Overview
A SmartTrac system was connected to an injection press molding a BMC circuit breaker housing. SmartTrac uses in-mold sensors to monitor the cure rate and automatically adjust the cure time. SmartTrac delivered the following results in this application:

- **Automatically detected and accounted for temperature variations** affecting the cure rate.
- Ensured no under-cured parts were produced.
- Reduced the cure time from 15 seconds to 11.7 seconds, representing a **cure time savings of 22%**.
- Demonstrated a full return on investment in less than one year.

Problem
A BMC product supplier to the electrical industry had limited ability to identify and address abnormal process variations. Without real-time cure monitoring, injection BMC molders are unable to determine the precise impact process variations have on the cure rate of the part. This inability prevents the molder from anticipating and correcting processing issues before they cause machine downtime. In addition, the molder is less efficient starting up and troubleshooting production, leading to further reductions in machine utilization.

Solution
A SmartTrac system was connected to the press with an impedance sensor mounted in the mold. The sensor measures the dielectric properties of the BMC, which change as the part cures. SmartTrac receives a signal from the press to start monitoring, analyses the in-mold sensor data to determine the proper time to end the cure, and sends a signal to the press to end the cycle. SmartTrac’s impedance signatures and variable cure times provide vision into the process, enabling proactive corrections to process parameters before they escalate into machine downtime.

Results – Accounting For Press Startup
The run chart below shows how SmartTrac changed cure times during the press startup. The run chart shows the cure times increasing nearly two seconds after the initial cycle. The first shots of BMC material significantly cooled the mold, requiring an increase in cure time to maintain consistent part properties. Due to the mold’s thermal inertia, approximately 30 cycles were required before the heaters
stabilized the mold temperature. SmartTrac detected and automatically accounted for the impact of the startup variations. The molder’s normal fixed cure time of 15 seconds was well above the optimum times identified during the startup. Without SmartTrac, safety margins are always added to cure times to ensure good parts are manufactured during process abnormalities. Some manufacturers even scrap the first few cycles, causing even lower machine utilization. In contrast, SmartTrac eliminates the need for safety margins and improves startup efficiency.

**Results – Accounting for Process Upsets**

At one point the mold was opened for 2 minutes while a jammed part was cleared. The run chart below shows the SmartTrac cure time was 1.5 seconds faster when molding resumed. This occurred because there was no material injection to cool the mold and counteract the heaters. The mold temperature decreased and the cure times resumed their previous pattern about 4 cycles after molding resumed. Even small process upsets can result in significant cure time changes. The SmartTrac system detected and adjusted for these variations automatically.

![Run Chart](chart.png)

**Summary**

SmartTrac gave this injection BMC molder a previously unavailable window into the process. SmartTrac’s ability to detect, display and automatically account for abnormal process variations enables the manufacturer to improve machine utilization by addressing problems before they cause downtime or scrapped parts. The following results were measured during this evaluation:

- SmartTrac automatically detected and accounted for normal process variations. This ability increases throughput by reducing scrap and increasing machine utilization.
- SmartTrac reduced the cure time by 22% in this application, while simultaneously assuring no parts were under cured.
- SmartTrac provides a full payback in less than 12 months based on cure time savings alone.