

## PRECISION AIRFRAME TOOLING FOR PRODUCTION AND MAINTENANCE

ATI has more than 70 years experience in designing and manufacturing airframe fabrication tools. ATI serves a wide range of customers including airlines, the military, commercial manufacturers, airframe and sheet metal mechanics, and maintenance and repair operations, or "MROs". The majority of the company's products are designed and



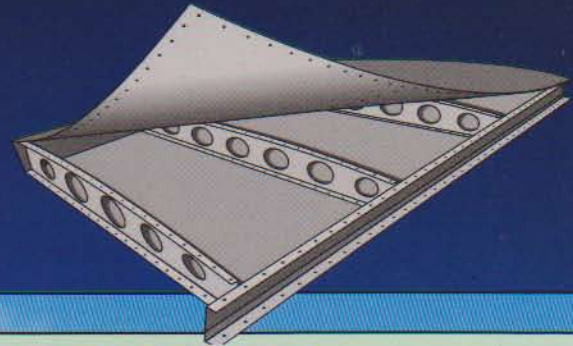
**ATI TOOLS**

manufactured in City of Industry, California. The broad assortment of ATI tools are used for hole location, drilling, deburring, hole preparation, and fastener installation and removal. Two core products of ATI are microstops and countersinks.

**Let's take a look.**

### SPECIALISTS IN AIRFRAME FABRICATION (SKINNING) TOOLS

When you look at the surface of an airplane, you're actually looking at multiple sheets that are attached to the frame to form its skin. The method used to attach sheets to the frame is very critical. When sheets are properly attached, the plane's outer shell has consistent strength and load distribution. ATI specializes in providing effective tooling solutions to address these challenges.

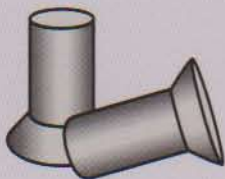


### WHY ARE HOLES SO IMPORTANT?

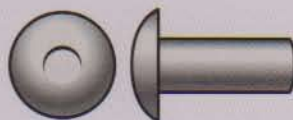
Did you know that the surface of an aircraft has multiple sections held in place by thousands of fasteners that have been installed into precisely drilled and prepared holes? That's so the forces that act upon the aircraft during

flight, or "loads", can be evenly distributed over the plane's entire structure. Viewed from this perspective, properly prepared holes are the very foundation of airframe construction.

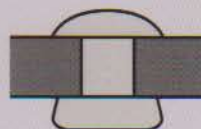
#### COMMON AVIATION FASTENERS



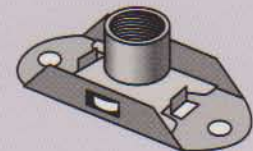
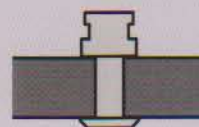
AN426  
Flush Rivet



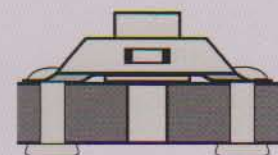
AN470  
Universal Head Rivet



Hi-Lok®  
Pin & Collar



Nutplate





## SO EXACTLY HOW IS A HOLE PREPARED?

First things first. The aircraft manufacturer typically specifies the type of fastener to be used on the specific area of the aircraft, and this information dictates the tools needed to install these fasteners. To provide some perspective, consider that aircraft fasteners make up approximately half of the parts used to fabricate a commercial aircraft.

Once the hole location for the fastener has been determined, a "starter" hole is drilled. Then, a microstop and a countersink work together to form the hole. This creates the correct profile and precise depth for installing the fastener.



## WHAT IS A MICROSTOP AND WHAT DOES IT DO?

A "microstop" is a cylindrical tool that holds a cutting tool known as a "countersink."

The microstop allows the countersink to move perpendicular to the cutting surface at precise depths. When countersinking, the microstop can make "micro" adjustments up and down, and "stop" the countersink at the exact depth to match the profile of the fastener to be installed. The countersink depth is controlled by rotating the microstop skirt. The adjustments are extremely precise. Rotating the countersink skirt adjusts the countersink depth by only 0.0005 in.

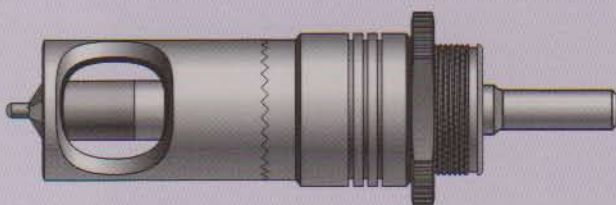
Extreme precision is important when countersinking a hole because it enables the ultimate objective: to ensure that the fastener – typically a flush rivet – fills the countersunk hole completely. Usually a rivet gun is used for installing and deforming the flush rivet into the hole's geometry.

When each countersunk hole is precisely drilled and fasteners are properly installed, every part of the plane's skin has consistent strength and load distribution. The use of a microstop allows for uniformity and helps achieve this goal.

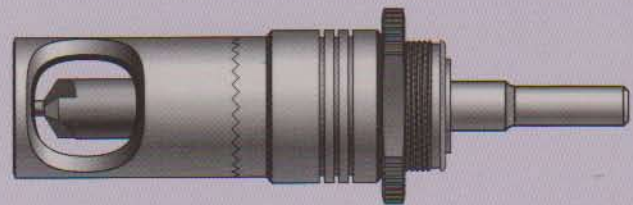
A versatile tool, a microstop works with any type of threaded shank cutter in applications where the depth of cut requires extreme precision. This would include countersinks, counterbores, and hollow cutters, just to name a few.



**NOTE:** Skirt remains stationary when in contact with the cutting surface, enabling the operator to view the cutter.



"Microstop & Countersink Cutter"  
in advanced position



"Microstop & Countersink Cutter"  
in retracted position

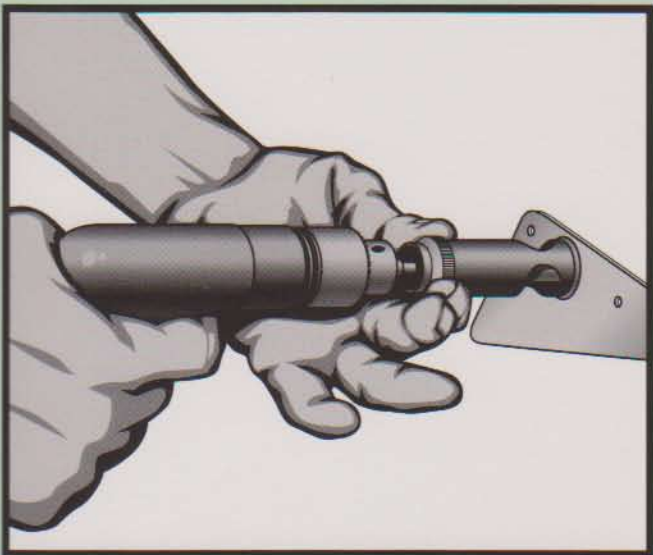
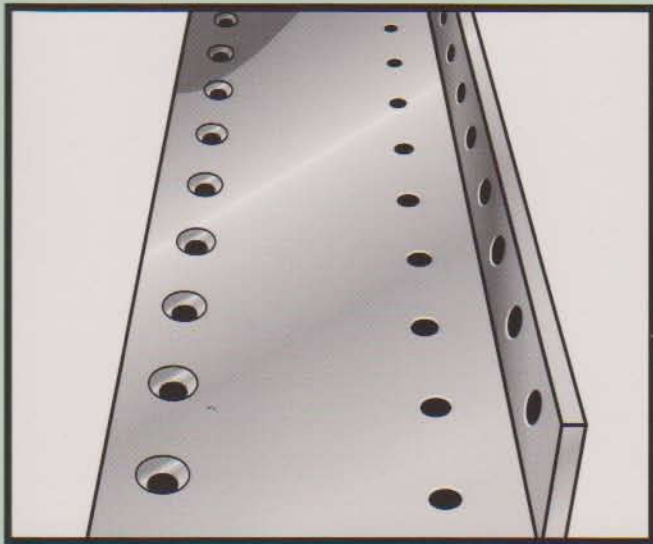


## WHAT IS A COUNTERSINK AND WHAT DOES IT DO?

A countersink is a precision cutting tool used to form a hole that will be filled by a pre-determined flush rivet.

Here are the steps involved.

1. The countersink cutter, or countersink, is threaded into the microstop shaft, and the microstop is chucked into the drill.
2. The countersink pilot (blunt tip) is inserted into the pre-drilled hole and the operator activates the drill.
3. The countersink removes material to form a cone-shaped hole, with the wider part of the hole nearest the top surface.
4. The microstop allows precise control of the depth of the countersink, and therefore the depth of the countersunk hole. The depth can be controlled to 0.0005-inch increments.



## WHAT IS A COUNTERSINK MADE OF?

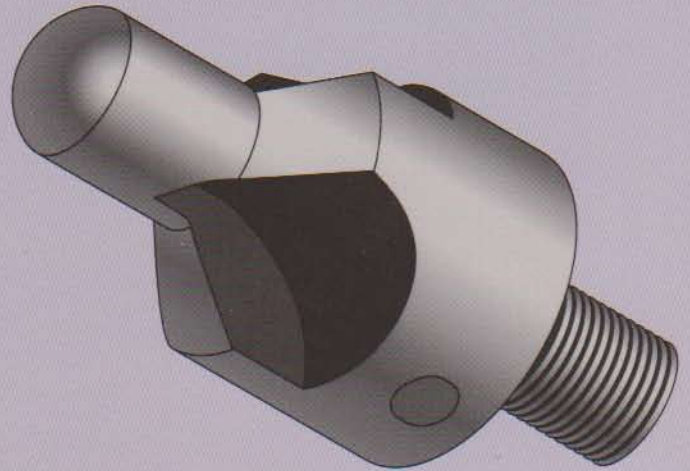
A countersink is made of very hard and durable materials and is manufactured to extremely accurate specifications.

**Materials:**

**High-speed Steel (HSS)** is a cost-efficient material that is well suited for cutting aluminum sheet metal.

**Cobalt Steel** is harder than HSS and is often used for cutting stainless steel and other aluminum alloys.

**Carbide** is much harder, and therefore lasts longer than cobalt or HSS.



## WHAT HAPPENS IN PREPARATION FOR INSTALLING FLUSH RIVETS?

1. New aluminum sheets are cut to fit the appropriate section of the aircraft.
2. These new layers are temporarily clamped to installation points on the airframe or on existing layers as appropriate.
3. Punch marks are made on layers to be added, aligning with installation points on the airframe or on holes of existing layers as appropriate.
4. Preliminary holes are drilled at punch marks, where countersunk holes will be cut. (*Occasionally, when holes are hard to locate, a specialty tool may be needed.*)
5. Upon completion, the countersunk hole is cleaned and prepared for fastener installation (*a process called "deburring"*).
6. When these steps have been followed, the hole is then properly prepared for fastener installation.



## ANATOMY OF A COUNTERSINK

A countersink is a tool used to cut and form a hole so that a flush fastener can be installed. The main features of a countersink are the threaded shank, body, cutting angle, and pilot.

### THREADED SHANK

The threaded shank is inserted into the microstop shaft and its thread size is specified by the user. Industry standard thread sizes are 10-32, 1/4"-28, 3/8"-24, and 7/16"-20. The most common countersink shanks are 1/4"-28.

### BODY

The body of a countersink is typically cylindrical in shape and its diameter is determined by the fastener to be installed.

### CUTTING ANGLE

The cutting angle is determined by the fastener to be installed and is specified by the user. The cutting angle also indicates what the angle of the conically shaped hole will be when the hole is formed. The most common cutting angle is 100 degrees.

**NOTE:** Integral countersink cutter shown. Countersinks are offered with interchangeable or integral pilot configurations.

### PILOT

The pilot diameter on a countersink is specified by the user and typically is the same diameter of the pre-drilled hole. It's important for the pilot end to be smooth and to have a hemispherical tip in order to prevent scratching. The pilot acts like a guide when it is inserted into the pre-drilled hole (called the "pilot hole"). The pilot facilitates countersinking by properly aligning the countersink to the target hole.

### THE COUNTERSINK CUTTER

The countersink cutter rotates at a very high speed and removes material to form a hole shaped like an inverted cone. This hole is cut to form the exact specifications of the fastener to be installed.

### EXTREME PRECISION AND ACCURACY

The microstop controls the countersink's depth with precise accuracy. Typically, the depth of cut is adjustable in increments of .001 inch, with more precise microstops available in .0005-inch increments. Once the microstop and countersink assembly is configured for the job, the assembly can be used hundreds of times with repeatable results.

**NOTE:** Microstop allows the countersink to move perpendicular to the cutting surface at precise depths.

COUNTERSINK  
CUTTER

CUTTING ANGLE

THREADED  
SHANK

BODY

THROUGH-HOLE

COUNTERSINK  
CUTTER

PILOT

