

TECHNICAL ASSISTANCE BULLETIN

TOPIC: STEEL CLOSURE MOISTURE REMOVAL SYSTEM GUIDELINES

NUMBER: 0018 REVISION: B ISSUED: December 8th, 2021



Purpose: This bulletin summarizes the importance and best practices for moisture removal from the raw cut edges and annular space of steel closures after capping, processing, and cooling.

Definitions

- **Annular Space:** The opening area between the glass finish and the inside of the applied closure. This area must be kept clean and dry to prevent any potential growth, Filiform Corrosion, or lug rust starting at the closure raw cut edges (Figure 1).
- **Raw Cut Edge:** Unprotected (uncoated) edge formed when metal blanks are punched from a coated sheet during manufacturing. Steps are taken to protect the raw cut edge by enclosure in the “curl” of the closure (Figure 1).
- **Filiform Corrosion:** Pattern of corrosion characterized by the appearance of filaments that typically start at the raw cut edge between lugs or a damaged lug that over time propagates in the direction of the steel grain, up the closure sidewall and over the center panel. The filaments form as thin tunnels just under the coating surface and detach the coating from the metallic support. The filament acts as an anode-cathode electrochemical cell. The presence of water allows for the oxidation of metal ions in the anode head, which then react with hydroxide ions in the cathode tail to form insoluble corrosion precipitates (Figures 2 & 3).
- **Lug Rust:** Rusting that can occur when water pools for an extended period in the lug curl (Figure 1). The raw cut edge of the lug acts as a starting point for rust formation. When the package is opened, rusty water is evident on the external surface of the bottle finish.

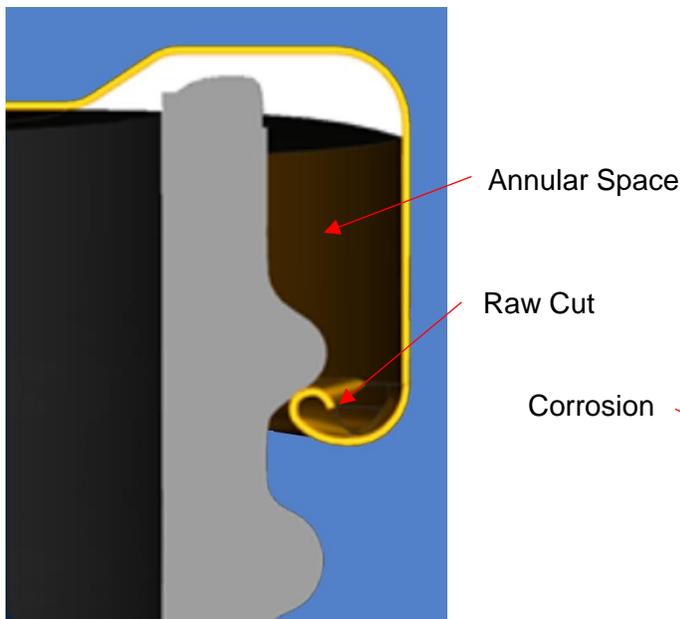
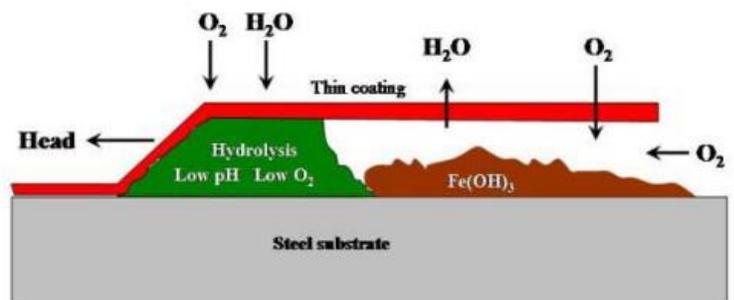


Figure 1: Fully applied steel closure sectioned view of the curl



Cross sectional view of a corrosion filament on a steel substrate

Figure 2: Filiform corrosion mechanism of action



Figure 3: Filiform corrosion example

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Moisture Removal System Guidelines

- Air knives should be located before the labeling machine on a single file conveyor lane
- Air knives should be evenly spaced on at least a 20" span of straight conveyor
- Each side of the conveyor should consist of at least 3 or more air knives
- Air knife assembly should be fully adjustable for both height and width
 - Air knives should be positioned so that the air flow is pointed into the direction of the annular space
- Air pressure should be adjustable
- Air quality should be dry and clean
- Moisture removal systems should be checked on a routine basis for proper functioning:
 1. Remove consecutive packages exiting the moisture removal system
 2. Dry package body and exterior over a dry surface
 3. Grip the container and shake over a dry surface or your free hand
 4. If water droplets are detected, the moisture removal system should be adjusted until the water trapped in the curl/finish area of the package is eliminated



Figure 4: Commonly used Paxton cap dryer system. Silgan recommends this or a similar style system for effective moisture removal.

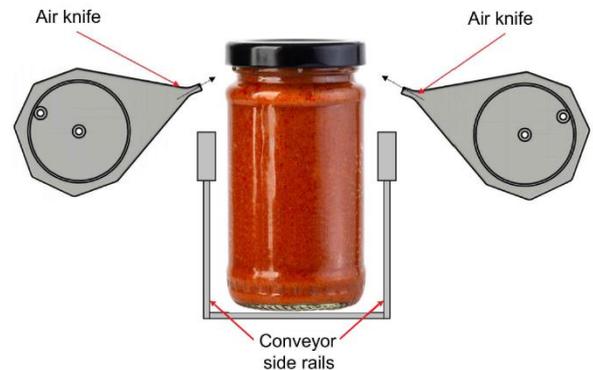


Figure 5: Blower System knife setup

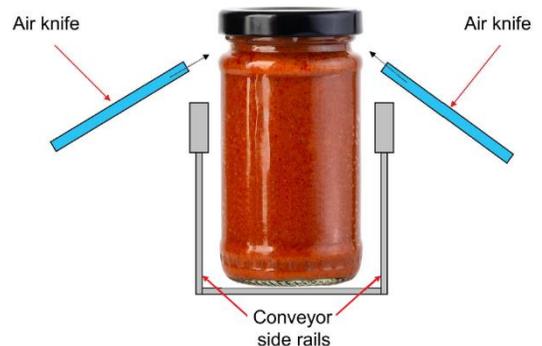


Figure 6: Forced Air knife setup

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