

$$\bar{D}_C + \beta_0 T_M + \beta_1 T_m + \beta_3 T_M T_m$$

It was found that mold temperature (T_M) and melt temperature (T_m) were significant and that their combined effect was not significant. The equation could then be reduced to

- a. $D_C = \bar{D}_C + \beta_1 T_m + \beta_3 T_M T_m$
- b. $D_C = \bar{D}_C + \beta_0 T_M + \beta_1 T_m$
- c. $D_C = \beta_0 T_M + \beta_1 T_m$

9) In an experiment with three factors, mold temperature (T_M), melt temperature (T_m), and cooling time (t), the following linear equation is used:

$$\begin{array}{ccccccc} \text{Critical dimension, } D_C = & & & & & & \\ \bar{D}_C + \beta_0 T_M + \beta_1 t + \beta_2 T_m + \beta_3 T_M t + \beta_4 T_M T_m + \beta_5 t T_m + \beta_6 T_M T_m t & & & & & & \\ \hline () & () & () & () & & & () \end{array}$$

Write the number of each description below its corresponding component of the equation.

1. Average measurement
2. Effect of cooling time
3. Combined effects
4. Effect of melt temperature
5. Effect of mold temperature

Appendices

I – Troubleshooting

II – Universal Mold Data

III – General Procedures for *Universal Molding™*

IV – English Terms in Spanish

V – Spanish Terms in English

VI – Operational Costs

I - Troubleshooting

During troubleshooting, experience plays an important factor. In the event there is a problem that you cannot solve, seek help. Do not sacrifice production or quality; ask. This list is only a reference; use it judiciously.

Brittle Parts - The parts become brittle or break

<i>Possible Causes</i>	<i>Actions</i>
1. Resin is too cold	1.a. Increase backpressure. 1.b. Increase melt temperature.
2. Material degradation in the barrel	2.a. Reduce melt temperature. 2.b. Reduce backpressure. 2.c. Reduce the injection rate. 2.d. Purge, if necessary.
3. Material contamination	3.a. Verify material in the hopper. 3.b. Purge, if necessary.
4. Material degradation during the drying process	4. Decrease dryer time and/or temperature.
5. Moisture in the material	5. Verify moisture content, dry properly.

Bubbles (voids) - Air trapped inside the part

<i>Possible Causes</i>	<i>Actions</i>
1. Moisture in the material	1. Check moisture content, dry properly.
2. Material is too hot	2. Decrease the melt temperature by adjusting to a suitable barrel temperature profile.
3. Inadequate venting	3. Ensure that the mold has adequate and clean vents.
4. Internal bubbles caused by shrinkage	4.a. Increase backpressure and/or hold pressure. 4.b. Decrease the melt temperature.

Weld line - Lines on the part formed by two or more melt flows joining together

<i>Possible Causes</i>	<i>Actions</i>
1. Low mold temperature	1. Increase mold temperature.
2. Material is too cold	2. Increase melt temperature.
3. Low injection rate	3. Increase speed. Injection time should be significantly reduced.
4. Humid resin	4. Dry material properly.

Fading - Inadequate color

<i>Possible Causes</i>	<i>Actions</i>
1. Degraded material in the barrel	1. Purge the barrel.
2. High melt temperature	2. Decrease melt temperature by adjusting to a suitable barrel temperature profile.
3. Contaminated material	3. Check the material.
4. Inadequate vents	4. Clean existing vents or ventilate mold properly.

Burns - Marks on the part due to degradation

<i>Possible Causes</i>	<i>Actions</i>
1. High injection speed	1. Decrease injection speed.
2. High backpressure	2. Decrease backpressure.
3. Inadequate vents	3.a. Verify that there are vents. 3.b. Clean vents.
4. Problems in mold design (material suffers friction, causing degradation)	4.a. Change the location of the gate. 4.b. Ensure that the part has generous radii (no sharp corners).
5. Nozzle hole is too small or clogged	5. Replace or clean the nozzle.
6. High screw recovery	6. Decrease screw recovery speed.
7. High melt temperature	7. Decrease the melt temperature by adjusting to a suitable barrel temperature profile.

Buckling - Twisting or curving of the parts due to uneven shrinkage

<i>Possible Causes</i>	<i>Actions</i>
1. Hot parts upon ejection	1.a. Lower the mold temperature. 1.b. Increase the cooling time.
2. Uneven part cooling	2. Adjust the temperatures of the mold faces.
3. Non-uniform wall thickness	3. Redesign the part.
4. Parts are overpacked	4. Decrease the hold pressure.

Cloudiness - Cloudy appearance in parts (more noticeable in clear parts)

<i>Possible Causes</i>	<i>Actions</i>
1. Material contamination	1.a. Check material and change if necessary. 1.b. Increase melt temperature.
2. Gases or moisture in the resin	2.a. Dry material properly. 2.b. Ventilate mold properly.
3. Material is too cold	3. Increase the melt temperature.
4. Mold is too cold	4. Increase mold temperatures.
5. Mold release	5. Eliminate the use of mold release.

Flash - Excess plastic around the parting line

<i>Possible Causes</i>	<i>Actions</i>
1. High hold pressure	1. Decrease hold pressure.
2. Mold is too hot	2. Lower mold temperatures.
3. Inadequate closing force	3. Increase tonnage.
4. High melt temperature	4. Lower the melt temperature.
5. Late transfer position to hold	5. Adjust to an appropriate transfer position and compensate by adjusting the same distance to the recovery position.
6. Material with moisture	6. Improve drying.

Flow lines - Marks in the direction of the melt flow

<i>Possible Causes</i>	<i>Actions</i>
1. Low mold temperature	1. Increase the mold temperature.
2. Material is too cold	2. Increase the melt temperature.
3. Inadequate runner/gate	3. Check the size of runner and gates, and request a redesign.
4. High injection speed	4. Decrease injection rate.
5. Humid resin	5. Dry material properly.

Worm-shaped jetting on the surface of the parts