

TALAT Lecture 4103

Self-Piercing Riveting

8 pages, 7 figures

Basic Level

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Objectives:

- to describe the processes of self-piercing riveting, which is a relatively new fastening method for sheet metal parts

Prerequisites:

- General mechanical engineering background
- TALAT Lecture 4101

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4103 Self-Piercing Riveting

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4103.01 Definition and Classification

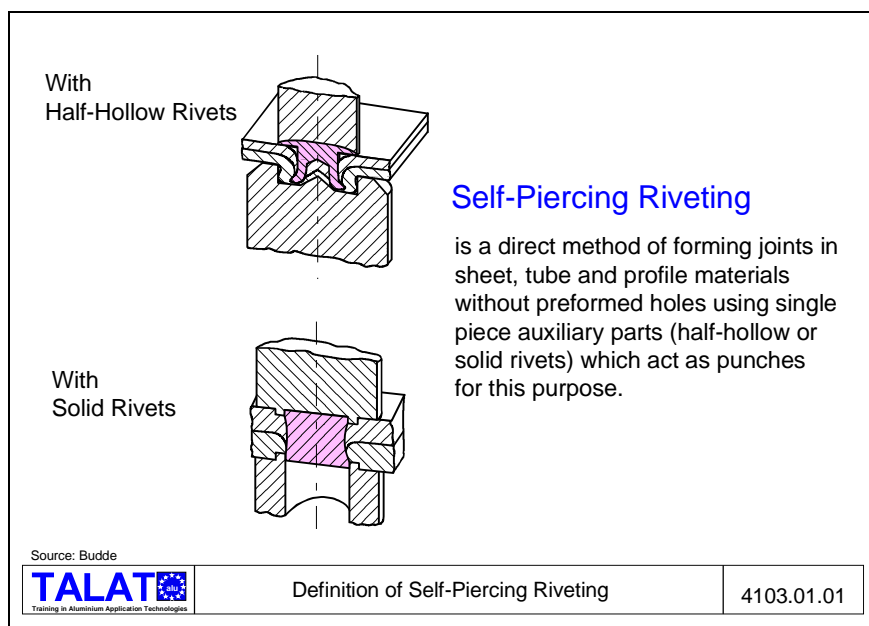
- Definition of indirect self-piercing riveting
- Trade names for indirect self-piercing riveting processes

Definition of Indirect Self-Piercing Riveting

Among the mechanical fastening methods using auxiliary joining elements, self-piercing riveting appears to be most promising for fastening aluminium because of its estimated development potential.

In lieu of the nonexistent standard definition, self-piercing riveting can be classified as a process in which the prior formation of holes, necessary for conventional riveting processes, becomes unnecessary and is replaced by a combined cutting-riveting operation.

Depending on the type of rivet used (half-hollow or solid), two principle types of fastening technologies are being used industrially (**Figure 4103.01.01**).



Trade Names for Indirect Self-Piercing Riveting Processes

The individual self-piercing riveting systems with half-hollow and solid rivets are, as in the case of clinching systems, better known and used under their trade names (see **Figure 4103.01.02**).


The fact that in self-piercing riveting the individual joining problems have to be solved by the proper choice of rivets and riveting tool is a source of problems. Consequently, a close cooperation between user and system producer is essential in

order to arrive at the best fastening results.

This is also valid for single-step clinching, with or without local incision.

Self-Piercing Riveting *	
with Half-Hollow Rivets	with Solid Rivets
<ul style="list-style-type: none"> - "RIV-SET"-System - "VTS"-System - "S&D RIVET"-System - "FAST-RIV"-System - 	<ul style="list-style-type: none"> - "TURK-RIVET"-System - "FAS-NER"-System - - -

* Source: DIN 8593, Part 5

	Trade Names for Self-Piercing Riveting Processes	4103.01.02
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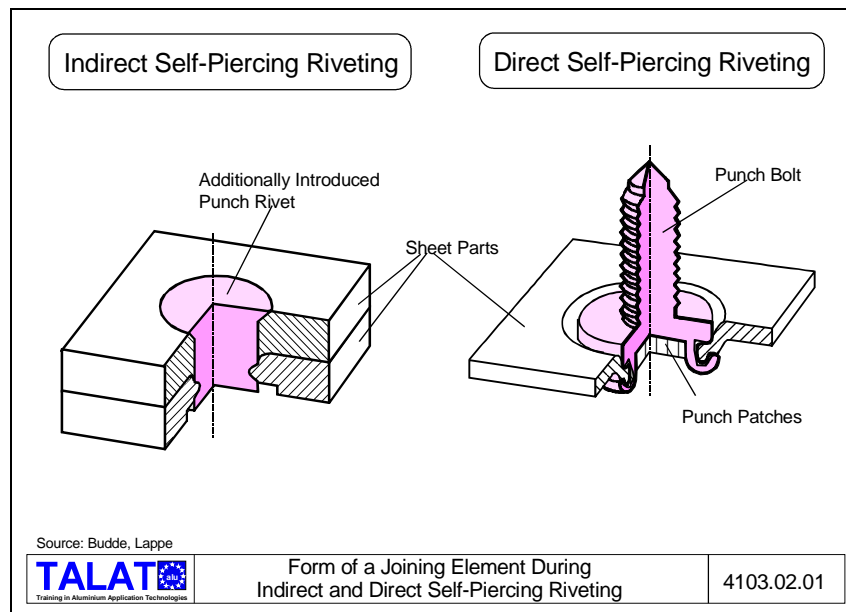
4103.02 The Riveting Process

- Form of a joining element during indirect and direct self-piercing riveting
- Process steps of self-piercing riveting with a half-hollow rivet
- Process steps for self-piercing riveting with solid rivets
- A comparison of the fields of application of fastening technologies

Form of a Joining Element During Indirect and Direct Self-Piercing Riveting

Besides the indirect punch riveted joints described here, self-punching joining parts, i.e., punch nuts and punch bolts, have also been developed and sold in recent years.

In direct self-piercing riveting, the rivet part of the bolt is pierced through the metal sheet. The further closing motion of the tool, together with the specially shaped counter die, causes the rivet head to be formed in such a manner that the pierced sheet is covered over in the joining region (**Figure 4103.02.01**).

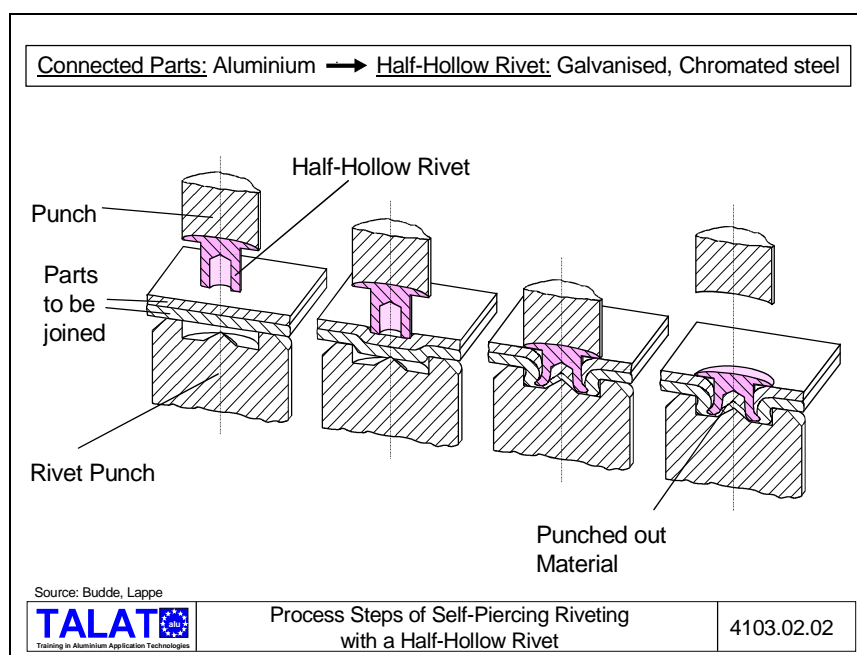


Process Steps for Self-Piercing Riveting with a Half-Hollow Rivet

During self-piercing riveting with half-hollow rivets, the rivet is forced to pierce through the punch-side sheet and while penetrating the die-side sheet it is caused by the special form of the die to be plastically formed and forced sideways into this sheet. The rivet collar thus created in the plastically formed material acts as the closing head (**Figure 4103.02.02**).

Just as in the case of conventional riveting, different head forms are used for simple and complex components and for varying loads. The rivet elements can be stored in magazines or supplied directly.

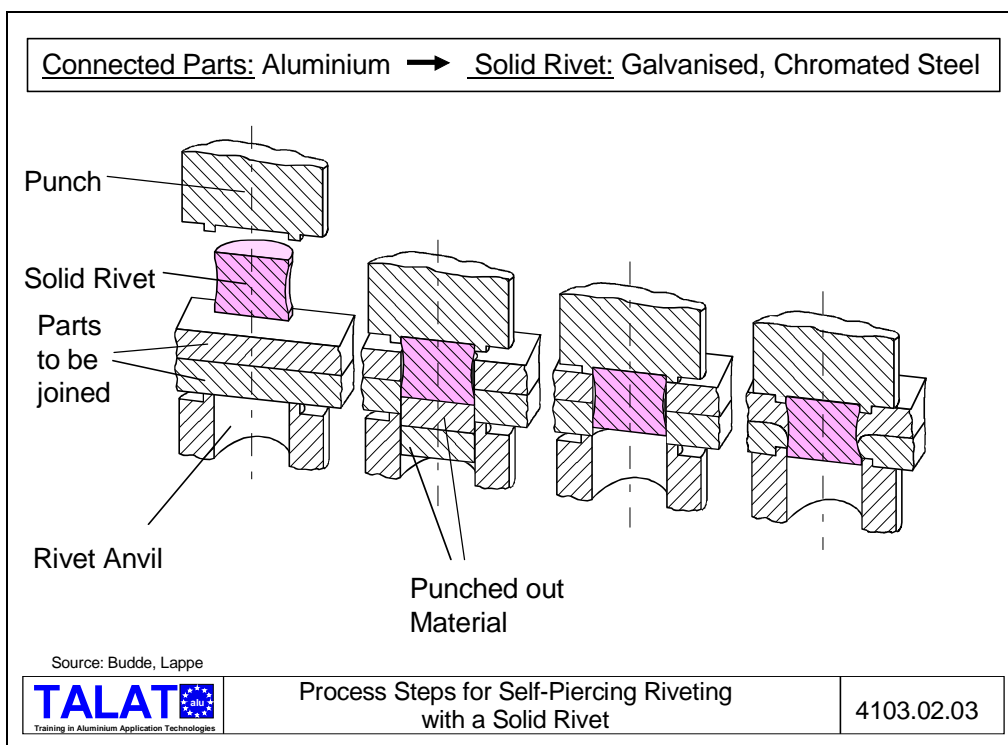
The rivets can be protected against corrosion by surface coating, whereby almost all known coating methods in trolleys or drums may be used. Currently, chromated and galvanised steel rivets are generally used for punch riveting aluminium.



Process Steps for Self-Piercing Riveting with Solid Rivets

During self-piercing riveting with solid rivets, the rivet sits flush with the sheet and retains its original geometrical form almost fully (**Figure 4103.02.03**).

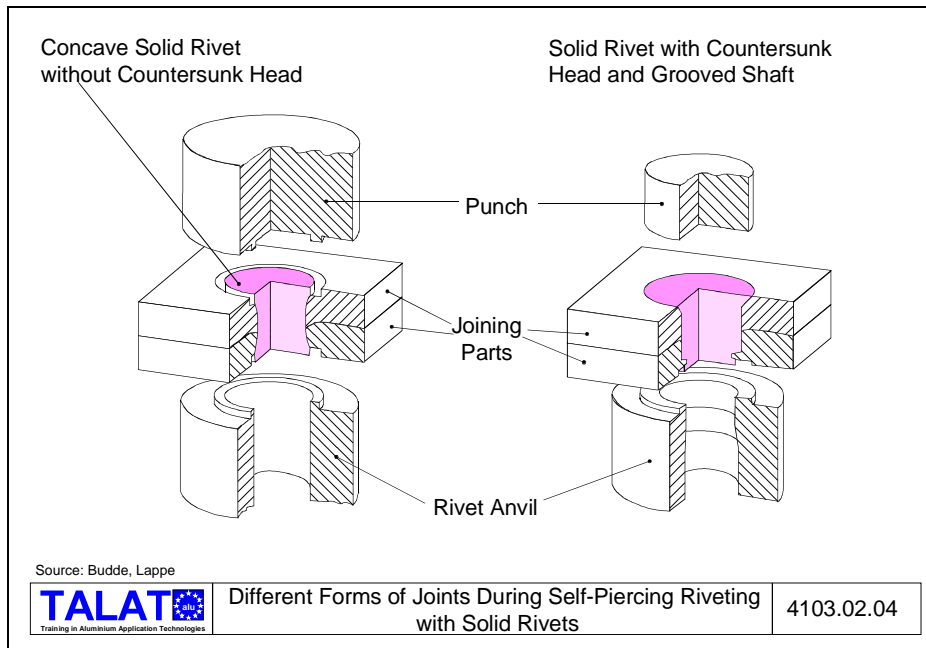
The parts of the sheet punched out during the punch process do not remain in the hollow shaft as in punch riveting with half-hollow rivets but have instead to be removed. Thus, the tools used must have an arrangement for allowing the punched out parts to be removed.



Different Forms of Joints during Self-Piercing Riveting with Solid Rivets

Two variations of self-piercing riveting with solid rivets are used industrially to produce quasi form locked rivet joints (see **Figure 4103.02.04**).

During the continuous fastening process, the material in the region of the cut joint is either forced to flow around the rivet plastically due to the action of shoulders on the punch and die or the punch-side rivet is held while a shoulder in the die causes the material of the lower sheet to flow into a groove in the rivet shaft.



A Comparison of the Fields of Application of Fastening Technologies

Mechanical fastening methods for stressed and/or non-stressed aluminium joints are used in a wide range of applications (**Figure 4103.02.05**).

The initial impulse for the use of mechanical fastening methods in the aluminium manufacturing industry came, as it still does, from the aircraft and the automotive industry.

A Comparison of the Fields of Application of Fastening Technologies

Joining Technology \ Characteristic	Adhesive Joining	Spot Welding	Clinching	Riveting
Application	single, small large series production	single, small large series production	single, small large series production	single, small large series production
	Light structures machine constr. electrical engg. building repair	Light structures machine constr.	Light structures machine constr.	Light structures machine constr. electrical engg. repair
	<u>stressed and unstressed</u> joints	<u>stressed and unstressed</u> joints	<u>stressed and unstressed</u> joints	<u>stressed and unstressed</u> joints

Source: Budde

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A Comparison of the Fields of Application of Fastening Technologies

4103.02.05

4103.03 Literature/References

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4103.04 List of Figures

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4103.02.02	Process Steps for Self-Piercing Riveting with a Half-Hollow Rivet
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