

# TECHNICAL ASSISTANCE BULLETIN



**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022

---

## **Purpose**

This bulletin is intended to define the important quality checks for our plastic closures, as well as to describe the procedures for completing the quality checks. For our 2-piece lined closures, pull-up, removal torque, security, and touch-off should be used together to properly gage closure application. For our linerless, plug style closures, pull-up and removal torque should be used together to properly gauge closure application. Bottle pull-up mark verification should be checked before running any new bottle to ensure you are using the correct recommended range. Touch-offs should be completed before running any new 2-piece lined closure and bottle finish combinations. Band break torque is an optional test that can be completed to gauge the package tamper evidence function. Cap shell temperature checks are recommended to be performed on any closure that is heated with steam prior to application.

## **Sequential Order**

Quality checks should be completed in a sequential order on each package. For example, for 2-piece lined closures, sample 1 should be measured for Pull-up → Removal Torque → Band Break Torque (Optional) → Security before moving on to sample 2.

## **Sample Collection**

### **Hot fill:**

Measurements taken after capping should be completed within 1 minute. Measurements after cooling should be made immediately after packages exit the cooler provided product temperatures are no greater than 80°F (27°C).

### **Cold/ESL/Aseptic Fill:**

Measurements should be completed at least 10 minutes after capping for accurate removal torque readings.

# TECHNICAL ASSISTANCE BULLETIN



**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022

## 1. Bottle Pull-up Mark Degree Verification

Bottle finishes can have different pull-up index mark positions. Index marks are measured in degrees from a fully formed thread on the bottle finish. There are three most common pull-up mark degrees, 0°, 42°, 78°. It is important to note the angle before starting your measurements as the pull-up range will change depending on the mark position.

**Equipment:** Correct diameter pull-up gauge, marker

### Procedure:

1. With a marker, draw a line through the first fully developed portion of the thread start. See example below
2. Align the 0 point of the gauge on the fully formed thread section and record the pull-up marks between the fully formed thread and the bottle index mark (Figure 1). A 0° bottle will be about 0, a 42° will be about 10, and a 78° will be about 16 (Figures 2-4).

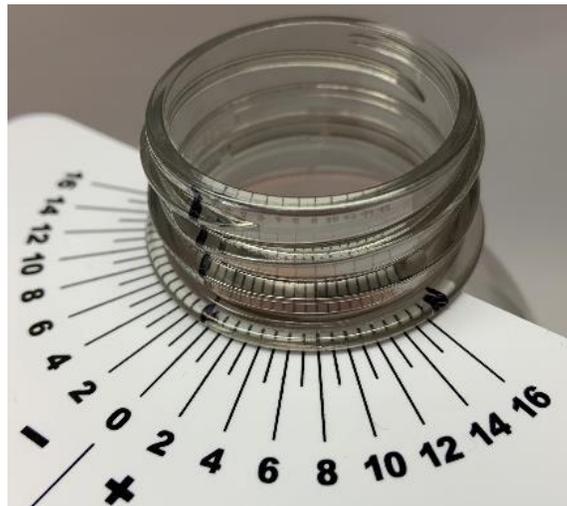


Figure 1: Proper bottle finish pull-up mark degree check on a 78° bottle finish.

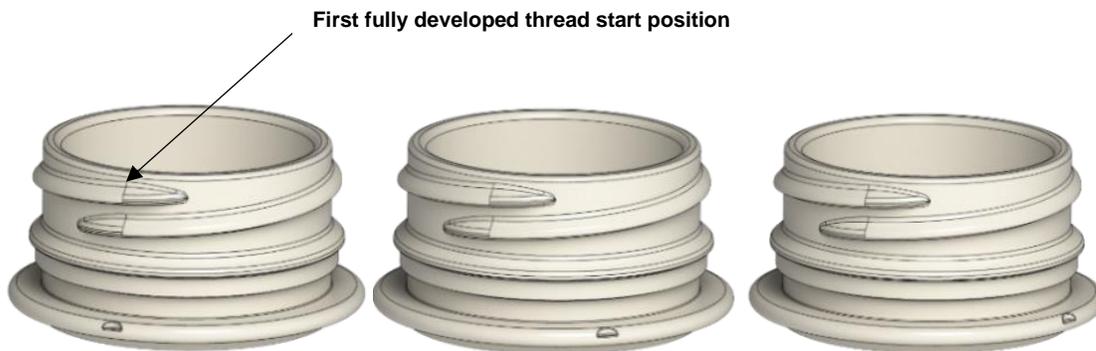


Figure 2: 0° pull-up mark bottle finish example.

Figure 3: 42° pull-up mark bottle finish example.

Figure 4: 78° pull-up mark bottle finish example.

# TECHNICAL ASSISTANCE BULLETIN



**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022

## 2. Pull-up

Pull-up is the mechanical relationship of cap thread to bottle thread. It is a non-destructive test reference of closure application. Pull-ups are measured in 1/16" increments.

**Equipment:** Correct diameter pull-up gauge (Figure 5), marker.

### Procedure:

1. On a fully applied closure, locate the pull-up index marks on the closure and bottle (Figure 6).
2. Make a mark from the closure to the bottle finish for 2-piece lined closure security checks.
3. Measure the distance between the index marks on the bottle and closure using the pull-up gauge. The 0 point on the gauge should correspond with the index mark on the bottle transfer flange (Figure 7).
4. Record your pull-up reading. A positive pull-up will be one with the closure index mark to the right of the bottle index mark. A negative value, the closure pull-up index mark to the left of the bottle index mark.

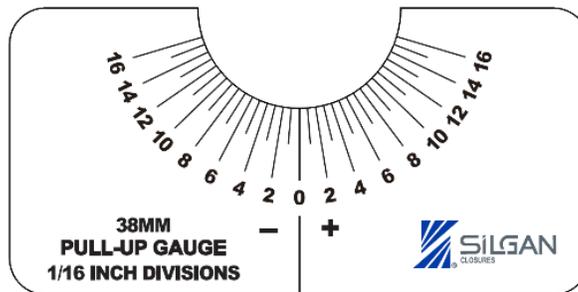


Figure 5: 38mm Pull-up Gauge to complete Pull-up checks on 38mm closures.

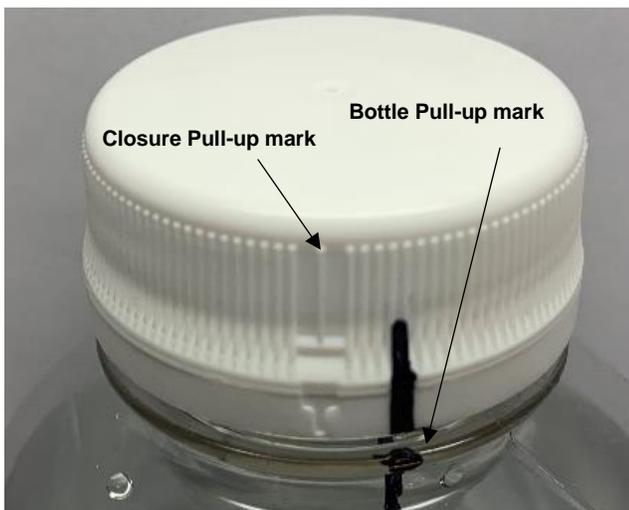


Figure 6: Closure and bottle Pull-up index mark examples.

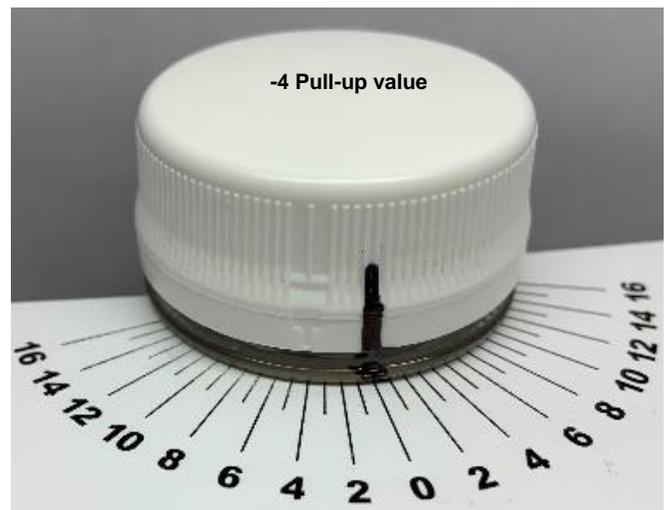


Figure 7: Proper Pull-up measurement technique

# TECHNICAL ASSISTANCE BULLETIN

**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022



## 3. Removal Torque (T1)

Removal Torque, or T1, is used to determine proper closure application and measure the initial torque required to rotate the closure on the bottle finish prior to breaking the Tamper Evident (TE) band.

**Equipment:** Removal Torque Meter

**Procedure:**

1. Tightly secure the package in the torque meter device (Figure 8). The package should not move when completing the opening.
2. Open the package by rotating the closure in a counterclockwise direction in a smooth, continuous motion. Only the initial torque required to move the closure on the container finish should be recorded.



*Figure 8: Proper hand removal torque setup*

\*Recommended removal torque ranges are based on data collected by hand removal. If removal torques are going to be completed via automated removal torque opening devices, a gauge R+R study should be conducted between both methods to amend the recommended torque ranges in the closure TDS.

# TECHNICAL ASSISTANCE BULLETIN

**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022



## 4. Band Break Torque (T2, Optional)

Band Break Torque, or T2, measures the peak torque required to break the bridges between the TE Band and the shell of the closure.

**Equipment:** Removal torque meter

**Procedure:**

1. After completing T1, zero the removal torque meter.
2. Open the package by rotating the closure in a counterclockwise direction in a smooth, continuous motion, until bridges break and record the peak torque (Figure 9).



*Figure 9: Closure rotated until all TE band bridges are broken.*

# TECHNICAL ASSISTANCE BULLETIN



**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022

## 5. Security (2-Piece Lined Closures Only)

Security measures the amount of liner compression and seal pressure from application. Security values are measured pull-up values, or 1/16" increments.

**Equipment:** Pull-up gauge, marker

**Procedure:**

1. Ensure that the TE Band has been completely disengaged from the closure shell and remove the TE band from the bottle finish.
2. Reapply the closure to 2 in-lbs using a removal torque meter.
3. Measure the distance between the closure and bottle mark made prior to completing the pull-up check (Figure 10). This reading should always be positive. If negative, it means the package as not properly sealed.



Figure 10: Proper Security measurement

# TECHNICAL ASSISTANCE BULLETIN



**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS  
**NUMBER:** 014 **REVISION:** C **ISSUED:** April 22<sup>nd</sup>, 2022

## 6. Touch-Off (2-piece Lined Closures Only)

Touch-off is used to define the recommended pull-up range for a closure and bottle combination by measuring the minimum closure liner to bottle top sealing surface contact point.

**Equipment:** Pull-up gauge, marker, removal torque meter.

**Procedure:**

1. Collect 6 unused bottles and closures, preferably bottles from different mold cavities and closures with different liner mold numbers.
2. Label the bottles and closures 1 through 6 and remove the TE bands from the closures.
3. Secure bottle 1 in the removal torque meter, and manually apply closures 1 through 6 to 2 in-lbs, recording the pull-up value for each touch off performed.
4. Next, repeat this test for bottles 2 through 6 building a 6x6 matrix with 36 total touch-offs (Figure 11).
5. Next, locate the minimum recorded touch off value in the 6x6 matrix. The minimum recommended pull-up value will be 5 pull-up marks deeper or more negative than the minimum touch off value recorded. For example, if the lowest pull-up noted in the touch off is a +1 then the minimum application pull-up value would be 1 - 5 = -4. If the minimum touch off is +6 then the minimum application pull-up value would be 6 - 5 = +1.
6. Next, determine the full revised pull-up range. If the original recommended pull-up range was -3 to -12 in our example above, the entire pull-up range would shift negative by 1 pull-up mark for a new pull-up range of -4 to -13. If the original range was -1 to -10, then our range would shift negative by 3 pull-up marks for a new pull-up range of -4 to -13 (Figure 12).

		Caps					
		1	2	3	4	5	6
Bottles	1	1	1	1	2	1	2
	2	1	1	1	1	1	2
	3	1	1	1	1	1	2
	4	2	2	1	2	2	3
	5	2	1	1	2	2	3
	6	2	1	1	1	2	3

Figure 11: 6x6 touch-off matrix example.

Minimum Finger Tight Pull-up	1
------------------------------	---

Target Pull-Up Range Chart		
Minimum Finger Tight Pull-up	Minimum Application Pull-up	Maximum Application Pull-up
4	-1	-10
3	-2	-11
2	-3	-12
1	-4	-13
0	-5	-14
-1	-6	-15
-2	-7	-16
-3	-8	-17
-4	-9	-18

Figure 12: Target pull-up range calculation chart.

\*For a 6x6 touch-off matrix, if the pull-up difference between minimum and maximum touch-off values exceeds 4, further investigations should be taken as this could be an indication of high closure or bottle dimensional variability.

# TECHNICAL ASSISTANCE BULLETIN



**TOPIC:** PLASTIC CLOSURE QUALITY CHECKS

NUMBER: 014 REVISION: C ISSUED: April 22<sup>nd</sup>, 2022

## 7. Cap Shell Temperature (2-Piece Lined Closures Only)

Cap shell temperatures are performed on lined closures with steam preheating to ensure proper steam preheating is being completed. Refer to closure specific Technical Data Sheets for specific preheating temperature ranges and whether a closure requires steam preheating.

**Equipment:** Infrared Thermometer

**Procedure:**

1. Immediately after packages exit the capper, point the infrared thermometer at the closure shell. Ensure that the thermometer is held at the right height so that it correctly reads the cap shell temperatures and not the product temperature or air temperature above the package (Figures 13-15).



Figure 13: Correct cap shell temperature reading.



Figure 14: Incorrect high cap shell temperature reading.



Figure 15: Incorrect low cap shell temperature reading.

### CONFIDENTIAL PROPRIETARY INFORMATION

This information, and the subject matter thereof, is Silgan Closures property and is confidential information. Disclosure or use of such information without the prior written consent of Silgan Closures is prohibited, except as provided by separate written agreement. When not in use, this document should be kept in a secure location or destroyed. Silgan Closures believes that the statements, technical information, and guidelines contained herein are reliable. They are, however, given without warranty or guarantee of any kind, express or implied, and Silgan Closures assumes no responsibility for any loss, damage, or expense, direct or consequential, arising out of their use. Silgan Closures reserves the right to modify the information contained herein without notice unless other specific arrangements are made with the buyer of this product.

*Note: This is an uncontrolled document. Please consult your Silgan Closures Representative to confirm this is the latest revision prior to implementing any information contained herein.*