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Sticking Sprues or Parts? Lots of Possible Causes and Solutions

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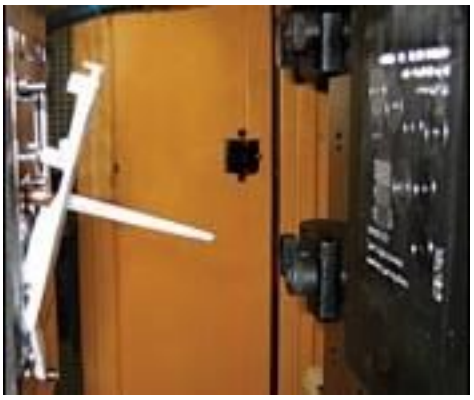

This part stuck in the mold because improper ejection cocked the part at an angle, causing a deep projection to bind in the cavity. The remedy is more ejection area with more pins on each side of the projection.

Material sticking in the mold can be a production killer, whether it is the sprue or the formed part in the cavity. The root causes of such sticking can be traced to one of several equipment or process issues.

Keep in mind that where the part sticks in the mold is not necessarily the area of the mold that is the cause. Different sections of the mold can hang onto the part, and this tug can cause the part to bind in another section. Carefully evaluate what happens as the mold opens.

EQUIPMENT FIXES

One of the most common causes of sticking is an improper degree of polish. Too high a polish can cause a vacuum to form during molding that holds the part to the steel. On the other hand, too little polish may not allow good part release. If a vacuum is holding the part onto the mold surface, an air pipette may be the answer.

Scratches in the mold or sprue created during use or polishing can cause sticking. Circular polishing can create minute scratches that become undercuts or gouges in the steel that fill with melt. Scratches can cause sticking of the sprue, part sticking on the “A” side of the mold upon mold opening, or part sticking to the “B” side of the mold at part ejection.

To solve sprue sticking, scratches or undercuts can be removed during mold maintenance. In addition, try draw-polishing the mold (i.e., using a back-and-forth motion in the direction of part ejection instead of a circular or elliptical motion) to a number 2 finish. Or try vapor honing (a variation of sandblasting). Vapor honing is better at preventing sticking of soft materials.

When polishing or scratches cause part sticking, you need to determine on which side of the tool the problem lies. If the part sticks on the “A” side, whether that is the stationary or moving mold half or carries the core or cavity, one possible answer is to slowly open the tool under manual control and note any noises or cocking/shifting of the part. If the part is deformed upon mold break, the problem is occurring on the side of the mold that does not eject the part.

If the part adheres to the “B” side, slowly eject the part and note if a corner or section of the part hangs up or shows cocking at this stage.

In either case, possible solutions are draw polishing, removing the undercuts, or using a vapor-honed surface to aid release. Another possible cause of sticking is plate-out on the mold. Inspect the mold surface for build-up and clean if necessary.

Other components in the press or tool can be a source of sticking. A nozzle tip radius that is mismatched with the sprue bushing, or a nozzle tip orifice that is too large can cause sprue problems. Check that the nozzle radius is correct with a simple test. Place a piece of cardboard over the sprue-bushing orifice and press the nozzle tip against the cardboard. The nozzle tip should leave a smooth imprint on the cardboard, indicating a good mating pattern between components. If there are tears or cuts in the cardboard, change the nozzle tip for a better size match. Also check that the nozzle tip is free of burrs and that the nozzle tip orifice is at least 0.030 in. (0.75mm) smaller in diameter than the sprue.

A sprue puller can also be a source of trouble. Be sure it is large enough and properly designed for the application. Adding undercuts, a Z-puller, or more reverse taper can end the problem. Sticking can also be a consequence of too small a taper on the sprue. If the taper is 0.5 in./ft, try increasing it.

Another possible culprit is cocking of the ejector plate. Check for uniform length of the knockout bars, which should be within 0.003 in. of each other.

Another possible source of sticking is a parts-removal robot that distorts or twists the parts. Check the end-of-arm-tooling and the movement of the part on the robot arm.

PROCESS PROBLEMS

Several processing missteps can cause sticking of the sprue or part. Unbalanced filling, especially in a multi-cavity tool, can cause over- or under-packing and subsequent part sticking. A test of mold-filling balance is one way to confirm or eliminate this factor.

Overpacking is the major process-related cause of sprue sticking. If some plastic remains stuck in the sprue channel, the next injection cycle will cause extremely high packing pressures, preventing normal shrinkage of the sprue that allows for release. So more sticking will result. The sprue can also be overpacked by high backpressure during screw recovery.

If overpacking is the cause, run tests to determine the gate-seal time and then run the part with the gate sealed and gate unsealed. Determine whether the difference in pack/hold time makes a difference in sticking.

Packing can also be related to part sticking. Overpacking the mold with melt can result in too little shrinkage of the part, making ejection difficult. Reducing the pack or hold pressure (or time) is one solution to try. Pressure and time taken from the second-stage pack and hold should be added to the cooling or cure.

Note that under-packing the mold can cause excessive shrinkage onto cores, which can also result in sticking. Here, molders should increase the second-stage pack/hold time and pressure while decreasing cooling time to maintain the same overall cycle time. Sometimes it helps to reduce the cooling time to minimize shrinkage onto a core. But extending the overall cycle time by lengthening the cooling time can work also if you need more time for the part to shrink away from a cavity onto a core.

Mold or material temperature can also be a source of sticking problems. Degraded materials tend to stick, so check to see that the process temperatures are correct, especially at the nozzle, where both setpoint and actual temperatures need to be controlled tightly. Molders have considerable leeway to raise or lower the mold temperature, as long as it does not cause mold damage. But also check the water flow rate in mold-cooling lines to make sure that you achieve a Reynold's number of 5000 or greater for turbulent flow and optimal cooling. The temperature difference between the inlet and outlet water lines should be less than 4° F.

Crazing of the part surface can also be a sign of the cause of sticking. Look for symptoms in the area of the part that is sticking, such as stress-whitening near ejector pins. Then check the tool for a source of stress on the part in those areas. Make sure the crazing is not caused by residual cleaning solvents or mold sprays that can attack certain resins.

A sprue that is too soft or not frozen can cause sticking. You can try to downsize the sprue, or cool the sprue bushing, or try lowering the nozzle or melt temperature. A last resort is to increase the cooling time.

Last, but not least, check whether there is mold release agent in the resin, and what kind. Try adding more or changing to a different type or grade.