Background

A pouch seal is a structural element that joins flat film material, and a component designed to close a pouch airtight. Traditional test methods e.g. peel strength or burst, can measure the joint strength of the seal, using destructive methods. However, this type of testing is often unreliable. A strong seal is not necessarily an airtight one, and the flow of gas or liquid through the seal (leak) is just one type of seal defect. As such, there is a fundamental challenge to any leak testing method, whether it is a fish tank-bubble, vacuum deferential, or helium test: none of these methods detect non-leaking seal defects.

No physical theory conclusively links the transparency or reflectivity of pouch material to seal quality. Yet, visual inspection methods e.g. human vision (ambient light) or machine vision (IR, UV, laser), are still widely used. The assumption is that defects are visible (at least if transparent material is used to make a pouch). Point of fact is that vision based inspection is inherently unreliable as it fails to recognize invisible defects and falsely rejects properly sealed pouches that exhibit cosmetic irregularities.

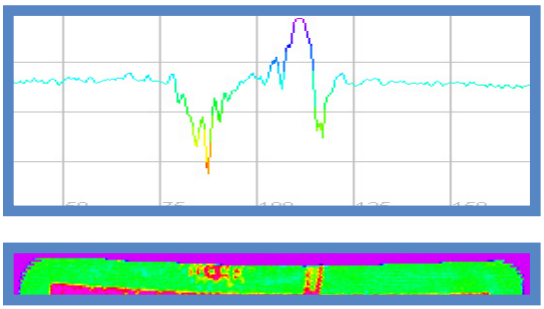
In order to use ultrasonic inspection effectively, it must be possible to place the seal in a direct line between a pair of transducers and move it (or move the transducers) along the seal. The ultrasound is transmitted and reflected at the transition from one media to the next. The greater the acoustic difference between mediums (most evident at a gas to solid transition) the more sound is reflected and the less sound transmitted through. The variation of the material thickness has only a minor effect.

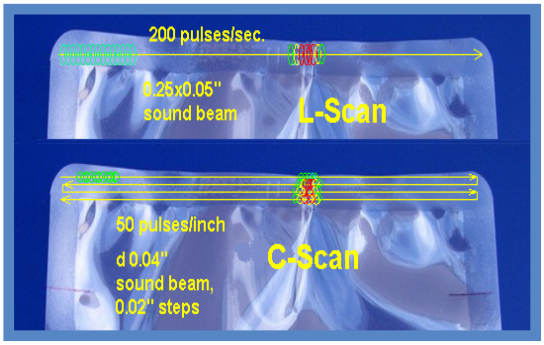
Any material fold, foreign media inclusion and even a microscopic air gap between layers of pouch material causes the significant reflection, so transmitted signal is lower. A small cut, abrasion or missing layer in a material causes the less reflection, so transmitted signal is higher. Therefore, the level of a signal received after passing through the seal is a function of the seal quality. Various types of defects, visible and invisible, leaking and non-leaking, process-related and random, are detectable.

Contact or liquid coupled ultrasonic testing has been used for years. However, the practical implementation of contact/liquid-coupled ultrasound for flexible packaging proved to be very difficult, if not impossible. PTI's Seal-Scan™ and Seal-Sensor™ are non-contact air coupled ultrasonic test technologies.

Seal-Scan™ and Seal-Sensor™ technology has been proven in the field with several on-line and off-line units installed. PTI's ability to adapt this technology into various production constraints and environments make it an excellent solution for flexible packaging systems. It has been established as one of the most effective methods for non-destructive testing of flexible packages, and was awarded 1st Place for Innovation at the IPA World Food Process Exhibition 2004 in Paris. The boundaries of airborne ultrasound technology continue to grow, giving this technology great promise for current and future applications.

Scan Data





The high resolution Seal-Scan™ takes 200-250 readings per second. The signal digitized and presented as 6000 shades of color. The space resolution is as small as 0.5mm. A single linear scan (L-Scan) takes only a few seconds and presents the quality of the seal as a line graph.

If time permits, compiling several linear scans with offset on the Y-axis creates a digital image of the seal (C-Scan). Both C-Scan and L-Scan modes produce a statistical summary of the signal strength which is compared with adjustable acceptance criteria for a "pass", "warn" or "fail" result.

Key Benefits of Seal-Scan™ and Seal-Sensor™

- Fast, non-destructive, non-invasive, and requires no sample preparation.
- Suitable for 100% on-line as well as off-line process control.
- Scans materials regardless of color, transparency, print, surface finish and porosity.
- Applicable to all stages of the packaging process.
- Identifies defect location.
- Provides visual indicators and numeric data.
- Repeatable, reliable, easy to calibrate and validate.
- Safe to use.