Tetra Pak Aseptic Package Integrity

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Aseptic Packaging

Definition:

“Hermetically sealed to prevent re-infection”
Tetra Brik Aseptic®

1. Polyethylene
   Protection against outside moisture

2. Board
   Stability

3. Polyethylene
   Adhesion layer

4. Aluminium Foil
   Oxygen, flavor and light barrier

5. Polyethylene
   Adhesion layer

6. Polyethylene
   Seals in the liquid
Barrier Properties

Product

Moisture

Light

AIR

Microorganisms

Sensory + nutritional attributes

Odors

Product

Public

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Longitudinal Strip

MPM Strip
Making A Seal

All Seals are Plastic to Plastic

- **HEAT** - Melt the layers of plastic
- **PRESSURE** - Press the two surfaces together under force until the molten plastic layers become one
- **TIME** – Time that the jaws are in contact
- **COOLING** - Allow the molten plastic pool (the seal) time to cool before it is exposed to mechanical forces.
Package Integrity Tests

► Transversal Sealing
► Longitudinal Sealing
► Inside Layer Ruptures
► Pull Tab
► Package Forming
Package Integrity Tests

► Transversal Sealing
  – Tear Down Test / Accurate Check
  – Package Dissolving & Red Ink

► Longitudinal Sealing

► Inside Layer Ruptures

► Pull Tab

► Package Forming
Transversal Seal Evaluation
Tear Down Test

► MTD1201 (BoC) & OM

What will be revealed:
– Rupturing of the material layers
– Consistency of the Seal quality

Specific Tools
– Stretch/Seal Pliers
– 10x magnifier with 0.2mm divisions
  (preferably illuminated)

Method
– TAKE two sample packages
– EMPTY packages of product
– CUT off the top and bottom Transversal Seals
– CUT no more than 1mm off the ends of the seals
– USE the Stretch Pliers, and (if necessary) the magnifier, to evaluate the seal quality
TS Teardown Test
TS Teardown Test

Plastic lumps/Ridge

Cold Channel
Transversal Seal Evaluation
Package Digestion & Red Ink

► MTD1208 (BoC) & OM

What will be revealed:
– Heat distribution along the TS
– TS tightness using red ink

Specific Tools
– Acid or Alkaline Dissolving Agent
– 10x or more magnifier with at least 0.2mm divisions (preferably illuminated)
– Red Ink

Method
– PREPARE the packages for digestion (BoC)
– DISSOLVE the packages using an acid or alkaline solution
– DRY the digested packs completely
– PUT SOME RED INK with a plastic pipette and allow to dry
– EVALUATE seal quality according to the BoC
Critical Measurement Parameters (BoC)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Acceptable (mm)</th>
<th>NOT Acceptable (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>B</td>
<td>≥ 0.2</td>
<td>&lt; 0.2</td>
</tr>
<tr>
<td>C</td>
<td>≥ 1</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>D</td>
<td>≥ 1</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>

Length = 1.59 mm

Length = 0.41 mm
Good Seal

► Sealing is smooth and even
► Appearance of bubbles is absent/minimal
► No red dye leak
Defective Seal

► Plastic Lumps on 2 areas of the TS
Defective Seal

- Large, numerous bubbles and ridge breaking indicative of a hot seal
Defective Seal

- Product residue (e.g. fruit fibers) trapped into the TS causing leakage

- Particles greater than 600µm (30 Mesh Sieve) present an increased risk of package integrity failures
Package Integrity Tests

Transversal Sealing

Longitudinal Sealing
- Tear Down Test / LS Tearing
- Red Ink Injection

Inside Layer Ruptures

Pull Tab

Package Forming
What will be revealed:
- Measurement of Air Gap
- Evaluation of Heat Zone & Strip position
- Evidence of Channels
- Rupturing of material layers

Specific Tools
- 10x magnifier with 0.2mm divisions (preferably illuminated)
- Zonoscope (90243-0203)
- Red ink solution (*saturated Erythrosine B in pure Isopropanol*)
- Vernier Caliper or ruler

Critical Issues
- **TAKE** two packages and unfold to expose LS, DO NOT crease the strip
- **MEASURE** the strip position and heat zone
- **INJECT** ink into one air gap, check for leaks through longitudinal creases
- **CUT** up the middle of the Strip remove overlap, pull off strip at 90°
- **EVALUATE** seal quality according to OM
Longitudinal Sealing

Tools:
- Zonoscope
  Heat distribution (hot air application)
- Manual tearing
  To verify tightness
- Red Ink and syringe
  To confirm tightness

Critical areas:
- Top and Bottom creases
- Sample preparation

Definition:
- The sealing is good if, when torn, it breaks in any layer EXCEPT where the sealing occurs
- No channels allowed
Longitudinal Seal Evaluation

No Channels allowed
Package Integrity Tests

☑️ Transversal Sealing
☑️ Longitudinal Sealing

► Inside Layer Ruptures
  - Visual Check
  - Conductivity Test
  - Red Ink Test
  - Copper Test

► Pull Tab

► Package Forming
Conductivity Test

MTD1203

What will be revealed:
– Detects contact with Aluminum layer

Specific Tools
– Conductivity meter 90243-110
– Salt bath (10g NaCl/ltr water)
– Glass or plastic beaker

Critical Issues
– EMPTY packages of product
– CUT packages in half but do not cut LS
– FOLD package at the LS
– PLACE package in Salt Bath
– POUR Salt solution into both halves of the package using beaker (Do not wet the cut edges)
– PLACE one probe in the bath and one in one half of the package
– CHECK for continuity, repeat for other half of the package

IF ANY SAMPLE SHOWS POSITIVE TO CONDUCTIVITY CONTINUE WITH RED INK TEST
How Conductivity Test Works

Zoom on the Longitudinal Sealing

1. Power source
2. Conductimeter
3. Electrode immersed in NaCl solution
4. Electrode immersed in NaCl solution
5. TBA package panels

- Inner PE layer
- Aluminium foil in contact with the outer NaCl solution

PE 2
PE 1
Aluminium-Foil Lamination PE
Paper Board
Outer PE
Red Ink Test

MTD1204

- Performed when package shows positive to conductivity

What will be revealed:
- Ruptures of the Microbiological barrier
- Pull-Tab integrity

Specific Tools
- Red ink solution (saturated Erythrosine B in pure Isopropanol)
- Pipette

Critical Issues
- **EMPTY** packages of product
- **DRY** packages of water (before introducing ink)
- **COVER** all critical spots
- **EXPOSURE** to the ink (5 minutes)
- **ASPIRATE** excess ink with pipette and dry with paper towel
How the Ink Test Works

This test indicates if there is any rupture through the inside layers of PE, the Aluminium Foil and the PE laminate.

WORKING PRINCIPLE

- The red ink is a visible, penetrating liquid.
- Due to the rupture through all the internal layers, the red ink will reach the paper board and, free from any barrier, will be visible from the outside.

*Note:* Tetra Pak Aseptic Definition: 
*Tightness* = **Red Ink Tightness**!
What is a “Tight Package”? 

Tetra Pak Aseptic Definition: 

Tightness = Red Ink Tightness!

<table>
<thead>
<tr>
<th>Depth of defect</th>
<th>Conductivity Test</th>
<th>Red Ink Test</th>
<th>Copper Test</th>
<th>Tight Package</th>
<th>Corrective actions needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>B</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>C</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

1. Outer coating  
2. Paperboard  
3. PE Lamination  
4. Al-foil  
5. Adhesion layer  
6. Inner layer (PE, m-PE)
## Conductivity and Ink test comparison

<table>
<thead>
<tr>
<th>Layer</th>
<th>Conductivity Test</th>
<th>Red ink</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE 2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PE 1</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Aluminium Foil</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Lamination PE</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Paper Board</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Outer PE</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Copper Test

MTD1207

Done when package shows positive to conductivity

What will be revealed:
  – Shows location of the contact to aluminum foil

Specific Tools
  – Copper Sulfate solution
  – Copper tester

Critical Issues
  – EMPTY packages of product
  – DRY packages of water (before introducing solution)
  – COVER all critical spots

Note!
If the red ink test (MTD1203) is going to be performed on the packages, do it before the copper test. The copper test can cause an enlargement of the cracks in the packaging material, compromising the results of the ink penetration.
Package Integrity Tests

- Transversal Sealing
- Longitudinal Sealing
- Inside Layer Ruptures

► Pull Tab
  - Visual Check
  - Red Ink Test

► Package Forming
Pulltab evaluation methods

- Polarized light (Zonoscope)
- Mechanical stress of the patch
- Red Ink tightness

Warning: if the patch is over-heated in the hole edge zone, some paper fibers can easily pierce it and cause pin holes (leakages)

MTD 0003
For PT21 0500

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Pulltab evaluation methods

- Polarized light (Zonoscope)
- Mechanical stress of the patch
- Red Ink tightness

MTD 0003
For PT21 0500

Leakages
Package Integrity Tests

- Transversal Sealing
- Longitudinal Sealing
- Inside Layer Ruptures
- Pull Tab
- Package Forming
Package Forming

Crease Lines
- a must for LS-sealing and a good package shape

LS-overlap
- a check of tube diameter and packaging material

Design
- a must for good machine efficiency

Volume (Weight)
- the package should contain what it’s labelled

Flap Sealing
- a must for package integrity and machine efficiency

Date Printing
- a legal demand

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Recommended TBA package integrity flow

Visual defect and design check (OM)

Transversal Seal Evaluation (MTD 1201, OM)

Longitudinal Seal Evaluation (MTD 1202, OM)

Pull-Tab Seal Evaluation (MTD 1211, OM)

Contact to Aluminium Foil (MTD 1203)

Result

Red Ink Leakage Evaluation (MTD 1204)

Result

Checks at machine

Checks at end of line

Unacceptable Package

Acceptable Package

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# TBA Package Integrity Schedule

<table>
<thead>
<tr>
<th>Method</th>
<th>Frequency</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transversal Seal By Teardown (MTD 1201)</td>
<td>&lt; 30 minutes, at setting &amp;</td>
<td>Determine adhesion quality</td>
</tr>
<tr>
<td></td>
<td>material change</td>
<td></td>
</tr>
<tr>
<td>Longitudinal Seal By Teardown (MTD 1202)</td>
<td>&lt; 30 minutes, at setting &amp;</td>
<td>Determine if strip fused to inner plastic layer (SA &amp; LS)</td>
</tr>
<tr>
<td></td>
<td>material change</td>
<td></td>
</tr>
<tr>
<td>Longitudinal Seal Observation zone (MTD 1202)</td>
<td>&lt; 30 minutes, at setting &amp;</td>
<td>Check heat zone, alignment heat on SA &amp; LS</td>
</tr>
<tr>
<td></td>
<td>material change</td>
<td></td>
</tr>
<tr>
<td>Longitudinal Seal with Red Ink (MTD 1202)</td>
<td>&lt; 30 minutes, at setting &amp;</td>
<td>Check for LS channels</td>
</tr>
<tr>
<td></td>
<td>material change</td>
<td></td>
</tr>
<tr>
<td>Pull Tab Evaluation (MTD 1211)</td>
<td>&lt; 30 minutes, at setting &amp;</td>
<td>Check pull tab seal alignment and seal quality</td>
</tr>
<tr>
<td></td>
<td>material change</td>
<td></td>
</tr>
<tr>
<td>Electrical conductivity Foil (MTD 1203)</td>
<td>Production Start &amp; &lt; 1 hour</td>
<td>Determine contact to aluminium layer by electrical conductivity</td>
</tr>
<tr>
<td>Red Ink Test (MTD 1204)</td>
<td>As indicated by Electrical</td>
<td>Determine contact to paper</td>
</tr>
<tr>
<td></td>
<td>Contact to Aluminum Foil</td>
<td></td>
</tr>
<tr>
<td>Exposure of Inner two plastic layers and Red</td>
<td>Troubleshooting or periodic</td>
<td>Give clear indication of TS and LS quality</td>
</tr>
<tr>
<td>Ink Test (MTD 1208)</td>
<td>evaluation</td>
<td></td>
</tr>
</tbody>
</table>

Conducted at Operation Level & Lab Level

Conducted at Operation Level or Lab Level on Distribution Packs

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Questions?