LEAK INSPECTION FOR CARBONATED BEVERAGES IN PET BOTTLES

**Tested:** PET Bottles Post Capper  
**Inspection Desired:** Leak Inspection for Carbonated Bottles  
**Tested with:** TapTone 4000 Dual Sensor Compression (DSC) System

The purpose of the evaluation was to establish the effectiveness of the T4000-DSC in identifying containers with defective cap’s or cap liners, misapplied caps or imperfections in the container’s thread area or sealing surface. Carbonated beverages in PET containers typically have internal pressure ranging from 30-60 PSI, so obtaining a proper seal in the capping process is a critical control point.

TECHNOLOGY CORNER *How it works*

The T4000-Dual Sensor Compression system finds and rejects leaking and damaged flexible bottles at production line speeds up to 300 feet per minute. The system is designed with dual parallel belts suspended over the customers’ existing conveying system.

As the container passes through the system, the dual parallel belts apply force to the sidewall of the container. This action compresses the headspace of the container which allows a comparative measurement to be taken at both the infeed and the discharge of the system. Comparing the container to itself between the infeed and discharge of the system, eliminates typical variations seen in the production environment (Fill Level, Product Temperature, and Container Density).

Utilizing advanced DSP technology the T4000 controller analyzes the comparative measurement and assigns a merit value to each container. If the merit value is outside of the acceptable range, a reject signal activates a remote reject system.
Test Review
Cola - 2 Liter

Good Bottles
Two sample bottles were tested 5 times each to get a base line for good, non-leaking containers. The good bottles were opened to release the internal pressure. The bottles were then capped, held for 5 seconds then inspected. This was done to simulate a bottle being filled, capped then tested on a TapTone T4000-DSC located approximately 10 meters from the filler/capper. The first data point for each of the good bottles simulates a bottle with close to zero internal pressure and no leak. The next four data points for each good bottle are increasing. This indicates that the internal pressure was building in the non-leaking container as it rotated around the conveyor.

Using data from the first pass of each of the two good bottles, the average entry sensor value was 240 and the average exit sensor value was 170. The Average leak value was 830.

The seal was not broken to release pressure between tests of the good bottles.

Cap backed off ¼ revolution from tight
One sample was used to simulate a bottle with a cap loosened ¼ rotation. This container would be detected using the entry or exit sensor values. The entry sensor value for the container on the first pass was 138 and the exit sensor value was 5. These values were below the entry and exit sensor values for the good bottle.

Bottle with 0.254mm hole in head space
One sample bottle was used to simulate a bottle with a small leak in the head space. A precision drill was used to make a 0.254mm hole in the head space of the bottle. The cap was reapplied then the bottle was tested. The entry sensor value was 101 and the exit sensor value was 7. These values were below the entry and exit sensor values for the good bottle.

Test Review
Lemon Lime - 2 Liter

Good Bottles
Two sample bottles were tested 5 times each to get a base line for good, non-leaking containers. The good bottles were opened to release the internal pressure. The bottles were then capped, held for 5 seconds then inspected. This was done to simulate a bottle being filled, capped then tested on a TapTone T4000-DSC located approximately 10 meters from the filler/capper. The first data point for each of the good bottles simulates a bottle with close to zero internal pressure and no leak. The next four data points for each good bottle are increasing. This indicates that the internal pressure was building in the non-leaking container as it rotated around the conveyor.

Using data from the first pass of each of the two good bottles, the average entry sensor value was 300 and the average exit sensor value was 240. The Average leak value was 840.

The seal was not broken to release pressure between tests of the good bottles.

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Application Notes

Cap backed off ¼ revolution from tight
One sample was used to simulate a bottle with a cap loosened ¼ rotation. This container would be detected using the entry or exit sensor values. The entry sensor value for the container on the first pass was 52 and the exit sensor value was 0. These values were below the entry and exit sensor values for the good bottle.

Bottle with 0.254mm hole in head space
One sample bottle was used to simulate a bottle with a small leak in the head space. A precision drill was used to make a 0.254mm hole in the head space of the bottle. The cap was re-applied then the bottle was tested. The entry sensor value was 38 and the exit sensor value was 0. These values were below the entry and exit sensor values for the good bottle.

Test Summary
Testing was done on two bottles of each flavor. The test was done with bottles and product at ambient temperature. The line speed during the test was 180 feet per minute. The product may have been bottled some time ago which may or may not effect the internal pressure and CO2 content of the product. Consideration should be given to bottles that may sit on the conveyor line between the capper and the TapTone system for some period of time due to a line stop. These containers may build up internal pressure. For this reason, the squeeze belts were not set to generate an optimum sensor value reading on a non-pressurized bottle.

The hole drilled in the head space was done using a precision drill bit which may not have generated a clear leak path of 0.254mm.

Given the variables of the laboratory test the assumption can be made that the TapTone T4000-DSC could detect containers with loose caps or with leaks in the head space of 0.254mm – 0.381mm.

Test results achieved in the test laboratory may be different from results seen in the production environment.

LEMON LIME COLA - 2 LITER BOTTLE

- Good plastic bottles
- ¼ twist off from tight cap
- 0.254mm hole drilled on the head space of the bottle

Test results achieved in the test laboratory may be different from results seen in the production environment.

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