

# BLIND RIVETS

The experts at Avdel offer this essential guidance on blind side riveting – what it is, what it does and how it saves time and cost

**R**ivets have been assembling materials for thousands of years, but it wasn't until the mid-1930s that designers in Europe and the US 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.

The blind (or 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 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.

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.

## Design challenge

Designers select blind rivets for the way they set in particular applications, and mandrels for how they perform as a built-in tool. 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.

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.

## Breakstem benefits

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 1mm of their expansion range. Rivet body compression during installation compensates for such irregularities, and so do metal legs that expand the load bearing surface.

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:** Blind rivets are available in a range of diameters, and 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. A 1/2in 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 190mm. Specials install in materials as thin as 5mm for cell phones and computer chassis, and for assemblies as thick as 50mm 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, aluminium 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.

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