# IT 1002

Stud Welding Unit

Ceramic/Gas/Automatic/Process Control
93-60-1206

HBS EFFICIENT TECHNOLOGY

# Operating Manual

2025

**After-sales service for Germany:**

**HBS Welding Systems GmbH**
**Felix-Wankel-Strasse 18**
**85221 Dachau**
**GERMANY**

**Phone** **+49 8131 511-0**
**E-mail** **sales@hbswelding.systems**
**Web** **www.hbswelding.systems**

**IT 1002 Operating Manual Issue 2025-04 Order No. E-BA 93-60-1206**

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 Welding Systems GmbH**

Dear Customer,

Many thanks for buying a stud welding machine from HBS Welding Systems.

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 Welding Systems GmbH

Felix-Wankel-Strasse 18

85221 Dachau

GERMANY



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

©HBS Welding Systems GmbH

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

# Table of Contents


**1 Important Safety Precautions ..... 8**

**2 Symbols and Terms Used ..... 12**

**3 Scope of Supply ..... 15**

**4 Accessories ..... 15**

**5 Technical Data ..... 16**

**6 Intended Use ..... 17**

**7 Warranty ..... 18**

**8 Components of the Stud Welding Unit ..... 19**

8.1 Main Assemblies ..... 19
8.2 Control Panel and Display ..... 21

**9 Welding Process ..... 24**

Drawn-Arc Stud Welding ..... 24
MARC - Welding with magnetically impelled electric arc ..... 30

**10 Preparing Workplace and Welding Process ..... 34**

10.1 Preparing Surfaces ..... 35
10.2 Checking the Welding Gun ..... 36
10.3 Checking the Stud Welding Head ..... 36
10.4 Checking the Automatic Stud Feeder ..... 37

**11 Connection ..... 38**

11.1 Connecting the Welding Gun to the Stud Welding Unit ..... 39
11.2 Connecting the Welding Head to the Stud Welding Unit ..... 39
11.3 Connecting the Fully Automatic Stud Feeder to the Stud Welding Unit ..... 40
11.4 Shielding Gas Connection ..... 40




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

11.5 Connecting the Compressed Air Connection for Automatic Stud Feeding ..... 42
11.6 Connecting the Ground Cable ..... 44
11.7 Connecting the Stud Welding Unit to the Mains Supply ..... 45
11.8 Integrate the Stud Welding Unit into a CNC System ..... 46
11.8.1 External Welding Start ..... 48
11.8.2 Contact ..... 49
11.8.3 OK/ERR ..... 50

**12 Welding ..... 51**

12.1 Switching on the Stud Welding Unit ..... 52
12.2 Determining the Welding Time and the Welding Current ..... 52
12.3 Checking Shielding Gas Flow Rate ..... 64
12.4 Possible Settings ..... 65
12.4.1 Setting the Welding Parameters ..... 65
Adjusting the Welding Time ..... 65
Adjusting the Welding Current ..... 66
Adjusting the Gas Pre-Flow Time ..... 66
Adjusting the Stud Feeding Time (Blow Time) ..... 67
12.4.2 Library Mode ..... 67
12.4.3 Electrode Mode ..... 68
12.4.4 Adjusting the Controls ..... 69
12.4.5 Adjusting the Date ..... 74
12.4.6 Adjusting the Time ..... 74
12.4.7 Adjusting the Language ..... 75
12.5 Performing the Welding Process ..... 76

**13 Checking the Quality of the Weld ..... 80**

13.1 Quality Check - Drawn-Arc Stud Welding ..... 80
13.1.1 Carrying Out Visual Inspection ..... 80
13.1.2 Carrying out Bending Test ..... 82
13.2 Quality Check - MARC Welding Procedure ..... 84
13.2.1 Carrying Out Visual Inspection ..... 84
13.2.2 Performing Torque Test ..... 85
13.2.3 Welding Seam Errors during MARC Welding Procedure ..... 86
13.3 Optimisation of Welding Parameters ..... 86
13.4 Blowing Effect and Remedies ..... 87
13.5 Analysis of Parameters via RS 232 Interface CP ..... 88

**14 Troubleshooting ..... 95**


©HBS Welding Systems GmbH
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

**15 Shutting Down ..... 97**

**16 Maintenance and Care ..... 98**

16.1 Cleaning ..... 98

16.2 Inspection and Tests ..... 99

**17 Storage ..... 100**

**18 Disposal ..... 100**

**EC Declaration of Conformity ..... 101**

**Service & Support ..... 102**

**Index ..... 103**



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 Welding Systems GmbH

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 Welding Systems GmbH

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 Welding Systems GmbH

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 Welding Systems GmbH

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 |

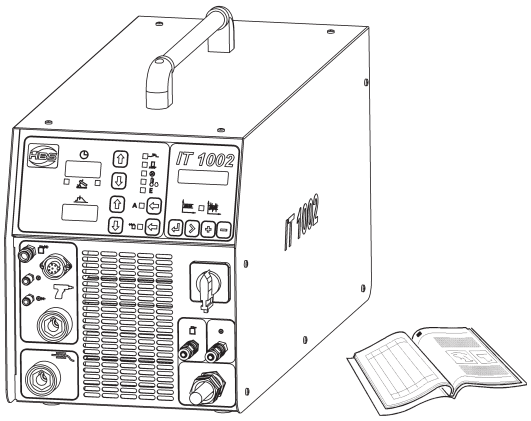

©HBS Welding Systems GmbH

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 | IT 1002 | 93-60-1206 |
| 1 | Operating manual | IT 1002 | E-BA 93-60-1206 |




- 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).

# 4 Accessories

The following **accessories** are available:

| No. of pieces | Part | Type | Order No. |
|---|---|---|---|
| 1 | Ground cable for | 5 m, 25 mm² | 93-40-020 |
| 1 | Shielding gas connecting hose | | 88-27-696 |


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

# 5 Technical Data

**Stud welding unit IT 1002**

– for ARC stud welding

– for MARC welding with magnetically impelled electric arc

according to current standards

| | |
|---|---|
| Gas/Automation/Process control | Series/Series/Series |
| Welding range | Studs dia. 2 to 14 mm, M3 to M16 (Type RD),<br>Sleeves and MARC welding nuts type Hex$^{Nut}$<br>M6 to M12 |
| Welding material | Studs: Mild steel, stainless steel, aluminium<br>Sleeves and MARC welding nuts type Hex$^{Nut}$:<br>Mild steel, stainless steel |
| Welding rate | Stud welding: M12 = 25 studs/min<br>Nut welding [1]: Welding nuts type Hex$^{Nut}$<br>M12 = 4 sleeves/min |
| Welding current | 1 000 A |
| Current adjustment range | 100 to 1 000 A<br>Electrode: 50 to 400 A (stepless) |
| Welding time | 5 to 1 000 ms (stepless) |
| Primary power | 400 V, 3 phases, 50/60 Hz, 35 AT<br>(alternative input voltages available) |
| Primary plug | 32 A (400 V mains) |
| Connected load | 50 kVA (400 V mains) |
| Cooling type | F (temperature controlled cooling fan) |
| IP Code | IP 23 (also permits operation outdoors) |
| Ambient temperature limits | 0 °C to 40 °C |
| Dimension L x W x H | 660 x 280 x 340 mm (without handle) |
| Weight | 31 kg |

[1] The maximum welding rate is limited by a variety of parameters.


©HBS Welding Systems GmbH

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:

– for drawn arc stud welding with the welding guns A 12, A 12-FL, A 16 and CA 08, the automatic welding gun PAH-1, the welding heads KAH 412 and KAH 412 LA as well as the automatic stud feeder VBZ-3 or

– for MARC welding with magnetically impelled electric arc with the welding gun A 12 M.

The intended use also implies observance of the operating manual of the component used 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.**



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.

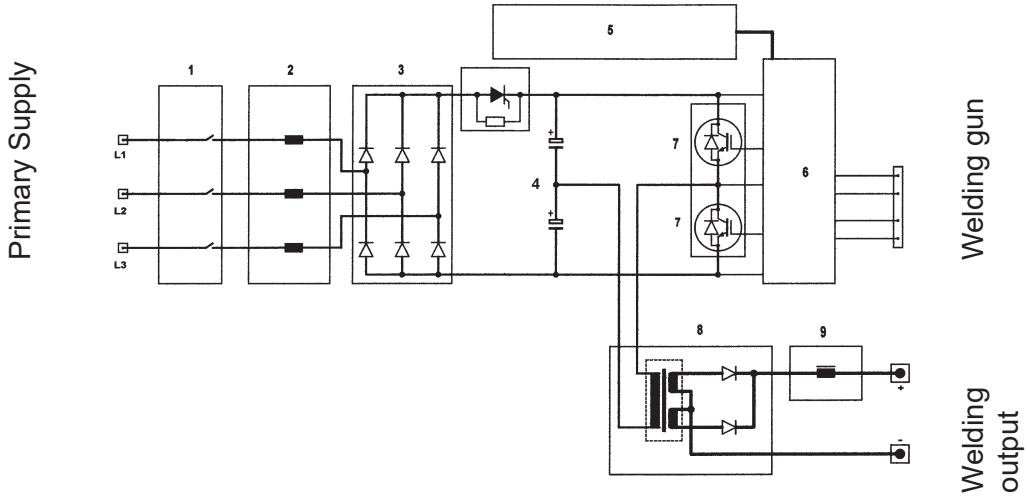
We expressly point out that only spare parts and accessories or components approved by us may be used. The same applies likewise to installed units from our sub-suppliers.


©HBS Welding Systems GmbH

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

# 8 Components of the Stud Welding Unit

## 8.1 Main Assemblies




1 - Mains switch
2 - EMC-filter
3 - Bridge rectifier
4 - Electrolytic capacitors
5 - Control unit
6 - Control unit
7 - IGBT switch
8 - Middle-frequency transformer with diodes
9 - Welding current stabilizer

After passing the **mains switch (1)** and the **EMC-filter (2)**, the mains alternating current is converted in the **bridge rectifier (3)**.

The rectified voltage is smoothed by the **electrolytic capacitors (4)** and transferred to the **IGBT switches (7)**. These switches convert the direct current into a high-frequency alternating current of 30 kHz.

The energy is transferred via the middle-frequency transformer with **diodes (8)** and rectified.

The **stabilizer (9)** smoothes the current and passes it on to the welding sleeves.

Control of the **IGBT switches (7)** is carried out by the **control unit (6).**



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

The **control unit (5)** synchronises the mechanical sequence (lifting the welding element) with the electronic control (ignition of pilot arc, ignition of main arc, sequence of welding time).

**Welding with shielding gas/forming gas**

During the welding processes, the stud welding unit automatically regulates the timing of the gas flow.

Welding time and welding current are steplessly adjustable.

**Type plate**

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

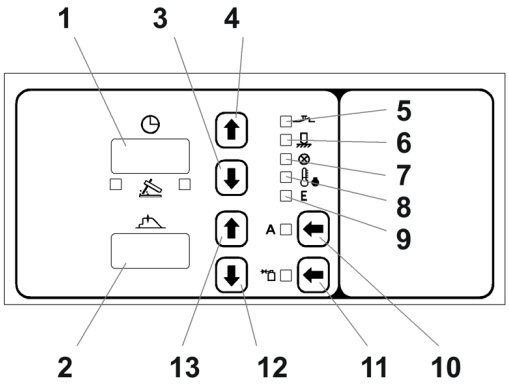
The type plate contains the following information:

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


©HBS Welding Systems GmbH

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

## 8.2 Control Panel and Display




1 - Welding time
2 - Welding current
3 - Shorter
4 - Longer
5 - Trigger
6 - Contact
7 - Locked
8 - Temperature
9 - Error (fault)
10 - Automation
11 - Shielding gas
12 - Lower
13 - Higher

The condition of the welding unit is monitored after switching-on.

After self-test, the digital displays show the last set **welding time (1)** and **welding current (2)**.



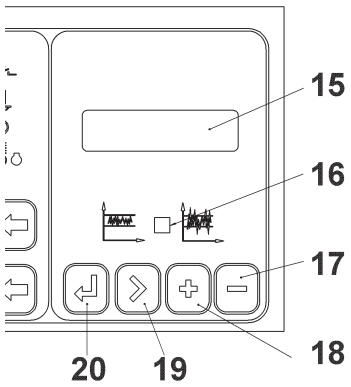
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

To the right of the displays (1) and (2) are light-emitting diodes (LED) with the following meanings:

| | | |
|---|---|---|
| | Yellow | Lights up when the welding gun button is triggered |
| | Yellow | Lights up when electrical contact exists between the welding element and the workpiece. |
| | Red | The stud welding unit is locked<br>– After welding as long as there is electrical contact with the workpiece. |
| | Green | The stud welding unit is ready for welding. |
| | Red | The stud welding unit is locked<br>– if the stud welding unit is overheated.<br>(8888 appears on the display and LED E lights up).<br>After a short cooling period, the work can be continued. |
| E | Red | The stud welding unit is locked<br>– if the stud welding unit is overheated.<br>– if there is a malfunction of the power element. |
| A | Green | Lights, automatic mode is switched on. |
| | Green | Lights, shielding gas is switched on. |


©HBS Welding Systems GmbH
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

The **LCD display (15)** show the last set values:




| | | | | |
|---|---|---|---|---|
| 15 | - LCD Display | | | |
| 16 | - LED | green | = | value inside of adjusted tolerance range |
| | | red | = | value out of adjusted tolerance range |
| 17 | - Minus key | | | |
| 18 | - Plus key | | | |
| 19 | - Arrow key | | | |
| 20 | - Enter key | | | |

**LCD Display**

2 x 16 characters, height 5 mm

with background illumination

**Keys**

| | | |
|---|---|---|
| ↵ | ENTER | Confirmation of selected function |
| > | ARROW | Marks the selected program item |
| + | PLUS | Increases the selected value |
| - | MINUS | Decreases the selected value |

**LED**

If you are working with process sequence control (PAF [1)]), then the LED's inform whether the output voltage value is inside the tolerance range of the reference or not.

| | |
|---|---|
| Green | value inside of adjusted tolerance range |
| Red | value out of adjusted tolerance range |

[1)] PAF = Process Analysis Factor



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

# 9 Welding Process

Stud welding with a drawn arc process is divided into drawn-arc stud welding with ceramic ferrule and drawn-arc stud welding with shielding gas. This stud welding unit must be used exclusively for stud welding with drawn arc.

The face of a stud-shaped welding element and the opposite surface of the workpiece are molten by an arc. Stud welding is suitable for the welding of joining elements across the entire cross-section, mainly using pin-shaped metallic welding elements with metallic workpieces.

The various processes of arc stud welding are distinguished by:

– The method of weld pool protection (shielding gas - SG, ceramic ferrule - CF or no protection - NP)
– The length of welding time (standard ARC or short-cycle drawn-arc stud welding - SC)
– The energy source (welding rectifier supplied by mains, inverter, capacitor battery).

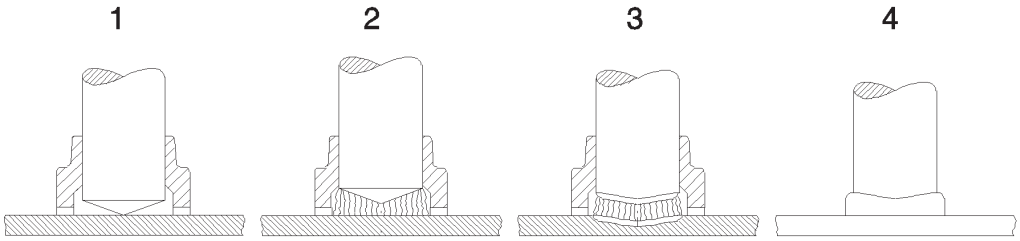
## Drawn-Arc Stud Welding

The HBS stud welding unit operates by process of ‘arc stud welding with drawn-arc ignition’ according to the current standards. The standards assign this method of joining pin-shaped elements with plane workpieces to the so called ‘Arc Pressure Welding’.

Joining is carried out in plastic or liquefied condition of the welding zone. The process can be carried out mechanically or automatically, depending on the used welding guns/welding heads.

Generally, the positive pole of the stud welding unit is connected to the workpiece. The welding element is manually or automatically inserted into the chuck of the welding gun or of the welding head. Then it is placed onto the workpiece - possibly equipped with a ceramic ferrule (see figure, **position 1**). When the button of the welding gun is triggered, the automated welding process starts, which works as follows:


©HBS Welding Systems GmbH
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer




– At the beginning of the welding process, the welding element (stud) in the welding gun is lifted clear off the workpiece by a lifting device (solenoid). An initial switched current triggers a pilot arc of a low current power (see figure, **position 2**). Then the main arc ignites between the face area of the welding element and the workpiece.
– The main arc burns at the set current during the welding time preselected at the stud welding unit. The selected welding energy must match the requirements of the selected welding element. The energy of the arc melts the face of the welding element and the workpiece (see figure, **position 3**).
– At the end of the preset welding time, the stud is mechanically moved to the workpiece. On plunging into the weld pool, the two weld zones join and solidify. The contact of stud and workpiece extinguishes the arc in a short-circuit and the main current is switched off.
– The weld zone solidifies and cools down. The welding element is now welded to the workpiece over its entire cross-section of the welding element (see figure, **position 4**). As soon as the weld metal is cooled down, the welding gun can be carefully withdrawn from the welding element. When using shielding gas, the shielding gas flow is switched off with the withdrawal of the welding gun. If a ceramic ferrule is used, it can be removed by light hammer blows.

The welding range of drawn-arc stud welding is about 3 to 25 mm diameter when using mild steel/stainless steel. Welding elements with rectangular cross-section should not exceed a ratio length : width of about 5 : 1. All technical information and adjustment values are based on the use of welding elements which correspond with current standards.


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

## Variants of drawn-arc stud welding

| Item | Drawn arc stud welding with ceramic ferrule | Drawn arc stud welding with shielding gas | Short-cycle drawn arc stud welding with shielding gas |
|---|---|---|---|
| Diameter welding element d metric in mm (imperial) | 3 - 25 (#4 or 12 gage to 1“) | 3 - 12 (16)<br>(#4 or 12 gage to 1/2“ (5/8“)),<br>by using aluminium up to 12 mm/ 1/2“) | 3 - 12 (#4 or 12 gage to 1/2“),<br>by using brass and aluminium with shielding gas |
| Max. current I in A | 3 000 | 3 000 | 2 000 |
| Welding time t in ms | 100 - 2 000 | 100 - 2 000 | 10 - 100 |
| Energy source | Welding rectifier, inverter | Welding rectifier, inverter | Welding rectifier, inverter |
| Weld pool protection | Ceramic ferrule CF | Shielding gas SG | Shielding gas SG or<br>no protection NP |
| Material welding element (suitable for welding) | Mild steel, stainless steel | Mild steel, stainless steel, aluminium (up to 12 mm) | Mild steel, stainless steel, brass and aluminium with shielding gas |
| Workpiece surface | Metallic bright (rolling skin, rust film, welding primer) | Metallic bright (rolling skin, rust film, welding primer) | Metallic bright, galvanised<br>(< 40 µm), slightly oiled |
| Min. thickness of workpiece | 1/4 d<br>min. 1 mm | 1/8 d<br>min. 1 mm | 1/10 d<br>approx. 0.7 mm |
| Adjustable parameters | Welding current<br>I in A = 80 x d<br>(up to 16 mm) | Welding current<br>I in A = 80 x d<br>(up to 16 mm) | Welding current<br>I in A = 100 x d<br>(up to 12 mm) |
| | Welding time<br>t in ms = 20 x d<br>(up to 12 mm) | Welding time<br>t in ms = 20 x d<br>(up to 12 mm) | Welding time |
| | Lift<br>(arc length) | Lift<br>(arc length) | Lift<br>(arc length) |
| | Protrusion, immersion speed<br>(plunge damper from 14 mm diameter) | Protrusion, immersion speed<br>(plunge damper from 14 mm diameter) | Protrusion, immersion speed |


©HBS Welding Systems GmbH

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

**Drawn-Arc Stud Welding with Ceramic Ferrule**

Drawn-arc stud welding with ceramic ferrule is used with welding elements of 3 to 25 mm diameter (preferably above 12 mm diameter) and with welding times of about 100 to 2 000 ms. It is generally suitable for all welding positions. When stud welding with ceramic ferrule, the welding position is PA (flat position). The major part of all applications applies to this procedure.

The ceramic ferrule (CF):

– prevents atmosphere from getting to the weld pool by a formation of metal vapor in the arc chamber
– stabilizes and concentrates the arc, thus decreasing the arc blow effect
– forms the melt under pressure to a weld collar and supports the weld pool on a vertical wall and overhead
– protects the welder from arc radiation and welding spatters

Normally, the ceramic ferrule is used for only one weld and is removed after solidification of the weld pool.

Standard welding elements and ceramic ferrules are described in EN ISO 13918. When using concrete anchors or shear connectors the front area can be plane constructed with a small pressed-in aluminium ball.

Studs with cone-shaped front area and aluminium ball are preferably used with ceramic ferrule.



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

### Drawn-Arc Stud Welding with Shielding Gas

Drawn-arc stud welding with shielding gas is used with welding elements for a diameter range of 3 to 12 (16) mm and with welding times from 100 to 2000 ms. Principally, it is suitable for all welding positions, however, it is preferably used in flat position PA. With stud welding with shielding gas, the weld area is protected by shielding gas. The shielding gas, which is fed from outside through a gas control and an additional device, displaces the ambient atmosphere from the welding area and reduces considerably pore formation.

| | Recommendation according | Recommendation according HBS |
|---|---|---|
| Mild steel / stainless steel | DIN EN ISO 14175-M21:<br>(82 % Ar / 18 % $CO_2$) | 90 % Ar / 10 % $CO_2$ *)<br>92 % Ar / 8 % $CO_2$ *) |
| Aluminium and aluminium alloys | DIN EN ISO 14175-I1<br>DIN EN ISO 14175-I3 | 85 % Ar / 15 % He<br>70 % Ar / 30 % He **) |

*) As a result of the higher amount of $CO_2$ the surface tension of the weld pool is reduced, which may lead to increased spatter formation.

**) For larger plate thicknesses the helium content may be increased.

The shielding gas influences

- the arc and the melting behavior of welding element and workpiece,
- the development of the weld collar and the penetration shape via the surface tension.

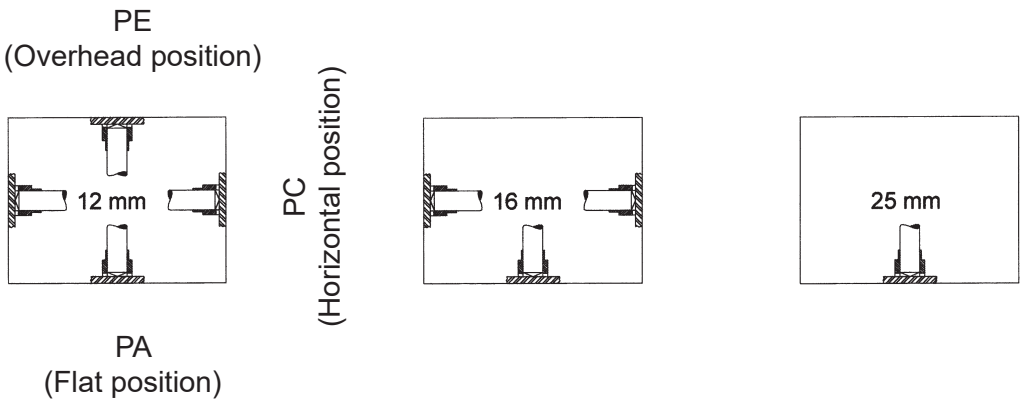
With stud welding with shielding gas, the shape of the weld collar is not reproducible, as the shielding gas has no forming effects on the melt – different from a ceramic ferrule. And so an additional ceramic ferrule may be used in special cases.

The standard welding elements for drawn-arc stud welding with shielding gas are described in EN ISO 13918. Welding elements with cone-shaped front area and without an aluminum ball are preferably used.


©HBS Welding Systems GmbH

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

☞ **With shielding gas, you should only weld in position PA (flat position) because due to gravity, the shielding gas cannot prevent flow of the molten metal.**




**Short-Cycle Drawn-Arc Stud Welding with Shielding Gas**

Short-cycle drawn-arc welding with shielding gas is used for welding elements within a diameter range of 3 to 12 mm (nominal diameter without flange) and welding times between 10 and 100 ms

Due to the short welding times, the energy input and the weld pool are so small that also welding elements up to 12 mm diameter can be welded on thin workpieces.

Normally, welding elements with flange (according to current standards) are used, which forms a larger welding area compared with the shaft diameter. In this way, higher tensional forces than in the stud shaft can be transmitted in spite of some pores in the weld zone. To minimize pore formation, the use of shielding gas for stud diameters upwards of 8 mm is recommended.



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

## MARC - Welding with magnetically impelled electric arc

MARC – Magnetic Rotated Arc, is an innovative stud welding process with rotating electric arc. This new process permits the gas-tight welding of threaded sleeves, nuts and pipe fittings, etc., up to 30 mm outside diameter to even thin sheets of metal.

Conventional stud welding processes allow only pins and studs to be welded. A electric arc is generated by an electricity source. This arc locally melts the underside of the studs and the surface of the workpiece within tenths of a millimetre. The two melt zones are then pressed together under slight pressure before they cool and solidify again. The conventional stud welding process cannot be used for ring-shaped geometries as the electric arc burns only at one point and hence cannot produce a continuous, ring-shaped weld seam.

That is the difference compared with the MARC process. The electric arc generated between e.g. a sleeve and the workpiece is set in rotation by an external magnetic field (field former) at the welding head (up to 1 800 rotations per second). This produces a uniform, circular weld pool. At the end of the necessary welding time (200 - 1 000 milliseconds), the sleeve is pressed with slight pressure into the still molten weld pool. A gas-tight and pressure-tight joint with high strength is thus created with a low energy input.

The reason for the movement of the electric arc in the magnetic field is the Lorentz force.

In order for the welding electric arc to constantly travel along a closed circular path, e.g. at the end face of a sleeve, there must be a radial magnetic field component at every point along this path. For an optimum electric arc movement, the magnetic field lines should pass radially and symmetrically through the weld gap (figure 1).


©HBS Welding Systems GmbH

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

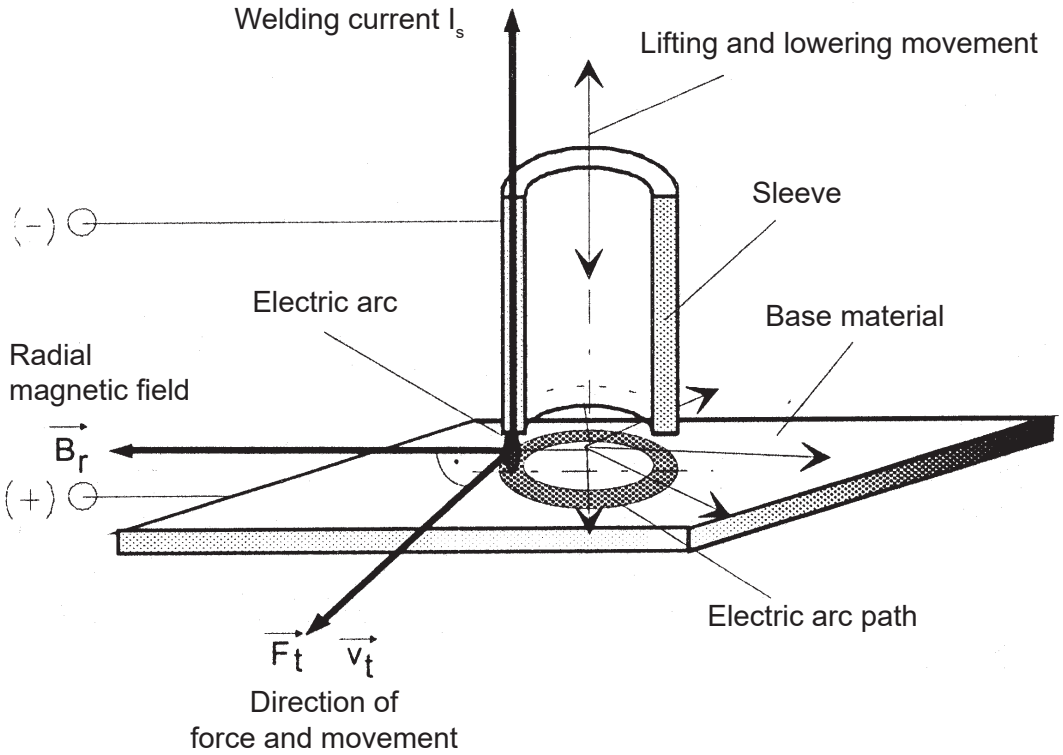



*Figure 1:*
*Movement of a DC electric arc between sleeve and plate under the influence of a radial magnetic field*


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

A DC-excited magnetic coil is used to move the DC-fed welding electric arc on a circular path. This is located concentrically to the path of the electric arc so that its magnetic flux lines pass as perpendicularly as possible through the electric arc (figure 2). The ring coil is thereby completely embedded in a housing that serves as a magnetic return path.

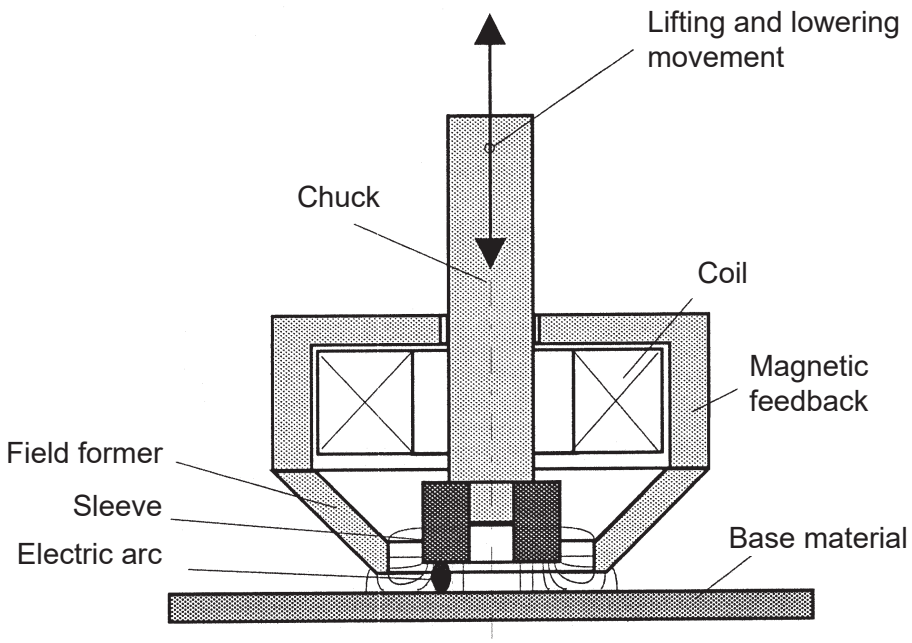



*Figure 2: Principle diagram of the head of the welding gun*

A cone-shaped field former guides the flux lines in the immediate vicinity of the welding point and concentrates them in this area. The magnetic flux thus passes over practically its whole path through chuck, sleeve, weld gap, field former and return path in material with good magnetic conduction. This closed guidance of the magnetic flux results in high flux densities in the weld gap.


©HBS Welding Systems GmbH

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

Advantages of MARC welding:

- Very short welding times
- Minimum component distortion due to controlled heat input
- Transportable current source with handy welding gun
- All welding positions can be controlled
- Comparatively low procurement costs
- Very high quality of the welded joints

Fields of application are to be found wherever nuts, sleeves, bushes or similar structural elements are to be welded quickly and reliably to perforated or unperforated sheet metal or any thickness.



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.


©HBS Welding Systems GmbH

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*).



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

## 10.2 Checking the 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:

– for drawn arc stud welding with the stud welding guns A 12, A 12-FL, A 16, CA 08 and PAH-1 or

– for MARC welding with magnetically impelled electric arc with the nut welding gun A 12 M.

◆ Check the chuck of your welding gun for proper fit and ensure it is tightened.

◆ Check the bellows of your welding gun for damage.

◆ Check if spring force and lift are set according to the welding parameter table in the operating manual of the welding gun.

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

## 10.3 Checking the Stud Welding Head

◆ Always check the operating manual of your stud welding head 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 heads KAH 412 and KAH 412 LA.

◆ Check the chuck of your stud welding head for proper fit and ensure it is tightened.

◆ Check the bellows of your stud welding head for damage.

◆ Check if spring force and lift are set according to the welding parameter table in the operating manual of the stud welding head.

◆ Check whether the stud welding head equipment has been selected correctly according to the welding task.

◆ **Refer here to the operating manual of your stud welding head.**


©HBS Welding Systems GmbH

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

## 10.4 Checking the Automatic Stud Feeder

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

This stud welding unit can only be used with the fully automatic stud feeder VBZ-3.

◆ **Refer here to the operating manual of your automatic stud feeder.**



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.

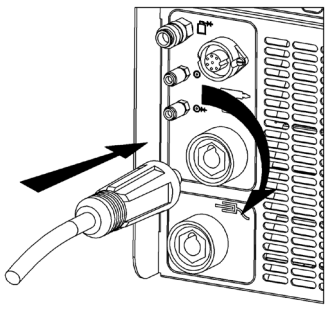
- **Secure the cables.**

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 Welding Systems GmbH

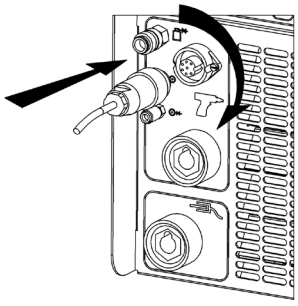
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

## 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 in the connector 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 Welding Head to the Stud Welding Unit

- Connect the welding current cable and the control cable.
- Proceed as described in section „*11.1 Connecting the Welding Gun to the Stud Welding Unit*“.

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

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

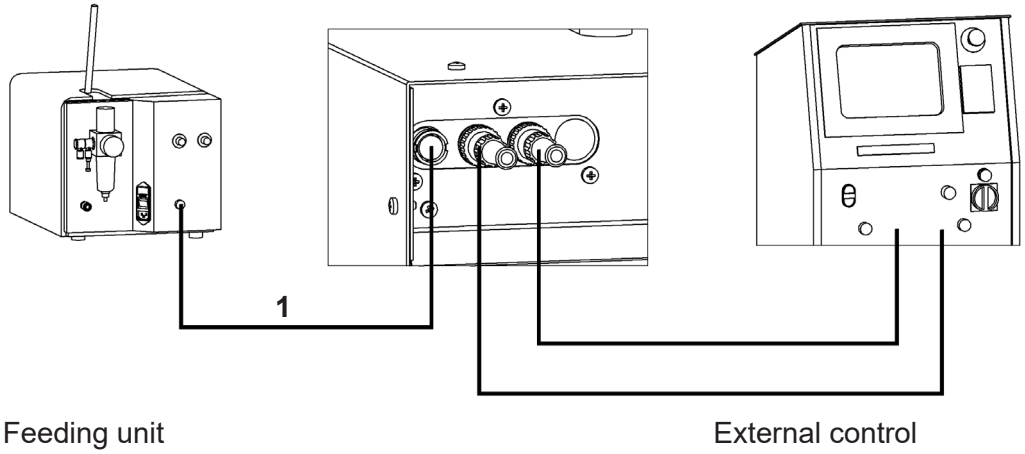
This prevents a poor contact and hence overheating of the plug connectors.



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

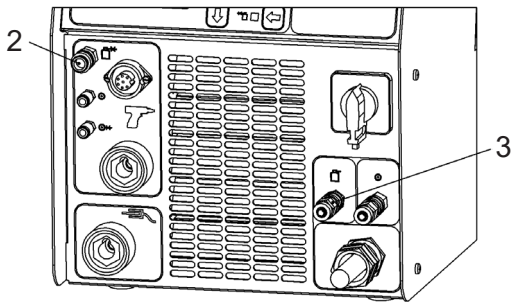
## 11.3 Connecting the Fully Automatic Stud Feeder to the Stud Welding Unit

◆ Connect the control socket of the feeding unit (front side) to the control socket of the stud welding unit (rear side):




1 - VBZ connection 5 poles

## 11.4 Shielding Gas Connection




2 - Gas outlet

3 - Gas inlet shielding gas bottle

◆ Connect the gas hose of the shielding gas bottle to the gas inlet of the stud welding unit.

◆ Connect the gas hose of the welding gun to the gas outlet.


©HBS Welding Systems GmbH

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

◆ Set the flow meter of the shielding gas bottle to 8 - 16 liters/min.

**Minimum flow rate for stud welding with shielded gas is 8 l/min.**

For stud welding a shielding gas mixture according DIN EN ISO 14175 is used.

◆ Please refer to *chapter 9* for more detailed information.

◆ **You must not put the air hose into the gas valve of the stud welding unit!**

The valve would be destroyed.

**If the conduits are wrongly connected, feeding and welding malfunctions will occur.**

**Danger from incorrect securing and handling of shielding gas cylinders**

Incorrect handling and insufficient securing of shielding gas cylinders can result in severe injury!

◆ Follow the instructions from the gas manufacturer and given in the relevant compressed gas regulation.

◆ Place the shielding gas cylinder in the cylinder holder intended for this purpose.

◆ Secure the shielding gas cylinder properly!

Do not secure the cylinder by its valve!

◆ Take measures to prevent the shielding gas cylinder from heating up.

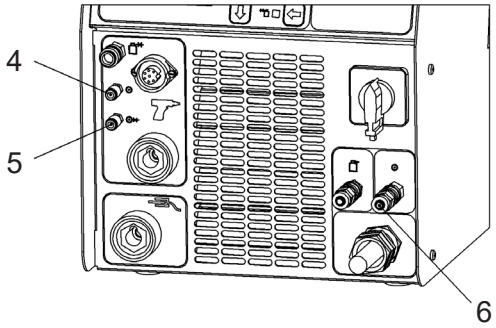


All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

## 11.5 Connecting the Compressed Air Connection for Automatic Stud Feeding

In automatic mode the welding gun PAH-1 or the welding heads KAH 412 and KAH 412 LA can be used to weld welding elements from dia 3 up to 8 mm.

You can insert the welding elements into the welding gun by hand (semiautomatic) or work with a fully automatic stud feeder.




4 - air outlet blue

5 - air outlet black

6 - connector compressed air inlet

STOP

◆ **You must not put the air hose into the gas valve of the stud welding unit!**

The valve would be destroyed.

STOP

**If the conduits are wrongly connected, feeding and welding malfunctions will occur.**



©HBS Welding Systems GmbH

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

### Connecting the fully automatic stud feeder VBZ-3

- If you use the automatic stud feeder, plug the air hose into the compressed air supply (6 bar, 800 l/min) of the feeding unit VBZ-3.
- Connect the compressed air outlet of the feeding unit to the compressed air inlet of the stud welding unit.

**You can set the operating pressure of max. 6 bars with the pressure reducing valve of the feeding unit. In the filter unit, the compressed air is cleaned and drained.**

- **You must not put the air hose into the gas valve of the stud welding unit!**

  The valve would be destroyed.

### Connecting the automatic welding gun PAH-1

- Plug the air connectors of the welding gun into the air outlet bushes at the front of the stud welding unit.
- Observe the color markings:

| | | |
|---|---|---|
| **black** | = | **switched air** (during stud feeding time) |
| **blue** | = | **continuous air**, for pressing the stud into the chuck and as a stop |

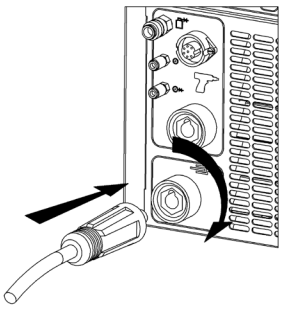
The stud welding unit controls the air between these two bushes.

**If the conduits are wrongly connected, feeding and welding malfunctions will occur.**



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

## 11.6 Connecting the Ground Cable



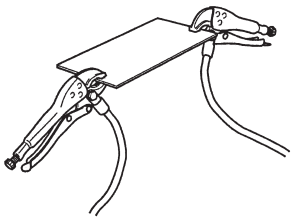
**Connect the ground cable**

- 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).

**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 clamps**

- Remove rust, paint and dirt from the points on the workpiece to which you wish to connect the ground clamps.
- Attach the ground clamps to the workpiece as tightly as possible.
- Pay attention to a good contact and symmetrical connection.

**The welding point should be in the middle between the two ground clamps.**


©HBS Welding Systems GmbH

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

## 11.7 Connecting the Stud Welding Unit to the Mains Supply

**Electric shock hazard**

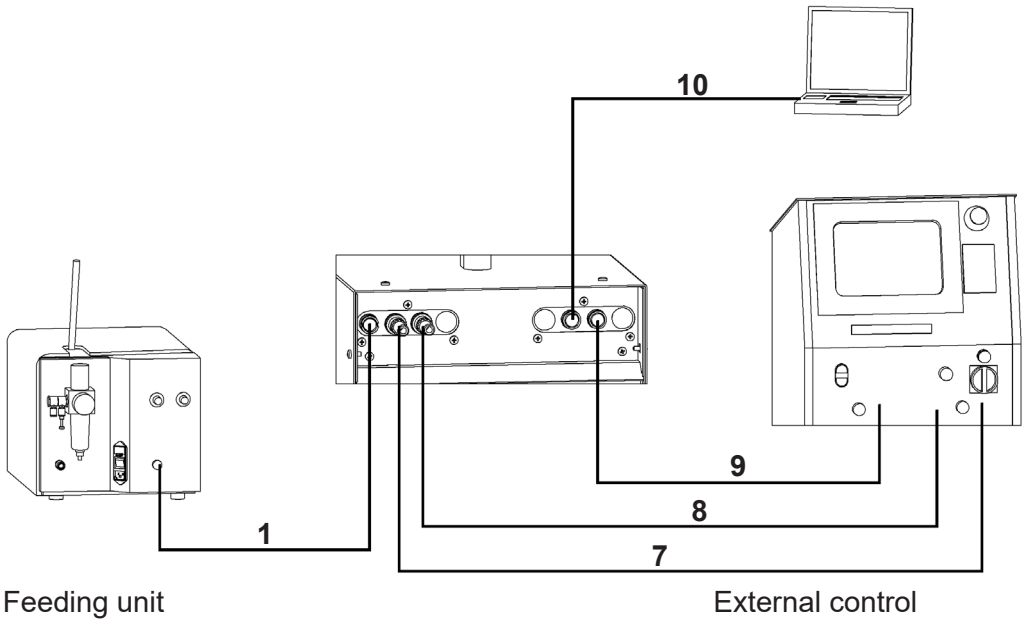
- Have an electrician check whether the plug socket to which you intended to connect the stud welding unit is correctly earthed.
- Connect the stud welding unit only to a mains supply with the same mains voltage as that indicated on the type plate.
- Compare the current consumption indicated on the type 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.



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

## 11.8 Integrate the Stud Welding Unit into a CNC System

- Connect the control socket of the feeding unit (front side) to the control socket of the stud welding unit (rear side).
- Proceed as described in section *11.3 Connecting the Fully Automatic Stud Feeder to the Stud Welding Unit*.
- Then connect the control cables 7, 8 and 9 as follows:




6 - VBZ connection 5 poles

7 - External welding start 4 poles

8 - Contact socket 3 poles

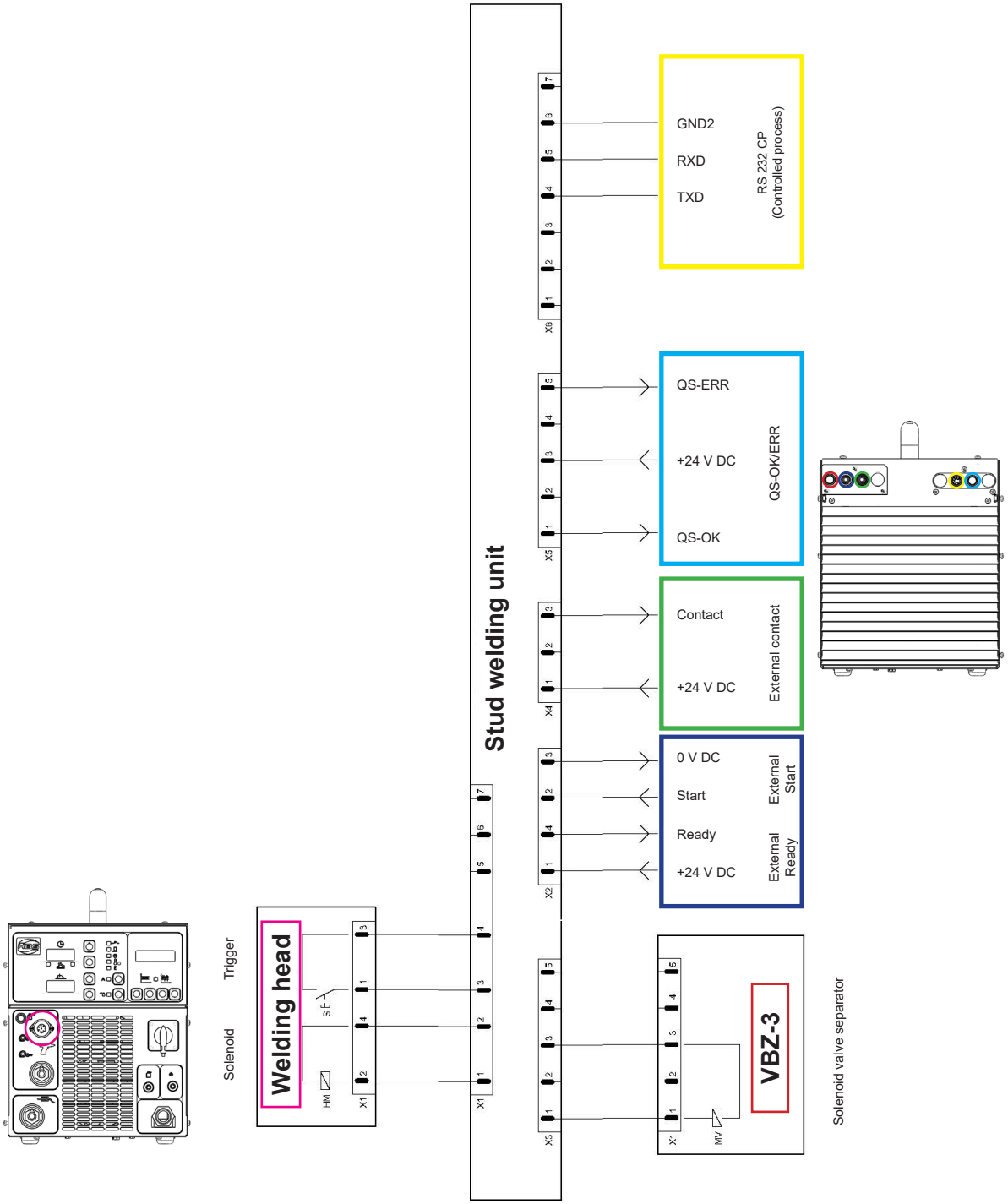
9 - OK / Error 5 poles

10 - RS 232 interface CP 7 poles


©HBS Welding Systems GmbH

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

## Automatic Interfaces IT 1002

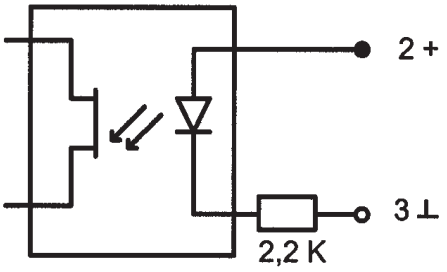





All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

### 11.8.1 External Welding Start

To integrate the stud welding unit in CNC stud welding systems, an additional external welding start is provided at the rear side of the stud welding unit (control socket 4, pins 2; 3). The inlet is designed for 24 V DC control units (signal time min. 200 ms).

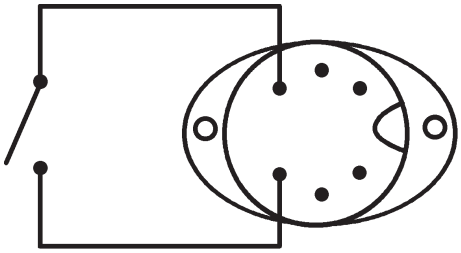



Min. switch current

$I_{min}$ = 10 mA ( min. 22 V)

$I_{max}$ = 20 mA

A welding start can also be provided with the welding gun control plug at the front side of the stud welding unit (pins 3; 4).



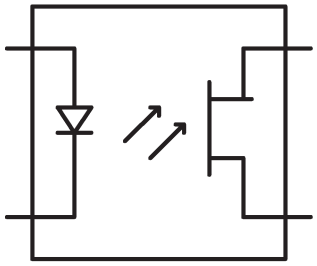
To start welding, you must shortcircuiting pin 3 and 4 for at least 100 ms.


©HBS Welding Systems GmbH

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

**Charging Supervision (Ready)**

For best control of time sequence of CNC machines, a charging supervision is provided. As soon as the stud welding unit is ready for welding, the transistor is switched on (control socket 4 poles, pins 1; 4)




1 - Input

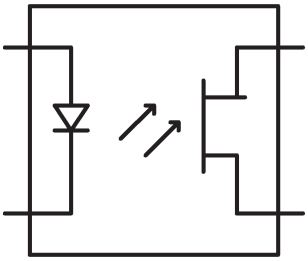
4 - Output

Operating voltage 24 V DC

Current capacity max. 50 mA

## 11.8.2 Contact

For best control of time sequence of CNC machines, an external contact inquiry between work piece and welding head is provided. As soon as a contact is recognized, the transistor is swiched on (control socket 3 poles, pins 1; 3).




1 - Input

3 - Output

Operating voltage 24 V DC

Current capacity max. 50 mA

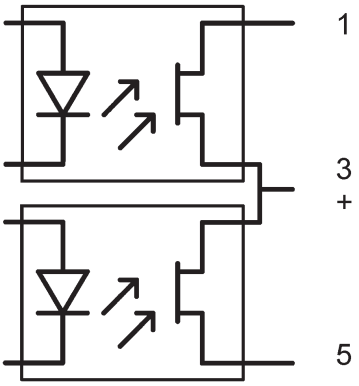
◆ **Refer here to the operating manual of your welding head.**



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

### 11.8.3 OK/ERR

This interface informs your control whether the welded value is inside or outside the tolerance range.




1 - Output OK

3 - Input +

5 - Output ERR

Operating voltage 24 V DC

Current capacity max. 50 mA



©HBS Welding Systems GmbH

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:

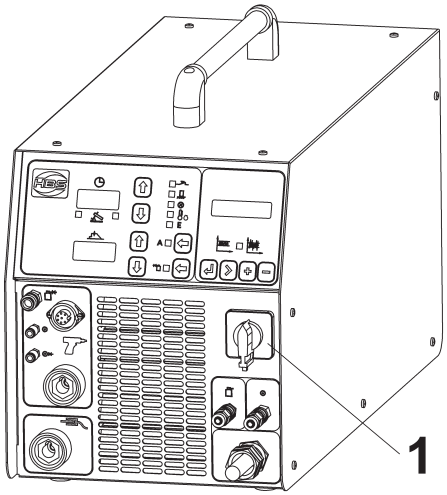
– Workers with active implanted medical devices
– Workers with passive implanted medical devices that contain metal
– Workers with medical devices worn on the body
– Pregnant workers.

- 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 Welding Time and the Welding Current

Determination of welding time and welding current at the stud welding unit using the arrow keys depends i.a. on

– the welding gun used,

– the material of the welding element,

– the diameter of the welding element,

– the material of the workpiece.

◆ Determine welding time and welding current to be set at the stud welding unit using the following tables.

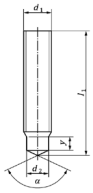
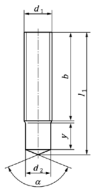
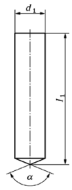
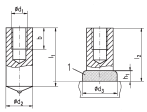
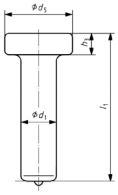
☞ **The figures in these tables are indicative values and must be checked by means of a test welding on the original material with the same properties as the original workpiece.**


©HBS Welding Systems GmbH

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

## Determining the Welding Time and the Welding Current for Welding Guns A 12, A 12-FL, A 16 and CA 08

for drawn-arc stud welding with ceramic ferrule

| Welding elements<br>Material:<br>4.8 (suitable for welding) | | Diameter of welding elements | | | | Welding current [1] IT 1002 I in A | Welding time [1] IT 1002 t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | RD (MR) [3] | M6 | 4.7 | 1/4 | 0.185 | 300 | 150 |
| | RD (MR) [3] | M8 | 6.2 | 5/16 | 0.244 | 450 | 170 |
| | RD (MR) [3] | M10 | 7.9 | 3/8 | 0.311 | 500 | 250 |
| | RD (MR) [3] | M12 | 9.5 | 1/2 | 0.374 | 550 | 330 |
| | RD (MR) [3] | M16 | 13.2 | 5/8 | 0.520 | 800 | 550 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | FD/PD/MD (DD) [3] | M6 | 5.35 | 1/4 | 0.211 | 450 | 100 |
| | FD/PD/MD (DD) [3] | M8 | 7.19 | 5/16 | 0.283 | 500 | 250 |
| | FD/PD/MD (DD) [3] | M10 | 9.03 | 3/8 | 0.356 | 550 | 330 |
| | FD/PD/MD (DD) [3] | M12 | 10.86 | 1/2 | 0.428 | 675 | 420 |
|  | | Ø $d_1$ | | Ø $d_1$ | | | |
| | UD/ND [3] | 3 (ISO) | | #4 / 12 gage | | --- [5] | --- [5] |
| | UD/ND [3] | 4 (ISO) | | #8 | | --- [5] | --- [5] |
| | UD/ND [3] | 5 (ISO) | | #10 / 3/16 | | --- [5] | --- [5] |
| | UD [3] | 6 | | 1/4 | | 300 | 180 |
| | UD [3] | 8 | | 5/16 | | 500 | 250 |
| | UD [3] | 10 | | 7/16 | | 550 | 330 |
| | UD [3] | 12 | | 1/2 | | 675 | 420 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | ID [3] | M6 | 10 | 1/4 | 0.394 | 550 | 330 |
| | ID [3] | M8 | 12 | 5/16 | 0.472 | 675 | 420 |
|  | | Ø $d_1$ - 0.4 | | Ø $d_1$ - 0.4 | | | |
| | SD [3] | 10 | | 3/8 | | 550 | 330 |
| | SD [3] | 13 | | 1/2 | | 675 | 420 |

[1] to be checked by test weldings

[2] When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

[3] Information and recommendations on this can be found in **DIN EN ISO 14555**.

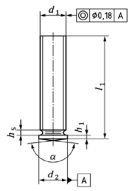
[5] We recommend the “drawn arc stud welding with shielding gas” welding procedure.



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

## Determining the Welding Time and the Welding Current for Welding Guns A 12, A 12-FL, A 16 and CA 08

for drawn-arc stud welding without ceramic ferrule

| Welding elements<br>Material:<br>4.8 (suitable for welding) | | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | PS (US, IS) [4] | M3 | 4 | 1/8 | 0.157 | 400 | 10 |
| | PS (US, IS) [4] | M4 | 5 | 5/32 | 0.197 | 600 | 15 |
| | PS (US, IS) [4] | M5 | 6 | 3/16 | 0.236 | 700 | 15 |
| | PS (US, IS) [4] | M6 | 7 | 1/4 | 0.276 | 800 | 20 |
| | PS (US, IS) [4] | M8 | 9 | 5/16 | 0.354 | --- [5] | --- [5] |
| | PS (US, IS) [4] | M10 | 11 | 3/8 | 0.433 | --- [5] | --- [5] |

[1] to be checked by test weldings

[2] When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

[4] Information and recommendations on this can be found in **DVS 0902**.

[5] We recommend the “drawn arc stud welding with shielding gas” welding procedure.

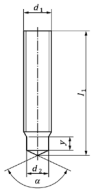
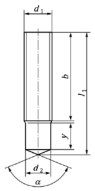
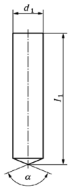
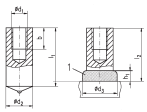


©HBS Welding Systems GmbH

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

## Determining the Welding Time and the Welding Current for Welding Guns A 12, A 12-FL, A 16, CA 08 and PAH-1

for drawn-arc stud welding with shielding gas [6]

| Welding elements<br>Material:<br>4.8 (suitable for welding) | | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | RD (MR) [3] | M6 | 4.7 | 1/4 | 0.185 | 400 | 100 |
| | RD (MR) [3] | M8 | 6.2 | 5/16 | 0.244 | 525 | 160 |
| | RD (MR) [3] | M10 | 7.9 | 3/8 | 0.311 | 670 | 160 |
| | RD (MR) [3] | M12 | 9.5 | 1/2 | 0.374 | 800 | 210 |
| | RD (MR) [3] | M16 | 13.2 | 5/8 | 0.520 | 1 000 | 550 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | FD/PD/MD (DD) [3] | M6 | 5.35 | 1/4 | 0.211 | 490 | 120 |
| | FD/PD/MD (DD) [3] | M8 | 7.19 | 5/16 | 0.283 | 670 | 180 |
| | FD/PD/MD (DD) [3] | M10 | 9.03 | 3/8 | 0.356 | 840 | 220 |
| | FD/PD/MD (DD) [3] | M12 | 10.86 | 1/2 | 0.428 | 970 | 275 |
|  | | Ø $d_1$ | | Ø $d_1$ | | | |
| | UD/ND [3] | 3 (ISO) | | #4 / 12 gage | | 250 | 60 |
| | UD/ND [3] | 4 (ISO) | | #8 | | 320 | 90 |
| | UD/ND [3] | 5 (ISO) | | #10 / 3/16 | | 425 | 150 |
| | UD [3] | 6 | | 1/4 | | 500 | 120 |
| | UD [3] | 8 | | 5/16 | | 680 | 170 |
| | UD [3] | 10 | | 7/16 | | 840 | 220 |
| | UD [3] | 12 | | 1/2 | | 970 | 275 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | ID [3] | M6 | 10 | 1/4 | 0.394 | 840 | 220 |
| | ID [3] | M8 | 12 | 5/16 | 0.472 | 970 | 275 |

[1] to be checked by test weldings

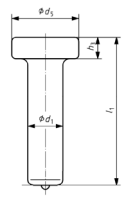
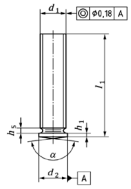
[2] When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

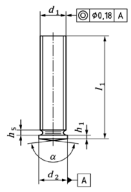
[3] Information and recommendations on this can be found in **DIN EN ISO 14555**.

[6] Shielding gas according to DIN EN ISO 14175-M21, see *chapter 9 "Welding Process"*



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

| Welding elements<br>Material:<br>4.8 (suitable for welding) | | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2] | | | | | | | |
|  | | Ø $d_1$ - 0.4 | | Ø $d_1$ - 0.4 | | | |
| | SD [3] | 10 | | 3/8 | | 840 | 220 |
| | SD [3] | 13 | | 1/2 | | 970 | 275 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | PS (US, IS) [4] | M3 | 4 | 1/8 | 0.157 | 400 | 20 |
| | PS (US, IS) [4] | M4 | 5 | 5/32 | 0.197 | 500 | 25 |
| | PS (US, IS) [4] | M5 | 6 | 3/16 | 0.236 | 600 | 30 |
| | PS (US, IS) [4] | M6 | 7 | 1/4 | 0.276 | 700 | 40 |
| | PS (US, IS) [4] | M8 | 9 | 5/16 | 0.354 | 950 | 40 |
| | PS (US, IS) [4] | M10 | 11 | 3/8 | 0.433 | 1 000 | 100 |

| Welding elements<br>Material: AlMg3 [7] | | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Aluminium [7] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_3$ | Ø $d_1$ | Ø $d_3$ | | |
| | PS (US, IS) [3] | M6 | 7 | 1/4 | 0.276 | 850 | 15 |
| | PS (US, IS) [3] | M8 | 9 | 5/16 | 0.354 | 900 | 40 |
| | PS (US, IS) [3] | M10 | 11 | 3/8 | 0.433 | 1 000 | 120 |

1) to be checked by test weldings

2) When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

3) Information and recommendations on this can be found in **DIN EN ISO 14555**.

4) Information and recommendations on this can be found in **DVS 0902**.

7) Shielding gas according to DIN EN ISO 14175-I1/HBS recommendation, see *chapter 9 "Welding Process"*; for better welding results, we recommend changing the polarity of the welding voltage by reversing the welding current and ground cables.

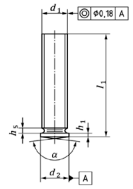


©HBS Welding Systems GmbH

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

## Determining the Welding Time and the Welding Current for Welding Heads KAH 412 and KAH 412 LA [4)]

for drawn-arc stud welding without weld pool protection

| Welding elements<br>Material of workpiece:<br>4.8 (suitable for welding) | | Diameter of welding elements | | | | Welding current [1)]<br>IT 1002<br>I in A | Welding time [1)]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2)] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | PS (US, IS) [4)] | M3 | 4 | 1/8 | 0.157 | 400 | 10 |
| | PS (US, IS) [4)] | M4 | 5 | 5/32 | 0.197 | 600 | 15 |
| | PS (US, IS) [4)] | M5 | 6 | 3/16 | 0.236 | 700 | 15 |
| | PS (US, IS) [4)] | M6 | 7 | 1/4 | 0.276 | 800 | 20 |
| | PS (US, IS) [4)] | M8 | 9 | 5/16 | 0.354 | --- [5)] | --- [5)] |
| | PS (US, IS) [4)] | M10 | 11 | 3/8 | 0.433 | --- [5)] | --- [5)] |

1) to be checked by test welds

2) When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

4) Information and recommendations on this can be found in **DVS 0902**.

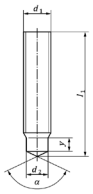
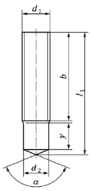
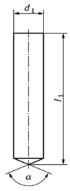
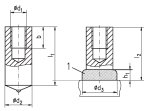
5) We recommend the “drawn arc stud welding with shielding gas” welding procedure.



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

## Determining the Welding Time and the Welding Current for Welding Heads KAH 412 and KAH 412 LA

for drawn-arc stud welding with shielding gas [6]

| Welding elements<br>Material of workpiece:<br>4.8 (suitable for welding) | | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | RD (MR) [3] | M6 | 4.7 | 1/4 | 0.185 | 400 | 100 |
| | RD (MR) [3] | M8 | 6.2 | 5/16 | 0.244 | 525 | 160 |
| | RD (MR) [3] | M10 | 7.9 | 3/8 | 0.311 | 670 | 160 |
| | RD (MR) [3] | M12 | 9.5 | 1/2 | 0.374 | 800 | 210 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | FD/PD/MD (DD) [3] | M6 | 5.35 | 1/4 | 0.211 | 490 | 120 |
| | FD/PD/MD (DD) [3] | M8 | 7.19 | 5/16 | 0.283 | 670 | 180 |
| | FD/PD/MD (DD) [3] | M10 | 9.03 | 3/8 | 0.356 | 840 | 220 |
| | FD/PD/MD (DD) [3] | M12 | 10.86 | 1/2 | 0.428 | 970 | 275 |
|  | | Ø $d_1$ | | Ø $d_1$ | | | |
| | UD/ND [3] | 3 (ISO) | | #4 / 12 gage | | 250 | 60 |
| | UD/ND [3] | 4 (ISO) | | #8 | | 320 | 90 |
| | UD/ND [3] | 5 (ISO) | | #10 / 3/16 | | 425 | 150 |
| | UD [3] | 6 | | 1/4 | | 500 | 120 |
| | UD [3] | 8 | | 5/16 | | 680 | 170 |
| | UD [3] | 10 | | 7/16 | | 840 | 220 |
| | UD [3] | 12 | | 1/2 | | 970 | 275 |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | ID [3] | M6 | 10 | 1/4 | 0.394 | 840 | 220 |
| | ID [3] | M8 | 12 | 5/16 | 0.472 | 970 | 275 |

[1] to be checked by test welds

[2] When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

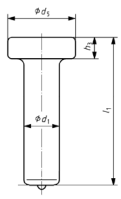
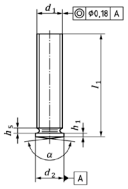
[3] Information and recommendations on this can be found in **DIN EN ISO 14555**.

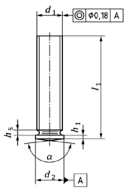
[6] Shielding gas according to DIN EN ISO 14175-M21, see *chapter 9 “Welding Process”*



©HBS Welding Systems GmbH

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

| Welding elements<br>Material of workpiece:<br>4.8 (suitable for welding) | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|
| | metrisch | | imperial (US) | | | |
| | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Mild steel (suitable for welding) [2] | | | | | | |
|  | | Ø $d_1$ - 0,4 | | Ø $d_1$ - 0,4 | | |
| | SD [3] | 10 | | 3/8 | --- [8] | --- [8] |
| | SD [3] | 13 | | 1/2 | --- [8] | --- [8] |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | PS (US, IS) [4] | M3 | 4 | 1/8 | 0157 | 400 | 20 |
| | PS (US, IS) [4] | M4 | 5 | 5/32 | 0.197 | 500 | 25 |
| | PS (US, IS) [4] | M5 | 6 | 3/16 | 0.236 | 600 | 30 |
| | PS (US, IS) [4] | M6 | 7 | 1/4 | 0.276 | 700 | 40 |
| | PS (US, IS) [4] | M8 | 9 | 5/16 | 0.354 | 950 | 40 |
| | PS (US, IS) [4] | M10 | 11 | 3/8 | 0.433 | 1 000 | 100 |

| Welding elements<br>Material of workpiece: AlMg3 [7] | Diameter of welding elements | | | | Welding current [1]<br>IT 1002<br>I in A | Welding time [1]<br>IT 1002<br>t in ms |
|---|---|---|---|---|---|---|
| | metric | | imperial (US) | | | |
| | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Material of workpiece: Aluminium [7] | | | | | | |
|  | | Ø $d_1$ | Ø $d_3$ | Ø $d_1$ | Ø $d_3$ | | |
| | PS (US, IS) [3] | M6 | 7 | 1/4 | 0.276 | 850 | 15 |
| | PS (US, IS) [3] | M8 | 9 | 5/16 | 0.354 | 900 | 40 |
| | PS (US, IS) [3] | M10 | 11 | 3/8 | 0.433 | 1 000 | 120 |

1) to be checked by test welds

2) When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

3) Information and recommendations on this can be found in **DIN EN ISO 14555**.

4) Information and recommendations on this can be found in **DVS 0902**.

7) Shielding gas according to DIN EN ISO 14175-I1/HBS recommendation, see *chapter 9 "Welding Process"*; for better welding results, we recommend changing the polarity of the welding voltage by reversing the welding current and ground cables.

8) We recommend the "drawn arc stud welding with ceramic ferrule" welding procedure.



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

## Determining the Welding Time and the Welding Current for Welding Gun A 12 M

for MARC welding with magnetically impelled electric arc and shielding gas [6)]

### Welding on hole

| Material HBS Hex[Nut] | Size of the metric thread in mm | Hole-diameter in mm | Welding current [1) 8)] IT 1002 I in A ± 50 A | Welding time [1) 8)] IT 1002 t in ms ± 50 ms |
|---|---|---|---|---|
| Workpiece material: Stainless steel (suitable for welding) [2)] | | | | |
| A2-50 | M6 | 10.7 - 11.0 | 300 | 300 |
| | | | 400 | 250 |
| | | | 450 | 200 |
| | M8 | 10.7 - 11.0 | 300 | 300 |
| | | | 400 | 250 |
| | | | 450 | 200 |
| | M10 | 12.7 - 13.0 | 400 | 300 |
| | | | 500 | 200 |
| | | | 550 | 150 |
| | M12 | 15.0 - 15.3 | min. 350 | 650 |
| | | | 400 | 500 |
| | | | 500 | 400 |
| | | | max. 550 | 375 |

### Welding on metal sheets

| Material HBS Hex[Nut] | Size of the metric thread in mm | Welding current [1) 8)] IT 1002 I in A ± 25 A | Welding time [1) 8)] IT 1002 t in ms ± 50 ms |
|---|---|---|---|
| Workpiece material: Stainless steel (suitable for welding) [2)] | | | |
| A2-50 | M6 | 300 | 350 |
| | | 400 | 250 |
| | M8 | 400 | 250 |
| | M10 | 400 | 500 |
| | M12 | 450 | 550 |

| Material Nut DIN EN ISO 4032/ DIN 934 | Size of the metric thread in mm | Welding current [1) 8)] IT 1002 I in A ± 25 A | Welding time [1) 8)] IT 1002 t in ms ± 50 ms |
|---|---|---|---|
| Workpiece material: Stainless steel (suitable for welding) [2)] | | | |
| A2-50, A2-70 A4-50, A4-70 A5-50, A5-70 | M6 | 350 | 150 |
| | M8 | 300 | 350 |
| | M10 | 400 | 500 |
| | M12 | 450 | 550 |

1) to be checked by test weldings

2) When using alloyed steels, the welding energy (welding time) must be reduced by about 10 %.

6) Shielding gas according to DIN EN ISO 14175-M21, see *chapter 9 "Welding Process"*

8) Material thickness s = 2 mm



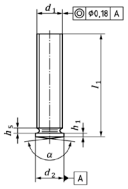
©HBS Welding Systems GmbH

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

## Determining the Welding Time and the Welding Current for Welding Gun A 12 M

for MARC welding with magnetically impelled electric arc and shielding gas [5)]

### Drawn arc stud welding (shielding gas application)

| Material of welding elements: 4.8 (schweißgeeignet) / A2-50 | | Diameter of welding elements | | | | Welding current [1)] IT 1002 I in A | Welding time [1)] IT 1002 t in ms |
|---|---|---|---|---|---|---|---|
| | | metric | | imperial (US) | | | |
| | | Stud diameter in mm | eff. diameter in mm | Stud diameter in inches | eff. diameter in inches | | |
| Workpiece material: Mild steel (suitable for welding) / stainless steel (suitable for welding) [4)] | | | | | | | |
|  | | Ø $d_1$ | Ø $d_2$ | Ø $d_1$ | Ø $d_2$ | | |
| | PS (US, IS) [4)] | M5 | 6 | 3/16 | 0,236 | 300 | 110 |
| | | | | | | 350 | 100 |
| | | | | | | 400 | 80 |
| | | | | | | 450 | 70 |
| | PS (US, IS) [4)] | M6 | 7 | 1/4 | 0,276 | 300 | 130 |
| | | | | | | 350 | 110 |
| | | | | | | 400 | 100 |
| | | | | | | 450 | 90 |
| | | | | | | 500 | 80 |
| | | | | | | 550 | 70 |
| | | | | | | 600 | 60 |
| | PS (US, IS) [4)] | M8 | 9 | 5/16 | 0,354 | 350 | 150 |
| | | | | | | 400 | 130 |
| | | | | | | 450 | 120 |
| | | | | | | 500 | 110 |
| | | | | | | 550 | 100 |
| | | | | | | 600 | 90 |
| | | | | | | 650 | 80 |
| | PS (US, IS) [4)] | M10 | 11 | 3/8 | 0,433 | 400 | 350 |
| | | | | | | 500 | 270 |
| | | | | | | 600 | 200 |
| | | | | | | 700 | 150 |
| | | | | | | 800 | 120 |
| | | | | | | 900 | 110 |

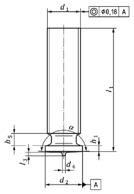
1) to be checked by test weldings

4) Information and recommendations on this can be found in **DVS 0902**.

6) Shielding gas according to DIN EN ISO 14175-M21, see *chapter 9 “Welding Process”*



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

| Material: | Diameter of welding elements | | | | Welding current [1] IT 1002 I in A | Welding time [1] IT 1002 t in ms |
|---|---|---|---|---|---|---|
| | metric | | imperial (US) | | | |
| | PT, UT [4] | IT [4] | PT, UT [4] | IT [4] | | |
| Workpiece material: Mild steel (suitable for welding) / Material of welding elements: 4.8 (suitable for welding) /<br>Workpiece material: Galvanised steel (suitable for welding) / Material of welding elements: 4.8 (suitable for welding) /<br><br>Workpiece material: Alloyed steel (suitable for welding) / Material of welding elements: A2-50 /<br>Workpiece material: Alloyed steel (suitable for welding) / Material of welding elements: CuZn37 | | | | | | |
|  | M5, 5 mm | 5 mm, M3 | 3/16 | #10-32 | 300 | 110 |
| | | | | | 350 | 100 |
| | | | | | 400 | 80 |
| | | | | | 450 | 70 |
| | M6, 6 mm | 6 mm, M4 | 1/4 | 1/4-20 | 300 | 130 |
| | | | | | 350 | 110 |
| | | | | | 400 | 100 |
| | | | | | 450 | 90 |
| | | | | | 500 | 80 |
| | | | | | 550 | 70 |
| | | | | | 600 | 60 |
| | M8, 7.1 mm | 7.1 mm, M5 | 5/16 | 5/16-18 | 350 | 150 |
| | | | | | 400 | 130 |
| | | | | | 450 | 120 |
| | | | | | 500 | 110 |
| | | | | | 550 | 100 |
| | | | | | 600 | 90 |
| | | | | | 650 | 80 |

[1] to be checked by test weldings

[4] Information and recommendations on this can be found in **DVS 0902**.



©HBS Welding Systems GmbH

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

☞ The welding parameters necessary for **welding aluminium studs** according to DIN EN ISO 13918 are to be ascertained and checked by the user due to the material characteristics (differences in alloy composition) and the used shielding gas options.

Information and recommendations on this can be found in **DIN EN ISO 14555**.

☞ When **welding with shielding gas** an approximately 10 % longer welding time is generally selected for the same welding current.

For alloyed steel a 10 % lower current is generally selected.

The specified values apply for welding in welding position PA. When welding in welding position PC, the welding time must be reduced.

For short-cycle stud welding with drawn arc, the welding time is less than 100 ms. It is dependent not only on the stud diameter, but also on the available current:

(I in A = min. 100 x Ø in mm)

When welding without weld pool protection, the welding time should be selected as short as possible.

The welding energy is selected through the welding time alone.



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

## 12.3 Checking Shielding Gas Flow Rate

**Minimum flow rate for stud welding with shielding gas is approx. 8 l/min.**

- Check that the stud welding unit is switched on.
- Switch on the „Shielding gas“ option on the stud welding unit.
- Actuate the welding gun button without placing the stud welding gun on the workpiece (= „air shot“).

The flow meter displays the amount of shielding gas flowing in l/min.

- Set the flow rate according to your welding task.


©HBS Welding Systems GmbH
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

## 12.4 Possible Settings

You can switch on the process-sequence control with the plus key [+].

**Basic settings**

You can set the machine according to your requirements. Call-up the main menu with the Enter key [↵].

The following menu items are available:

| | |
|---|---|
| REFERENCE MODE | Activate process sequence control |
| SET DATE | Set the current date |
| SET TIME | Set the current time |
| SELECT LANGUAGE | Select a language |

Basically, you select a menu item with the arrow key [>] and then you open it with the enter key [↵].

Confirmation of settings and quitting the menu item is also carried out with the enter key [↵].

### 12.4.1 Setting the Welding Parameters

#### Adjusting the Welding Time

- **First determine the necessary welding time.**
- Read and observe here Point 12.2 *„Determining the Welding Time and Welding Current“*.

- Only now set the welding time (digital display ◷) with the arrow keys.



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

### Adjusting the Welding Current

- **First determine the necessary welding current.**
- Read and observe here Point 12.2 *„Determining the Welding Time and Welding Current“*.

- Only now set the welding current (digital display ) with the arrow keys.

### Adjusting the Gas Pre-Flow Time

If working with shielding gas, you have to set the gas pre-flow time. Adjust at the display, how long the shielding gas should flow before the welding process starts. The gas flows automatically until the stud welding gun is removed from the joined welding element.

- Adjust the flow meter at the gas bottle to 8 to 16 litres/min (minimum 8 l/min.).
- Press the shielding gas key, LED shielding gas lights up.
- The display welding time ( ) shows the gas pre-flow time.
- Set the gas pre-flow time with the two arrow keys ( longer – shorter).

After approx. 2 seconds, the display welding time ( ) automatically switches back to the previously set welding time.

- **If you are working with ceramic ferrules, then trigger the shielding gas key, the shielding gas LED is off.**

**In this way, the gas valve remains closed during the welding procedure.**


©HBS Welding Systems GmbH

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

### Adjusting the Stud Feeding Time (Blow Time)

In automatic mode, you can set the blow time (stud feeding time).

◆ Adjust the selected compressed air supply to 6 bars.

◆ Press the key Automation, LED Automation A lights.

The display welding time (◷) shows the blow time.

◆ Set the blow time with the two arrow keys ⬆ ⬇.

The display welding time (◷) automatically switches back to the last set blow time after approx. 2 s.

☞ **If you do not work in automatic mode, press the key Automation, LED A extinguishes. The gas valve remains closed.**

## 12.4.2 Library Mode

In the library mode, you can call up and modify charging voltages, depending on stud diameter (UD/pins).

◆ Simultaneously press both arrow keys of welding time (⬆ ⬇) next to the welding time display (◷) for about one second.

The display welding time shows 0 - 06 (06 means the set welding current and welding time for stud diameter of 6 mm).

◆ You can pre-select the stud diameter (6 mm to 12 mm) with both arrow keys (⬆ longer – ⬇ shorter).

After about 3 seconds the display (◷) jumps onto the preselected welding time and the display (⏚) onto the pre-selected welding current.

◆ In addition, you can modify the welding time and welding current individually by pressing the arrow keys (as described above).

☞ ◆ **If you are working with shielding gas, different welding parameters for stud diameters (from 6 mm to 12 mm) are available in library mode.**



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

### 12.4.3 Electrode Mode

You can switch the stud welding unit to electrode mode.

◆ Simultaneously press both arrow keys (⬆⬇) next to the welding current display for about one second.

The display welding time shows EL.

◆ You can pre-select the welding current (from 50 to 400 A) with both arrow keys (⬆ lower – ⬇ higher).

If you touch the work piece with the electrode, the stud welding unit is switched on.

☞ ◆ **If you switch the stud welding unit off and on, the stud welding unit is automatically reset to stud welding.**


©HBS Welding Systems GmbH

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

### 12.4.4 Adjusting the Controls

To be able to assess the process sequence during welding, an average value is calculated from the existing output voltage values. You don't need any special welding guns and/or additional welding cables for this system of function monitoring

During welding the reference, the micro controller determines a reference output voltage value. This is the average value of eight consecutive weldings.

During standard working process, the current output voltage value is compared with the reference output voltage value. If this value is out of the set tolerance range, the system indicates a deviation which is displayed via LED's.

Green - value is inside the set tolerance range

Red - value is out of set tolerance range

If desired, the unit can be locked after a deviation was indicated.

As an option, you can manually enter an output voltage value. This value must be determined by 8 reference wedings in advance. In this way, the output voltage value can be stored for different program sequences. So you can store a special output voltage value for each stud/lot dimension and carry out a process monitoring.

How to enable the control:

◆ Switch on the stud welding unit.

The following menu is displayed (delivery condition):

| | | |
|---|---|---|
| REF-U: 00.00V<br>REFERENCE: 8 | or | QS-1000: AUS |

(With the keys [+] or [-] you can toggle between these displays).

◆ Press the enter key [↵].

The following menus are displayed:

| **Sequence 1:** | **Sequence 2:** |
|---|---|
| REFERENCE MODE<br>WELDING | REFERENCE MODE<br>INPUT |

You determine the reference value with sequence 1, sequence 2 is manual entry. With the keys [+] or [-] you can toggle between the menu items.



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

### Reference Mode Welding (Sequence 1)

◆ Press the enter key ↵.

The following menu is displayed:

| |
|---|
| REFERENCE MODE |
| TOLERANCE: 10% |

◆ Here you define the tolerance range:

+ Increase tolerance range

- Decrease tolerance range

With the arrow key > you change the position

| | | | |
|---|---|---|---|
| 1 % | - | small tolerance range = | high sensitivity |
| 20 % | - | large tolerance range = | low sensitivity |

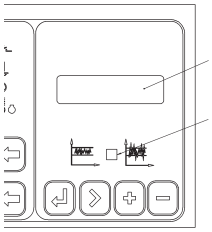
◆ Press the enter key ↵.

The following menus are displayed:

| | | |
|---|---|---|
| REFERENCE MODE<br>STOP: OFF | or | REFERENCE MODE<br>STOP: ON |

With + or - you can toggle between the menu items.

| | |
|---|---|
| Stop if Red >ON< | Your stud welding unit stops automatically if output voltage value is out of tolerance range.<br>The LCD display shows an error message.<br>With a click on the enter key ↵, the stud welding unit is ready for welding again. |
| Stop if Red >OFF< | The stud welding unit continues to weld, LED's show whether welds are in or out of tolerance range. |



15 - LCD Display

16 - LED green = inside the set tolerance range

red = out of set tolerance range



©HBS Welding Systems GmbH

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

◆ Press the enter key ↵.

The following menu is displayed:

```
REF-U: 00.00V
REFERENCE: 8
```

The display shows the average voltage and the number of reference welds that are still possible.

◆ Now carry out the 8 reference welds.

☞ **The welded reference value is deleted if a setting at the stud welding unit is changed during sequence 1 or if the stud welding unit is switched off.**

**New reference welds are required.**



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

**Reference Mode Input (Sequence 2)**

```
  PROGRAM SELECT
PRG 1:      25.00V
```

With [+] or [-] you can select the programs 1 to 8.

◆ Press the enter key [↵].

The following menu is displayed:

```
  PROGRAM 1
U-REF:      25.00V
```

With [+] or [-] you can enter the individual digits.

With the arrow key [>] you change the position.

U-REF 25.00V means that you define the set reference value 25 V for the program place 1.

◆ Press the enter key [↵].

The following menu is displayed:

```
  PROGRAM 1
TOLERANCE:     10%
```

◆ Here you define the tolerance range:

[+] increase tolerance range

[-] decrease tolerance range

With the arrow key [>] you change the position

| | | | | |
|---|---|---|---|---|
| 1 % | - | small tolerance range = | | high sensitivity |
| 20 % | - | large tolerance range = | | low sensitivity |

HBS recommends a tolerance of 10 %.



©HBS Welding Systems GmbH

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

◆ Press the enter key ↵.

The following menu is displayed:

| | | |
|---|---|---|
| PROGRAM 1<br>STOP: OFF | oder | PROGRAM 1<br>STOP: ON |

With + or - you change between the individual menu boxes.

| | |
|---|---|
| Stop with red >ON< | Your stud welding unit stops automatically if output voltage value is out of tolerance range.<br>The LCD display shows an error message.<br>With a click on the enter key ↵ the stud welding unit is ready for welding again. |
| Stop with red >OFF< | The stud welding unit continues to weld, LED's show whether welds are in or out of tolerance range. |

◆ Press the enter key ↵.

The stud welding unit automatically switches to the program mode.

◆ Now carry out the welds.

The following menu is displayed:

| |
|---|
| REF - U1: 25.00V<br>ACT - U: 00.00V |

REF-P1 displays the current program position and reference voltage set for it .
ACT-U displays the current voltage.

☞ **The settings of the stud welding unit must be checked after changes of base material, lot of welding elements or settings of welding gun.**

**With changed conditions, the reference value must be redetermined.**



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

### 12.4.5 Adjusting the Date

Via the serial interface of the stud welding unit, the continuously captured data can be output in ASCII format for possible recording *(see section 13.5 “Analysis of Parameters via RS 232 Interface CP“)*.

You can select the current date for your QA report in the main menu.

- To do this, press the arrow key [>] until the “Date” menu appears.

```
ADJUSTING DATE
  07.03.2012
```

- Use key [+] or [-] to set the individual numbers.

```
ADJUSTING DATE
  08.03.2012
```

- Press the arrow key [>] to switch between day, month and year.
- Confirm your entry with the Enter key [↵].

The set date is retained even after the stud welding unit is switched off.

### 12.4.6 Adjusting the Time

Via the serial interface of the stud welding unit, the continuously captured data can be output in ASCII format for possible recording *(see section 13.5 “Analysis of Parameters via RS 232 Interface CP“)*.

You can select the current time for your QA report in the main menu.

- To do this, press the arrow key [>] until the “Time” menu appears.

```
ADJUSTING TIME
  15:07:30
```

- Use key [+] or [-] to set the individual numbers.

```
ADJUSTING TIME
  14:07:30
```

- Press the arrow key [>] to switch between hours, minutes and seconds.
- Confirm your entry with the Enter key [↵].

The set time is retained even after the stud welding unit is switched off.

Date and time are stored with the help of a battery.

STOP

- **Inform your service department** if the date and time settings are not displayed correctly after switching on.


©HBS Welding Systems GmbH

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

### 12.4.7 Adjusting the Language

In the main menu, you can select the “language” in which text is output on the display.

◆ To do this, press the arrow key [>] until the “Language” menu appears.

```
SELECTION LANGUAGE
  ENGLISH
```

◆ Use key [+] or [-] to select the language.

```
SET LANGUAGE
  ENGLISH
```

The following languages are available:

– German

– English

◆ Confirm your entry with the Enter key [↵].

The set language is retained even after the stud welding unit is switched off.



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

## 12.5 Performing the Welding Process

- **First set the necessary welding parameters.**
- Read and observe here point *12.4.1 „Setting the Welding Parameters“*.

**Electric shock and electric 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 electric 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.


©HBS Welding Systems GmbH
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.



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

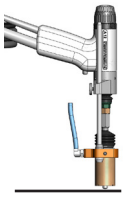
**Danger due to noise**

- 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.


©HBS Welding Systems GmbH

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*.



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

– Status displays and message of the welding system on the display

– Visual inspection

– Torque test

– Macrosection and hardness test as well as

– Tensile test.

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

## 13.1 Quality Check - Drawn-Arc Stud Welding

### 13.1.1 Carrying Out Visual Inspection

Criteria are:

– Ease of movement of the thread,

– Uniformity of the weld seam,

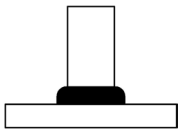
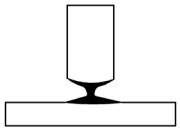
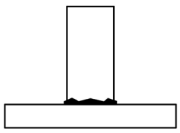
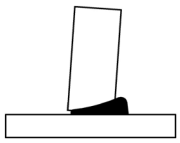
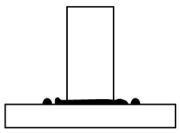
– Weld spatter and

– Porosity.

◆ Carry out the visual inspection on all welding elements.


©HBS Welding Systems GmbH

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

| Visual Inspection | | | |
|---|---|---|---|
| Condition | | Possible cause | Corrective actions |
|  | Collar regular, bright and complete.<br>Lengths after weld within tolerances | Correct parameters | none |
|  | Contraction of weld collar<br>Welding element too long | Plunging depth or lift too low<br><br>Weld power too high<br><br>Ceramic ring not centered correctly<br><br>Plunge rate too high | Increase plunging depth, check lift and centering of the ceramic ring<br><br>Reduce current and/or time<br><br>Check centering<br><br>Adjust plunge and/or gun dumper |
|  | Weakly developed, uneven weld collar with mat surface<br>Welding element too long | Weld power too low<br><br>Ceramic ferrule is moist<br><br>Lift too low | Increase current and/or time<br><br>Dry out ferrules in oven<br><br>Increase lift |
|  | Collar off centre<br>Undercut | Effect of arc blow<br><br>Ceramic ferrule incorrectly centred | See arc blow effect<br><br>Check centring |
|  | Weld collar low, shiny surface with many spatters<br>Welding element too short | Weld energy too high<br><br>Plunging speed too high | Decrease current and/or time<br><br>Adjust plunging depth and/or damping factor |

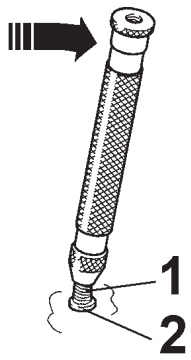


All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

### 13.1.2 Carrying out Bending Test

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

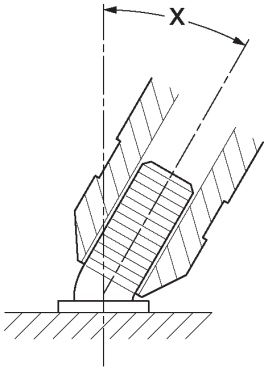
The bending test serves as an easy work sample and as a check for the selected welding parameters. The welded joint is stressed by bending in a non-defined way.




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 60° 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 60° towards the failing seam.

For a **non-destructive strength test** of the welding elements HBS offers a **torque bending test device** in accordance with DIN EN ISO 14555 (Order No. 92-40-135A).

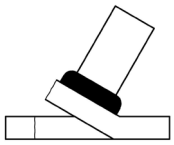
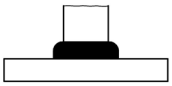
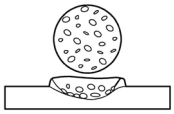
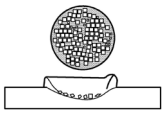

©HBS Welding Systems GmbH

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 |
|  | Tearing of parent material | Correct parameters | none |
|  | Fracture above collar after sufficient deformation | Correct parameters | none |
|  | Fracture within the weld.<br>High porosity | Weld energy too low<br><br>Unclean surface<br><br>Material not suitable for stud welding | Increase current and/or welding time<br><br>Clean the surface<br><br>Select suitable material |
|  | Fracture of weld<br>Bright appearance | Welding time too low. | Increase welding time |

**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.



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

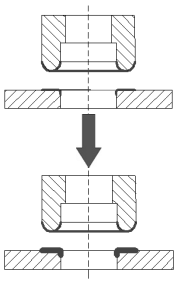
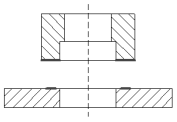
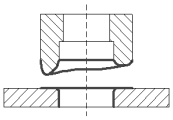
## 13.2 Quality Check - MARC Welding Procedure

### 13.2.1 Carrying Out Visual Inspection

Criteria are:

- Ease of movement of the thread/through-screwing
- Uniformity of the weld seam,
- Spatter and
- porosity.

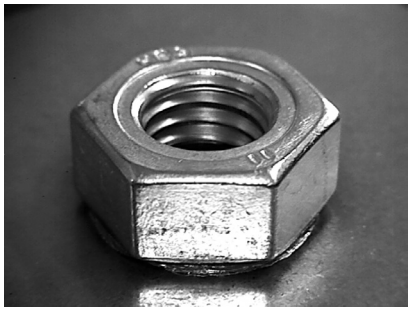
◆ Carry out the visual inspection on all welding elements.

| Melting behaviour and forming of the weld seam | | | |
|---|---|---|---|
| Characteristic | | Possible cause | Corrective measures |
|  | Welding seam uniform, shiny and closed<br>Length of the welding element after welding within tolerance<br><br>**Optimisation of the results:**<br>Increase penetration by extending the welding time while reducing the welding current | Correct parameters | None |
|  | Poorly formed, irregular welding seam with matt surface | Welding energy too low | Increase current and/or time |
|  | Welding seam one-sided<br>Drop formation on the welding element<br>Drop short-circuit | Welding energy too high | Reduce current and/or time |


©HBS Welding Systems GmbH

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

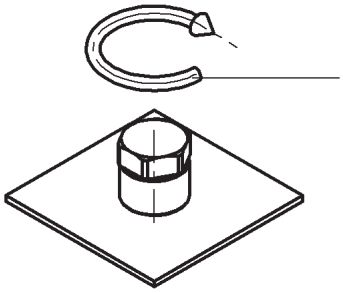
As an example of a very good weld seam appearance, here a standard sleeve of size M8 is welded to a drilled stainless steel plate (1.4301).

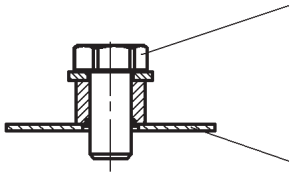


*Front and rear view of a specimen part*

### 13.2.2 Performing Torque Test

The torque test can be performed as follows:




**During the torque test, pay attention that no transverse or shearing forces are exerted on the test piece.**

**This can falsify the determined strength.**

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



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

**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.

### 13.2.3 Welding Seam Errors during MARC Welding Procedure

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

## 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 according to the table under *point 12.2 "Determining the Welding Time and Welding Current".*

- Optimise the welding parameters of the stud welding unit.
- Check the settings of the welding gun.
- If necessary re-adjust the lift and spring pressure.

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

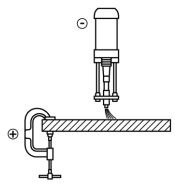
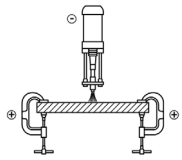
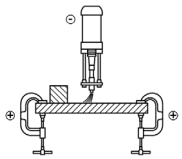
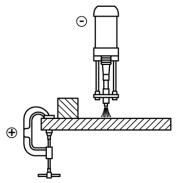
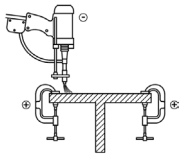
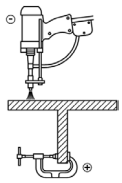

©HBS Welding Systems GmbH

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 |
|  |  |
|  |  |
|  |  |

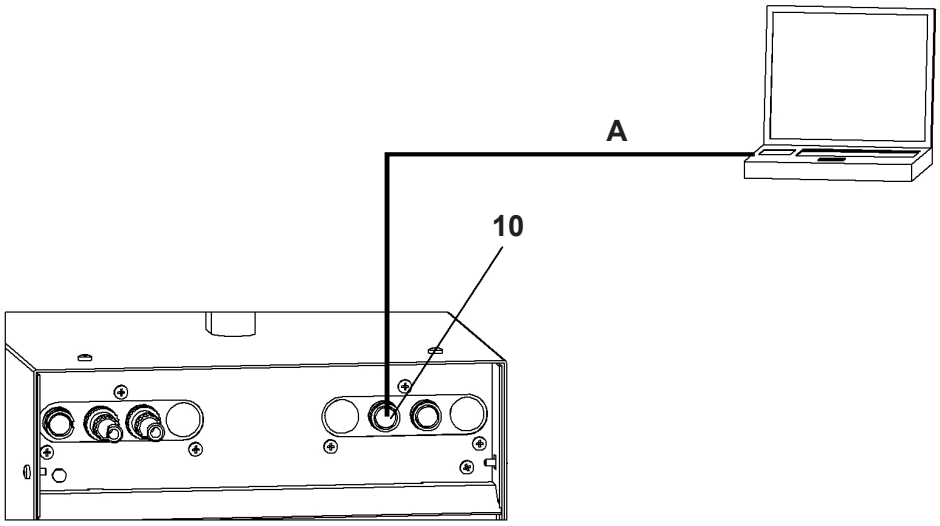


All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

## 13.5 Analysis of Parameters via RS 232 Interface CP

Via the serial interface of the stud welding unit, the actually recorded data can be output for a potential storage in ASCII format.

A data cable is required which can be ordered as a consumable at HBS (order no. 80-70-308).




10 - RS 232 interface CP 7 poles

A - Data cable, order no. 80-70-308

This data collection can be evaluated by a terminal program (e.g. Hyper Terminal).

Connection settings of the serial interface at a PC or notebook:

| | |
|---|---|
| Bits per second: | 115 200 |
| Data bits: | 8 |
| Parity: | None |
| Stop bits: | 1 |


©HBS Welding Systems GmbH

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

**Transmission of Recognized Data With Microsoft® HyperTerminal**

Microsoft® HyperTerminal is a tool to transfer performance data directly onto your PC or notebook. The program is automatically integrated into Microsoft Office until version 2007.

For later versions of Microsoft Office, such as Office 2010, the program HyperTerminal can be downloaded free of charge for your personal use.

- ◆ Switch on the controlling function of the output voltage.
- ◆ Proceed as described in section *„12.4.4 Adjusting the Controls“*.

Any data can individually be processed in the window Microsoft® Hyper Terminal.

- ◆ Link the data cable (HBS Order no. 80-70-308) to the serial sleeve of the stud welding unit and to the serial sleeve (com1 or com2) of a PC/notebook.



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

◆ Now call up the Hyper terminal:

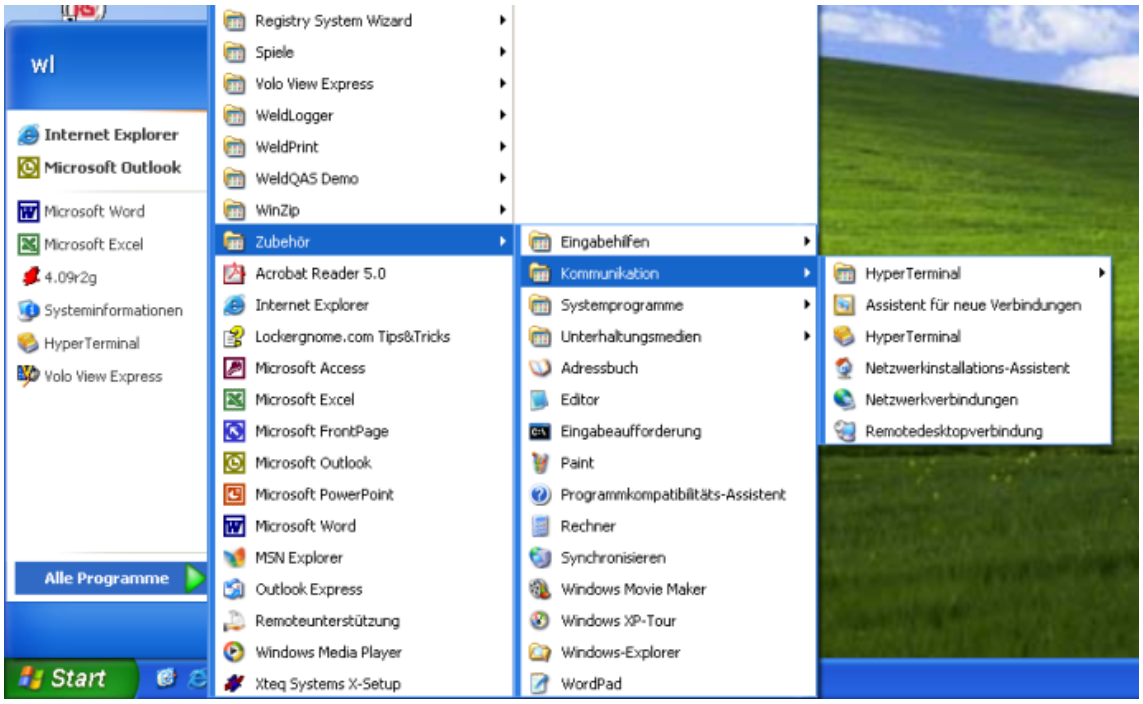
↳ Start

↳ Programs

↳ Accessory

↳ Communication

↳ Hyper Terminal





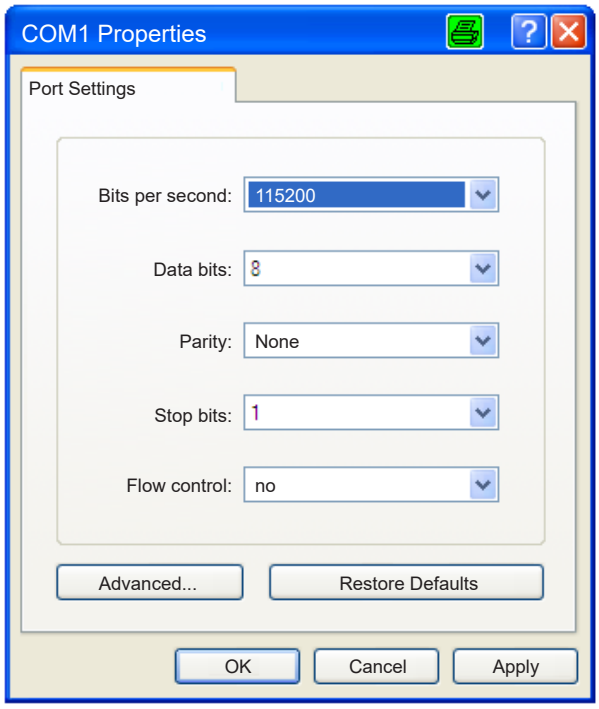

©HBS Welding Systems GmbH

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

- Name the connection (e.g. the company name or a date - however without dots).
- Select any icon.
- Confirm with OK.

- Define the interface (com1 or com2 at the PC).
- Confirm with OK.

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




◆ Define the connection settings:

**Transmission rate:** (Bits per second)

– CDMi and IT stud welding units 115200

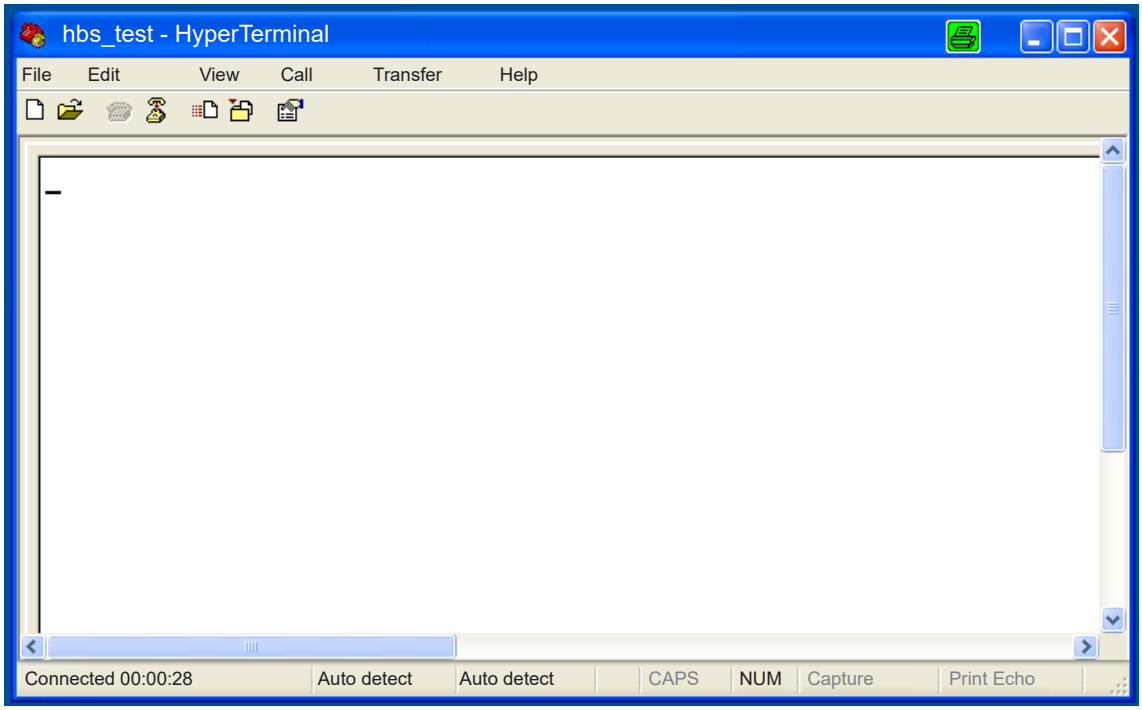
– CDM stud welding units 19200

◆ Confirm with OK.

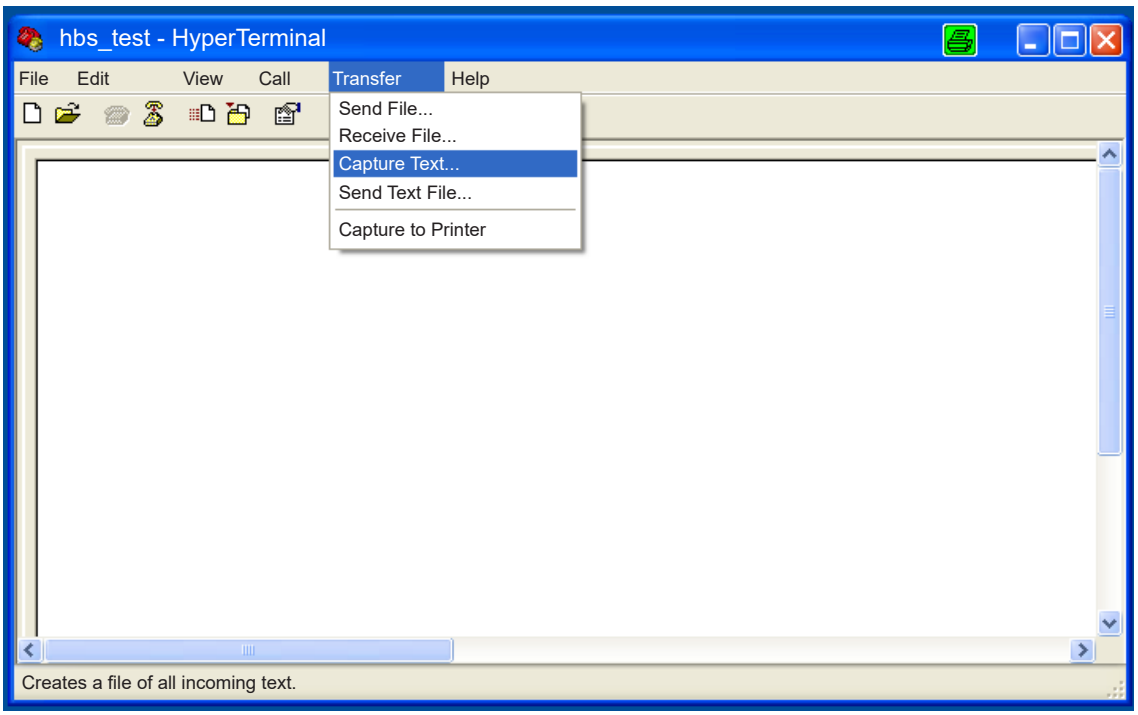


©HBS Welding Systems GmbH

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

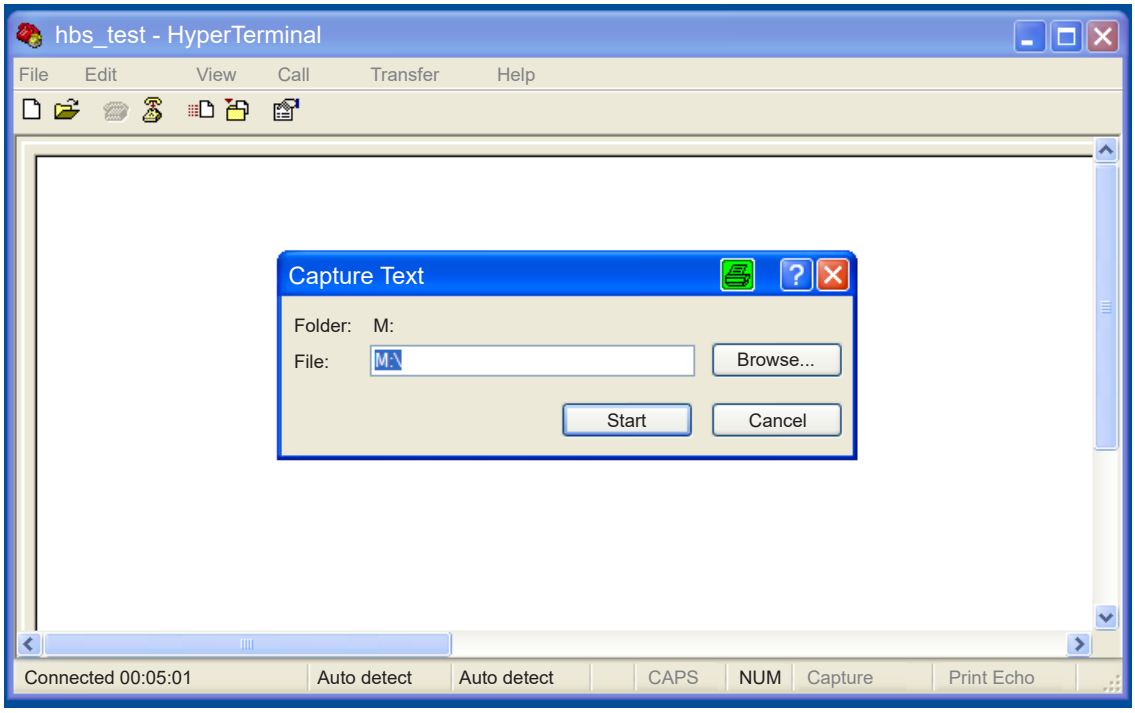



◆ Do not forget to save data.






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




- Give a file name.
- Confirm with start.

**Example for data output at serial output (e. g. Microsoft® Hyper Terminal):**

| Head | Counter | Date | Time | Mode | Curr. Nom | Time Nom | Gas time | R/M | Nom. Volt. | Stop | Toleran-ce | Act. Curr. | Act. Volt. | Act. Time | Energy | OK/ERR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KO:1 | 14776 | 26.08.2008 | 10:00:25 | REF8 | 950A | 15ms | 900ms | R | 32.82V | OFF | 15% | 943A | 32.82V | 15ms | 464Ws | |
| KO:1 | 14777 | 26.08.2008 | 10:00:39 | REF7 | 950A | 15ms | 900ms | R | 31.69V | OFF | 15% | 942A | 31.69V | 15ms | 447Ws | |
| KO:1 | 14778 | 26.08.2008 | 10:00:50 | REF6 | 950A | 15ms | 900ms | R | 33.34V | OFF | 15% | 942A | 33.34V | 15ms | 470Ws | |
| KO:1 | 14779 | 26.08.2008 | 10:01:01 | REF5 | 950A | 15ms | 900ms | R | 32.20V | OFF | 15% | 940A | 32.20V | 15ms | 454Ws | |
| KO:1 | 14780 | 26.08.2008 | 10:01:19 | REF4 | 950A | 15ms | 900ms | R | 32.82V | OFF | 15% | 943A | 32.82V | 15ms | 464Ws | |
| KO:1 | 14781 | 26.08.2008 | 10:01:31 | REF3 | 950A | 15ms | 900ms | R | 33.22V | OFF | 15% | 943A | 33.22V | 15ms | 469Ws | |
| KO:1 | 14782 | 26.08.2008 | 10:02:03 | REF2 | 950A | 15ms | 900ms | R | 31.75V | OFF | 15% | 940A | 31.75V | 15ms | 447Ws | |
| KO:1 | 14783 | 26.08.2008 | 10:02:50 | REF1 | 950A | 15ms | 900ms | R | 32.39V | OFF | 15% | 942A | 32.39V | 15ms | 457Ws | |
| KO:1 | 14784 | 26.08.2008 | 10:03:00 | | 950A | 15ms | 900ms | R | 32.53V | OFF | 15% | 940A | 31.36V | 14ms | 412Ws | OK |
| KO:1 | 14785 | 26.08.2008 | 10:03:18 | | 950A | 15ms | 900ms | R | 32.53V | OFF | 15% | 943A | 32.54V | 14ms | 429Ws | OK |
| KO:1 | 14786 | 26.08.2008 | 10:03:28 | | 950A | 15ms | 900ms | R | 32.53V | OFF | 15% | 944A | 33.08V | 14ms | 437Ws | OK |
| KO:1 | 14787 | 26.08.2008 | 10:03:38 | | 950A | 15ms | 900ms | R | 32.53V | OFF | 15% | 945A | 32.44V | 15ms | 429Ws | OK |


©HBS Welding Systems GmbH
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 |
|---|---|---|---|---|
| Primary switch does not rest in position 1 | Primary switch defective | Check primary switch*) | Replace primary switch*) | Qualified specialists |
| | Fuse F4 1 AF for primary switch defective | Check voltage supply of primary switch*) | Replace fuse F4 1 AF*) | Qualified specialists |
| | Primary cable defective | Check primary cable for breaks*) | Replace primary cable*) | Qualified specialists |
| No LED display at the front | Fuse F5 1 AF defective | Check fuse F5 1 AF*) | Replace fuse F5 1 AF*) | Qualified specialists |
| No display | No ground connection | Check ground connection on workpiece | Tighten ground connection properly | Trained personnel |
| | Welding gun not connected | Check welding gun connection | Connect welding gun properly | Trained personnel |
| | Transition resistance (between stud and workpiece) too high | Check material surface | Clean or grind material surface | Trained personnel |
| | Ground cable broken | Check ground cable*) | Replace ground cable*) | Qualified specialists |
| | Welding gun cable broken | Check welding gun cable*) | Replace welding gun cable*) | Qualified specialists |
| No display | Defective connecting line of welding gun | Check function of connecting line*) | Replace connecting line*) | Qualified specialists |
| | Welding gun trigger button defective | Check control cable for electrical flow with triggered start button*) | Replace welding gun trigger button*) | Qualified specialists |
| | Control cable broken | Check control cable for electrical flow*) | Replace control cable*) | Qualified specialists |



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

| Fault | Possible cause | Fault localisation | Fault remedy | Performance |
|---|---|---|---|---|
| Continuously red<br>Display: 8888 | Welding sequence too fast | Stud welding unit resets automatically | Let switched on stud welding unit cool down | Trained personnel |
| Gun does not lift, in spite of and | No lift adjusted | Check settings of welding gun | Modify set parameters | Trained personnel |
| | Short circuit of solenoid circuit of the gun | Check resistance value at control cable connector (18 Ω to 22 Ω) between Pin 1 and Pin 2*) | Replace control cable connector, control cable and solenoid*) | Qualified specialists |
| | Solenoid defective | Check solenoid (18 Ω to 22 Ω)*) | Replace solenoid*) | Qualified specialists |
| | Fuse F3 4 AF defective | Check fuse F3 4 AF*) | Replace fuse F3 4 AF*) | Qualified specialists |
| Lifting impossible | Solenoid circuit interrupted | Check resistance value at control cable connector (18 Ω to 22 Ω) between Pin 1 and Pin 2*) | Replace solenoid or control cable*) | Qualified specialists |
| No shielding gas | Shielding gas not connected | Check shielding gas connection | Connect shielding gas | Trained personnel |
| | Shielding gas control not enabled | Check gas control for activity | Switch on shielding gas control | Trained personnel |
| | Shielding gas valve defective | Check shielding gas valve*) | Replace shielding gas valve*) | Qualified specialists |
| No automatic stud feeding | Compressed air not connected | Check compressed air connection | Connect compressed air | Trained personnel |
| | Compressed air control not enabled | Check compressed air control for activity | Switch on compressed air control | Trained personnel |
| | Compressed air valve defective | Check compressed air valve*) | Replace compressed air valve*) | Qualified specialists |

STOP

**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 Welding Systems GmbH

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 Welding Systems GmbH

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.

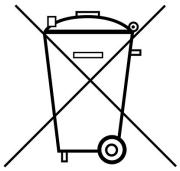
**Storage temperature:**

-5 °C to +50 °C

**Relative humidity:**

0 % - 50 % at +40 °C
0 % - 90 % at +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 Welding Systems GmbH
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

# EC Declaration of Conformity

in Accordance with Directive 2006/42/EC, Annex II 1 A
(Original EC Declaration of Conformity)

**Herewith the manufacturer**

HBS Welding Systems GmbH
Felix-Wankel-Strasse 18
85221 Dachau
GERMANY
Phone +49 8131 511-0

**declares for the following product**

Machine information: Stud welding unit
Type: IT 1002
Order No: 93-60-1206
Serial No: 93-60-1206/251XXXX
Year of manufacture: 2025

in conjunction with HBS components

**that the machinery fulfils all the relevant provisions to this Directive, including changes to the Directive to be applied at the moment of this declaration.**

The product is conform with following further EU Directives, including changes to the Directives to be applied at the moment of this declaration:

„Low voltage guideline“ 2014/35/EU
„EMC guideline“ 2014/30/EU
„Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment“ 2011/65/EU

Following harmonised standards (or parts thereof) were applied:

| | |
|---|---|
| DIN EN 60974-1 | Arc welding equipment - Part 1: Welding power sources |
| DIN EN 60974-10 | Arc welding equipment - Part 10: Product standard for arc welding equipment |
| DIN EN 60204-1 | Safety of machinery - Electrical equipment of machines; Part 1: General requirements |

The following national standards and other specifications (or parts thereof) were applied:

VDE 0544-1

**Persons who are based in the European community and who are authorised to compile the technical documentation:**

Name: Address: see manufacturer

Dachau, 01.04.2025
Place of issue, Date

Stephen Burgtorf (CEO HBS)



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


©HBS Welding Systems GmbH
All rights reserved – Reprinting, in whole or in part, only with the approval of the manufacturer

# Index


## A

accessories . . . . . 15
airborne particulates . . . . . 9, 34
air connectors . . . . . 43
automatic mode . . . . . 42
automatic welding head . . . . . 14

## B

bang . . . . . 10, 78
basic configuration . . . . . 15
basic settings . . . . . 65
batch . . . . . 79
bending device with inserts . . . . . 82
bending test . . . . . 82
blowing effect . . . . . 87
bridge rectifier . . . . . 19

## C

capacitor . . . . . 14
charging supervision . . . . . 49
checking the quality . . . . . 80
cleaning . . . . . 98
clothing, non-flammable . . . . . 10
compressed air connection . . . . . 42
contact . . . . . 49
control cable . . . . . 39
control panel and display . . . . . 21
controls . . . . . 69
control unit . . . . . 19

## D

damage to the plug connectors . . . . . 39
danger from incorrect use . . . . . 8
disposal . . . . . 100
drawn-arc stud welding, variants . . . . . 26

## E

ear protection . . . . . 12
electrical hazards . . . . . 12
electric arc . . . . . 14
electrode mode . . . . . 68
electrolytic capacitors . . . . . 19
electromagnetic fields . . . . . 12
EMF directive, safety notices . . . . . 11
external contact inquiry . . . . . 49
external welding start . . . . . 48

## F

fire extinguisher . . . . . 10, 77
fire extinguisher, approved . . . . . 34
fire hazard . . . . . 10
form „Service & Support“ . . . . . 96, 102
full-ear hearing protection . . . . . 10
fully automatic stud feeder . . . . . 40
fumes, harmful to health . . . . . 9, 34
fuse . . . . . 45

## G

glossary . . . . . 14
goggles with visor . . . . . 10
ground cable . . . . . 44
ground clamps . . . . . 44

## H

hazards for the machine . . . . . 12
hazards for the operator . . . . . 12
heart pacemaker . . . . . 9, 12, 51
helmet . . . . . 10

## I

intended use . . . . . 17, 36, 37

## L

library mode . . . . . 67
liquids, inflammable . . . . . 34

## M

main assemblies . . . . . 19
mains power supply . . . . . 45
mains switch . . . . . 19
mains voltage . . . . . 45
maintenance and care . . . . . 98
maintenance and care, regular . . . . . 98
MARC-welding process . . . . . 30
materials, inflammable . . . . . 34
Microsoft HyperTerminal . . . . . 89
minimum flow rate . . . . . 41, 64

## O

operating manual . . . . . 15

## P

protective apron . . . . . 10
protective equipment . . . . . 10




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

protective equipment, personal . . . . . 12
protective gloves . . . . . 10

**R**

rectifier. . . . . 14
risk of burns . . . . . 77
risk of falling. . . . . 34
risk of fire . . . . . 77
risk of tripping . . . . . 34
RS 232 interface CP . . . . . 88

**S**

safety goggles . . . . . 12
safety goggles with sight glass . . . . . 10
safety precautions . . . . . 8
scope of supply . . . . . 15
settings, possible . . . . . 65
shutting down . . . . . 97
spacer . . . . . 78
storage. . . . . 100
storage temperature . . . . . 100
stud feeder. . . . . 14
stud feeding time . . . . . 67
stud welding gun . . . . . 14
stud welding system . . . . . 14
stud welding unit . . . . . 14
substances, explosive . . . . . 34
surface of base material . . . . . 83, 86
surface of welding element . . . . . 83, 86
switch on the stud welding unit . . . . . 52
symbols used. . . . . 12

**T**

technical data . . . . . 16
test welding . . . . . 52
torque test . . . . . 85
troubleshooting . . . . . 95
type plate . . . . . , 20

**V**

vessels, welding work on. . . . . 77
visual inspection . . . . . 80, 84

**W**

warranty entitlement . . . . . 18
welding current . . 53, 54, 55, 57, 58, 60, 61
welding current cable. . . . . 39
welding current, determination . . . . . 52
welding current stabilizer . . . . . 19
welding element. . . . . 14
welding gun attachment. . . . . 78
welding head . . . . . 39
welding parameters . . . . . 14, 36
welding process. . . . . 24
welding time. . . . . 53, 54, 55, 57, 58, 60, 61
welding time, determination. . . . . 52
workpiece . . . . . 14


©HBS Welding Systems GmbH

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

HBS Welding Systems GmbH
Felix-Wankel-Strasse 18 • 85221 DACHAU • GERMANY
Phone +49 8131 511-0 • E-mail sales@hbswelding.systems

**www.hbswelding.systems**