ID Inline Application Note

MEASURING APPEARANCE QUALITY OF BLOW MOLDED CONTAINERS

Overview

Transmission appearance is a critical quality parameter for blow molded PET bottles, shaping first impressions, customer satisfaction, and brand reputation. High clarity and low haze signal manufacturing excellence and product quality, helping bottles stand out on the shelf and build trust with consumers.

In sectors ranging from beverages to personal care, consistent transmission appearance demonstrates product integrity and influences buying decisions.

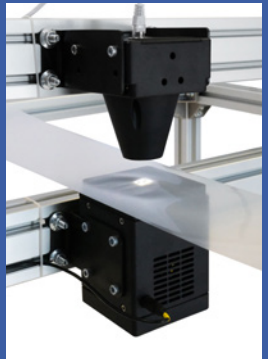
Blow molded bottles serve as a direct reflection of the contents' quality and value. Superior appearance ensures products have maximum shelf appeal and consumer confidence. Measurement of optical properties allows manufacturers to detect and address flaws—such as haze, waviness, or loss of sharpness—early in the process, preventing costly waste and customer complaints. This proactive control helps guarantee every bottle aligns with market expectations.

Quantifiable, repeatable measurement also provides brands with a powerful differentiator. Reliable transmission data supports premium positioning, enables quality claims and meets increasingly stringent customer and regulatory requirements. Customers that see and experience consistent clarity will reward brands with loyalty and preference.

Importantly, the Rhopoint ID Transmission Appearance instrument is the only technology able to directly and non-destructively measure these critical appearance parameters on intact, three-dimensional bottles.

Unlike traditional haze and clarity meters - which require flat or cut samples and do not reflect actual product presentation - the Rhopoint ID measures whole, finished bottles exactly as customers experience them, setting a new global standard for bottled product quality control.

RHOPOINT iD
MEASURE WHAT YOU CAN SEE IN-LINE



What is the Rhopoint ID-Inline?

The Rhopoint ID-Inline is a camera-based system which fully quantifies product transparency with parameters that are highly correlated to human perception.

There are two versions of the Rhopoint ID-Inline. The short focal length version has a separation distance of 45mm between the camera and graticule, and can be used for non-contact measurement of any sheeted or planar material - including plastic films, or glass. It can also be used for non-contact inline measurement of glass or plastic tubes. The long focal distance version has a separation distance of 170mm, which is most suitable for production processes where the large focal distance is more suited to the customer production line.

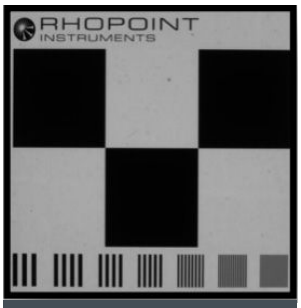
Measured parameters:

Haze: Quantifies the loss of *contrast* for objects viewed through a material.

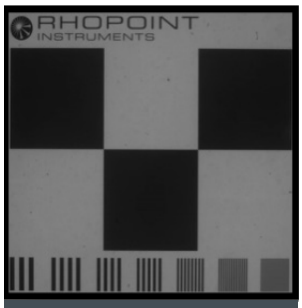
When a material has haze, it changes the appearance of both the material and any objects viewed through it. This can lead to a reduction in perceived quality.

- The product viewed through the material appears lifeless and dull - but details remain sharp.
- The colour of a viewed object appears washed-out and faded

The material itself appears cloudy or milky. plastic tubes. The long focal distance version has a separation distance of 170mm, which is most suitable for production processes where the large focal distance is more suited to the customer production line.



Haze = 0%



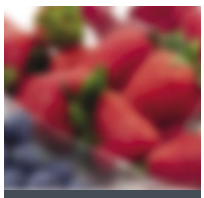
Haze = 30%

Sharpness: Quantifies the loss of perceived detail for objects viewed through a material.

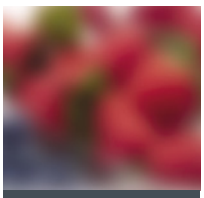
When viewed through a material with high sharpness, an object appears sharp and distinct. As material sharpness decreases, the object appears blurry and obscured.

High Sharpness (S = 98.71%)

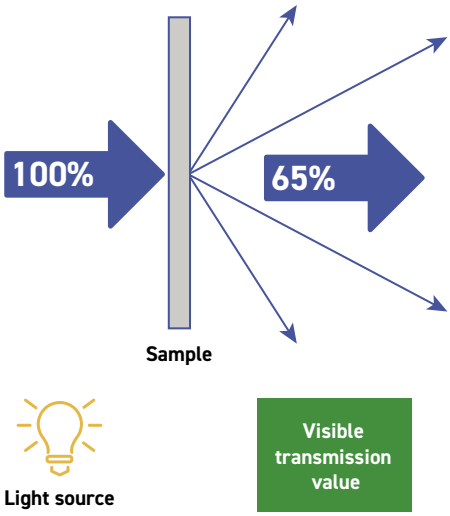
Medium-High Sharpness (S = 76.34%)



Medium-Low Sharpness (S = 49.62%)



Low Sharpness (S = 18.02%)



Transmission (Visible Transmittance):

When considering how material is perceived by a consumer it is important to consider how bright an object viewed through it will appear.*

- Rhopoint Transmittance (TID) quantifies the amount of light passing through the material and reaching the camera/eye of the observer.
- This measurement describes the brightness/luminosity of the viewed object and is correlated to how one perceives the quality of the material.
- In the short focal distance version; the Visible Transmittance readings are compatible with the desktop Rhopoint ID instrument.

*Traditional hazemeters measure total transmission which is related to light absorption not visual perception.

Methodology- Observer Ranking Process

Sample preparation: Six PET water bottles were selected to reflect process variability.

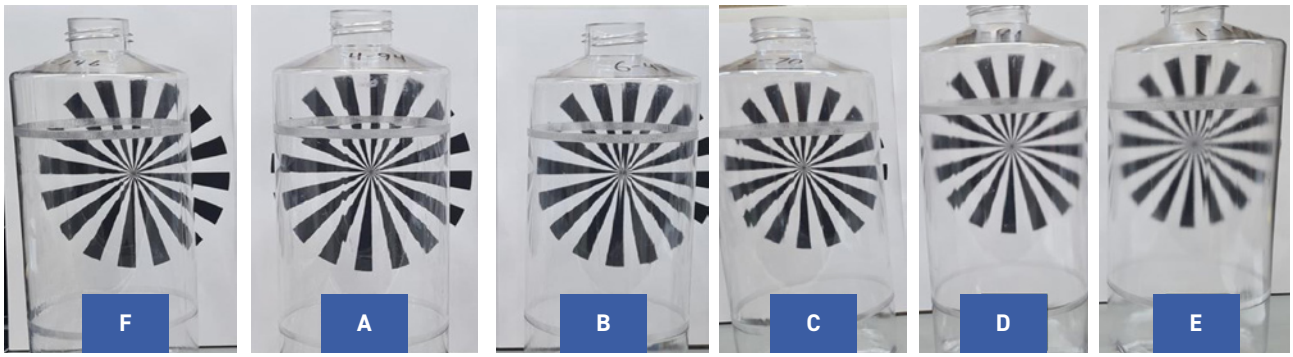
Visual assessment: Seven untrained observers ranked bottle appearance using Siemens Star targets, revealing distinctions in haze, clarity, and surface distortion.

Instrumental measurement: Each bottle was measured intact on the Rhopoint ID in-line system, using a long focal lens and custom fixture. Measurements included:

- Haze (scattering, contrast loss)
- Sharpness (clarity through the bottle)
- Transmission (light passing through)
- Surface waviness (image distortion)
- Overall clarity

Table 1 - Observer rankings

Sample	F	A	B	C	D	E
Observer 1	1	2	3	4	5	6
Observer 2	1	3	2	4	5	6
Observer 3	2	1	4	3	5	6
Observer 4	1	2	4	3	5	6
Observer 5	1	2	4	3	5	6
Observer 6	2	1	3	4	5	6
Observer 7	1	2	4	3	5	6
Average Ranking	1.28	1.85	3.42	3.428	5	6



Images: Samples placed in front of a Siemens star pattern.

Instrumental Analysis Setup

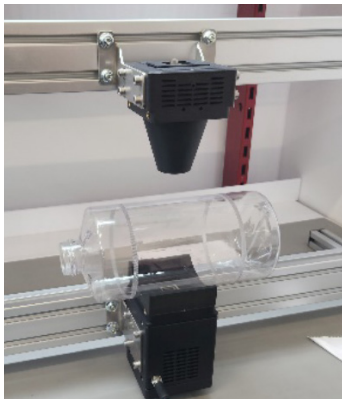
The bottles were measured uncut using the Rhopoint ID long focal length device.

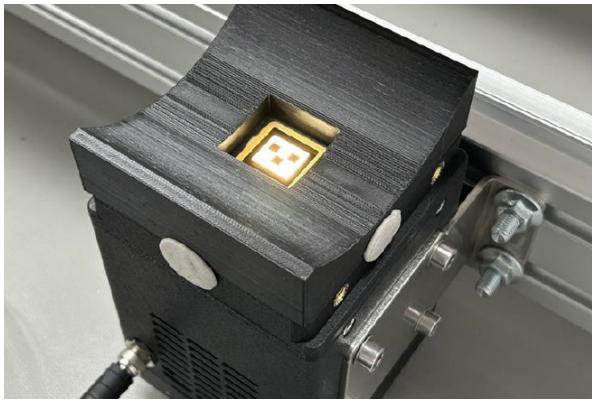
A custom 3D printed jig was fabricated to improve positioning consistency between samples.

The instrument was set to auto-align for each measurement to ensure accurate readings.

Before each measurement, bottle position was adjusted using the live measurement view to achieve optimal measurement conditions.

Some measurements were discarded when high optical distortion caused the graticule to be too distorted for successful detection.

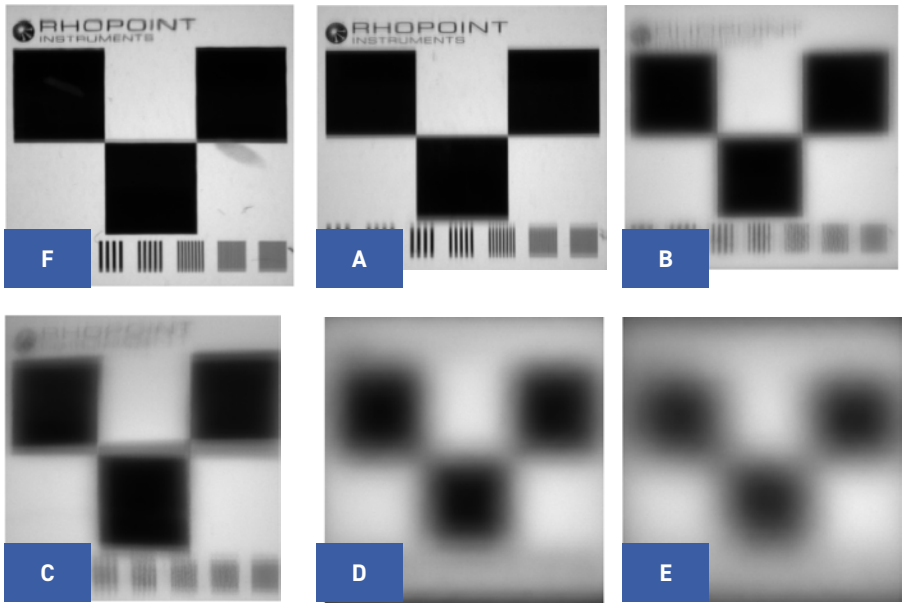




Measurement Challenges

During testing, it was observed that the clearer bottles (particularly samples A and F) presented measurement challenges due to their high clarity and high optical distortion due to irregular shape.

The distortion made it difficult for the instrument to detect reference points. Manual positioning using the live view feature was essential to obtain valid measurements from these high-clarity specimens.



Measurement Parameters

Each bottle was measured using the Rhopoint ID Transmission instrument, which captured five key optical parameters:

Haze (H): Measurement of light scattering that causes cloudy appearance

Sharpness (S): Clarity of transmitted images

Transmission (T): Amount of light passing through the material

Waviness (W): Surface distortion that affects visual quality

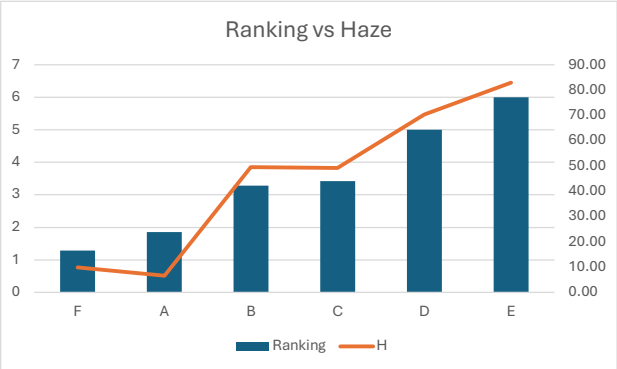
Clarity (C): Overall transparency quality

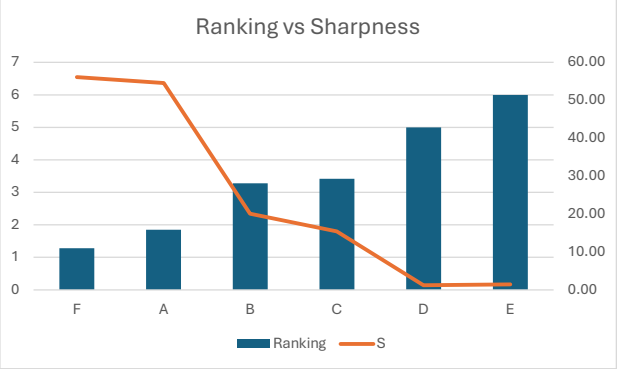
Results

The Rhopoint ID measurements revealed significant differences between samples:

- Sample F showed excellent optical properties with low haze (9.79), high sharpness (56.105), good transmission (83.875) and low waviness (20.1).
- Sample A exhibited the lowest haze (6.59) and highest sharpness (54.52), though with lower transmission (82.55)
- For low haze Samples (F & A) Sharpness may be more important than haze in judging appearance quality.
- Samples B through E showed progressively higher haze values and lower clarity scores

Sample	Ranking	H	S	T	W	C
F	1.28	9.79	56.11	83.88	20.10	90.05
A	1.85	6.59	54.52	82.85	25.80	89.69
B	3.28	49.55	20.08	100.00	114.68	81.85
C	3.42	49.17	15.39	100.00	146.45	80.79
D	5.00	70.29	1.24	100.00	178.37	77.56
E	6.00	82.93	1.47	100.00	180.38	77.62





Key Findings

The study demonstrates that the Rhopoint ID Transmission instrument effectively quantifies optical properties that align with human perception of PET bottle quality. The data shows:

1. Low Haze and High Sharpness values strongly correlated with positive observer rankings

2. The technique was effective without the need to cut the bottles.

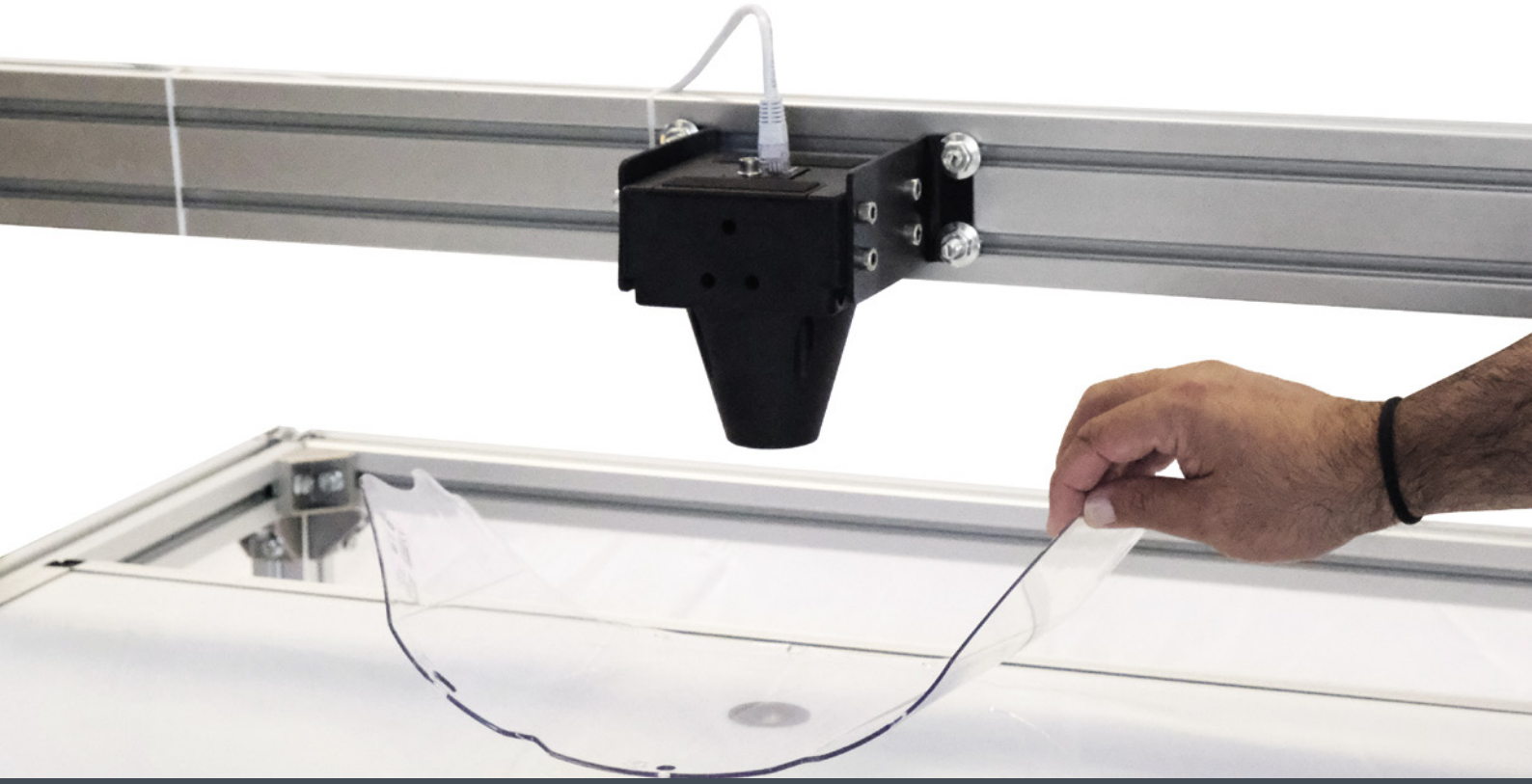
3. The ID inline would make an effective tool for Quality control tool for blown pet bottles.

Conclusion

By integrating Rhopoint ID measurement into blow molded PET bottle manufacturing, producers benefit from:

- Early, reliable detection of optical defects and process deviations.
- End-to-end assurance that each bottle meets strict customer specifications.
- Brand and product differentiation supported by robust, human-relevant appearance metrics.
- The exclusive capability to non-destructively, rapidly, and repeatably assess a bottle's transmission appearance.

Rhopoint ID stands alone as the solution for companies leading in PET bottle clarity, quality, and customer satisfaction.



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