Solving Mold Alignment Problems with the Right Alignment Lock

By Klaus Wieder

Molders, mold makers and mold designers should all take a stake in the decision making process when it comes to choosing the proper alignment mold lock. *Choosing the correct alignment lock can save maintenance expense, molding down time and increase part quality over the entire life of the mold.* ***Make your lock choice carefully!*** Alignment and mold lock-up is a crucial function of any mold. Stationary and movable mold halves, slides and lifters all must align to assure consistent plastic molded part quality. This is where alignment locks come in to play.

Alignment is usually the function of the leader pins and bushings. Typically leader pins and bushings have sufficient clearance to avoid binding and seizing between .0015 to .003, and additional clearance with accumulative tolerance. For most molds this is not sufficient, requiring additional **Locking** components to assure location under injection molding melt pressures, and to maintain consistent molded part thickness.

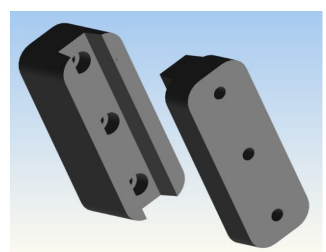
Lock Types

There are three basic types of alignment locks:

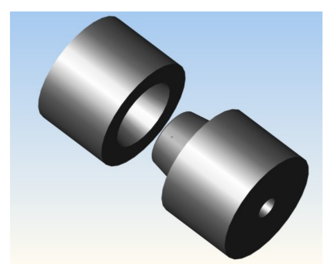
- **Tapered** with variations of bar and round.
- **Straight** with variations of side, top and needle bearing.
- **Combination Taper Straight and Roller Bearing** (**Tri-Lock)** with variations of side and top.

Tapered Locks

Tapered Bar locks are primarily used to prevent core shift during injection melt. All Tapered Bar locks typically use a non-locking taper greater than 7°, with most locks using a 10° taper per side. The long rectangular bar with large locking contact does not provide early alignment for protection of cores and the mold must be completely closed to provide an accurate location. Before installing bar locks you must also consider thermal expansion. A 10° F difference at 24 inches will cause a .0015 interference. Depending on the temperature and size of the mold interference can even be larger. Tapered Bar locks should always be installed parallel to the expansion. This puts limits on the flexibility of installation location.



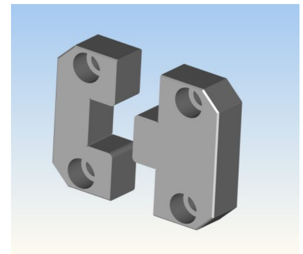
Tapered Round Locks are usually used as locators only. As with tapered bar locks they do not provide early alignment or protection of cores and thermal expansion must also be considered because of the 360° contact area. Tapered Round Locks are usually not recommended for mold bases with a large distance between locators. Tapered Round Locks are recommended for use in mold inserts when the distance between locaters is small, minimizing thermal expansion.



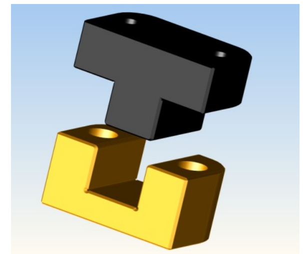
Straight Locks

Straight Locks are the most widely used lock in the industry. Designs are virtually identical between all manufactures with the exception of material, coatings, grease grooves, and graphite plugs. Straight locks were designed to eliminate the thermal expansion problem. Allowing the locks to move freely in one direction, while maintaining location on the opposite direction. Installing four locks will ensure the mold is always on center regardless of the temperature differential between the two mold halves. The basic design has a male and female component each having a few ten thousands clearance per side.

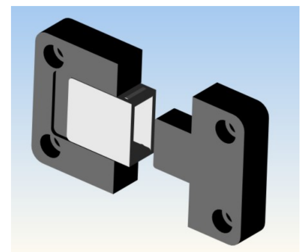
Standard Side Locks are used to create lock-up location which helps overcome injection melt pressures. Side Locks provide for a small degree of early engagement protection depending on the particular profile (See Fig.1). Side Locks are typically machined on the centerline axis, both vertically and horizontally on the outside of the mold. Side Locks require the least amount of space for installation. Machining lock pockets should be done with both halves clamped together to insure parallel location between mold halves. Generally, side locks can easily be installed in a precise accurate location.



Standard Top Locks, like side locks, provide lock-up location to overcome injection melt pressures with a small degree of engagement protection. Top Locks are typically machined on the centerline axis, both vertically and horizontally from the face of the mold. Top locks should be machined at the same time as the leader pins and bushings to insure parallelism and proper location relative to the leader pins. Unlike side locks, Top Locks are machined in two separate set-ups, requiring a high degree of machining precision.

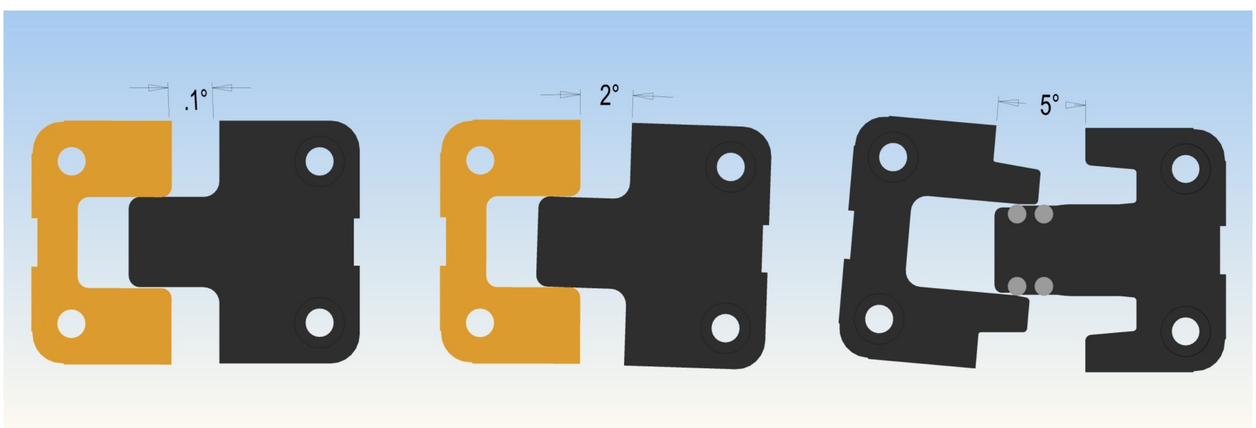


Needle Bearing Locks are a relatively new innovation that attempts to address some of the short-comings of the standard straight lock design, specifically initial engagement. The single point radial contact provides a non-binding lift to align a sagging mold which is an effective alignment method Needle Bearing Locks provides some early engagement protection but will fall short of molder expectations when trying to overcoming injection melt pressure in final lock-up with single point contact. Simply the strength is not there.



Although Straight locks are considered an alignment component, they rely on the leader pins and bushings to align the mold, and function as a locking device. In a perfect world, when the tool is new with concisely machined square parting line pockets, new leader pins and bushings, and a new molding machine with perfectly square platens, the standard straight locks work flawlessly. However, in the real world where even new molds are subjected to molding machines with worn tie bars and bushings, molds tend to sag and lean down and forward under their own weight. Leader pins alone are incapable of providing a suitable location to provide a smooth entry into a straight lock that only has .0002 ten thousands clearances, causing an interference fit (see Figure 1). A one tenth degree misalignment will cause a .00022 interference. A 2° misalignment has .0072 thousands interference, thus guaranteeing a seizing and binding problem.

Figure 1

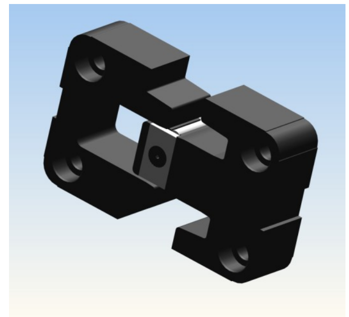


Standard Straight Lock with Tenth Degree Misalignment .00022 interference

Standard Straight Lock with 2 Degree Misalignment .007 interference

Tri-lock with 5 Degree Misalignment .000 interference

Combination Straight, Taper and Roller Bearing Alignment Locks…….the Tri-Lock

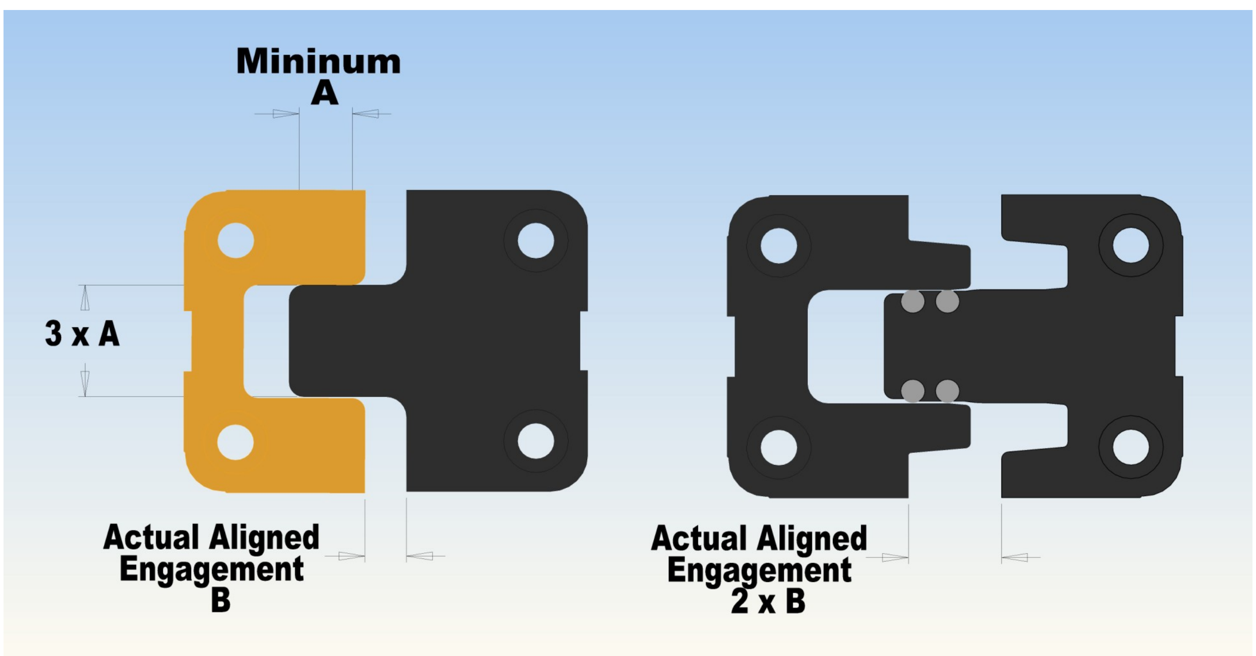


*The best of all worlds, the **Tri-Lock** is a proven, newly patented combination alignment lock which combines the best features of the tapered, straight and needle bearing locks with additional benefits*. Starting with the first phase of initial alignment, the Tri-Lock uses large hardened rollers and a lift radius on the female side which creates an effortless engagement even when a large mold misalignment exists. In the second phase, Tri-Lock alignment provides maximum early engagement protection, up to two times the length of standard straight and needle bearing locks with the same physical size! The third phase is final lock-up holding strength. The male side has a 5° taper with over travel protection, assuring the tightest tolerance, maximizing holding strength. Tri-Locks require the same machining as standard straight locks and in many cases have the identical footprint making substitution easy. Tri-Lock design symmetry allows full interchangeability between male and female components. **The superior design and long life expectancy of the Tri-Lock permits a limited One million cycle warranty.**

Tri-Locks are available for both Side and Top applications and insure:

- Effortless misaligned initial engagement.
- Provide the longest early engagement protection.
- The highest possible lock-up strength.
- May be identical with your current lock footprint.
- Interchangeable male and female components.
- The **Tri-Lock** has .000 interference even at 5° misalignment, eliminating the issue of seizing and galling.
- Reduced maintenance expense over the life of the mold.

Determining Early engagement of Standard Straight and Tri-Loc



Regardless of your alignment needs there are several factors that must be considered before the proper lock can be chosen:

1. What is the condition of your molding machine?
2. What is the condition of your mold?
3. How important is minimizing mold maintenance expense?
4. How important is minimizing molding downtime?
5. How important is consistent mold part quality?
6. How important is smooth friction free engagement?
7. How important is early engagement and tongue length?
8. How important is long term lock-up strength?

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