AVOID COMPROMISED FOOD PACKAGE WITH PACKAGE SEAL INTEGRITY TESTING

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Sensors & Teaching Equipment

Bestech Australia Pty Ltd
Global Technology, Local Support

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Ensuring safety of consumer food has been a priority for food manufacturers. They have been focusing on optimizing their supply chain and manufacturing process to ensure that the content quality does not deteriorate during transportation and the products reach their consumers in their freshest possible condition. Hence, in order to keep the food safe from contamination, various approaches have been implemented such as maintaining hygiene while preparation, checking for pesticide residues, ensuring valid certification and standardization and many other quality assurance checks.

Food contamination can occur during production, transportation, packaging, storage and even during the cooking process. It is the most common cause of food poisoning and spoilage. Food products are most prone to organic contaminants as the reaction between the organic substances and the food promotes the growth of bacteria. When they come in contact with food products, they cause irreversible bio-physiochemical changes due to the presence of high-water content, protein, carbohydrates and fat that promote the processes of oxidation and rancidity in these food items.

Importance of Package Integrity Testing

According to a report by the Food Standards Australia New Zealand (FSANZ), there were 106 incidents of food recalls in Australia in 2019, out of which 50% recalls were due to food contamination. This measure of food recalls has grown from 61 in 2016-17 to 106 in 2018-19, which is alarming. It is believed that leading causes of these contamination originated from leaks in the food packaging. The cause of leaks can be improper packaging, poor selection of packaging materials or compromised seal integrity. This is why it is essential for food manufacturers to implement stringent quality control measures to check for any leaks in the finished products before shipping them to customers.

Many products need to be tested to ensure that the packages are perfectly sealed against moisture, oxygen or biological contamination. Generally, the testing for package seal integrity is done at the production line before the packages are stacked and arranged for transportation. When the packaging is done poorly, it allows the foreign contaminants to interact with the food products which then accelerates their decomposition. As packaging has a profound impact in protecting the food content from the unwanted contaminants as well as enhancing the product marketing, the packages should be thoroughly checked either by visual observation or automated system to ensure that they meet production standards.

It is also important to select proper packaging materials as the choice of material used determines the quality of the packaging. In the food industry, the most used materials for packaging are generally made from plastics and metals. Plastics are popular for companies that manufactures snack food as they are light, space-saving and graphic friendly. However, they are not very environmental-friendly and are considered as the worst materials for recycling. Metals are used for canned food as well as beverages products. It is an ideal choice for packaging products that are sensitive to light. Even when proper procedures are followed, there is always a possibility that the packaging seals are not done properly.

Development of Package Leak Detection Systems

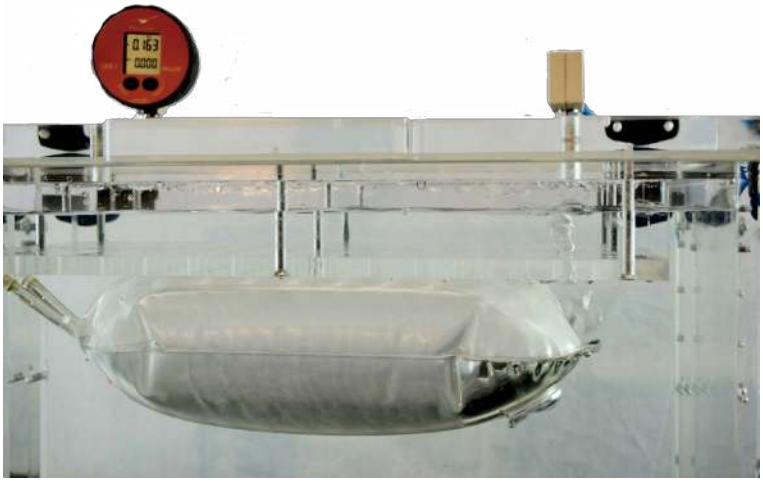
Packaging leaks or compromised seals are sometimes too small to be detected via visual inspections. Traditionally, manufacturers employed a bubble leak testing technology. With this system, operators need to visually observe this process and determine if the leaks are present. As leak is determined manually, the conventional bubble leak testing system is prone to error during long term operation, especially when fatigue starts to set in. Moreover, it is also expensive as the tested packages need to be discarded and cannot be returned to the production line.

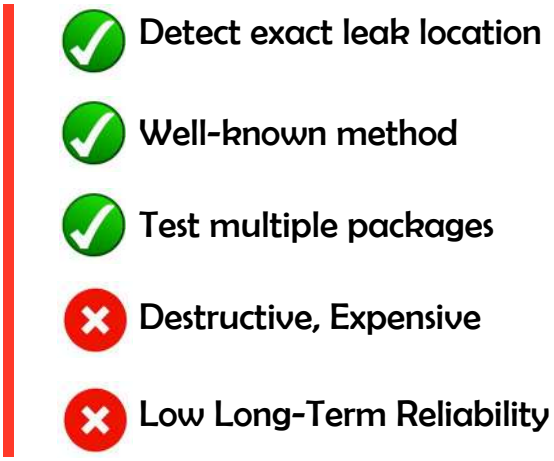
Therefore, this presents a need for a leak testing system that can automatically detects leaks in the packaging and is presumably able to alert the manufacturers for any leakage found in the package. Ideally, the tested package should be in a condition to be returned to the production line if they pass the test. Recent developments in the leak testing technology have enabled the design of a reliable package integrity testing system for industrial purposes.

The modern leak testing system allows data to be stored in the system for quality traceability. This is intended to make it easier for the operators to access the data to diagnose the root cause of the problem when inspection needs to be done. All these features help in optimizing the decision-making process by making it faster, more efficient and more reliable.

How leak detection be used to test seal integrity of food packaging?

As mentioned in the previous section, two types of leak detection machine are available; destructive and non-destructive. Underwater leak tester is a type of destructive leak testing machine that requires the package to be discarded after testing. This is to be expected as the packages get spoiled when submerged underwater and cannot be sent back to the production line. The underwater leak tester generally features a transparent acrylic case filled with water. The transparent case enables the operator to visually monitor the testing process. The vacuum level in the chamber can be adjusted to detect various degrees of leaks. A stream of bubbles will arise from the location of leaks.





The non-destructive leak tester uses vacuum decay testing principle and is suitable for testing the integrity of non-porous, rigid and flexible packaging. The test is initiated by placing the test package in a test chamber, which is then evacuated to a pre-set vacuum level. The rise in the vacuum decay is monitored for a predetermined length of time using a differential pressure transducer. Based on these results, the testers are programmed to determine whether the packages are leaking.

When the test package is placed under a vacuum and then isolated, any leaks will allow a return to the atmospheric pressure. A pressure profile similar to the one shown in the Figure 1 below will be generated when the vacuum is measured. Leakages can be determined from the generated pressure profile. From this curve, a number of characteristic points are identified to determine leakages.

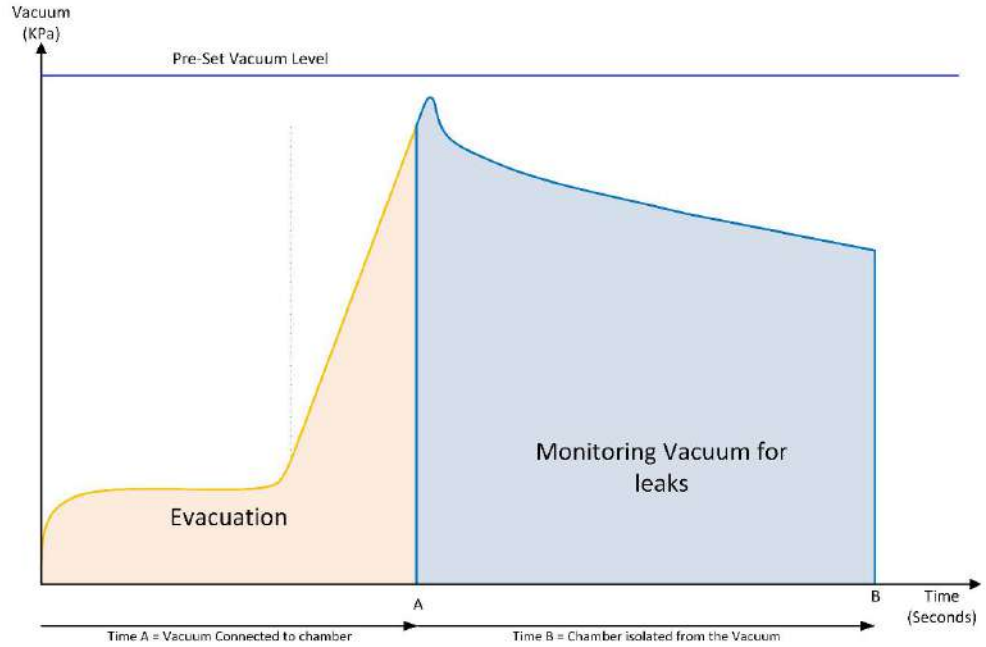


Figure 1 Generated Pressure Profile in Vacuum Decay Leak Tester

The Figure 2 below shows the points where measurements are concentrated. The coarse or large leaks are identified when the time required to reach the set vacuum level is longer than the maximum allowable time (T2). Similarly, small or fine leaks are determined when the rate of vacuum decay towards the atmospheric pressure is larger than the preset leak rate limit (S4). A lower maximum allowable leak rate can be specified if packages need to be tested against smaller leak sizes.

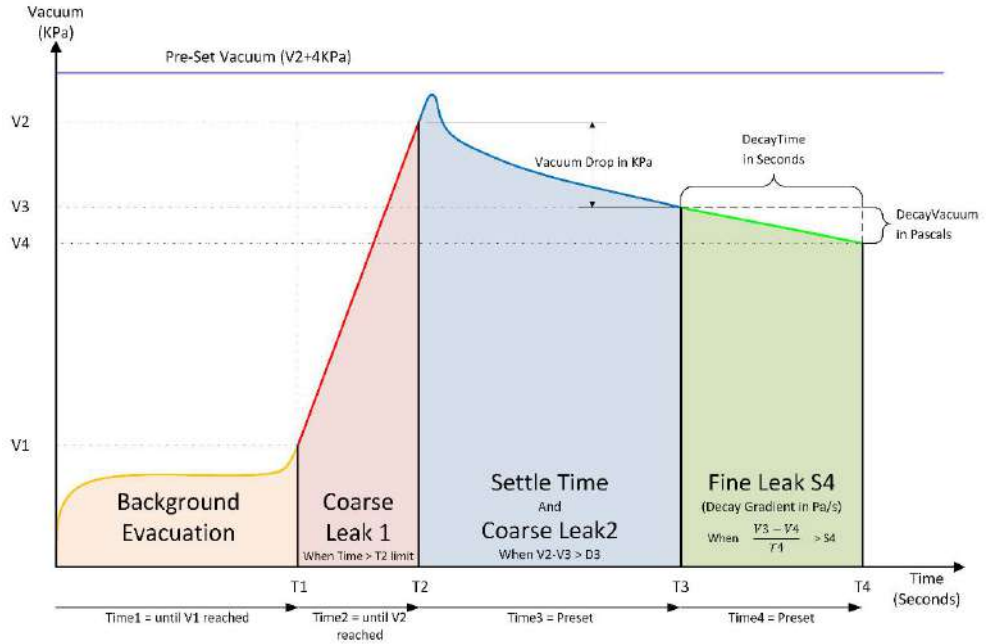


Figure 2 Critical Measurement Points in Vacuum Decay Profile for Leak Detection

Vacuum Decay Leak Testing Equipment by Sealtick

The vacuum decay testing device is undoubtedly an ideal machine used for detecting leaks in food packages. It provides fast testing which does not delay production and also offers data storage for quality traceability. Despite this, some manufacturers still prefer to utilise the conventional underwater leak tester in their production line. It has the benefit to allow manufacturers to identify the location of the leak and the price tag of the underwater leak tester is on the lower end of the spectrum. However, it should be noted that the underwater leak tester is heavily operator-reliant for detecting leaks. Therefore, during long hours of operation, the testing reliability is expected to drop due to operator's fatigue. It is also not possible to measure the size of the leak using the underwater leak tester and the tested packages need to be discarded after testing.

Bestech Australia provides innovative package seal integrity testing devices from Sealtick. We have a commendable selection of package leak testers to cater for the testing requirements of a wide variety of packages including but not limited to flexible packaging, can, large bags, heavy bags and many more. The Sealtick leak tester is an easy-to-use non-destructive leak tester that has been developed and perfected for seal integrity testing of food and pharmaceutical packages. The tests can be completed in less than 20 seconds, are dry and reliable. Furthermore, they do not stress or inflate the packages allowing them to be returned to the production line after testing. The system is housed in a robust Stainless Steel housing for applications in the production and industrial environment.

The Sealtick instrument only requires air and power to operate. Operators just need to switch on the device, open the door, and the device is ready for testing. Tests are initiated by placing the packages in the test chamber and close the door. Within a few seconds, the display panel will indicate whether the packages pass or fail. The quantitative results are log in the internal storage which can be retrieved by connecting via Ethernet or USB. The test procedure can be modified for testing different products with specific requirements.

Figure 3 (left) Sealtick TSE6086b in Open / Starting Position
Figure 3 (right) Various types of products that can be tested with Sealtick device

The Sealtick TSE6086b is our flagship leak testing system for flexible packaging in food and pharmaceutical industry. This non-destructive leak testers can be used to test dry packages with maximum size up to 360x 300mm. It has been used around the world for leak testing of a wide range of consumer products. The packages need to have a head space, dry and should only contain dry products such as snack food, coffee or powder. Therefore, Vacuum sealed packages may not be suitable for testing due to the absence of free air in the package. The presence of moisture in some products such as meats may mask the leaks which returns inaccurate results.

Figure 4 (left) Trolley-typeTSE 6081 (right) Horizontal test bed TSE6089

As shown in Figure 4 above, the Sealtick TSE6081 and TSE6089 are variants of the TSE6086b for testing of larger size packages. The TSE6081 features a flexible mounting system in a trolley for testing of larger size packages which cannot fit into the TSE6086b. The TSE6089 is actually a horizontal test bed that allows the testing of heavy packages such as pet food, grains, coffee or powders. This configuration allows the packages to be easily lifted for testing. In addition, Sealtick also offers the TSE6084 for testing can-type packaging. The test chamber is rigid and is slightly different from the other Sealtick products. The chamber can be easily modified to test different sizes of canned products. This is done by including an insert or a support platform to minimize the air space between the chamber and the can. The modification is required to reduce the free space between the can and the chamber which can return inaccurate reading.

Figure 5 TSE6084 Can package integrity tester and inserts

Guarantee Customer Satisfaction

Our leak testers have been proven to help manufacturers in meeting quality standards and avoid recalls of their products due to improper packaging.

One of our highly valued customers is a leading supplier of tortilla or flatbread in Australia. In their manufacturing process, they use Modified Atmosphere Packaging (MAP) to allow a maximum shelf life without requiring the need for chemical preservatives or stabilizers. The idea behind using MAP technology is to select the right gas mixture, usually is an optimal blend of pure oxygen, nitrogen and carbon dioxide within the right barrier materials or permeable packages.

The customer originally relied on the conventional leak testing methods such as manual inspection by squeezing the package with hand and bubble emission leak testing device. For instance, one of the methods to assess for gross leaks involved puncturing the sealed bags with a needle and covering the needle-package interface area with a finger. This is done so that air does not escape when the package is inflated with an air hose. They then manually check for leaks by submerging the package into the water for a defined period of time. The bubble emission would indicate any seal issue in this case. However, these system were not ideal to be applied in the production environment due to hygiene and food safety issues. The tests were to be performed in a separate laboratory, which was time-consuming and not efficient. The afore-mentioned tests were also not suitable to test the presence of very fine leaks. This is due to the fact that the surface tension of water prevents the air inside the package from coming out, thus stopping the bubble from arising from the location of leaks. The customers also need to discard the products after testing which accumulate the waste in the factory.

With the recommendation from our applications engineer, the customer implemented the Sealtick TSE6086b in the production line. They found that the Sealtick TSE6086b is able to address all of their issues and made their manufacturing process much more efficient and productive. As the test hardly takes 15-20 seconds, the customer was able to test over 100-1000 samples in a production unit per day. The Sealtick leak testers can also be used for test in any type of modified atmosphere as it does not require a certain mixture of gases as a tracer.

Putting it all together

As a summary, packaging leak testing is crucial and should be implemented in every food and pharmaceutical manufacturing process to avoid deterioration in product quality. Although the conventional water bath tester is still popular in many factories worldwide, the non-destructive leak testers have considerable advantages in providing fast, reliable and accurate results with add-on features for quality traceability. It can also be used in any types of modified atmosphere packaging, provided that the contents are dry. The devices can also be customized based on specific requirement and can be programmed to test a various degree of leaks.

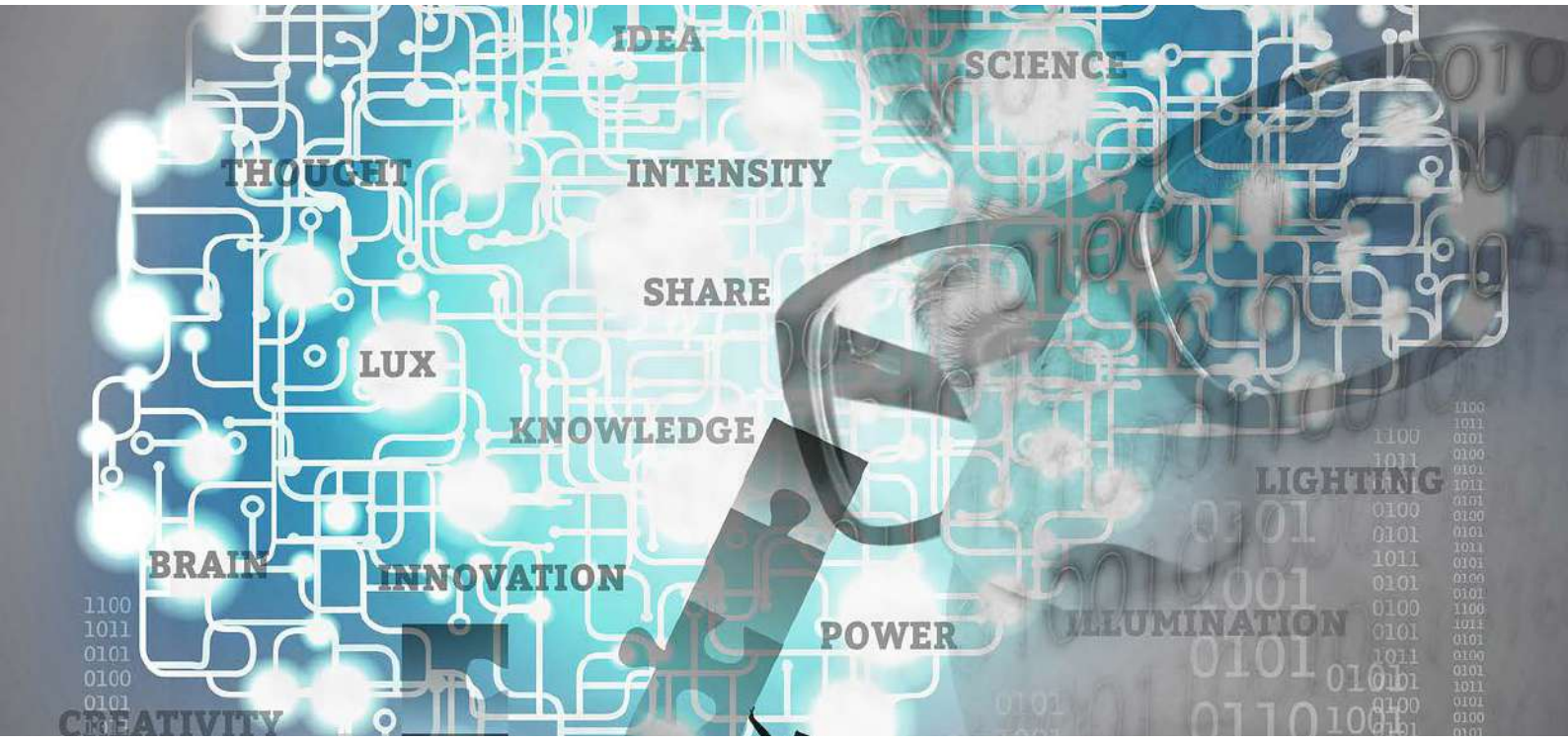
ABOUT US

Founded in 2002, **Bestech Australia** is an ISO9001 certified company. We specialize in supplying, designing and manufacturing sensors and instrumentation for measurement of physical parameters, as well as data acquisition systems and technical teaching equipment for teaching and training of vocational and engineering education.

We are one of the fastest growing sensors company in Oceania. Our services provide efficient solutions which could be an individual product or a complete turn-key system. We are constantly expanding our product portfolio to support the industry requirements for test and measurements as well as workforce upskilling. Our products are sourced from world leading suppliers and we complement this by own design and manufacturing capabilities backed by local technical support, service and calibration.

Our customers come from both industries and academia in the fields of engineering, mining, automotive, process & chemical, railway, food & beverages, aerospace, manufacturing, defence, energy and condition monitoring utilise our sensors and measuring instruments for monitoring processes, model validations, optimise products and gain insights from the measurement data as well as use our training equipment for developing and upgrading their on-site employee training program.

Our services include project consulting, sensors design, implementations, test and commissioning, specialists deployment, customer-specific design and development as well as system integration. Bestech consistently provide high-quality services to support your high-end sensors, measurement and technical training requirement.



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Bestech Australia Pty Ltd
Unit 14, 44 Garden Boulevard, Dingley, VIC 3172
P: 03 9540 5100 F: 03 9551 5541
E: enquiry@bestech.com.au
www.bestech.com.au

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