How Lightweight Fillers Affect Recipes

What are lightweight fillers?
A Lightweight Filler is an engineered filler package designed to do the following:
- Reduce cast part weight
- Improve thermal shock resistance
- Reduce stress fractures
- Reduce cracking during cure
- Reduce shrinkage
- Reduce resin usage
- Save money.

Typically, a lightweight filler contains a lightweight polymeric microsphere that is blended with a calcium carbonate filler (other lightweight additives may be available – contact your filler supplier for additional information). The lightweight fillers can be supplied as a concentrate or as a blended particle packed product. Weight savings between 15% and 50% can be achieved. Tubs, shower bases, wall panels and bowl back fills are good uses of the lightweight fillers.

Cost savings is achieved in the following areas:
- Reduction in resin usage
- Labor reduction in manufacturing and handling of finished parts
- Reduction in shipping cost
- Reduction in parts lost to thermal shock, cracking, and part warpage

The following information was provided by The R. J. Marshall Company on their Prolite lightweight filler product. Similar product information can be obtained from other lightweight filler manufacturers.

<table>
<thead>
<tr>
<th></th>
<th>Standard Marble</th>
<th>Prolite 15</th>
<th>Prolite 25</th>
<th>Prolite 35</th>
<th>Prolite 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin (lbs)</td>
<td>23.0</td>
<td>21.6</td>
<td>20.0</td>
<td>21.0</td>
<td>21.0</td>
</tr>
<tr>
<td>Filler (lbs)</td>
<td>77.0</td>
<td>68.4</td>
<td>55.0</td>
<td>44.0</td>
<td>29.0</td>
</tr>
<tr>
<td>Total Weight (lbs)</td>
<td>100.0</td>
<td>90.0</td>
<td>75.0</td>
<td>65.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Resin Percentage Of Total Weight</td>
<td>23.0%</td>
<td>24.0%</td>
<td>26.6%</td>
<td>32.0%</td>
<td>42.0%</td>
</tr>
<tr>
<td>Filler Percentage Of Total Weight</td>
<td>77.0%</td>
<td>76%</td>
<td>73.3%</td>
<td>67.7%</td>
<td>58.0%</td>
</tr>
</tbody>
</table>

Note: The test results above are based on pot mixing using a resin with 800-1000 Centipois viscosity. Total resin savings is dependent upon the resin viscosity, resin temperature and the particle distribution of the filler used. Heating the resin will help lower its viscosity, allow more filler to be used in the matrix, and reduce the overall resin usage. The resin heating also will help provide a more consistent matrix/process throughout the year.

It is important to notice two important relationships:
1. Use of lightweight fillers will lead to a reduction in the amount (volume) of resin used.
2. The resin percentage of total weight will increase because of the overall reduction in filler weight.
3. Total volume of matrix using lightweight filler will be comparable with standard calcium carbonate based matrix given the same target output.

Based on the information above, it is understandable why any manufacturer would consider using a lightweight filler.

Lightweight Fillers Impact On Batchmaster II and Batchmaster III
The Batchmaster II and Batchmaster III can use both Volumetric and Scale based metering. There are three different configurations of the Batchmaster II/III available. They are Volumetric, Weight Loss (scale located under filler metering hopper), and Weight Gain (scale located under mixer). In each of these configurations, the metering mode is set for each raw material in the setup screens during the initial setup of the machine.

In the Batchmaster II and Batchmaster III, the PLC uses 3 pieces of information to control the metering and mixing process for each raw material once the metering mode has been set:

Batchmaster Metering = Calibration Factor or Scale Input x Recipe x Batch Size

1. A Calibration Factor is used to determine the amount of material dispensed with each revolution of the auger or pump.
2. A Scale Input is an electrical signal sent by a scale to the PLC that indicates the weight registered on the scale at that moment. The scale input can be used in a weight loss or weight gain calculation.
3. Recipe Parameters - The following recipe parameters that can be adjusted for each saved recipe on this screen as well. Those parameters are:
   • Resin %: Enter the percentage (%) of the total mix by weight you want to be resin.
   • Optional Catalyst 1 %: Enter the percentage (%) of resin total to be catalyst.
   • Filler # (1-2) %: For each filler item enter the percentage (%) of total filler by weight to be from the corresponding filler number. Filler 1 + Filler 2 percentage (%) must equal 100 percent of the filler used.
   • Optional Base Color %: Enter the percentage (%) of total output to be base color.
4. A Batch Size is entered manually or through a preset button to specify the total batch size to dispense.

When using lightweight fillers in a Batchmaster II or Batchmaster III, the impact on the metering will be seen in the calibration factor (if scale not used) and in the recipe resin percentage. In Volumetric mode, the lightweight filler must be calibrated prior to producing material to ensure that the correct amount of filler is delivered per revolution of the filler metering hopper auger. The resin percentage contained in the recipe must reflect the percent of resin weight to the total matrix weight. Once initial testing is complete, the recipe resin percentage can be changed to reflect the impact on resin viscosity due to resin heating.

Lightweight Fillers Impact On Autocaster Economizer And Autocaster Ultra
In the Autocaster, the PLC uses 4 pieces of information to control the metering and mixing process for each raw material:

Autocaster
Volumetric Metering = Drive Factor x Calibration Factor x (Recipe + Control Panel Output +/-)
5. A Drive Factor is a constant derived from the inverter setup, motor specifications, and hardware layout.
6. A Calibration Factor is used to determine the amount of material dispensed with each revolution of the auger or pump.
7. Recipe Parameters - The following recipe parameters that can be adjusted for each saved recipe on this screen as well. Those parameters are:
   • Resin %: Enter the percentage (%) of the total mix by weight you want to be resin.
   • Catalyst 1 %: Enter the percentage (%) of resin total to be catalyst.
   • Catalyst 2 %: Enter the percentage (%) of resin total to be catalyst.
   • Filler # (1-4) %: For each filler item enter the percentage (%) of total filler by weight to be from the corresponding filler number. The percentage remaining display box will show how much difference from 100% the current setting is.
   • Base Color %: Enter the percentage (%) of total output to be base color.
   • Base Color #: Select the number relating to the base color you wish to run for each motor system. Zero (0) will disable a system.
   • Total: Enter the total output desired in kg/minute.
8. The Control Panel Output +/- on the Autocaster main control screen contains push buttons or toggle switches that allow the operator to increase/decrease the output rate, resin %, and catalyst %.

For lightweight fillers, the impact on the Volumetric Metering will be seen in the calibration factor and in the recipe resin percentage. The lightweight filler must be calibrated prior to producing material to ensure that the correct amount of filler is delivered per revolution of the filler metering hopper auger. The resin percentage contained in the recipe must reflect the percent of resin weight to the total matrix weight. Once initial testing is complete, the recipe resin percentage can be changed to reflect the impact on resin viscosity due to resin heating.

Conclusion
When using lightweight fillers, you will see the following:
   • Change in calibration factor for filler when going to a lightweight filler.
   • Change in the recipe showing a higher percentage of resin to total weight due to the decrease in filler weight.
   • For a given volume of matrix, you will see a lighter weight and reduced resin demand.