TECHINHERIT / TECHNICAL NOTE 02

Injection Mold Venting: Diagnosing Burn Marks and Short Shots

A mold-focused guide to finding trapped air, verifying vent routes and separating venting defects from ordinary filling problems.

A burn at the end of fill and an incomplete part can share the same air-trap cause. Increasing pressure or speed before checking the escape route may make the defect worse. Diagnose the filling pattern first, then decide whether the correction belongs in the tool or the process.

Executive summary

As melt enters a mold, it displaces air from the sprue, runners and cavity. Air must leave through a connected route to the outside of the tool. If a flow front seals a pocket before its air escapes, pressure rises locally; the part may show a dark burn, a dull patch, a weak meeting line or an unfilled extremity. Inadequate venting is one possible cause of a short shot, alongside restricted flow, premature freeze-off, insufficient shot volume and machine limitations.

A useful investigation compares defect location, staged short-shot samples and the actual vent path. The vent is not merely a shallow mark on the parting line: it needs a controlled land at the cavity, a relief channel and an unobstructed outlet. Both the land and the exit route must be designed for the particular material, tool and flash limit.

Three questions at first review

Where does the front stop?	Where can the gas leave?	What changed?
Map the last-fill point and any meeting fronts on every cavity.	Trace cavity to land to relief to atmosphere; check ribs and blind pockets.	Compare new-tool trials with later runs; inspect vent fouling and process drift.

This note gives no universal vent depth or processing setpoint. Such dimensions must be validated against the resin grade, tool construction and observed flash margin.

1 Recognize an air trap without assuming every short shot is one

Patterns that justify a venting investigation

Burn marks often appear where air is compressed near an end-of-fill pocket or a converging flow front. A repeatable short shot at the same last-fill location, especially with a nearby burn or dull surface, strengthens the venting hypothesis. A defect that appears only after production hours can indicate a vent that has become contaminated rather than an originally misplaced vent.

These clues are not proof. A short shot without burn may be caused by low delivered shot volume, a blocked gate or runner, hesitation in a thin section, a cold mold or inadequate injection capacity. A dark mark can also come from degraded material, local overheating or contamination. Record the pattern before changing tool steel.

Observation	First check	Competing explanation
Burn at a consistent last-fill point	Trace the vent and outlet at that cavity.	Local melt degradation or excessive shear.
Short shot plus burn	Run staged fill study; check air route.	Insufficient pressure/volume plus coincident discoloration.
Short shot, no burn	Check cushion, shot volume, runner/gate and temperatures.	Trapped air remains possible but is not established.
Defect grows over a shift	Inspect deposits at land and relief.	Drifting melt/mold temperature or machine delivery.

2 Map the filling sequence

A filling simulation can suggest air traps before the mold is built. At T0 or T1, verify the predicted pattern with controlled short-shot samples from each cavity. Keep the resin, temperatures, injection profile and machine setup recorded; step the delivered fill amount in a controlled sequence. Mark the last-fill location and where fronts meet around holes, ribs, bosses or inserts.

The map should distinguish one cavity from another. A balanced runner does not guarantee identical local air routes, and a process adjustment can shift the final meeting point. Photograph labeled parts and mark gate, flow direction, cavity number and nominal fill stage. A full part alone can hide where gas was trapped immediately before fill completion.

If the observed last-fill point moves after a gate or speed change, re-evaluate the vent plan. A vent placed for the old flow pattern may no longer serve the new air trap.

3 Design a complete vent path, not just a shallow slot

Entrance: the shallow land at the cavity or parting line must pass gas while limiting melt flash. Its depth and length depend on the material and the tool. Treat published grade-specific dimensions as starting guidance only, never as universal values.

Relief and outlet: beyond the land, the passage needs enough relief and an open discharge to atmosphere. A correctly sized land is ineffective if the relief is blind, blocked by deposits or sealed by mold components. Inspect the route physically after assembly, not only on a drawing.

Locations: typical candidates are end-of-fill regions, convergence zones and deep ribs or pockets. Where a parting-line route is impractical, evaluate ejector-pin or sleeve venting, vented inserts or another maintainable route. The method must preserve part appearance, dimensional tolerances and ejection function.

Review item	Question for the mold drawing / trial
Land	Is the cavity entrance dimensioned for this grade and flash limit?
Relief	Does the passage widen or deepen after the land without trapping gas?
Outlet	Is there a continuous path to atmosphere after tool assembly?
Access	Can deposits be inspected and cleaned without damaging sealing surfaces?
Multi-cavity consistency	Are corresponding last-fill areas and vents equivalent across cavities?

4 Separate tool correction from process correction

Before cutting a new vent, confirm shot size and cushion, check-valve behavior, gate/runner obstruction, melt and mold temperatures, injection-pressure limit and fill time. Change one variable at a time. If fill improves but a localized burn intensifies, the escaping gas path remains suspect. If the short shot follows a cold thin wall and no trapped-air evidence appears, a flow or thermal correction may be more appropriate.

Clean existing vents before increasing their depth. Fouling can reduce their effective section. If the vent is undersized or misplaced, modify the tool based on the mapped air trap and a steel-safe trial plan. Excessive vent opening can cause flash and maintenance problems. Slowing injection near the final fill can reduce gas compression in some tools but may worsen freeze-off in others; it must be tested in the full quality window.

Action	Evidence that supports it	Check for unintended effect
Clean vent path	Deposits or a previously successful tool.	Defect recurrence interval.
Add/relocate vent	Repeatable air trap with no outlet.	Flash, parting-line wear, appearance.
Adjust fill profile	Burn sensitivity to end-of-fill velocity.	Incomplete fill, weld-line quality, cycle time.
Revise gate/runner	Unbalanced or shifted last-fill pattern.	New air-trap location and packing.

5 Confirm a production-ready solution

Validate the correction with parts from every cavity at start-up and steady production. Track burn and short-shot frequency, vent cleanliness, flash, dimensions, weld-line quality and cycle stability. Re-run a representative fill study after a major gate or runner change. Record the cleaning interval and an objective trigger for maintenance, such as visible deposit or recurrence at the same mapped location.

A successful release is not merely one full cavity. The tool should repeatedly fill and pack within an agreed process window without burns, unacceptable flash or a new defect elsewhere. Keep trial samples, photos, process settings and tool-revision notes together so the next production team can identify a returning vent problem quickly.

Release checklist: mapped last-fill area; documented vent route; cleanable outlet; stable fill across cavities; acceptable flash and appearance; recorded maintenance method.