

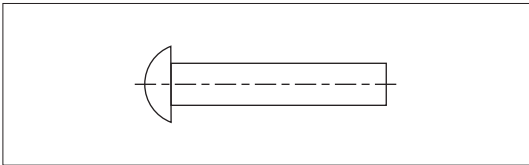
10. RIVETING

10.1 Rivet types

10.1.1 Solid rivets

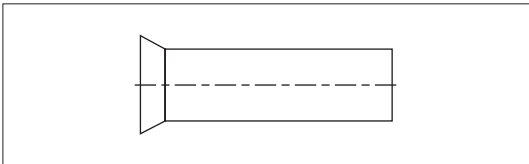
Solid rivets are used less and less. They have been replaced in many cases by welding or bonding.

The most common head form is the round head rivet (DIN 660 (to 8 mm), DIN 124 (from 10 mm)), which is still used occasionally in steel constructions. However, riveting is being replaced here as well by joining with HV fasteners.



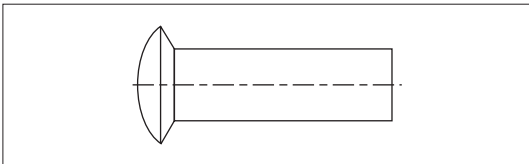
Round head rivet

Countersunk head rivets (DIN 661 (to 8 mm), DIN 302 (from 10 mm)) are used wherever the rivet head must not project. However, the connection can only support lower loads.



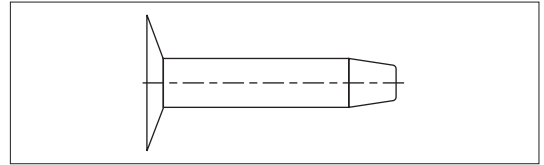
Countersunk head

Oval head rivets (DIN 662) are still used in many cases for stairs, treads and catwalks where the surface has to be non-slip and safe to walk on without risk of an accident.



Raised countersunk head

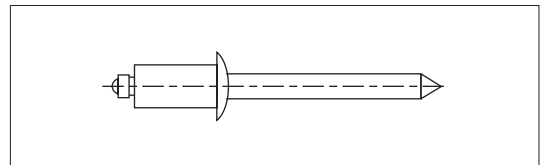
Because of the large countersinking angle of 140° flat countersunk head rivets (DIN 675) are very often used to join soft materials such as leather, felt, rubber (no tearing).



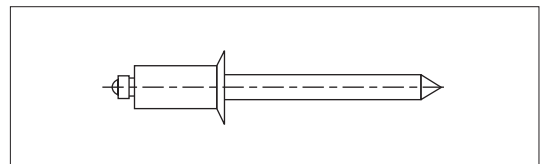
Countersunk head rivet

10.1.2 Hollow rivets

In contrast to solid rivets, hollow rivets are still in demand. Over the last ten years blind rivets above all have experienced an enormous boom because they are relatively easy to work with.



Blind rivet, round head



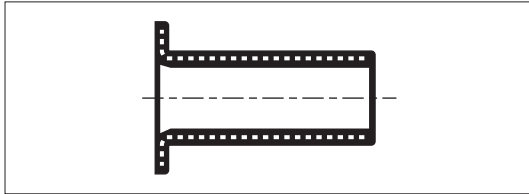
Blind rivet, countersunk head

Rivet pins are simple cylindrical steel pins whose end face is either countersunk to 120° or has a short bore hole. The end faces are only slightly flared to secure the pins from falling out. For this reason only a load causing shear stress is permissible.

10.1.3 Tubular rivets

Tubular rivets (DIN 7339 (made from strip), 7340 (made from tube)) are cylindrical sleeves that have a flat edge at one end. A special tool is used to flange the other end during processing. This type of rivet is frequently used to join metal parts with sensitive materials (leather, cardboard, plastics) in electrical engineering and in the

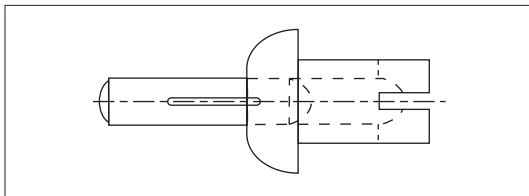
toy industry. A further advantage of these tubular rivets: cables can be led through the very clean hollow part.



Hollow rivet, one-piece

10.1.4 Expanding rivets

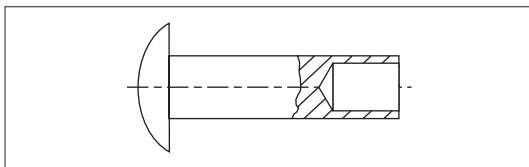
Expanding rivets (hammer drive rivets). No special tools are required for these rivets. A hammer is used to drive a pressed slotted pin or a grooved expanding mandrel into the hollow part. This creates a firm riveted connection with good properties against vibrations.



Expanding rivet

10.1.5 Semi-tubular pan head rivets

This rivet type (DIN 6791 and DIN 6792) is characterised by the fact that only the rivet end has to be processed. Same uses as for rivet pins.

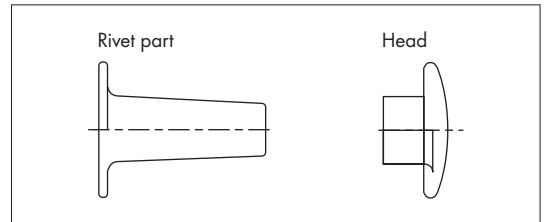


Round head

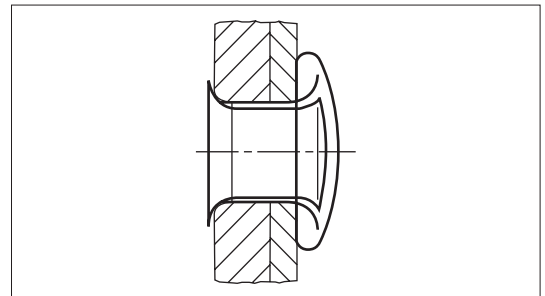
Semi-tubular pan head rivet

10.1.6 Two-piece hollow rivet

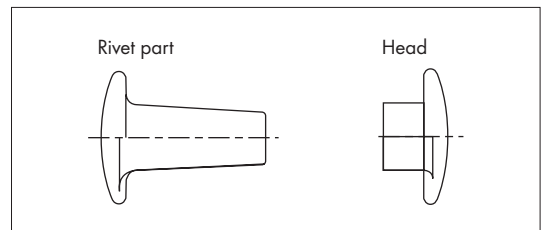
This type of rivet is used very frequently for subordinate purposes. It is differentiated in accordance with the type of the rivet part:



Style A, rivet part open



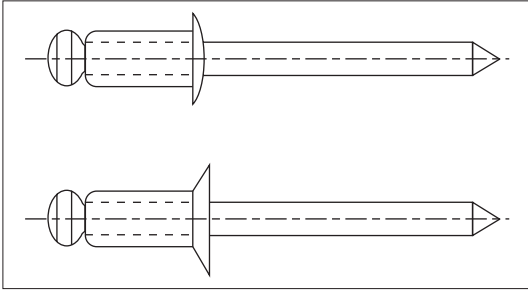
In place



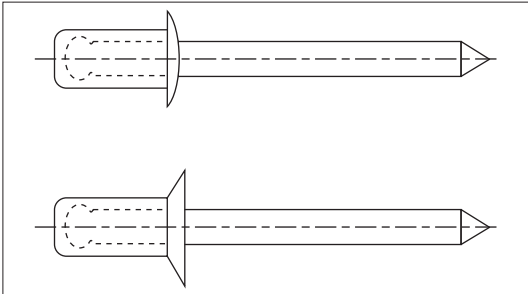
Style B rivet part closed

10.1.7 Blind rivets

This type of rivet has gained greatly in importance, in particular for joining thin-walled plates or in hollow profile construction. In addition, the great advantage is that the rivet can be inserted from one side, i.e. it is fitted blind. The rivet consists of the rivet sleeve and a mandrel. Two types are differentiated as follows: closed blind rivets (cup-type blind rivets) are suitable for making splash-proof connections.



Blind rivet, open (standard type)

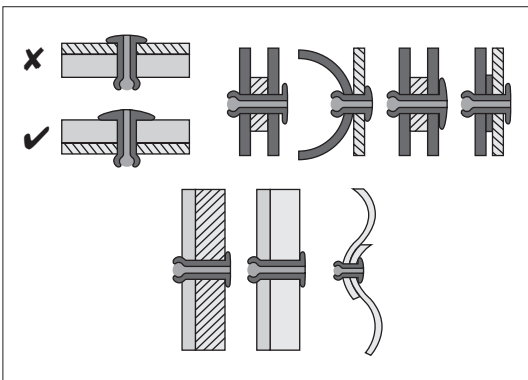


Blind rivet, closed (cup-type blind rivet)

10.2 Instructions for use

10.2.1 Joining hard to soft materials

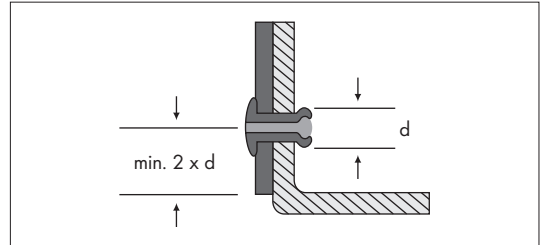
Soft and hard parts are often fastened with the help of an additional washer at the sleeve head that is pressed against the soft material. A much better method is to use a rivet with a large mushroom head and to place the sleeve head against the hard material.



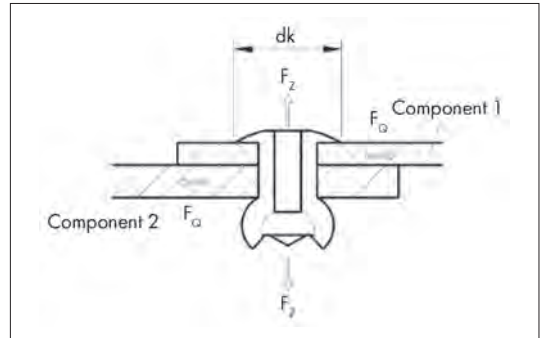
Soft claw blind rivets, blind rivets with a grooved rivet shaft, all-purpose rivets (press clip rivets) are recommended for this application.

10.2.2 Corner clearances for connections:

To enable the greatest possible joint strength, the clearance from the centre axis of the rivet to the edge of the workpiece should not be less than twice the diameter of the sleeve.



10.3 Definitions and mechanical parameters

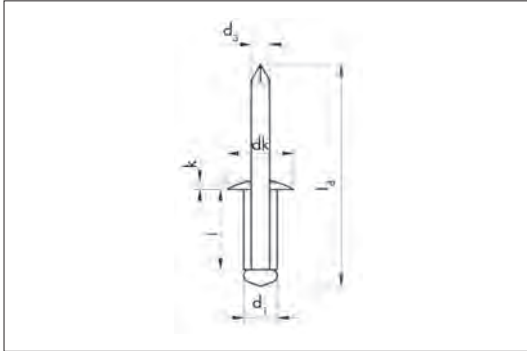


d_k Head diameter

F_z Tensile force affecting the sleeve

F_Q Shearing force affecting the sleeve

Splice plate joint



- d_1 Sleeve diameter
- d_3 Mandrel diameter
- d_k Head diameter
- l Sleeve length
- l_d Mandrel length
- k Head height

10.4 Using blind rivets

The rivet is placed with the rivet mandrel into the opening of the rivet tool and into the bore hole with the rivet sleeve. When the tool is operated, the clamping jaws grip the mandrel and pull it back. (Fig. 1)

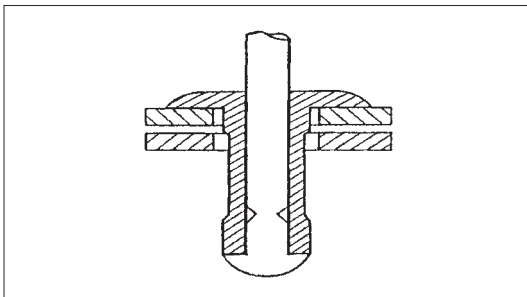


Fig. 1

The pulling movement causes the rivet head to deform the sleeve and this leads the two workpieces to be pressed firmly together. (Fig. 2)

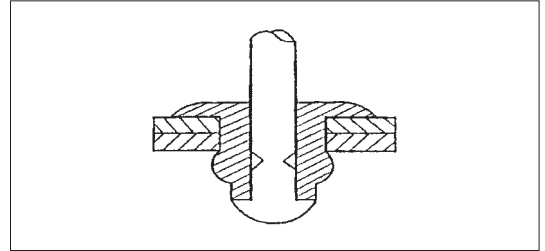


Fig. 2

The sleeve is pressed against the hole wall inside the material bore hole and at the same time is shaped from the "blind" side to the closing head. The mandrel breaks off at the predefined rupture joint, while the remainder of the mandrel in the rivet sleeve is sealed tight by the rivet sleeve. (Fig. 2)

The rivet connection is complete and does not require any more step to finish. (Fig. 3)

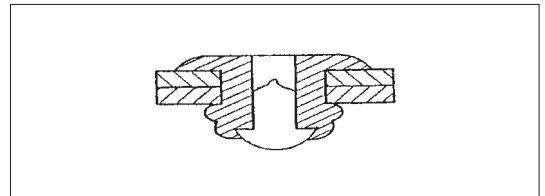
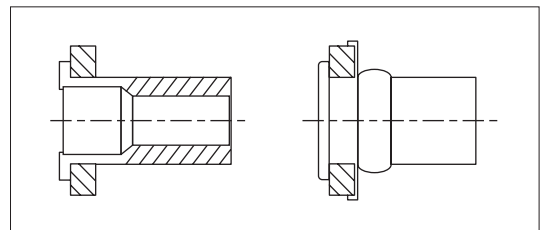


Fig. 3

10.5 Rivet nuts

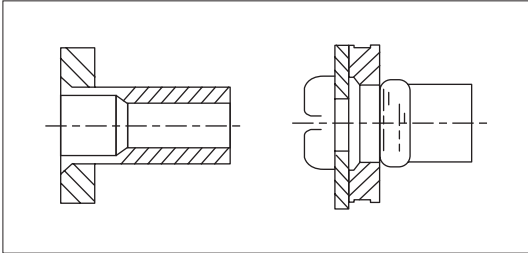
These nuts are mainly used with hollow bodies, because they can only be set from one side (blind assembly).

The very universal range is for material thicknesses of 0.5–7.5 mm.



Blind rivet nut, flat head

Rivet nuts combine two fastening types: blind riveting and an additional screw assembly.



Blind rivet nut, countersunk head

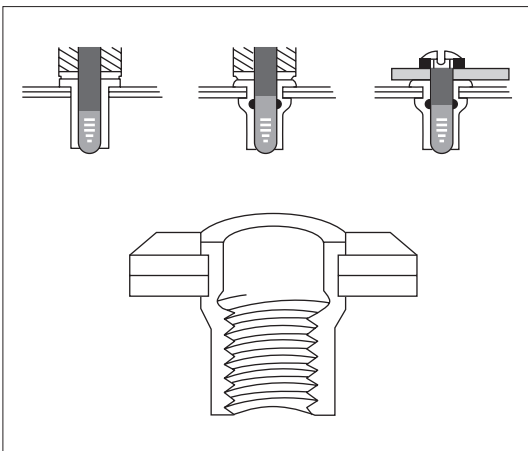
This makes it possible above all to use screw assemblies in relatively thin-walled construction elements.

10.5.1 Using rivet nuts

The blind rivet nuts are used in a similar way to blind rivets.

The blind rivet nut is screwed onto the threaded mandrel of the rivet tool.

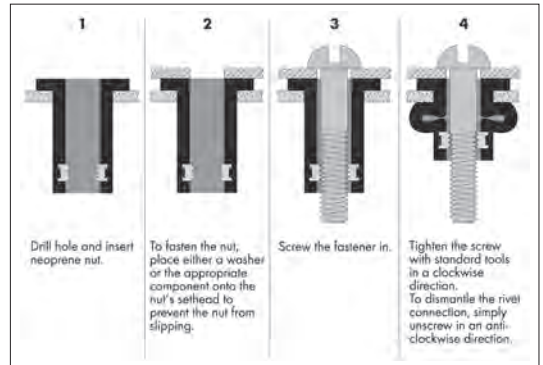
The nut is then placed into the prepared bore hole. When the tool is operated the threaded mandrel is withdrawn. The pulling movement causes the rivet head to deform the sleeve and this leads the two workpieces to be pressed firmly together.



10.5.2 Special types of rivet nuts

Neoprene rivet nuts

Detachable, electrically insulating rivet connection with oscillation and noise-restricting function for fastening metal and plastic connections.



Method of use

Design: mushroom head.

Material: rivet body made of neoprene (EPDM) with brass insert.

Hardness: 60 Shore.

Advantages: can be used in blind or pocket holes.

Double function as thread carrier or fastener. Air-tight and moisture-proof connection. Ideal for various materials.

Possible operating temperatures: -30°C to $+80^{\circ}\text{C}$.

Ozone-resistant.

Areas of application:

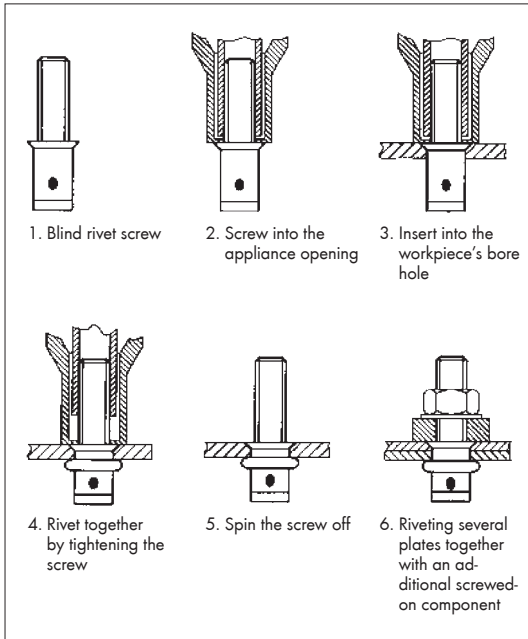
Electronics construction, vehicle construction, trailer construction, sign making, plant engineering, air-conditioning and refrigeration engineering, agricultural engineering

10.6 Rivet screws

Rivet screws are used analogously to rivet nuts. The rivet screw is screwed into the threaded sleeve of the rivet tool and the rivet sleeve is then inserted into the prepared bore hole.

When the tool is operated the threaded sleeve is withdrawn. The pulling movement causes the threaded mandrel to deform the sleeve and this leads the two workpieces to be pressed firmly together.

This type of connection results in a high-strength screw thread in thin-walled materials.



Procedure for use

10.7 Trouble shooting

10.7.1 Selected grip range too large:

- The mandrel does not break off at the rupture joint so that it may still project from the drawn sleeve after processing.
- The connection has insufficient or no tensile or shearing strengths.

10.7.2 Grip range too small:

- The connection has weak points in the area of tensile and shearing strength.
- The rivet mandrel breaks off at the rupture joint but still projects from the sleeve.

10.7.3 Bore hole too big:

- The rivet can be inserted but there is no high connection strength because the sleeve material is insufficient to fill the bore hole.

10.7.4 Bore hole too small:

- The rivet sleeve cannot be inserted into the material because the rivet sleeve diameter is greater than the bore hole.

Other assembly faults can occur through the choice of the incorrect grip or riveting tool.

10.8 Explanation of terms

10.8.1 Cup-type blind rivet:

Also known as sealed rivet. Its blind rivet sleeve is connected to the head in the shape of a cup and in comparison with open blind rivets is proof against splashed water.

10.8.2 Grip range:

The range in which a blind rivet with a given rivet sleeve length fulfils its riveting task perfectly.

The grip range of the components is the total of all components that are to be connected.

10.8.3 Multi-range blind rivet:

Blind rivet that unites several grip ranges in a single rivet (grip range to 20 mm possible).

10.8.4 Rivet sleeve diameter:

The external diameter of the rivet sleeve. Frequently also referred to as well as the shaft diameter.

10.8.5 Rivet sleeve length:

With blind rivets with mushroom heads the rivet sleeve length is measured to the start of the mushroom head.

With the countersunk head design the rivet sleeve length is the total length including the countersunk head and the sleeve.

10.8.6 Closing head:

The part of the blind rivet sleeve that is shaped by the head of the rivet mandrel after setting.

10.8.7 Setting head:

The factory-shaped head at the blind rivet sleeve that is not deformed. Designed as a round or countersunk head.

10.8.8 Rupture joint:

Mandrels have notches at which they break off on the maximum deformation of the rivet sleeve.