Introduction to Aerosol Valve Technology

Presented by:
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Objective

- Provide a basic overview of aerosol valves:
  - Valve Types & Models
  - Available Components
  - Product Design
  - Valve Technology
Determine Valve Requirements

- **Determine the Type of Product:**
  - Space Spray
    - Air Freshener
    - Air Sanitizer
  - Surface Spray
    - Pan Spray
    - Cleaner
    - Pre-Wash
    - Disinfectant
    - Polish
  - Starch
  - Paint
  - Insect Repellant
  - Insecticide
  - Lubricant
  - Industrial
- **Personal Care**
  - Body Spray/Deodorant
  - Antiperspirant
  - Hair Spray
  - Shave Foam or Gel
- **Specialty Product**
  - Whipped Cream
  - Fogger
  - Tire Inflator
  - Gas Lighter Refill

- **Consider Spray Characteristics:**
  - Spray Rate
  - Spray Projection
  - Spray Pattern
  - Particle Size
  - Flammability
  - Cloggage Potential

- **Type & Amount of Propellant**
  - Hydrocarbon
    - Propane (A-108)
    - Butane
      - \(n\)-Butane (A-17)
      - \(i\)-butane (A-31)
    - Propane/Butane Blend (A-17 – A-108)
  - HFC
    - 134a (70 PSIG)
    - 152a (62 PSIG)
  - DME (63 PSIG)
  - Compressed Gas
    - \(CO_2\)
    - \(N_2O\)
    - \(N_2\)
    - Air

- **Select the Type of Valve**
Aerosol Valve Types

Female

Tilt / Toggle Action Valve

Vertical Action Valve

Metered Valve

20mm
Valve Component Nomenclature
Actuator

- Dispenses Product
- Provides a Controlled Spray
  - Consistent Spray Rate
    - Actuator or Insert Orifice Diameter
  - Maintains Desired Spray Pattern
    - Actuator or Insert Orifice
    - Mechanical Break-Up (MBU) Configuration
      - Doughnut
      - Full Round
      - Fan Spray
      - Stream / Jet
      - Foam or Mousse
  - Controls Particle Size
    - Actuator Orifice
    - Mechanical Break-Up (MBU) Configuration
Female Valve Actuators

- ‘Valve Stem’ is Tailpiece of Actuator
  - Provides for consumer cleaning
  - Slot Size in Tail Piece Helps Control Spray Rate
Tilt Action Valve Actuators

- Note either angled finger pad or vertical spray

- Available in:
  - One Piece Non-Mechanical Break-Up
  - Two Piece Non-Mechanical Break-Up
  - Two Piece Mechanical Break-Up
  - Extension Tube Actuators
Vertical Action Valve Actuators

- Note flat/horizontal finger pad
- Available in:
  - One Piece Non-Mechanical Break-Up
  - Two Piece Non-Mechanical Break-Up
  - Two Piece Mechanical Break-Up
  - Extension Tube Actuators
**Twist & Spray**

- Locking feature prevents accidental actuation
- No need for an overcap
- Tactile and Audible Queue for open/closed
Trigger Spray
Triggers
Horns
Spray-Through-Overcaps

- One-Piece Spray-Through-Overcaps
- IBS (Inserted Button System)
- Shrouds

- Finished Stem to Curl Critical
One-Piece Non-Mechanical Break-Up

- Orifices from 0.020” to 0.050”
- Tapers:
  - Standard
  - Straight
  - Reverse
  - Fan Spray (Not Shown Below)
- Available in most style actuators

*Standard* | *Straight* | *Reverse*
Inserts

- Provides Terminal Orifice for Two Piece Non-MB and MB Actuator Assemblies.
- Controls Spray Pattern:
  - Full Round
  - Doughnut
  - Jet / Stream
  - Fan Spray
- Wide Array of:
  - Orifices: from 0.011” to 0.035”
  - Land Lengths: from 0.010” to 0.057”
  - Counter Bores: Flat Back (no counter bore), small, medium, & large
  - Fan Spray Configuration (Non-MB)
- Some Inserts will Accept an Extension Tube
Two-Piece Non-Mechanical Break-Up
Two Piece Mechanical Break-Up

- MB Styles:
  - 2-Arm
  - 4-Arm Styles (shown)

- Channel Depths (CD) Available in:
  - 0.008” Soft Spray
  - 0.010” Fine Spray
  - 0.018” Medium Spray
  - 0.025” Course Spray
  - 0.035”
  - 0.045”
Mounting Cup

- **Materials:**
  - Tinplated Steel
  - Tin Free Steel
  - Aluminum

- **Coatings:**
  - Plain (tinplate only)
  - Epoxy
  - PET
  - Microflex Organosol (aluminum bottom only)

- **Gaskets:**
  - Laminate (polypropylene)
  - Cut Gasket (rubber)

- **Dimples:**
  - From 0.002” to 0.018” Diameter

- **Profiles:**
  - Conical or High Profile
  - Flat

- **Pedestal Crimp**
  - Holds the valve together
    - Produced by Valve Manufacturer

- **Can Crimp**
  - Provides a permanent gas tight seal to the aerosol container
    - Produced by Filler
Stem Gasket

Materials:
- Buna
- Neoprene
- Butyl
- Viton

Function:
- Provide a gas tight seal
- Remain effective over time
  - Exposure to product concentrate and propellant
  - Exposure to temperature changes

Sizes (Female Valve Only):
- High Swell (Larger Virgin Gasket I.D.)
- Over Sized (Smaller Virgin Gasket I.D.)

Assembled Gasket I.D. (Female Valve Only):
- Wide Range of Possible Specifications
Stem Gasket Testing

- Swell Testing
  - Seven and Thirty day test results
  - 3 to 10% Swell Preferred
  - Shrinkage or Excessive Swell will result in valve malfunction or dead valves

- Gasket Hardness Testing
  - Durometer measurements
  - Concurrent with Swell tests
  - Slight Softening is Preferred
  - Hardening or Excessive Softening will result in valve malfunction or dead valves

- Color Leaching
  - Concurrent with Swell Testing

- Product Stability Testing
  - Long-term weight loss evaluation
  - Long-term spray performance

- All Testing is performed for free by Summit
  - Even Small changes in formulation can have dramatic effects on gasket performance
    - If you change the formula, re-test the gasket!
Tilt Action Stems:

- Orifices:
  - Single, Double, and Triple Orifices Available
  - Range from 0.013” to 0.030” Diameter

Retention Ring
Available on Ribbed and Non-Ribbed Styles

Straight Walled

Ribbed

Undercut

Ringed
Vertical Action Stems:

- Orifices:
  - Single & Double Orifices Available
  - Range from 0.011” to 0.040” Diameter
  - High Flow: 2 x 0.035” x 0.090”
- Stem Shank Length
  - Customized for particular actuator applications
SV-92 Fast Fill Valve
Spray Rate vs Vapor Pressure - Constant Body Orifice Diameter

- $y = 10.184 \ln(x) + 7.2215$
- $y = 5.371 \ln(x) + 3.085$
- $y = 3.9678 \ln(x) + 1.9961$
- $y = 2.0278 \ln(x) + 1.4712$
- $y = 2.0278 \ln(x) + 1.1182$
- $y = 1.8834 \ln(x) + 1.0283$
- $y = 1.8834 \ln(x) + 0.7621$
- $y = 0.7665 \ln(x) + 0.4151$
- $y = 0.638 \ln(x) + 0.3585$

Vapor Pressure (PSIG)

Spray Rate (g/s)
Spring

- Holds the Valve Stem in the Closed Position
- High and Low Force Springs Available in all Valve Models
- Materials:
  - 302 Stainless Steel
  - Hard Drawn Steel (Female Valve Only)
Body / Spring Cup

- Restricted Entrance (RE) from 0.013” to 0.080”
- Vapor Tap (VT) from 0.008” to 0.044”
- Ball Valve (Spray-Anyway)
- Slotted Spring Cups for Inverted Use Only

• Available in a wide array of RE and VT combinations

Female Valve
Spring Cups

Pressure Fill Spring Cups

Outside Fit Dip Tube

Outside Fit Dip Tube

Inside Fit Dip Tube

Upright/Inverted
Upright / Inverted Spring Cup

Upright Use

Inverted Use
Dip Tubing

Materials:

- **LDPE**
  - For standard (outside fit) bodies and Upright/Inverted bodies

- **MDPE**
  - For standard (outside fit) bodies
  - For Greater Dip Tube Retention in Aggressive Formulations
    - Standard ID: 0.125"
    - Upright/Inverted body ID: 0.184"

- **Polypropylene**
  - for Capillary (inside fit) bodies
    - Capillary dip tube can also control Spray Rate
    - ID’s:
      - 0.042"
      - 0.050"
      - 0.062"
Valve Development

- Assistance in Valve Development for:
  - New Products
    - or
  - Match Spray Characteristics of Existing Products

  - Submit your product concentrate with a brief and let us do the work
    - or
  - Supply us with some general information and we will submit samples for your evaluation

- Full Valve Development Testing Performed By Summit Free of Charge:
  - Spray Rate
  - Spray Pattern
  - Particle Size
  - Gasket Testing
  - Long Term Weight Loss Evaluations
  - Flammability Evaluations
  - Cloggage Evaluations
  - DOC Evaluations
  - Etc.
Pedestal to Curl & Stem to Curl

- Important for use with Spray-Through-Overcaps, etc.
  - To ensure Actuator Stem Bore and Stem Mate and Function Together Properly

- Causes of Pedestal to Curl, and therefore Stem to Curl Rise:
  - Crimping
  - Gassing
  - Hot Tanking

- Conical vs. Flat Mounting Cups
Crimping

- Collets
  - Segments
    - Six vs. Eight
  - Segment Gaps
  - Closed Diameter

- Plungers
Crimping

- Valve Manufacturer will Supply Recommend Crimp Depth and Diameter specifications
  - Dependent on:
    - Valve Mounting Cup
      - Tinplate
      - Aluminum
    - Gasket Type:
      - Laminate
      - Lathe Cut Gasket
      - PE Sleeve
    - Can Type
      - Tinplate
      - Aluminum
      - Outside Curl
      - Inside Curl
Crimping

Crimp Diameter

Crimp Depth

- Specifications are +/-0.005
  - There should **NOT** be 0.010” in-piece variation
  - In-Piece variation should be limited to 0.004”
  - Segment to Segment variation should not exceed 0.002”
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