# Twist Assist Coca-Cola Cap

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**48**HR REPACK    *Coca-Cola*

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**Abstract**

The standard bottle cap design often necessitates an opening force of approximately 533 Newtons (N), posing a significant challenge for elderly individuals whose average grip strength is around 347 N. This study introduces an innovative "Twist Assist" lever extension of 8 millimeters (mm) to the conventional bottle cap, aiming to enhance accessibility for users with diminished hand strength. Through torque calculations, we demonstrate that this modification reduces the required opening force to approximately 340 N, achieving a reduction of about 36%. This design not only aligns the necessary force with the average grip capabilities of older adults but also minimizes additional material usage, ensuring cost-effectiveness. The findings suggest that such ergonomic enhancements can significantly improve daily usability for the elderly population, promoting greater independence and ease in routine tasks.

**Keywords: Bottle Cap Design, Accessibility, Elderly Population, Torque Calculation, Ergonomics**

— Lever assisted cap

— Standard PCO 1881 thread
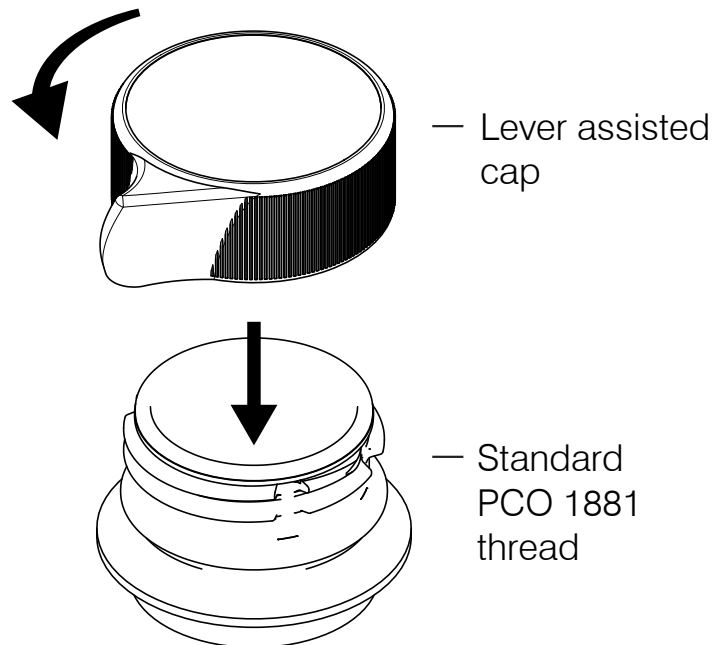
# 1 Cause and Concern

## 1.1 Torque Decrease Calculation

Individuals with disabilities often encounter significant challenges when attempting to open standard soda bottle caps, primarily due to the torque required to initiate and sustain the cap's rotation. Torque, denoted as $\tau$, is defined as the rotational force necessary to turn an object and is mathematically expressed as:

$$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F} \tag{1}$$

In this equation, $\mathbf{r}$ represents the position vector from the axis of rotation to the point where the force is applied, and $\mathbf{F}$ denotes the applied force vector. For practical purposes, when the force is applied perpendicularly to the radius.

Opening a standard bottle cap typically requires a torque of approximately $8\,\mathrm{N\,m}$ [1]. Given a cap radius of $15\,\mathrm{mm}$ (0.015 meters), the force needed can be calculated using the torque formula:

$$\tau = F \times r \tag{2}$$

Solving for $F$:

$$F = \frac{\tau}{r} = \frac{8\,\mathrm{Nm}}{0.015\,\mathrm{m}} \approx 533.33\,\mathrm{N} \tag{3}$$

Research indicates that the average grip strength for men aged 60 to 87 years is approximately $35.3\,\mathrm{kg}$, which equates to about $346\,\mathrm{N}$ [2]. This suggests that many older adults may struggle to open standard bottle caps due to insufficient grip strength.

To address this issue, our bottle cap design incorporates an $8\,\mathrm{mm}$ "Twist Assist" lever extension. This modification increases the effective radius to $23.5\,\mathrm{mm}$ (0.0235 meters), reducing the required force as follows:

$$F' = \frac{\tau}{r'} = \frac{8\,\mathrm{Nm}}{0.0235\,\mathrm{m}} \approx 340.43\,\mathrm{N} \tag{4}$$

The percentage reduction in required force is calculated as:

$$\text{Percentage Reduction} = \left( \frac{533.33\,\mathrm{N} - 340.43\,\mathrm{N}}{533.33\,\mathrm{N}} \right) \times 100 \approx 36.2\% \tag{5}$$

This design change not only makes the bottle more accessible to individuals with lower grip strength but also minimizes additional plastic usage, thereby keeping production costs low. By enhancing the ease of opening without significantly altering the cap's material composition, we achieve a balance between user-friendliness and cost-effectiveness.

## 1.2 Weight Increase Calculation

$$\text{Original Cap Weight} : 2.12\,\mathrm{grams}$$

$$\text{New Cap Weight} : 2.53\,\mathrm{grams}$$

$$\text{Weight Increase} : 2.53\,\mathrm{g} - 2.12\,\mathrm{g} = 0.41\,\mathrm{grams}$$

$$\text{Percentage Increase} : \left( \frac{0.41\,\mathrm{g}}{2.12\,\mathrm{g}} \right) \times 100 \approx 19.34\%$$

# 1. Adaptability to Existing PET Bottle Portfolio

- The *Twist Assist* cap is designed as a direct modification of the current Coca-Cola PET bottle closure, ensuring compatibility across all brands without altering the bottle's shape or impacting brand identity.

- The design functions as an additive enhancement to the existing cap, facilitating adaptation without fundamental changes to bottle characteristics.

# 2. Gas Tightness and Carbonation Retention

- The cap maintains existing threading and sealing mechanisms, ensuring gas tightness from production to shelf.

- The modification does not introduce additional moving parts or complex sealing mechanisms, preserving beverage carbonation until consumption without leakage or loss of fizziness.

# 3. Resealability & Leak Prevention

- The *Twist Assist* lever extension does not impact the cap's ability to reseal.

- The added ergonomic leverage makes it easier for consumers, especially the elderly, to fully tighten the cap, minimizing the likelihood of accidental spills when bottles are stored in bags.

# 4. Sustainability & Material Considerations

- The new cap is designed using rPET (recycled polyethylene terephthalate) 3D-printed filament, ensuring full compatibility with Coca-Cola's existing PET recycling streams and supporting the company's sustainability commitments. Incorporating rPET aligns with The Coca-Cola Company's goal to use 35% to 40% recycled material in its primary packaging, including increasing recycled plastic use to 30% to 35% globally by 2035 [3].

- The weight increase of the cap is minimal, with only **41 grams added**, translating to an overall **19% increase in material use**.

- Despite this small material increase, the *Twist Assist* significantly reduces the required torque by **36%**, demonstrating a strong tradeoff between sustainability and accessibility.

# 5. Cost-Effectiveness & Production Feasibility

- Since the design modifies only the cap and not the bottle threading, it requires minimal changes to the existing bottling process, making mass production and implementation straightforward.

- The additional material used is kept to an absolute minimum, ensuring that any increase in per-unit cost is offset by the added consumer accessibility and brand goodwill.

# 6. Impact on Packaging & Shelf Presence

- The *Twist Assist* maintains the general footprint of a standard Coca-Cola bottle and does not interfere with shrink-wrapped multi-packs or shelf placement.

- Due to the dead space around the bottle neck, the extended grip does not alter how bottles are stacked, transported, or displayed in stores.
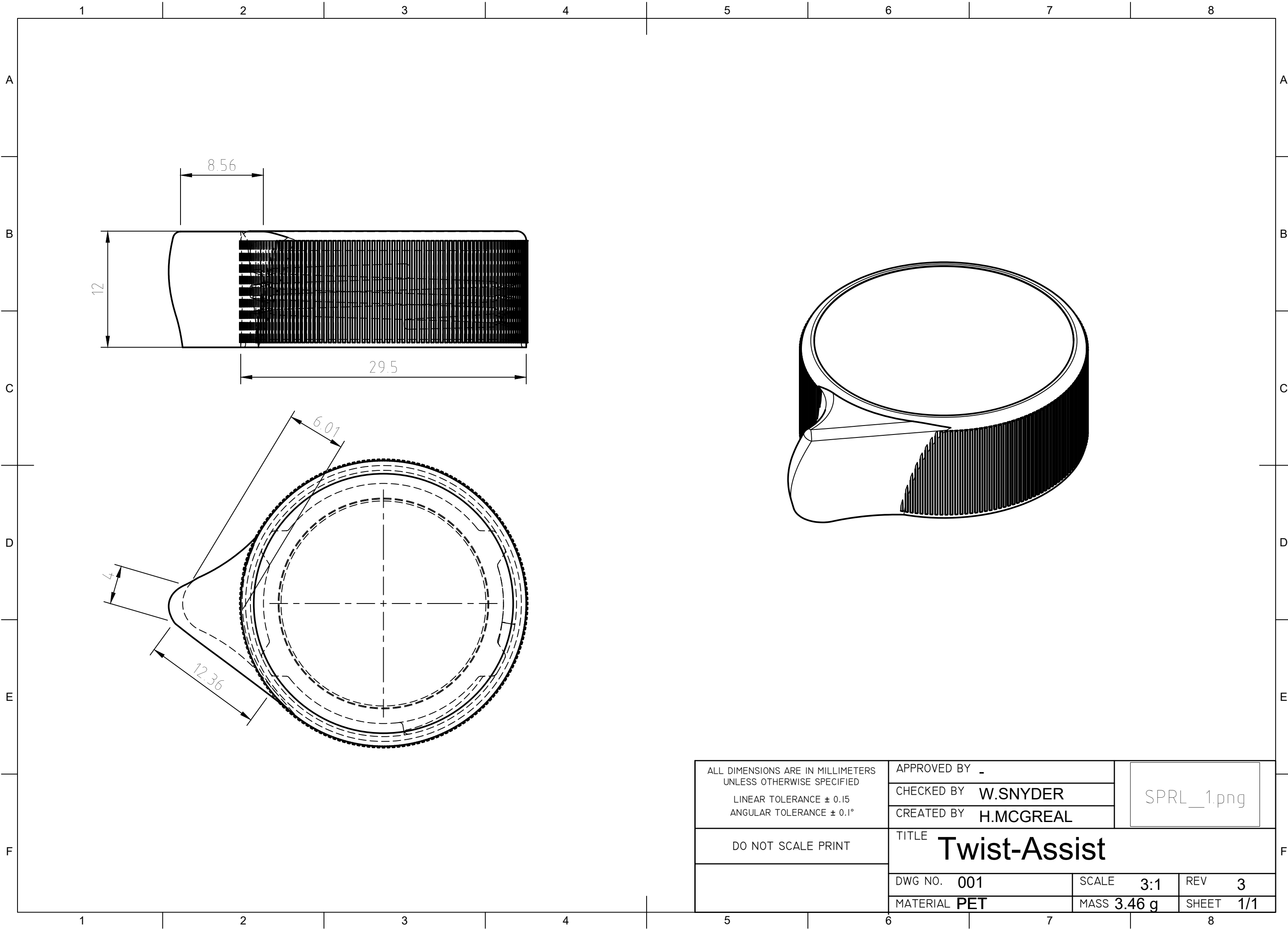
## 7. Brand Identity & Design Language

- The ergonomic shape of the *Twist Assist* cap is designed to resemble a crashing wave, reinforcing Coca-Cola's association with refreshment and enjoyment.

- The design subtly evokes the feeling of a cool wave hitting the shore on a hot summer day—the perfect moment to enjoy a Coca-Cola.

## Conclusion

The *Twist Assist* bottle cap successfully meets all outlined criteria, enhancing usability, sustainability, and brand experience while maintaining cost-efficiency and compatibility across Coca-Cola's PET bottle portfolio. This solution not only makes opening bottles easier but also preserves Coca-Cola's signature refreshing experience for a broader audience, because who said Coca-Cola was a young man's game?

## References

[1] National Science Teaching Association, *Lab 12. Torque and Rotation: How Can Someone Predict the Motion of an Object Around a Fixed Axis?*, 2017. Available at: `https://static.nsta.org/extras/adi-physics1/Lab12CheckoutQuestions-TorqueAndRotation.pdf`

[2] Maranhão Neto, G. A., et al. (2017). *Handgrip strength in elderly individuals: influence of elbow position. Journal of Bodywork and Movement Therapies*, 21(4), 939-943.

[3] The Coca-Cola Company, *Packaging Design*, Available at: `https://www.coca-colacompany.com/sustainability/packaging-sustainability/design`, Accessed: 2025-02-01.

8.56

12

29.5

6.01

4

12.36

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TITLE
Twist-Assist

| DWG NO. 001 | | SCALE 3:1 | REV 3 |
|---|---|---|---|
| MATERIAL PET | | MASS 3.46 g | SHEET 1/1 |