Achieving and Maintaining Double Seam Integrity

2012 IFTPS Symposium

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Dateline 1900 – United States

The first open-top sanitary style can is used. Within 20 years it becomes the universal metal food container.

Achieving and Maintaining Double Seam Integrity

Containers Come in Different Shapes and Sizes and Materials

Metal Containers with metal ends

Plastic Containers with metal ends

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And some Containers aren't even *round*!

Composite body with metal end

Container and End Structure

Achieving and Maintaining Double Seam Integrity

Container and End Structure

Flared end of the body cylinder,

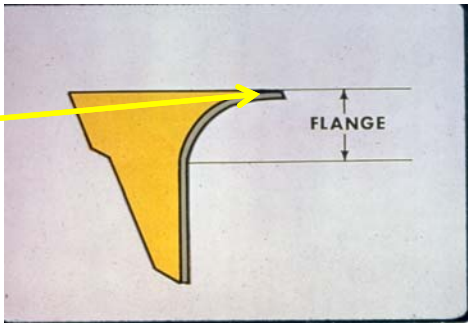
the flange,

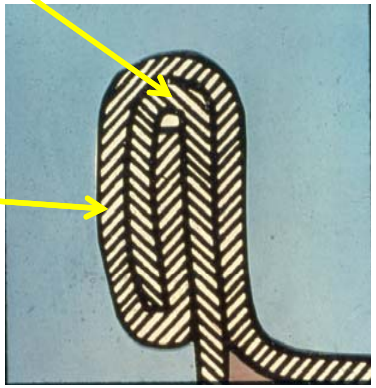
is formed into the Body Hook

and

becomes mechanically interlocked with the end curl that

forms the Cover Hook.





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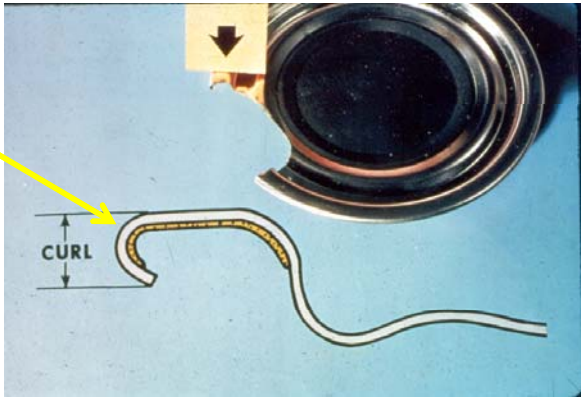
Container and End Structure

End curl forms the

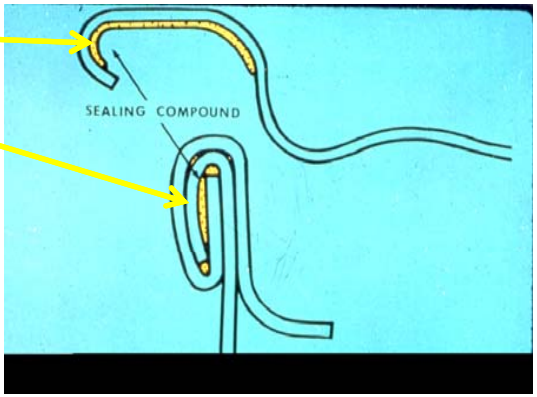
Cover Hook

which interlocks with the

Body Hook.



Sealing Compound location.



Double Seam Structure

The mechanically interlocked can body and end work together with sealing compound to form a

Hermetic Seam.

Hermetic Seam

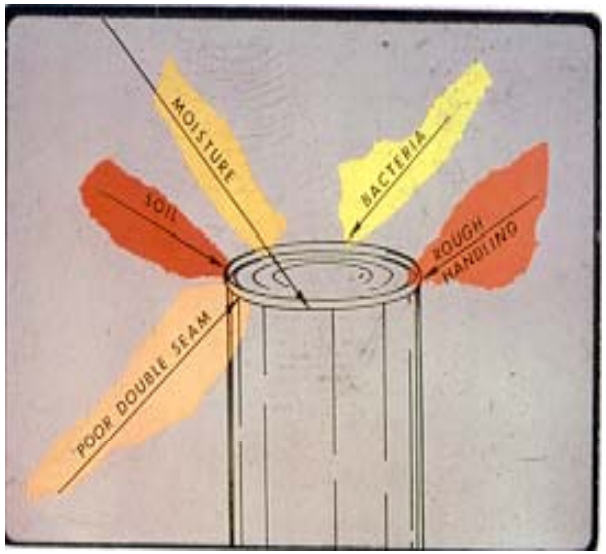
Container, end & seam **designed and intended to be secure against the entry of microorganisms; maintaining the commercial sterility of contents after thermal processing throughout distribution and shelf-life.**

Achieving and Maintaining Double Seam Integrity

Double Seam Structure

Poor seam integrity and/or rough handling can lead to product contamination by:

- Bacteria
- Moisture or cooling water
- Soil
- Air Ingress leading to vacuum loss



Achieving and Maintaining Double Seam Integrity

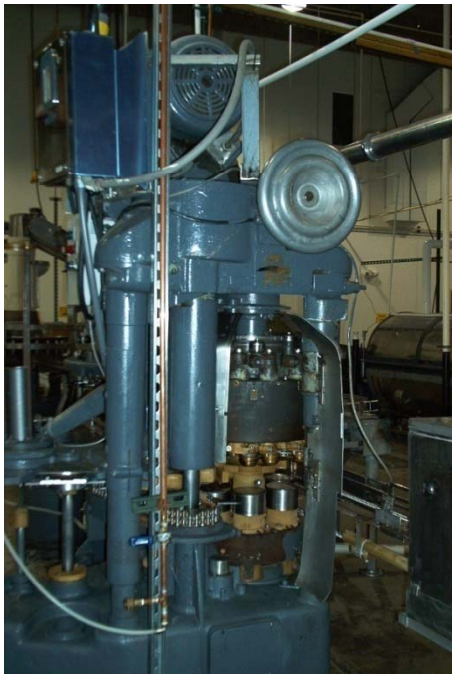
Double Seam Closing Machinery

Production Closing Machine

Single Head Closing Machine

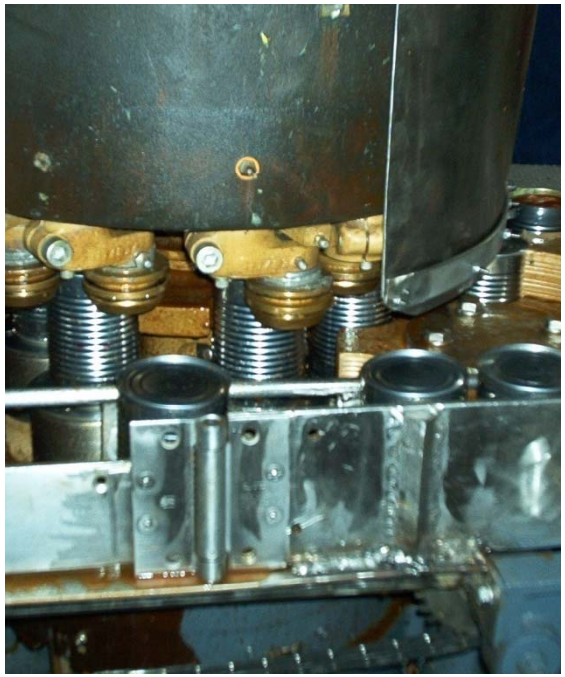
Achieving and Maintaining Double Seam Integrity

Double Seam Closing Machinery

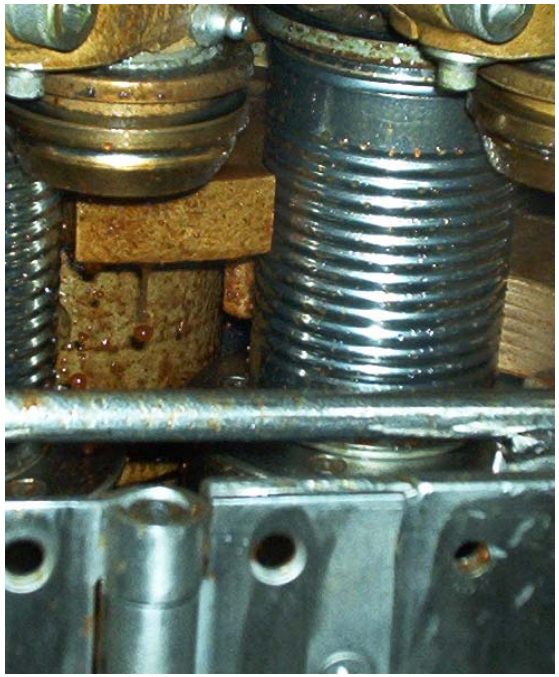


Production Double Seam Machine

(~ 500 CPM)



Cans entering (back), seamed, and exiting (foreground)



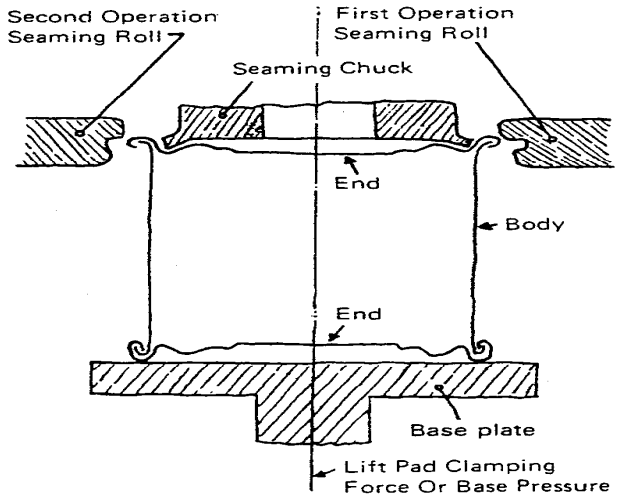
Close-up of can and seaming operation rollers

Achieving and Maintaining Double Seam Integrity

Closing Machine Operation

Basic Closing Machine components –

- Seaming Chuck
- 1st Operation Roll
- 2nd Operation Roll
- Base plate



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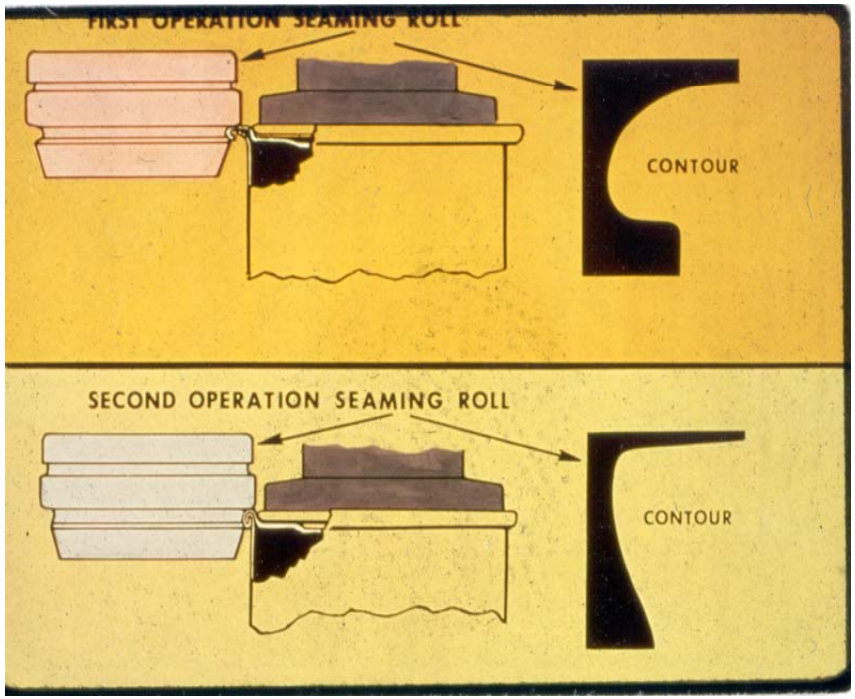
Closing Machine Operation

1st Operation Roll

2nd Operation Roll

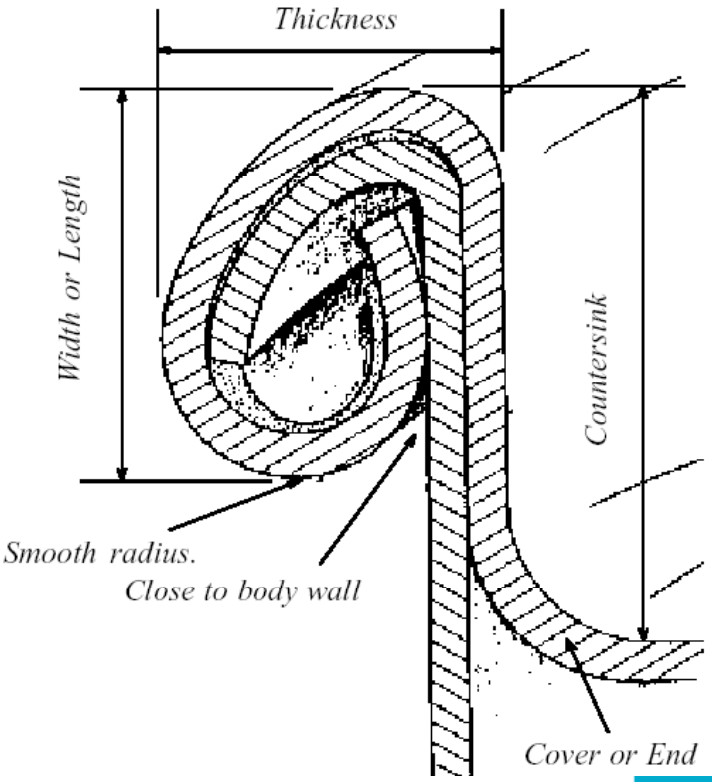


Achieving and Maintaining Double Seam Integrity

First Seaming Operation

First Seaming Operation –

- Must be formed correctly for second operation to finish the seam.
- Major key in controlling the Cover Hook.
- Should not be too loose or too tight.
- *Cannot* be corrected once formed.



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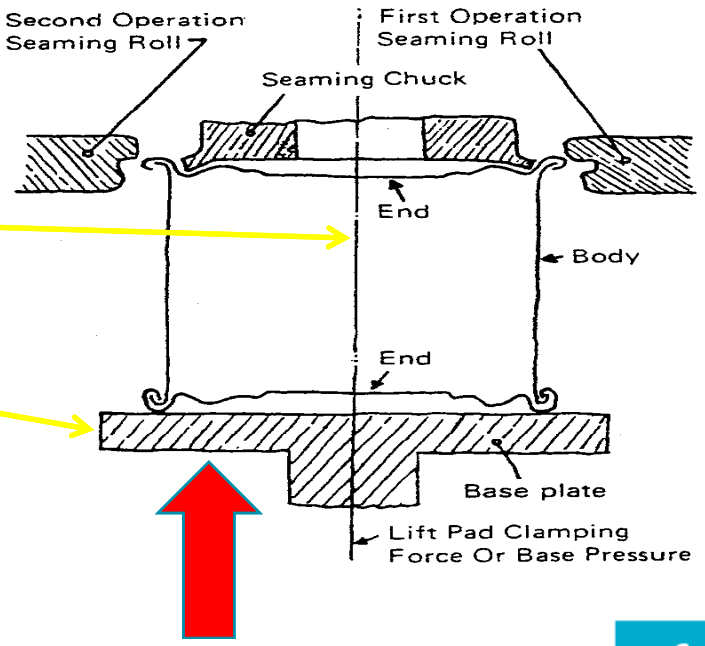
First Seaming Operation

First Operation will be properly formed if:

- Correct pin gauge height
- Correct base plate pressure



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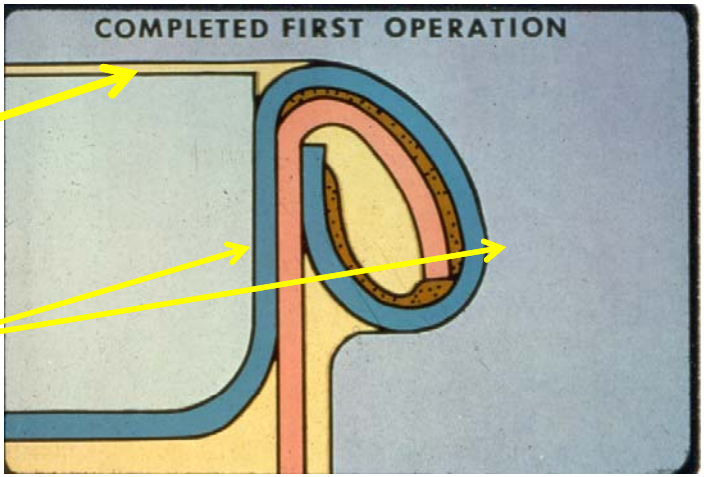
First Seaming Operation

First Operation will be properly formed if:

- Correct alignment of seaming roll to seaming chuck
- Correct tightness of 1st operation roll



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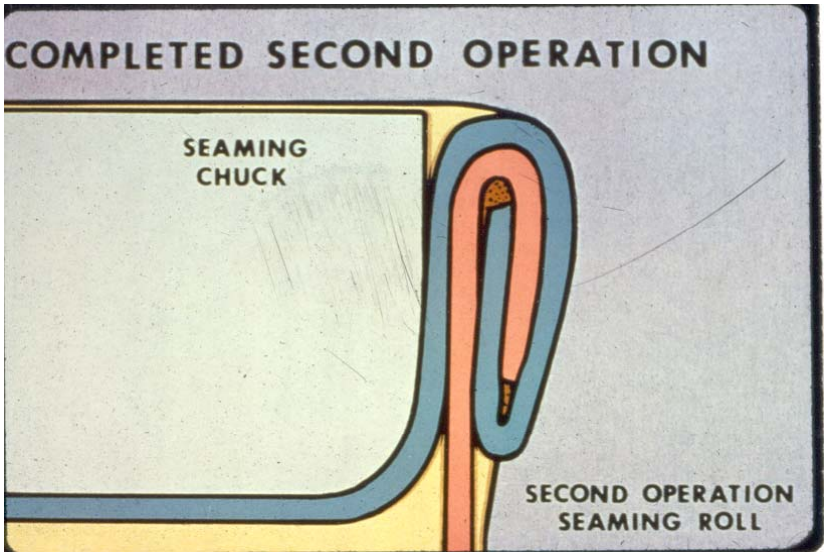
Second Seaming Operation

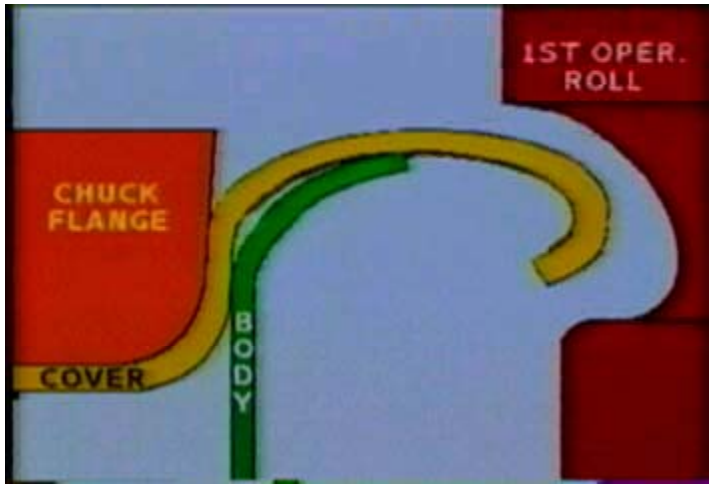
Second Operation seaming roll –

- Compresses the seam.
- Sealing compound fills seam voids not occupied by metal.
- Achieves finished double seam tightness.
- *Cannot* compensate for a poorly formed first operation.



Achieving and Maintaining Double Seam Integrity

Double Seam Formation in the Closing Machine

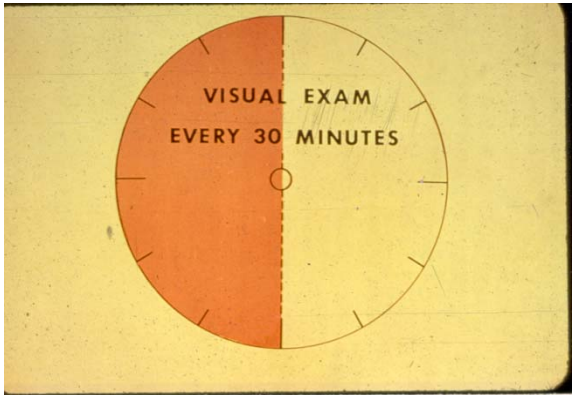


Evaluating Double Seams to Maintain Integrity

Achieving and Maintaining Double Seam Integrity

Visual Examinations - 21 CFR 113.60 (a)

Visual examinations are not to exceed 30 minutes of operation.



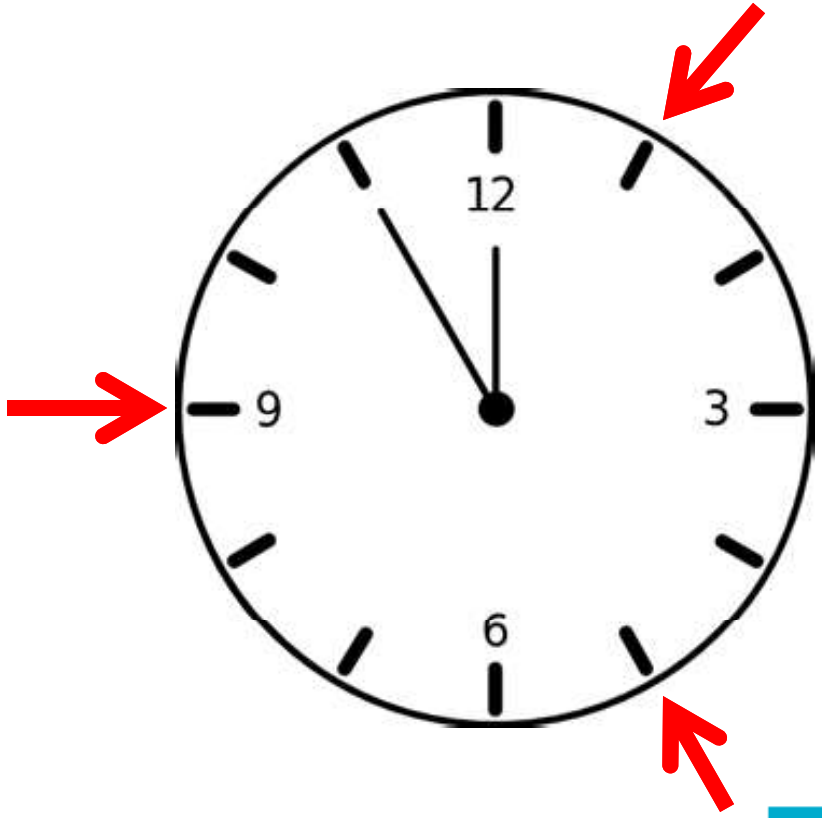
- One can from each seaming station or “head”.
- Observations and corrective actions shall be recorded.

Achieving and Maintaining Double Seam Integrity

Evaluation by Physical Inspection "Teardown"

21 CFR 113.60 (a)(1)

- Performed by a trained closure technician.
- Teardown examinations are to be made at intervals not to exceed four operating hours.
- Examination of packer's end using at least one can from each seaming station or "head."
- Measurements and any corrective actions taken shall be recorded.



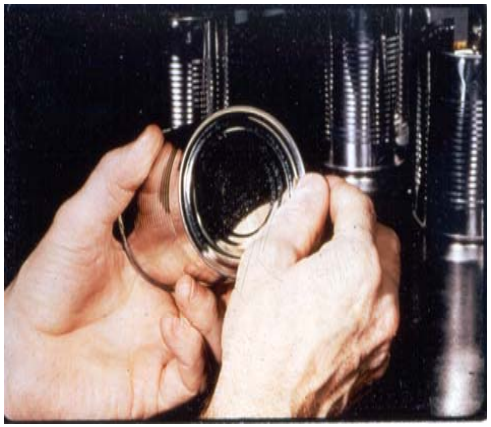
Achieving and Maintaining Double Seam Integrity

Double Seam Teardown Tools

- Countersink Gauge
- Seam micrometer
- Sanitary Can Opener
- No. 5 nippers or end cutters
- Optional equipment
  - Seam Saw
  - Seam Projector
  - Seam Scope

Achieving and Maintaining Double Seam Integrity

Visual and Physical Examinations



Visual Observations for External Defects and Measure External Dimensions

Remove End Center Panel with Sanitary Can Opener

Remove End Trim to Disengage Cover Hook from Body Hook

Achieving and Maintaining Double Seam Integrity

Required Double Seam Measurements – 21 CFR 113.60 (*a*) and (*b*)

Micrometer System (*a*)	
Required	**Optional**
Cover Hook Body Hook Seam Length (aka Width or Height) Seam Thickness Tightness (Examination for wrinkles)	Overlap (by calculation) Countersink
Seam Scope System (*b*)	
Body Hook Overlap Seam Thickness (by micrometer) Tightness (Examination for wrinkles)	Seam Length (aka Width or Height) Cover Hook Countersink

Achieving and Maintaining Double Seam Integrity

External Seam Measurements

Countersink Depth

- Distance from the top of the double seam to the end panel adjacent to the inside wall.

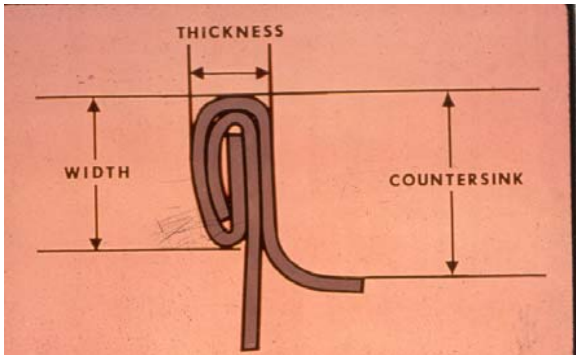
Seam Thickness

- Maximum distance measured across the seam.

Seam Length (aka width or height)

- Dimension measured from the top to the bottom of the seam.

Measure at least 3 points around can circumference.



Achieving and Maintaining Double Seam Integrity

Internal Seam Measurements

Body Hook

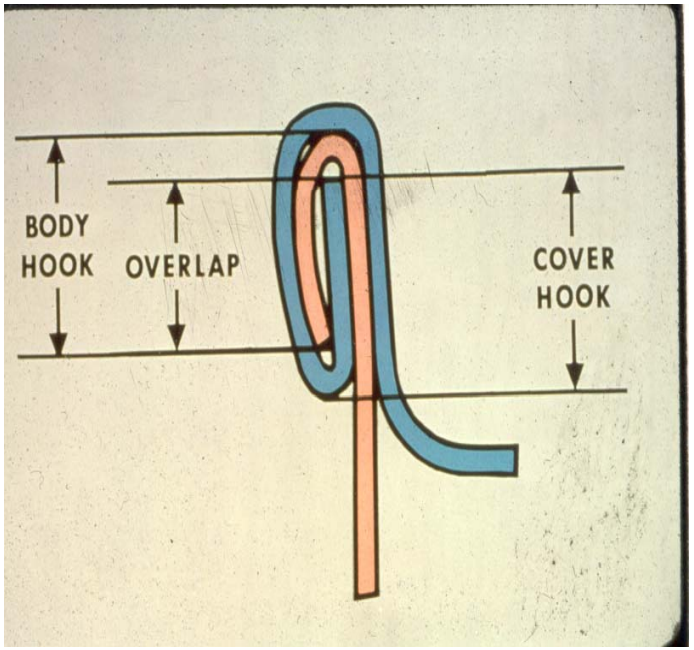
- Originally the can flange

Cover Hook

- Originally the end curl

Overlap (calculated or measured)

- Measure of interlock between Body Hook and Cover Hook



Achieving and Maintaining Double Seam Integrity

Calculating Double Seam Overlap

Overlap = CH + BH + ET – SL

where:

CH = Cover Hook Length

BH = Body Hook Length

ET = End Thickness (assume 0.010”)

SL = Seam Length (aka width or height)

Recommend using the average of 3 readings for Cover Hook, Body Hook & Seam Length.

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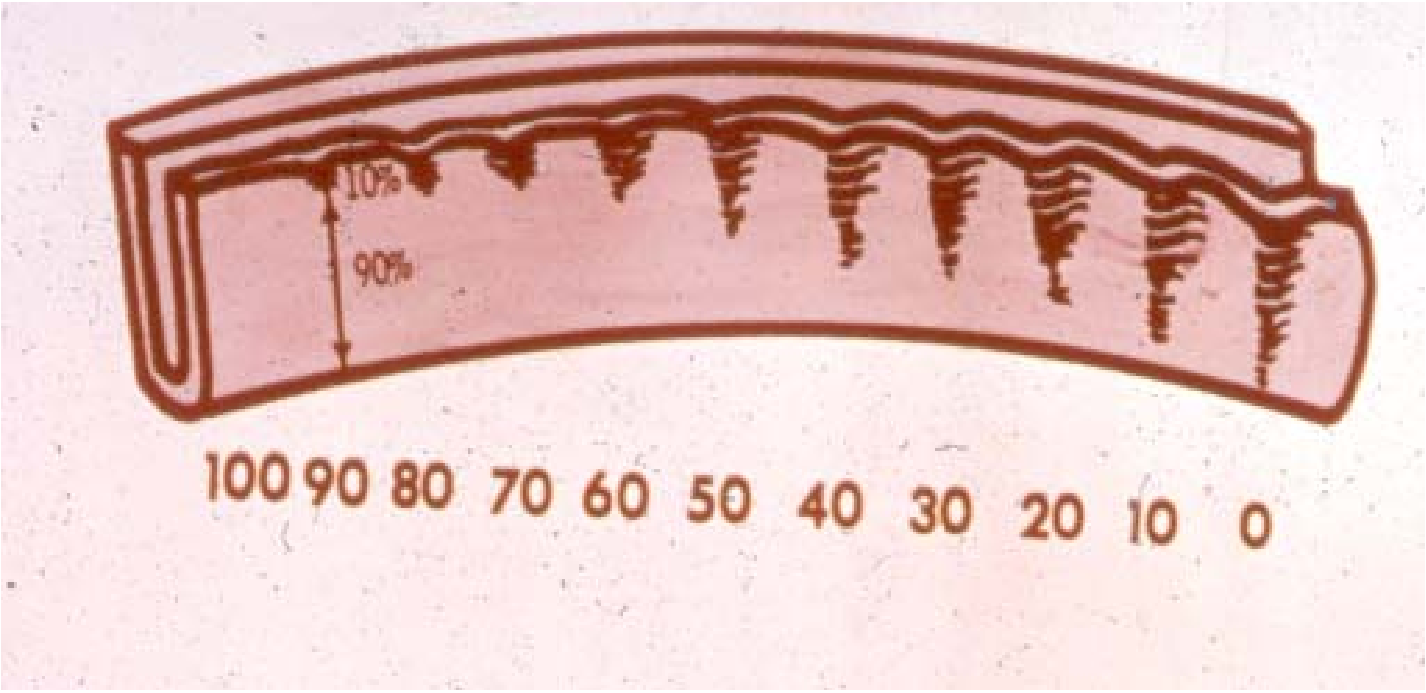
Tightness Rating Visual Evaluation (Non-wrinkle Percentage)

Cover Hook



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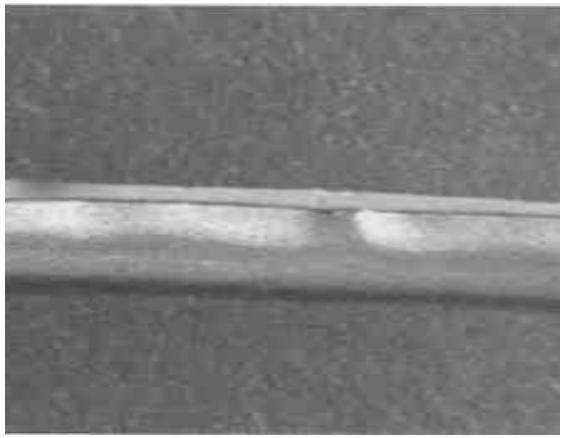
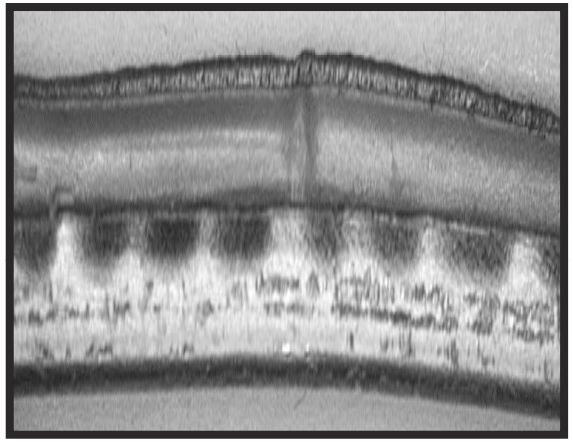
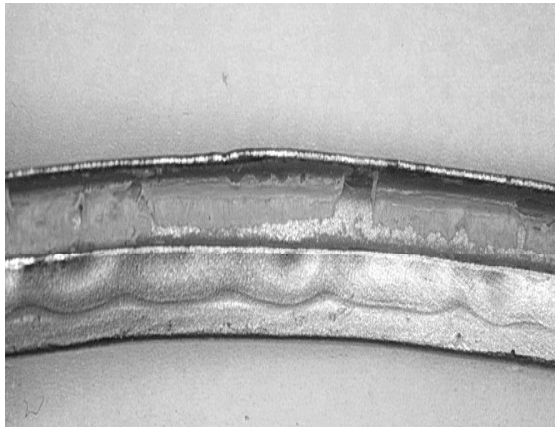
Percent of Tightness Rating



50% Tightness Rating
(50% Wrinkled Cover Hook)



70% Tightness Rating
(30% Wrinkled Cover Hook)



100% Tightness Rating
(Compound Impression)

Achieving and Maintaining Double Seam Integrity

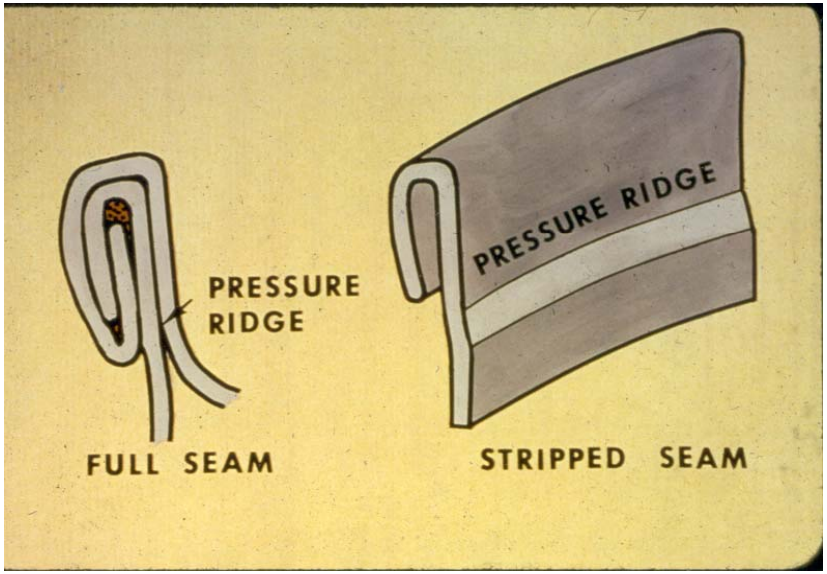
Pressure Ridge – Another Indicator of Tightness

Should be –

- Smooth
- Continuous
- Clearly Visible

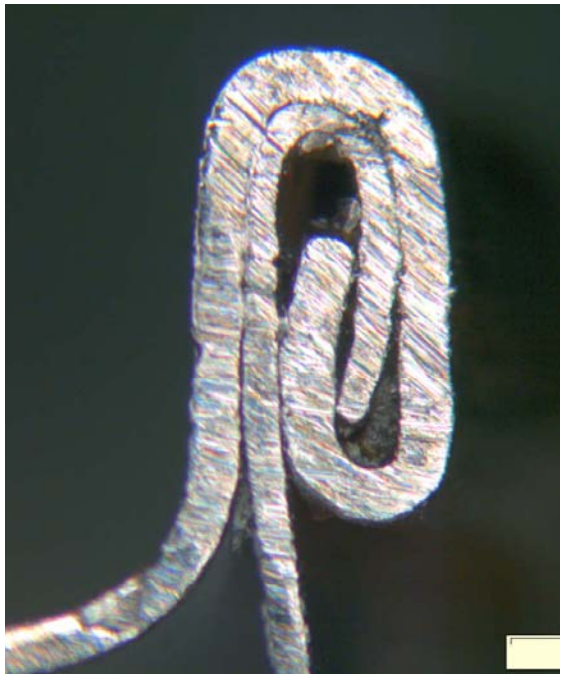
Should *Not* –

- Severe or Deep
- Fracture the Coating
- Fracture Body Sidewall



Achieving and Maintaining Double Seam Integrity

Seam Tightness via Cross-section View



Loose Seam

Normal Seam

Tight Seam

Achieving and Maintaining Double Seam Integrity

An Over Tight Seam – “T” Tight (Too Tight)

Probable Cause –

Improper Second Operation seaming roll setting

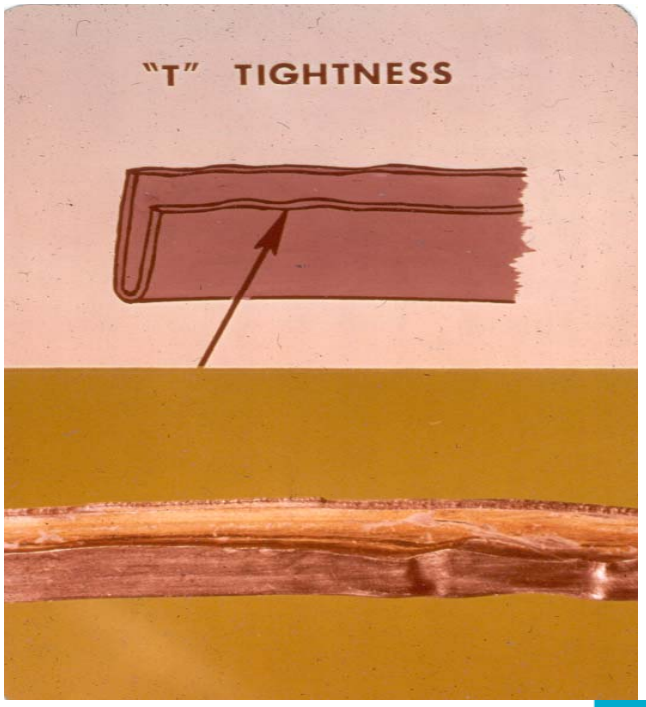
Resulting Problems –

Cut over

Cut seam

Distortion of internal seam components

Sealing compound squeeze-out



Achieving and Maintaining Double Seam Integrity

Recording Double Seam Measurements

Written Record of Results

- Visual examination and Dimensional measurements.
- Any corrective actions taken.
- Frequency –
  - At the beginning of production, then
    - Visual examination – every 30 minutes
    - Dimensional measurements – every 4 hours
  - Immediately following a severe jam,
  - After adjustments or changes to the seaming machinery.

Achieving and Maintaining Double Seam Integrity

Recording Double Seam Measurements

Analysis of Dimensional Measurements

- Compare measurements to guidelines.
- Repeat sampling if measurements or visual observations are unsatisfactory.
- If same unsatisfactory condition is found in a repeat sample then,
  - Decide when it is appropriate to make adjustments:
    - Immediately stop production – “Shut down to correct,”
    - Continue operating until the end of the production period, or
    - Continue until next normal down-time.

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Recording Double Seam Measurements

Examples of possible “shut down to correct” situations

- Measurement *below* minimum overlap or tightness.
- Any seam fracture.
- Severe droop *at the juncture* (three-piece cans only).
- False seam.
- Evidence of Skidding or Dead Head (partial seam achieved).
- Fracture of embossed end code.

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Double Seam Defects

External Visual Defects

Internal Structural Defects

Specification Infractions

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Double Seam Defects

Visual External Seam Defects (17)

- Compound Squeeze
- Fractured Seam – Sharp Seam and Cut-over Seam
- Droops and “Vees”
- False Seam and Knock-down Flange
- Damaged end cover curl
- Dead Head, Spinner, Skidder
- Miss-assembly and Can Body Buckling
- Broken chuck causing end damage
- Fracture at end code embossing
- Cocked Can Body – body on empty three-piece can miss-aligned
- Mushroomed Flange – on empty can

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Double Seam Defects

Internal Seam Defects (14)

- Jumped seam at juncture (three-piece can)
- Tight or loose first operation
- Excessively deep counter-sink
- Long or short seam length
- Long or short body hook
- Long or short cover hook
- Seam bump or sprung seam
- Hair-pinning of body hook (aka “R-ing”)
- Seam gap – excessive open space between body hook and cover hook at upper radius

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Double Seam Defects

Specification Infractions

One or more dimensional measurement is outside the recommended guideline.

- Seam thickness
- Seam length (aka width or height)
- Countersink
- Body hook
- Cover hook
- Overlap – calculated or optically measured
- Tightness rating

Achieving and Maintaining Double Seam Integrity
Conclusion

GOOD QUALITY CONTAINER & END

PROPER EQUIPMENT SET-UP

MEASUREMENT & ANALYSIS

+

JUDGEMENT

Achieving and Maintaining Double Seam Integrity

Further Resources

- Darex (W. R. Grace), "Evaluating and Controlling Double Seams", 2nd edition, 2002.
- CMC-Kuhnke, Inc. "Double Seam Troubleshooting Guide" at www.doubleseam.com, 2011.
- Your friendly *Can Supplier*.

Thank You

Questions ?