



## Philosophy of Troubleshooting BMC Injection Molding Problems

There is no "cure-all" for eliminating molding problems. Every mold is distinctive and has its own peculiarities, even molds which are exact duplicates. The same holds true for molding presses. Therefore, what works for one mold or press may not work for another.

Problems can differ with conditions such as the shop climate, material or equipment resulting in numerous variables, many of which are not obvious and are difficult to identify. The troubleshooting suggestions that follow have been used to successfully resolve the stated problem. However, due to the reasons mentioned above, several of them may seem to be contradictory.

The most important thing to remember is make a reasonable adjustment and carefully observe the results. Document the change and keep track of the response by comparing parts from before and after the adjustment, to determine if the effect is favorable. This will lead to other changes that should eventually produce a solution to the problem.

Thermoset materials cure as a result of a chemical reaction. Temperature has a major role in the speed of the reaction and to a lesser degree so do pressure and time. Therefore all three items need to be verified before troubleshooting any molding problem.

For **injection molding**, this means there are several items on the mold and press that should be checked before troubleshooting any molding problem. If problems are found they should be corrected and the parts re-evaluated before proceeding.

**Mold** - Check the actual mold temperature and its uniformity across the entire mold face and compare with what the temperature was, the last time this mold was run in this press. They should be the same or very close to it. If not try to determine why there are differences before starting to mold.

**Press** - Check actual settings for injection pressure, back pressure, holding pressure, injection speed, injection time, screw speed and return time with the settings used the last time this mold was run in this press. They should be the same or very close to it. If not, try to determine why there are differences before starting to mold.

# Injection Processing Problems

Please **NOTE** the following:

- Increased cycle time should not be used as a solution for a molding problem, except as the very last resort to maintain the integrity of the molded parts.
- Various processing changes are suggested as possible solutions for the different problems encountered during the molding of thermoset parts. In general these changes should not exceed the recommended ranges presented in the previous sections on injection startup procedures.
- This troubleshooting guide lists the processing problems in alphabetical order.
- For each problem, the possible solutions are listed in the order of the most frequent to the least frequent solution for that problem.
- Change only one processing variable at a time and thoroughly evaluate its results, before changing another processing variable.
- Please keep in mind, that in order to resolve any given processing problem, a combination of the possible solutions may need to be applied.
- Plenco's Technical Service Group is always available to assist you in troubleshooting processing problems. This may involve investigating material modifications or a different molding compound.

**CRAZING / CRACKING** - Cracking is hairline cracks that appear on the surface of the part but do not propagate through the entire thickness of the part.

## **POSSIBLE SOLUTIONS**

1. Check mold for back draft or undercuts and remove them.
2. Eliminate any sharp transitions from thick to thin cross sections.
3. Decrease the speed of ejection.
4. Increase the temperature differential between the cores and cavities.
5. Allow the parts to cool at a controlled, uniform rate.
6. Increase the size of the gate and if possible relocate it.
7. Use shrink fixtures to hold the parts flat as they cool.

**CONTAMINATION** - Any visible foreign material in the surface of the molded part.

**POSSIBLE SOLUTIONS**

1. Check all unmolded material for foreign matter and if possible remove it. If it can't be removed, quarantine the remaining material.
2. Check all equipment used in molding the material for potential sources of contamination and remove them.
3. Check for air borne particulates from other processes and eliminate their source.

**DIESELING** - A burnt spot on part, often accompanied by non-fills.

**POSSIBLE SOLUTIONS**

1. If mold is vacuum vented, check system to insure that it is pulling a minimum of 21" of Hg in the mold. If it is not, resolve problem with vacuum system.
2. Decrease injection pressure and/or speed.
3. Decrease screw position for transfer from primary to secondary pressure.
4. Increase the mold temperature and if that does not resolve the problem try decreasing it.
5. Vent the ejector pins.
6. Vacuum vent the mold.

**DRAG MARKS** - Surface scratches that occur during part ejection.

**POSSIBLE SOLUTIONS**

1. Check parallelism of ejector system and repair as needed.
2. Check mold for back draft or undercuts and remove them.
3. Check mold for amount of draft and increase if necessary.

**DULL APPEARANCE** - The surface of the part has a hazy or satiny appearance instead of a glossy appearance.

**NOTE:** Make sure part is completely filled out and mold is not stained.

### **POSSIBLE SOLUTIONS**

1. Increase mold temperature.
2. Increase stock temperature by increasing back pressure and/or barrel temperature.
3. Check condition of mold plating and re-plate if necessary. If mold is unplated, polish or plate it.
4. Polish the mold.

**FLASH (EXCESSIVE)** - Parts where the flash is thicker than 0.15 mm (0.006”) or with flash extending out into the land areas are considered to have excessive flash.

### **POSSIBLE SOLUTIONS**

1. Decrease shot size.
2. Decrease injection and holding pressures.
3. Increase stock temperature by increasing back pressure and/or barrel temperature.
4. Increase mold temperature.
5. Check parting line for wear or damage and repair as needed.
6. Increase clamp tonnage if possible.

**FLOW LINES** - Visible lines on the surface of the part that show the flow pattern of the material as it filled the cavity.

### **POSSIBLE SOLUTIONS**

1. Increase injection speed.
2. Increase injection and holding pressure.
3. Increase holding time.
4. Decrease mold temperature.
5. Decrease stock temperature by decreasing back pressure and/or barrel temperature.
6. Increase the size of the gate and if possible relocate it.

**INJECTION TOO SLOW** - During the injection portion of the molding cycle, the material does not fill the mold in the recommended injection time.

### **POSSIBLE SOLUTIONS**

1. Increase injection pressure.
2. Check injection throttle position and if possible, increase its setting.
3. Increase stock temperature by increasing back pressure and/or barrel temperature.
4. Increase the mold temperature and if that does not resolve the problem try decreasing it.

**KNIT LINES** - Areas where multiple flow fronts meet but do not fuse or knit together.

**POSSIBLE SOLUTIONS**

1. Increase the size of the gate and if possible relocate it.
2. Decrease injection pressure and/or speed.
3. Decrease mold temperature.

**LAKING** - Irregular dull areas on the surface of the part.

**POSSIBLE SOLUTIONS**

1. Increase clamp tonnage if possible.
2. Verify that the correct charge weight is being used and change as needed.
3. Verify that clamp pressure is being maintained on the mold during the entire cycle and correct as needed.
4. Decrease hold time.
5. Increase injection pressure and/or speed.
6. Increase mold temperature.
7. Check parting line for wear or damage and repair as needed.

**NONFILLS OR SHORT SHOTS** - Areas of surface porosity due to parts not being completely filled out.

**POSSIBLE SOLUTIONS**

1. Increase shot size.

2. Increase stock temperature by increasing back pressure and/or barrel temperature.
3. Increase injection and holding pressures.
4. Decrease mold temperature.
5. Check the vents and correct as needed. (See Section #6, "Thermoset Injection Mold Design Tips" )
6. Check the screw and barrel for wear and if necessary recondition or replace them.

**PIN CRACKING** - Small surface cracks around and/or above ejector pins.

**POSSIBLE SOLUTIONS**

1. Decrease speed of ejection.
2. Check mold for back draft or undercuts and remove them.
3. Check amount of draft and increase if necessary.
4. Increase mold temperature.
5. Increase cycle time.
6. Vent the ejector pins.
7. Relocate ejector pins or increase the diameter and/or number of pins.

**PRE CURE** - Localized areas of dull rough porosity.

**POSSIBLE SOLUTIONS**

1. Increase injection pressure and/or speed.
2. Decrease mold temperature.

**SCREW PICKUP IS ERRATIC** - During the screw return portion of the molding cycle, the screw does not return to its fully retracted position at a uniform rate.

**POSSIBLE SOLUTIONS**

1. Check material feed from stuffer.
2. Decrease screw speed.
3. Increase stock temperature by increasing back pressure and/or barrel temperature
4. Check the screw and barrel for wear and if necessary recondition or replace them.

**SCREW PICKUP IS TOO SLOW** - During the screw return portion of the molding cycle, the screw takes too long to return to its fully retracted position at a uniform rate.

**POSSIBLE SOLUTIONS**

1. Check material feed from stuffer.
2. Increase screw speed.
3. Decrease stock temperature by decreasing back pressure and/or barrel temperature.
4. Increase barrel temperature of the feed zone.

**SCUMMING** - Dulling or streaks in the part that usually transfer a similar pattern onto the tool surface.

**POSSIBLE SOLUTIONS**

1. Increase clamp tonnage if possible.
2. Verify that clamp tonnage is being maintained on the mold during the entire cycle and correct as needed.
3. Increase mold temperature.
4. Increase the size of the gate and relocate it.
5. Increase injection pressure and/or speed.

**SHRINKAGE** - There are two problems which will cause a part to not meet its dimensional requirements, the part has excessive shrinkage (undersize) or the part has insufficient shrinkage (oversize).

**POSSIBLE SOLUTIONS FOR EXCESSIVE SHRINKAGE (UNDERSIZE)**

1. Increase injection and holding pressures.
2. Increase mold temperature.
3. Increase stock temperature by increasing back pressure and/or barrel temperature.

4. Check the vents and correct as needed. (See Section #6, "Thermoset Injection Mold Design Tips")
5. Increase cure time.

#### **POSSIBLE SOLUTIONS FOR INSUFFICIENT SHRINKAGE (OVERSIZE)**

1. Decrease mold temperature.
2. Decrease holding pressure.
3. Check the vents and correct as needed. (See Section #6, "Thermoset Injection Mold Design Tips")
4. Decrease cure time.

**SINK MARKS** - Slight depressions on the surface of the part that resemble dimples.

#### **POSSIBLE SOLUTIONS**

1. Increase shot size.
2. Increase mold temperature.
3. Increase injection and holding pressures.
4. Decrease injection speed.
5. Check the vents and correct as needed. (See Section #6, "Thermoset Injection Mold Design Tips")

**SPRUE STICKING** - When the mold opens during the molding cycle, the sprue will not release from the sprue bushing and will remain on the fixed half of the mold.

#### **POSSIBLE SOLUTIONS**

1. Make sure the orifice of the sprue bushing is larger than the nozzle orifice. Also check the sprue bushing and nozzle for damage or wear and repair or replace as needed.
2. Decrease injection pressure.
3. Decrease holding pressure.
4. Check sprue tip for "soft bulb" on the end and adjust process parameters as needed to get it.

5. Check sprue puller design and revise as needed. (See Section #6, "Thermoset Injection Mold Design Tips")

**STICKING IN MOLD** - Runner, and/or part will not release from the mold and a piece or all of the item will remain stuck until it is manually removed.

#### **POSSIBLE SOLUTIONS**

1. Check mold for wear and correct as needed.
2. Decrease holding pressure.
3. Increase mold temperature.
4. Decrease shot size.
5. Check condition of mold plating and re-plate if necessary. If mold is unplated, polish or plate it.
6. Increase cure time.

**TRAPPED GAS (BURN MARK)** - A porous, dull, discolored and sometimes scorched area on the surface of a part.

#### **POSSIBLE SOLUTIONS**

1. If mold is vacuum vented, check if system is pulling a minimum of 21" Hg in the mold. If not, resolve problem with vacuum system.
2. Check the vents and correct as needed. (See Section #6, "Thermoset Injection Mold Design Tips")
3. Decrease stock temperature by decreasing back pressure and/or barrel temperature.
4. Decrease injection speed.
5. Decrease injection and holding pressures.
6. Decrease mold temperature.

7. Decrease clamp tonnage.
8. Increase gate & runner size.

**WARPAGE** - Part is twisted or warped rather than straight or flat. This can occur when **ejected from the mold** or **after cooling**.

**POSSIBLE SOLUTIONS FOR PART WARPAGE WHEN EJECTED FROM MOLD**

1. Check mold for wear and correct as needed.
2. Check condition of the mold plating and re-plate if necessary. If mold is unplated, polish or plate it.
3. Add undercuts to hold parts in the movable half of the mold until they are ready to be ejected.
4. Check dropping of parts from the mold or observe the part picker to see if the parts are being deformed.

**POSSIBLE SOLUTIONS FOR PART WARPAGE AFTER COOLING**

1. Increase mold temperature.
2. Increase stock temperature by increasing back pressure and/or barrel temperature.
3. Decrease injection speed.
4. Check the vents and correct as needed. (See Section #6, "Thermoset Injection Mold Design Tips")
5. Increase cure time.
6. Use shrink fixtures to hold the parts flat as they cool.
7. Increase the size of the gate and if possible relocate it.

**WOOD SCREWING** - During the screw return portion of the molding cycle, the screw will not pickup enough material as it rotates back to its fully retracted position.

**POSSIBLE SOLUTIONS**

1. Increase back pressure.
2. Decrease barrel temperature.
3. Decrease screw speed.

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This information is suggested as a guide to those interested in processing Plenco Thermoset molding materials. The information presented is for your evaluation and may or may not be compatible for all mold designs, runner systems, press configurations, and material rheology. Please feel free to call Plenco with any questions about PLENCO molding materials or processing and a Technical Service Representative will assist you.