MOLDERS SERVICES

MSI SCREW TIP SELECTION GUIDE

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MSI Screw Tip Selection Guide 2019

A good screw tip must provide positive shut off and create a consistent cushion while not restricting flow during recovery. The best tips also inhibit degradation and resist abrasion and corrosion.

How well *your* screw tip meets those requirements depends on the mechanics of the tip's seal, its internal flow geometry, and its construction materials.

This guide describes how each screw tip style affects production efficiency, output quality, and component durability, and what causes them to fail, so you can lower replacement costs and avoid downtime.

Tip Styles

In general, tip designs fall into one of the following categories: sliding check ring, locking check ring, ball check, poppet, and specialty.

Sliding Check Rings

Sometimes referred to as free flow, sliding check ring tips have three main components: a retainer, a check ring, and a rear "seat." In the open position, the check ring moves forward while the screw is recovering to allow material flow, then reverses direction to form a seal with the rear seat during the injection phase. This allows for positive cushion control. The major configuration difference within this category is whether the retainer contains the front seat, as in a 3-piece design, or if the front seat is made from a separate material – a 4-piece design.

Locking Tips

Popular with many Japanese OEMs, the locking, or Castle Tip is another variant of the sliding check ring design. In this configuration the check ring keys into the retainer rather than spinning independently from the screw. A benefit of this design is that a hardened front seat is less necessary since minimal friction can exist between the check ring and the front seat itself. MSI prefers to avoid this style where possible because of the potential for increased barrel ID wear from contact with the rotating check ring.

Ball Check and Poppet

Unlike sliding check ring styles, ball checks and poppet style tips utilize a ball, poppet, or similar component that floats within the tip housing and plugs the flow hole during injection. Because of their simplified internal geometry, ball checks are generally better for processing highly sensitive materials like polycarbonate and acrylic. They also provide a more positive shutoff when using low viscosity materials or small shot sizes. The quick shut-off valve (QSO), including many poppet style tips, was designed to offer an exceptionally high positive shutoff characteristics, also for use with low viscosity materials and applications like those described above.

The common characteristic shared by locking, ball check, and poppet tips is that their sealing OD rotates with the screw. MSI rarely recommends these tips since their fixed rotation with the screw introduces the likelihood of premature barrel internal diameter (ID) wear.

Specialty Tips

This broad category includes multi-piece variations that often include removable studs and mixing inserts. Usually sold by OEMs as an attempt to gain a competitive edge through differentiation, these designs are rarely worth the extra cost and nearly always perform similarly or slightly less effectively than generally available standard tips.

Tip Design Considerations

Tip design, regardless of style, includes two vital elements - flow restriction and internal geometry. Flow analysis calculations must be performed to help assure a tip will perform optimally across a broad array of resins. For this reason, it is improper to refer to any tip as “free flow,” since virtually every one can be designed with appropriate flow characteristics. At MSI, we analyze flow, resins, and overall applications *every time* we design a custom tip for our customers.

Internal geometry is also important in tip design and manufacturing. This is what will determine the extent to which material might hang up and eventually burn and / or degrade. All MSI tips have precision internal geometries to minimize sharp edges, steps, and dead ends – all causes of degradation and possible hang-ups and burning.

Once again, injection components are *not* all the same. MSI designs and manufactures all our tips in-house, which is why our designs often look different than the OEM tips and perform better than the competition!

Common Causes of Tip Failure

Tip durability failures are often attributable to the sealing surfaces. This includes the check ring outer diameter (OD) and the front seat on a check ring style tip, and the OD and ball / poppet on those style tips. Wear to the OD from the processing of abrasive resins often results in excessive clearance with the barrel wall inhibiting a strong cushion. Corrosion or abrasive wear on the ball or poppet decreases its ability to function properly. Likewise, a check ring, rear seat, ball, or poppet that has been exposed to unmelt will result in a compromised sealing surface and hence cushion failures.

Wear to the front seat on a sliding check ring tip is usually the result of excessive screw speeds. Visible as a notch on the seat and sometimes the front of the check ring, this type of wear results in excessive travel of the check ring. Causes of processing issues will often be evidenced by the inability of the check ring to find its seat within the injection phase, resulting in an inconsistent cushion. Note that these issues are different from the slippage resulting from excessive OD wear. Front seat wear may usually be resolved by lowering recovery RPM or going to a fixed tip design.

The above-described failures result from normal use. Even when optimal designs have been determined and the best base materials selected, the most careful processors may still wear out tips as a result of the resins they use. Corrosion failure is different from a design or specification failure, however. Processing problems with brand new tips, or that result when changing to a new resin may be easily corrected. MSI will always take a close look at your operation to determine whether a different tip design should be used or if an existing design might be modified for better results. In other cases, shot size, the resins processed, and possibly machine speeds will mandate a different tip style. Regardless of your processing environment, the sliding check ring style tip should always be your starting point since it is the most versatile and durable and has the fewest drawbacks when in use.

Note: Successful processing of PVC-R most often requires a smear tip due to its extreme sensitivity to changes in flow path. For more information on tips for these applications, please call us.

RECOMMENDATIONS:

The great majority of tips sold by Molders Services are sliding check ring. Of these, the overwhelming majority are now 4-piece designs. Why? They simply last longer and are more reliable. With the front seat separate from the retainer, we can make the seat with a harder, more durable material. This not only gives us a more durable front seat, but also provides a lower Rc stud, which may be drilled out if broken – an option virtually impossible when a compromised three-piece tip stud cannot be freed from a screw.

MSI can and does make retainers from stainless steel for highly corrosive applications. It is this kind of retainer option versatility that allows our customers to enjoy the improved performance of 4-piece tips at less cost due to the potential of using less expensive steel for certain applications.

Ask us about the tip alternatives best suited for your organization.