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For Immediate Release

Blind Side Riveting

- **What It Is**
- **What It Does**
- **How It Saves Time And Costs**

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WELWYN GARDEN CITY (UK) – 27 April 2009 – Rivets have been assembling materials for thousands of years, but it wasn't until the mid-1930s that designers in Europe and the U. S. developed blind versions of these fasteners. Blind riveting was a genuine manufacturing breakthrough, allowing fastening installations from one side of the workpiece when the opposite side was inaccessible with a tool, or could not even be seen. Prior to arrival of this special class of fasteners, it took two assemblers to set a rivet, one with rivet hammer to pound it through the hole, the other with a bucking bar to set it on the opposite side.



Blind rivets (also called breakstems) changed all that. They broadened design horizons, fastened in seconds, delivered consistent repeatability, and reduced costs. They were the ideal joining process to support greater use of aluminum and the emergence of such new materials as plastics. Breakstems allowed design and assembly of large, complex structures, and manufacturing of products

and equipment that could not be made without them, including tubular shapes and other enclosed systems. They demonstrated their value to worldwide markets in 1936 with the assembly of the first all-metal airplanes.

Breakstems have evolved and proliferated during the past 75 years, assembling everything from subminiature electronic components to steel beams supporting tons of weight in the world's largest bridges. They join diverse materials of varying thickness and composition and thrive in the most demanding environments. High-tech monitoring and controls deliver foolproof processing, allowing only the right rivets to be installed the right way in the right holes. Every major automotive and truck OEM, appliance maker, electronic components manufacturer, and commercial and military aircraft producer relies on the strength, consistency, productivity, and versatility of these fasteners.

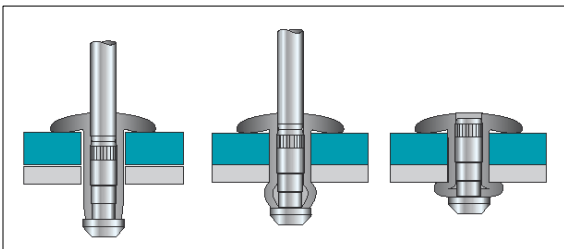
How Breakstems Work

A breakstem rivet has a smooth, cylindrical rivet body topped by a flared head, and a solid rod



mandrel with a bulbed head that extends from the hollow rivet shaft and looks like a nail. When a blind rivet is installed, setting tool nosepiece jaws grip the mandrel and pull it into the rivet body and through drilled or punched holes in a layer of materials. The mandrel head expands rivet walls radially, compressing them firmly in the hole while forming a tightly clinched load bearing area on the reverse side of the material.

As the mandrel penetrates the blind side, its unused portion at the opposite end of the rivet sleeve breaks off at a tensile load greater than the tension needed to fully deform the rivet body. Manufacturers decide the differences between upset load and break load and build it into their breakstems.

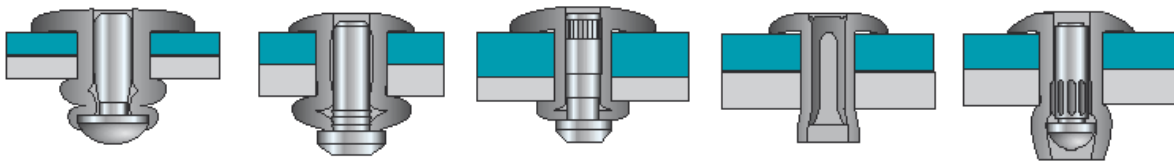


Mandrels have weakened grooves where this separation occurs, and some have a mechanical lock that snaps into place. This action plugs the opening in the rivet shell and captures the remaining portion of the mandrel inside the sleeve.

The entire installation cycle – from the time the operator pulls the trigger to the final setting of the rivet – takes about one second, and the result is a permanent, vibration-resistant joint.

Controlled expansion of the breakstem rivet body, achieved through proper mandrel design and material selection for specific applications, provides uniform compression and hole fill. This allows effective joining of many types of dissimilar materials, including metal to plastic, plastic to plastic, and metal to wood.

Designers select blind rivets for the way they set in particular applications, and mandrels for how they perform as a built-in tool. Standard rivet diameters are 3/32", 1/8", 5/32", 3/16", and 1/4". These dimensions are expanded as needed to accommodate customer needs, and combined with mandrels of varying sizes, designs and materials.



The design challenge is to marry right rivet sizes and configurations (tapered, float, sharp edged, or serrated) to the right mandrels to achieve strong joints while preserving rivet integrity. The goal is always to have rivet bodies deform precisely as specified, and mandrels to break at precise forces to ensure joint consistency, strength, and durability.

Breakstem Benefits

Applied with high-speed precision, blind rivets are the fastest mechanical joining method available, helping reduce in-place costs versus screw and other mechanical joining processes. Depending on the application and the setting tool, breakstems install at a rate of 150 to 500 per hour, and each setting is identical. Installation tools perform the same setting action in every cycle, and all the operator has to do is load the device, place the nosepiece in the hole, and pull the trigger.

Unlike threaded assemblies, there are no concerns over tool clearance, rotation failures, and secondary parts such as bolts and tapping plates, all of which add process time, weight, and cost. Tapping plates are flat parts fastened atop the workpiece to add strength and reinforcement to threaded parts installed in thin materials.

Blind rivets have none of the problems associated with over-torquing and stripping and under-torquing and loosening that crop up with threaded fasteners. By definition screws and bolts have variations in thread pitch to achieve necessary friction for strong joints, which requires balancing sufficient torque with too little torque. Breakstems create their own joint integrity by becoming as large as or larger than the hole in which they are placed, and through compression of the rivet in the joint. They do not loosen, shake out, or break off, and tight sealing helps block leaks and seepage.



Large load bearing surfaces on the blind side of the workpiece allow breakstem fastening in ductile materials and thin gage metals that require added fastener support. Blind rivets with large heads (those at least 50 percent larger than the hole, versus the standard 25 percent) spread the load on the blind side and bind parent materials in a tight clamp. When needed, three or four structural

folding legs spread diagonally across the surface to widen load bearing footprints in soft plastics. As a rule, mandrel heads must be big enough to spread the load but not so large as to waste material and add unnecessary weight.

Blind rivets also compensate for hole irregularities in parts fabricated in customer plants. During these processes operators drill or punch holes in materials before they are reshaped into components and before blind fasteners are applied. This can lead to misaligned or oversized holes, but this is not a problem for blind rivets when hole sizes are within .004" of their expansion range. Rivet body compression during installation compensates for such irregularities, and so do metal legs that expand the load bearing surface.

Breakstems also fasten painted parts and those with other finishes without fear of surface blemishes. Thread and bolt processes can scratch, dent, and dimple surfaces.

Types Of Blind Fasteners

There are two classes of blind fasteners – open end and closed end.

Open end breakstems, found principally in lightly loaded nonstructural applications and in more demanding structural applications, are the most commonly used blind fastener. Mandrels break off near the blind side head and have large flanges or countersunk heads for settings in thin-

gage metals and low-strength materials. Open end breakstems assemble thousands of products and components in virtually every manufacturing industry. These include computer chassis, wood-to-metal truck trailers, automotive mouldings, and exterior lighting.

Closed end breakstems seal holes by closing off the tail end of the rivet body and capturing the mandrel inside the rivet bore. They seal liquid containers such as hydraulic pumps and attach reflectors in sealed beam headlights. Closed end breakstems are not used as extensively as they once were, replaced by open end designs that seal the rivet body bore with equal effectiveness.

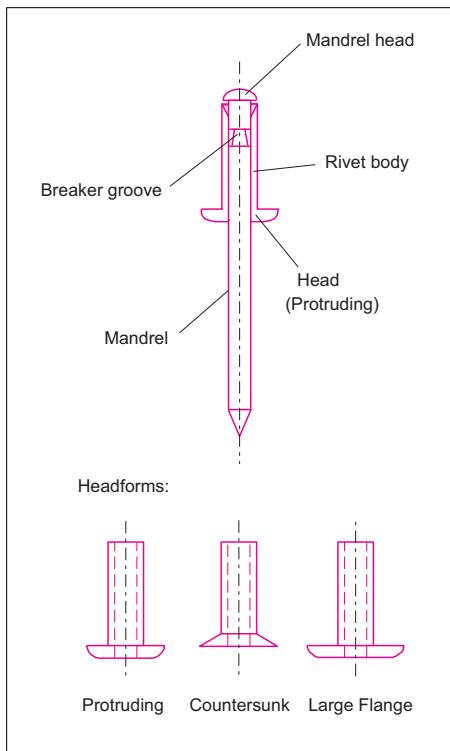
Design Considerations

Selecting and installing the right blind rivet in the right hole is a systematic process that carefully evaluates a range of factors affecting quality and durability of the final joint. Among these are rivet diameters, grip ranges, hole preparation, head styles, and corrosion resistance. Let's take a look at each of them.

Rivet Diameters: As noted, blind rivets are available in diameters ranging from 3/32" to 1/4", with 1/32" incremental increases available to provide a deep menu of selections for specific applications. Diameter selection is based on space, strength and material thickness. The larger the diameter the higher the shear and tensile strength, which is derived from the thickness of the rivet body and its material.

Grip Range: Parent material thickness must fall within a specified fastener grip range – the allowable tolerance of rivet length versus material thickness. Grip ranges are increased in 1/16" increments, with each fractional addition producing greater stem retention. A 1/2" grip range is usually the maximum length attained by standard breakstems, but special designs can stretch this to an inch. Standard size blind rivets join materials as thick as 0.750". Specials install in materials as thin as 0.020" for cell phones and computer chassis, and for assemblies as thick as 2.0" to bridge gaps in tubular assemblies – lawn chairs, for example.

Hole Preparation: The rivet must completely fill the hole, and principal factors for doing this are material thickness, grip range, and rivet diameter. If a hole is too big, it will not be filled and the result is loose rivets. If the hole is too small, the rivet won't fit. Otherwise, no special preparation is required as long as holes are free of excessive burrs.



Head Styles: There are three basic breakstem head styles: protruding, large flange, and countersunk. Protruding heads (also called dome or button head) and large flange versions are set on the top side of the material. The only difference between them is that large flange designs have heads four to five times the size of rivet body diameter for increased bearing surface. Countersunk heads are flush to top side material. Designers specify them for product surface appearance and to reduce wind drag – in aircraft fuselage assembly, for example.

Corrosion Protection: To prevent corrosion, rivet bodies and mandrels are often made from identical materials, including low carbon steels, nickel-copper alloys, aluminum alloys, and stainless steel. Protective coatings and sleeves prevent galvanic corrosion in breakstems when joining dissimilar

materials, or when rivets do not have the same physical and mechanical properties as parent materials. Stainless steel breakstems offer the best corrosion protection in such adverse environments as swimming pool ladders and city buses exposed to salt.

Installation Tools

There are many types of breakstem fastener installation tools, including hand held, lightweight, and semi-automated. All of them consist of a pulling head that grips and holds the mandrel during rivet body expansion.



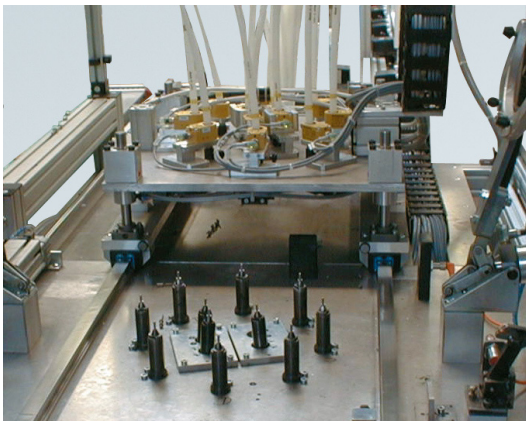
Hand held tools install fasteners with lower break loads, typically 1,000 pounds or less. They are portable, fast operating and permit quick interchange of pulling heads to adapt to different rivet sizes and configurations. Hydro-pneumatic hand tools are most commonly used for blind rivet installations. Others include pneumatic, manual and electric powered. Special nose assemblies

adapt tools for placements in narrow spaces, channels, insets, and right angles to the rivet body.

Up to the mid-1980s most hand tools were made of steel and weighed a hefty 15 pounds or more. Modern versions are lighter and more powerful than their bulky ancestors.

Hydropneumatic tools made from plastic and aluminum weigh an ergonomic four pounds and set one breakstem per second. Older versions installed blind rivets within a couple seconds, but operators slowed down lugging the heavier weight throughout a shift.

Multihead workstations fasten any number of assembly points in a single operation, applying as many as 268 breakstems simultaneously. Semiautomatic and fully automatic riveting machines paired with sophisticated monitors and foolproof sensors and controls assure proper riveting placement.



In this assembly station 12 blind rivets are placed simultaneously. The rivets are fed automatically. Positioning devices can be omitted, because the presented rivets serve as component take-up. By using this machine the assembly time was reduced by 75 %.

Avdel[®], an Acument[™] Global Technologies company, is a leader of blind-fastening products and associated installation tools. Thanks to a long period as a technology leader, Avdel's range of blind-fastening technologies is one of the widest available in the market. Avdel offers its customers world-wide availability with production facilities and sales networks in Europe, America and Asia/Pacific.

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