

Philosophy of Troubleshooting 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 steel temperature of the mold and its uniformity across the entire surface of both mold halves. Be sure to use a Calibrated Pyrometer and Surface probe. Compare the readings with the temperature readings of the last time the mold was processed. The data should be similar or close to it. If not, investigate why there are differences. Correct as necessary.

Press - Compare process parameters (primary & holding pressures, injection time, hold time, back pressure etc.) against process parameters from previous run. The data should be similar or close to it. If not, investigate why there are differences. Correct as necessary.

Injection Processing Problems

Please **NOTE** the following:

- 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. Allow the press to cycle at a minimum of 3 cycles and then thoroughly evaluate results before changing another processing variable.
- 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 available to assist you in troubleshooting processing problems.

BALL & SOCKET - An internal circular failure pattern observed on injection molded parts after breaking the thickest cross-sectional area. One surface will resemble a ball, and the other surface will resemble a socket. The texture and color of the socket area will differ from that of the ball.

POSSIBLE SOLUTIONS

1. If possible, relocate the gate perpendicular to the part instead of parallel flow to its geometry.
2. Decrease injection speed.
3. Increase primary and holding pressures.

BULGE OPPOSITE INSERT - Bulges that appear on the side opposite and directly over molded-in inserts.

POSSIBLE SOLUTIONS

1. Increase mold temperature.
2. Increase cure time.
3. Heat inserts to mold temperature before using.
4. Use a reduced size insert.

CURE BLISTER - Area of gas entrapment (blister) caused by not completely curing the part before removing it from the mold. This generally shows up as a bulge on opposite sides of the thickest cross-sectional area of the part. When broken open, there will be a large void in the center of the bulge.

POSSIBLE SOLUTIONS

1. Increase mold temperature.
2. Increase barrel temperature.
3. Increase screw back pressure.
4. Increase cure time.

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. Increase cure time.
4. Polish the mold.
5. Check condition of mold plating and re-plate if necessary. Polish and re-plate 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 primary pressure.
3. Decrease holding pressure.
3. Decrease injection speed.
4. Decrease back pressure.
6. Increase clamp tonnage.

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. Decrease primary pressure.
2. Decrease holding pressure.
3. Increase holding time.
4. Decrease injection speed.
5. Increase mold temperature.
6. Relocate gate if possible.

GAS BURNS - A porous, dull, discolored and sometimes scorched area on the surface of a part.

POSSIBLE SOLUTIONS

1. Check vents for blockage, clean if needed.
2. Check mold venting and correct as needed.
3. Decrease injection speed.
5. Decrease injection and holding pressures.
6. Increase back pressure.
7. Add a mold breathe to the process.
8. Review vent location, add or change location(s).
8. 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.

HARD SPOTS (PREURE) - Slight bumps on the surface of the part that are usually uneven, pointed, and rough and have definite outlines.

POSSIBLE SOLUTIONS

1. Check sprue tip for "soft bulb" and adjust conditions as needed.
2. Contact Material supplier.

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 speed.
2. Increase primary pressure.
3. Increase barrel temperature.
4. Increase back pressure.

MOLD STAINS - A build up of volatiles on the molding surface that will cause that surface area of the part to be dull and pit marked. This can eventually lead to part discoloration and parts sticking in the mold.

POSSIBLE SOLUTIONS

1. Review mold venting. Address as needed.
2. Polish areas of the mold that are dull.
3. Check condition of the mold plating. Address as necessary.

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

POSSIBLE SOLUTIONS

1. Increase shot size.
2. Decrease mold temperature.
3. Increase primary pressure.
4. Increase holding pressure.
4. Increase back pressure.
5. Check hopper to see if there is a material feeding issue.

NOZZLE FREEZE UP - Curing of the compound in the nozzle during the molding cycle which prevents the screw from injecting the material on the next cycle.

POSSIBLE SOLUTIONS

1. Decrease barrel temperature.
2. Decrease back pressure.
3. Increase primary pressure.
4. Increase holding pressure.
5. Increase injection speed.
6. Check sprue tip for "soft bulb" and adjust conditions as needed.

ORANGE PEEL - Surface appearance that looks like an undersurface craze or numerous small ripples and resembles the skin of an orange.

POSSIBLE SOLUTIONS

1. Increase mold temperature.
2. Increase back pressure.
3. Increase holding pressure.
4. Increase clamp tonnage.

RUBBERY PARTS OR RUNNER - Parts and/or runner that are rubbery on ejection from the mold.

POSSIBLE SOLUTIONS

1. Increase cure time.
2. Increase mold temperature.
3. Increase back pressure.
4. Increase barrel temperature.
5. Request from material supplier a version of the material that has a lower deflection specification.

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. Decrease screw speed.
2. Increase back pressure.
3. Increase rear barrel zone temperature only.
4. Check hopper to see if there is a material feeding issue.
5. Check the screw and barrel for wear. Address as necessary.

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. Increase screw speed.
2. Decrease stock temperature by decreasing back pressure and/or barrel temperature.
3. Increase barrel temperature of the feed zone.

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 primary pressure.
2. Increase holding pressure.
3. Increase mold temperature.
4. Increase barrel temperature.
5. Increase back pressure.
6. Increase cure time.

POSSIBLE SOLUTIONS FOR INSUFFICIENT SHRINKAGE (OVERSIZE)

1. Decrease mold temperature.
2. Decrease primary pressure.
3. Decrease holding pressure.
4. Decrease holding pressure time.
5. Decrease cure time.

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

POSSIBLE SOLUTIONS

1. Decrease injection speed.
2. Decrease barrel temperature
3. Decrease primary pressure.
4. Decrease holding pressure.
5. Increase mold temperature.
6. If possible, relocate the gate perpendicular to the part instead of parallel flow to its geometry.

SKIN BLISTERS - Small areas of gas entrapment (blisters) on the surface of the part, that when broken open, appear to have occurred just under the "skin" of the part. They are generally spaced randomly about the surface of the part, and many times will appear on only one surface.

POSSIBLE SOLUTIONS

1. Decrease injection speed.
2. Check vents for blockage.
3. Decrease primary pressure.
4. Increase back pressure.

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

POSSIBLE SOLUTIONS

1. Make sure the sprue bushing orifice is larger than the nozzle orifice.
2. Check sprue bushing for damage or wear. Replace it.
3. Decrease primary pressure.
4. Decrease holding pressure.
5. Increase mold temperature.
6. Increase cure time.
7. Check sprue puller design.
8. Decrease clamp slow open speed.

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

Please Note: When molding single stage phenolic molding compound or granular thermoset polyester compounds, PLENCO recommends that the mold be chrome plated, since these materials have a tendency to stick to non-chromed surfaces.

POSSIBLE SOLUTIONS

1. Add under cuts in the moveable mold half.
2. Decrease primary pressure.
3. Decrease holding pressure.
4. Increase cure time.
5. Decrease clamp tonnage.

SUBGATES STICKING IN MOLD - Subgates will not release from the mold and a piece or all of it will remain stuck until it is manually removed.

POSSIBLE SOLUTIONS

1. If a new mold, check subgate design and correct as needed.
2. If an existing mold, check subgates for damage or wear and repair or replace as needed.
3. Request from material supplier a version of the material that has a higher deflection specification.

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. Increase mold temperature.
2. Increase barrel temperature.
3. Increase back pressure.
4. Decrease ejection speed.
5. Decrease ejection pressure.
6. Request from material supplier a version of the material that has a lower deflection specification.
7. Check drop of parts from 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 barrel temperature.
3. Increase back pressure.
4. Increase cure time.
5. Use shrink fixture to hold the parts flat as they cool.
6. Request from material supplier a version of the material that has a lower deflection specification.

WOOD SCREWING – During the screw return portion of the molding cycle, the screw will not pickup enough material as it rotates back to its set point.

POSSIBLE SOLUTIONS

1. Decrease screw speed
2. Decrease back pressure.
3. Increase rear zone barrel temperature.
4. Check hopper to see if there is a material feeding issue.