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## Criteria Sheet for: Shrink film

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## 1. Preliminary note

The Raw Material used for Packaging in Beverage Machinery Industry is critical for the efficiency of the packaging lines and the quality of the product.

**The target of this ABMI Criteria sheet is:**


- to give manufacturer and users a reference tool to help them carry out the operation of the machine
- to determine the specification of each of the elements and the relevant interfaces
- to give all actors in this business sector a reference document for the establishment of technical documents and quality control procedures
- to facilitate diagnosis in case of malfunctions

**The content of this ABMI Criteria Sheet will cover the following items:**

1. Geometrical and dimensional accuracy
2. Physical properties
3. Storage and handling conditions
4. Processing and application

All diagrams, pictures and numerical data shown in this document intent to illustrate the topic and to facilitate the understanding of the matter. Some data may represent best recommendations from the machinery industry for the procurement of raw material. These values represent common practice at the date of publication.

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## 2. Specification Criteria of: Shrink film

### 2.1. Introduction

The Quality of a shrink pack depends on numerous factors, therefore this specification hints can only be a general recommendation.

### 2.2. Materials

There are different shrink film materials available on the market:

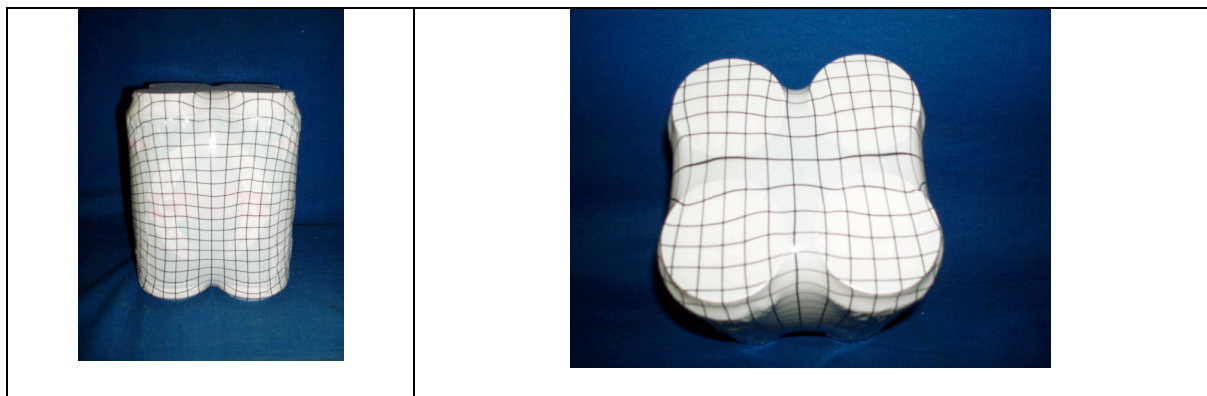
- LDPE (low density polyethylene)
- LLDPE (long low density polyethylene)
- HDPE (high density polyethylene)

### 2.3. Printing


Shrink film can be printed or unprinted.

For the selection of the printed area of the film it is important to take into account that the film has to adapt to the shape of the products during the shrink process in order to produce a stable pack. In the shrink process the film will be stretched to different degrees in certain areas and surfaces according to the shape of the products.

This aspect is shown in the photos below:

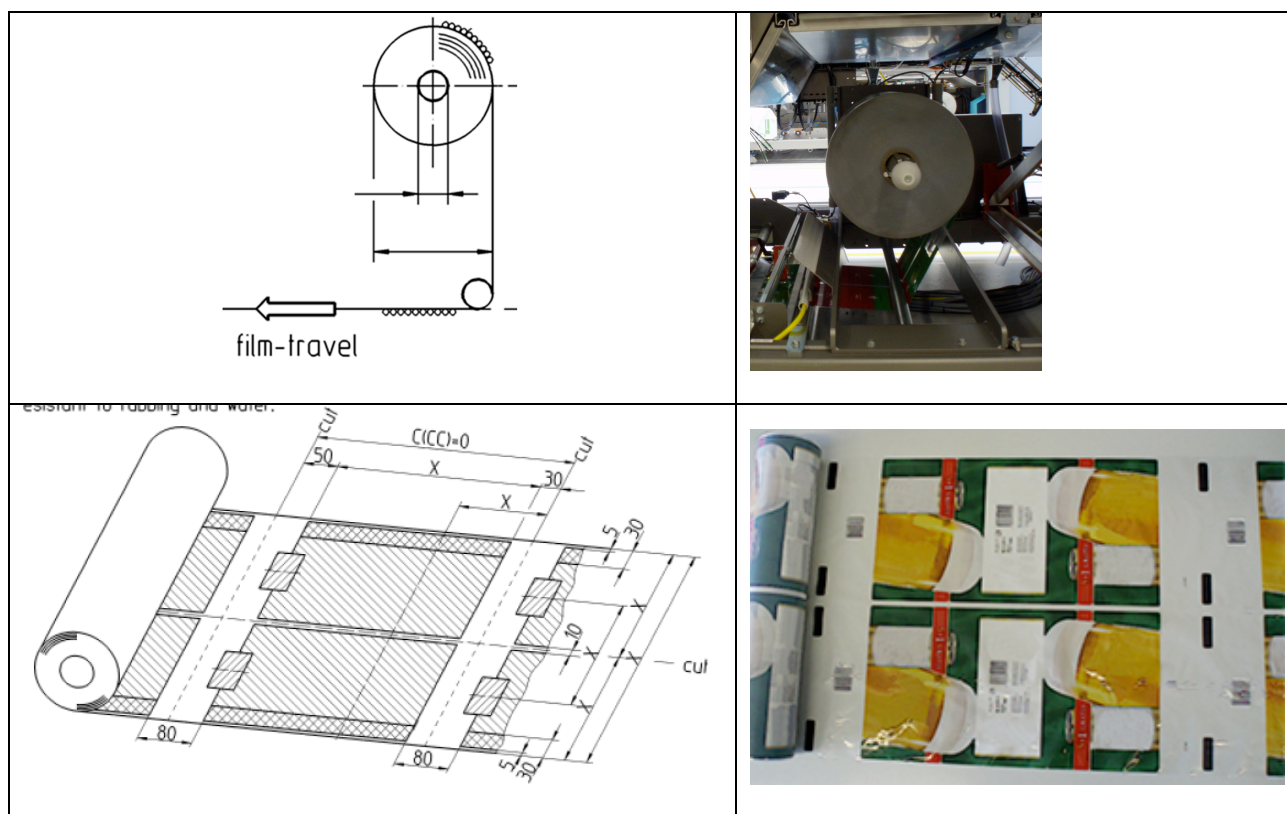


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## 2.4. Geometrical and dimensional accuracy

Criteria	Symbol	Unit
Film thickness	Th(f)	[ $\mu\text{m}$ ]
Max. width of film	W(f)	[mm]
Max. Diameter of film reel	D(r)	[mm]
Inner diameter of core	D(c)	[mm]
Conicity of the film reel	C(r)	[%]
Weight of the film reel	W(r)	[kg]
Straightness of film reel sides	S(r)	[mm]



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### 3. Physical properties

<b><u>Physical properties for shrink film</u></b>			
Criteria	Symbol	Remark	Unit
LDPE	LDPE	minimum percentage	%
LLDPE	LLDPE	maximal percentage	%
HDPE	HDPE	maximal percentage	%
Stretching	Stretch		(please specify)
Shrinkage values in Machine Direction	MD		%
Shrinkage values in Cross Direction	CD		%
Static charge	SC		kV
Shrink temperature / time	ST / St		°C / sec
Density of film	D(f)		g/cm <sup>3</sup>

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### 3.1. Storage and Handling conditions

The storage and handling shall never damage, soil or change the quality of the raw material.

In order to ensure optimal performance, certain precautions are necessary when storing shrink film prior to use:

<b><u>Recommended Storage conditions for shrink film</u></b>			
#	Requirement	Symbol	Possible consequence if requirement is not met / remarks
1	Shrink film reels have to be stored dust-free		Contaminated film
2	Direct UV radiation, extraneous odours or taints must be avoided during storage		Caps are not guaranteed to be odour- and taste- neutral
3	Avoid storage in areas of high humidity		Sealing and opening behaviour will be impaired
4	Film must be delivered carefully packed and the packaging must provide reliable protection against climatic influences, like temperature influences.		Sealing and opening behaviour will be impaired
5	During cold periods it is important that the film is conditioned for the specified conditioning time at application temperature prior to use.	cT at	This avoids application problems.
6	The application temperature of film must not differ significantly from recommended temperature (see data sheet issued by the film manufacturer)		Increasing of the fault and reject quota
7	The storage of film must be higher than their minimal storage time	min_st	Processing problems which can reduce performance
8	The storage of film must be shorter than their maximal shelf life time	max_st	Processing problems which can reduce performance
9	Apply first-in-first-out warehousing methods (FIFO)	FIFO	


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### 3.2. Processing and application

#	Requirement		Possible consequence if requirement is not met / Remarks
1	Containers have to be <b><u>clean</u></b>		
2	Containers have to be <b><u>dry</u></b>		- increased the energy requirements - negative influence on shrink results
3	Containers have to <b><u>withstand the energy</u></b> required for the Shrink process: temperature, amount of air, effective time) without damages		
4	Containers must stand stable enough		- The more contact surface between the products the higher the stability - The softer the containers the less stable the group
5	No draught i.e. caused by open doors		Reduction of tunnel temperature
6	Heavy pollution i.e. dust		Faults in film processing

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### 3.3. Application topics

Despite perfect machine function, the following conditions can occur at the shrink packs in practice. They do not represent imperfections caused by the machine.

#### 3.3.1. Deformations and Wrinkles

Deformations and wrinkles due to the product contour cannot be excluded in certain areas of the packs.

##### Compact, less contoured products like cans

Formation of slight wrinkles in the side areas at the film eye      Deformation of the print due to product contour




##### Slim, more contoured products like glass bottles

Formation of wrinkles in the side areas at the film eye and in the area of the caps      Deformation of the print due to product contour, in unfavorable positions the bar code can become unreadable.

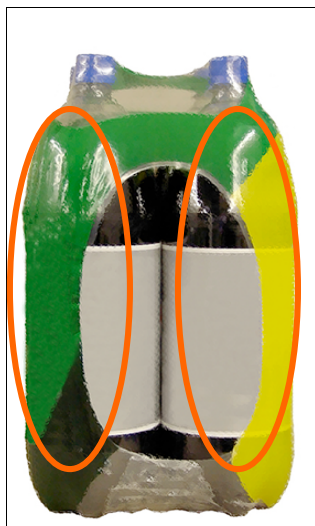


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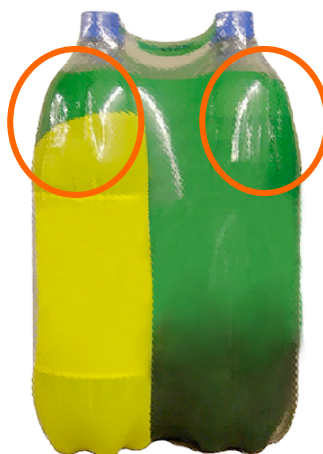
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### Very high, more contoured products like PET bottles

Formation of wrinkles in the side areas at the film eye



Formation of wrinkles in the upper area of the products due to the product contour




### Very high, more contoured products like PET bottles, particularly in case of short product groups in MD



Formation of wrinkles in the side areas at the film eye, particularly at the upper round contour.




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### 3.3.2. Defects at products and film, if these do not withstand the required shrink energy

Film	
Cracks in the color of the film occur, if the stretching ability of the print medium is insufficient.	
Holes in the film sleeves occur, if the sleeve is too thin, if the sleeve material is not suitable, or if the sleeve is not close fitting on the product.	

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## PET Bottles

Dents at the products occur, if the material of the vessel (PET bottles) is too thin



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### 3.3.3. Defects which can be caused by the state of the product or the product group

Wet bottles	
<p>Extreme formation of wrinkles due to wet bottles.</p>	

Large product groups	
<p>Reduced stability of the product group, if large container groups are wrapped in film only. Container move out of the group</p>	

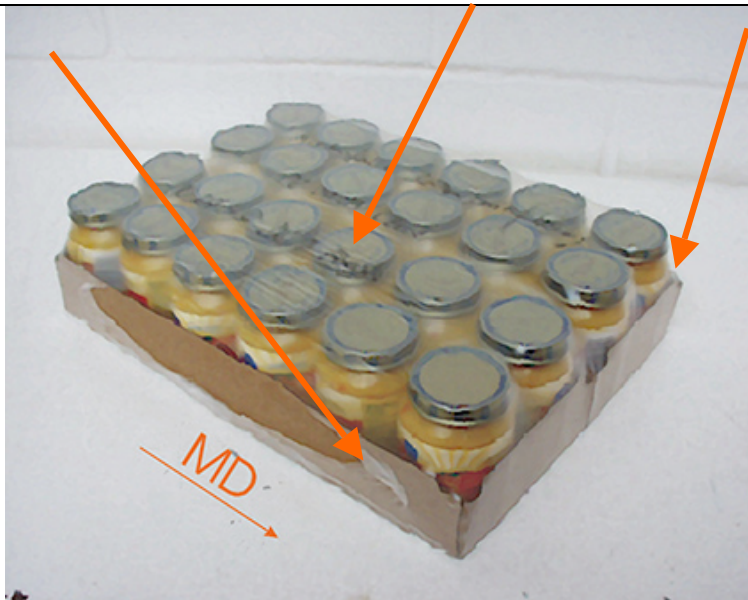
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### Others


- Reduced quality of the shrink results for long product groups in machine direction, and damages caused to the film by sharp corners and edges of the carrier material (tray or pad)
- Increased formation of wrinkles at the shrink eye, possibly reduced stability; possibly damages caused to the film.






- Unfavourable can rims climb on top of each other




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<b>Stability of the group</b>	
Reduced stability of the product group due to soft products, or due to vessels which were filled without pressure, or due to insufficient contact among the products.	
<b>soft, without pressure</b>	<b>Insufficient contact</b>
	

<b>Air Bubbles</b>	
Formation of air bubbles under the film, at the top of the packs, because the air cannot escape, when wrapping closed cartons in film	
<p>Air trapped under the film, because the edges are impervious.</p> <p>In this case it is recommended to use perforated film.</p>	

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## 5. Appendix: Table with Technical data

Criteria	Symbol	Value	Unit	Tolerance	Unit	Remark
Film thickness	Th(f)		μm		μm	Common practice between 30μm and 80μm.  The film thickness must be selected carefully depending on the weight of the formation.
Max. width of film	W(f)		mm		mm	
Max. Diameter of film reel	D(r)		mm		mm	
Inner diameter of core	D(c)		mm		mm	
Conicity of the film reel	Y(r)		%		%	
Weight of the film reel	W(r)		kg		kg	
Straightness of film reel sides	S(r)		mm			
Material 1	LDPE		min%		%	
Material 2	LLDPE		max%		%	
Material 3	HLDPE		max%		%	
Stretching	Stretch		(Please specify)			Common practice : biaxial
Shrinkage values in Machine Direction	MD		%			Common practice 60% - 80%
Shrinkage values in Cross Direction	CD		%			Common practice 10% - 40%
Static charge	SC		kV			
Shrink temperature / Shrink time	ST / St		°C / sec			
Density of film	D(f)		g/cm <sup>3</sup>			
conditioning time	cT		h			Common practice: 48h
application temperature	aT		°C		°C	
Minimal storage time	min_st		week			Common practice: 2 weeks
Maximal shelf life time	max_st		month			Common practice: 12 months

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