortunately, there is no acceptable or reproducible dispersal test available to measure this important property directly.

Mixes carried out on a two-roll mill or in a single-stage internal mixer cycle might not reach the required temperature for dispersion. If this happens, then an option would be to strip the film from the bales or to use a lower melting point film if this is practical.

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## Film for wrapping rubber bales —

### Part 3:

## Ethylene-propylene-diene rubber (EPDM), acrylonitrile-butadiene rubber (NBR), hydrogenated nitrile-butadiene rubber (HNBR), acrylic-ethylene rubber (AEM) and acrylic rubber (ACM)

**WARNING** — Persons using this part of ISO 20299 should be familiar with normal laboratory practice. This part of ISO 20299 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

### 1 Scope

This part of ISO 20299 specifies the material and physical property requirements for non-strippable film for wrapping general-purpose synthetic rubber bales and intended to keep the bales separate during storage.

It concerns wrapping film for the following types of rubber:

- ethylene-propylene-diene rubber (EPDM);
- acrylonitrile-butadiene rubber (NBR);
- hydrogenated nitrile-butadiene rubber (HNBR);
- acrylic-ethylene rubber (AEM);
- acrylic rubber (ACM).

Certain applications and processing methods require the removal of the film. This part of ISO 20299 does not deal with strippable films.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 306:2004, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

ISO 1872-1:1993, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

ISO 4591, *Plastics — Film and sheeting — Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*

ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization*

### 3 Material

The film shall be manufactured from one of the following:

- a) low-density polyethylene (polyethene) (PE-LD);
  - b) low-density polyethylene blended with ethylene-vinyl acetate copolymer (EVAC);
  - c) an appropriate grade of EVAC copolymer;
- or
- d) copolymers of ethylene having a content of other 1-olefinic monomers of less than 50 % (*m/m*) and a content of non-olefinic monomers with functional groups up to a maximum of 3 % (*m/m*) (see ISO 1872-1:1993, 1.3).

NOTE Antioxidants, slip agents and anti-blocking agents may be present.

### 4 Physical properties

#### 4.1 Thickness

When measured by a gravimetric technique as specified in ISO 4591, the film shall have a thickness between 0,040 mm and 0,070 mm for materials a), b) and c) in Clause 3 and between 0,040 mm and 0,085 mm for material d), although a thickness of 0,025 mm to 0,040 mm may be used instead if dispersion of the film during mixing poses problems.

#### 4.2 Thermal properties

##### 4.2.1 General

It is sufficient to satisfy only one of the following two thermal-property requirements.

##### 4.2.2 Vicat softening temperature

When determined in accordance with ISO 306:2004, method A50, the Vicat softening temperature shall be equal to or less than 95 °C.

##### 4.2.3 Peak melting temperature by DSC

When determined in accordance with ISO 11357-3, the peak melting temperature shall be less than 113 °C (Vicat softening temperature + 18 °C).

### 5 Test report

The test report shall include the following:

- a) a reference to this part of ISO 20299, i.e. ISO 20299-3;
- b) all details necessary for the identification of the sample;
- c) any unusual features noted during the determinations;
- d) the results obtained from the tests specified in Clause 4;
- e) the date of testing.