The POP® rivet installation sequence is simple.

1. Place the mandrel of the POP® rivet into the nosepiece of the setting tool.

2. Insert the POP® rivet body through the hole of the materials to be fastened.

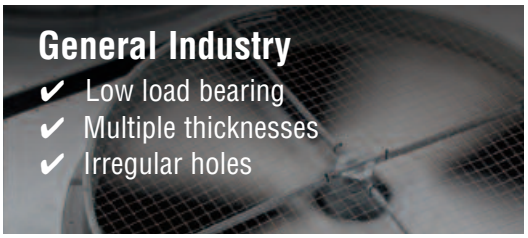
3. Pull the trigger of the setting tool. The POP® Rivet body clamps the materials together and expands to form a secondary head on the blind side of the joint. The mandrel breaks at a pre-determined force.

4. The materials are now fastened together.

Rivet Usage Guide

The POP® rivet range has been designed to meet the needs of a wide variety of industry requirements.

The technical features and setting characteristics of each range are suitable for many different applications.
An overview of typical rivet usage is shown here.



Open End
General purpose rivet

Multi-Grip™
General purpose Multi-Grip rivet accomodates a wide grip range

Multi-Grip™
General purpose Multi-Grip rivet accomodates a wide grip range

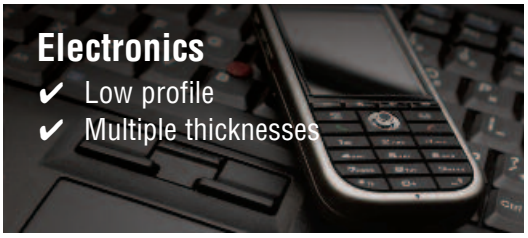
LS (Load Spreading)
Load spreading rivet ideal for use in vulnerable material

Closed End
Water / pressure tight

Grip Tite®
Exceptional clamp-up and increased blind side expansion

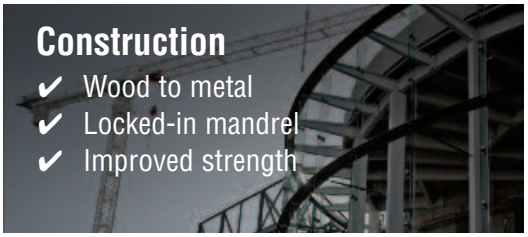
Ultra-Grip® (UG)
High shear and tensile strength with wide grip range capability

HS (High Strength)
1/4"(6.4mm) diameter rivet range with the strength of an 1/4" bolt



Pull-Thru (PT)
Sets flush on both sides of the application

Closed End
Mandrel head retention



HS (High Strength)
1/4"(6.4mm) diameter rivet range with the strength of an 1/4" bolt

Ultra-Grip® (UG)
High shear and tensile strength with wide grip range capability

POP®

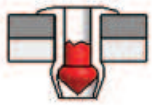
Rivet Types

Open End

General purpose rivet available in a wide range of materials and head styles. Suitable for applications with normal load bearing requirements.

Easy Entry

Easy Entry rivets line up odd shaped or misaligned holes in multiple sheets of material to make production easier and faster.



Soft Set

Soft-Set rivets incorporate a body and mandrel made from special aluminum alloys and are designed for soft or brittle materials.

Micro

With a 2.0mm diameter and a low head height for tight spaces and low secondary side protrusion, the Micro rivet is ideal for PCB's and thin sheet metal applications. Widely used in electronics applications.

Multi-Grip™

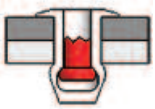
The Multi-Grip rivet is designed to accommodate a wider grip range than other rivets allowing for lower inventory levels. Provides good rattle free, vibration resistant joint construction even in irregular holes.

LS/LSR (Load Spreading Rivet)

Load spreading characteristics make this rivet ideal for use in vulnerable, friable and very soft materials.

Closed End

Designed with a completely closed body, this rivet is ideal for applications that need to be water/pressure tight or where mandrel retention is paramount.

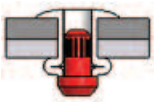


Pull-Thru (PT)

The Pull-Thru (PT) is a countersunk rivet ideal for low clearance applications and features a 'double flush' set on both sides of the application. With the unique patented pull-thru design, no mandrel heads will remain anywhere in the application making them ideal in electronics applications.

HS (High Strength)

High Strength rivets with large blind side expansion for structural applications. With excellent shear and tensile, also provides vibration resistance and enhances joint integrity.



Grip Tite® & HR®

Exceptional clamp-up capability and increased blind side expansion give the perfect combination for overcoming air gaps while expanding the load during setting. Excellent mandrel retention and rattle resistance after setting.

Self Plugger

This rattle resistant rivet offers positive mandrel head retention with mandrel gripping rings; mandrel remains in shear plain for optimum strength and is automation friendly.

T-Rivet

Ideal for joining softer and more brittle materials such as plastic, rubber or wood with the added benefit of clamp-up. Improved shear strength is also achieved due to the mandrel head retention after setting.

Ultra-Grip® (UG)

These high strength rivets with a positive mechanical locking system provide superior holding power. The locking feature seals the mandrel head into the body preventing head drop out keeping the application free from contamination. UG rivets offer superior shear and tensile properties in structural applications.

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Rivet Materials

POP® Rivets are available in Steel, Stainless Steel, Nickel Copper Alloy (Monel) Copper and several grades of Aluminum to meet the requirements of a wide variety of applications.

Rivet Material Selection

Generally the rivet selected should have the same physical and mechanical properties as the components to be joined.

Aluminum – 1100	Commercially pure aluminum for extremely soft or brittle materials; for lower shear/tensile requirements
Aluminum – 5052	Best used where higher shear & tensile is required; good corrosion resistance
Aluminum – 5056	Best used where higher shear & tensile is required; good corrosion resistance
Aluminum – 5154	Used for special products/applications
Steel – C1002-C1010	General purpose use; used for all steel rivet mandrels
Stainless Steel – 300 Series	Austenitic stainless steel; offers good corrosion resistance
Nickel Copper Alloy – 400	Offers extremely high corrosion resistance; has excellent elevated temperature properties
Copper – 110	Used where electrical conductivity is required

POP®

Rivet Head Styles

Head Styles

POP® Rivets are available with the following flange configurations:

Domed Head
Standard low profile head, suitable for most applications.

Large Flange
For use where thin, brittle, soft or vulnerable materials are fastened. Provides large bearing surface on primary side and ideal for covering enlarged holes or slots.

Countersunk
With a 120º head design, used wherever a flush surface is required.

Customer Specific Solutions*

We support the design and application needs of our customers through highly skilled and experienced application and design engineers.

If you require a rivet with a special feature or if you need advice as to the best solution for your application please contact Emhart Customer Service with the following application details:

- Application description
- Materials to be fastened - material types, thicknesses
- Hole sizes
- Annual volume
- Extraordinary fastener requirements

* Subject to minimum order quantities

Typical Customer Specific Design Solutions:

Extended Length Grooved Mandrel

Collar Assembly

Plastic Cap Rivet

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Rivet Finishes

Finishes

POP® Rivets in Steel are supplied with Zinc and Clear passivation as standard.
Steel, Stainless Steel and Copper components all meet the RoHS directive and are mercury free.

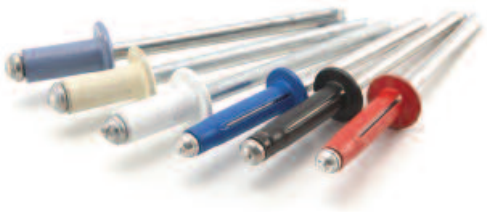
POP® Rivets in Nickel Copper are supplied zinc plated.

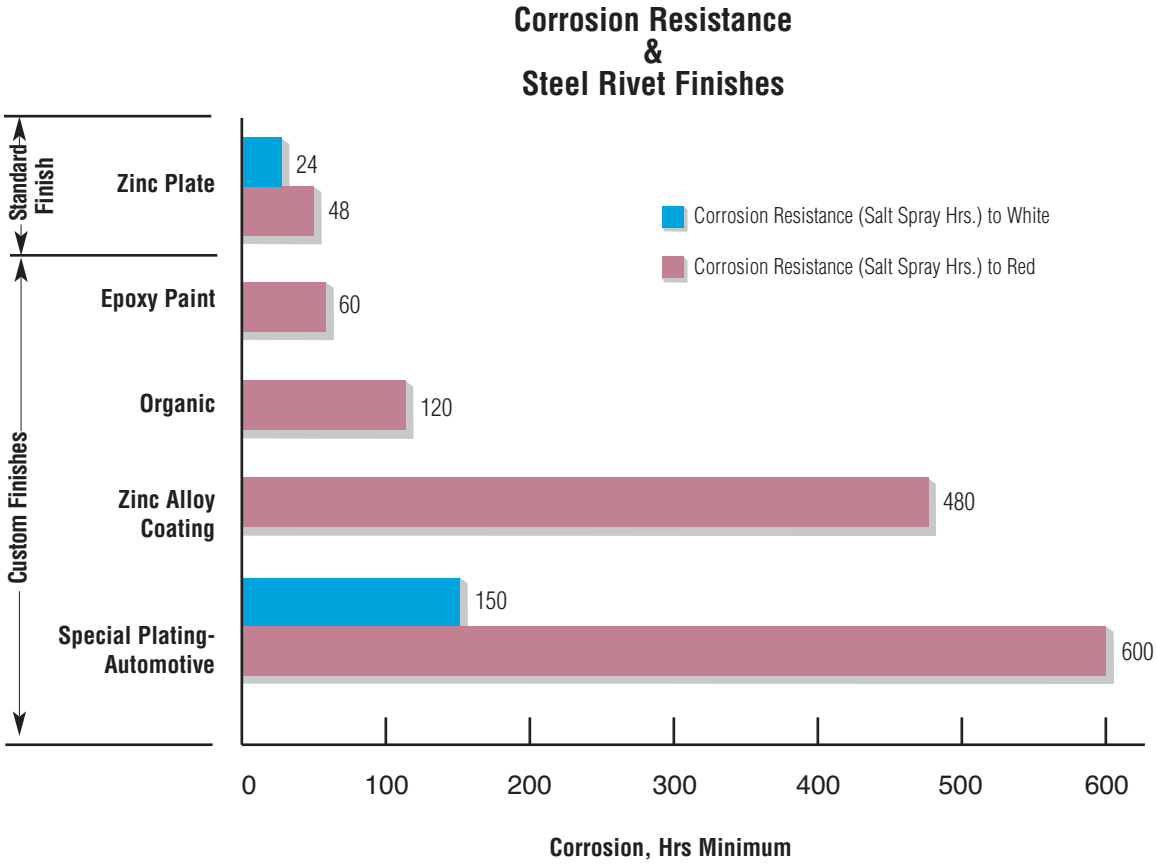
There are a wide variety of other finishes also available for aesthetic and environmental needs including:- Xylan, Anodization & Zinc Nickel.

We offer the complete color palette of paint finishes.

We can also match your application to a paint color if required. Please contact Emhart Customer Service.

Special finishes are subject to minimum order quantities.



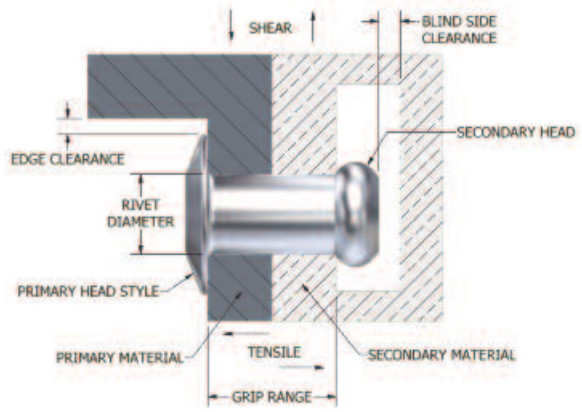


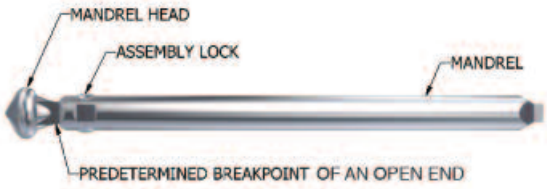
Note: Typical values for steel plates rivets tested in accordance with ASTM B117

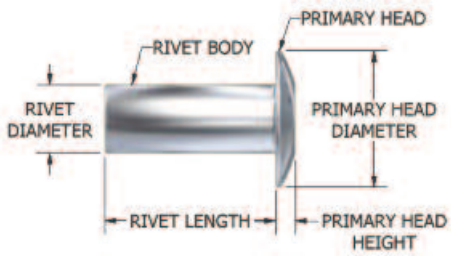
POP®

Design Guidelines

These illustrations provide a graphic representation of the rivet selection factors to be considered and described in greater detail in the accompanying text.







Rivet Terminology/Nomenclature

1. Hole size

Hole size can be important in blind riveting. Too small a hole will, of course, make rivet insertion difficult. Too large a hole will reduce the shear and tensile strengths. It may also cause bulging or separation of the members by allowing the rivet to expand between them instead of only on the blind side. (Best practice is to follow the hole size recommendations provided). Avoid burrs in and around the holes.

2. Grip Range

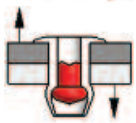
The recommended thickness range over which the body length will consistently provide a proper setting in a hole of the specified diameter.

3. Shear

The load applied to a fastener along the joint interface.

4. Tensile

The load applied to a fastener along its length.



5. Joint strength

First determine the single-joint tensile and shear values required for the application. These are functions of total joint strength, fastener spacing, rivet body material and rivet diameter. Then refer to the "Shear" and "Tensile" in the Rivet Selection Guide (pp14-50) on the product, and select a POP brand rivet that provides the values required. POP brand rivets are not certified for structural aerospace applications and such use is not recommended.

6. Joint thickness

Measure the total thickness of the materials to be joined. This determines the required "grip" of the rivet you select. Refer to the "Grip Range" in the Rivet Selection Guide (pp14-50) and select a rivet with a grip range that includes the work thickness required. Remember that insufficient rivet length will not allow proper formation of the secondary head at the back of the work.

7. Nature of materials

Both the rivet and the materials to be fastened will affect the ultimate joint strength. As a rule, the rivet materials should have the same physical and mechanical properties as the materials to be fastened, because a marked dissimilarity may cause joint failure due either to material fatigue or galvanic corrosion.

8. Head Style

The low-profile domed head is appropriate for most applications. However, when soft or brittle materials are fastened to a rigid backing member, the large flange head should be considered because it offers twice the bearing. surface. Where a flush surface is required, the countersunk head style should be selected.

Domed Head **Large Flange** **Countersunk**

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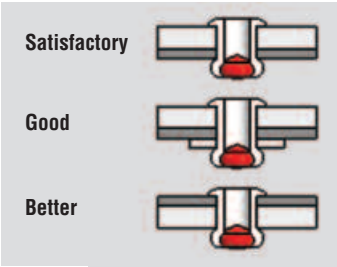
Design Guidelines

The material that follows will provide a useful planning guide for most applications. In addition, we offer the services of our engineering staff to help with unusual requirements.

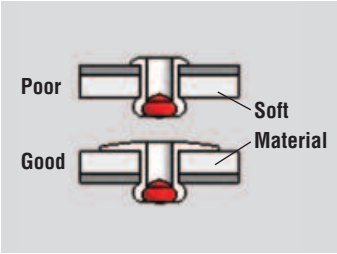
Some of the variables to consider are:

- Joint type, configuration, thickness and material
- Hole size
- Tool access
- Rivet size, material and spacing
- Tightness of clamp
- Hole type



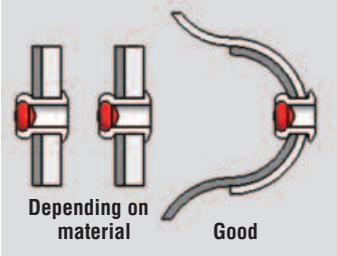
Thin & Thick Assembling

Wherever possible, set the secondary head against the thicker and therefore stronger material. Where the head must be set against the thinner material, consider using the POP HR or HS rivet or a backup washer when using Open End rivets. POP brand open end rivets are successfully set against aluminum stock as thin as .020".



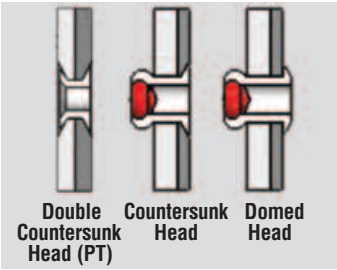
Fastening Soft to Hard

Soft-to-hard materials are sometimes assembled by using a backup washer and forming the secondary head against the soft material. It is best to use a Large Flange rivet and set the secondary head against the hard material. Whenever this is not possible, consider using POP LSR rivets.



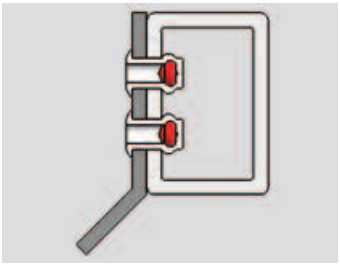
Plastics and Brittle Materials

Where the more fragile plastics are involved, POP Soft-Set or LSR rivets should be specified. Where the plastic is rigid enough to afford satisfactory clamping action, standard POP open end brand rivets can be set directly against plastics as shown here.



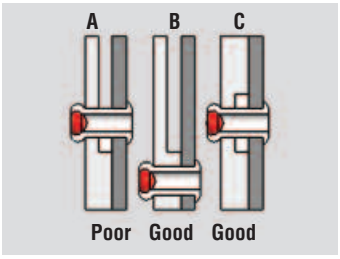
Head Clearance

Height and diameter of domed head rivets should be checked against specifications where no projection is permitted; rivets with 120° countersunk head style afford a truly flush surface. For a double flush set, use the POP Pull-Thru (PT) rivets.



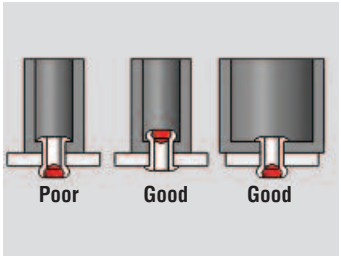
Fully Sealed Fastening

POP Closed End Rivets should be specified for all of the many applications where a fully sealed fastening is essential. This rivet design produces a seal that prevents passage of liquid or vapor at pressures up to 100 psi.



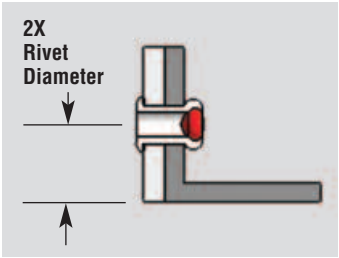
Tight Joints

Because POP Rivets exert a high gripping force when clamped, the joint shown in **A** would be unsatisfactory. The methods shown in **B** and **C** are better ways to handle the same assembly problem. For improved clamp-up force, consider using POP Ultra-Grip or HS rivets.



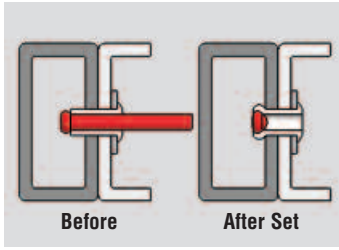
Channel Sections

Where narrow channels must be assembled, check clearance for adequate tool width. Alternately, set rivet from the underside – or widen the channel section – or use one of the available POP Rivet tool nosepiece extensions that can add up to an inch in length. In this case, a rivet with a larger mandrel is required.



Edge Clearance

For maximum joint strength, the distances from the rivet centerline to the edge of a sheet should not be less than twice the rivet diameter. Where joint strength is not critical, this dimension can be reduced.



Blind Side Clearance

This is the distance from the underside of the rivet head to the end of the mandrel before setting minus the combined thickness of the materials being fastened. Design must permit enough blind side clearance to allow a fully formed secondary head when setting the rivet. Consider using POP Pull-Thru rivets where clearance is a concern.

Design Guidelines

Galvanic Corrosion

Galvanic corrosion occurs when two dissimilar metals are in contact in the presence of an electrolyte, which is a medium through which an electrical current can flow (i.e. moisture). The rate of corrosion depends upon the amount and concentration of the electrolyte as well as the difference in electrical potential (anodic-cathodic relationship) of the metals as shown in the Galvanic Series Chart to the right.

A highly anodic material in contact with a highly cathodic material will corrode much more quickly than two highly cathodic materials or when the materials used are closer together in the Galvanic Series Chart.

When corrosion does occur, the anodic material is the most likely to corrode, whereas the cathodic material is the least likely to corrode. To reduce the likelihood of galvanic corrosion in a fastened joint, it's recommended to choose materials that are grouped together in the Galvanic Series Chart. Recommendations include:

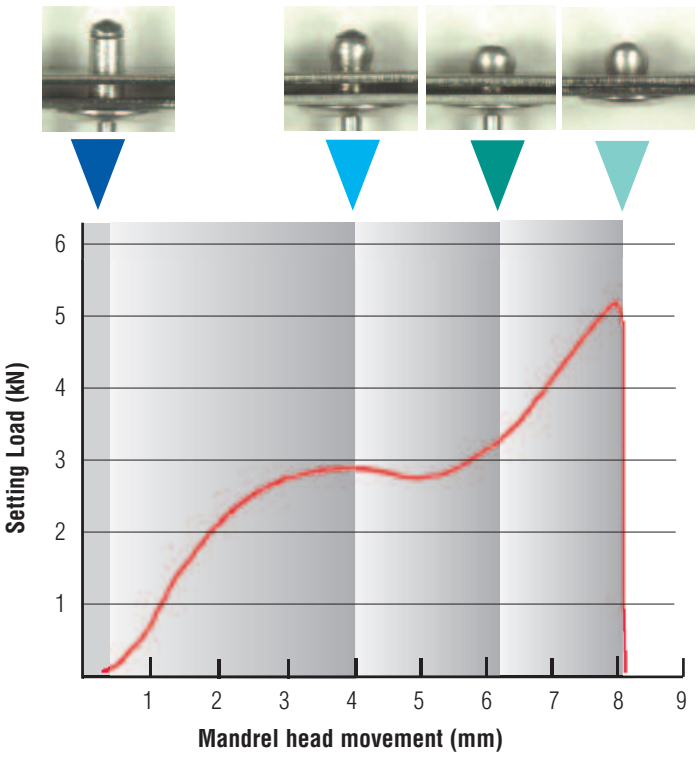
1) Select materials that are as close together as possible in the Galvanic Series Chart
2) Provide a barrier between the two metals, such as paint, non-metallic washer or gaskets
3) Design the fastener as the cathode so the cathodic area is small as compared to the anodic area
4) Use a metallic finish on the fastener that is close on the chart to the mating material

Corroded End
(Anodic, Least Noble)

Magnesium
Magnesium Alloys
Zinc
Aluminum 1100
Cadmium
Aluminum 2024-T4
Steel or Iron
Cast Iron
Chromium-Iron (active)
Ni-Resist Cast Iron
Type 304 Stainless (active)
Type 316 Stainless (active)
Lead-Tin Solders
Lead
Tin
Nickel (active)
Inconel Nickel-Chromium Alloy (active)
Hastelloy Alloy C (active)
Brasses
Copper
Bronzes
Copper-Nickel Alloy
Monel Nickel-Copper Alloy
Silver Solder
Nickel (passive)
Inconel Nickel-Chromium Alloy (passive)
Chromium-Iron (passive)
Type 304 Stainless Steel (passive)
Type 316 Stainless Steel (passive)
Hastelloy Alloy C (passive)
Silver
Titanium
Graphite
Gold
Platinum

Protected End
(Cathodic, Most Noble)

Typical Setting Cycle for an Open Rivet



1 The rivet is placed into the holes of the work piece

2 The setting tool applies a load to the mandrel and the mandrel head starts to enter the rivet body

3 Continued pulling of the mandrel causes the rivet body to expand, clamping the work piece plates

4 The pulling load gradually increases until the plates are clamped firmly together and, at a predetermined setting load, the mandrel breaks

Trouble Shooting Guide

Description of Typical Potential Problems

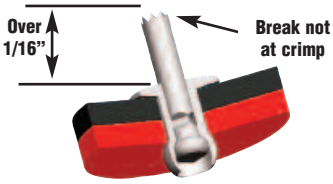
Pull Thru

Partial Pull Thru

Head Popper

Proper Set

Loose Set/Plate Freeze



High Mandrel Break

Sheared Secondary Head

Potential Cause	Problem Type						
	Pull Thru	Partial Pull Thru	Head Popper	Loose Set	Plate Freeze	High Mandrel Break	Sheared Secondary Head
Over maximum recommended hole	■	■	□	□	□	□	□
Under minimum recommended hole	□	□	■	■	□	■	■
Grip thickness over maximum	□	□	■	■	□	□	■
Grip thickness under minimum	■	□	□	■	□	■	□
Improper Hole Condition							
Excessive variation in size	■	■	■	■	□	■	■
Noncircular hole	■	■	■	■	□	□	■
Tapered hole	■	■	■	■	□	□	■
Burrs and sharp edges	■	■	■	■	□	□	■
Applicable material too soft	■	■	■	□	□	□	□
Non-perpendicular set (improper alignment of tooling to application)	■	■	■	■	■	■	■
Wrong nosepiece on tooling	■	■	□	■	□	□	□
Gap between material thicknesses	■	■	■	■	■	□	□
Insufficient secondary side clearance	□	□	□	■	■	□	□

■ = APPLICABLE □ = NOT APPLICABLE

Refer to Rivet Selection Guide for proper design conditions. If you need further assistance, contact our application engineers and be prepared to supply the following information and samples.

- Company Name / Contact Name
- Address / Tel. # / Fax # / EMail
- Sales representative or Distributor
- Frequency of failure
- Rivet part number
- Affected quantities
- Affected lot numbers
- Hole sizes (tolerances)
- Grip thickness (ranges)
- Tooling information
- Tooling nosepiece
- 50 unset rivets for tests
- Samples of failed rivets
- Sample of application