CDi 502

Stud Welding Unit

92-12-0502

HBS EFFICIENT TECHNOLOGY

Operating Manual

2023

After-sales service for Germany:

HBS Bolzenschweiss-Systeme GmbH & Co. KG
Felix-Wankel-Strasse 18
85221 DACHAU
GERMANY

Phone	**+49 8131 511-0**
Fax	**+49 8131 511-100**
E-mail	**international@hbs-info.com**
Web	**www.hbs-info.com**

CDi 502 Operating Manual Issue 2023-01 Order No. US-BA 92-12-0502

Translation of the Original Operating Manual

Please keep the manual in a safe place for future reference.

Transmission and duplication of this document, dissemination and notification of the contents are not permitted unless expressly approved.

All rights, errors and technical amendments reserved.

© HBS Bolzenschweiss-Systeme GmbH & Co. KG

Dear Customer,

Many thanks for buying a stud welding machine from HBS Bolzenschweiss-Systeme.

We at HBS wish you success at all times when working with this stud welding machine.

The high level of quality of our products is guaranteed by ongoing further development in the design, equipment and accessories. This may result in differences between the present operating manual and your product. No claims can therefore be derived from the data, illustrations and descriptions.

We have compiled the data and information in this reference work with the greatest care, and have made every effort to ensure that the information contained in this manual was correct and up-to-date at the time of delivery. We can nevertheless give no guarantee for an absolutely error-free document.

Should you discover any errors or unclear points when reading this operating manual, please do not hesitate to contact us.

We would also be grateful for any feedback should you have any suggestions or complaints to make about our product.

HBS Bolzenschweiss-Systeme GmbH & Co. KG

Felix-Wankel-Strasse 18

85221 Dachau

GERMANY

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Table of Contents

1 Important Safety Precautions 6

2 Symbols and Terms Used 10

3 Scope of Supply 13

4 Accessories 14

5 Technical Data 15

6 Intended Use 16

7 Warranty 17

8 Components of the Stud Welding Unit 18

8.1 Main Assemblies 18
8.2 Operation Panel and Display 20
8.3 Indicator Lights 21
8.4 Mains Switch 21

9 Welding Process 22

9.1 Contact Stud Welding 22

10 Preparing Workplace and Welding Process 25

10.1 Preparing Surfaces 26
10.2 Checking the Stud Welding Gun 27

11 Connection 28

11.1 Connecting the Welding Gun to the Stud Welding Unit 29
11.2 Connecting the Ground Cable 29
11.3 Connecting the Stud Welding Unit to the Mains Supply 30

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

12 Welding 31

12.1 Switching on the Stud Welding Unit 32
12.2 Determining the Charging Voltage 32
12.3 Setting the Charging Voltage 34
12.4 Performing the Welding Process 35

13 Checking the Quality of the Weld 39

13.1 Carrying out Visual Inspection 39
13.2 Carrying out Bending Test 40
13.3 Optimisation of Welding Parameters 41
13.4 Blowing Effect and Remedies 42

14 Troubleshooting 43

15 Shutting Down 45

16 Maintenance and Care 46

16.1 Cleaning 46
16.2 Inspection and Tests 47

17 Storage 48

18 Disposal 48

Service & Support 49

Index 50

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

1 Important Safety Precautions

The target group for this manual are qualified personnel who in view of their technical training, know-how and experience and knowledge of applicable regulations are able to assess the work assigned to them and recognise potential hazards.

Danger from incorrect use

- Use the stud welding machine only for the purpose described in this manual.

Otherwise you may endanger yourself or damage the stud welding machine.

You endanger yourself and others if you operate the stud welding machine incorrectly or fail to observe the safety precautions and warnings. This can lead to serious injury or extensive material damage.

Danger for unauthorised operating personnel

- Work with the stud welding machine only when
  - You are appropriately trained, instructed and authorised to do so, and
  - You have read and completely understood this operating manual.
- Never work with the stud welding machine when you are under the influence of
  - Alcohol,
  - Drugs or
  - Medication.

Danger from unauthorised modifications

- Never modify the stud welding machine or parts thereof without obtaining a clearance certificate from the manufacturer.

You will otherwise endanger yourself. This can lead to serious injury or extensive material damage.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Life-threatening danger for wearers of active implanted cardiac devices

Danger for workers at particular risk within the meaning of the EMF directive

Persons at particular risk within the meaning of the EMF directive are:

– Workers with active implanted medical devices
– Workers with passive implanted medical devices that contain metal
– Workers with medical devices worn on the body
– Pregnant workers.

◆ Never operate the stud welding machine if you are among the group of workers at particular risk within the meaning of the EMF directive.
◆ In this case, never remain in the vicinity of the stud welding machine during welding.
◆ Never operate the stud welding machine if persons are located nearby who are among the group of workers at particular risk within the meaning of the EMF directive.

Strong electromagnetic fields are produced in the vicinity of the stud welding machine during welding. These fields can adversely affect the function of medical devices as well as the course of a pregnancy.

Danger from fumes and airborne particulates

◆ Switch on the welding fume extractor at the place of work.
◆ Ensure that the room is well ventilated.
◆ Never weld in rooms with a ceiling height of less than 3 m.
◆ Observe furthermore your working instructions and the accident prevention regulations.

This will help to avoid health damage due to fumes and airborne particulates.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Danger from glowing metal spatter (fire hazard)

Glowing hot weld spatter and liquid splashes, flashes of light and a loud bang > 90 dB (A) must be anticipated during stud welding.

- Inform colleagues working in the immediate vicinity accordingly before starting work.
- Ensure that an approved fire extinguisher is available at the workplace.
- Do not weld when wearing working clothes soiled with flammable substances such as oil, grease, petroleum, etc.
- Wear your proper protective equipment, such as:
  - Protective gloves in accordance with the relevant standard,
  - Non-flammable clothing,
  - A protective apron over your clothing,
  - Full-ear hearing protection in accordance with the relevant standard,
  - A safety helmet when welding above your head,
  - Safety shoes,
  - Safety goggles with sight glass of protection level 2 in compliance with the applicable standards and do not look directly into the electric arc.
- Remove all flammable materials and liquids from the vicinity of the work area before starting welding.
- Weld at a safe distance from flammable materials or liquids. Select a safety distance large enough to ensure that no danger can arise from weld spatter.

Protection of the stud welding unit

- Protect the stud welding machine against the ingress of foreign matter and liquids caused by cutting or grinding work in the vicinity of your work area.

This will help to prolong the service life of your stud welding machine.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Safety notices in accordance with EMF directive 2013/35/EU

Currents flowing through electrical conductors during stud welding cause electric and magnetic fields that can occur, in particular, near the hand-held welding guns, the welding arrangement (e.g., welding cables) and the welding power sources.

Due to the high currents, high EMF exposures may occur.

Danger for workers at particular risk within the meaning of the EMF directive

Persons at particular risk within the meaning of the EMF directive are:

- Workers with active implanted medical devices
- Workers with passive implanted medical devices that contain metal
- Workers with medical devices worn on the body
- Pregnant workers.

Strong electromagnetic fields are produced in the vicinity of the stud welding machine during welding.

To reduce the danger posed by electromagnetic fields, we recommend, among other things, the following rules of conduct:

◆ Lay all cables as close together as possible.

For proper bundling and safeguarding of the cables, HBS offers protective tubes in various sizes.

◆ Do not position yourself between the welding cables.

◆ Only lay the cables to one side and position them as far as possible from the operating personnel.

◆ Do not loop the cables over your body, especially not at head level.

◆ Completely unwind the welding cables.

◆ Use the shortest possible welding cables.

◆ Place portable welding power sources as far away as possible while welding.

◆ If possible, do not operate welding power sources in the immediate vicinity of other persons, do not sit directly next to the welding power source while working and do not lean against it.

◆ In addition to these safety notices, also observe your work instructions and accident prevention regulations.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

2 Symbols and Terms Used

The symbols used in this operating manual have the following meanings:

Danger

Warns you of hazards that can lead to **injury of persons** or to **considerable material damage.**

Caution

Problems in operating **may occur** if this information **is not observed.**

No access for people with active implanted cardiac devices

No access for persons with implants made of metal

No access for pregnant women

Danger

Warns you of **electrical** hazards

Danger

Warns you of **electromagnetic fields** that can be generated during welding

These symbols prompt you to wear **personal protective equipment when working with the stud welding unit**.

This symbol prompts you to wear **ear protection**. **A loud bang > 90 dB (A) can occur during the welding process.**

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Tip

Cross-reference to **useful information** on the use of the stud welding machine

Cross-references in this operating manual are marked with this symbol or ***are printed in italics***

Fire hazard

Have a suitable fire extinguisher for the working area ready before starting work.

◆ **Work instruction**

– **List**

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Glossary

Automatic welding head:	Device for welding of welding elements
Capacitor:	Component for storage of electrical energy.
Electric arc:	Autonomous gas discharge between two electrodes when the current is high enough. A whitish light is emitted in the process. The electric arc allows very high temperatures to be generated.
Rectifier:	Electrical component that converts alternating voltage into direct voltage
Stud feeder:	Device for automatic feeding of welding elements
Stud welding gun:	Device for welding of welding elements
Stud welding system:	Stud welding unit including stud welding gun or welding head
Stud welding unit:	Device for provision of the electrical energy for stud welding
Thyristor:	Electronic component for contact-free switching of high currents; switching takes place via the control input
Welding element:	Component such as stud or pin that is welded to the workpiece
Welding parameters:	Mechanical and electrical settings at the stud welding gun or welding head and at the stud welding unit (e.g. spring force, charging voltage)
Workpiece:	Components such as sheet metal or tubes to which the welding elements are to be fastened

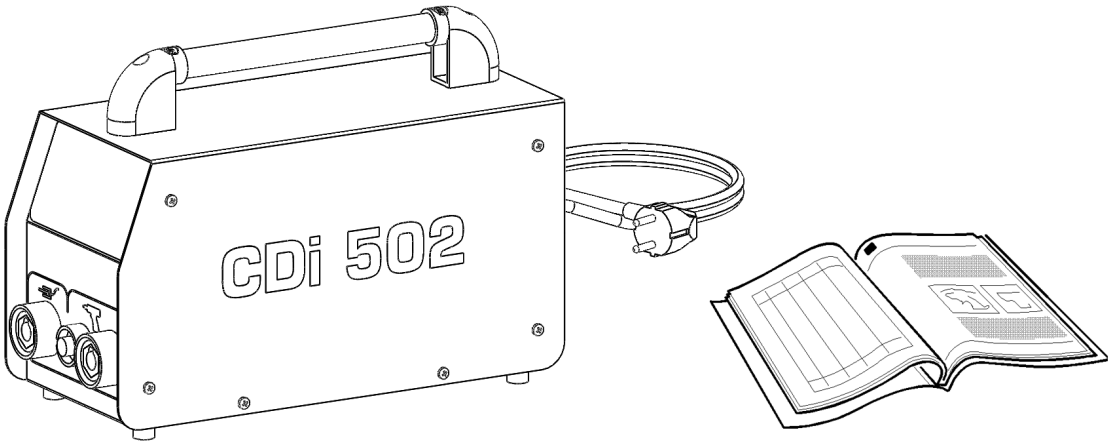
©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

3 Scope of Supply

The **basic configuration** of your stud welding unit contains the following parts:

No. of pieces	Part	Type	Order No.
1	Stud welding unit	CDi 502	92-12-0502
1	Operating manual	CDi 502	US-BA 92-12-0502



- Inspect the shipment for visible damage and completeness immediately on receipt.
- Report any transport damage or missing components immediately to the delivering shipping agent or the dealer (address, see page 2).

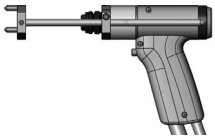
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

4 Accessories

The following ground cables are available as **accessories**:

No. of pieces	Part	Type	Order No.
1	Ground cable for CD welding elements	C 06-3 2.5 m, 25 mm², 1 vice grip 10“ (not possible to extend)	92-40-154
1	Ground cable for cupped head pins	CI 03 6.7 m, 16 mm², 1 vice grip 10“ (not possible to extend)	92-40-091

The following **stud welding guns** are recommended:

Welding range*)	M3 to M6, Ø 2 to 6 mm			Ø 2 and 3 mm	Ø 2 and 2.7 mm
Stud length	6 to 40 mm		15 to 55 mm	20 to 280 mm	9.5 to 152.4 mm
	C 06-3	**C 06-3**	**C 06-3**	**C 06-3**	**CI 03**
					
	• Easy handling • No setting for lift and spring pressure • Aluminium to M4 (#8)				• Especially suitable for welding of cupped head pins (HVCA)
Welding elements					
Welding process	CD (contact)				
Stud type	CD threaded studs (PT), pins (UT), Studs with internal thread (IT)			CD ISO nails	Cupped head pins
Welding cable	3 m, 25 mm², SK 50				9.3 m, 6 mm², SK 50
	Order No.	**Order No.**	**Order No.**	**Order No.**	**Order No.**
	92-20-288 (welding gun C 06-3 incl. centering tube PPR-2)	**92-20-275** (welding gun C 06-3 with foot ring and feet)	**92-20-275** (welding gun C 06-3 with foot ring and feet)) **92-40-010** (distance ring with screws) not included in delivery	**92-20-275** (welding gun C 06-3 with foot ring and feet) **92-40-043** (ISO leg assembly PSI with 3-point rest) not included in delivery	**92-20-254** (welding gun CI 03 complete)

*) recommended welding range CDi 502 / welding gun with this equipment

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

5 Technical Data

Stud Welding Unit CDi 502 (with digital display)
for CD stud welding (capacitor discharge welding) according to current standards

Welding range	Studs (mild steel, stainless steel): #4 to 1/4‘‘, dia. 14 ga to 1/4“ (M3 to M6, dia. 2 to 6 mm); Studs (aluminium): #4 to #6, dia. 1/8“ to 5/32“ (M3 to M4, dia. 3 to 4 mm); Cupped head pins dia. 14 ga and 12 ga (2 and 2.7 mm);
Welding material	Mild steel, stainless steel, aluminium
Welding rate	M6 = 10 studs/min. (Charging voltage 95 V) Cupped head pins dia. 2.7 mm = 10 pins/min. (Charging voltage 85 V)
Capacity	100 000 µF
Welding time	1 to 3 ms
Charging energy	500 Ws
Charging voltage	50 to 100 V (stepless voltage regulation)
Connection	100 V to 240 V, 50/60 Hz, 10 AT
Power source	Capacitor
Cooling method	F (temperature controlled cooling fan)
IP Code	IP 23 (also permits use outdoors)
Ambient temperature limits	32 °F to 104 °F (0 °C to 40 °C)
Dimension L x W x H	14.29“ x 6.42“ x 10.12“ (363 x 163 x 257 mm) with handle
Weight	21.83 lbs (9.9 kg)

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

6 Intended Use

Our stud welding units are designed and built exclusively for industrial use. Nonindustrial use is expressly forbidden due to the lack of know-how about the welding technology employed and the applicable standards.

The stud welding unit is intended exclusively for stud welding of standardised welding elements. Any other use will result in the desired strength of the welded joint being reduced.

This stud welding unit can only be used with the HBS stud welding guns

– C 06-3 (order no. 92-20-275 or 92-20-288) with ground cable 25 mm^2 (order no. 92-40-154) and

– CI 03 (order no. 92-20-254) with ground cable 16 mm^2 (order no. 92-40-091).

The intended use also implies observance of the stud welding gun operating manual and compliance with the intervals and conditions for inspection and maintenance of the stud welding unit and the components employed.

◆ Always check the operating manual of your stud welding gun whether it may be used with this stud welding unit.

The stud welding unit must be suitable for welding the welding elements in use.

Welding elements manufactured with the cold formed process have a flange and an ignition tip. During welding, the flange prevents the arc getting to the cylindric part of the welding element and increases simultaneously the welding area.

◆ **Please refer to the operating manual of your stud welding gun for detailed information on which welding elements may be used.**

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

7 Warranty

Please refer to the latest "General Terms and Conditions" for the scope of the warranty.

The warranty does not cover faults caused by e.g.

- Normal wear,
- Improper handling,
- Failure to observe the operating manual,
- Failure to observe the safety precautions,
- Use for other than the intended purpose, or
- Transport damage.

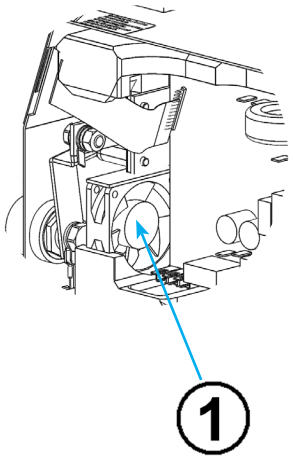
Warranty entitlement shall no longer be valid if modifications, changes or service and repair work is carried out by unauthorised persons or without the knowledge of the manufacturer. Invalidation of warranty entitlement shall also render the declaration of conformity invalid. The CE marking shall be declared invalid by the manufacturer.

We expressly point out that only spare parts and accessories or components approved by us may be used. The same applies likewise to installed units from our sub-suppliers.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

8 Components of the Stud Welding Unit

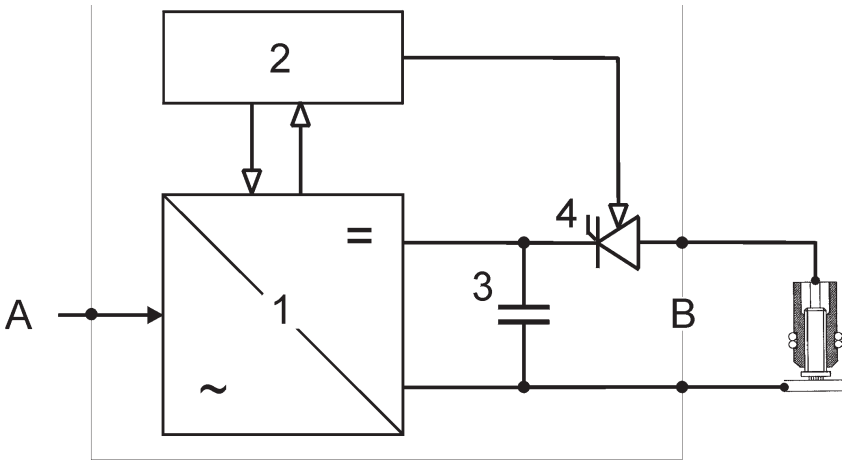
The CDi 502 is ideal for use on construction sites:



1 **Protection against internal soiling:**

- Internal fan
- Casing without ventilation slots to the outside

8.1 Main Assemblies



1- Charging device

2 - Control

3 - Welding capacitors

4 - Welding thyristor

A - Primary supply

B - Welding circuit

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

The mains alternating voltage is converted to direct voltage in the **charging device (1)**. Charging of the **welding capacitors (3)** is performed with the charging device and is fully adjustable. The welding capacitors store the energy required for the welding process. The quantity of energy is defined by the operator via the charging voltage.

The **welding thyristor (4)** releases the charging voltage.

The charging process and the welding process are controlled by the **control system (2)**.

The negative pole of the capacitor is connected to the welding gun. The positive pole is usually connected to the workpiece via vice grips.

The type plate is located on the backside of the stud welding unit.

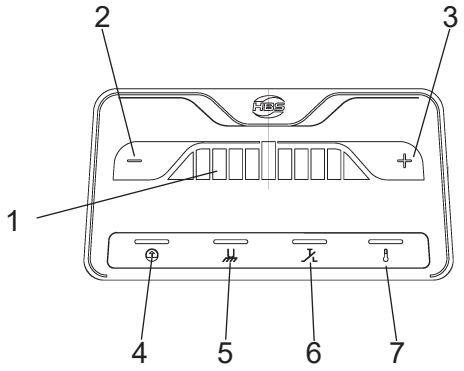
Type plate

The type plate contains the following information:

– Manufacturer
– Type
– Order No./Serial No.
– Primary voltage
– Fuse
– Power consumption
– Cooling class
– IP code
– Date

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

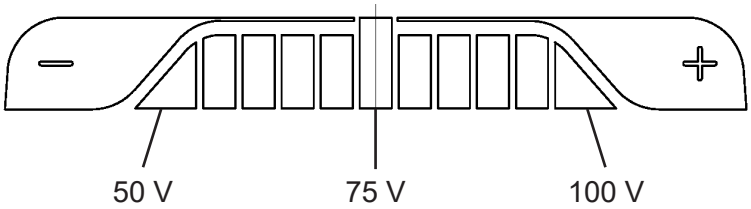
8.2 Operation Panel and Display



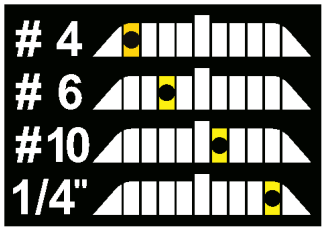
1 - Display for charging voltage
2 - Decrease
3 - Increase
4 - Ready
5 - Contact
6 - Trigger
7 - Temperature

The stud welding unit is switched on and off via the mains switch on the rear side.

The charging voltage is indicated on the LED in the **display (1)**:



A sticker on the top of the stud welding unit shows the recommended charging voltage:



#4: 55 V

#6: 65 V

#10: 80 V

1/4“: 95 V

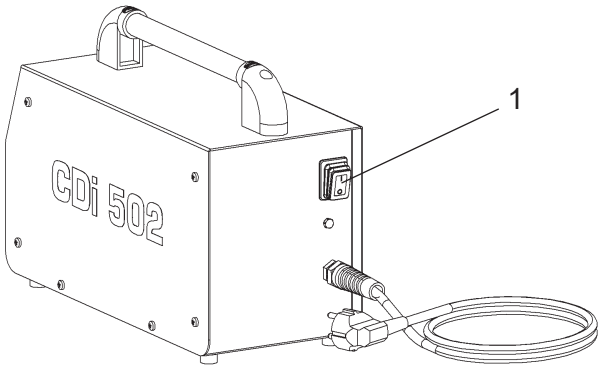
Use the pushbuttons (- **decrease (2)** - + **increase (3)**) to set the charging voltage of the capacitor battery.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

8.3 Indicator Lights

	Yellow	The set charging voltage of the capacitor battery. The charging voltage can be set in 5 V increments from 50 V to 100 V.
	Flashing yellow	The welding capacitors are charging.
	Constant yellow	The welding capacitors are charged.
	Yellow	There is electrical contact between the welding element and the workpiece.
	Yellow	The welding gun trigger is being actuated.
	Yellow	The stud welding unit has overheated. Allow the stud welding unit to cool down while switched on.

8.4 Mains Switch



1 - Mains switch

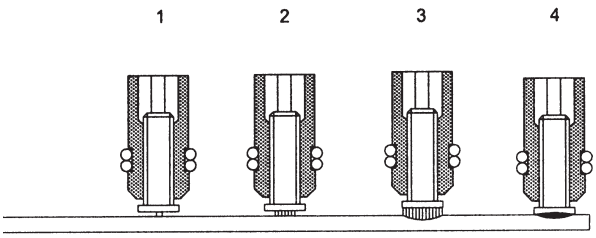
The switch for mains mode is located on the rear of the stud welding machine.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

9 Welding Process

Stud welding with tip ignition is divided into contact stud welding and gap stud welding. This stud welding unit may exclusively be used for contact stud welding and gap stud welding.

9.1 Contact Stud Welding

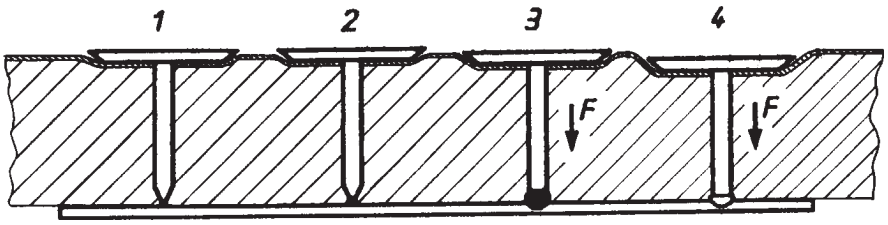


- The welding gun is placed onto the work piece (see figure, **position 1**). The welding element which projects above the welding gun support legs, is pushed back tensioning a pressure spring.
- After positioning the welding gun against the workpiece, the operator presses the welding gun trigger and starts the welding process; thus the current circuit is closed.
- The capacitors of the stud welding unit are discharged. Because of the high discharge current, the ignition tip evaporates explosion-like. The air gap between welding element and workpiece is ionized (see figure, **position 2**), an electric arc is produced.
- The electric arc melts the face of the welding element together with an area of the workpiece of about the same dimension (see figure, **position 3**).
- Caused by the pressure spring, the welding element moves to the workpiece with a speed of 0,5 to 1 m/s. The adjusted spring force controls the plunging speed of the welding element.
- Higher plunging speed leads to shortened arc time and consequently to lower welding energy with identical voltage setting.
- The electric arc is cut as soon as the welding element touches the workpiece.
- Now the capacitors are short-circuited and the rest of the energy drains off (see figure, **position 4**).
- The pressure spring continues to push the welding element into the weld pool.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

– The weld pool solidifies and the welding element is physically connected to the workpiece.
– The time period between ignition of the arc and solidification of the weld pool is about 3 ms.
– The use of contact welding for rapidly oxidising materials like aluminium and aluminium alloys is not recommended because the arcing period with contact welding is longer than with gap stud welding.

Contact stud welding - application for insulation



– The welding gun with the put-on welding element is placed onto the insulating mat and the welding element is pressed through the mat up to the workpiece (see figure, **position 1**). With ongoing pressure, the pressure spring is tensioned until its stop.
– Then the pressure to the welding gun and/or the workpiece is gently released in such a way that the welding piston of the welding gun lifts by approx. 2 to 5 mm. The tip of the welding element sufficiently remains under pressure and touches the workpiece. The current circuit is closed. The operator presses the welding gun trigger and starts the welding process.
– Capacitors of the stud welding unit are discharged.
– Caused by the high discharge current, the tip of the welding element evaporates explosionlike. In this way, a gap is developed between welding element and workpiece, an electric arc will be ignited.
– In the ionized gap, an electric arc ignites between welding element and workpiece (see figure, **position 2**).

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

– Heat is generated and melts the tip of the welding element together with an area of the workpiece of approx. the same size (see figure, **position 3**).
– As soon as the welding element touches the workpiece, the arc extinguishes (see figure, **position 4**).

☞ **With high plunging speed, the gap closes faster after evaporation of the ignition tip and welding time (arc burn time) is reduced.**

– Now capacitors are short-circuited and remaining energy is flowing off.
– The pressure spring continues to press the welding element into the weld pool.
– The weld pool solidifies and the welding element is firmly fixed to the workpiece.
– Time between ignition of the arc and solidification of the weld pool is about 3 ms.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

10 Preparing Workplace and Welding Process

Danger from fumes and airborne particulates

- Switch on the welding fume extractor at the workplace.
- Ensure that the room is well ventilated.
- Never weld in rooms with a ceiling height of less than 3 m.
- Observe furthermore your working instructions and the accident prevention regulations.

This will help to avoid health damage due to fumes and airborne particulates.

Danger from fire and explosion

- Remove all inflammable materials and liquids from your working area.
- Ensure that there are no explosive materials in your working area.
- Ensure that an approved fire extinguisher is available at the workplace.

Danger from tripping and falling

- Lay cables and connecting leads in such a way that they are protected against damage and
- that you or third parties cannot trip over them or fall.

Warning of weld spatter

- Ensure that there is no equipment or apparatus in the working area that could be damaged by weld spatter.
- Remove if necessary.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Warning of electromagnetic fields

- Ensure that there is no equipment or apparatus in the working area that could be damaged by magnetic fields.
- Remove if necessary.

Danger!

- Ensure that there is a free circulation of air through the housing of the stud welding unit.
- Always place the stud welding unit on a stable, level and clean surface.
- Check the condition of all cables and cable connections.
- Have defective cables or their connections immediately repaired or replaced by a qualified electrician.

10.1 Preparing Surfaces

- Remove
  - Paint, oil and other impurities,
  - Rust,
  - Non-conductive coatings (of surface-coated materials)

from the welding surface and the contact points of the ground clamps.

This ensures a high strength of the welded joints.

- **Weld the welding element only to a flat surface.**
- Ask your application consultant at HBS about welded joints on tubes and riffle plates (*see page 2*).

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

10.2 Checking the Stud Welding Gun

- Always check the operating manual of your stud welding gun to see whether it may be used with this stud welding unit.

This stud welding unit can only be used with the HBS stud welding guns C 06-3 (order no. 92-20-275 or 92-20-288) and CI 03 (order no. 92-20-254).

- Check the chuck of your stud welding gun for proper fit and ensure it is tightened.
- Check the bellows of your stud welding gun for damage.

- **Refer here to the operating manual of your stud welding gun.**

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

11 Connection

- **First prepare your workplace.**
- Read and observe here *point 10 "Preparing Workplace and Welding Process"*.

Electric shock hazard

- Leave the stud welding unit switched off during connection of the connecting leads.

In this way you can avoid any unintentional starting of the welding process.

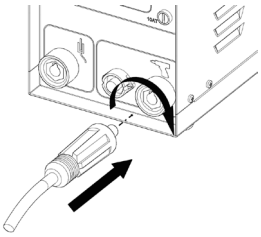
- **Secure the cables.**

Strong magnetic fields are generated during the welding process that can lead to whipping of the cables. This can cause the cables to come out of the plug sockets.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

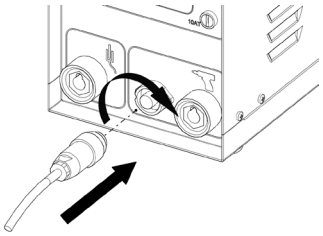
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

11.1 Connecting the Welding Gun to the Stud Welding Unit



Connect the welding current cable

- Only now plug the welding current cable into the corresponding socket of the stud welding unit.
- Press in the plug and turn it firmly clockwise (to the right).



Connect the control cable

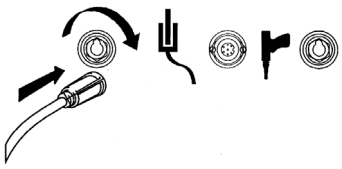
- Plug the control cable into the corresponding socket of the stud welding unit.
- Twist the retaining nut of the control cable connector clockwise.

Only loosely made connections will result in damage to the plug connectors.

- Therefore always check that the plug connector is firmly inserted.

This prevents a poor contact and hence overheating of the plug connectors.

11.2 Connecting the Ground Cable



Connect the ground cable

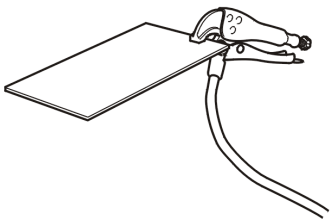
- Plug the ground cable into the corresponding socket of the stud welding unit.
- Press in the plug and turn it firmly clockwise (to the right).

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Only loosely made connections will result in damage to the plug connectors.

- Therefore always check that the plug connector is firmly inserted.

This prevents a poor contact and hence overheating of the plug connectors.



Connect the ground clamp

- Remove rust, paint and dirt from the points on the workpiece to which you wish to connect the ground clamp.
- Attach the ground clamp to the workpiece as tightly as possible.

11.3 Connecting the Stud Welding Unit to the Mains Supply

Electric shock hazard

- Have an electrician check whether the plug socket to which you intended to connect the stud welding unit is correctly earthed.
- Connect the stud welding unit only to a mains supply with the same mains voltage as that indicated on the type plate.
- Compare the current consumption indicated on the type plate with the fuse of your mains power supply.
- Check that the stud welding unit is switched off.
- Only now insert the plug into the plug socket.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

12 Welding

◆ **First connect up the stud welding unit.**

◆ Read and observe here *point 11 „Connection“*.

Life-threatening danger for wearers of active implanted cardiac devices

Danger for workers at particular risk within the meaning of the EMF directive

Persons at particular risk within the meaning of the EMF directive are:

– Workers with active implanted medical devices

– Workers with passive implanted medical devices that contain metal

– Workers with medical devices worn on the body

– Pregnant workers.

◆ Never operate the stud welding machine if you are among the group of workers at particular risk within the meaning of the EMF directive.

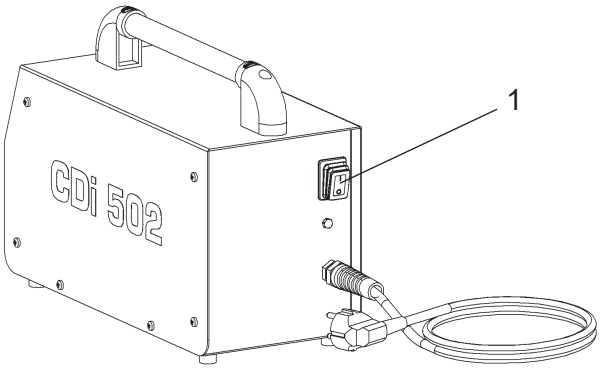
◆ In this case, never remain in the vicinity of the stud welding machine during welding.

◆ Never operate the stud welding machine if persons are located nearby who are among the group of workers at particular risk within the meaning of the EMF directive.

Strong electromagnetic fields are produced in the vicinity of the stud welding machine during welding. These fields can adversely affect the function of medical devices as well as the course of a pregnancy.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

12.1 Switching on the Stud Welding Unit



1 - Mains switch

◆ Only now switch on the stud welding unit at the **mains switch (1)**.

12.2 Determining the Charging Voltage

The setting of the charging voltage on the stud welding unit via the [-] and [+] push-buttons is dependent on, among other things

– The welding gun used,

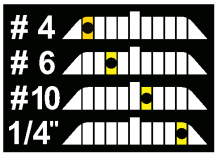
– The material of the welding element,

– The diameter of the welding element,

– The material of the workpiece.

◆ Determine the charging voltage to be set at the stud welding unit using the following tables.

◆ Observe the HBS recommendations for charging voltage:



#4: 55 V
#6: 65 V
#10: 80 V
1/4“: 95 V

☞ **The figures in these table are indicative values and must be checked by means of a test welding on the original material with the same properties as the original workpiece.**

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Determining the charging voltage for welding gun C 06-3

for CD welding elements

Material of welding elements	Diameter of welding elements				Charging voltage [1] CDi 502 in V
	metric		imperial (US)		
	PT, UT	IT	PT, UT	IT	
Material of workpiece: Mild steel (suitable for welding)					
4.8 (suitable for welding)	M3, 3 mm	--	1/8“, #4	--	55
4.8 (suitable for welding)	M4, 4 mm	--	5/32“, #6	--	65
4.8 (suitable for welding)	M5, 5 mm	5 mm, M3	3/16“, #10	--	80
4.8 (suitable for welding)	M6, 6 mm	6 mm, M4	1/4“	1/4”, #8-32	95
Material of workpiece: Alloyed steel (suitable for welding)					
A2-50	M3, 3 mm	--	1/8“, #4	--	55
A2-50	M4, 4 mm	--	5/32“, #6	--	65
A2-50	M5, 5 mm	5 mm, M3	3/16“, #10	--	80
A2-50	M6, 6 mm	6 mm, M4	1/4“	1/4”, #8-32	95
Material of workpiece: Aluminium					
AlMg3	M3, 3 mm	--	1/8“, #4	--	55
AlMg3	M4, 4 mm	--	5/32“, #6	--	65

for CD ISO Nails

Material of welding elements	Diameter of welding elements		Charging voltage [1] CDi 502 in V
	metric	imperial (US)	
	CD ISO Nails		
Material of workpiece: Galvanised steel (suitable for welding)			
4.8 (suitable for welding)	2	14 ga	70
4.8 (suitable for welding)	3	#4	90
Material of workpiece: Alloyed steel (suitable for welding)			
A2-50	2	14 ga	70
A2-50	3	#4	90

[1] to be checked by test welds

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Determining the charging voltage for welding gun CI 03
for cupped head pins

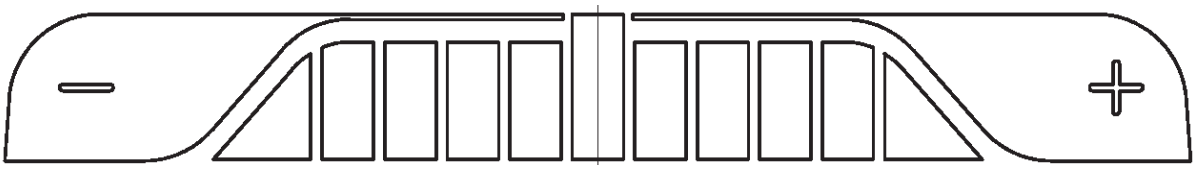
Material of welding elements	Diameter cupped head pin		Charging voltage [1] CDi 502 in V
	metric in mm	imperial (US)	
Material of workpiece: Mild steel (suitable for welding) / Galvanised steel (suitable for welding)			
4.8 (suitable for welding)	2	14 ga	70
4.8 (suitable for welding)	2.7	12 ga	85
Material of workpiece: Alloyed steel (suitable for welding)			
A2-50	2	14 ga	70
A2-50	2.7	12 ga	85

[1] to be checked by test welds

12.3 Setting the Charging Voltage

- **First determine the necessary charging voltage.**
- Read and observe here *point 12.2 "Determining the charging voltage"*.
- Now first set the required charging voltage with the + and - pushbuttons.

Voltage values of the LED



50	55	60	65	70	75	80	85	90	95	100
CDi 502 charging voltage display in volts										

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

12.4 Performing the Welding Process

- **First set the necessary charging voltage.**
- Read and observe here *Point 12.3 "Setting the Charging Voltage"*.

Electric shock and light arc hazard

- Never touch the welding elements, chuck, retaining nut or electrically conductive parts in their vicinity during the welding process.

These parts are live.

- Never wear metal jewellery, even a wristwatch, on your body during the welding process.

This will help to avoid injuries and damage due to electric power or electromagnetic fields.

Electric shock and light arc hazard

- Stand on an insulated mat if you have to weld under the following conditions:
  - In confined spaces with electrically conductive walls
  - Under cramped conditions between or against electrically conductive parts
  - Where there is limited mobility on electrically conductive parts
  - In damp, wet or hot rooms.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Danger of deflagration of explosive gases and substances

- Never weld in rooms with an explosion hazard.
- Never weld on vessels containing or that have contained substances
  - which are inflammable or promote combustion,
  - which may create health-endangering gases, fumes or airborne particulates,
  - or which could cause explosions.

Such work may only be carried out by welding specialists.

- Do not carry out such work if you have not been specially trained for it.

Risk of fire and burns due to glowing weld spatter

- Wear your personal protective equipment and
- your safety goggles with sight glass of protection class 2.
- Wear a protective helmet when welding over head.
- Remove all inflammable materials and liquids from the vicinity of the place of work before starting welding.
- Ensure that an approved fire extinguisher is available at the place of work.
- Observe furthermore your working instructions and the accident prevention regulations.

Glowing hot weld and liquid spatter occur during welding.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Danger due to noise

- Wear your ear protection during welding.
- Observe furthermore your working instructions and the accident preventi-on regulations.
- Inform colleagues working in the immediate vicinity accordingly before starting work.

A > 90 dB (A) bang can occur during the welding process.

- Ensure that the welding gun has been prepared in accordance with the corresponding operating manual.

- Check whether a welding element has been inserted into the welding gun.
- Insert a welding element, if necessary.

- Place the welding gun perpendicularly onto the workpiece as soon as the stud welding unit is ready for the welding process.
- Press the welding gun firmly with both hands against the workpiece until the welding gun attachment (spacer) is resting uniformly on the workpie-ce.
- Hold the welding gun firmly, steady and straight.
- Ensure that you do not touch any metal parts of the welding gun.
- Only now should you press the button of the welding gun.

The welding process is started.

- **Always pull the welding gun perpendicularly away from the welding element after the welding process**.

If you pull the welding gun away at an angle, you will strain the chuck and shorten its service life.

Risk of burns

The gun head becomes very hot during the welding process. The same applies to the welded element and the workpiece.

- Wear your proper protective clothing.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

- **Use only welding elements of one batch.**
- Pay strict attention not to mix welding elements from different batches.
- Carry out test welds again after a batch change.

Even the slightest changes to the geometry, in particular to the tip of the welding elements require different settings for the welding process.

- Now check the quality of the welded joint before inserting a new welding element and repeating the welding process.
- Work in accordance with the following *point 13*.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

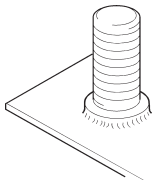
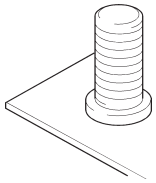
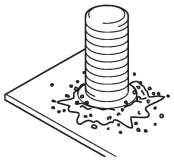
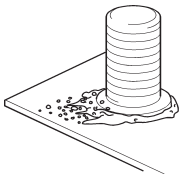
13 Checking the Quality of the Weld

You can check the quality of the weld by means of a visual inspection and a bending test.

The number and type or method of the tests to be performed and the acceptance criteria are defined in respective standards for quality demands.

13.1 Carrying out Visual Inspection

◆ Carry out a visual inspection on all welding elements.

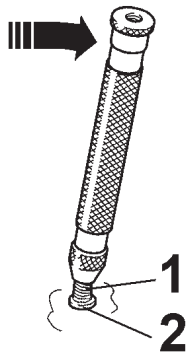
Visual Inspection			
Condition		Possible cause	Corrective actions
	Good welded joint Low spatters around the weld without outer flaws The weld pool forms a collar around the flange of about 1 - 1.5 mm	Correct parameters	none
	Gap between flange and workpiece	Weld energy too low Plunging speed too low Insufficient support of parent material	Increase weld energy Correct plunging speed Provide support
	Many spatters around the weld	Weld energy too high Insufficient plunging speed	Reduce weld energy Increase plunging speed
	One-sided weld pool One-sided spatter collar Weld pool came out on one side	Effect of arc blow Unsymmetric ground connection Welding gun put at an angle	Take care for symmetrical ground connection Put welding gun vertically to the workpiece

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

13.2 Carrying out Bending Test

You can purchase from HBS a bending device with inserts for various diameters of the welding elements.

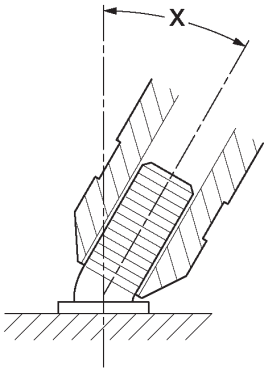
The bending test serves as an easy work sample and as a check for the selected welding parameters. The welded joint is stressed by bending in a non-defined way.



1 - Welding element

2 - Welded joint

◆ Place the bending device on the **welding element (1)** and



◆ bend the **welding element (1)** with the bending device once by 30° in any direction.

The bending test is passed if a crack or a fracture of the welded zone does not occur.

☞

◆ **Further tests should be conducted if the connection fails in the weld area.**

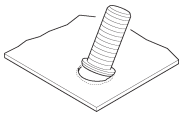
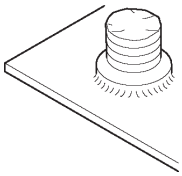
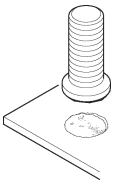
◆ In this case, **bend** the welding element exactly in the opposite direction by 30° towards the failing seam.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

◆ You don’t need to test all studs.

It is sufficient to carry out stud tests on several production samples that are picked at random.

Bending Test			
Type of fracture		Possible cause	Corrective actions
	Base material buckling	Correct parameters	none
	Fracture in welding element above flange	Correct parameters	none
	Fracture in the weld metal	Weld energy too low Plunging speed too low Unsuitable stud/base material combination	Increase weld energy Increase plunging speed Replace welding element or workpiece

If the strength of the joint is inadequate, then:

◆ check the setting of the stud welding unit.

◆ check whether the surface of welding element and base material are clean and electrically conductive.

They must be free from scale, oil, paint, oxide layers.

◆ Grind off hardened workpiece surfaces (e.g. roll hardening).

◆ Check the piston of the welding gun for ease of movement.

13.3 Optimisation of Welding Parameters

◆ **As first step, conduct the tests outlined under points 13.1 and 13.2.**

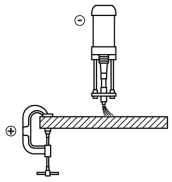
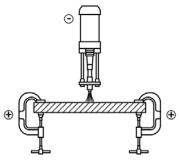
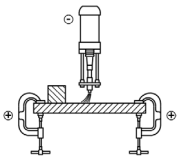
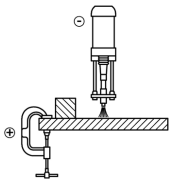
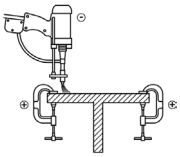
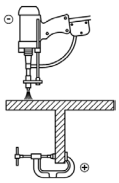
◆ As second step optimise the welding parameters of your stud welding unit.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

13.4 Blowing Effect and Remedies

With asymmetric ground connections, different material distributions or when welding at the edge of a workpiece a "blowing effect" can occur. This is an undesirable deflection of the electric arc. This results in uneven melting of the stud material, in increased poring and undercuts in the welding area.

The blowing effect is proportional to the current amperage and can be influenced by symmetrical connection of the ground terminals, by connecting compensating grounds or (on welding guns with external welding cable) by turning the welding gun about its vertical axis.

Blowing effect	
Cause	Remedy
	
	
	

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

14 Troubleshooting

Danger from insufficiently qualified operating personnel

- Carry out only the work described here on your stud welding unit or stud welding gun.
- Repairs may only be carried out by appropriately qualified personnel.
- Inform your dealer or your maintenance department.

Fault	Possible cause	Fault localisation	Fault remedy	Performance
The mains control lights in the mains switch do not illuminate	Mains connection socket defective	Check mains connection socket*)	Replace mains connection socket*)	Qualified specialists
	Interruption in mains cable	Check mains cable*)	Replace mains cable*)	Qualified specialists
No LED indicator on the front side	Line interruption	Check lines*)	Replace lines*)	Qualified specialists
No display	No ground connection	Check ground connection at the workpiece	Properly secure the ground connection	Trained personnel
	Stud welding gun not connected	Check gun connection	Connect the stud welding gun correctly	Trained personnel
	Contact resistance (between studs and workpiece) too high	Check workpiece surface	Clean or sand down workpiece surface	Trained personnel
	Cable breakage - ground	Check ground cable*)	Replace ground cable*)	Qualified specialists
	Cable breakage at stud welding gun	Check welding gun cable*)	Replace welding gun cable*)	Qualified specialists
No display	Fault in connecting line of the stud welding gun	Check function of the connecting line*)	Replace connecting line*)	Qualified specialists
	Welding-gun start button defective	Check control cable for continuity with the push-button pressed*)	Replace welding-gun start button*)	Qualified specialists
	Cable breakage in the control line	Check control cable for continuity*)	Replace control cable*)	Qualified specialists
LED illuminates yellow	Stud welding unit overheated	---	Allow stud welding unit to cool down while switched on	Trained personnel
LED fast flashing	Thyristor is defective	---	Switch the welding unit off and on again	Trained personnel

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Work marked with *) may only be carried out by qualified electricians!

- Please contact our Service department if none of the measures described remedies the situation.
- Please use the form „Service & Support“ in the annex to send in the stud welding unit.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

15 Shutting Down

- Switch off the stud welding unit.
- Pull out the mains plug.
- Disconnect the control cable and welding cables from the stud welding unit.
- Protect the stud welding unit and its components against the ingress of liquids and foreign matter.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

16 Maintenance and Care

Electric shock hazard

- Always switch off the stud welding unit before starting maintenance and care work.
- Pull out the mains plug.

Danger from insufficiently qualified operating personnel

- Carry out only the work described here on your stud welding unit.
- Repairs may only be carried out by appropriately qualified personnel.
- Inform your dealer or your maintenance department.

16.1 Cleaning

- Clean the surface of the stud welding unit with a slightly damp cloth, when necessary.
- Add a little household detergent to the cleaning water.

- **Do not use solvents for cleaning.**

These can damage the surface of your stud welding unit.

The inside of the stud welding unit must be cleaned at least every three months.

- Inform your dealer or your maintenance department.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

16.2 Inspection and Tests

- **Inspect the condition of the mains cable.**
- Inform your dealer or maintenance department if you discover any damage.

- Check whether the readings on the display of the stud welding unit are still legible before starting work.
- Clean display and control panel in the event of soiling.

- Replace any removed or damaged signs:

Before opening machine disconnect mains

Observe the operating manual

Warning of electric shock hazard

We recommend that the stud welding unit be subjected to an annual periodic inspection in compliance with the standard IEC 60974-4 “Periodic inspection and testing”.

Please contact your customer advisor for further information.

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturers

17 Storage

- Store the stud welding unit in a safe and dust-free location when not in use.
- Protect the stud welding unit from moisture and metallic contamination.

- Store the stud welding unit only under the following ambient conditions.

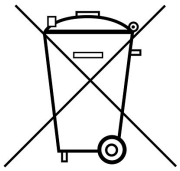
Storage temperature:

23 °F to 122 °F (-5 °C to +50 °C)

Relative humidity:

0 % - 50 % at 104 °F (+40 °C)
0 % - 90 % at 68 °F (+20 °C)

18 Disposal



- Dispose of the stud welding unit only via the manufacturer or a specialist disposal company.
- Never dispose of the stud welding unit in the domestic refuse.

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Service & Support

With the return please attach a copy of the filled out form together with the repair number given by HBS! Repairs without repair number will not be processed.

Repair number
(given by HBS)

_____

Company: _____
Name / Surname: _____
Street: _____
City, State and ZIP/Postcode: _____
Country: _____
Phone & Fax: _____
E-mail address: _____

Stud welding unit / stud welding gun type of model: _____
Serial number: _____
Date of purchase: _____
Purchased at distributor: _____

Detailed descriptions of errors: _____

Service & Support may be done up to the value of EUR _____ without quotation: ☐ Yes ☐ No

Could you find any damage / burn marks

on the cables: ☐ Yes ☐ No

on chucks: ☐ Yes ☐ No

Are all plug and screw connections tightly fastened *: ☐ Yes ☐ No

Are there any burn marks on plug or screw connections: ☐ Yes ☐ No

Is there any other visual damage (e.g. cracks, dents): ☐ Yes ☐ No

Have you checked the fuses: ☐ Yes ☐ No

Default on the display of the stud welding unit:

ARC / IT					CD / CDM / SC					
○	⊗				●		⊗			**

Which LED´s are illuminated (please mark with a cross)?

Please e-mail or fax this form to service@hbs-info.de or fax: +49 8131 511-100.
In case a repair is necessary a repair number will be given!

* See also operating manual chapter „Connection“
** Doesn´t light when using a contact welding gun

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

Index

A
accessories 14
airborne particulates 7, 25
automatic welding head. 12

B
bang. 8, 37
basic configuration. 13
batch 38
bending device with inserts 40
bending test. 40
blowing effect. 42

C
capacitor 12, 22
charging device 18
charging voltage . . . . . , 20, 33
checking the quality. 39
cleaning 46
clothing, non-flammable 8
contact stud welding 22, 23
control 18
control cable 29

D
damage to the plug connectors 29, 30
danger from incorrect use 6
disposal 48

E
ear protection. 10
electrical hazards. 10
electric arc 12
electromagnetic fields 10
EMF directive, safety notices. 9

F
fire extinguisher 8, 36
fire extinguisher, approved 25
fire hazard 8
form „Service & Support“. 44, 49
full-ear hearing protection 8
fumes, harmful to health 7, 25
fuse 30

G
gap stud welding 23
glossary 12
goggles with visor 8
ground cable 29

H
hazards for the machine 10
hazards for the operator 10
heart pacemaker 7, 10, 31
helmet 8

I
ignition tip 22
indicator lights 21
intended use 16, 27

L
liquids, inflammable. 25

M
main assemblies 18
mains power supply. 30
mains switch 21, 32
mains voltage 30
maintenance and care. 46
maintenance and care, regular 46
materials, inflammable. 25
materials, rapidly oxidizing 23

O
operating manual. 13
operation panel and display. 20

P
plunging speed 22
protective apron. 8
protective equipment 8
protective equipment, personal 10
protective gloves 8

R
rectifier. 12
risk of burns 36
risk of falling. 25
risk of fire 36
risk of tripping 25

S
safety goggles 10
safety goggles with sight glass 8
safety precautions 6

©HBS Bolzenschweiss-Systeme GmbH & Co. KG

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

scope of supply 13
setting the charging voltage. 32, 34
shutting down 45
spacer 37
storage. 48
storage temperature 48
stud feeder. 12
stud welding gun 12, 14
stud welding system 12
stud welding unit 12
substances, explosive 25
surface of base material 41
surface of welding element 41
switching on the stud welding unit. 32
symbols used. 10

T

test welding 32
troubleshooting 43
type plate. 19, 30

V

vessels, welding work on. 36
visual inspection 39

W

warranty entitlement 17
welding capacitors. 18
welding current cable. 29
welding element. 12
welding energy 22
welding gun attachment. 37
welding parameters 12
welding process. 22
welding thyristor. 18
workpiece 12

All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

©HBS Bolzenschweiss-Systeme GmbH & Co. KG
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

HBS Bolzenschweiss-Systeme GmbH & Co. KG
Felix-Wankel-Strasse 18 • 85221 DACHAU • GERMANY
Phone +49 8131 511-0 • Fax +49 8131 511-100 • E-mail international@hbs-info.com

www.hbs-info.com