3-Piece Tinplate Aerosol Cans
Factors in Container Selection and The Manufacturing Process

Southern Aerosol Technical Association
Aerosol 101 – Three Piece Steel Cans
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Overview

- Factors and Test Methods - Container Selection
- Regulatory / USDOT Requirements
- Commercial Standards / CSPA
- Materials and the Can Manufacturing Process
Can Size and Style

- Aerosol Can Sizes
  - Sales Code Designation
    - Expresses can diameter (at doubleseam) X can height (doubleseam to doubleseam)
    - Three digit number
      - First digit = whole number of inches
      - Second two digits = 16th’s of an inch
    - Example: 211 x 604
      - Can Diameter = 2-11/16 inches
      - Can Height = 6-4/16 inches
Can Size and Style
Formula/Container Selection

- Solvent or water-based formula
- Typically
  - Solvent-based: plain (unlined) cans
  - Water-based: plain or lined cans
pH is a critical factor in corrosivity and when considering whether to employ a can lining

- pH > 7.0 recommended, > 8.0 even better
  - pH 7-9, consider lined cans
  - Linings often unnecessary and incompatible with more alkaline formulas
    - pH > 9 or 10, consider plain cans
- Consider adding corrosion inhibitors to combat liquid and/or vapor phase corrosion
To avoid product and container degradation, a variety of test methods are available to evaluate formula/container compatibility.

- Electrochemical Testing
- Testpacks / Can Stability
Several “accelerated” corrosion test methods are commonly used, often in combination
- Crevice cell, driven can cell, cyclic polarization, electrochemical impedance spectroscopy

Can predict the mode and severity of corrosion that is anticipated with a given formula

These are screening tools, not a replacement for testpacks

Quick indication of stability, reduce development time and expense wasted on failed testpacks
Testpacks / Can Stability

- Static storage of filled cans
- Cans stored at various controlled temperatures
- Opened and evaluated at specific intervals
- Best measure of product/container stability, but time consuming
Regulatory

- USDOT is the regulatory body for aerosols
- Primary Purpose - Safe shipment of filled cans
- Code of Federal Regulations (CFR)
  - CFR 49, §100 to 185
Regulatory

- Aerosol - USDOT Classification
- Three main groups, based on internal pressure of filled can at 130 F
  - Non-spec (2N)
  - 2P
  - 2Q
- Customer/Filler must determine which can spec is needed based on actual pressure @ 130F
### Regulatory

#### Overview: Non-Spec, 2P, & 2Q

<table>
<thead>
<tr>
<th></th>
<th>Non-Spec (2N)</th>
<th>DOT 2P</th>
<th>DOT 2Q</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Pressure-MAX</strong></td>
<td>140 psig.</td>
<td>160 psig.</td>
<td>180 psig.</td>
</tr>
<tr>
<td><strong>Buckle Strength-MIN</strong></td>
<td>140 psig.</td>
<td>160 psig.</td>
<td>180 psig.</td>
</tr>
<tr>
<td><strong>Burst Strength-MIN</strong></td>
<td>210 psig.</td>
<td>240 psig.</td>
<td>270 psig.</td>
</tr>
<tr>
<td><strong>Wall Thickness-MIN</strong></td>
<td>N/A</td>
<td>.007”</td>
<td>.008”</td>
</tr>
<tr>
<td><strong>Req’d Can Marking</strong></td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Pressure Testing</strong></td>
<td>N/A</td>
<td>1/25,000</td>
<td>1/25,000</td>
</tr>
</tbody>
</table>
Commercial Standards

- **CSPA Standards**
  - Covers the most common can sizes
  - Information for both straight-sided and necked-in cans
  - Dimensions typically given a letter designation, i.e. “K-dimension”
Commercial Standards
3-Piece Can Manufacturing

- Incoming Material
- Coil Cutting
- Coating
- Lithography
- End Manufacturing
- Can Assembly
Incoming Material

- **Electrolytic Tin Plate (ETP)**
  - Steel onto which a very thin layer of tin is electrolytically deposited

- **Base Box**
  - Unit of surface area = 31,360 in²

- **Basis Weight / Baseweight**
  - Expression of metal thickness as weight/SA (pounds per Base Box)
Incoming Material

- **Basis Weight (BW)**
  - Plate Thickness expressed in Pounds/Base Box
  - Calculation: \( BW \times 0.00011 = \text{Thickness (inches)} \)
  - Basis Weight Range for Aerosol Body Plate
    - 65# to 85#
  - Basis Weight Range for Aerosol End Plate
    - 100# to 135#
Temper: Measure of plate hardness

- Contributes to can strength
- Higher temper allows for use of lower basis weight, but offers reduced ductility

Temper Values:
- Single Reduced: T1 to T5
- Double Reduced: DR8 - DR9

Common tempers used in aerosol components:
- Bodyplate: DR8
- Domes/Tops: T2-T4
- Bottoms: T5
Incoming Material

- Tin Coating
  - Refers to the amount of tin distributed on both sides of the plate
  - 0.20 lb/BB typical for aerosol cans (20 ETP)
  - Differential Plate: 0.50/0.20 lbs/BB
    - 0.25 lb/BB on one side
    - 0.10 lb/BB on the other
Coil Line

- **Coil Cutting**
  - Typical Coil is 18,000 to 25,000 lbs
  - Ordered by width, cut to specific sheet length
Coating

- Interior Coatings
  - Common interior coating systems
    - Epoxy
    - Epoxy Phenolic
    - Vinyl
Coating

- Exterior Coatings
  - Size Coat, if necessary
  - White Coat
  - Varnish
Lithography

- **Offset Lithography**
  - Multiple color presses: allows for the application of two or more colors in one “pass”
  - Half-tones allow the appearance of shading and gradation of different colors for photo-quality decoration
  - Protective varnish applied over the decorated plate
  - Both conventional (temperature/heat cure) and UV-cured inks and varnishes are used in decorating aerosols
4-Color Process Lithography
Aerosol dome (top) manufacture

- Sheets are either fed directly or sheared into strips and fed into a punch press
- “Blank and Draw” - Blanks are punched from the strip, this initial draw forms a “cup”
End Manufacture

- Aerosol dome (top) manufacture
  - Cup is transferred through multi-stage conversion press
  - Cup is trimmed and critical dimensions are formed, including the one-inch curl
  - Cut-edge is curled
  - Compound is applied, this compound serves as a gasket in the doubleseam to ensure hermetic seal
End Manufacture
End Manufacture

- Aerosol Bottom Manufacture
  - Begins with sheared strips or sheets being fed into a punch press
  - Blank is punched and the bottom is formed
  - Cut-edge is curled
  - End compound is applied
Can Assembly

- **Slitter/Bodymaker**
  - Sheets of body plate are cut into individual body blanks. Size is dependent upon the diameter and height of the can.
  - Body blanks are transferred to bodymaker. The blank is flexed into a cylinder with a slight overlap for welding.
Can Assembly

- **Welder**
  - The overlapped portion of the cylinder is passed between two copper electrodes. Electrical current and pressure are applied to weld the two surfaces together.
Can Assembly

- Sideseam Stripe Application (optional)
  - A liquid or powder coating is applied to the uncoated metal adjacent to the weld. The cylinder is transported through a series of ovens to cure the stripe material
  - May be applied to interior and/or exterior of cylinder
Can Assembly

- **Necking (where applicable)**
  - The diameter of the cylinder at the top and bottom are reduced
  - Provides cosmetic appeal/shape

- **Flanging**
  - Each end of the cylinder is flanged, this will later become the body hook of finished doubleseam
Can Assembly
Can Assembly
Can Assembly

- Top and Bottom Doubleseam
  - One end is seamed on first, then the can is inverted and the other end is applied
  - Takes place in two operations
    - The body hook and cover hook are first formed with the end curl and cylinder flange
    - Pressure is applied around the seam to tighten and smooth
Can Assembly

Cross-Section of Doubleseam
Can Assembly

- Tester
  - Cans are fed through an in-line rotary air tester
  - The can is sealed in the pocket and internal pressure is applied (90 - 120 psig)
  - If a minimum volume of air displacement is detected, the can is rejected

- Packaging (palletizer)
Thank you

Questions?
Contact Kevin Richards at
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