

# How to Retain Pin Bushings

Simplify pin-bushing retention and reduce machining time by four to one for each bushing hole by implementing a new process.

Chad Meyer and Mike Dieken

A few moldmakers have adopted a new practice for bushing retention using snap rings, which helps create a more robust, more reliable and more easily serviceable mold. It replaces the conventional retention methods: a small cap screw that overlaps the bushing lip at one point. In the new method, retention forces are distributed uniformly around the ring rather than concentrating on just one point of the bushing lip.

The idea started in the Midwest, where three or four moldmakers have made it standard practice and half a dozen others are in varying stages of converting. Timesavings per mold set average four to five hours for simple molds containing eight to 10 bushings. On bigger, more complex mold sets with 40 to 50 bushings, the timesavings mount up proportionately.

## Bushing Retention

Bushing retention locks pin-guide bushings in place in the mold block. The bushings are made of hardened metal, as are guide pins, to resist wear as they rub against each other during mold open/close cycles. If either member did wear, the mating mold halves could get out of alignment and produce bad parts. Likewise, if the bushings shift while the mold is in operation, bad parts could be produced and the molds and machine could be damaged. A safety hazard also could be created by a damaged mold part or machine part breaking loose like a piece of shrapnel.

## Snap Ring Process

In the new method, a snap ring holds the bushing in place, and

The snap ring process helps create a more robust, more reliable and more easily serviceable mold.



photo courtesy Ingersoll Cutting Tools

Switching from boring to snap-ring grooving cuts machining and assembly time for bushing retention by two to one in plastic molds. Left: carbide boring tip creates the counterbore to accommodate the bushing's top lip. Center: switching tips, a 10 to 15 second job with  $\pm 0.0005$ -inch positional repeatability. Right: slotting tip after completing the snap ring groove.

## One Step Forward

A mold shop using this process originally machined the grooves with a four-flute, high-speed, steel-grooving tool, just after completing the bushing counterbore. Cutting the slot was faster than opening the screw hole, but still left plenty of room for improvement. Although the spindle and mold block remained in position in the X-Y plane for both operations, changing from the boring tool to the groove slotter did take time. Sometimes it also involved raising the spindle or lowering the table to make room for the exchange, which could create an error source. Making the actual cut was slow going to avoid overloading and deflecting the high-speed steel cutter due to lateral forces.

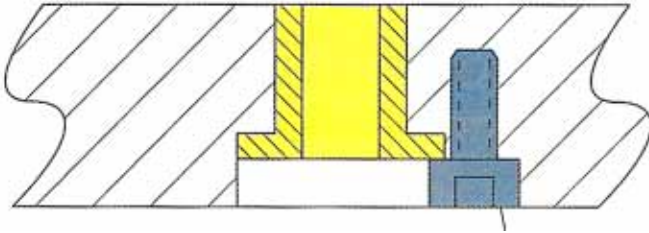
Switching to an interchangeable tungsten carbide cutter on a high-speed steel shank sped up the process considerably. The moldmaker can bore the bushing hole and counterbore with a boring tool, then simply change to a grooving tip for the snap ring groove—all with the spindle, table and toolshank left in

position. Then cutting the groove is a matter of making an orbiting cut. Since everything is left in place and the interchangeable tips hold axial and radial positional repeatability to datum within  $\pm 0.0005$  inches location accuracy of the snap ring groove is ensured.

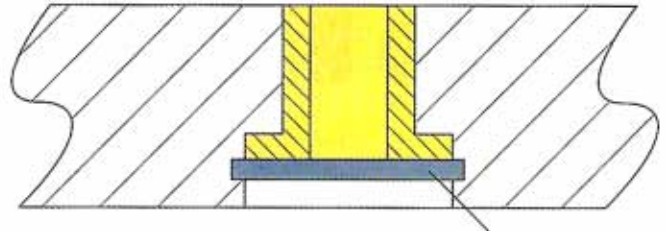
At one mold shop using the carbide slotter, tool changes averaged 10 to 15 seconds and actual machining of the slot took 12 seconds, half the time as before. They mill the slot with depths-of-cut up to  $1/8$ " in a  $1-3/4$ " bore.

When the cutters go dull, moldmakers simply replace them rather than regrinding. In the long run it's cheaper to replace a slot-cutting tip than to get into regrinding. Given the four-week turnaround with regrinders and the shipping times, a mold shop would need to own four cutters to keep just one ready for service at any time.

Traditional



New and Improved



The old and new design for retaining pin bushings in plastic molds. The old way used a socket screw to pin the bushing in place with one point contact, required three machining operations and changing the setup. The new way uses a snap ring in a groove.

the groove to accommodate that snap ring is machined with the same tool as the bushing hole itself, and on the same centerline. Cutting the groove saves mold machining and assembly time while making the mold stronger (see **Bushing Retention: Cap Screw Versus Snap Ring Sidebar**). After opening the bushing hole, moldmakers only need to put a different tip—a slotting

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### The Cutting Tools

The referenced applications use Ingersoll's Chip-Surfer Pak for Retainer Rings (S037T06KA-12-98).

The kit contains one shank, four different width T-Slot tips, and a wrench. Each tip produces a standard snap ring groove width.

The carbide tips were run at 450 SFM and .003" chipload.

tool—onto the toolshank already in place, add an orbiting step to the machining program, and they will have the snap ring slot. Total machining time: four to eight minutes, or about one-fourth the time of creating the screw hole. There are no slow machining operations such as drilling and tapping, and design time is not needed to locate the retaining screw.

The new practice hinges on retention by snap rings rather than socket-head screws. The process centers on:

1. Machining a snap-ring groove in the counterbore that accommodates the bushing's lip. Using a tool with interchangeable tips, the grooving step is done on the same centerline as the bushing bore itself, with the toolshank still in place in the spindle.
2. Inserting the bushing and snap in the retaining ring.

The snap rings go in and out in seconds following a simple process:

1. Compress the snap ring with conventional snap ring pliers.
2. Place it in the groove.
3. Let go.

Switching from cap screws to snap rings for bushing retention saves machining, assembly and repair time while creating a more robust mold.

MMT

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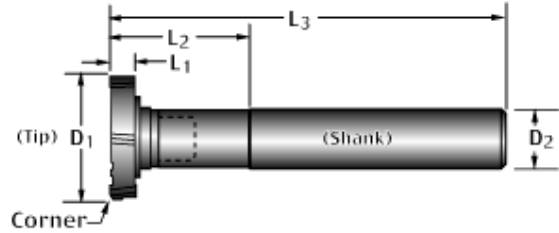
### Bushing Retention: Cap Screw Versus Snap Ring

	Cap Screw	Snap Ring
Machining time per bushing (minutes)	16-32	4-8
Tools required	3-4	1
Programming steps required	Locate new center drill, ctrbore tap	Orbit on same center
Retention force distribution	Single point	Uniform around entire rim
Retainer installation time (seconds)	10-20	3-5

# CHIP SURFER™

## PAK for Retainer Ring Slots


Contents: 4 Different Tips, 1 Shank, 1 Wrench



**T-Slot Pak (6 Flutes)**  
Multi-Purpose, PVD - TiCN-Coated IN1030

Pak Number	T-Slot Tips	Shank	D1 Nominal Dia.	Corner	D2 Shank Adaption	L1 Width of Cut	L2 Projection Length	L3 Assem. Length	Wrench
S037T06KA-12-98	18T-6205T6N02	S037T06CA-12 (Carbide)	0.625	R.015	.375 Cylindrical	0.056	1.45	4.190	DS-T20T
	18T-6206T6N02					0.068			
	18T-6208T6N02					0.086			
	18T-6212T6RN01					0.125			

### Typical Application

 Internal Snap Ring	TRUARC (BASIC N5000) or equivalent For housings and bores	
	Size Range	0.25 - 10 in.
		6.4 - 254 mm