Module 16. Closures for Metal Containers

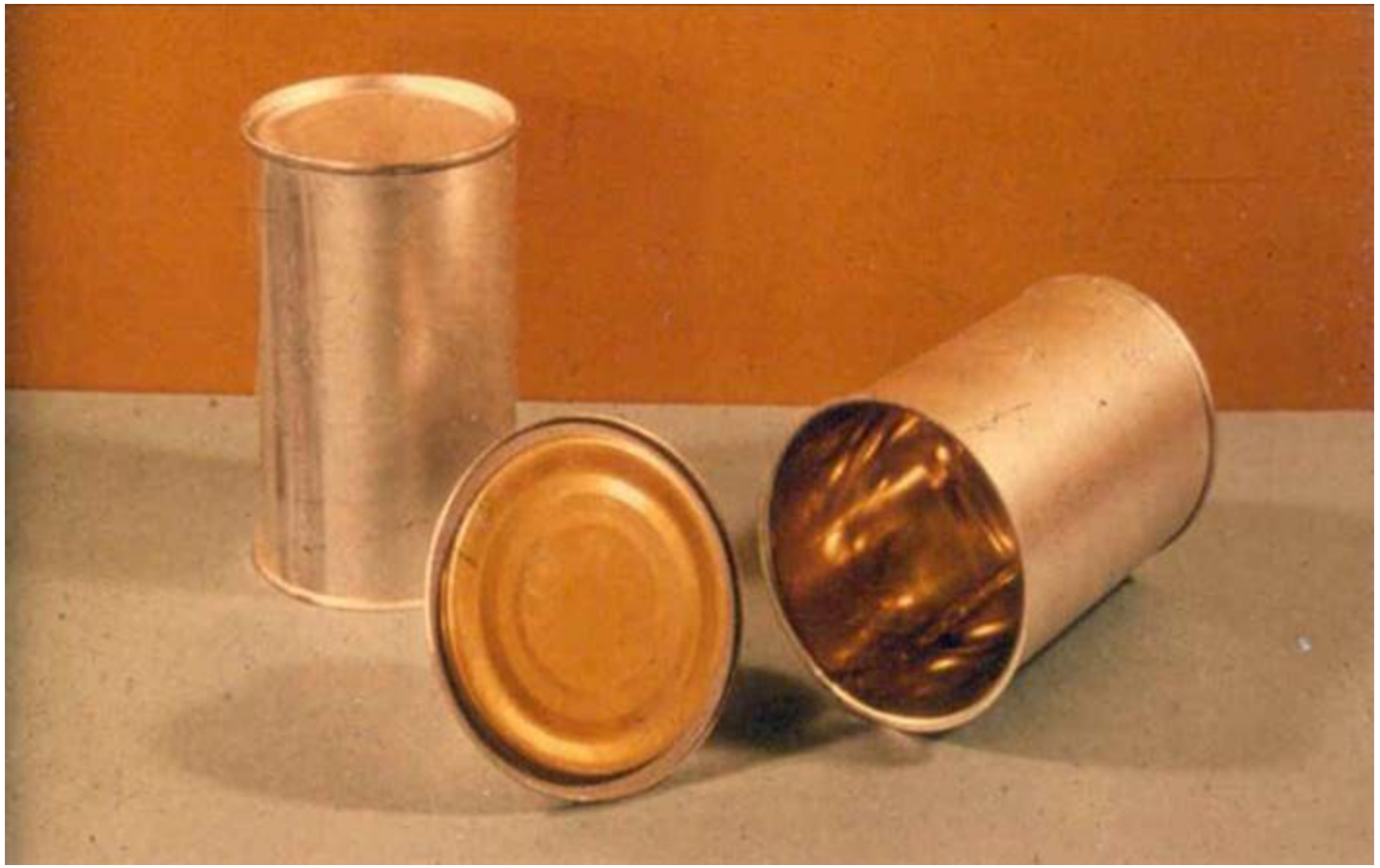
Thermal Processing for Meat and Poultry Products Training

USDA

Container Integrity
Primary Intent Of Part 9 CFR 431.2

- To prevent product adulteration due to leakage during cooling and handling after retorting.

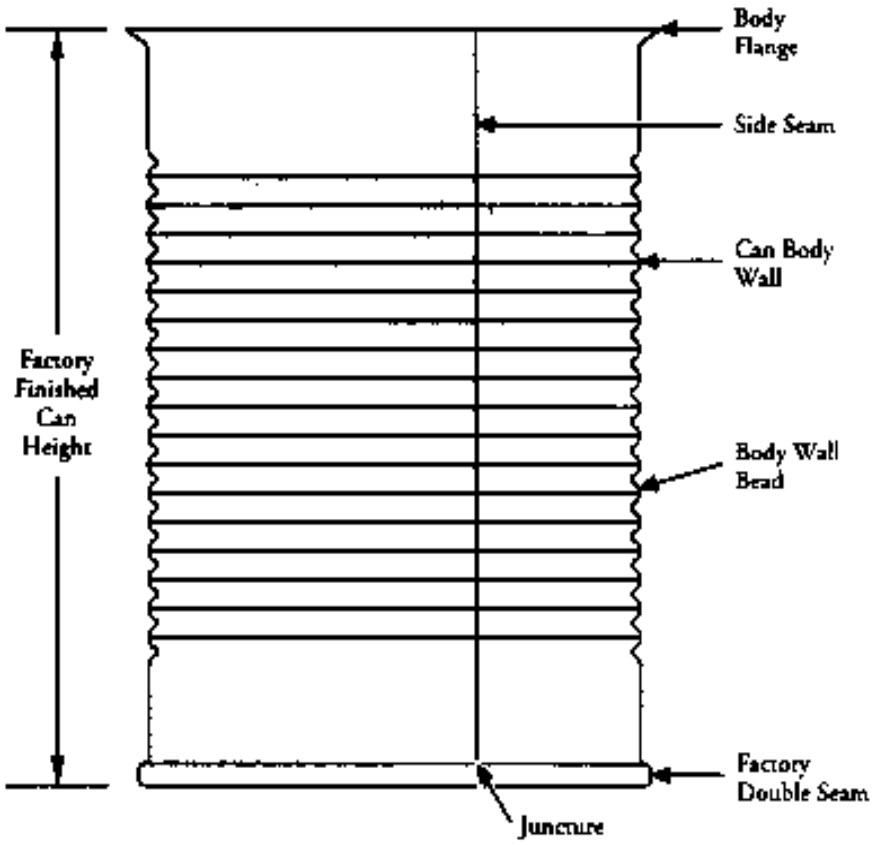
Sanitary (Open Top) Can



Can Manufacturing Plate

- Tin coated steel plate
- Tin free steel plate
- Temper indicates the hardness of the metal plate; T1 = very soft, T5 = very hard
- Base weight = plate thickness/.00011
- Plate characteristics affect double seam characteristics

Factory Finished Can

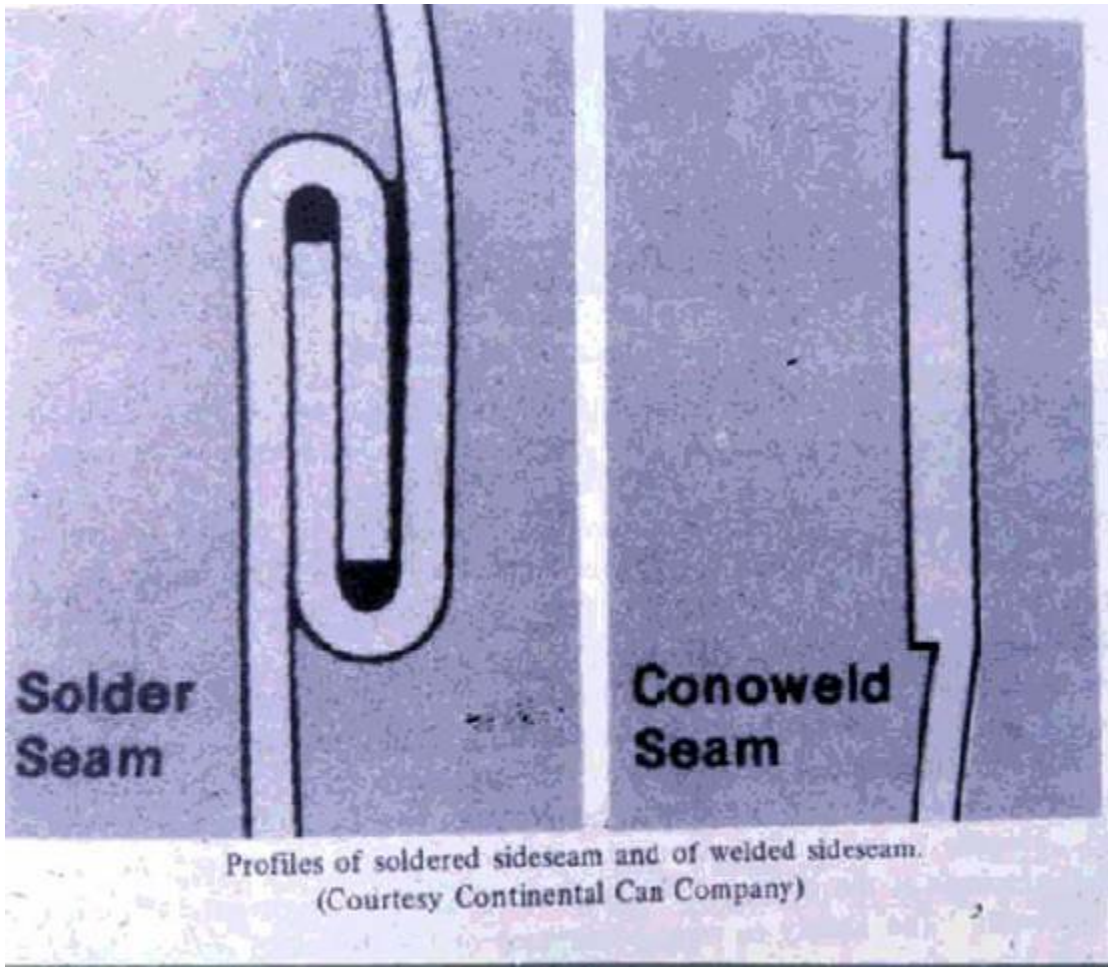


Factory Finished Can
as received by our customers.

Metal Cans

3-PIECE SOLDERED 3-PIECE WELDED 2 PIECE DRAWN

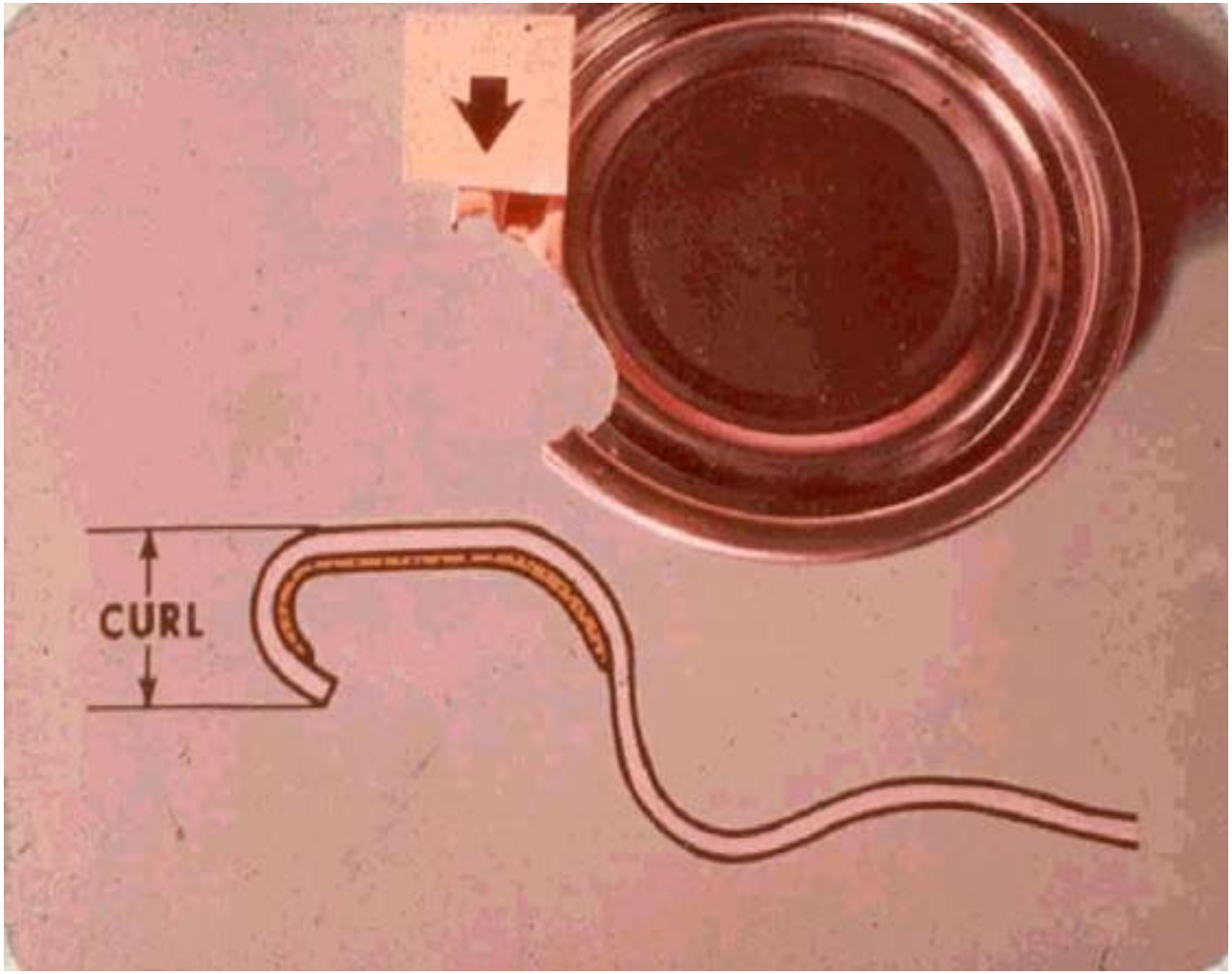
Seams



Profiles of soldered sideseam and of welded sideseam.
(Courtesy Continental Can Company)

Half-Size Seam Table Tray

End (Lid) Curl

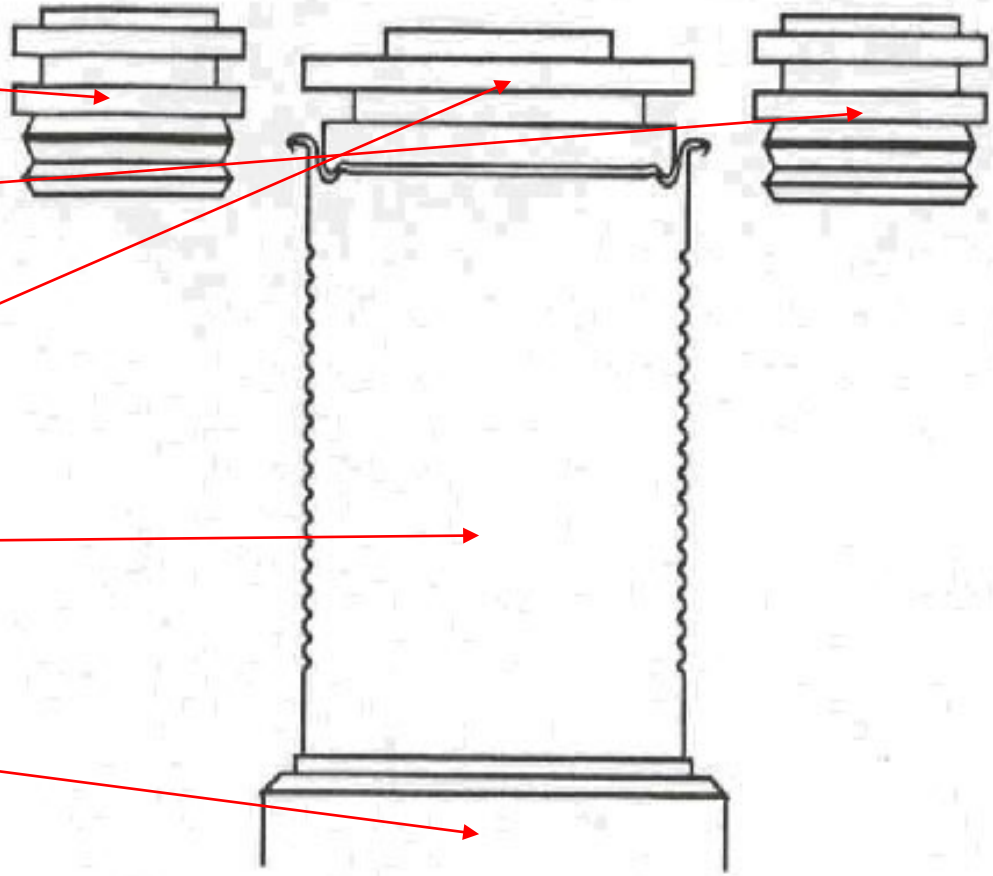


Double Seam

- Formed by joining body of can with end
- Body flange interlocked with end curl
- Formed in two operations

Double Seamer Head

- First Operation Roll
- Second Operation Roll
- Seaming Chuck
- Can
- Base Plate

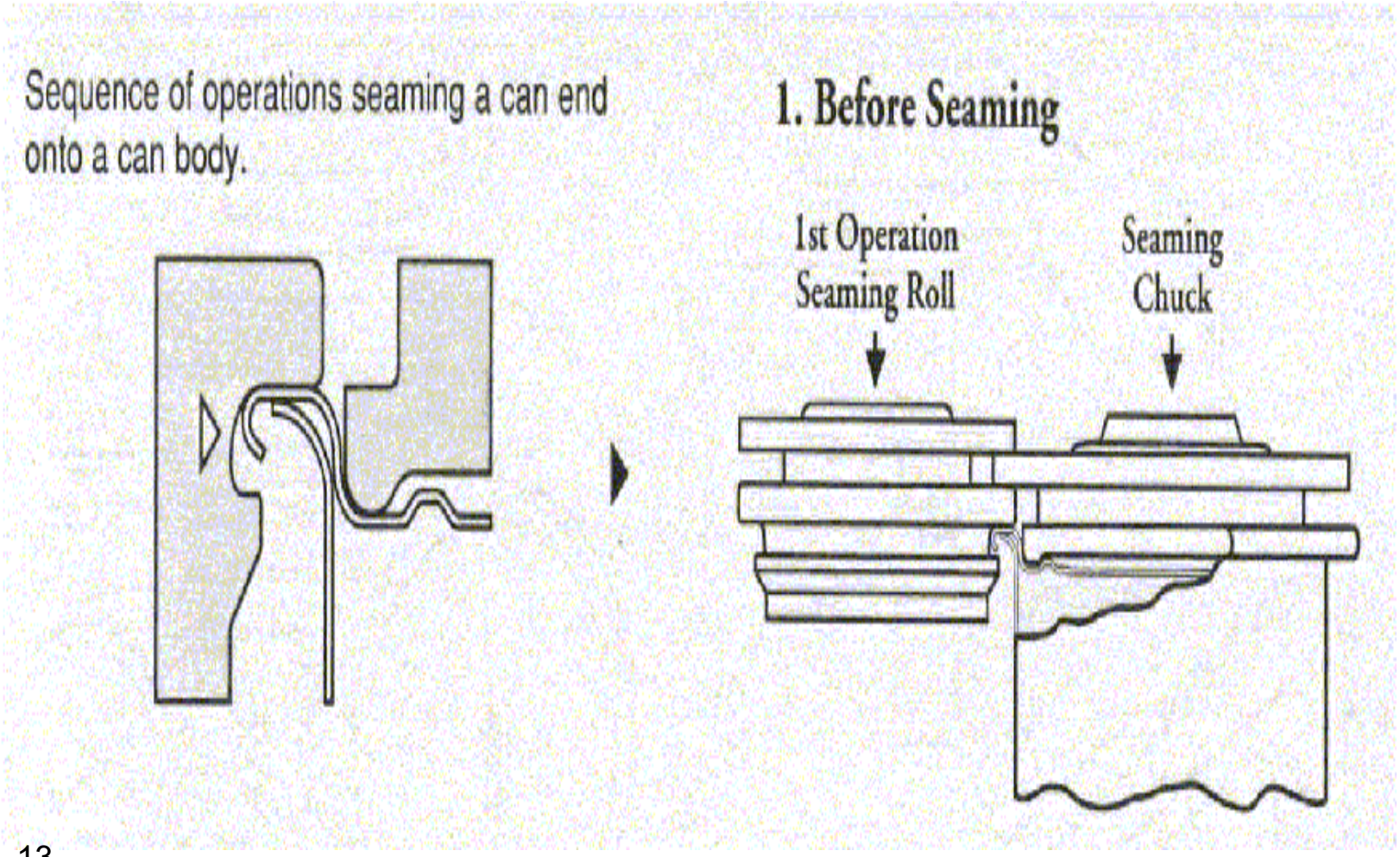


First Operation

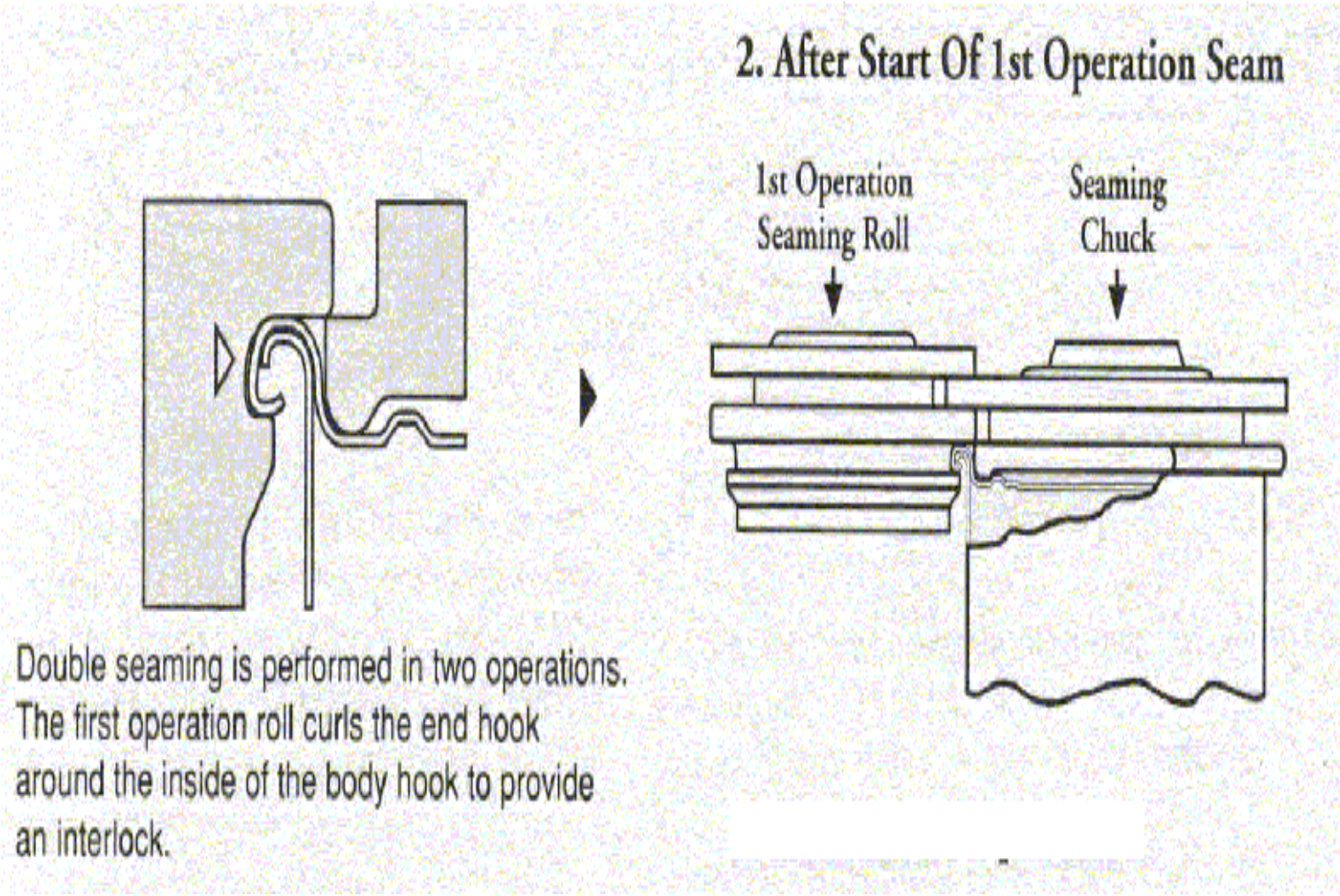
- Contoured groove of seaming roll (narrow/deep) forms the seam profile
- End curl is interlocked with body flange
- Faulty first operation will result in a faulty finished seam

First Operation

Sequence of operations seaming a can end onto a can body.



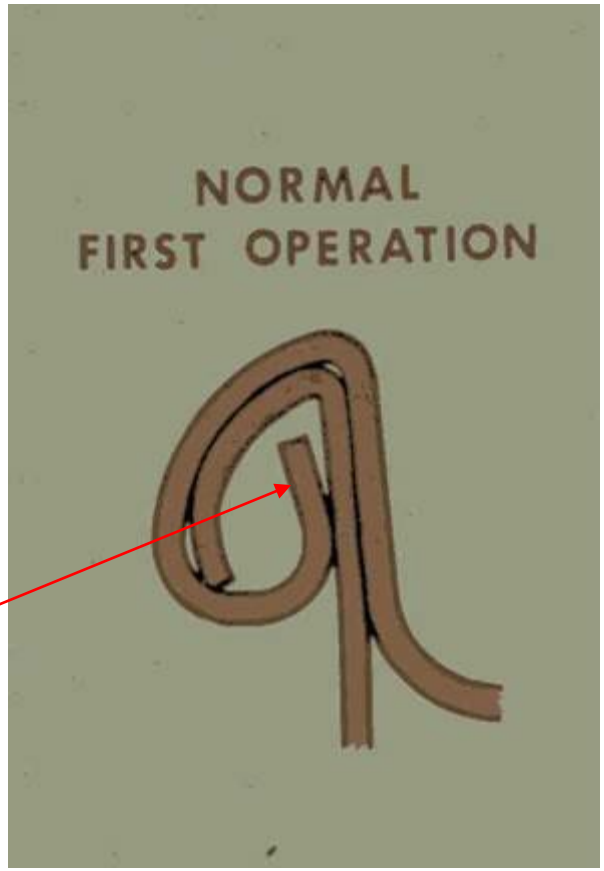
First Operation



Double seaming is performed in two operations. The first operation roll curls the end hook around the inside of the body hook to provide an interlock.

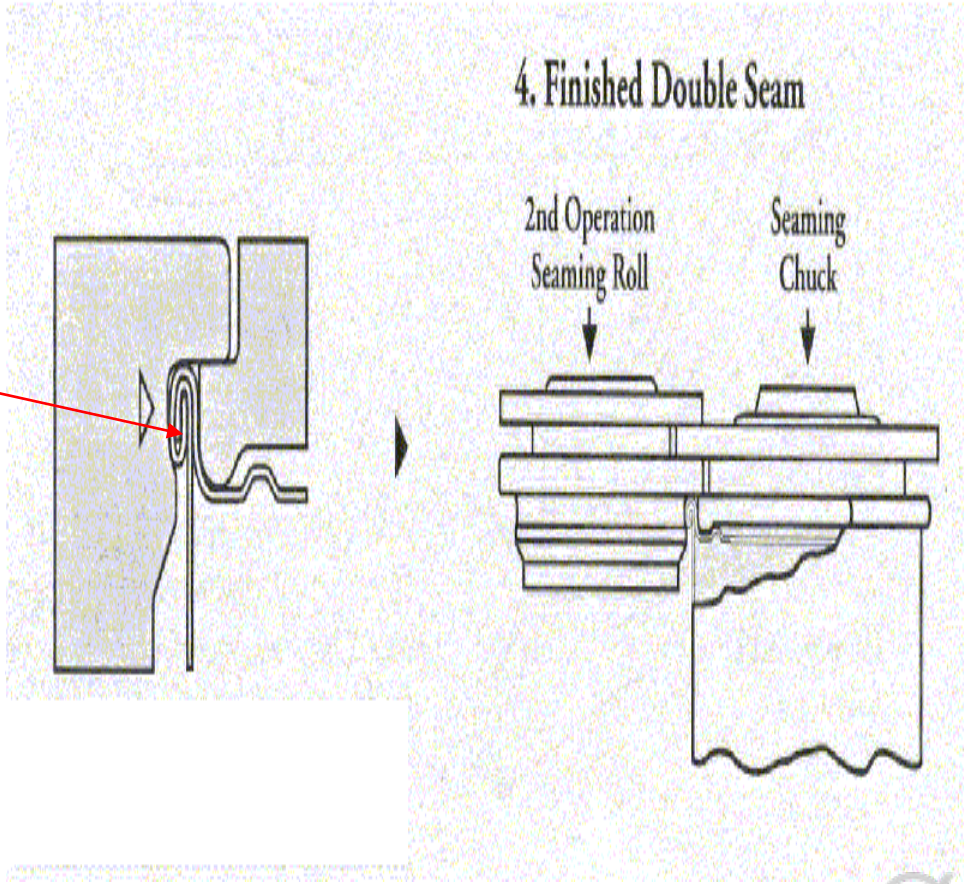
Complete First Operation

- Body Hook (BH) approximate parallel to Cover Hook (CH)
- BH tucked down in CH radius
- CH rounded and adjacent to or touching can body wall
- Wrinkle created in CH at end of hook

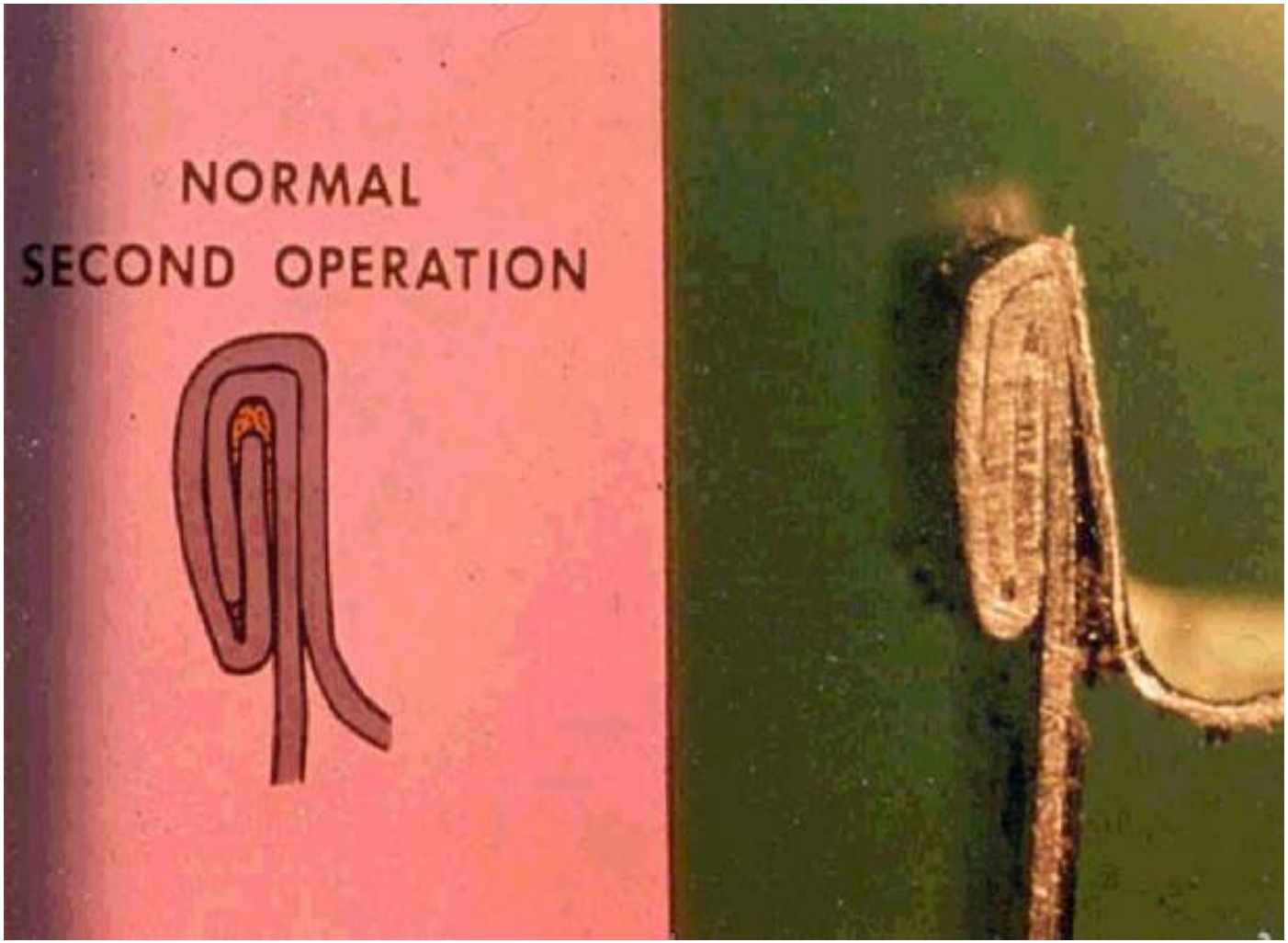


Second Operation: (Seaming Roll Contour Shallow & Flat)

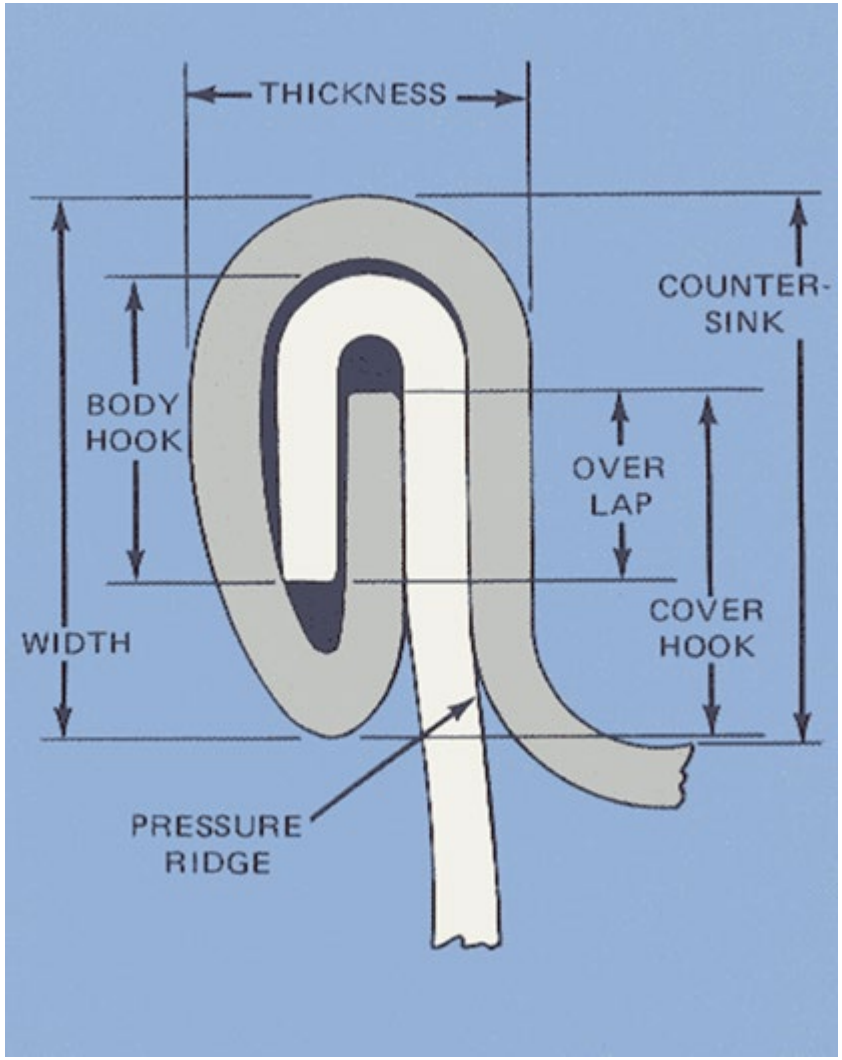
- Flattens and tightens the hooks
- Irons out CH wrinkle
- Seaming compound forced into voids of seam



Second Operation



Double Seam Measurements



Double Seam Measurements

The most critical measurements to a can's double seam are:

- Overlap
- Tightness

Overlap

- The degree of interlock between the body hook and cover hook
- Formula when using a micrometer

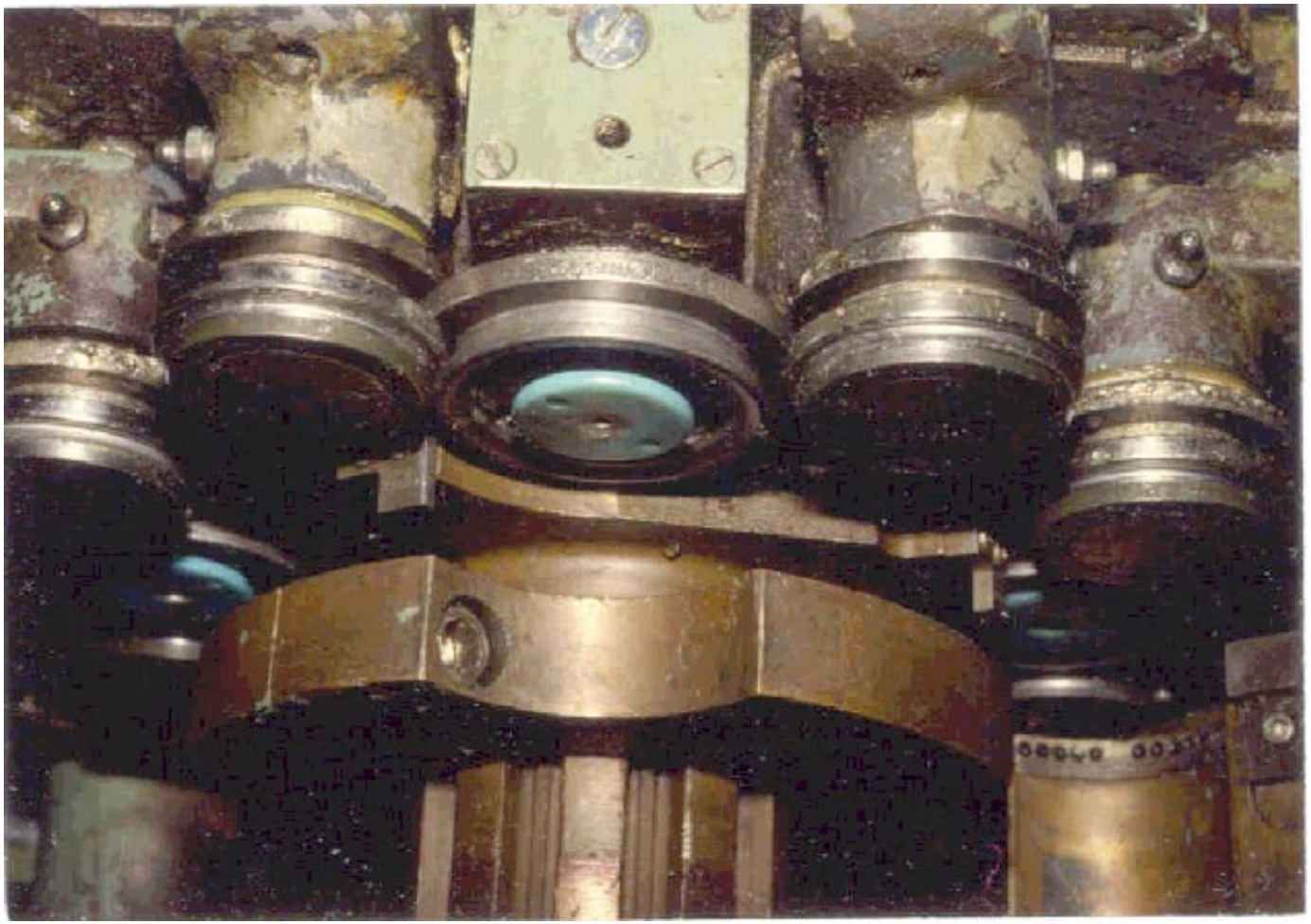
BODY HOOK + COVER HOOK + END THICKNESS (.010 IN.) – SEAM WIDTH

Tightness

- Degree of cover hook wrinkle after double seaming
- Tightness rating indicates relative freedom from wrinkles

Canco 4-head Double Seamer (Can Spin Type)

Seaming Rolls and Chuck

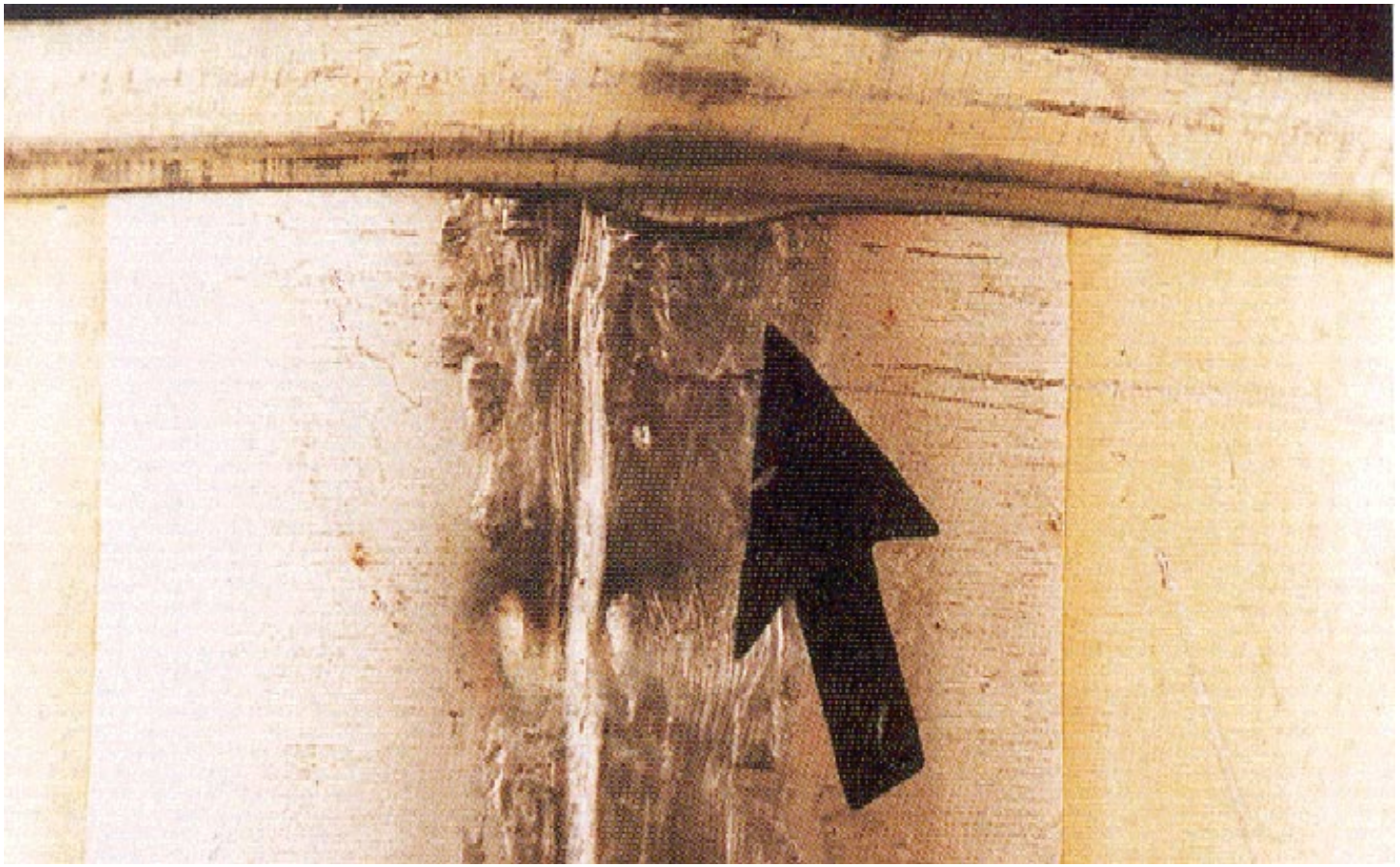


Juncture Area

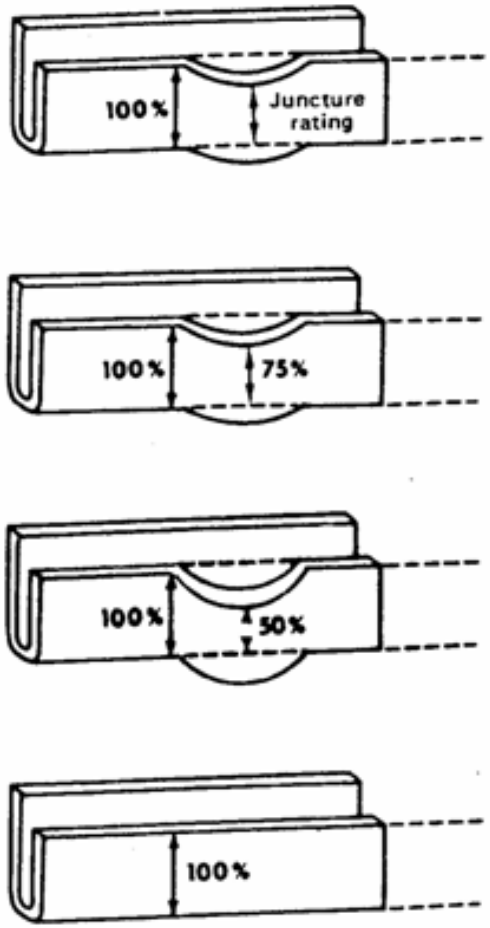
- Location where double seam crosses welded side seam

Juncture Area

Droop at Crossover
3-piece soldered can



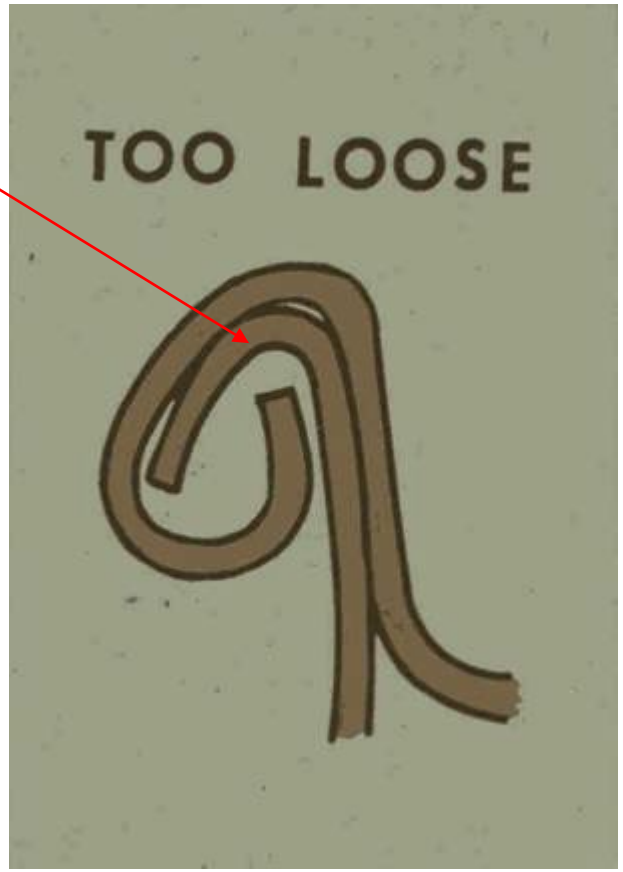
Juncture Area



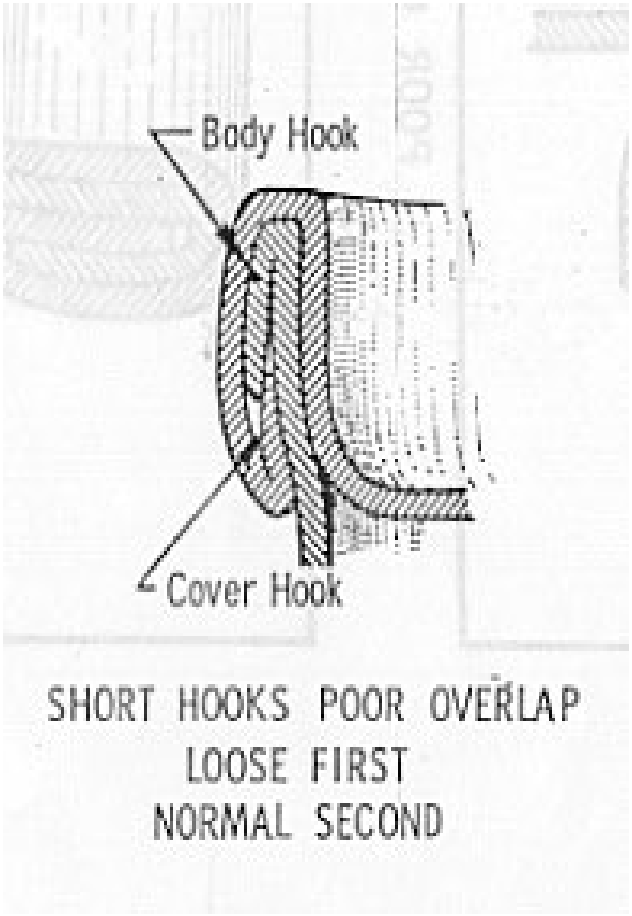
Can Seam Defects

Can Seam Defects: First Operation Too Loose

- Formation of cover hook and overlap may be affected
- Possible cause—improper setting of first operation seaming roll, worn seaming roll, wrong groove profile

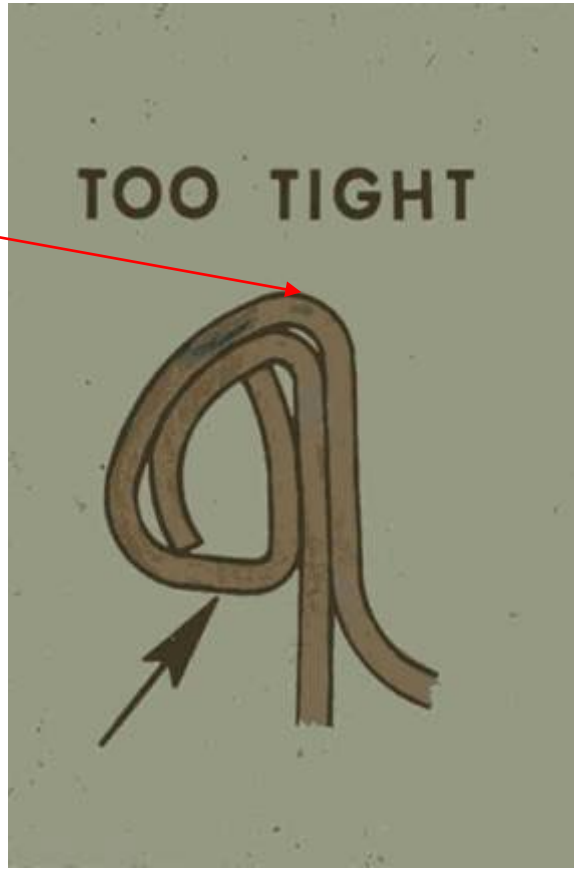


Can Seam Defects: Loose First/Normal Second Operation

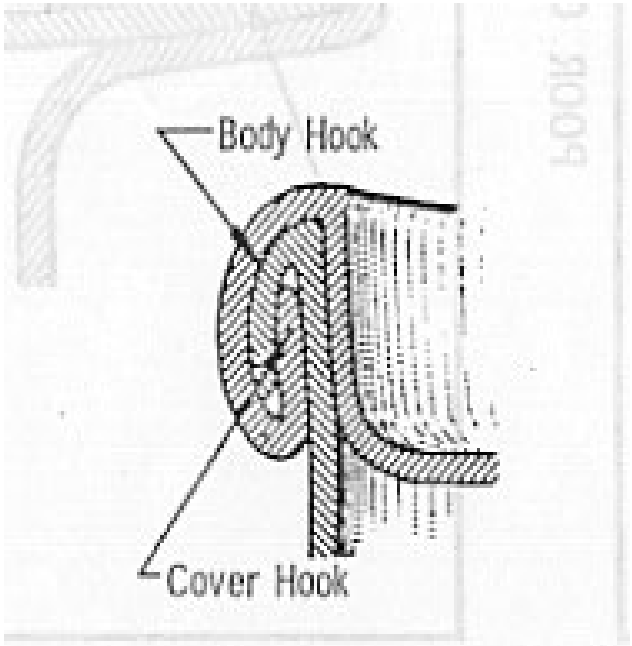


Can Seam Defects: First Operation Too Tight

- Results in flattened seam bottom, sharp seam and poor cover hook
- One possible cause—tight setting of first operation seaming roll, worn seaming roll, groove profile too narrow



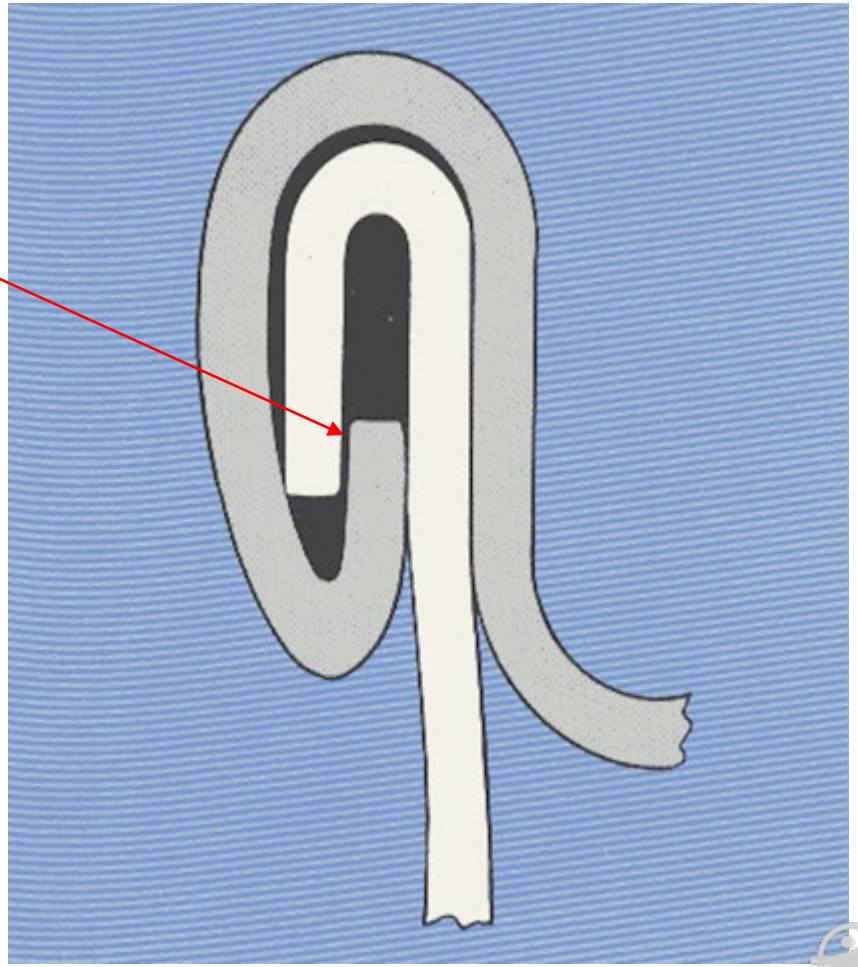
Can Seam Defects: Tight First/Loose Second Operation



LOOSE SEAM AND CUTOVER
TIGHT FIRST
LOOSE SECOND

Can Seam Defects: Short Cover Hook

A short cover hook may result in short overlap:

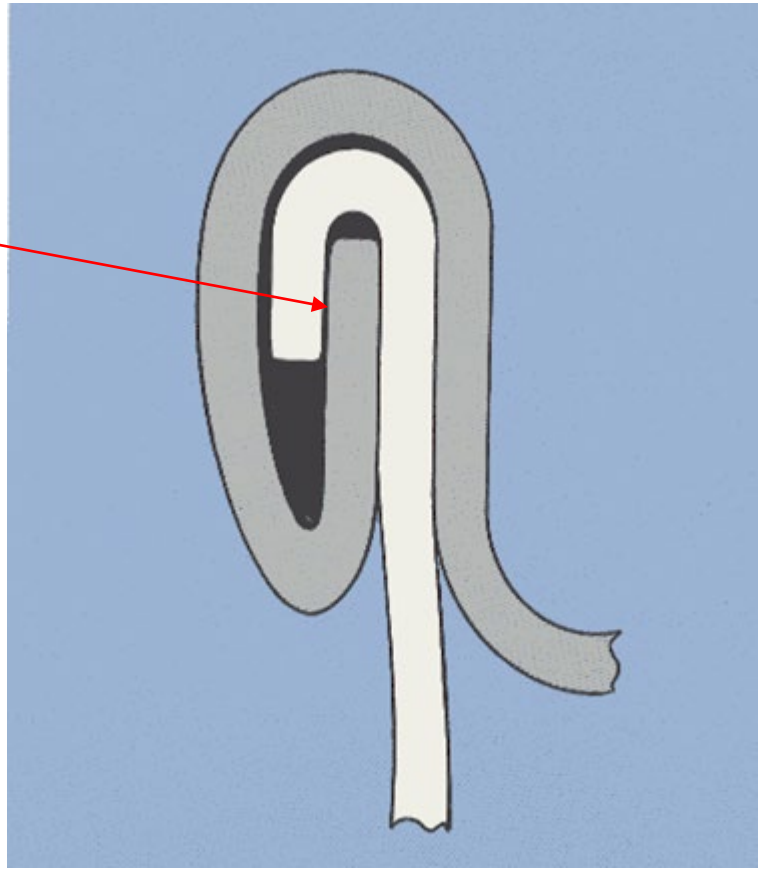


Possible Causes:

- Loose first operation roll
- Excessive lifter pressure
- Excessive countersink depth

Long Cover Hook - May Result In Reduced Overlap (Possible Cause):

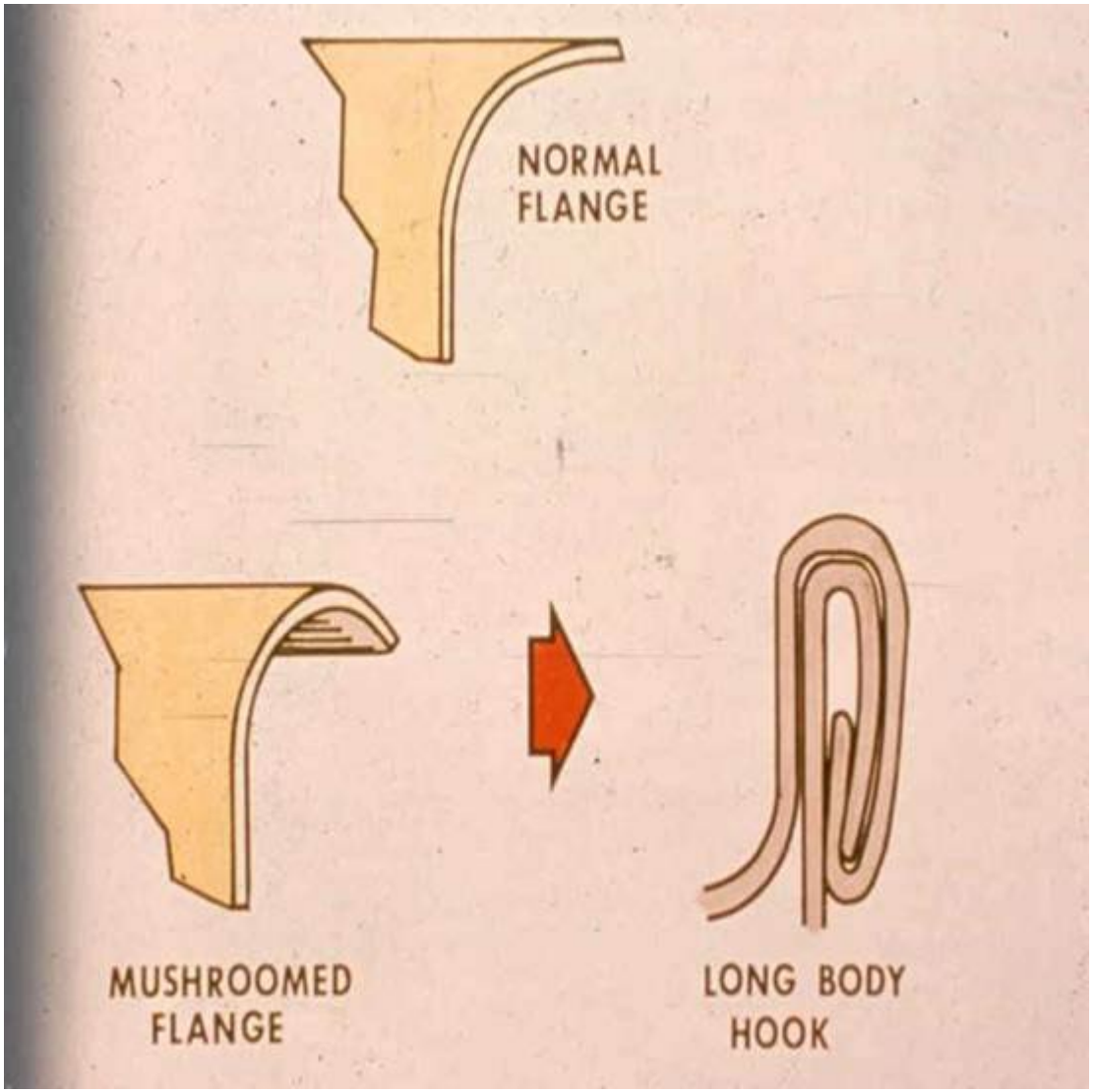
A long cover hook may result in reduced overlap:



Possible Cause:

First operation seaming roll set too tight.

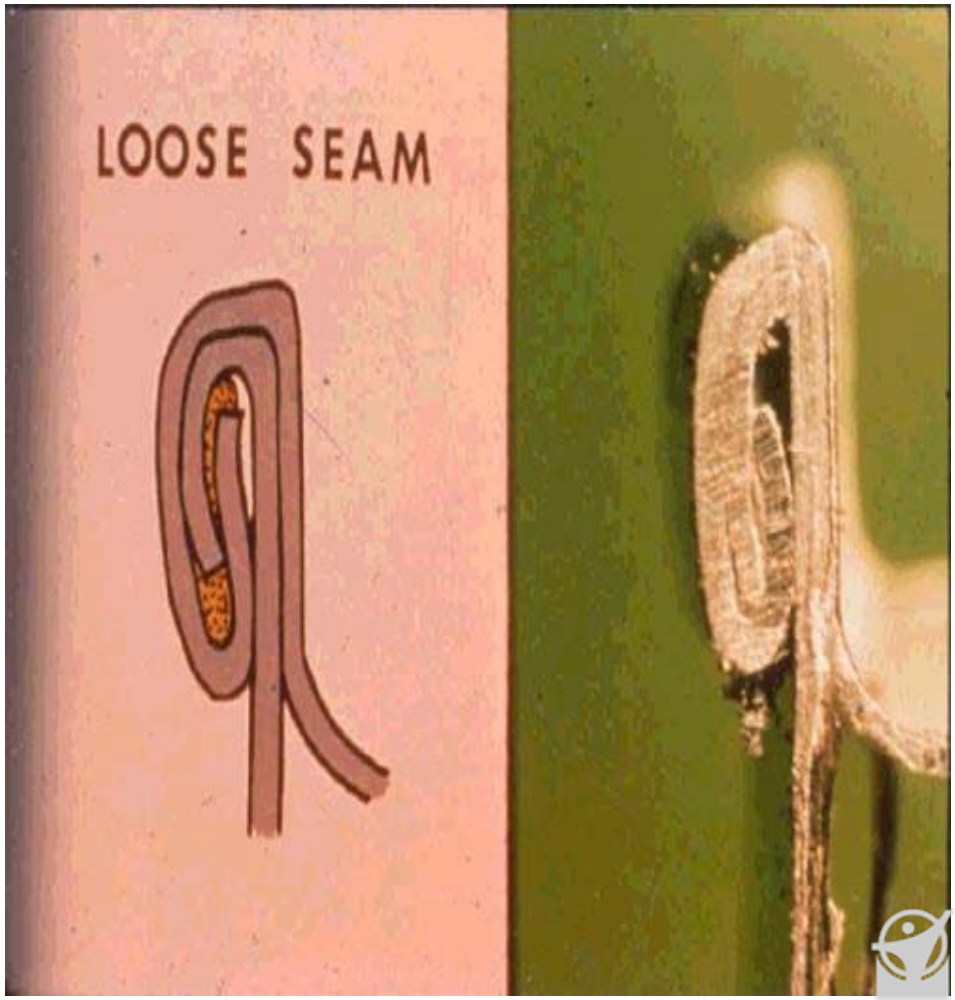
Mushroomed Flange



Can Seam Defects: Loose Second Operation Seam

Possible Causes:

- Folds of metal may not be pressed together tightly enough
- Cause may be improper setting of or worn second operation seaming roll

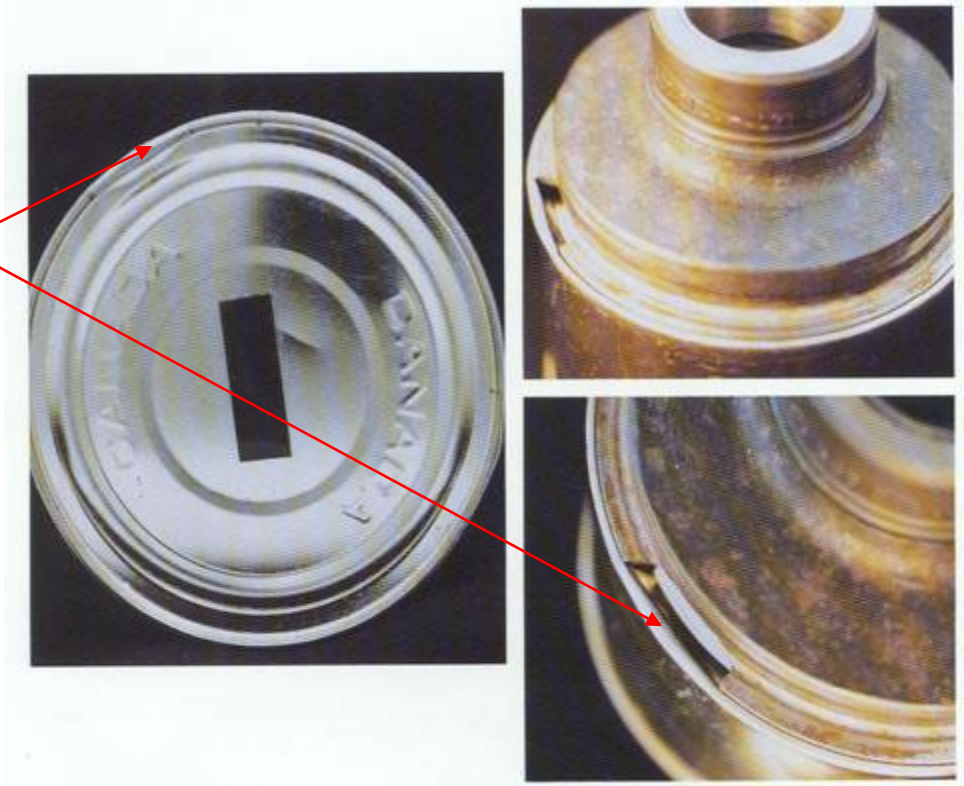


Loose Seam

Can Seam Defects: Broken Chuck

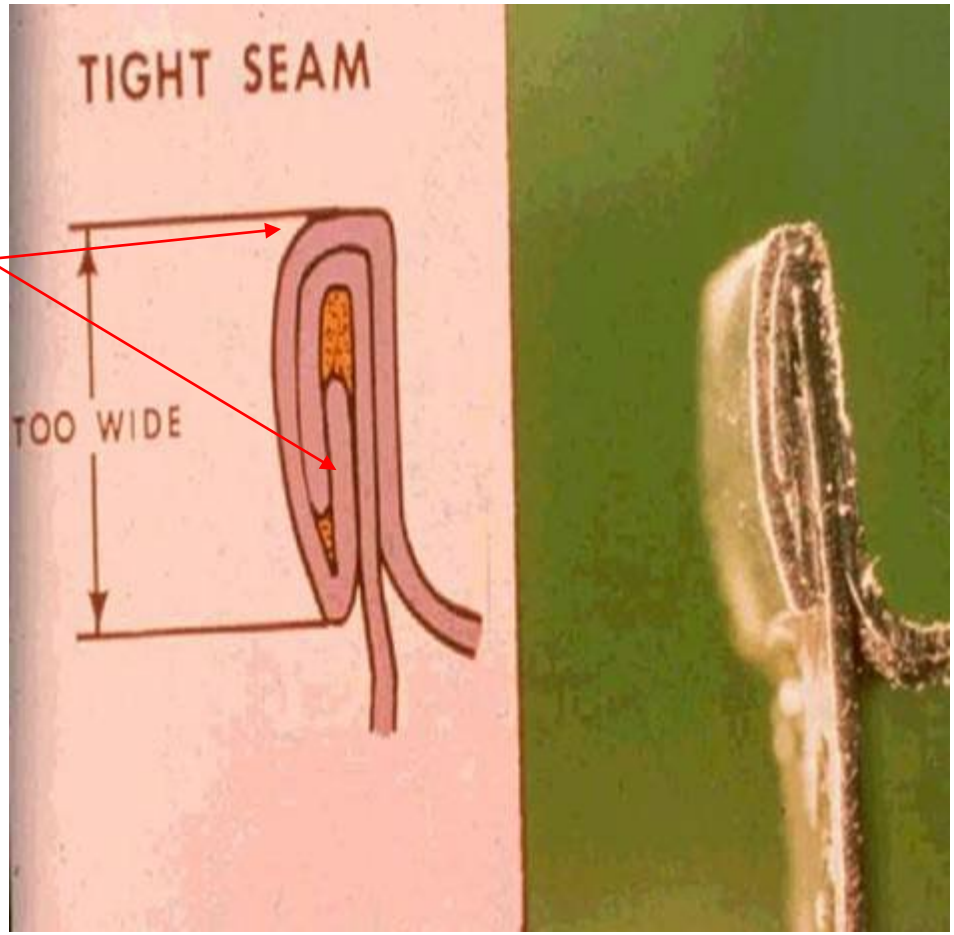
Possible Causes:

- Portion of chuck lip missing
- Loose seam at that point
- Several possible causes of chuck damage



Excessively Tight Second Operation

May cause reduction of overlap, sharp seam and/or compound to squeeze out of the seam.

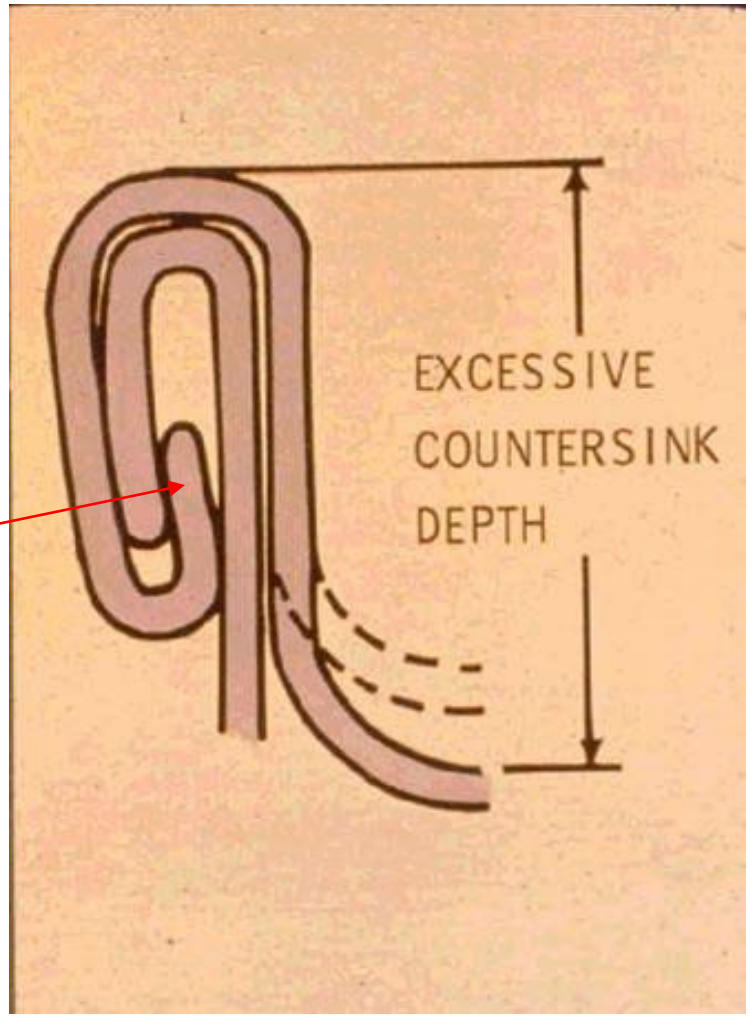


Insufficient Overlap Possible Causes

- Irregular can body flange
- Irregular end curl
- Poor closing machine adjustment

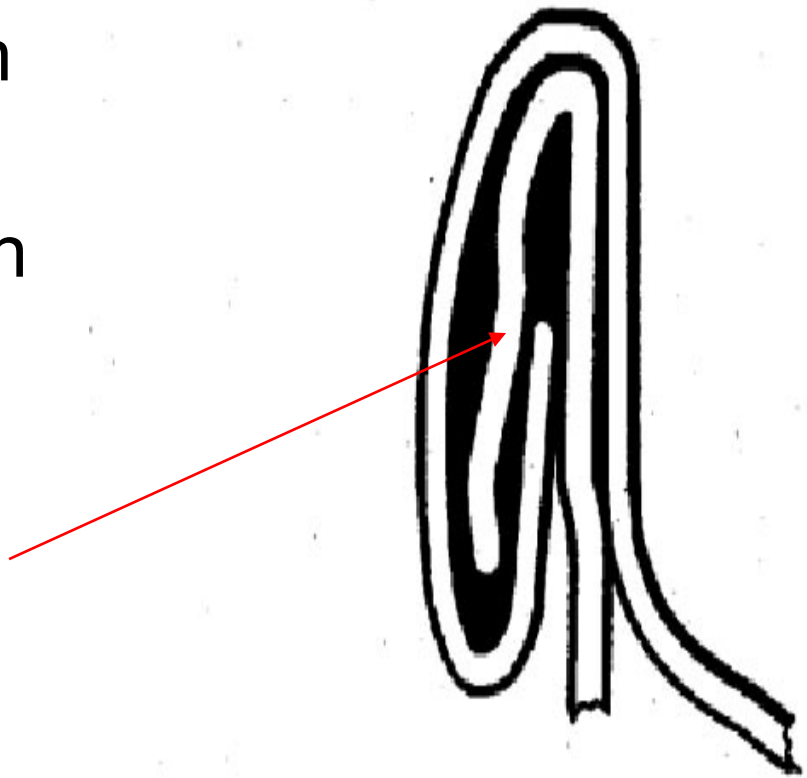
Excessive Countersink Depth

- Results in shortened cover hook and overlap
- Excessive baseplate pressure or chuck set too deep are possible causes



Seam Bumps

- Most often on 2-piece or welded side seam cans
- Localized increase in packer's end seam thickness
- Distorted body hook



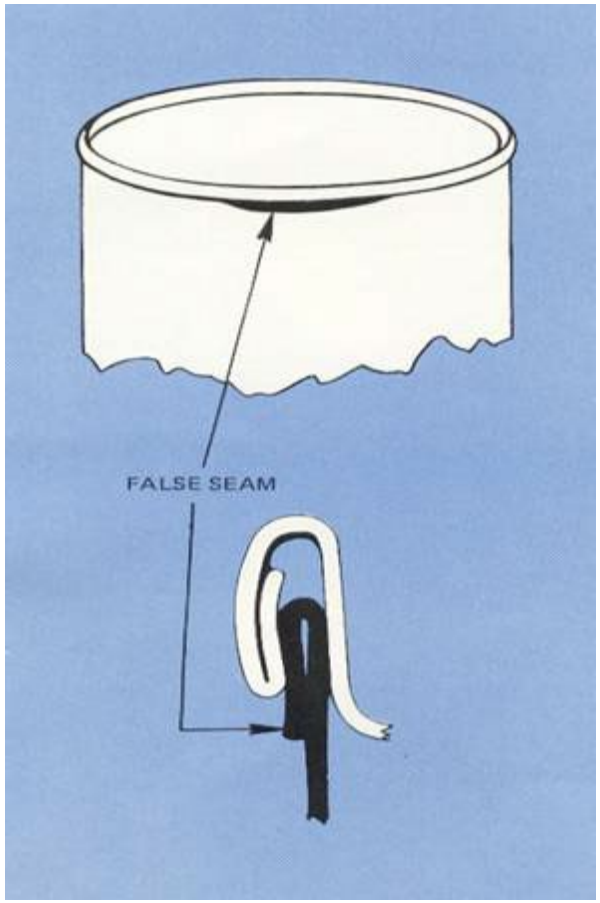
Seam Bumps

Possible Causes:

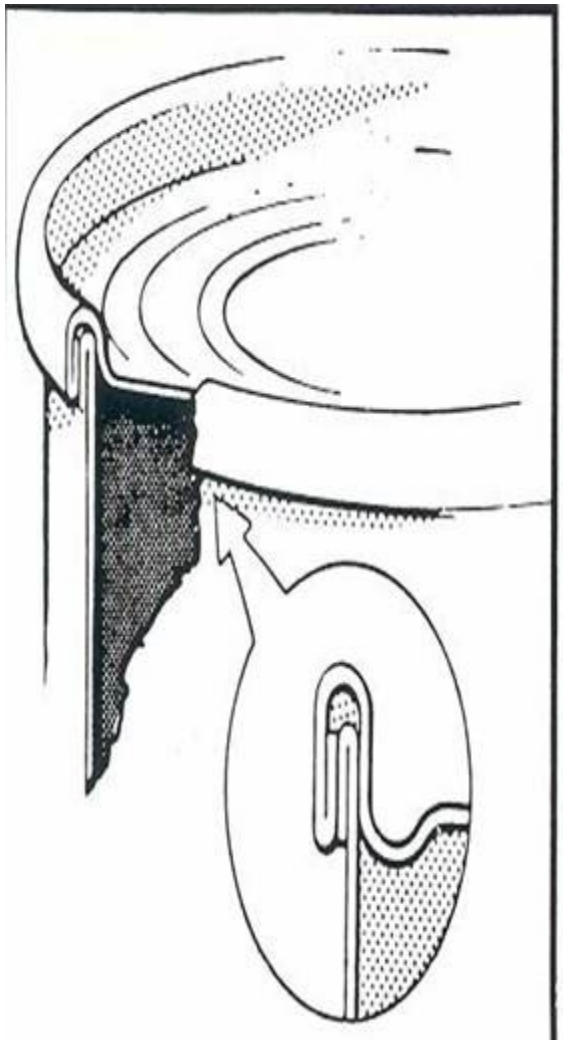
- Excessively tight finished seam
- Long body hooks
- Excessive sealing compound (gasket) in the end curl

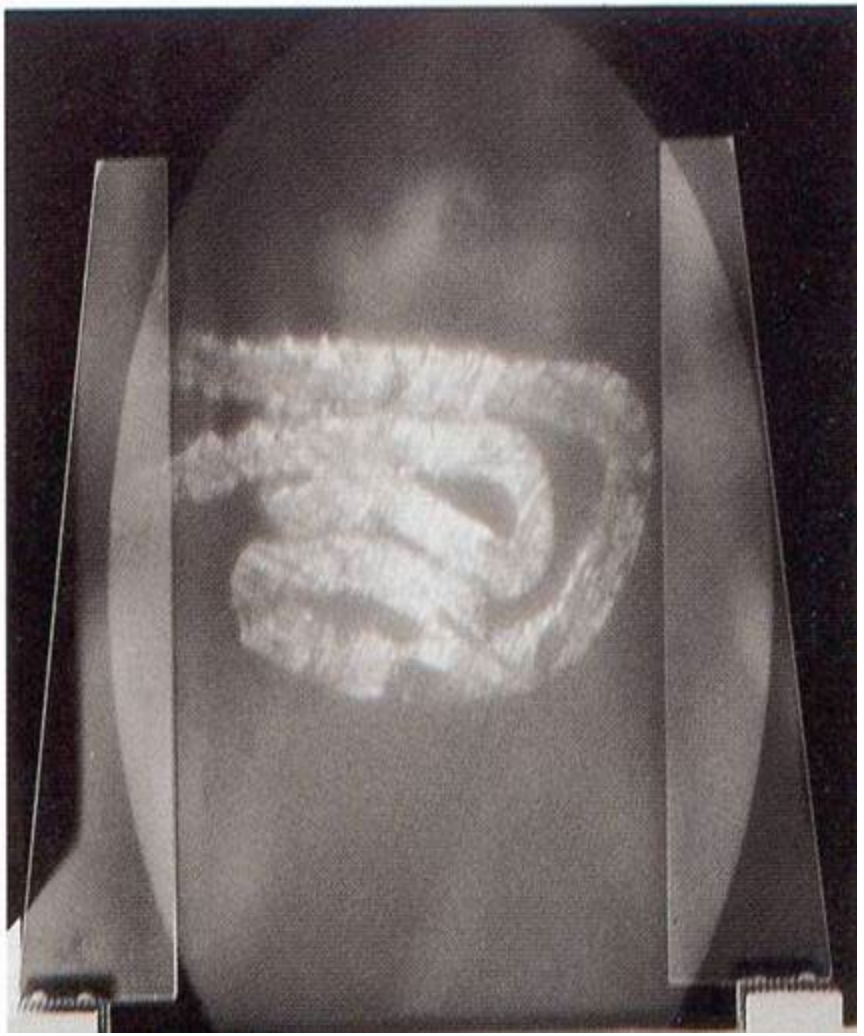
False Seam

- Seam which is entirely unlocked
- Not always detected by visual examination
- Revealed by teardown examination



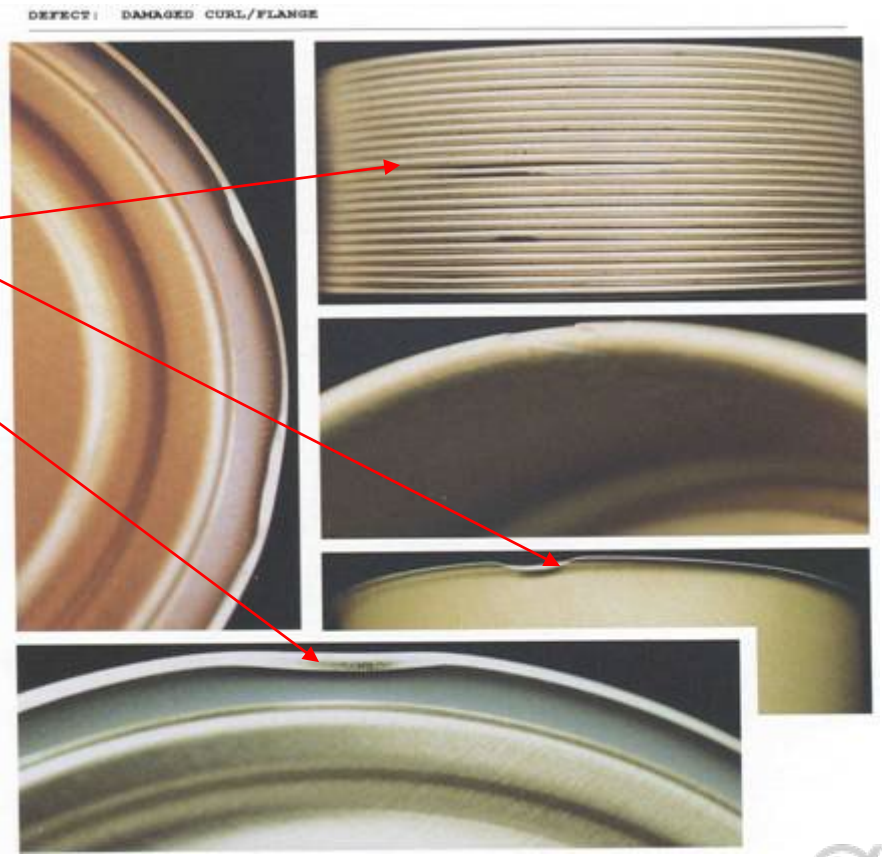
False Seam



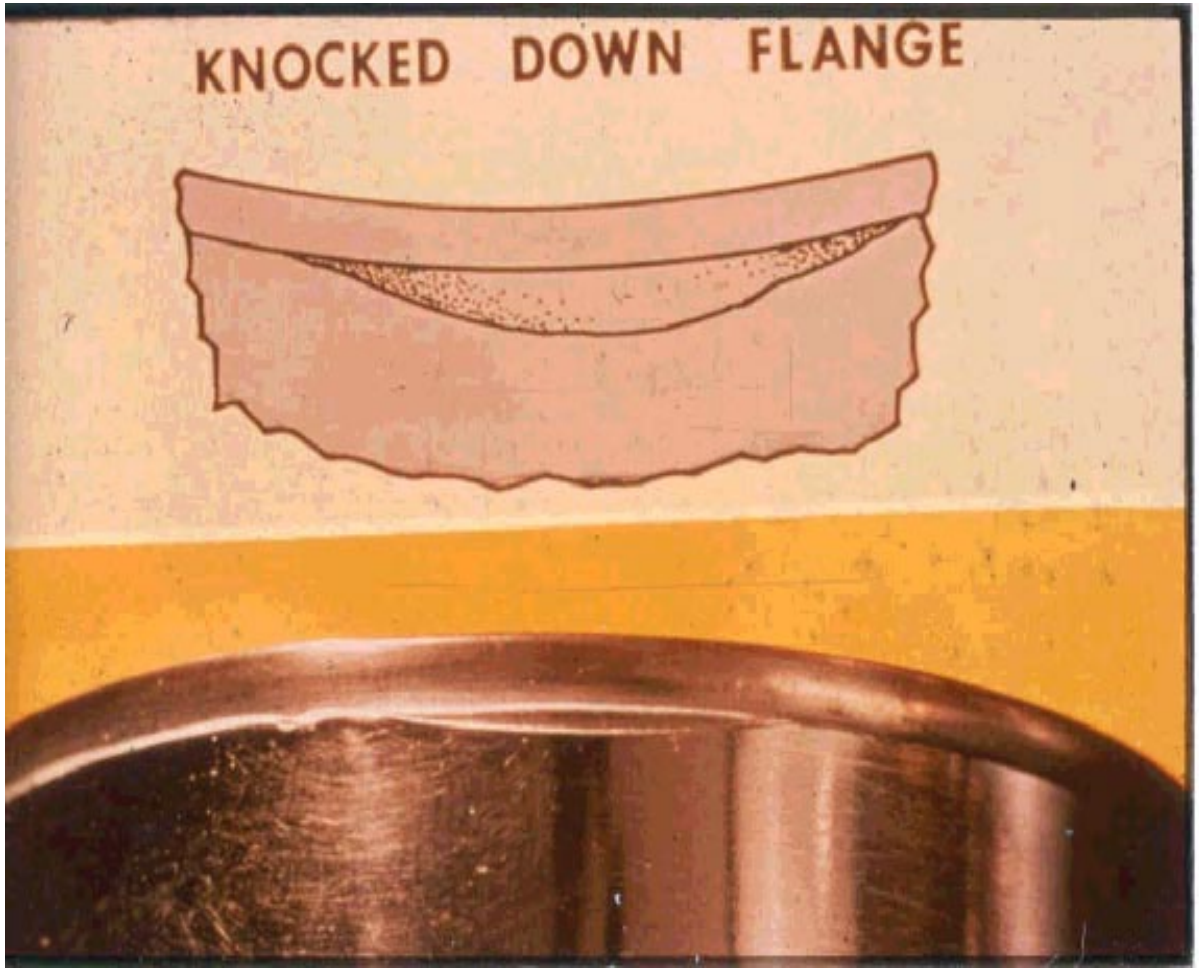


Damaged Flange and End Curl

- Damaged flange
- Damaged end curl

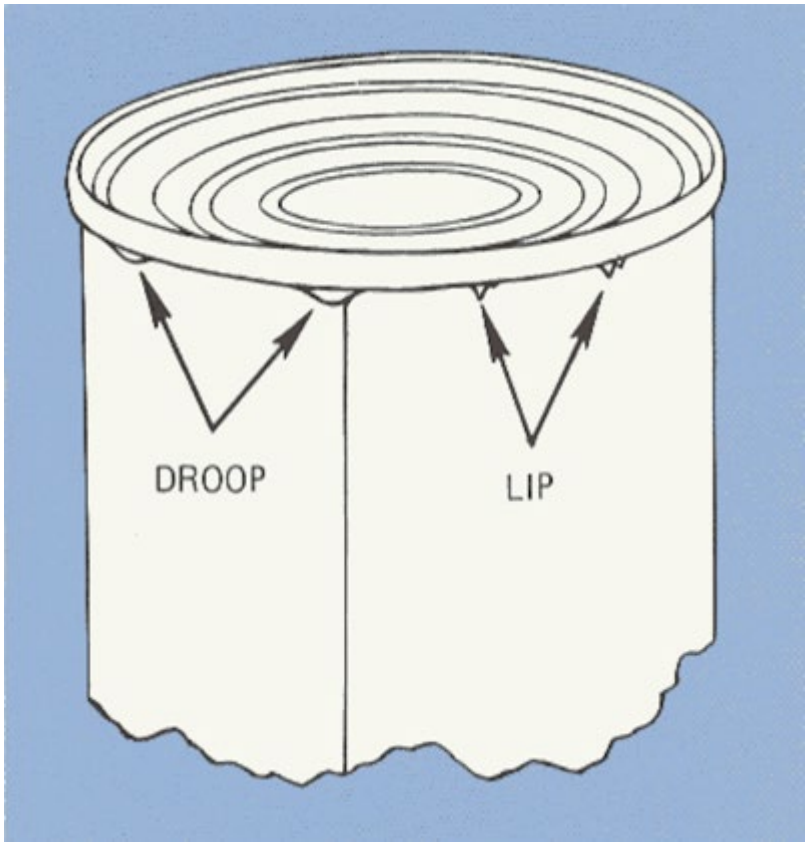


Knock Down Flange

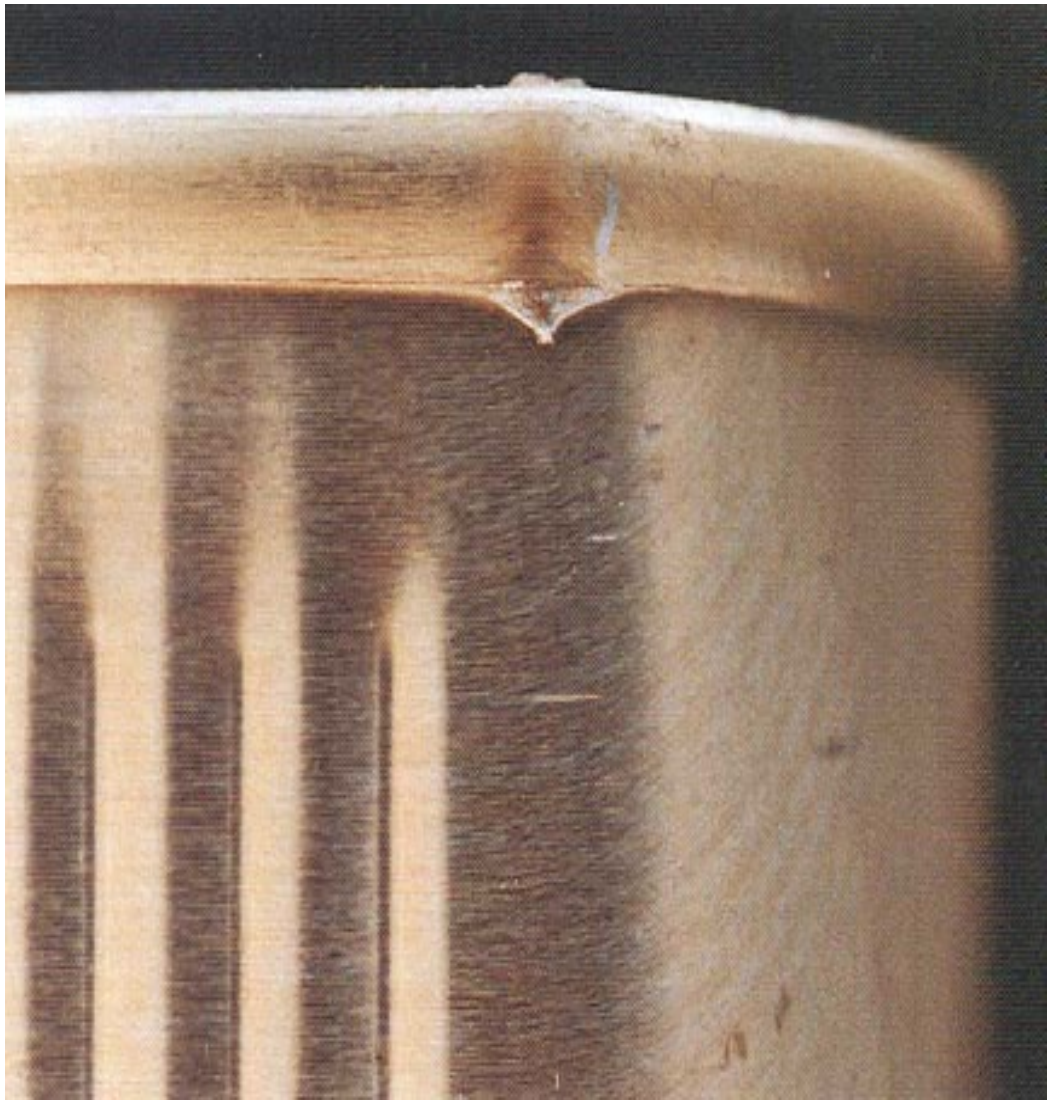


Droop

- Smooth projection of the double seam below the bottom of normal seam
- Possible causes: excessive body hook, loose first operation, product trapped in the seam, too much gasket material in end curl

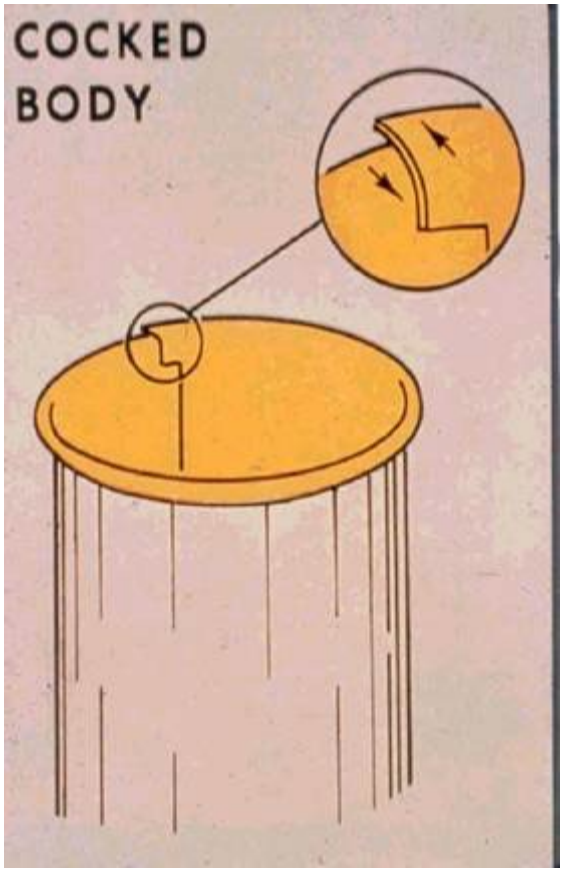


“Vee”, Lip, or Spur



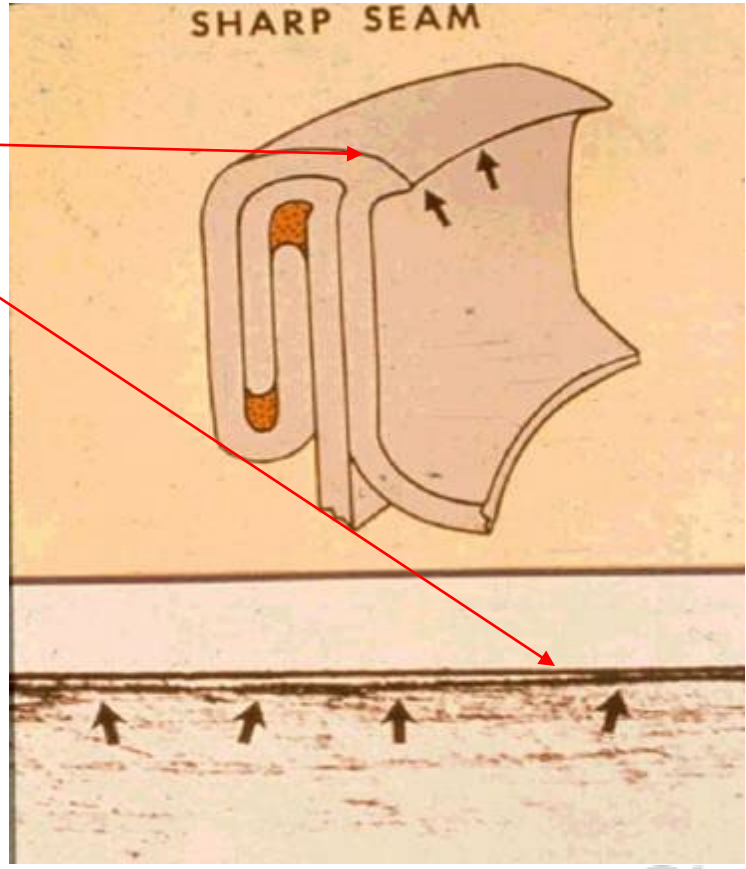
Cocked Body

- Can body blank out of square causing unevenness at lap
- Can manufacturing defect



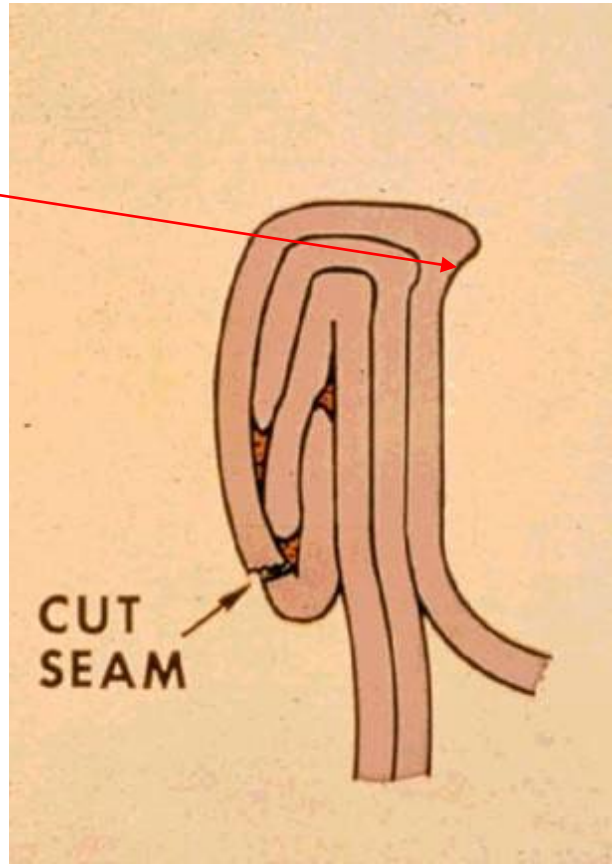
Sharp Seam

- Sharp edge at the top inside portion of seam
- More easily felt with finger nail than seen

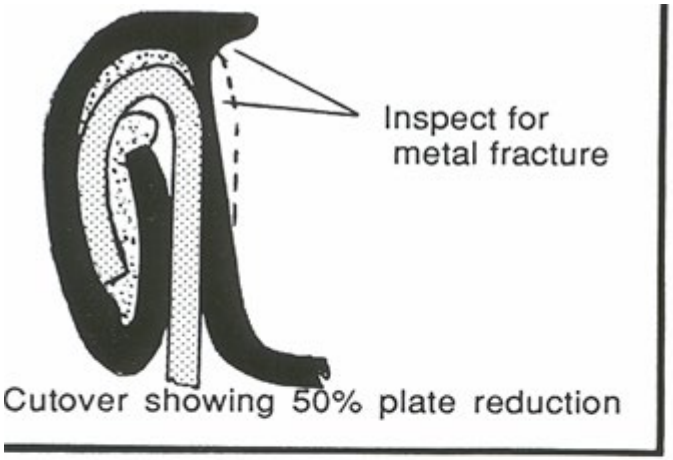


Cut Over

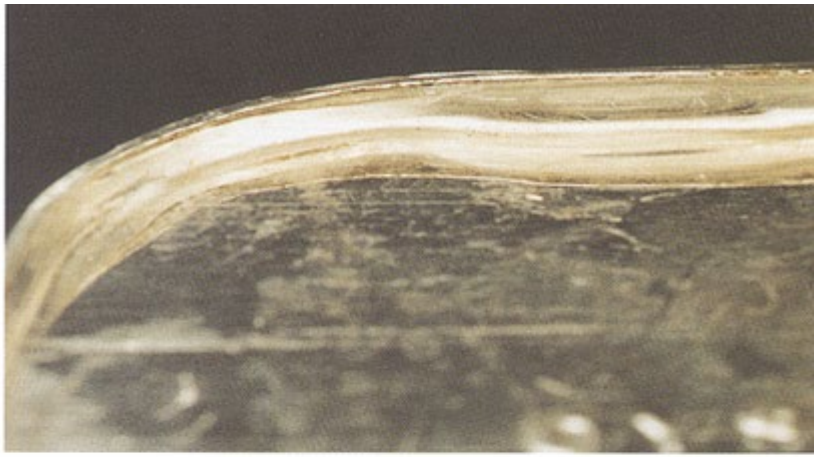
- Seam that is sharp enough to fracture the metal at the top inside portion of seam
- Several possible causes

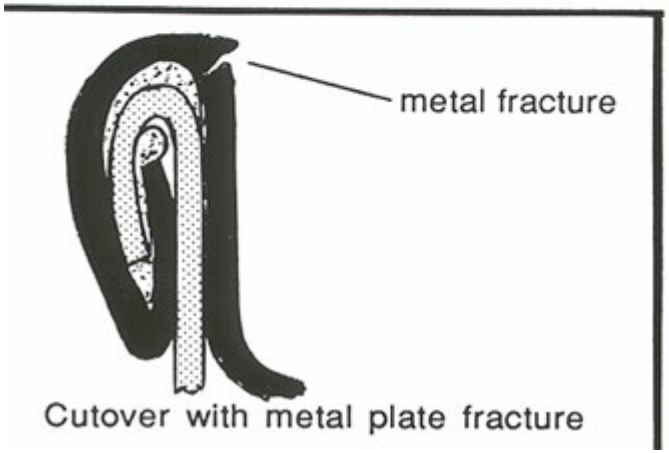


Cutover and Fracture

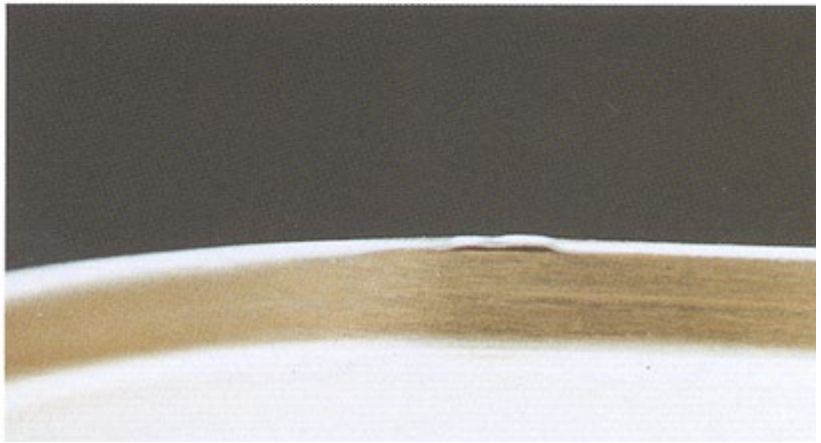


Cutover showing 50% plate reduction



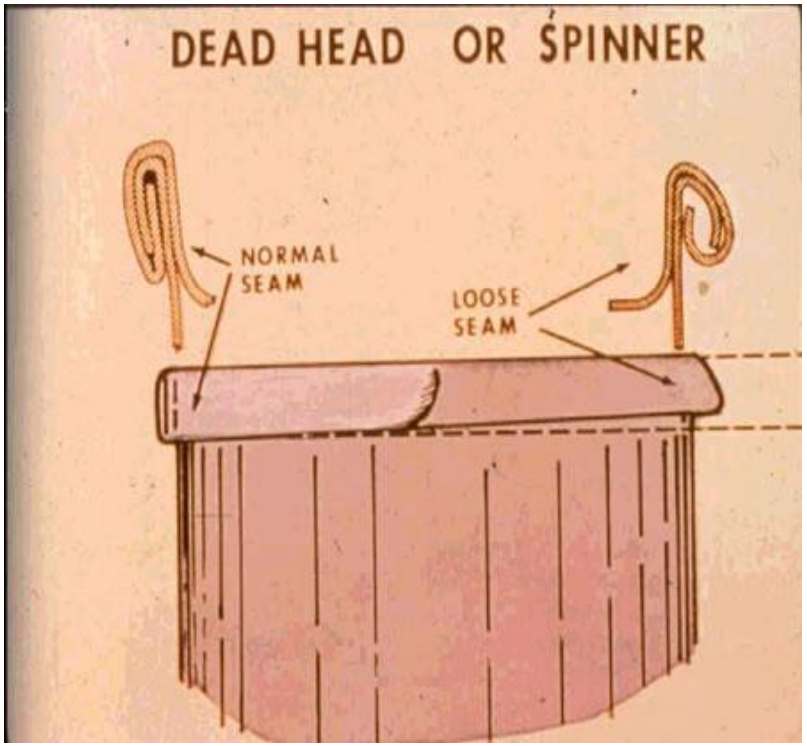


Cutover with metal plate fracture

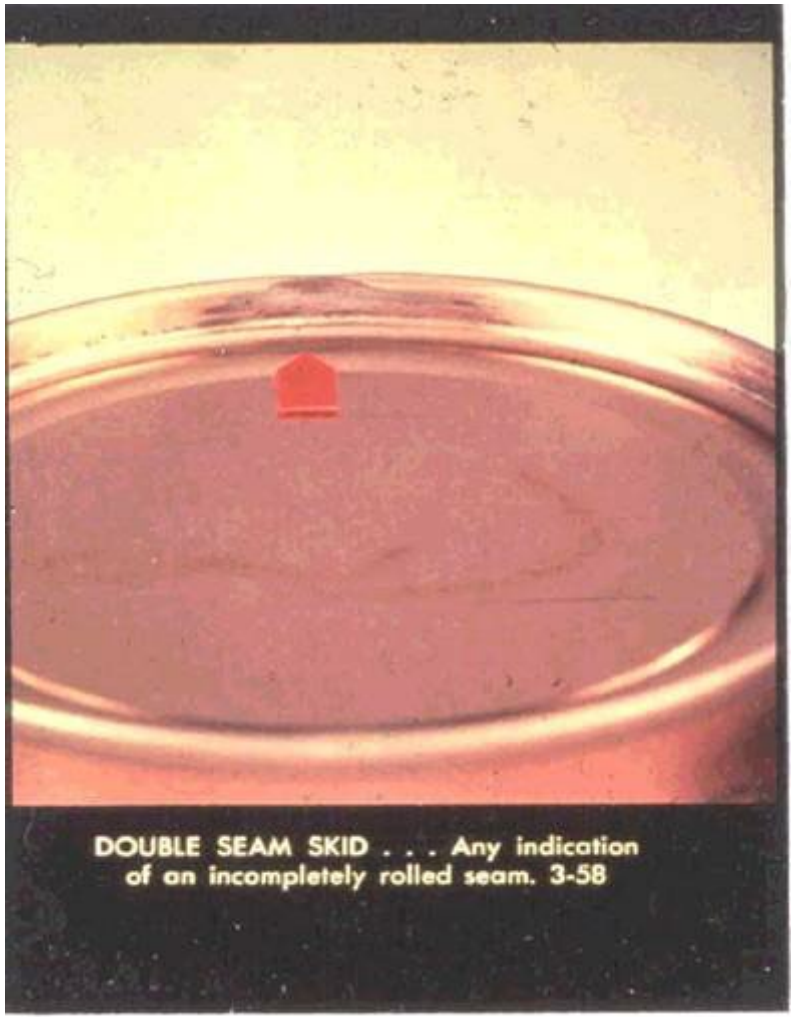


Deadhead (Spinner)

- Incomplete seam caused by chuck spinning in countersink
- Caused by grease/oil on chuck, insufficient pin—gage setting, no second operation, insufficient base plate pressure

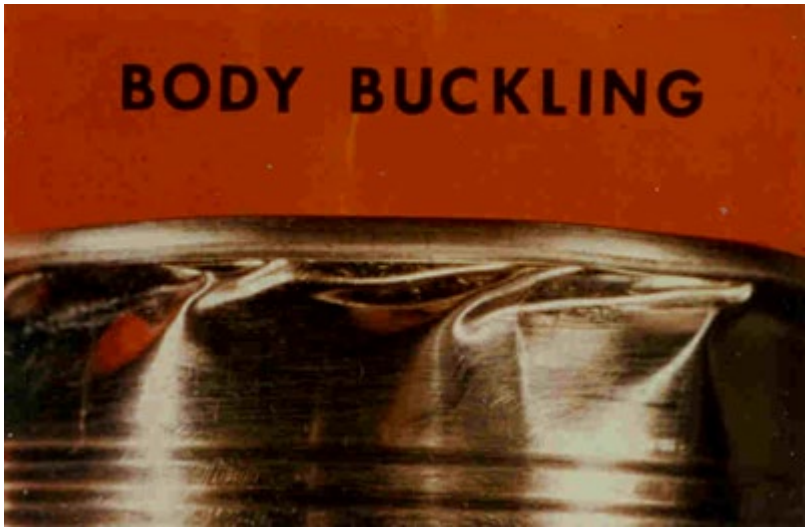


Double Seam Skip



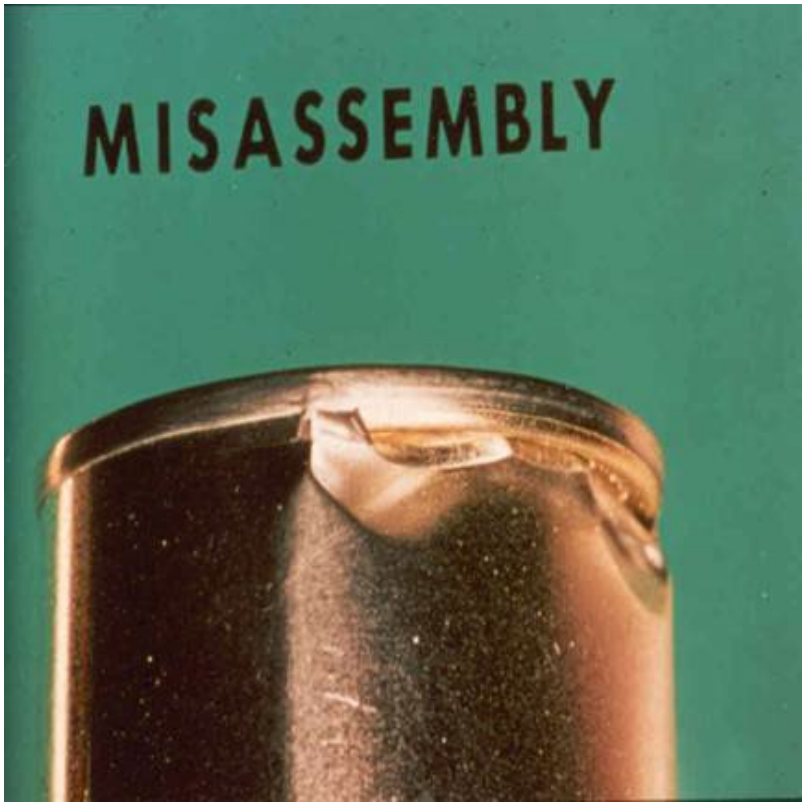
Can Body Buckling

- Buckled or twisted condition under finished double seam
- Possible causes: excessive base plate pressure, chuck set too low



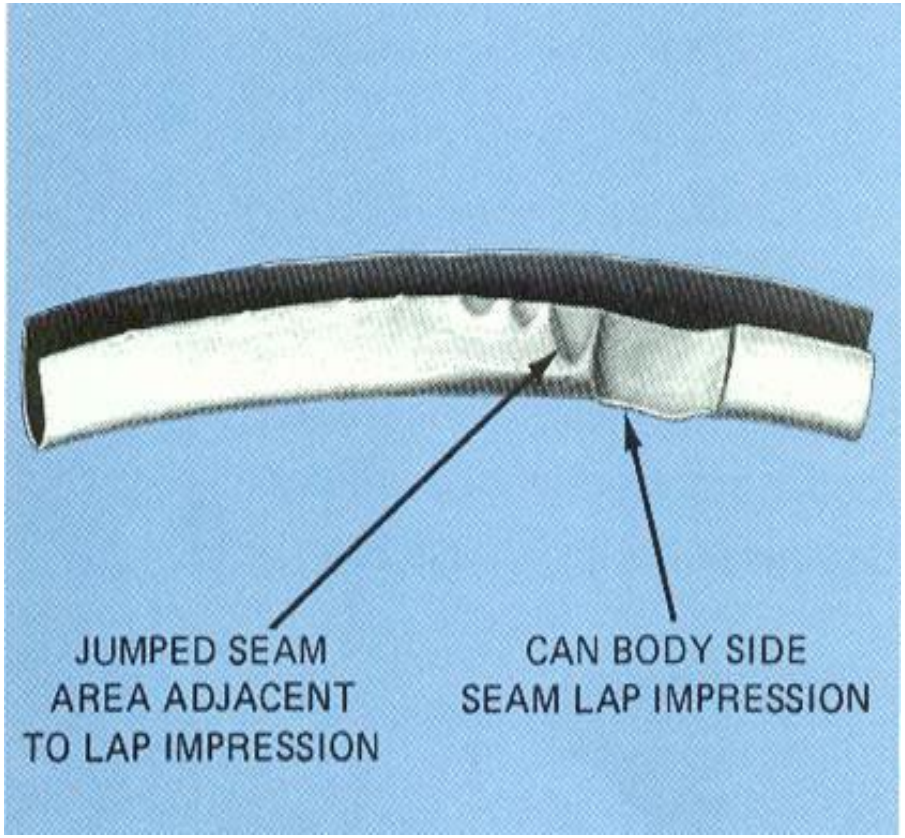
Misassembly

- Referred to as misplaced cover
- Can body and end improperly aligned in closing machine



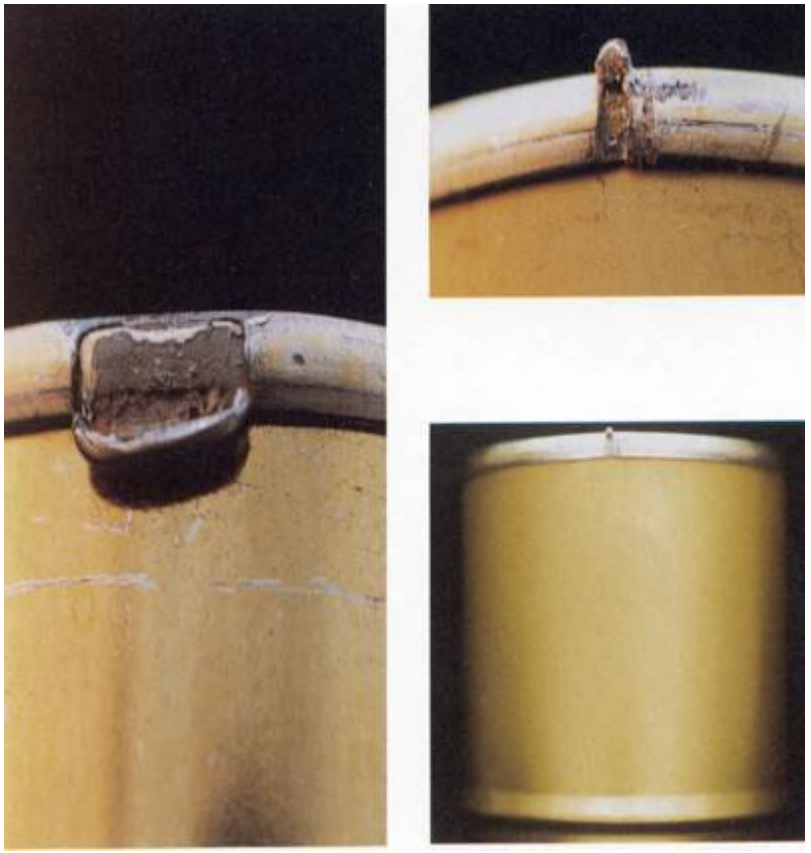
Jumped Seam Or “Jump-over”

- Seam not rolled tight enough next to juncture
- Caused by jumping of seaming rolls after passing over top of juncture area



Cut Seam

- Outer layer of double seam fractured
- Possible causes: damaged chuck, excessive seaming compound (gasket) material in end curl



Fractured Embossed Code

Results when metal of can has been cut through at the code mark.

Swollen Can

Possible Causes:

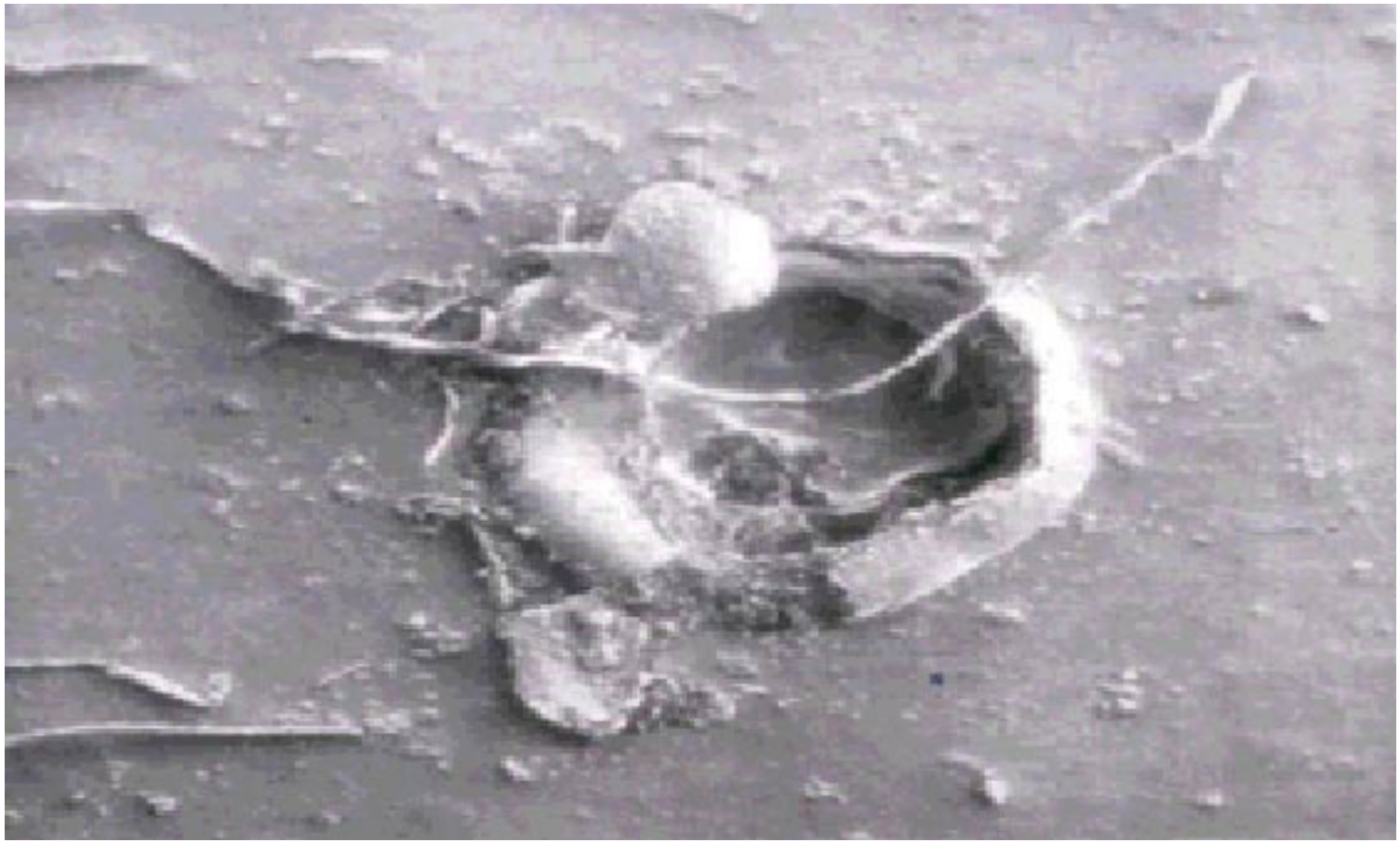
- Under-processing
- Post process leakage
- Hydrogen swell
- Incipient spoilage

Panelling

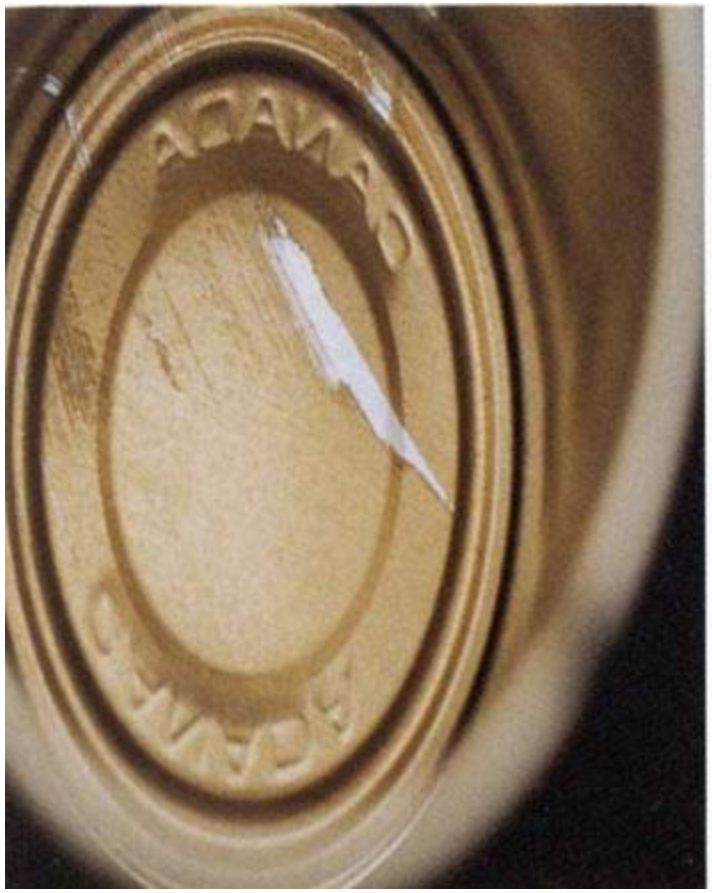
Caused by inadequate pressure control during cooling in the retort

Corrosion

Internal Can Corrosion (Pinhole Development)

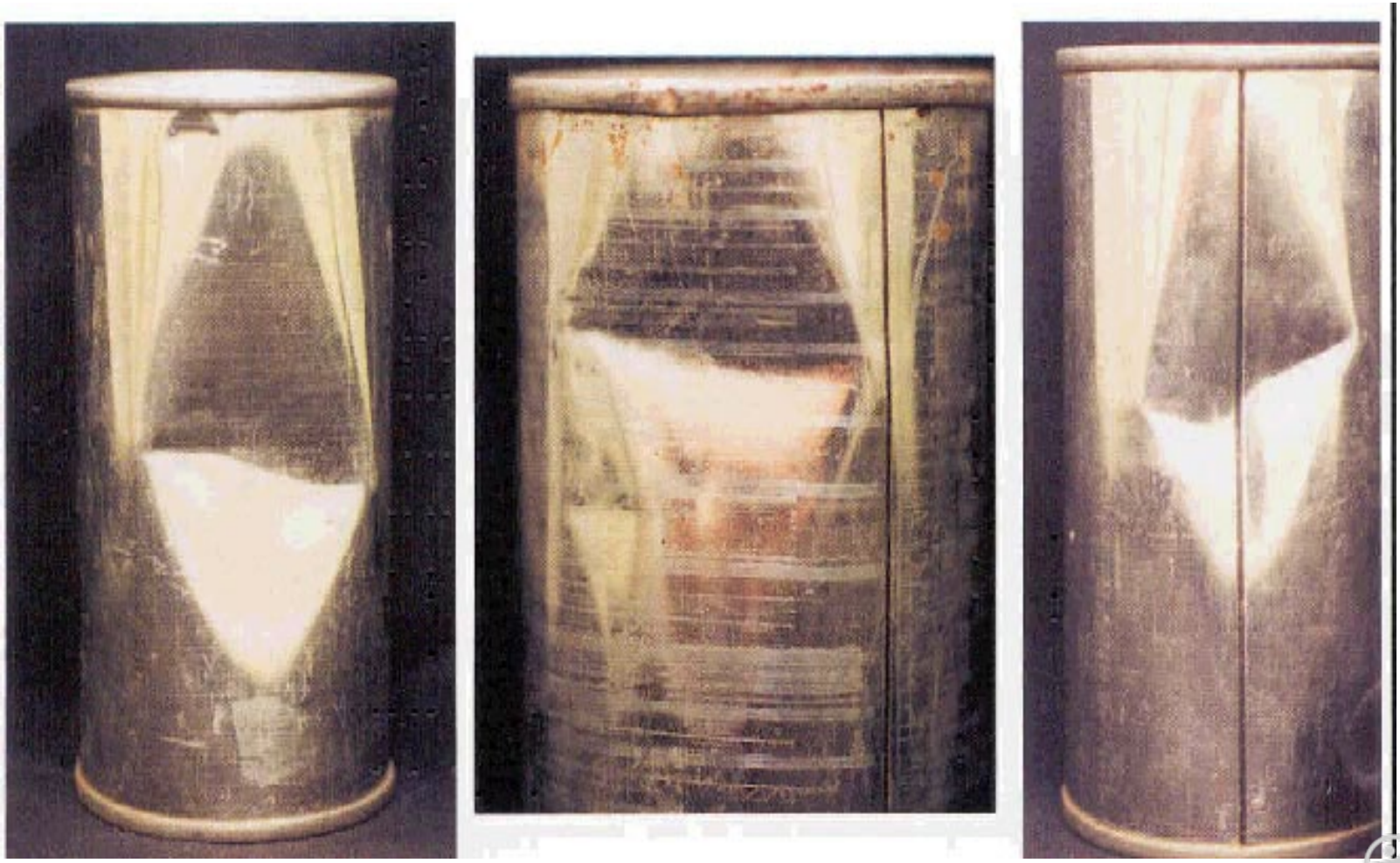


Damaged Coating



Open Weld At Side Seam

Dents



Evaluating Double Seam Integrity

Evaluation of Double Seam Integrity

- Inspections must be performed by a trained technician
- Inspections must include visual and teardown examinations

Good Seam Formation

- Cannot be judged purely by mechanical means or measurement
- Requires experience and skill which cannot be quickly imparted

Visual Inspection Requirements 9 CFR 431.2(b)(1)

- At intervals of sufficient frequency, the container closure inspector must visually examine either the top seam of a can randomly selected from each seaming head or the closure of any other type of container being used.
- Measurements/recordings should be made at intervals not to exceed 30 minutes.

Visual Can Inspection

Visual Inspection Requirements

- For double-seam cans, each can should be examined for gross defects such as cutover or sharpness, skidding (deadheading), false seam, droop at the crossover or lap, and condition of the inside of countersink wall for evidence of broken chuck.
- **Must** record the observations made and any corrective action taken.

Visual Can Inspection

Visual Inspection Requirements

- Additional visual closure inspections **must** be made immediately following a jam in a closing machine, after closing machine adjustment, or after start-up of a machine following a prolonged shutdown.
- All pertinent observations must be recorded.
- When irregularities are found, the corrective action must be recorded.

Visual Inspection Requirements

Regular observations must be maintained during production runs for gross closure defects. Any such defects must be recorded and corrective action taken.

Visual Inspection Requirements

Immediate Corrective Action Required When:

- Sharp cut-overs/fractures
- Heavy cut-over at crossover
- Severe droop at cross-over
- VEES or LIPS
- False seam
- Distorted seam
- Skidding or deadheading
- Fractured code

Teardown Examination for Double-seam Cans 9 CFR 431.2(b)(2)

- Must be performed by a qualified individual
- Must be performed at intervals of sufficient frequency on enough containers from each seaming head to ensure maintenance of seam integrity

Teardown Examinations

Should Perform Teardown Examinations:

- At the beginning of production
- Immediately after severe jam
- After adjustment or changes to seaming machine

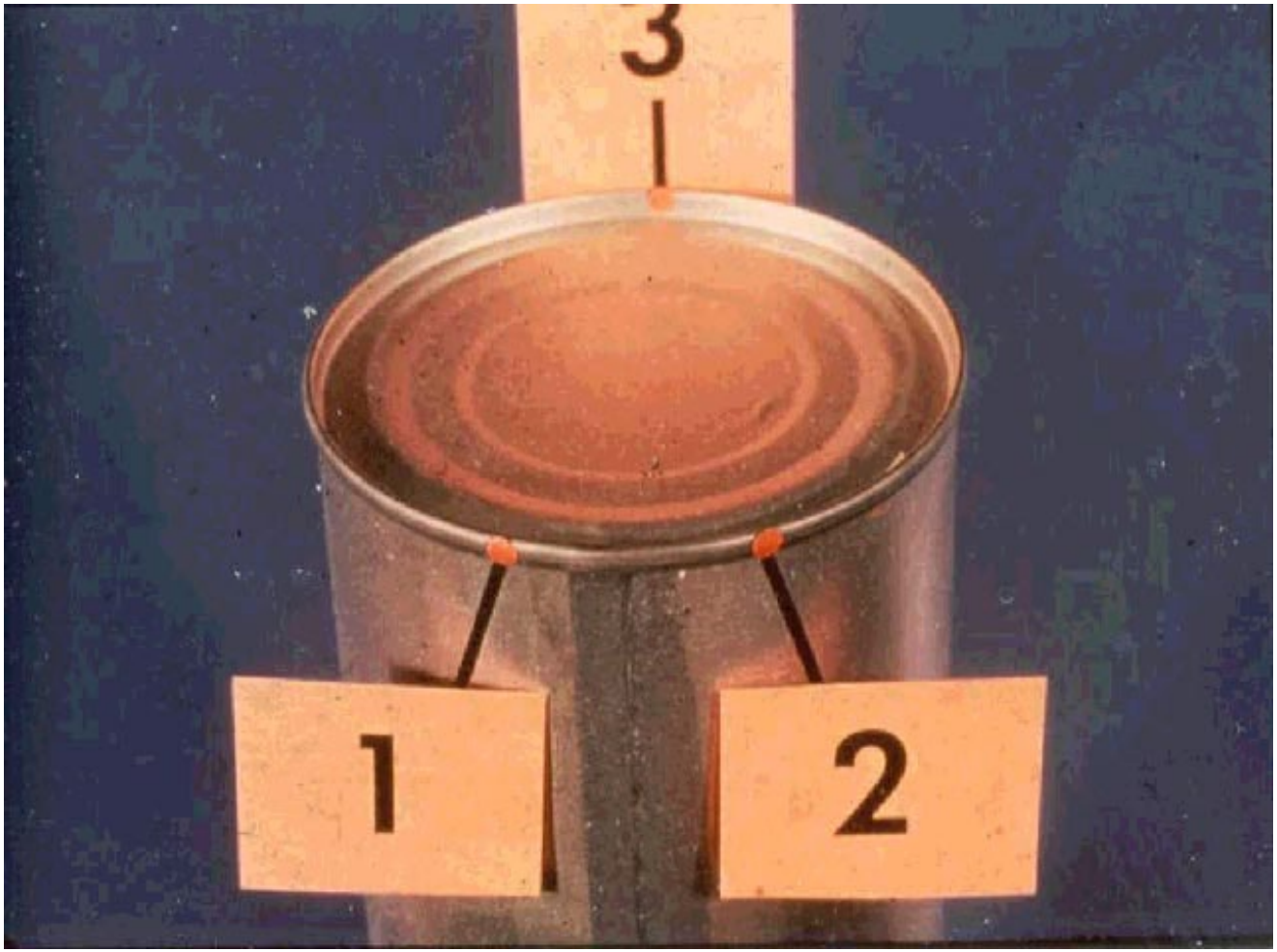
Teardown Examinations

Seam Teardown Equipment

Micrometer Measurement System

- Three measurements made 120° apart excluding the side seam juncture
- Body hook, cover hook, width, thickness, juncture rating (USDA) and tightness are required

Marking Seam for External Measurements



Can Seam Micrometer

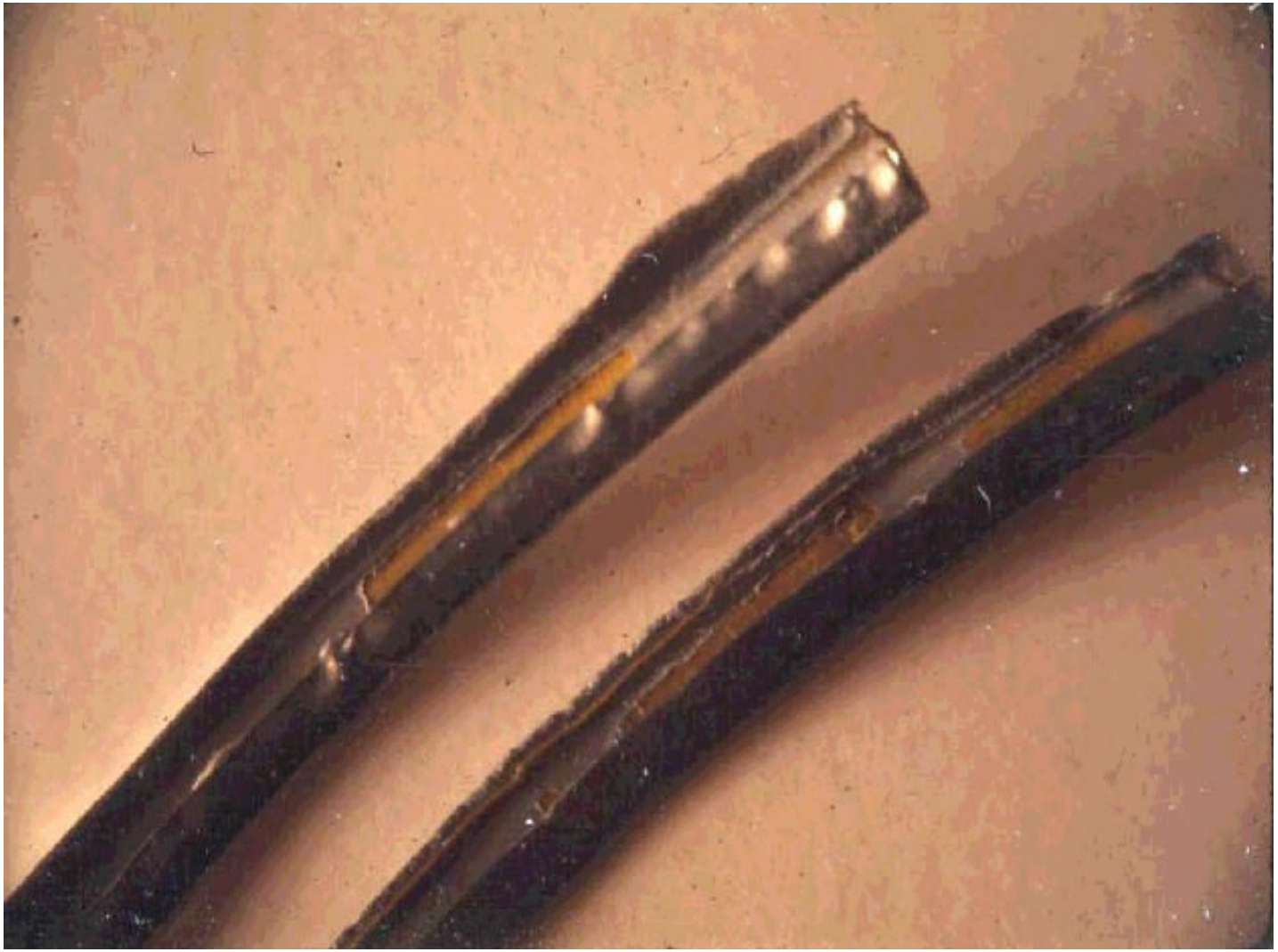
Teardown Measurement Procedure

External measurements (seam width, thickness and countersink)

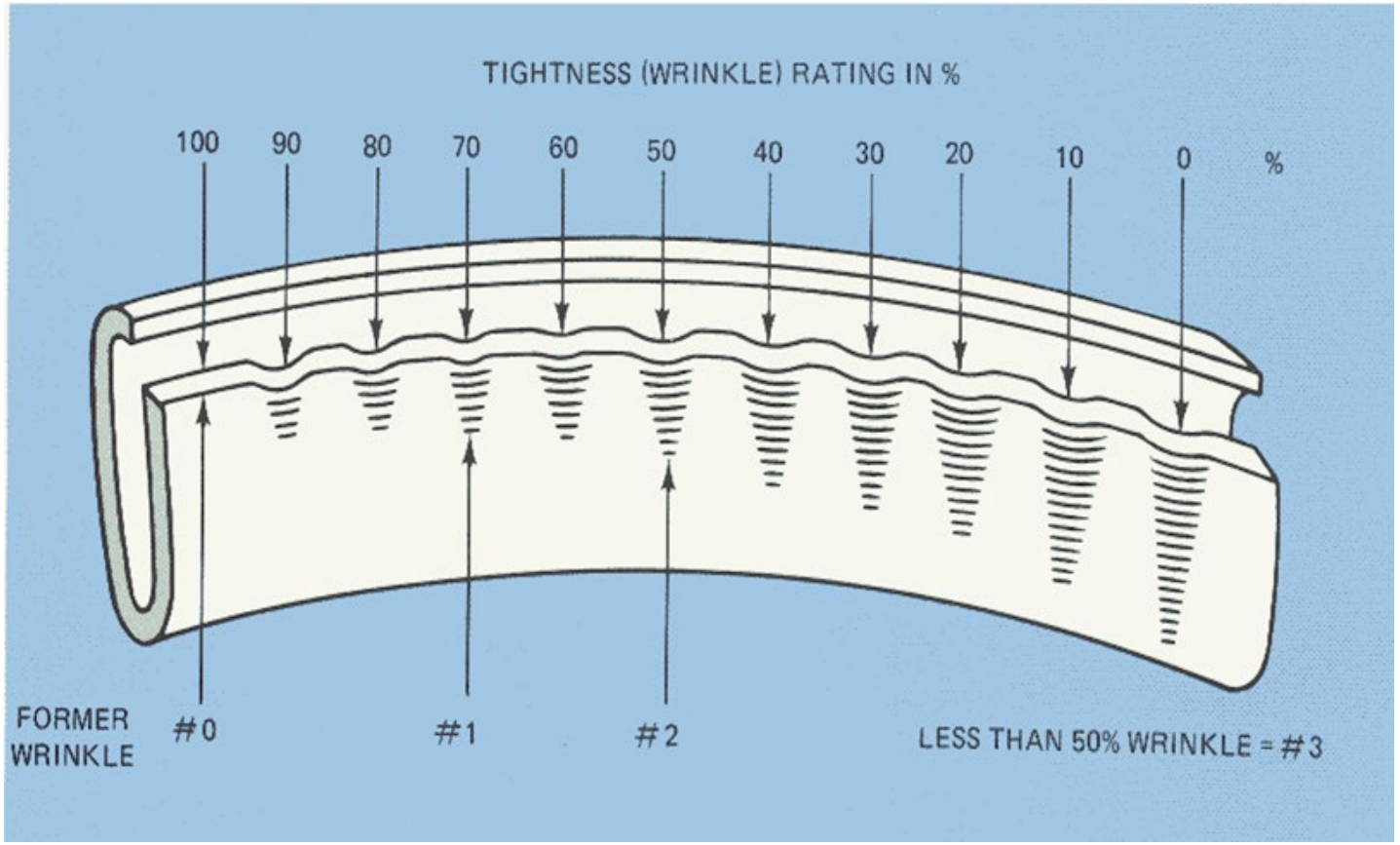
followed by

Internal measurements (body and cover hooks, tightness, pressure ridge and juncture rating

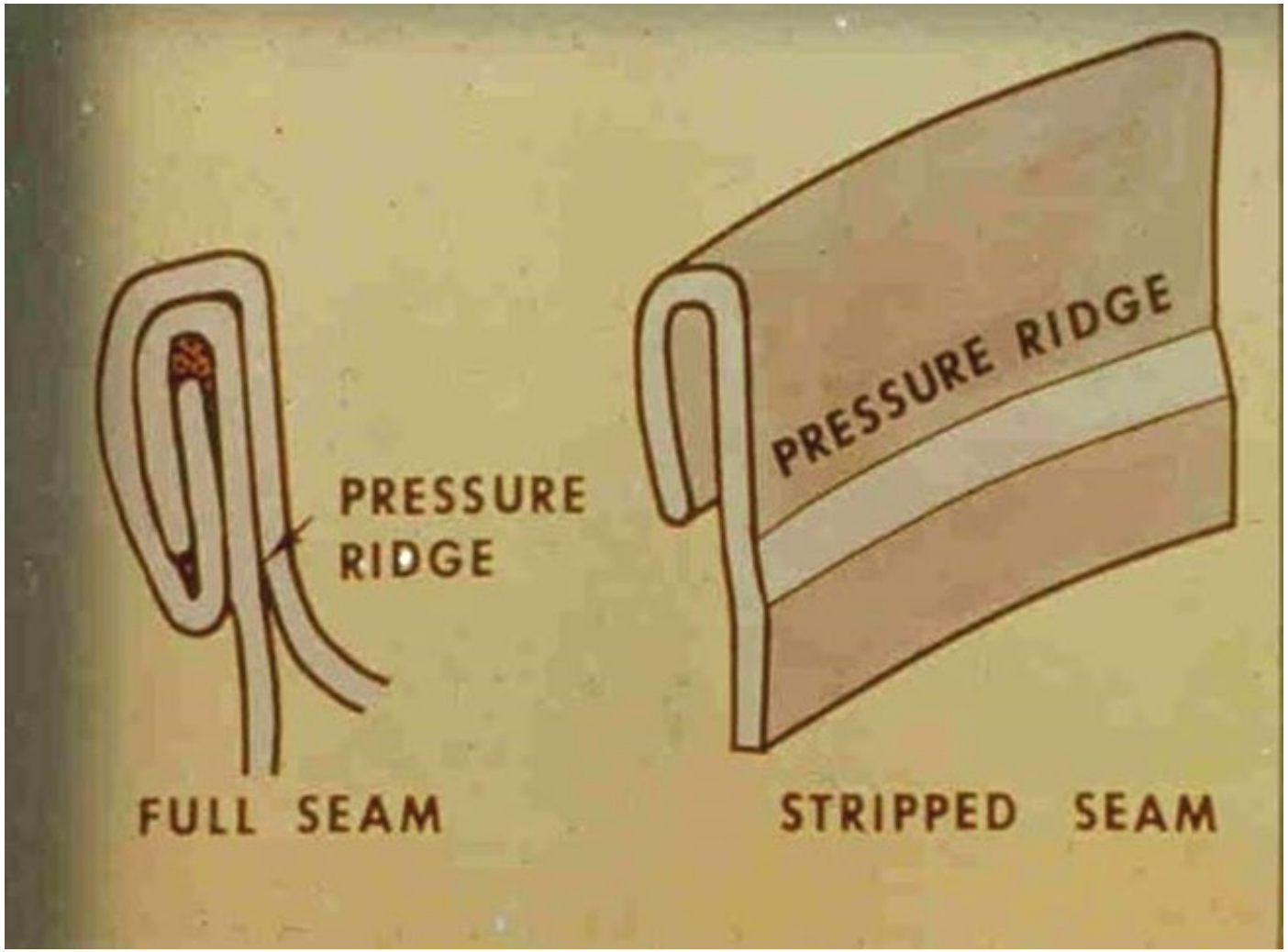
Cover Hook Wrinkle



Cover Hook Wrinkle Rating



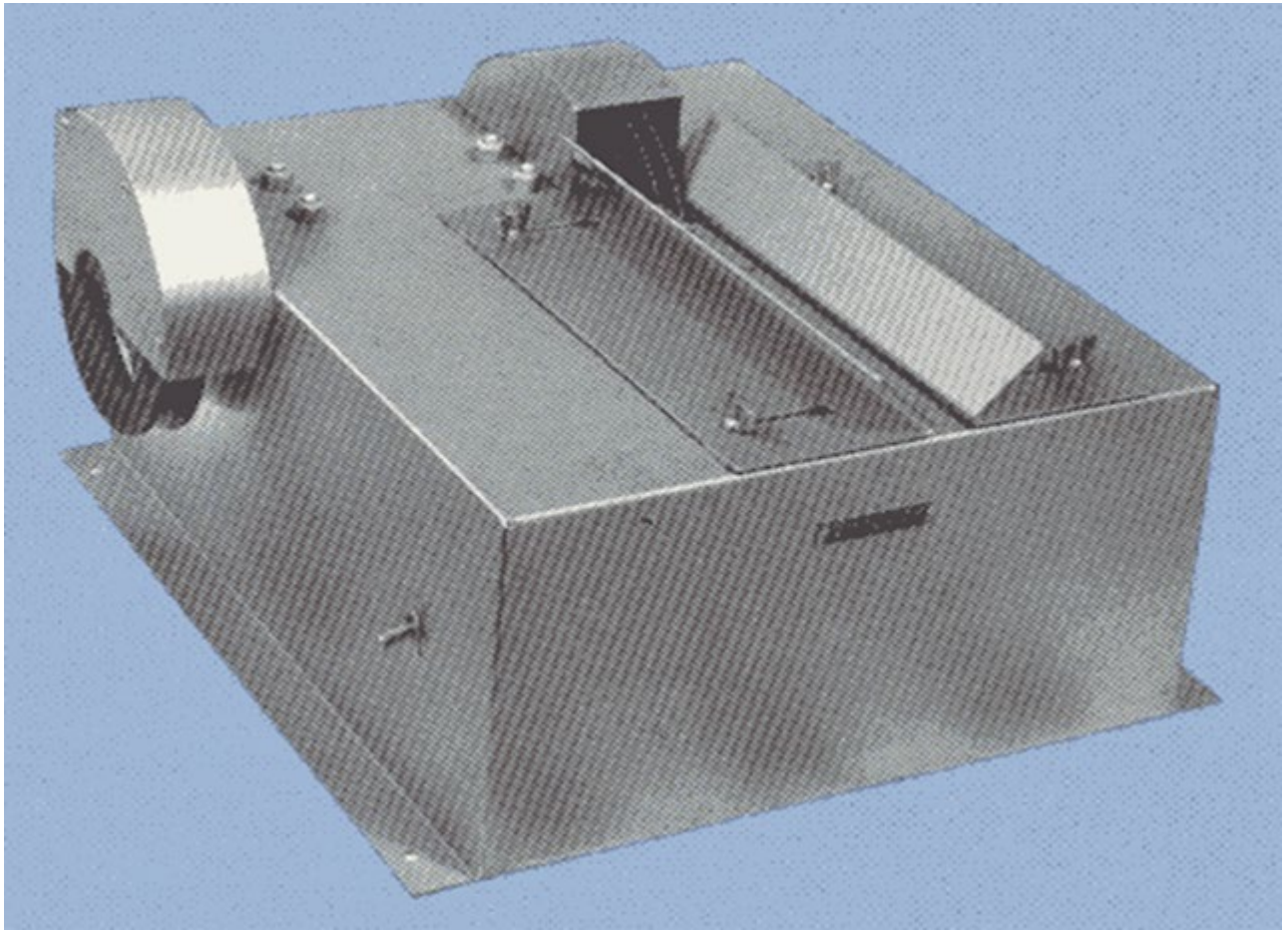
Pressure Ridge



Optical Measurement System

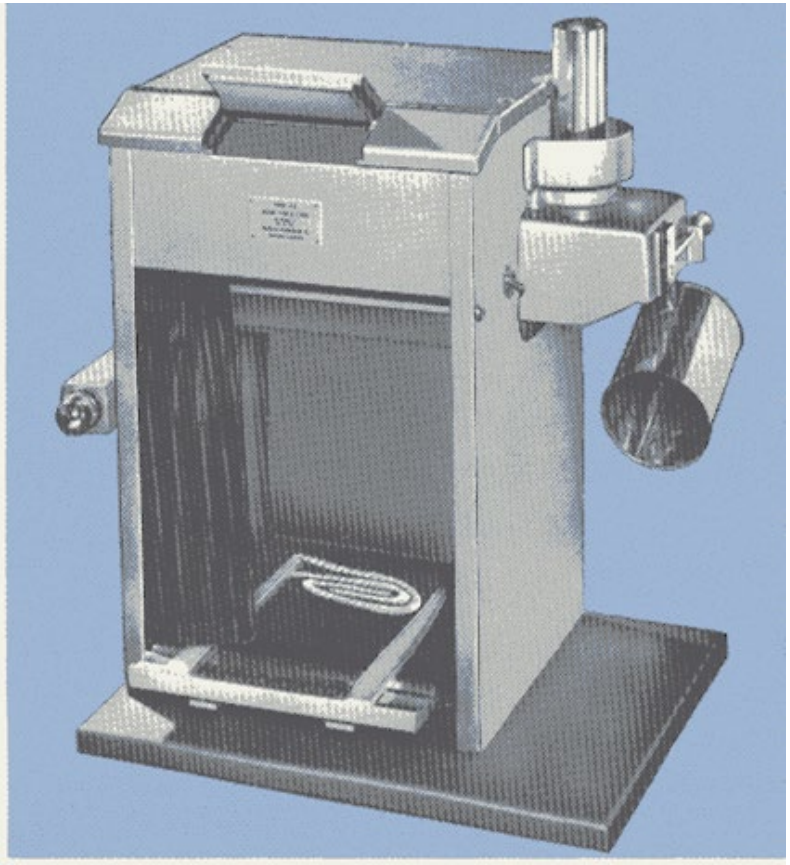
- Cuts should be from at least 2 different locations
- Body hook, overlap, thickness, tightness, and juncture rating are required

Seam Saw

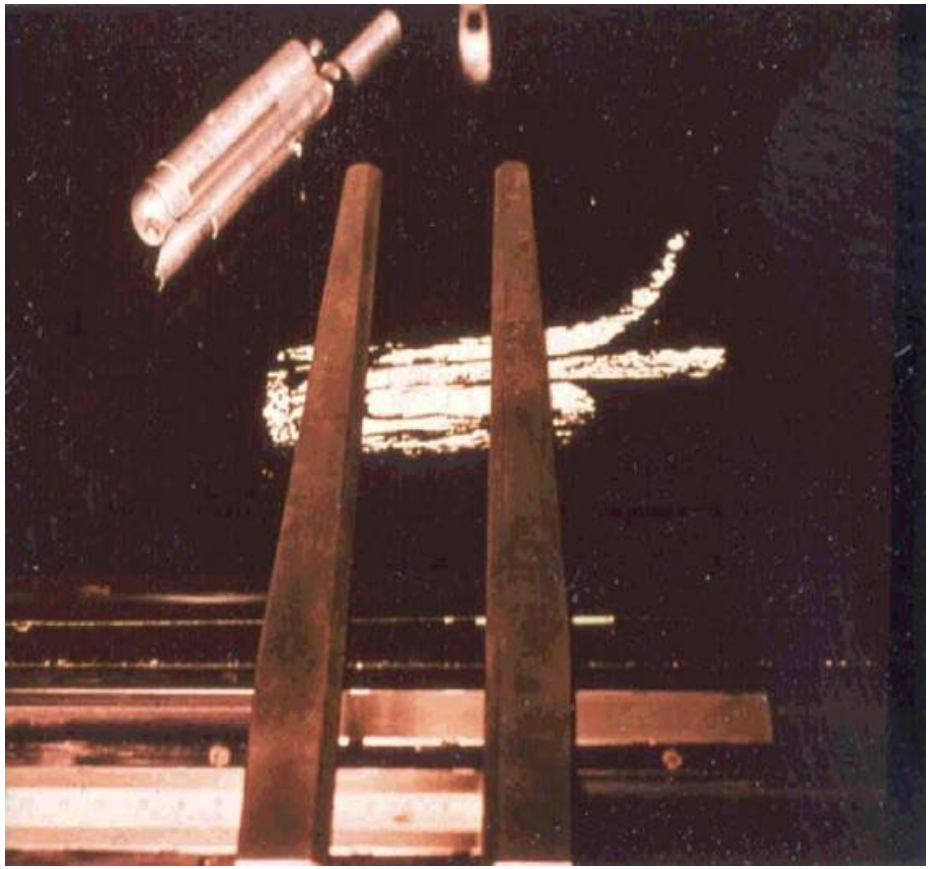


Cutting Cross Section of Double End Seam With Seam Saw

Seam Projector



Measuring Double Seam on Seam Projector



Interpretation of Inspection Results

- Resample if results are unsatisfactory, then assess severity of defect
- Timeliness of corrective action depends upon severity of defect

Teardown Inspection Results

If critical factor measurements are beyond adjustment tolerance limits, immediate adjustments must be made.

Teardown Inspection Results

Shut the line down immediately and adjust double seamer if:

- Cut overs
- False seams
- Severe droops
- Skidding/deadheading
- Fractured embossed code

Records

Can Seam Evaluation:

- All visual examinations and measurements must be recorded
- Must record defects and steps to correct problems

Evidence of Container Defects Needed for Regulatory Action

Plants Need Documentation when:

- Seam defects occur
- Product contains viable microorganisms or is spoiled
- Deviations from Part 431

Regulations and Guidelines

- 9 CFR 431.2—LACF Regulations
- Reference Manual—Guide to Inspection of LACF Manufacturers, Part 3, Container Integrity

Questions

Questions?