

CASE STUDY

RIOT Industrial | Jul 23, 2025



Overview

Who We Are



Manufacturing

RIOT helps Manufacturers with PLC controls and closed-source AI Assistants to accelerate troubleshooting efforts and minimizing downtime.



Oil & Gas

Operators use RIOT to monitor wells, tanks and pipeline infrastructure to stay informed about production, alarms and site conditions.



Municipalities

RIOT helps Cities across the southwest control their water, wastewater and treatment plants. With 99% uptime, Cities can trust RIOT's reliability & security.

RIOT Industrial is a leading SCADA and technology company for industrial applications. With a user-friendly interface and powerful machine learning and AI-based analysis, we support a variety of industries while delivering the latest technology right to your fingertips.

Case Background

A manufacturing company makes a blended product that is shipped around the world. Sometimes, the product comes out wrong and can't be used because it doesn't meet the right standards. When this happens, the company has to throw away the bad batch and try making a new one, hoping it turns out better. The operations team would look at the data from both the good and bad batches, trying to find out what went wrong. They checked things like temperature, pressure, and RPMs, but everything looked normal. There were no clear signs or events in the data that explained why the product failed.

Each product run was at risk of not meeting standards and having to be scrapped.

The Challenge

Identifying an operational anomaly with little or no context is highly challenging for AI. Without baseline parameters, historical trends, or defined thresholds, the system must infer "normal" behavior purely from raw data patterns—which risks misclassifying noise or natural variation as anomalies.

AI models typically rely on labeled data, contextual cues (like machine type or production stage), and domain-specific rules to make accurate decisions. Lacking that context, the AI must essentially “guess” what is expected behavior, making it more prone to false positives or missing subtle, critical faults.

This is where RIOT's AI Model is set apart. We are able to ‘educate’ the AI about the type of data it's analyzing, where it came from and how it applies to the physical operations.

Technical Implementation

NONE! RIOT was able to use data provided by the Manufacturer, educate the AI and run the analysis external of the control and operating system. No hardware installation and no interruption to operations. Our ‘Spot Analysis’ was able to identify subtle, but consistent occurrences during bad product runs.



Outcome

The Manufacturer engaged RIOT Industrial to identify the root cause of bad batch runs. They provided RIOT with two machine data logs containing more than 6.9 million individual datapoints. RIOT Industrial utilized its closed-source AI software named **Automated Engineer** to analyze the data.

Known Failed Materials Were Produced:

May 6, 2025 between 10:00 pm and 11:50 am

May 9, 2025 between 3:00 am and 7:00 am

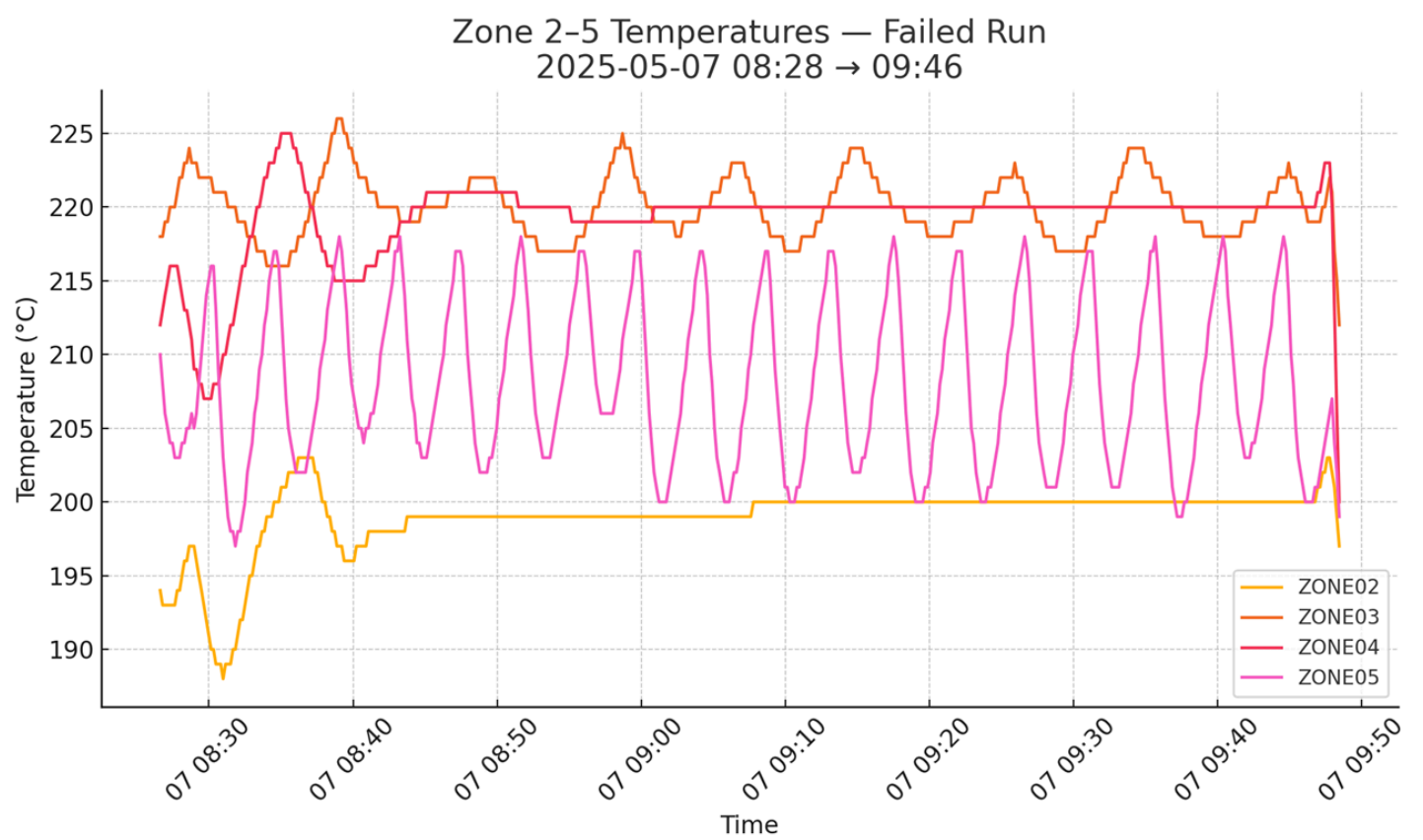
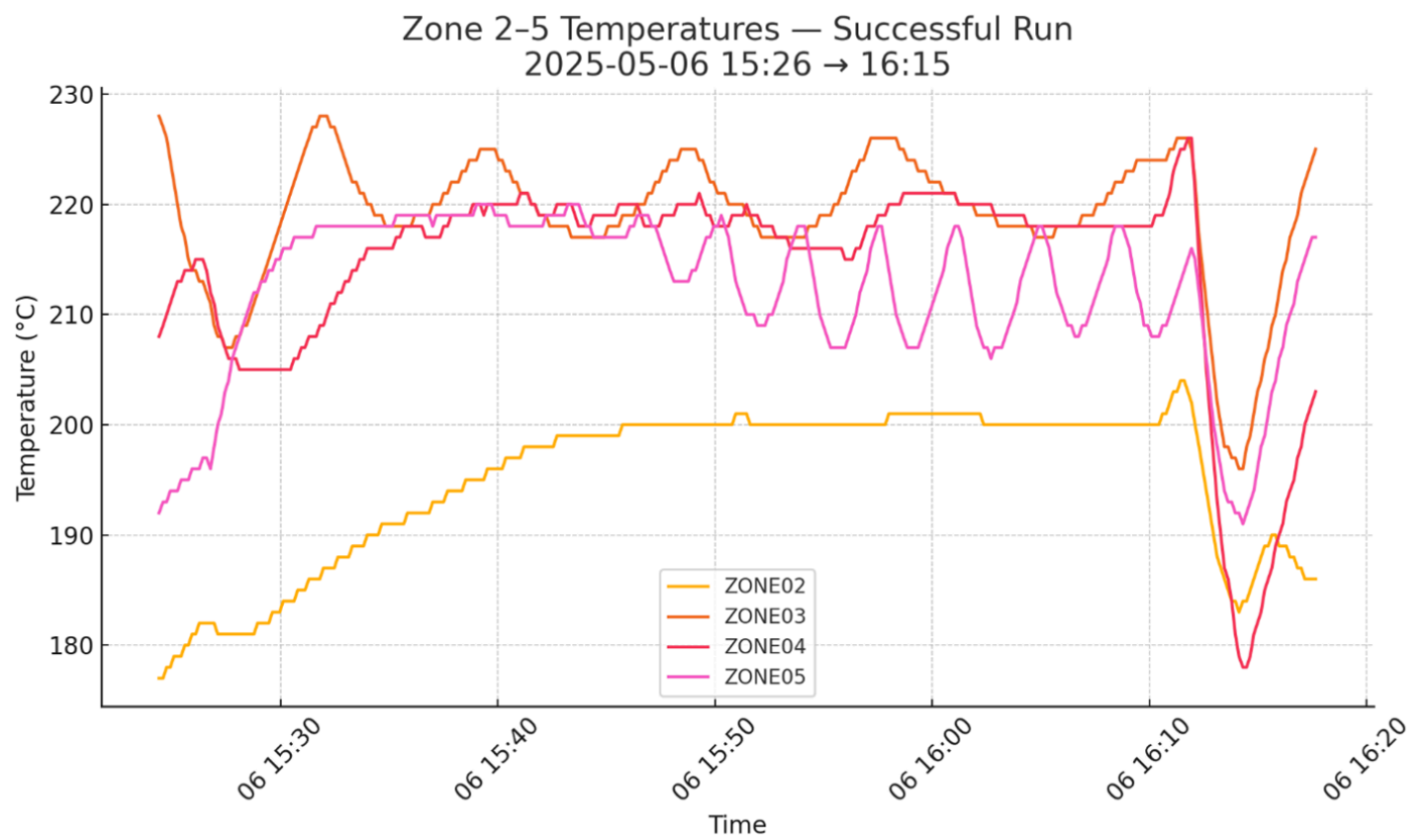
May 9, 2025 around 9:00 am

Three bad batches in 96 hours
(each one a \$2000 loss) = \$180,000/yr

Executive Summary from the Automated Engineer

During optimal production runs, barrel zone temperatures generally remain below approximately 222 °C, with Zone 5 exhibiting minimal fluctuation—typically within a four-degree range per cycle. In contrast, during defective (scrap) runs, those same zones experience temperature spikes reaching 224–227 °C and sustain elevated levels for longer durations. Additionally, Zone 5 demonstrates increased variability, swinging by nearly eight degrees per cycle. Although average temperatures remain consistent across both scenarios, the issue lies in the higher peak temperatures and increased thermal instability, rather than a shift in set-point.

In short, the successful runs ran a few degrees cooler in the mid-barrel zones and showed slightly tighter, more synchronized temperature control - especially Zone 5.



Pattern	Implication
 Hotter Zones 3–5	Mid-barrel overheating is a repeat pattern across all failed windows — most pronounced in the 5/9 morning run.
 Zone 5 Oscillation	Present in all runs but amplified and less synchronized in failures — suggests unstable heater control or external feedback loop (e.g., inconsistent melt back-pressure).
 Minimal response in melt pressure	Suggests that melt pump or screeners are not sensitive enough to catch in-process thermal drift unless large excursions occur.
 Torque creeps in failed runs	A slowly increasing torque profile (like in the 5/7 PM and 5/8 AM runs) likely reflects thicker, overcooked melt, possibly due to higher temps or stalled feeder flow.

AI Product Run Comp

Category	✓ Good Runs	✗ Failed Runs (5/7, 5/8, 5/9)
Zone 3 Temperature (Mid-barrel heating)	- Typically holds steady at 215–219 °C - Minimal drift or ramp during the run - Slight ripple ($\pm 1\text{--}2\text{ °C}$)	- Starts hot and climbs to 222–227 °C - Sustained overshoot or rising trend - Sharp spikes seen in 5/8 run
Zone 4 Temperature (Downstream barrel)	- Stable at 210–215 °C - Closely tracks Zone 3 behavior	- Ramps up to 218–225 °C - Slight lag behind Zone 3 but same upward trend
Zone 5 Temperature (Front zone)	- Gentle oscillation ($\pm 2\text{--}3\text{ °C}$) - Very regular, sinusoidal pattern - Peak & trough spacing $\sim 3\text{ min}$	Oscillation amplitude increases to $\pm 6\text{--}8\text{ °C}$ - Less regular — some delayed peaks or compression - Often drifts hotter over time
Zone 2 Temperature (Rear barrel)	- Low ramp-up, stabilizes $\sim 190\text{--}195\text{ °C}$ - No oscillation	- Also stabilizes $\sim 195\text{ °C}$ - Sometimes shows slow upward creep of $\sim 3\text{ °C}$ during longer runs
Melt Pump Exit Pressure	- Very flat trace with low fluctuation - Minor drift may correlate with feed rate	- Still generally stable - Occasional small spikes ($\sim 10\text{ psi}$) when Zone 3 jumps - Not a major differentiator
Screw Speed	- Flat and consistent - Occasional very small drops/reset behavior	- Also flat, though sometimes slightly more noisy - Minor drops more frequent (e.g. in 5/7 PM run)
Extruder Torque	- Stable and flat across run - Indicates melt viscosity and loading are balanced	- Slightly higher average torque - More “texture” — likely response to increased melt resistance from heat

What Stands Out

1. Oscillation in Zone 5 is a constant theme

- roughly a 5–8 °C swing, period 2–3 minutes, regardless of date.
- suggests that heater band or controller PID is hunting.

2. Mid-barrel heat rise on 9 May

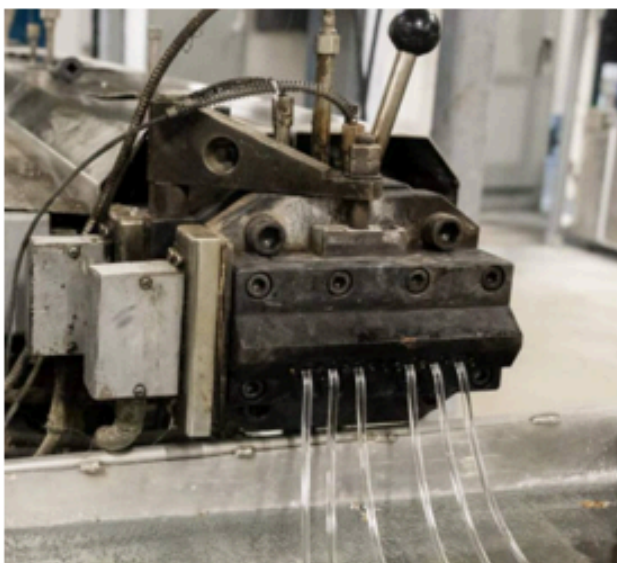
- Zones 3-4 sit ~3–5 °C hotter than on the 6–8 May runs.
- If the formulation is heat-sensitive or shear-sensitive, this aligns with the last batch of scrap.

3. Brief temperature spikes (Zone 3) on 8 May morning

- Hit 226–227 °C, then drop; could indicate a transient heater overshoot or reduced feed causing less cooling.

Action Items

1. Watch live temperatures; if Zone 3 or 4 stay over 223 °C for more than half a minute note the time and product.
2. Tighten or replace the thermocouples and heater bands on Zones 3-5.
3. Retune the controller on Zone 5 (lower the P gain or run auto-tune) to cut the large swings.
4. Compare melt pressure or motor torque between good and bad runs to see if feed is starving.
5. Add a temporary alarm that warns whenever Zone 3 or 4 stays above 223 °C for more than 30 seconds so you can catch the issue before scrap is made.



Conclusion

A manufacturing company partnered with RIOT Industrial to uncover the root cause of inconsistent product quality during certain production runs. RIOT analyzed over 6.9 million datapoints from machine logs using its AI tool, Automated Engineer. The analysis revealed that while average operating temperatures appeared normal, failed runs were marked by higher peak temperatures and wider thermal swings—especially in Zones 3 to 5 of the extruder. Zone 5, in particular, showed unstable oscillations suggesting possible control loop issues or sensor inaccuracies. These subtle but critical variations led to degraded product quality, which traditional analysis methods had failed to detect. By identifying these patterns, the company can now take targeted corrective actions to reduce waste and improve consistency.

We would love to hear from you!

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