

6 Keys to Molding Quality Parts

Manufacturers of molded product must be focused on making high quality parts. Release agents play an important role in this effort. Regardless of whether you are molding concrete, urethane, composite or rubber components the following factors are critical to maintaining quality:

- Application training
- Benchmarking manufacturing process conditions
- Release agent mixing
- Raw material polymer uniformity & stability
- Process uniformity, equipment configuration & monitoring
- Uniformity in the mold cleaning and conditioning processes



Training most often focuses on release agent application with a manual spray gun. In applying release agent the key factor is avoiding over application while maintaining complete, consistent coverage. For best results, operators must use smooth, sweeping motions with the gun held at a right angle from the mold surface. Ensuring complete coverage particularly for the detailed portions of the mold is also critical. Water based release agents are generally less robust than solvent based releases, so application precision is required to avoid defective parts. Excess release or incomplete coverage causes problems. Huron Technologies' spray training video is available at <http://video.google.com/videoplay?docid=-2762791626157433915#>.

Other key training issues include the processes for demolding parts and mold cleaning. For optimum results use written instructions, "hands on" demonstrations and easy access to training information. When the initial training is completed, ongoing monitoring of the release agent application and training of new employees is critical. Using a new release agent or a different polymer often requires training updates and recalibrating the amount of release agent output for each part.

Benchmarking Manufacturing Process Conditions is a second area of focus to ensure molded part quality. An incredible range of processes and equipment is used in manufacturing. Measuring and monitoring every process is not critical--instead determine the key processes that impart quality. A manufacturer might have ten processes or equipment parameters used in making a specific part, but only four may be key to ensuring parts quality. Identifying those critical processes and the acceptable measurements provides operational priorities.

For many molders maintaining consistent mold temperatures, providing the correct heat, optimizing mold release output, allowing an effective duration for the cure process and scheduled monitoring of gauge accuracy are most important.

- ✓ Sufficient temperature supports effective heat conductivity within the mold to allow the complete reaction of the polymer. This allows the necessary mechanical strength of the polymer to develop. Without the complete reaction and the resulting development of the physical properties

of the polymer, parts fail, often in the demolding process. This type of failure with incomplete reaction increases if the part is made with a less dense polymer.

- ✓ Measuring mold release output is another key benchmark. The most common error is over application. However, measuring the actual amount of release agent by weight gives production workers a defined target. Without this benchmark, eyeballing release output generates scrap.
- ✓ For best results one also needs to determine the right cure time before demolding. Insufficient curing compromises quality. Test the cure time to determine what length of time produces a quality part while supporting an effective production speed.
- ✓ Finally, monitoring the equipment gauges proactively verifies readings are accurate when the key process measurements are taken. Without well calibrated gauges, processes and parts fail.

Release Agent Mixing is also important in manufacturing quality molded products. Assuming that one doesn't need to mix a release agent before using, is the wrong assumption. Precise mixing becomes more critical as the finish of the part grows in importance. At a very basic level stirring the release before use is the best practice. Using a mechanical mixing device is the next step in assuring quality. For certain applications using a filter to remove any potential impurities is the third step. For the most demanding molding applications, recirculation of a portion of the release agent before it reaches the spray orifice may be required--in addition to mixing and filtering. Determining the appropriate level of mixing necessary for the required level of part quality is a significant benchmark. Implementing the correct mixing process and regularly monitoring mixing helps assure the quality of molded parts.

Polymer materials consistency & stability means quality is possible. Whether the parts are molded from primarily polyurethane, rubber, composite or even concrete, the material being used must be consistent. Enemies of consistency can be ambient conditions such as the temperature and humidity of the air. Cure times for concrete can be dramatically different in winter than in summer. Verifying that polymeric materials handling, storage and shelf life is consistent with the original benchmarked conditions is another means of ensuring molded part quality. Using the same polymeric material may seem obvious, but also needs to be noted. Modifying or replacing polyurethane systems being used may trigger dramatic changes in part quality and even the effectiveness of an existing release agent. While most high volume manufacturers require material quality to be monitored by their suppliers as a condition of doing business, when problems arise, verifying the consistency of the polymer must be done. When materials change, parts change--usually not for the better.

Process uniformity, equipment configuration & monitoring is another important factor in maintaining quality molded parts. Having established and recorded benchmarks as noted in the second point, making certain that the correct line speed and configuration is monitored helps to guarantee excellence. With slight speed increases, materials may not have the proper time to cure before demolding, resulting in increased scrap. Variations in line speed can also mean that the polymer is placed in the mold before the release agent is dry. Then the time necessary to form an effective coating on the mold to deliver good release, does not occur. Surface quality can suffer when the release coating is imperfectly formed. An additional consideration is that while the shape of the line doesn't suddenly change without monitoring, the performance of fixed spray heads or articulating robotic sprayers can shift. Spray heads must be periodically evaluated to avoid over application, or under application of the release agent. At times visual observation is sufficient. In other situations, specifically measuring spray output, nozzle settings or spray patterns may be needed.

Uniformity in the mold cleaning and conditioning processes is a final step in maintaining quality when manufacturing molded parts. Defining benchmarks for mold cleaning and conditioning and adhering to them is critical in manufacturing quality molded parts. Initially, wipe or brush off easily removed excess molding residue. Then follow defined cleaning steps whether this involves chemical or mechanical cleaning efforts. When chemical cleaners are used, include a visual inspection for effectiveness. After the first inspection there must be a verification of cleanliness--usually based on visual or tactile inspection of the mold to make certain the required standard of quality can be met.

Consistency is important when cleaning molds for two reasons. First, dirty molds or molds with excessive build-up can increase scrap. The fine detail of certain molds is not precisely replicated when the molds need to be cleaned. Demolding parts, whether manual or automated may be different when build up interferes with mold structure. Second, cleaning molds consistently means that the start up process works more effectively. While the cleaning and conditioning process is unique to each part manufactured, the failure to condition the molds effectively and consistently will result in excessive scrap when the molds are returned to service. Careful conditioning done in the same manner each time allows the release coating to form more quickly and consistently when the newly cleaned molds are used again. Since each combination of mold, materials, operating conditions and desired part quality is different, one standard for mold cleaning and conditioning doesn't make sense. Whether measuring the number of times a mold is used before cleaning, the level of surface tension necessary on a clean mold or a different metric, matching the cleaning benchmark to the specific manufacturing project is necessary.

While molded parts vary, using this checklist with its emphasis on training, benchmarking and monitoring can help guarantee the required quality for the unique molded parts you produce.