MARLEN
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INDUSTRY ANALYST REVIEW

OPTIMIZING OVEN PROCESS REPEATABILITY

The key to oven process repeatability is proven reliability.

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INTRODUCTION

Generations of food processing plant managers probably suspected that production staff often resorted to "oven failure" as the explanation for a product problem. These associates include experienced processing personnel whose opinions are the result of years of experience, unfortunately grounded in fact. Until total reliability is designed into the processing equipment on which they rely, and performance proven, it is difficult to separate these people from the experiences that taught them to think this way.

This white paper addresses the key components of food processing ovens, the achievable results associated with repeatability and the cooking process to deliver product uniformity and processing efficiency.

THE PROBLEM

Plant personnel deserve food processing equipment as reliable as they themselves are expected to be. Repeatability of process cannot be maintained as long as these associates have to question the "state of tune" of their food processing ovens and related equipment.

HISTORY

Designs of industrial-sized food processing ovens have evolved among manufacturers, but perhaps with more focus on construction than on performance and reliability. Fortunately, there are exceptions – with at least one US manufacturer showing a genuine understanding of the value of reliability.

Others have shown good intentions. Credit for innovation is deserved for a European design that has found its way into a few US food processing plants. However, these units have an overly complicated method of performing the basic function of alternating airflow.

Alternating Airflow

Alternating airflow is important and is acknowledged to be a primary factor in oven performance as it creates constant turbulence, resulting in more uniform processing conditions throughout the oven.

Processing efficiency is optimized when equipment is in every respect completely reliable: no adjustments required. This may mean fewer mechanical components, to the extent that elimination of mechanical devices doesn't actually complicate oven designs unnecessarily and/or increase energy consumption.

Most ovens found in the US market use a mechanical device to alternate airflow from the discharge of a single fan. A rotating damper assembly, two damper blades offset in rotation by 90 degrees, is most common. The high wear factor of early drive systems that used roller chains and sprockets meant that reliability suffered.

Damper blades do an excellent job of dividing, and in the course of their rotation, alternating the airflow. As one damper is fully closed, the opposing damper is fully open, causing a continuous collision of high velocity air and low velocity air *(see 'Break Point White Paper' for more information)*. Most ovens of this design must be "re-balanced" with some frequency, but fortunately there are ovens that require no re-balancing at all. This is important as oven balancing is not a skill present within every plant maintenance department.

The first of European oven designs imported to the States utilized multiple fans for circulation of process air. This resulted in, for example, those ovens sized to accommodate eight product carriers were equipped with eight fans. Reliability was very poor.

Alternating Airflow (continued)

The latest of European oven designs uses two main recirculating fans versus the more typical single fan arrangement favored by US manufacturers. Of course, two fans require two fan motors and two variable speed controllers which must be synchronized. This alternating airflow concept includes ramping the speed of the two motors up and down, opposite one another. Unfortunately, there is no evidence which suggests anything is gained with this system. The second fan and motor do not provide any redundancy. If just one fan, motor or drive fails, the oven is then unusable. Of course, the anticipated failure rate is 100% greater as opposed to single fan ovens.

The energy efficiency of a dual fan system is also questionable. Theoretically, dual fans will draw more electrical energy than a single fan at least during the period when the up-ramping motor's speed equals the speed of the down-ramping motor. While this "crossover" only occurs for a few seconds, it is a few seconds out of every minute of operation.

More recently, ovens have been equipped with a damper drive of solid shafts and gearboxes, eliminating the troublesome chain driven damper systems. The very latest iteration of this system employs a PLC controller that allows damper blades to be paused as best process air balance may dictate. This latest hybrid mechanical/electronic damper drive shows reliability for maintaining the critical 90-degree offset and is preferable to the dual fan arrangement. The wear rate and failure of mechanical parts is more predictable and unanticipated downtime can therefore be minimized.

Processing Oven Reliability

With regard to processing ovens, 'reliability' wears many faces and is probably more likely found in the least complicated, time proven design. The "sizzle" of an apparent innovation wears off quickly when the maintenance budget must be increased to accommodate such a design.

Reliability can be forecast by the quality of materials and components and the engineering and manufacturing processes that should turn promises into reality. Processors should invest in a detailed procurement process that gives them a complete evaluation of suitability to intended purpose, as well as materials, sourcing, fabrication and assembly methods.

Reliability is measurable. A manufacturer committed to delivering reliable equipment will declare a high "uptime" factor (98% is not too much to ask). There should also be a commitment to a speedy service response. When the processor has questions, they should be met with prompt answers from the manufacturer.

It must be understood that maintaining oven reliability requires collaborative effort. Just as the most statistically reliable automobile will disappoint if scheduled services are not performed, processors have to invest themselves in following manufacturer's recommendations for oven inspection and service. Of course, this starts with manufacturers providing the best of operational and maintenance training and processors committing personnel for such training. Training should include testing for comprehension and there should be convenient links to additional support as required.

SOLUTION

Being constructed of stainless steel, most of today's processing ovens offer long life, so it is important to make thoughtful selection based on proven oven reliability and processing efficiency or live with a problematic design for a long, long time.

Fortunately, at least one US manufacturer set out to overcome this challenge and designed and built a better oven. By doing so, the company has demonstrated a genuine understanding of the value of oven process repeatability through proven reliability. That company is Marlen. Marlen food processing ovens use innovative technology that provides optimal processing efficiency without the need for adjustment.

SOLUTION (continued)

Product Uniformity

Marlen's permanent air balance of supply and return air results in full control of the all-important "breakpoint" – the physical point at which the high velocity air mass collides with the low velocity air mass. Errant movement of the breakpoint can result in product that varies in weight, appearance, and internal temperature. Marlen's permanently balanced system ensures that the breakpoint is where it's supposed to be which is essential for a repeatable process and quality, uniform product.

It is Marlen that also greatly improved the reliability of the alternating damper drive with stainless steel shafting and gearboxes (replacing chains and sprockets) to further ensure precise breakpoint control. Having eliminated the need for balancing or adjustment of any kind, Marlen delivers reliable management of the most efficient air handling system in the industry. The Marlen system has – at its heart – a fan design that in fact uses less energy while delivering optimal, balanced airflow.

Ease of Operation and Maintenance

When it comes to operation, Marlen food processing ovens read the operator's instructions through Powis Corporation technology – the most responsive and intelligent computer control systems in the industry. Their 'Auto-Report' feature even collects, and emails completed cook-cycle data to all selected parties so that plant managers can stay in the loop, even when they are not in the plant.

Maintaining a food processing oven shouldn't have to involve shutting down operations or performing gymnastics to reach serviceable areas. Marlen makes maintenance simple with generous service access even to the point of providing for the change-out of wet bulb wicks while the oven is loaded with product. And, Marlen control systems provide functional diagnostics of every operational system.

SUMMARY

Innovation is worthless if the equipment doesn't work. It's important to source a food processing oven that has been designed with your operational and application needs in mind and to gain a full understanding of the oven's key components that contribute to and deliver optimal repeatability.

About Faivre Technical LLC
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About Marlen
Recognized as a global manufacturer of highly engineered food processing equipment and systems, Marlen designs and builds innovative solutions for the food processing industry. Our premium products have long set the standard for quality and performance in vacuum stuffing and pumping, portioning, size reduction, thermal processing, and food handling. Marlen is a Duravant Company.