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Troubleshooting Induction Systems

Identify and Fix the Real Causes of Seal Failure

Induction sealers often get a bad rap. When products come off the assembly line exhibiting inconsistent seals, fingers far too often start pointing at the induction system as the culprit.

But, would you believe that 99% of the time the induction sealer is *not* at fault? Realizing this fact is the first step to understanding the real cause of an inconsistent sealing situation—and to finding a genuine solution.

Heating things up

First, it's important to note exactly what defines an induction sealer. An induction sealer is, in fact, an induction *heater*.

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Consider the example of a system used to apply foil inner seals to plastic milk cartons. The induction system doesn't perform a sealing function. Rather, it simply heats the foil. For a seal to occur, the liner must come in intimate contact with the container lip—which is not the function of the induction system. In fact, the foil could be heated to the melting point by the induction system and still not achieve a seal.

Induction sealing is a non-contact heating process that achieves the hermetic sealing of a container with a closure that includes a heat-sealable foil laminate inside of the closure.

Two-piece innerseals add a second layer in addition to the foil laminate. Popular materials are pulpboard, wax, aluminum foil and heat-activated polymers. This method typically is used to create a leak-preventive secondary seal in the cap. This requires sufficient heat both around the liner's perimeter and throughout the liner to melt the wax. A one-piece liner requires only perimeter heat.

Bad-seal symptoms

Now that we've defined an induction system, let's explore the factors required for induction-sealing success. For the sake of simplicity, the industry-recognized term "induction sealer" rather than the more accurate "induction heater" will be used.

But to comprehend what's needed for success, it's necessary to understand the situations in which the induction sealer has *not* contributed to a sealing failure.

Symptoms of poor seals include: partial, weak or no seal; difficult-to-remove seal; difficult-to-remove cap; burnt cardboard liner; low removal torque; pinholing; and liner pinwheel effect. Now, the question is: What caused these poor seals to occur? Hint: It wasn't a faulty induction sealer.

The following table provides a rundown of the sources for each of these dilemmas.

Symptom	Cause
partial, weak or no seal	• insufficient power from sealer; conveyor too fast; or power set too low • improper coil height • insufficient application torque • induction liner incompatible with the bottle material • bottle neck finish has been flame or chemically treated • imperfections in container finish, land area • product touching liner, heat-sink effect
difficult-to-remove seal	• sealer power set too high • conveyor speed set too slow
difficult-to-remove cap	• insufficient wax melt, conveyor speed too fast or output power set too low • improper coil height (too high) • excessive application torque • foam-liner material welds to polymer in induction liner • product touching liner, heat-sink effect
burnt cardboard liner	• excessive sealer power, conveyor too slow or power set too high • bottles back up under sealing head • insufficient application torque • gap between liner and container lip caused by defect in container
low removal torque	• insufficient application torque, closure not securely applied • excessive application torque, threads of closure stripped • void created when wax is absorbed into pulpboard
pinholing	• excessive power from sealer, conveyor too slow or power set too high • product may be attacking liner, if pinholes occur well after a good seal has been confirmed
liner pinwheel effect	• retorquing too soon after induction sealer • wax not absorbed into pulpboard completely

"It's necessary to understand the situations in which the induction sealer has not *contributed to a sealing failure."*

Sometimes, a customer will contact his supplier because he believes something is wrong with his induction equipment because "only" 97 of 100 containers run through the system were sealed. In this case, as in those situations mentioned above, nothing is wrong with the induction unit. What might be the reason for 3 out of 100 not sealing? Typically, it's due to insufficient torque on the 3 containers that didn't seal. Either the foil wasn't in intimate contact with the container lips or the lips were deformed. Another cause could be the caps might have been cocked and not exerting sufficient downward pressure on the foil.

If a series of identical containers are sent through an induction field and one seals, then all should seal. When runs reach into the thousands or millions of containers and caps, it's certainly not uncommon to experience an occasional bad lip, insufficient torque or cocked cap. But again, the induction equipment isn't to blame.

Proper preparation

The best way to prevent mishaps is proper preparation. Manufacturers should be expected to fully understand their customers' applications. This helps ensure the induction sealer has a power supply and sealing head appropriately configured for the specific application.

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Two major factors determine the appropriate induction sealer for a particular application: cap size and production-line speed. In addition, a food application might require a washdown enclosure. Also, consider container type and composition, innerseal material, and product type (wet, dry, and flammable).

Regarding appropriate power-supply size, it's true a higher kilowatt rating generally means a more powerful system. But this doesn't necessarily yield higher sealing rates. Kilowatt rating is just one part of the equation. The key to creating efficient and consistent seals is energy transfer from one part of the system to the other.

It's imperative to create a coil design that achieves efficient and effective power transfer from the power supply into the innerseal foil. In the case of an incorrect coil design, increasing the power supply output only wastes energy and doesn't significantly improve sealing quality or rate.

By being mindful of these factors—and realizing the errors not attributable to induction sealers—companies can experience efficient output and get the very best from their induction systems.

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