



CASE STUDY

OPTIMIZING DISCONTINUOUS GARAGE DOOR PRODUCTION THROUGH PROCESS AND MATERIAL EXPERTISE

Executive Summary

A leading North American garage door manufacturer approached FSI seeking a compliant polyurethane system utilizing **Ecomate®** blowing agent technology to meet evolving environmental regulations.

During the qualification process, FSI identified that the foam formulation was only one component of a much larger manufacturing challenge. Variability in dispensing, equipment sizing, and process temperature control were contributing to inconsistent panel quality and limiting production performance.

Rather than simply replacing the foam system, FSI partnered with the manufacturer to evaluate the entire foaming process. The result was a comprehensive manufacturing optimization strategy that significantly improved foam quality, process consistency, and long-term production reliability.



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Project Snapshot

Application	Discontinuous polyurethane insulated garage door panels
End-Use Markets	✓ Residential garage doors ✓ Commercial overhead doors ✓ Insulated sectional doors
Primary Objective	Implement an environmentally responsible polyurethane system while improving manufacturing consistency and finished panel quality.
Technical Challenges	✗ Inconsistent foam distribution ✗ Visible voids and surface defects ✗ Variable dispensing rates ✗ Aging process equipment ✗ Poor temperature control

The Production Challenge

The manufacturer initially sought a direct replacement for its existing polyurethane system using a compliant blowing agent. During onsite process evaluation, FSI's technical team observed that foam chemistry alone would not resolve the production issues.

Finished panels exhibited inconsistent fill, surface imperfections, and internal voids that indicated broader process variability throughout the manufacturing operation.

A comprehensive process assessment identified several critical factors limiting production performance.

Process Assessment - Optimizing Foam Distribution

The existing process dispensed foam from a single injection point. While acceptable for shorter panels, the configuration limited

complete material distribution across longer panel geometries before the foam reached gel time.

FSI recommended redesigning the dispensing pattern to utilize multiple injection locations, allowing the polyurethane system to fill the cavity more uniformly.

Results included:

- ✓ Improved cavity fill
- ✓ Reduced void formation
- ✓ Better density consistency
- ✓ Improved finished panel appearance

Improving Dispensing Accuracy

Further evaluation revealed that the existing gear pumps were oversized for the required production rates. Operating below their intended flow range created inconsistent chemical delivery and reduced process control.

FSI recommended properly sized pumps matched to the required dispensing rates, significantly improving metering accuracy and repeatability.

Benefits included:

- ✓ Stable chemical flow rates
- ✓ Improved mix ratio consistency
- ✓ Better shot-to-shot repeatability
- ✓ Reduced process variation



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Restoring Process Temperature Control

Temperature consistency proved to be another significant contributor to production variability.

The existing manufacturing equipment lacked sufficient control over:

- ✓ Chemical storage temperatures
- ✓ Day tank temperatures
- ✓ Fixture surface temperatures
- ✓ Ambient process conditions

Since polyurethane processing is highly dependent on temperature, inconsistent operating conditions directly affected foam flow, cure profile, and finished part quality.

FSI worked with the manufacturer to evaluate equipment capabilities and develop recommendations for improved thermal process control.

The FSI Solution

As the investigation progressed, it became clear that incremental equipment modifications would not fully address the underlying process limitations.

FSI partnered with the customer to develop specifications for a modern foaming line capable of delivering consistent dispensing performance, accurate process control, and repeatable product quality while supporting implementation of an **Ecomate®**-based polyurethane system.

Rather than simply supplying chemistry, FSI provided application expertise spanning material selection, process engineering, dispensing optimization, and equipment guidance.

Customer Outcome

By addressing both material and process variables, the manufacturer transformed an inconsistent production operation into a significantly more controlled manufacturing process.

Results included:

- ✓ Improved panel fill consistency
- ✓ Reduced voids and cosmetic defects
- ✓ Greater process repeatability
- ✓ Improved dispensing accuracy
- ✓ Enhanced manufacturing efficiency
- ✓ Successful implementation of an environmentally compliant **Ecomate®** polyurethane system
- ✓ A long-term production platform capable of supporting future manufacturing growth

