TELEDYNE TAPTONE
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TapTone APPLICATION NOTES

News and information from Teledyne TapTone, a leader in the package inspection industry.

HOW TO DETERMINE IF A CONTAINER CAN BE INSPECTED WITH THE T4000 DUAL SENSOR COMPRESSION SYSTEM

PART 3
FILL LEVEL & CONTENTS

Tested: Various Plastic Containers
Inspection Desired: Leak Inspection
Tested with: T4000-Dual Sensor Compression

The purpose of this series of application notes is to explain how to determine if a container is suitable for inspection with a TapTone T4000-DSC.

The application note will be divided into three parts;

PART 1 – Container Design - See Application Note Volume 4, No 3, Part 1
PART 2 – Caps & Closures - See Application Note Volume 4, No 4, Part 2
PART 3 – Fill Level and Contents

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.

T4000 Dual Sensor Compression (DSC) System. Sensor has a cantilever design that suspends over the existing conveyor.

It goes without saying that no process can ever perform perfectly 100% of the time. This is especially true of filling/capping equipment in the packaging industry; hence the need for inspection systems to detect and remove defective product from the line before it reaches the consumer. The final topics of this series are Fill Level, Contents, and Conditions, all of which will affect the detection of micro leaks with the T4000-DSC.

Fill Level

The T4000-DSC by virtue of its name, dual sensor compression, was designed with two sensors. One on entry and one on discharge. This allows for each container to be inspected against itself, thereby reducing or eliminating variables that can affect the inspection process. Three values are used in the inspection process, entry, exit and a calculated value referred to as leak. Variability in fill level is inherent on any processing line and can be caused by a number of issues related to filler maintenance, performance, and other plant conditions. While the design of the T4000-DSC allows for accurate leak inspection in spite of fill-level variation, it is not intended as a fill level inspection technology and should be used in conjunction with an X-Ray fill level unit.

Gross Underfills

A grossly under-filled container will have more headspace than a properly filled container resulting in lower values (merit values) upon inspection with the T4000-DSC. Since the container is measured against itself, it will not read as a leak, but values will most likely fall outside the desired set parameters resulting in a rejected container. A review of rejected containers will identify upstream issues, in this case, perhaps a filler valve issue. However, as stated before, the T4000-DSC is not intended as a fill level inspection device and should be used in conjunction with a suitable fill-level inspection system to ensure optimal results.

Flood Fills or Brim Fills

The function of the T4000-DSC is to compress the container sidewall, thereby raising the liquid level towards the cap and creating pressure within the headspace area of the container. The T4000-DSC was designed to inspect for leaks which are in the headspace / cap area. These are considered "dry" leaks because the area of the leak is above the normal fill level in the "dry" region of the container. The DSC's compression cycle will push air out of small defects in the container, or around a misapplied closure, making it possible to find micro leaks. Leaks as small as .006 of an inch can be detected in typical applications. Products that are filled to the top are called flood or brim filled containers and there is no headspace. When there is no headspace (air) above the product line, the product itself will need to be forced out of the leak area before a change in pressure can be detected. Since liquid molecules are much larger than air molecules, it may be difficult or impossible to force liquid through a small leak area. In this example, the system will only be able to find gross (large) leaks. Therefore, flood or brim filling is never a desirable condition for the detection of micro leaks.

With containers that are not flood or brim filled and adequate headspace is present for leak inspection, occasionally, an over or under filled container may still pass through the system. Over and under filled containers can sometimes mimic leaking containers leading to false rejects . For these instances, the DSC has a function called "fill compensation" which can be utilized. With the fill compensation mode on, both the entry and exit merit values must be outside their respective limits for the container to be rejected. If the calculated "leak value" is outside its limit, the container will also be rejected.

Why is fill level important? Aside from their potential effect on leak inspection, gross overfills can result

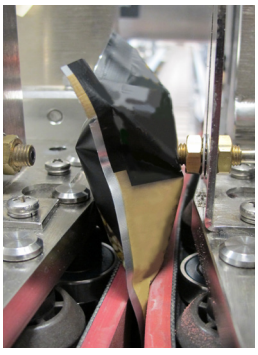
in wasted product and underfills can give your brand a poor appearance.

Contents

Do the contents of a container make a difference when we are talking about leak detection? If there is a leak, and the container is filled correctly, how do the contents effect the system? Let's examine a couple of content related issues that can effect leak detection.

Product Viscosity

As we discussed in the fill level section above, molecule size can have an effect on detectable leak size. If the product does not come in contact with the area of the leak in the container and there is sufficient headspace present, product viscosity is not an issue. However, if a viscous product is sloshed onto the defect due to motion created during the filling or conveying process, the viscous product can plug the defect preventing air from escaping and potentially allowing a faulty container to pass through the system. Imagine pudding or syrup splashing onto a tiny leak. Air will not be able to escape through the hole and potentially this leaking container could pass inspection. Understanding your product and the conditions it will be subjected to during its trip down the conveyor can help to create optimal testing conditions. This is especially true with food substances such as puddings, baby food, and fruit in cups. A hole plugged or partially occluded by food will prevent appropriate inspection but will still allow air and bacteria to enter resulting in spoilage. Keep viscous products out of the container headspace for optimal results.



Dry Versus Liquid Product

The T4000-DSC was designed to test liquid product (beverages, food products, chemicals, etc.) which are "fluid" in nature. Unlike liquids, some dry products are compressible and do not result in increased headspace pressure when compressed. Examples might include dry formula, powders, etc. These products may still be testable but should be evaluated first.

Pressurized Versus Non-pressurized Product

The T4000-DSC was designed for leak detection on still liquid products. Still products are those where the state of the container contents has not been altered with the introduction of a pressurizing agent. If a container and its contents have been subjected to pressure (e.g. CO2 or Liquid Nitrogen) an alternative Teledyne TapTone technology would be suggested.

That being said, the T4000-DSC can on occasion be utilized for applications where internal pressure results as an element of the process. An example of this would be steam, due to hot fill product. In this case, position on the line is essential to create the best testing environment. Please contact a TapTone Inspection Specialist for assistance.

Conditions

Temperature can play a significant role in leak detection. Both temperature of the product itself and variable processing temperatures can effect the pliability of the container. Consistent temperatures make testing more reliable, while wide fluctuations in temperature can cause a host of issues.

Location on the Line: Hot Side vs Cold Side

Depending on the filling process, there may be two sides of the line; a hot side and a cold side. Determining which side is best suited for leak inspection may depend on both the contents and the container. If there is little or no pressure inside the container, but the contents are heated during the manufacturing process, the heat can cause temporary pressure in the headspace making the container easier to test. In this case, positioning the system on the hot side of the line might be desirable. If the container is rigid, inspecting on the hot-side where the container is more pliable will yield better results. In general heat will expand the container and the contents and cooling will contract the container and contents. The cooling process can

create a vacuum condition inside the container, sometimes causing the container to "panel". This can render the container unsuitable for compression testing. In this situation, finding a testing position on the hot side of the line may be the only solution.

Line Stops

When a line stops during production, filled containers on the line will begin to heat up or cool down depending on the process (hot fill or cold fill). Moderate or prolonged line stops may cause the temperature change in the filled containers to go beyond normal variations in product temperature compared to steady run conditions. A software feature called "Auto Tracking" can be utilized in these instances. Auto Tracking adjusts the limit for "good" containers based on external temperature trends. The system automatically adjusts the "good container" pressure range around the mean merit values observed over a programmable sampling of tested containers. Hard reject limits can still be set, but utilizing the auto tracking feature will result in fewer false rejects in these instances

Conclusion

In this three part series, we have examined variables in Container Design, Closures and Seals, Fill Level and Contents and the impact they may have on leak detection. As we can see, there are many variables to consider when you are assessing the your testing requirments and conditions. Please feel free to contact us directly. Our product specialists will be happy to answer your questions and give you guidance on which systems are best suited for your testing needs and processing environment.

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