



ONURFIX®

KAH 412 LA

Automatic Welding Head

94-37-412



Operating Manual

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Dear customer,

Thank you very much for purchasing a power unit from HBS Bolzenschweiss-Systeme.

We from HBS wish you always successful working with this stud welding unit.

We ask you to observe the following points:

- Store the operating manual in a way that it can always be accessed by the operator.
- Let the operator sign before starting up that he has read and completely understood the operating manual.
- This operating manual applies only to this stud welding unit.
- Protect the stud welding unit from unauthorized use.
- The stud welding unit must only be operated by trained personnel.
- Let an electrician check whether the wall sockets where you want to connect the related stud welding unit, are properly fused and grounded.
- Inform our customer service in case of malfunction.
- In case of accident, inform a physician and the responsible official body.



THREAT TO LIFE!

Persons fitted with a pace maker must not operate the stud welding machine.



MAGNETIC FIELDS!

During stud welding, strong electro-magnetic fields are generated. Do not weld in the vicinity of the electrical equipment which could be affected.

Safety instructions are a delicate subject. Anybody who handles a stud welding unit, whether it is the welding gun or the power unit, should be familiar with them, because improper use of stud welding units can be dangerous to life.

For your own sake you should know the safety instructions for operating your HBS stud welding units inside out.

In addition to the protection of your health and the capital value of the enterprise, the safety instructions are intended to clarify any responsibilities, which arise from ownership and operation of the equipment.

This chapter of the operating manual offers you clear and easy to understand information for the safe operation of your HBS stud welding unit.

Your power unit may differ in some details from the captions in this manual. This has no effect on the operation of the welding machine.

Should you have questions about this manual or in case you want to order some more copies, please provide the order number listed in the foot line.

Important reminder:

Data and information herein were collected with greatest care. Although we did our very best to correctly update any information up to the time of delivery, there is no guarantee in respect of errors.

If you should detect errors or mistakes right in this manual, please contact us:

HBS Bolzenschweiss-Systeme GmbH & Co. KG

Felix-Wankel-Strasse 18

85221 Dachau / Germany

A feedback blank is provided in the appendix.

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1 General

Persons addressed by this operating manual

This operating manual is written for operators, personnel of the end user, and authorized service technicians. It provides you with all necessary information to operate the welding head.

Required user qualification

The welding head must only be operated by qualified personnel.

- ◆ Let the welding head only be operated by persons who
 - are qualified through a suitable training according to the current standards (see appendix),
 - are properly instructed,
 - are physically and intellectually suitable,
 - can be expected to reliably fulfill the requested job.

What else must the owner observe?

- ◆ Make sure that this operating manual is always in reach of the welding head.
- ◆ Read the entire manual before operating the power unit.
- ◆ Strictly observe the safety instructions.
- ◆ Before starting up the power unit, let the operator sign the confirmation that he/she has read and fully understood the operating manual (see appendix).
- ◆ Do not commence stud welding until you have understood all operating processes.
- ◆ Contact us if there are any doubts on certain operating procedures.
- ◆ Protect the welding head against unauthorized use.
- ◆ Inform our service in case of malfunction.

Based on this operating manual, a company specific work order, as well as a company specific maintenance instruction must be drawn up. The company specific work order must consider the special user conditions in your company.

Make sure that operators of the welder are provided with and wear personal protective equipment, e.g. protective goggles, gloves, shoes, ear protection etc.

Owners and operators make sure that the welding head is only used as directed.

- ◆ During any activity such as transportation, set-up, (re-)assembly, production, maintenance etc. observe the information given in this operating manual.

1.1 Guide to this Operating Manual

This operating manual provides you with the following information

| | |
|------------------------------|--------------|
| "Delivery" | in Chapter 2 |
| "Starting-up" | in Chapter 3 |
| "Functional Principle" | in Chapter 4 |
| "Stud Welding Process" | in Chapter 5 |
| "Switching off" | in Chapter 6 |
| "Care and Maintenance" | in Chapter 7 |
| Technical Data and much more | in Appendix |

THREAT TO LIFE and risk of serious health and material damage in case of improper use of the welding head. Observe all notes in this operating manual.



Note for qualified operators (see chapter 1).



All instructions contained in this manual must also be observed by qualified operators.

The welding process and the sequence of procedures to carry out a weld are described in chapter 5.

1.2 Safety Symbols

Symbols and markings used in this operating manual mean:



Threat to life or risk of personal injury



Risk of material damage



Ban for persons fitted with a pace maker



Warning of dangerous electrical voltage



Warning of electromagnetic fields



Wear protective clothes



Wear protective goggles



Wear ear protection



Additional tips for operation and service safety



Prompt



List

1.3 General Safety Instructions



Improper operation of the welding head is LIFE-THREATENING!

Threat to life

- by electric shock and arc
- by toxic vapors and airborne particles
- by red-hot metal spatters (fire risk)
- by blow-up of explosive gases and materials
- by strong magnetic fields for persons fitted with a pace maker

In addition, through improper use damage to the stud welding unit and to material can be caused. For details, see chapters 1, 3 and 5.

1.4 Intended Use



Danger

Warning: Unauthorized interference with the stud welding unit as well as unauthorized alteration of the stud welding unit are prohibited and result in complete cancellation of any guarantee and liability claims against HBS.



Operation of the welding head is only allowed with HBS power units, this clause is also part of "use as directed".

The welding head is intended to weld welding elements according to actual standards (see chapter 5 and appendix). Any other use is regarded as not used as directed. The manufacturer is not liable for damages resulting from the welding head not used as directed. Any risk is carried by the user.

The welding head is designed according to specific standards and accident prevention regulations. Basics are European Union guidelines and in Germany valid standards. *Please note that in your country additional standards and safety conditions (especially rules for accident prevention) may differ from the standards mentioned in this operating manual.* The welding head was manufactured to the latest developments in technology and is regarded as safe to operate (place of operation see section 8.1).

The welding head KAH 412 can be connected to the HBS power unit ARC 500 Automatic, ARC 800 Automatic, ARC 1550 Automatic, IT 90 Automatic, IT 1001 Automatic, IT1002 Automatic, CDM 1601 Automatic, CDM 2401 Automatic, CDM 3201 Automatic and SCD 3201 Automatic. For details please contact the HBS customer service (address see page ii).

- ◆ Check in any case the operating manual of the HBS power unit whether this welding head can be used.

Observing the operating manual of the used power unit is also part of the "use as directed".

1.5 Transportation, Packaging, Storage

HBS delivers products in a specific transport package.

- ◆ Save the undamaged packing. Ship and transport the device only in its original packing.

Right before delivery, the welding head is once again checked for proper functioning and a control mark is attached. When receiving the delivery, check everything for damages and completeness. If damages occurred during transportation or components are missing, inform the manufacturer or the haulier immediately (see page ii).

Proper functioning of the welding head can only be checked before starting-up by visual inspection (visible damage).

The following items are to be observed if the welding head is not to be put into operation immediately after delivery.

- The welding head must be stored in a secure place
- The welding head must be protected against humidity, dust, metallic dirt.
 - Storage temperature: -5 °C to +50 °C
 - Relative humidity: 0% to 50% at +40 °C
0% to 90% at +20 °C
- ◆ If you resell the welding head, please provide us with the name and postal address of the new owner so that we can advise them of any changes to the operating manual.

1.6 Accompanying Documents

In addition to this operating manual, you must observe the operating manual of the power unit as well as applicable accident prevention and safety instructions.

1.7 Markings

There are various markings and safety symbols attached to your power unit (see section 8.1).

- ◆ Make sure that all markings remain clearly visible.

Type plate

The type plate contains the following data:

Manufacturer

Type

Order No./Serial No.

Primary voltage

Fuse

Power consumption

Cooling class

Protection class

Date

Safety symbols



Replace illegible or damaged markings



Before opening machine disconnect mains



Observe operating manual



Warning of dangerous electrical voltage

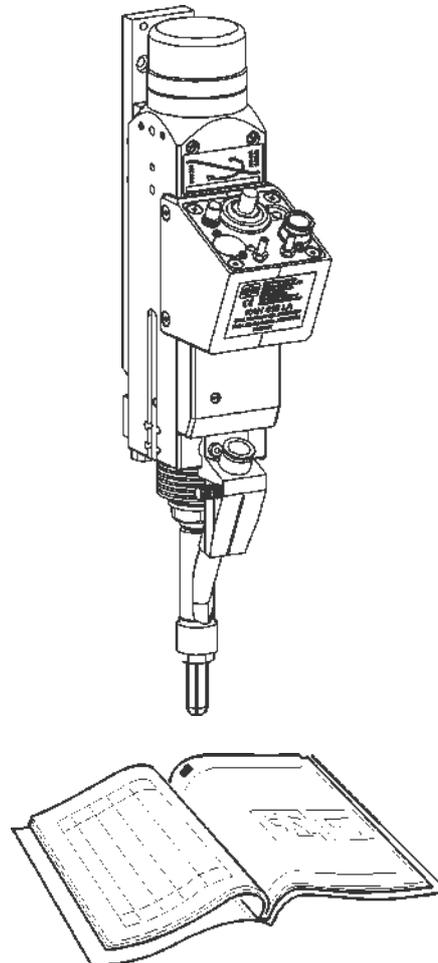
- ◆ Secure the following safety symbols in the area of welding place:



2 Delivery

The basic equipment of your welding head contains the following components:

| No. of pieces | Part | Type | Order No. |
|---------------|---|------------|-------------|
| 1 | Welding head equipped for one stud dimension | KAH 412 LA | 94-37-412 |
| 1 | Operating manual | KAH 412 LA | BA94-37-412 |



3 Starting-up

In this chapter you learn what to observe during setting-up and starting-up of the welding head.

3.1 Requirements of Workplace



The welding head corresponds with protection class IP 20. It must not be used in humid conditions!



Vapors and airborne particles may occur during stud welding operations. Especially with surface treated materials, toxic vapors may be produced.

- ◆ Ensure that a fume extraction is available and that the room is adequately ventilated according to accident prevention regulations.
- ◆ If possible, do not weld in rooms which are lower than 3 meters.
- ◆ Special regulations apply for confined rooms, according to accident prevention regulations of the official bodies (see appendix).
- ◆ Weld only in adequate distance from combustible articles or liquids.
- ◆ Before you start welding, remove any combustible articles or liquids in vicinity of the workplace.
- ◆ Make sure that a fire extinguisher is within reach.
- ◆ Never weld in rooms exposed to risk of explosion.
- ◆ Do not set-up the product in the vicinity of any apparatus or equipment which is sensitive to welding spatters or magnetic fields.
- ◆ Set-up the welding head:
 - on a stable, clean, and level surface
 - so that no-one is influenced or injured by welding spatters
 - so that all cables and primary lines are protected from being damaged
 - so that nobody will trip or fall over the cables or connection lines.
- ◆ Ensure that air is able to circulate freely through the housing.



If heat is built-up inside the housing caused by bad air circulation, the stud welding unit will be seriously damaged.

- ◆ Secure the following safety symbols in the area of welding place:



THREAT TO LIFE to persons fitted with a pace maker

Strong electro-magnetic fields occur in the vicinity of the stud welding unit during welding. Such fields may affect the proper function of a pace maker. Thus persons equipped with a pace maker must not operate the stud welding unit and must not stay in its vicinity during welding.



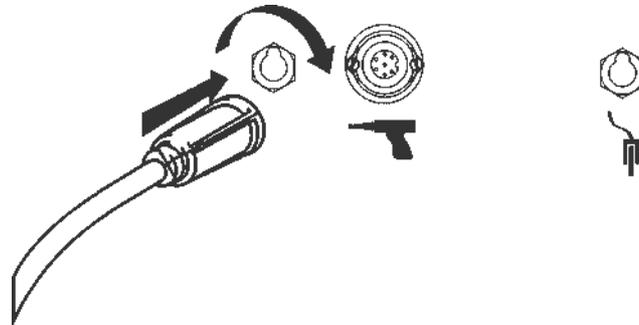
During the actual welding process, you must expect red-hot welding spatters, possibly liquid spatters, a flash, and a loud bang > 90 dB (A). Alert any colleagues who are occupied in the vicinity of the welder. Wear your personal protective equipment according to actual standards (see appendix).

3.2 Connecting the Welding Head to the Power Unit



Switch off the power unit. In this way, you avoid any risk of electrical shock.

- ◆ Plug the connecting line of the welding head into the socket of the power unit.
- ◆ Press-in the plug and twist firmly to the right.



The connection is not secured against working itself loose! Check the plug connections regularly to ensure that they are properly locked. In case of loose connection, heat may build up in the plug and may destroy the entire plug connection.

- ◆ Plug the control cable of the welding head into the appropriate connection of the power unit.
- ◆ Twist the retaining nut of the control cable plug clockwise to secure the connection.



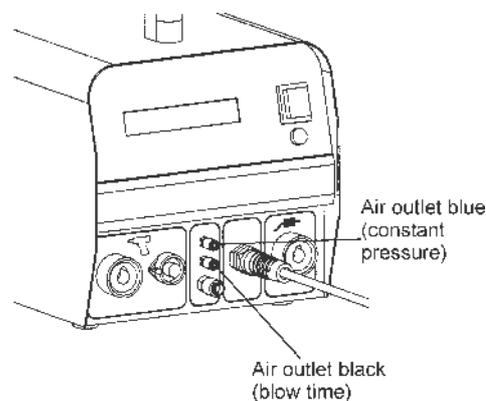
The welding head cables must not be coiled during welding. Coiled cables work as a coil and may negatively affect the welding result. Before welding, lay out the cables lengthwise.



Take care to ensure good connection on the welding head before you pin the pneumatic connections onto the power unit.

- ◆ Plug-in the connectors of your air pressure supply into the appropriate bushings at the front side of the power unit.

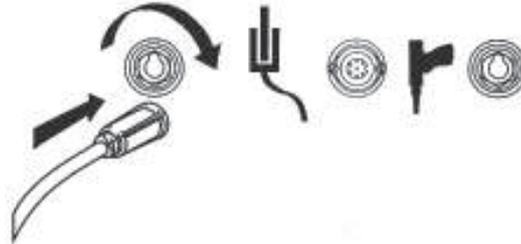
The power unit controls the air between booth bushings.



Air connection B (blue marking) and air connection A (black marking) must not be interchanged (ends up in failure during feeding and welding).

3.3 Ground Connection

- ◆ Plug the ground cable in the connector of the power unit.

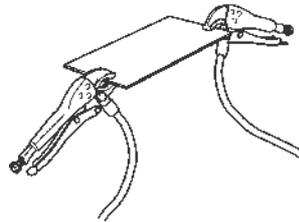


- ◆ Press in the plug and twist firmly clockwise.



The connection is not secured against working itself loose! Check the plug connections regularly to ensure that they are properly locked. In case of loose connection, heat may build up in the plug and may destroy the entire plug connection.

- ◆ Remove any rust, paint, or contaminants from the workpiece in the areas where you intend to connect the ground cables.
- ◆ Connect the ground clamp to the workpiece as securely as possible.



Take care to ensure good contact and symmetrical connection. The welding location must lie directly between the two ground clamps.

3.4 Change Working Place



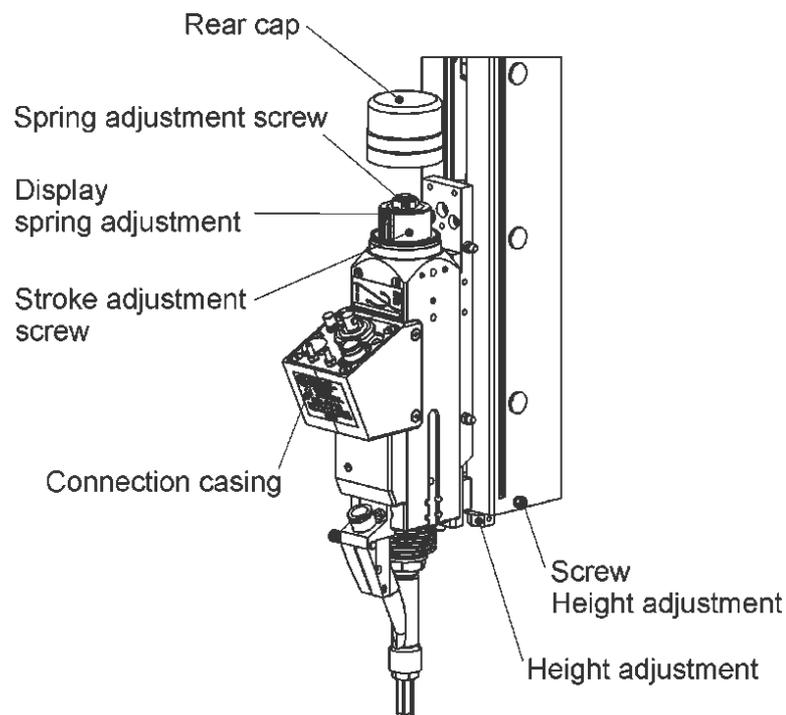
Switch off the power unit. In this way, you avoid any risk of electrical shock.

- ◆ When you move your workplace, disconnect the welding head and the ground cable from the power unit. Proceed in reversed sequence as described in section 3.2 and 3.3.
- ◆ After changing the workplace, check the welding head and the ground cables for possible damage or missing components.

4 Function

In this chapter you learn more about the design of the welding head and how to use the various setting options.

4.1 Components of the Welding Head



The basic body of the welding head KAH 412 is made of an aluminum square.

All supply lines are plugged in the connection casing (welding current cable, control cable, air pressure hoses).

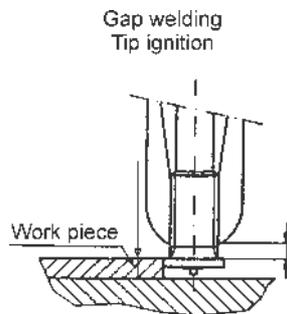
At the front side of the welding head KAH 412 the slot tube is located, which may be quickly replaced by means of the stop spring. Supplying the welding fittings to the chuck (manually or automatically) is done through the slot tube with guide bushing. The plunger cylinder, which is integrated in the piston and equipped with linear ball bearings with zero backlash, transports the fitting pneumatically through the chuck in welding position.

Above the connection casing, the complete adjusting mechanism for lift-off and spring force is positioned. The spring force is directly displayed on a scale.

Attaching the welding head KAH 412 in Z-direction is done with the quick-change prism system, which is mounted on the backside. The fixture is performed pneumatically or motor-driven, depending on customer's needs.

4.2 Adjusting the Working Position

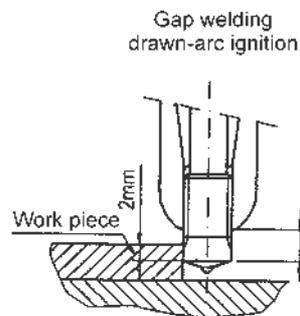
- ◆ Feed a welding fitting into the chuck.
- ◆ Remove the rear cap.
- ◆ Move the Z-axis into working position (adjustment mode) until a contact signal is shown at the power unit.
- ◆ Adjust the penetration depth acc. to your welding task by means of the adjustment element.
- ◆ Move the Z-axis to starting position.



Projection of the welding element: 2 mm



The upper side of the flange must be level with the surface of work piece.

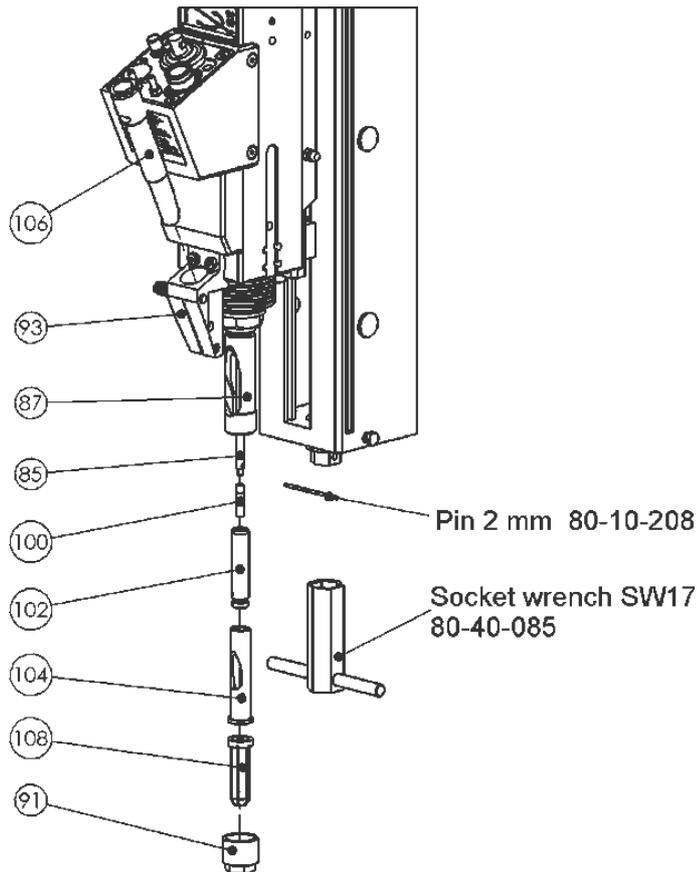


Projection of the welding element
selection: length stop one step below standard
e.g. length of the welding element 12 >
length stop 10

4.3 Equipping the Welding Head for a Welding Fitting



When you equip the welding head, turn off the power unit and pull out the air connection B (blue marking).



The equipment, which is delivered together with the welding head, consists of components of your choice:

| Position | Number | Description | Order-No. |
|----------|--------|--------------------|-----------|
| | 1 | Socket wrench SW17 | 80-40-085 |
| | 1 | Pin 2 mm | 80-10-208 |
| 108 | 1 | Chuck * | |
| 104 | 1 | Guide bushing * | |
| 102 | 1 | Pin stop * | |
| 100 | 1 | Plunger * | |
| 106 | 1 | Feeding tube * | |

* Choice according to type and dimension of the welding element

- ◆ Select the conversion components, which fit to your welding element (see section 8.4).
- ◆ Unscrew the retaining nut (91) by means of the socket wrench SW17 from the slot piston (87).
- ◆ Charge the welding head with a short air pressure pulse from air connector B, to position the piston rod (85) in its front-end position (if any part is still inside the welding head, it will be squeezed out).
- ◆ Put the pin 2 mm into the cross hole of the piston rod and turn the plunger (100) with pliers until it is tight.
- ◆ Screw the pin stop (102) with the pin 2 mm onto the guide bushing (104).
- ◆ Slide the unit (102/104) in the slot piston. The correct position is ensured by the guide pin in the slot piston and the groove in the guide bushing.



Ensure that the unit (102/104) is completely put in the slot piston (87), when properly assembled.

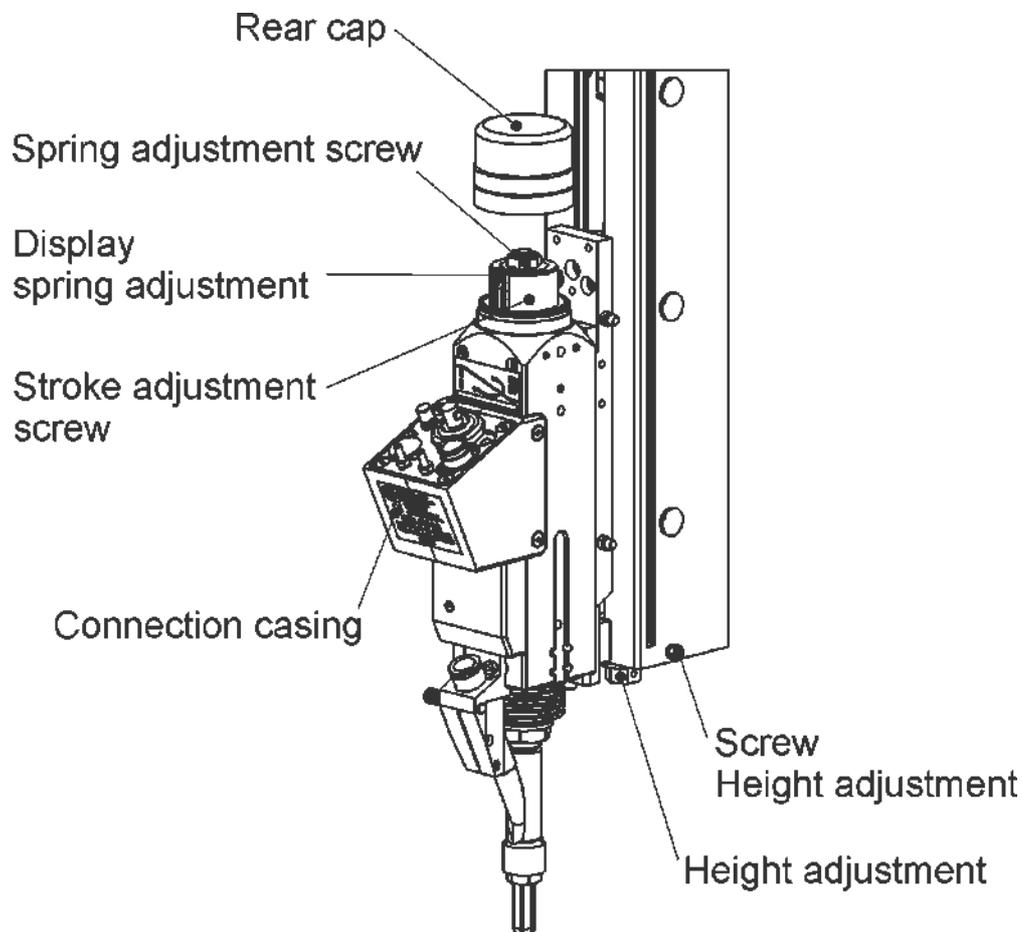
- ◆ Position the chuck (108) on the slot piston and fix it with the retaining nut.



A loose retaining nut damages the chuck, the slot piston, the retaining nut.

- ◆ Press the trigger pin and put the feeding tube (106) into the holder (93). Take care for the trigger pin: when it springs back into its initial position, the feeding tube is now correctly positioned and secured.
- ◆ Now you may plug-in the air connector blue again.

4.4 Adjustments



Adjusting the Stroke and Spring Force

- ◆ Insert the fitting.
- ◆ Move the Z-axis to work position (adjusting mode).
- ◆ Move the Z-axis to starting position.
- ◆ Set the solenoid core in base position up to the stop to the left. Now you achieved the minimum lift value of 0.5 mm.
- ◆ Now you can adjust the lift value (depending on your welding parameters). Turn the lift adjustment screw clockwise to adjust the screw in catching steps of 0.1 mm.



Total piston stroke is 7 mm. If the plunging depth is 2 mm, you can lift max 5 mm.

Adjusting the Spring Pressure

- ◆ Adjust the spring pressure through turning the spring adjustment screw from its zero position counter-clockwise.
- ◆ You find the correct spring pressure value in the table of welding parameters, which correspond to your welding task.



Please note that the stroke has to be checked as soon as you changed work piece or welding elements.

- ◆ Check the welding head for easy operability of the function unit before you start a new job; deflect manually the spring of the chuck in axial direction:
- ◆ Remove welding spatters from chuck and slot piston.
- ◆ After you finished the adjustments, put on the rear cap again.

5 Stud Welding Procedure

This chapter contains the basics of welding, how you must actually proceed, and what must be observed. You learn to select correct welding parameters and which welding elements can be used.

5.1 Safety Instructions



Improper operation of the welding head is LIFE-THREATENING!

Threat to life

- by electric shock and arc
- by toxic vapours and airborne particles
- by red-hot metal spatters (fire risk)
- by blow-up of explosive gases and materials
- during welding of hollow parts
- by strong magnetic fields to persons fitted with a pace maker



THREAT TO LIFE by electrical shock and arc

During the actual stud welding process, do not touch the welding elements, chuck, or retaining nut nor any electrically conductive parts in their vicinity. These are all electrically life.

Step onto an insulating mat, if you have to weld under the following conditions:

- in confined rooms with electrically conductive walls
- under confined conditions between or on electrically conductive parts
- with restricted freedom of movement on electrically conductive parts
- in wet or hot areas.

When operating the stud welding unit, you must not wear any metallic jewellery incl. wrist watches, especially on hands. Remove any electrically conductive or electromagnetically sensitive parts from your body before you start welding. In this way, you avoid the risk of electric shock and influence of electromagnetic fields.



THREAT TO LIFE by toxic vapors and airborne particles

Toxic vapors and airborne particles may occur during stud welding operations, especially with surface treated materials.

Ensure that a fume extraction is available that the room is adequately ventilated according to accident prevention regulations.

If possible, do not weld in rooms which are lower than 3 meters. Special regulations apply for confined rooms according to accident prevention regulations of the official bodies of your country (see appendix).



THREAT TO LIFE by red-hot metal spatters (fire risk)

Make sure that a fire extinguisher is within reach.

Do not wear clothes during welding, which are contaminated with combustible materials like oil, grease, kerosene etc. during welding.

Always wear your personal protective equipment like:

- protective gloves to current standards (see appendix),
- safety goggles with a window providing protection class 2 to current standards (see appendix),
- non-combustible clothes,
- ear protection to current standards (see appendix),
- a protective apron over your clothes,
- a protective headgear when welding overhead.

Before starting to weld, remove all combustible articles and liquids in vicinity of the workplace.

Weld only in sufficient distance from combustible articles or liquids. Choose a safety distance where there is no risk to injury from welding spatters!



THREAT TO LIFE by blow-up of explosive gases and materials

Never weld in rooms exposed to danger by explosion.

Special know-how is required when welding hollow parts which

- are combustible or support combustion,
- can emit toxic gasses, vapors or airborne particles,
- can explode.

Never execute such operations, if you do not have such special know-how.



Observe the regulations for accident prevention and standards which apply to the use of your stud welding unit (see appendix). The official Professional Association of your country will provide you with further information.

Please note that in your country additional standards and safety conditions (especially rules for accident prevention) may differ from the standards mentioned in this operating manual.

**THREAT TO LIFE to persons fitted with a pace maker**

Strong electromagnetic fields occur in the vicinity of the stud welding unit during welding. Such fields may affect the proper function of a pace maker. Thus persons equipped with a pace maker must not operate the stud welding unit and must not stay in its vicinity during welding.



During the actual welding process, you must expect red-hot welding spatters, possibly liquid spatters, a flash and a loud bang > 90 dB (A). Alert any colleagues who are occupied in the vicinity of the welder. Wear your personal protective equipment according to actual standards (see appendix).

**MAGNETIC FIELDS!**

During stud welding, strong magnetic fields are present. Do not weld in the vicinity of electrical systems and machines which could be affected.

**Danger**

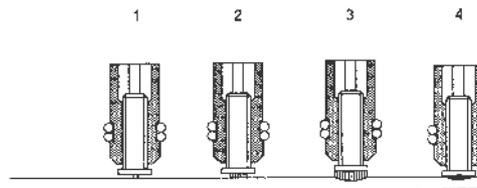
Warning: Unauthorized interference with the stud welding unit as well as unauthorized alteration of the stud welding unit are prohibited and will result in complete cancellation of any guarantee and liability claims against HBS.

- ◆ In case of any accidents whatsoever, advise a physician, your supervisor, and the official bodies immediately.

5.2 Functional Principle of Stud Welding

Stud welding with tip ignition is divided into gap stud welding and contact stud welding.

5.2.1 Contact Stud Welding



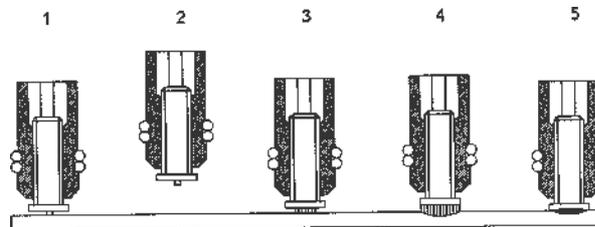
- The welding head is placed onto the workpiece (figure 5.2.1, position 1). The welding element which projects above the welding head support legs, is pushed back tensioning a pressure spring.
- After positioning the welding head against the workpiece, the operator triggers the welding head button and starts the welding process; thus the current circuit is closed.
- The capacitors of the power unit are discharged. Because of the high discharge current, the ignition tip evaporates explosion-like. The air gap between welding element and workpiece is ionized (see figure 5.2.1, position 2), an arc is produced.
- The arc melts the face of the welding element together with an area of the workpiece of about the same dimension (see figure 5.2.1, position 3).
- Caused by the pressure spring, the welding element moves to the workpiece with a speed of 0,5 to 1 m/s. The adjusted spring pressure controls the plunging speed of the welding element.
- Higher plunging speed leads to shortened arc time and consequently to lower welding energy with identical voltage setting.
- The arc is cut as soon as the welding element touches the workpiece.
- Now the capacitors are short-circuited and the rest of the energy drains off (see figure 5.2.1, position 4).
- The pressure spring continues to push the welding element into the weld pool.
- The weld pool solidifies and the welding element is physically connected to the workpiece.
- The time period between ignition of the arc and solidification of the weld pool is about 3 ms.



With high plunging speed of the welding element, the air gap closes after vaporization of the ignition tip faster, thus the arc time becomes shorter. With rapidly oxidizing materials like e.g. aluminum, the arc must only burn a very short time.

- The use of contact welding for rapidly oxidizing materials like aluminum and aluminum alloys is limited, as the arcing period with contact welding is longer than with gap stud welding.

5.2.2 Gap Stud Welding



- The solenoid, which is integrated into the welding gun, lifts the welding element from the workpiece (see figure 5.2.2, position 1) to the adjusted value "lift" above the workpiece and tensions a pressure spring (see figure 5.2.2, position 2).
- As soon as the welding piston has reached the upper stop, the current to the solenoid is cut. Simultaneously, the welding thyristor is triggered and releases the current flow to the welding element.
- The capacitors of the power unit are discharged. Because of the high discharge current, the ignition tip evaporates explosion-like. The air gap between welding element and workpiece is ionized (see figure 5.2.2, position 3), an arc is produced.
- The arc melts the face of the welding element together with an area of the workpiece of about the same dimension (see figure 5.2.2, position 4).
- The welding element is moved by the pressure spring to the workpiece with a speed of 0,5 to 1,5 m/s. The adjusted spring force and the preset lift distance controls the plunging speed of the welding element.
- Higher plunging speed leads to shortened arc time and consequently to lower welding energy with identical voltage setting.
- The arc is cut as soon as the welding element touches the workpiece.
- Now the capacitors are short-circuited and the rest of the energy drains off (see figure 5.2.2, position 5).
- The pressure spring continues to push the welding element into the weld pool.
- The weld pool solidifies and the welding element is physically connected to the workpiece.
- The time period between ignition of the arc and solidification of the weld pool is about 1 to 2 ms.



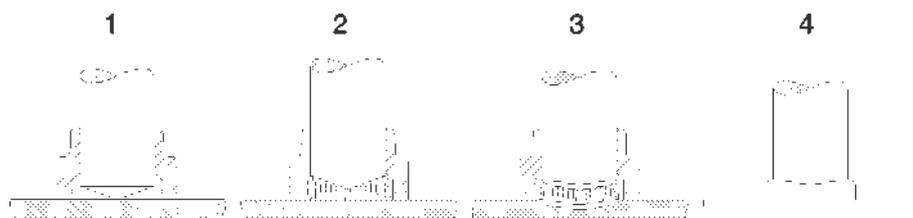
With high plunging speed of the welding element, the air gap closes after vaporization of the ignition tip faster, thus the arc time becomes shorter. With rapidly oxidizing materials like e.g. aluminum, the arc must only burn a very short time.

5.2.3 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 (see appendix). The standards assign this method of joining pin-shaped elements with plane workpieces to the so called 'Arc Pressure Welding' (code BH).

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 power 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 position 1). When the button of the welding gun is triggered, the automated welding process starts, which works as follows:



Pre-flow of shielding gas depending on set pre-flow time (only with shielding gas for weld pool protection).

- 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 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 power 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 position 3).
- At the end of the preset welding time, the welding element is mechanically moved to the workpiece. On plunging into the weld pool, the two weld zones join and solidify. The contact of welding element 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 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 (see appendix).

Variations on Drawn-Arc Stud Welding

| Item | Drawn-arc stud welding with ceramic ferrule/ring | Drawn-arc stud welding with shielding gas | Short-cycle stud welding with shielding gas | Capacitor-discharge stud welding with drawn-arc |
|---|--|--|---|---|
| Diameter welding element d [metric mm (imperial)] | 3 - 25 (#4 or 12 gage to 1") | 3 - 12 (16) (#4 or 12 gage to 1/2" (5/8")) | 3 - 12 (#4 or 12 gage to 1/2") | 2 - 8 (14 gage to 5/16") |
| Max. current I [A] | 3000 | 2500 | 1500 | 5000 |
| Welding time t [ms] | 50 - 2000 | 50 - 2000 | 5 - 100 | 3 - 10 |
| Energy source | Welding rectifier Welding transformer | Welding rectifier Welding transformer | Welding rectifier | Capacitor |
| Weld pool protection | Ceramic ferrule CF | Shielding gas SG | Shielding gas SG No protection NP | No protection NP |
| Material welding element | S 235 CrNi steel Aluminum (up to 12 mm/0,47") | S 235 CrNi steel Aluminum (up to 12 mm/0,47") | S 235 CrNi steel Brass (with shielding gas) | S 235 CrNi steel Aluminum, brass, copper |
| Workpiece surface | Metallic bright (rolling skin, rust film) | Metallic bright (rolling skin, rust film) | Metallic bright, galvanized, light oiled | Metallic bright, galvanized, light oiled |
| Min. thickness of workpiece | 1/4 d min. 1 mm (0,04") | 1/8 d min. 1 mm (0,04") | 1/8 d min. 0,6 mm (0,02") | 1/10 d min. 0,6 mm (0,02") |
| Adjustable parameters | Welding current I [A] = 80 x d (up to 16 mm/0,63") | Welding current I [A] = 80 x d (up to 16 mm/0,63") | Welding current I [A] = 100 x d (up to 12 mm/0,47") | Charging voltage |
| | Welding time t [ms] = 20 x d (up to 12 mm/0,47") | Welding time t [ms] = 20 x d (up to 12 mm/0,47") | Welding time | Ignition point / lift |
| | Lift (arc length) | Lift (arc length) | Lift (arc length) | Spring pressure (plunging speed) |
| | Plunging depth | Plunging depth | Plunging depth | Plunging depth |

5.2.4 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 50 to 2000 ms. Principally, it is suitable for all welding positions, however, it is preferably used in vertical 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.



With steel and CrNi steel, the gas mixture 82% Ar and 18% CO₂ (DIN EN ISO 14175 – M21) is mainly used.



With aluminum, pure argon Ar 99,99 (DIN EN ISO 14175 – I1) or Ar-He mixtures (DIN EN ISO 14175 – I3) are used.

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.

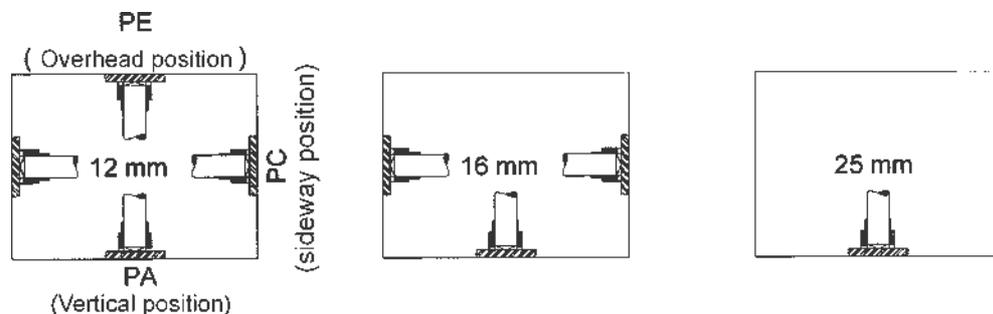
With stud welding with shielding gas, the shape of the weld collar is not reproducible, as the shielding gas has no forming effects on the melt – different from a ceramic ferrule. And so an additional ceramic ferrule may be used in special cases.

The standard welding elements and ceramic ferrules for drawn-arc stud welding are described in several standards (see appendix). Welding elements with cone-shaped front area and without an aluminum ball are preferably used.

Welding elements with cone-shaped front area  preferably used under shielding gas.



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



5.2.5 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 5 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, see appendix) 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.

5.2.6 Drawn-Arc Capacitor-Discharge Stud Welding

With drawn-arc capacitor-discharge stud welding, the welding energy is taken from a capacitor. As a result, welding currents are very high and welding times (< 10 ms) very short. Normally, a weld pool protection is not required. The process is mainly used for welding elements in a diameter range of up to 8 mm.

5.3 Welding Preparation

- ◆ Read the safety instructions in chapters 1, 3 and 5.
- ◆ Observe the workplace requirements (chapter 3, "Starting-up").
- ◆ Check all cables and connections for proper condition.
- ◆ Replace immediately defective cables and cable connections to avoid electrical shocks.
- ◆ Check the chuck for proper seat (see operating manual of according power unit).
- ◆ Before welding, make sure that the bellows are checked for damage and proper seat.

5.4 High-strength Welds

- ◆ The following must be removed both from the weld zone and the ground clamp connection areas:
 - paint, oil and any other impurities,
 - rust,
 - non-conductive coatings from surface treated workpieces.
- ◆ Weld to smooth and flat surfaces only.



For welding to pipes or punched plates consult our responsible application manager (address of customer service see page ii).

5.5 Determination of Welding Parameters

The adjustment of welding parameters on the power unit (e.g. charging voltage by energy control) or on the welding head (e.g. spring force) depends amongst others on

- material of the welding element
- diameter of the welding element
- material of the workpiece

You can take guidelines from the operating manual of the power unit. These guidelines should be verified by test welding on the actual material and be changed if necessary. For an assessment of welding results, see sections 5.7 and 5.8.



Data given in the following table are only guidelines. They must be verified by trial welds on the actual material according to actual standards and DVS guidelines (see appendix). Before you use another lot of welding elements, carry out some trial welds to verify the parameter setting.



In case of disregard you will obtain bad welding results.

5.5.1 Standard Welding Parameters for Tip Ignition with Gap

Adjusting the penetration depth see chapter 4

| Base material Welding elements | Diameter of welding elements | | | | CDM 1601 2.3) Charging voltage [V] | KAH 412 LA 2.3) | |
|---|------------------------------|------------|------------|---------|---|------------------------|----------------------------|
| | (metric) | | (imperial) | | | Lift [mm] | Spring pressure [mm] |
| | PT, UT | IT | PT, UT | PT, UT | | | |
| Material of workpiece: Mild steel, shiny S235 / St37.3k (4.8) weldable | | | | | | | |
| S235 / St37 (4.8) | M3, 3 mm | -- | 1/8" | #6-32 | 70 | 2,0 | 5 |
| S235 / St37 (4.8) | M4, 4 mm | -- | 5/32" | #8-32 | 100 | 2,0 | 5 |
| S235 / St37 (4.8) | M5, 5 mm | 5 mm, M3 | 3/16" | #10-32 | 120 | 2,0 | 5 |
| S235 / St37 (4.8) | M6, 6 mm | 6 mm, M4 | 1/4" | 1/4-20 | 140 | 2,0 | 5 |
| S235 / St37 (4.8) | M8, 7,1 mm | 7,1 mm, M5 | 5/16" | 5/16-18 | 190 | 2,0 | 5 |
| S235 / St37 (4.8) | M10, -- | -- | 3/8" | 3/8-16" | 1) | 2,0 | 5 |
| Material of workpiece: Steel galvanized S235 | | | | | | | |
| S235 | M3, 3 mm | -- | 1/8" | #6-32 | 90 | 1,0 | 5 |
| S235 | M4, 4 mm | -- | 5/32" | #8-32 | 110 | 1,0 | 5 |
| S235 | M5, 5 mm | 5 mm, M3 | 3/16" | #10-32 | 140 | 1,0 | 5 |
| S235 | M6, 6 mm | 6 mm, M4 | 1/4" | 1/4-20 | 170 | 1,0 | 5 |
| S235 | M8, 7,1 mm | 7,1 mm, M5 | 5/16" | 5/16-18 | 220 | 1,0 | 5 |
| Material of workpiece: Cr-Ni stainless steel 1.4301, 1.4303 | | | | | | | |
| 1.4301, 1.4303 | M3, 3 mm | -- | 1/8" | #6-32 | 70 | 2,0 | 5 |
| 1.4301, 1.4303 | M4, 4 mm | -- | 5/32" | #8-32 | 90 | 2,0 | 5 |
| 1.4301, 1.4303 | M5, 5 mm | 5 mm, M3 | 3/16" | #10-32 | 110 | 2,0 | 5 |
| 1.4301, 1.4303 | M6, 6 mm | 6 mm, M4 | 1/4" | 1/4-20 | 140 | 2,0 | 5 |
| 1.4301, 1.4303 | M8, 7,1 mm | 7,1 mm, M5 | 5/16" | 5/16-18 | 190 | 2,5 | 5 |
| 1.4301, 1.4303 | M10, -- | -- | 3/8" | 3/8-16" | 1) | 2,5 | 5 |
| Material of workpiece: Brass CuZn37 | | | | | | | |
| CuZn37 | M3, 3 mm | -- | 1/8" | #6-32 | 80 | 2,0 | 5 |
| CuZn37 | M4, 4 mm | -- | 5/32" | #8-32 | 100 | 2,0 | 5 |
| CuZn37 | M5, 5 mm | -- | 3/16" | #10-32 | 110 | 2,0 | 5 |
| CuZn37 | M6, 6 mm | -- | 1/4" | 1/4-20 | 140 | 2,0 | 5 |
| CuZn37 | M8, 7,1 mm | -- | 5/16" | 5/16-18 | 1) | 2,5 | 5 |
| Material of workpiece: Aluminum | | | | | | | |
| AlMg3 | M3, 3 mm | -- | 1/8" | #6-32 | 80 | 2,5 | 5 |
| AlMg3 | M4, 4 mm | -- | 5/32" | #8-32 | 110 | 2,5 | 5 |
| AlMg3 | M5, 5 mm | 5 mm, M3 | 3/16" | #10-32 | 130 | 3,0 | 5 |
| AlMg3 | M6, 6 mm | 6 mm, M4 | 1/4" | 1/4-20 | 150 | 3,5 | 5 |
| AlMg3 | M8, 7,1 mm | 7,1 mm, M5 | 5/16" | 5/16-18 | 210 | 4,0 | 5 |

- 1) power unit with higher capacity recommended
- 2) to be checked by trials
- 3) Welding parameters may differ from rated values if another ground cable configuration is used.

5.5.2 Standard Welding Parameters for Gap Stud Welding with Drawn-Arc Ignition under Shielding Gas

Adjusting the penetration depth see section 4

| Base material Welding element | Diameter of welding elements | | | | ARC 800 2,3) Time [ms] | KAH 412 LA 2,3) | |
|--|------------------------------|------------|---------------------|---------------------|------------------------------|--------------------|----------------------------|
| | (metric) | | (imperial) | | | Lift [mm] | Spring pressure [mm] |
| | PS (PT), US (UT) | IS (IT) | PS (PT), US (UT) | PS (PT), US (UT) | | | |
| Material of work piece: steel, shiny S235 / St37.k (4.8) weldable | | | | | | | |
| S235 / St37 (4.8) | M3, 3 mm | -- | 1/8" | #6-32 | 5 | 1,5 | 5 |
| S235 / St37 (4.8) | M4, 4 mm | -- | 5/32" | #8-32 | 10 | 1,5 | 5 |
| S235 / St37 (4.8) | M5, 5 mm | 5 mm, M3 | 3/16" | #10-32 | 15 | 1,5 | 5 |
| S235 / St37 (4.8) | M6, 6 mm | 6 mm, M4 | 1/4" | 1/4-20 | 20 | 1,5 | 5 |
| S235 / St37 (4.8) | M8, 7,1 mm | 7,1 mm, M5 | 5/16" | 5/16-18 | 35 | 1,5 | 5 |
| Material of work piece: Cr-Ni steel 1.4301, 1.4303 | | | | | | | |
| 1.4301, 1.4303 | M3, 3 mm | -- | 1/8" | #6-32 | 5 | 1,5 | 5 |
| 1.4301, 1.4303 | M4, 4 mm | -- | 5/32" | #8-32 | 10 | 1,5 | 5 |
| 1.4301, 1.4303 | M5, 5 mm | 5 mm, M3 | 3/16" | #10-32 | 15 | 1,5 | 5 |
| 1.4301, 1.4303 | M6, 6 mm | 6 mm, M4 | 1/4" | 1/4-20 | 20 | 1,5 | 5 |
| 1.4301, 1.4303 | M8, 7,1 mm | 7,1 mm, M5 | 5/16" | 5/16-18 | 35 | 1,5 | 5 |

2) to be checked by trials

3) Welding parameters may differ from rated values if another shielding gas or another ground cable configuration is used.



Further notes on

- welding elements
- prestress at installation (tie load) and torque
- material combinations

see appendix and operating manual of the according welding gun.

5.6 Welding Procedure



Improper operation of the stud welding unit is LIFE-THREATENING! The stud welding unit must only be operated by qualified personnel (see chapter 1). First read the safety instructions in chapters 1, 3 and 5.

- ◆ Prepare the stud welding unit, the ground connection, and the workpiece according to the instructions given in the operating manual.



Chapter 5 contains guideline for welding parameters. The data given are only guidelines. They must be verified by trial welds on the actual workpiece according to actual standards and DVS regulations (see appendix).



During the actual welding process, you must expect red-hot welding spatters, possibly liquid spatters, a flash, and a loud bang may occur > 90dB (A). Inform any colleagues who are occupied in the vicinity of the welder about the bang. Wear always your personal protective equipment according to actual standards (see appendix).



The welding process can only be initiated, if the current circuit is closed, i.e. the welding element is in electrical contact with the base material.



After the welding process has been completed, withdraw the welding head straight back from the welding element. If you remove the welding head at an angle, the chuck will be stretched, this reduces its life expectancy.

You can now insert a new welding element in the chuck and repeat the welding process as described above.

5.7 Checking the Quality of the Weld

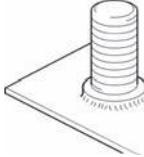
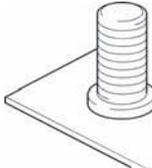
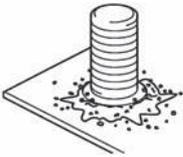
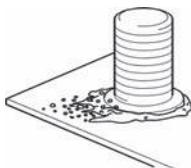
You can check the quality of the weld by means of a visual inspection and a bending test.



See also actual standards in the appendix “Arc stud welding of metallic materials“, in section irregularities and corrective actions.

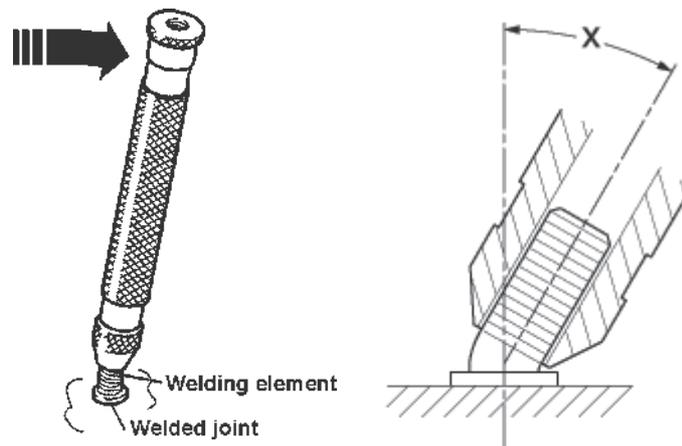
5.7.1 Visual Inspection

A visual inspection must be carried out with each welding element.

| Visual Inspection | | |
|--|--|--|
| Condition | Possible cause | Corrective actions |
| <p>Good welded joint Low spatters around the weld without outer flaws The weld pool forms a collar around the flange of about 1 - 1,5 mm</p>  | <ul style="list-style-type: none"> - Correct parameters | <ul style="list-style-type: none"> - None |
| <p>Cold weld pool Gap between flange and workpiece</p>  | <ul style="list-style-type: none"> - Heat input too low - Plunging speed too low - No sufficient backing of workpiece | <ul style="list-style-type: none"> - Increase charging voltage - Adjust plunging speed correctly - Provide sufficient backing |
| <p>Hot weld pool Many spatters around the weld</p>  | <ul style="list-style-type: none"> - Heat input too high - Plunging speed too low | <ul style="list-style-type: none"> - Reduce charging voltage - Increase plunging speed |
| <p>One-sided weld pool One-sided spatter collar Weld pool came out on one side</p>  | <ul style="list-style-type: none"> - Arc blow effect - Unsymmetric ground connection - Welding gun put at an angle | <ul style="list-style-type: none"> - Take care for symmetrical ground connection - Put welding gun vertically to the workpiece |

5.7.2 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.

- ◆ Using the put-on bending device, bend the welding element one time by 30° in the case of tip ignition and 60° in the case of drawn-arc ignition. Carry out the test in different directions.

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

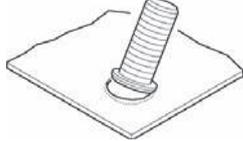
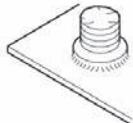
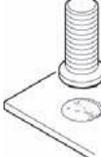
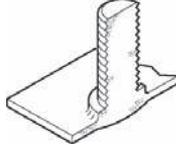
- ◆ Please note the instructions on fault recognition and corrective actions in chapter 5.



You don't need to test all welding elements. It is sufficient to carry out stud tests at random.

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 (must be free from scale, oil, paint, oxide layers)
- ◆ grind off hardened workpiece surfaces (e.g. roll hardening).
- ◆ check the piston of the welding head for ease of movement.

| Bending Test | | |
|---|---|--|
| Type of fracture | Possible cause | Corrective actions |
| Base material buckling  | <ul style="list-style-type: none"> - Correct parameters | <ul style="list-style-type: none"> - none |
| Fracture in the welding element above flange  | <ul style="list-style-type: none"> - Correct parameters | <ul style="list-style-type: none"> - none |
| Fracture in the weld metal  | <ul style="list-style-type: none"> - Heat input too low - Plunging speed too low - Welding element/base material combination not suitable | <ul style="list-style-type: none"> - Increase charging voltage - Increase plunging speed - Replace welding element or workpiece |
| Backside deformation  | <ul style="list-style-type: none"> - Heat input too high - Pressure too high - Contact stud welding not suitable - Workpiece too thin | <ul style="list-style-type: none"> - Reduce charging voltage - Reduce pressure - Use gap stud welding instead of contact stud welding - Adapt thickness of workpiece |

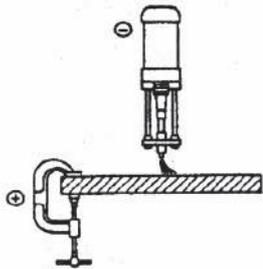
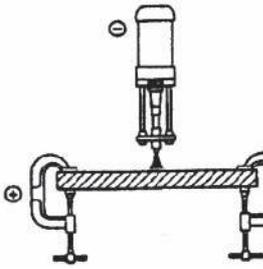
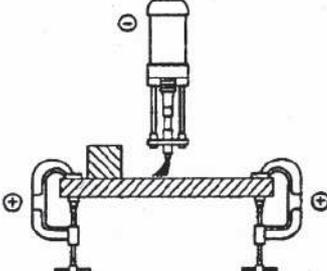
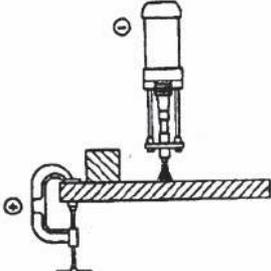
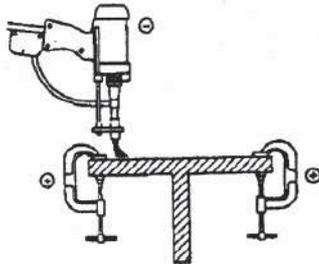
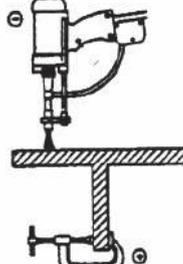
5.7.3 Arc Blow Effect

A so called arc blow effect can occur with unproportionally distributed ground connections in relation to the base material mass, varying material distribution, or welding at the edge of a workpiece. This is an undesired deflection of the arc. It causes a single-sided melting of the stud material, increased pore formation, and undercuts in the welding area.

The arc blow effect is proportional to the current and can be influenced by symmetric installation of the ground clamps, by fitting of compensation masses, or by rotating the welding gun around its vertical axis (applies for welding guns with external welding cable).

Arc blow effects and some corrective actions

(according to standards, see appendix)

| Cause | Corrective action |
|---|--|
|  |  |
|  |  |
|  |  |

5.8 Possible Malfunctions and Corrective Actions

| Malfunction | Possible cause | Identification | Corrective action | Done by |
|--|---|--|--|---------------------------|
| Studs not firmly attached | Wrong welding parameters selected | Check adjustments on power unit | Change adjusted parameters | Instructed operator |
| | | Check stroke of automatic welding head | Change adjusted parameters | Instructed operator |
| | Plunging speed of stud too low | Check welding piston and bearing for dust and dirt *) | Clean *) | Trained special personnel |
| Scorchings at welded stud | Chuck is worn | Check chuck for possible wear | Replace chuck | Instructed operator |
| Automatic welding head does not weld | Control cable defective (with present contact signal on power unit) | Check control cable at socket (Pin 3/4) of the control cable socket with pressed automatic welding head trigger *) | In the case of no flow : Replace control cable *) | Trained special personnel |
| | | Check control cable at socket (Pin 3/4) of the control cable socket with pressed automatic welding head trigger *) | In the case of no flow : Replace micro switch *) | Trained special personnel |
| | Ground connection defective (no contact signal on power unit) | Check, whether ground cable is connected to work piece | Connect ground cable | Instructed operator |
| | | Check ground cable for electrical flow | In the case of no flow : Replace ground cable | Instructed operator |
| | Welding cable defective (no contact signal on power unit) | Check, whether welding cable is connected to power unit | Connect welding cable | Instructed operator |
| Check welding cable for electrical flow *) | | In the case of no flow : Replace welding cable, replace connection cable *) | Trained special personnel | |
| Power unit defective | Follow the instructions of the connected power unit *) | Repair required *) | Factory service or authorized agencies | |



Actions marked with *) must only be carried out by qualified electricians!



If none of the actions is successful, please contact our service department.

5.9 Welding Elements

The stud welding unit must be suitable for welding the welding elements to be used. Observe the instructions in the operating manuals.

Cold-punched welding elements show a flange and a so called ignition tip. Design according to current standards (see appendix). The flange is formed by punching the ignition tip. During welding, it prevents the arc from sparking over to the cylindrical part of the welding element and increases the welding area at the same time.

We recommend the following standard welding and fastening elements (see appendix).



Use only welding elements of the same lot. Take particular care not to mix-up different lots. Slightest variations in geometry of the welding elements, especially of the ignition tip, require modified settings of the welding process.

| Threaded stud (PT) | Diameter | Length | Chuck | Weldable with |
|--------------------|----------|----------|-----------|---------------|
| | M3 | 6-30 mm | 84-50-003 | KAH 412 |
| | M4 | 6-40 mm | 84-50-004 | KAH 412 |
| | M5 | 8-40 mm | 84-50-005 | KAH 412 |
| | M6 | 8-40 mm | 84-50-006 | KAH 412 |
| | M8 | 10-40 mm | 84-50-008 | KAH 412 |

| Pin (UT) | Diameter | Length | Chuck | Weldable with |
|----------|----------|----------|-----------|---------------|
| | Ø 3 mm | 6-25 mm | 84-50-003 | KAH 412 |
| | Ø 4 mm | 6-25 mm | 84-50-004 | KAH 412 |
| | Ø 5 mm | 6-40 mm | 84-50-005 | KAH 412 |
| | Ø 6 mm | 8-40 mm | 84-50-006 | KAH 412 |
| | Ø 7,1 mm | 10-40 mm | 84-50-071 | KAH 412 |

| Pin with internal thread (IT) Internal thread bushes | Diameter | Length | Chuck | Internal thread | Weldable with |
|---|----------|----------|-----------|-----------------|---------------|
| | 5 mm | 6-30 mm | 84-50-005 | M3 | KAH 412 |
| | 6 mm | 8-30 mm | 84-50-006 | M3 | KAH 412 |
| | 6 mm | 8-30 mm | 84-50-006 | M4 | KAH 412 |
| | 7,1 mm | 10-30 mm | 84-50-071 | M5 | KAH 412 |
| | 8 mm | 10-40 mm | 84-50-008 | M6 | KAH 412 |

All elements are available in the base materials S235 / St37.3k (4.8), 1.4301, 1.4303, CuZn37 and AlMg3 ex stock.

Other weldable base materials on request.

6 Switching off the Power Unit

This chapter describes what you should observe when you switch off the power unit temporarily or completely.

6.1 Temporary Switching off

- ◆ Switch off the power unit.
- ◆ Unplug the control cable and the welding cable from the power unit.
- ◆ Protect the welding head against ingress of fluids and foreign bodies.

6.2 Disposal

If you shut down the installation, you can return the complete power unit to HBS (for address see page ii).

We will take care of environmentally correct material separation and disposal.

7 Care and Maintenance

This chapter shows care and maintenance of the welding head to provide long life expectancy.

7.1 Safety Instructions



Let maintenance and repair operations be carried out only by qualified personnel or by your competent service technician.



Before starting any repair or maintenance operation, always switch the power unit off and disconnect the primary plug.

7.2 Regular Maintenance Operations



Any maintenance and repair operation should only be carried out by qualified personnel or by your competent service technician.

You must only carry out the following service operations.

- ◆ Before starting welding, check welding cable and control cable for faults and damage.



THREAT TO LIFE!

Never work with damaged cables. Use of damaged cables means risking an electrical shock.



Before you start any cleaning and maintenance operation with welding head, turn the mains switch off and disconnect control cable and welding cable from power unit.

- ◆ Clean the surface of the welding head of dirt and dust.



Danger

Do not use any solvent containing cleaning agents. Solvent containing cleaning agents may damage the plastic components of the welding head.

- ◆ Check the chuck from time to time. If you disclose scorching areas on the chuck, replace the chuck (see chapter 4 and 5).
- ◆ Before you start working, check the bellows at the front end of the welding head for possible damage and if properly installed.



Danger

Never work with damaged or improperly installed bellows. This may significantly affect life expectancy of your welding head.

There are some markings (type and adjustment guides) placed at the welding head.

- ◆ Take care that markings remain clearly visible.
- ◆ Replace illegible or damaged markings.

7.3 Maintenance and Cleaning the Welding Head



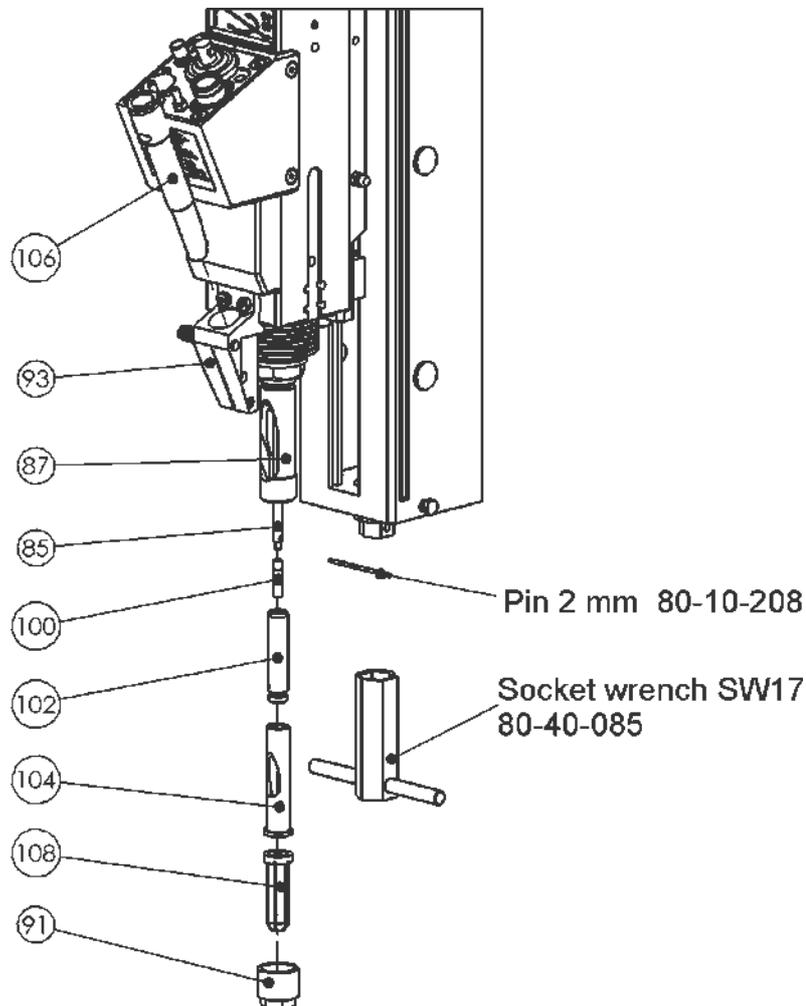
Always turn the primary power switch off before you carry out any cleaning operation on the welding head.

| | Each shift | Daily | Weekly | 2 months | 6 months | |
|---|------------|-------|--------|----------|----------|--|
| Maintenance Recommendations: | S | D | W | 2M | 6M | |
| Power supply and control cable connection | X | | | | | Check if it fits properly |
| Chuck | | X | | | | Section 4.3/7.4 Operating manual |
| Guide bushing | | | X | | | Section 4.3/7.4 Operating manual |
| Plunger | | | X | | | Section 4.3 Operating manual |
| Feeding tube | | | X | | | Section 4.3/4.7 Operating manual |
| Length limiter | | | X | | | Section 4.3/4.7 Operating manual |
| Feeding tube | | X | | | | - Check if there is a kink - Feeding tube must be firmly fixed in hose coupling - Check for wear |
| Cleaning automatic welding head | | | X | | | Cleaning with a vacuum cleaner or a cloth; never use compressed air (Chapter 7) |
| Adjustment automatic welding head | | | X | | | Chapter 4 Operating manual |
| Clean and grease piston rod | | | X | | | See Position 85, Section 4.3 Operating manual with Amblygon TA 15/2 |



This maintenance recommendation is regardless of the particular situation in your company. Therefore it is necessary to write down a suitable servicing schedule.

7.4 Removing the Equipment



- ◆ Pull off the blue air hose from the power unit.
- ◆ Screw off the retaining nut (item 91) with the socket wrench SW17.
- ◆ Remove the chuck (item 108).
- ◆ Charge the blue air hose with a short air pulse to expel the guide bushing (item 104) and stop pin (item 102).
- ◆ Press the trigger pin and pull out the slot tube (item 106).

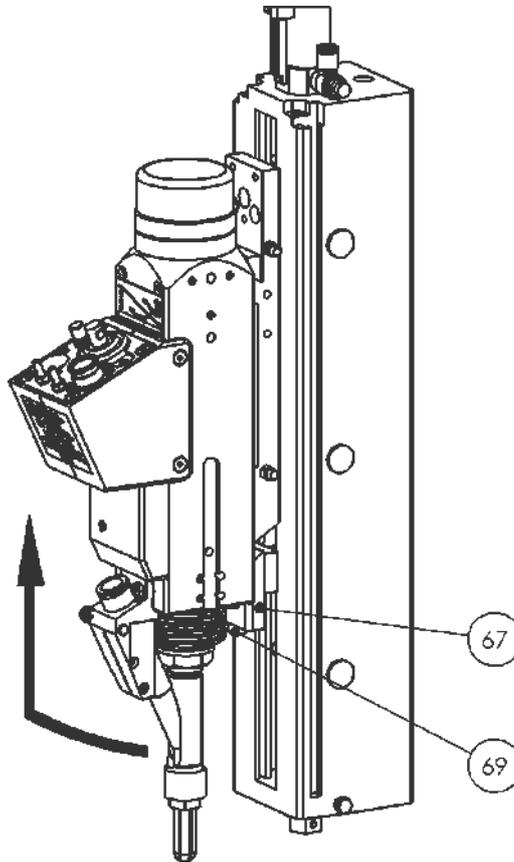


Replace defective and worn equipment components.



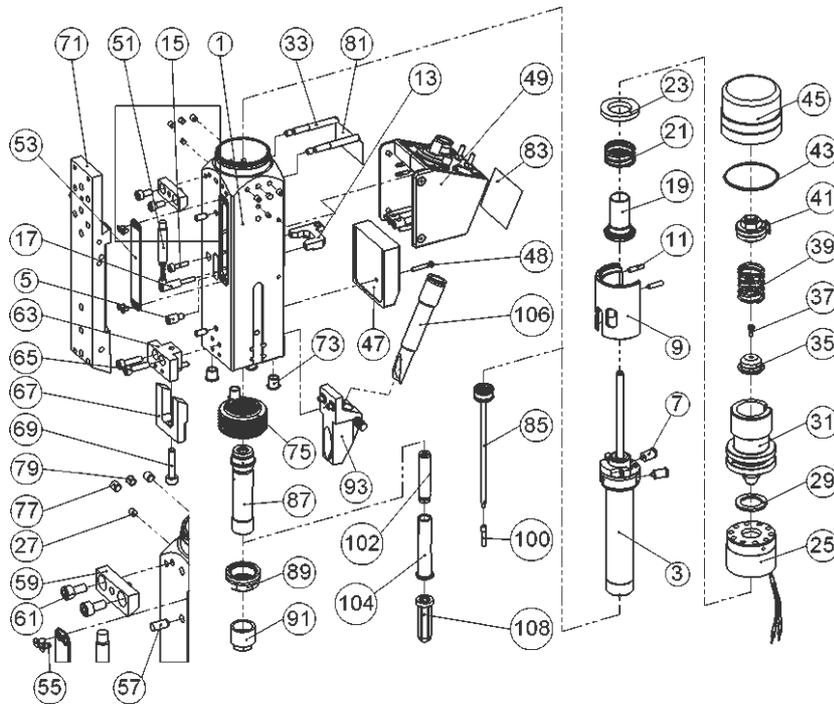
Pay special attention to any dirt on the parts 102 and 104 and 106. Soiling may cause an interruption of the feeding of welding elements into the chuck.

7.5 Detaching the Welding Head



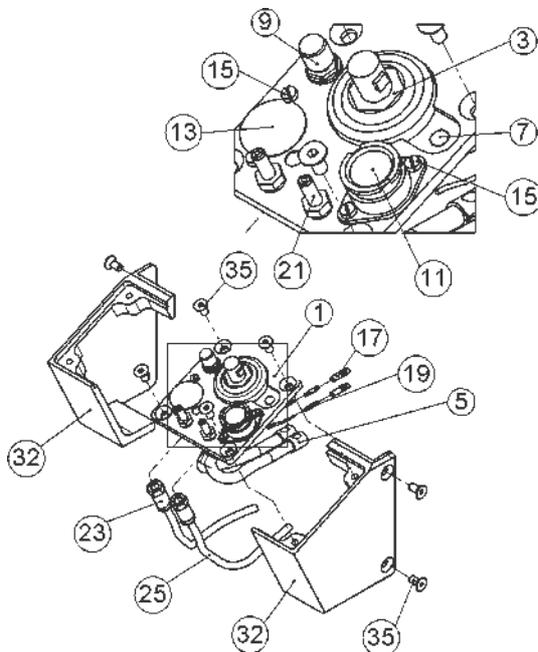
- ◆ Uncouple all supply lines.
- ◆ Make loose the clamp strap (item 67) with the screw M6 x 30 DIN 912 (item 69) and take down the welding head.

7.6 Dismounting and Cleaning the Welding Head



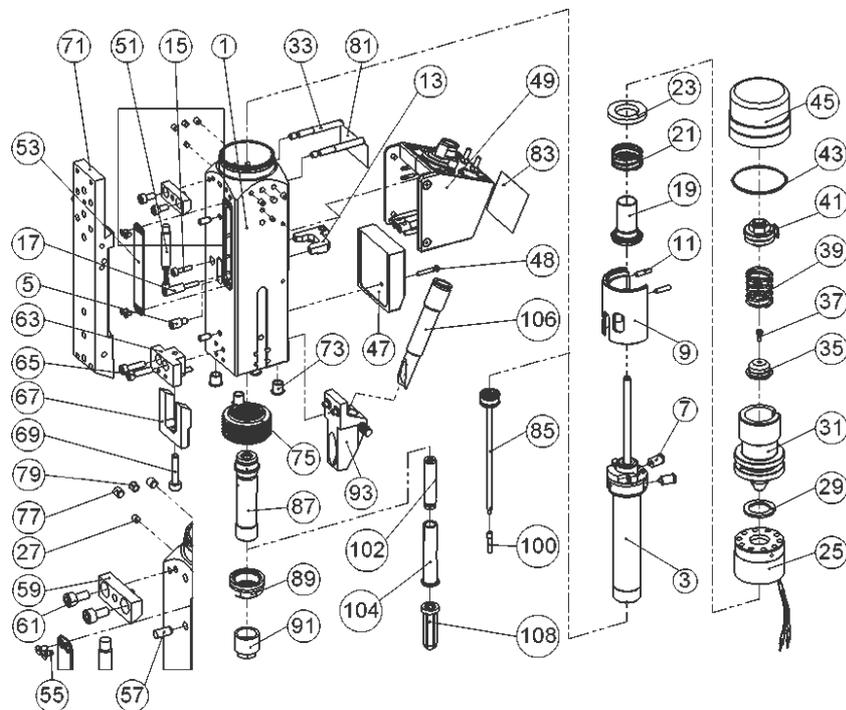
- ◆ Make loose the hexagonal nuts M4 DIN 934 and remove the holder for the feeding tube (item 93).
- ◆ Unscrew the tension nut (item 89) with the socket wrench SW27 and remove the bellows (item 75).
- ◆ Remove the slot piston (item 87) from the centering of the guide piston (item 3).
- ◆ Check the components (item 3,87) for wear and scorching areas, replace defective components.
- ◆ Remove the eight countersunk screws at the connecting casing (item 49).
- ◆ Pull off the connection casing (item 49) sideways.
- ◆ Remove the cylinder head bolt (item 48) and take off the cover plate (item 47).
- ◆ Pull off the rear cap (item 45). Turn out the spring force adjustment (item 41) from the adjustment screw (item 31).
- ◆ Take the pressure spring (item 39).
- ◆ Lock the tie rod of the solenoid keeper and loosen the cylinder head bolt DIN 912 (item 37).
- ◆ Remove the spring admission (item 35).
- ◆ Pull off the air pressure hoses from the swivel connections (item 7). Loosen the threaded pins (at item 3) and remove the connecting cables.

- ◆ Separate the connection cables of the lift solenoid (item 25).
- ◆ Remove the pin screws (item 33).
- ◆ Pull the stroke adjustment mechanism (item 31) out of the casing (item 1) and take out the stop washer (item 29).
- ◆ Make loose the attachment screws for the solenoid (item 27) and get the lifting solenoid (item 25) slide out of the casing (take care for the solenoid connectors - you must not shear them!)
- ◆ Remove the spring washer (item 23), the pressure spring (item 21) and the length compensation (item 19).
- ◆ Remove the cover (item 53), the screws (item 55), the shock absorber (item 51) and the pin screw (item 17).
- ◆ Screw out the threaded pins DIN 913 (item 11) and remove the stop block (item 9).
- ◆ Remove the swivel connection (item 7 - Attention: Hexagon socket) and the locking pin (item 5) out of the guide piston (item 3) and take them out carefully.
- ◆ Check the guide piston and the linear ball bearings for backlash, wear, dirt.



- ◆ *Check the male connector (item 3), the connecting cable (item 5) and the push button (item 9) for damages. Replace defective and worn components.*

7.7 Assembling the Welding Head



- ◆ Insert the guide piston (item 3) carefully and correctly positioned into the casing (item 1), so that you can screw in the locking pin (item 5).
- ◆ Take care that the locking pin is freely movable in the countersinking of the casing, otherwise bad welding may occur.
- ◆ Now screw the swivel connection (item 7 – Attention: Hexagon socket) into the guide piston (item 3).
- ◆ Push the stop block (item 9) into the casing (item 1) and fix it with the threaded pins (item 11).
- ◆ Then screw in and/ or insert the pin screws (item 17) and damper (item 51) and fix the cover (item 53) using the screws (item 55).
- ◆ Attach the length compensation (item 19) properly positioned onto the guide bar of the piston (item 3).
- ◆ Subsequently, insert pressure spring (item 21) and spring washer (item 23).
- ◆ Push the lift solenoid (item 25) carefully into the casing (item 1). Make sure that the solenoid connections are not being sheared off.
- ◆ Clamp the lifting solenoid with the screws (item 27) and check whether the clamping screws are positioned onto the respective sinkings in the lifting solenoid casing.

- ◆ Insert the stop washer (item 29) centrally.
- ◆ Turn on the solenoid keeper limit stop into the adjusting mechanism (item 31) by hand.
- ◆ Now insert the unit - correctly positioned - into the casing. Take care that the groove in the solenoid keeper limit stop fits with the pin of the solenoid casing (item 25).
- ◆ Screw the pin screws (item 33) into the casing (item 1). Check the adjustment mechanism for ease of movement.
- ◆ Pull the connecting cables of the solenoid through the connection casing (item 49) and plug them in.
- ◆ Plug the two connection cables [crimping to the top] into the guide piston and tighten them with the threaded pins.
- ◆ Plug the two air pressure hoses into the swivel connection (item 7).
- ◆ Screw on the spring admission (item 35) with Loctite 222 together with the cylinder head bolt DIN 912 (item 37) to the locked guide bar (item 3).
- ◆ Insert the pressure spring (item 39) and turn in the complete spring adjustment (item 41). Take care that the pointer is positioned correctly in the groove of the adjustment screw (item 31), the digits shall be readable.
- ◆ Put on the rear cap (item 45).
- ◆ Push in the connection casing (item 49) from the side, screw it tight with eight countersunk screws.
- ◆ Before you assemble the piston rod with the double grooved ring (item 85), grease it with Amblygon. Insert carefully this unit into the guide piston (item 3) and remove the surplus grease from the guide piston. Now you may screw on the slot piston (item 87) (correctly positioned - pin into groove) to the guide piston by means of the tension nut (item 89).
- ◆ Tighten firmly the tension nut and put on the bellows (item 75). Take care that the bellows are positioned correctly in the respective grooves.
- ◆ Screw on the slot tube holder.
- ◆ Now you may attach the welding head to the machine and equip it with components which fit to your next application.

8 Appendix

In the appendix, there is information of interest regarding technical data, spare part lists, accessories, standards, etc.

8.1 Technical Data

Automatic Stud Welding Head KAH 412 LA with length compensation for CD or ARC stud welding with automatic stud feeding according to current standards

| | |
|------------------------------------|--|
| Welding range | M3 to M8, dia. 3 to 8 mm (#4 to 5/16", dia. #4 to 5/16") (dia. 10/12/12.7 mm (dia. 3/8" to 1/2") with modification only) |
| Stud length | 8 to 40 mm (0.31" to 1.57") other lengths on request |
| Stud material | Mild steel, stainless steel, aluminum, brass |
| Total stroke of piston | 7 mm (0.28") |
| Stroke/Length compensation | 5/2 mm, 4/3 mm (0.2"/0.08", 0.16"/0.12") |
| Spring pressure | Arresting |
| Protection class | IP 20 (protect against humidity) |
| Workplace noise level | > 90 dB (A) may occur during welding |
| Operational and storage conditions | According to current standards |
| Dimension L x W x H | 375 x 66 x 145 mm (14.76" x 2.60" x 5.71") with chuck and quick change system |
| Weight | 3.4 kg (7.50 lbs) |

8.2 Spare Parts

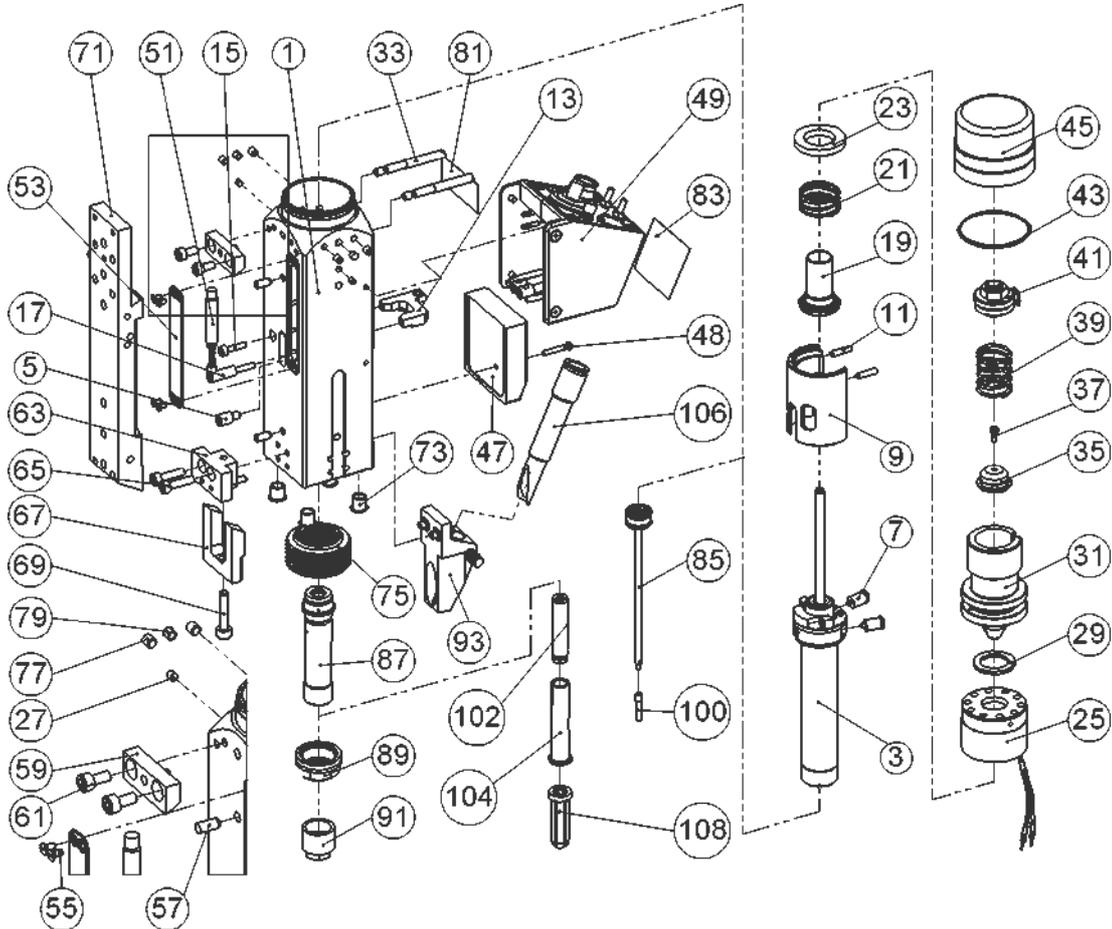
When ordering spare parts, please specify type of welding head and serial number.
The serial number is seen on name plate.

Spare parts welding head KAH 412 LA (94-37-412)

| Pos. | Quantity | Order No. | Description |
|------|----------|-----------|-------------------------------|
| 1 | 1 | 88-17-041 | Casing, complete |
| 3 | 1 | 88-17-518 | Piston, complete |
| 5 | 1 | 80-07-581 | Locking pin, complete |
| 7 | 2 | 80-11-175 | Swivel connection |
| 9 | 1 | 88-17-033 | Stop block |
| 11 | 2 | 80-90-314 | Screw M4 x 16, DIN 913 |
| 13 | 1 | 88-10-424 | Carrier |
| 15 | 1 | 80-90-292 | Screw M4 x 16, DIN 912 |
| 17 | 1 | 88-17-036 | Pin screw |
| 19 | 1 | 88-17-030 | Length compensation, complete |
| 21 | 1 | 80-05-540 | Pressure spring |
| 23 | 1 | 88-17-034 | Spring washer |
| 25 | 1 | 80-07-869 | Solenoid, complete |
| 27 | 2 | 80-90-112 | Screw M5 x 5 |
| 29 | 1 | 80-07-872 | Stop washer |
| 31 | 1 | 88-17-520 | Adjustment screw, complete |
| 33 | 2 | 88-10-428 | Pin screw M5 x 56 |
| 35 | 1 | 88-17-055 | Spring washer |
| 37 | 1 | 80-90-132 | Screw M3 x 8 |
| 39 | 1 | 80-10-400 | Pressure spring KAH |
| 41 | 1 | 88-17-521 | Spring adjustment complete |
| 43 | 1 | 80-11-537 | O-ring 44 x 2 |
| 45 | 1 | 80-07-552 | Rear cap |
| 47 | 1 | 88-17-541 | Cover plate |
| 48 | 1 | 80-90-309 | Screw M3 x 20 |
| 49 | 1 | 88-17-523 | Connection casing, complete |
| 51 | 1 | 88-11-418 | Shock absorber |
| 53 | 1 | 88-17-035 | Cover damper |
| 55 | 4 | 80-90-107 | Screw M3 x 6 |
| 57 | 2 | 80-11-045 | Cylindrical pin |

| | | | |
|----|---|-----------|------------------------------------|
| 59 | 1 | 80-07-759 | Holder, complete |
| 61 | 2 | 80-90-166 | Screw M5 x 10 |
| 63 | 1 | 80-07-758 | Clamp plate, complete |
| 65 | 2 | 80-90-136 | Screw M5 x 20 |
| 67 | 1 | 80-07-756 | Clamp strap |
| 69 | 1 | 80-90-117 | Screw M6 x 30 |
| 71 | 1 | 88-17-529 | Terminal plate, complete |
| 73 | 4 | 80-10-159 | Cap |
| 75 | 1 | 80-07-574 | Bellows |
| 77 | 4 | 80-90-238 | Screw M5 x 6 |
| 79 | 2 | 80-11-087 | Cap |
| 81 | 1 | 88-17-056 | Sticker, Lift |
| 83 | 1 | 88-17-532 | Type plate |
| 85 | 1 | 88-17-528 | Piston rod, complete |
| 87 | 1 | 88-17-527 | Slot piston, complete |
| 89 | 1 | 80-07-565 | Tension nut |
| 91 | 1 | 80-07-564 | Retaining nut |
| 93 | 1 | 88-17-524 | Support for feeding tube, complete |

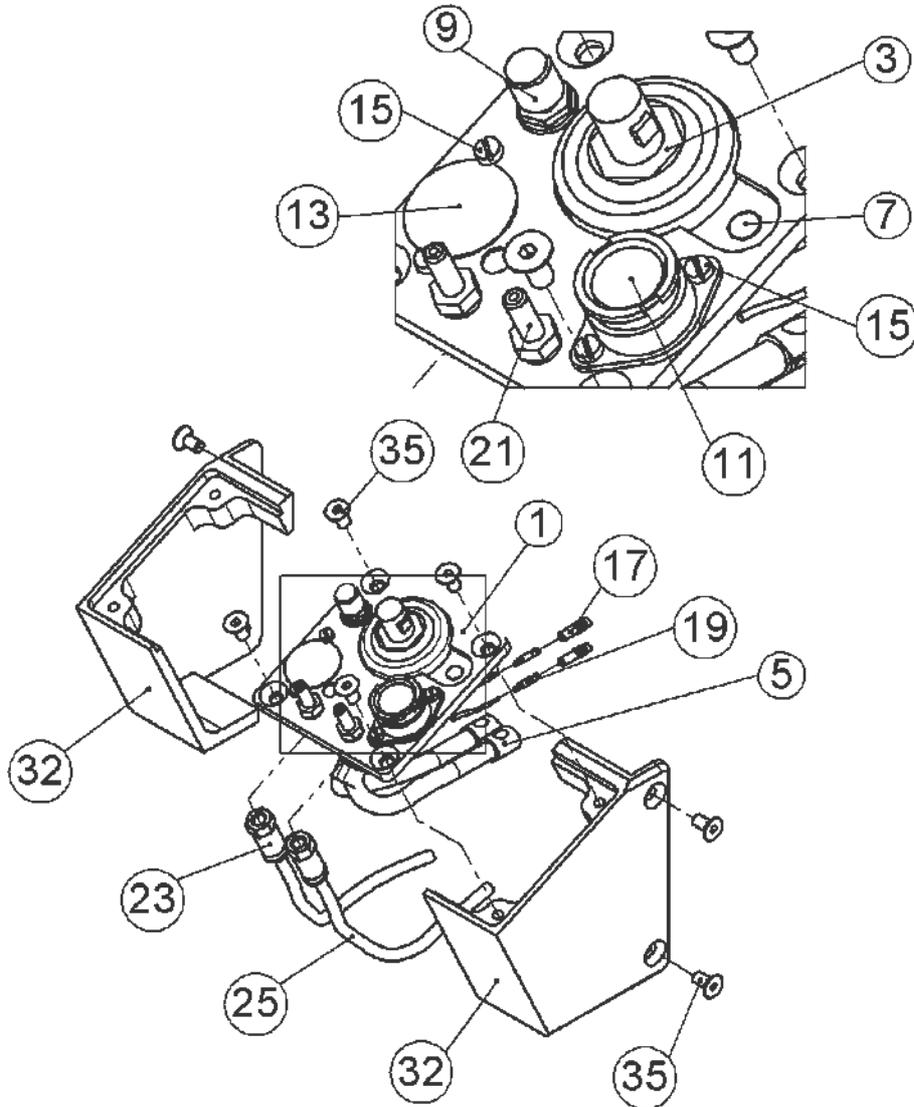
Welding head KAH 412 LA (94-37-412)



Spare parts connection casing, complete KAH 412 (88-17-523)

| Pos. | Quantity | Order No. | Description |
|------|----------|------------|-----------------------------|
| 1 | 1 | 88-11-319 | Casing cover |
| 3 | 1 | 80-50-051 | Male connector |
| 5 | 1 | 80-07-755A | Connection cable, duo |
| 7 | 1 | 80-11-087 | Cap |
| 9 | 1 | 80-50-010 | Push button |
| 11 | 1 | 80-50-045 | Control cable sleeve |
| 13 | 1 | 80-10-160 | Cap |
| 15 | 4 | 80-90-323 | Screw M2,5 x 6 |
| 17 | 2 | 80-11-169 | Insulating nozzle |
| 19 | 2 | 88-11-170 | Machine cover left side |
| 21 | 2 | 80-11-530 | Connector male |
| 23 | 2 | 80-11-129 | Swivel connection |
| 25 | 0.20 m | 80-11-176 | Plastic hose |
| 32 | 1 | 88-11-320 | Connection casing, complete |
| 35 | 8 | 80-90-170 | Screw M4 x 8 |

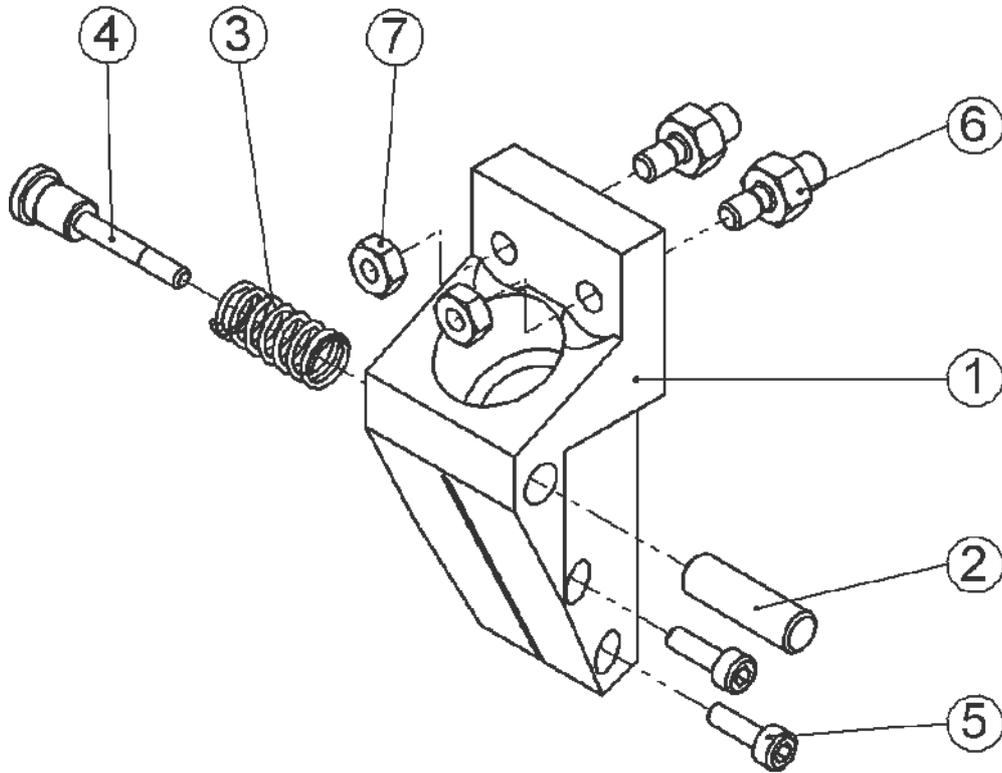
Connection casing, complete KAH 412 (88-17-523)



Spare parts support for feeding tube, complete KAH 412 (88-17-524)

| Pos. | Quantity | Order No. | Description |
|------|----------|-----------|--------------------------|
| 1 | 1 | 88-10-433 | Support for feeding tube |
| 2 | 1 | 80-07-908 | Locking pin |
| 3 | 1 | 80-40-241 | Pressure spring |
| 4 | 1 | 80-07-909 | Trigger pin |
| 5 | 2 | 80-90-133 | Screw M3 x 10 |
| 6 | 2 | 80-09-265 | Stud bolt |
| 7 | 2 | 80-90-153 | Nut DIN 934 M4 |

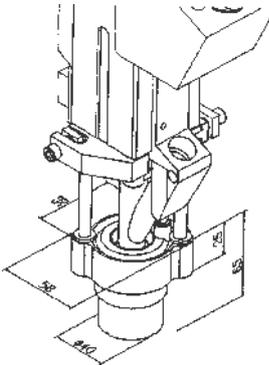
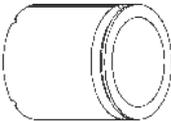
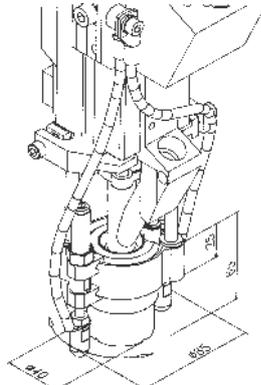
Spare parts support for feeding tube, complete KAH 412 (88-17-524)



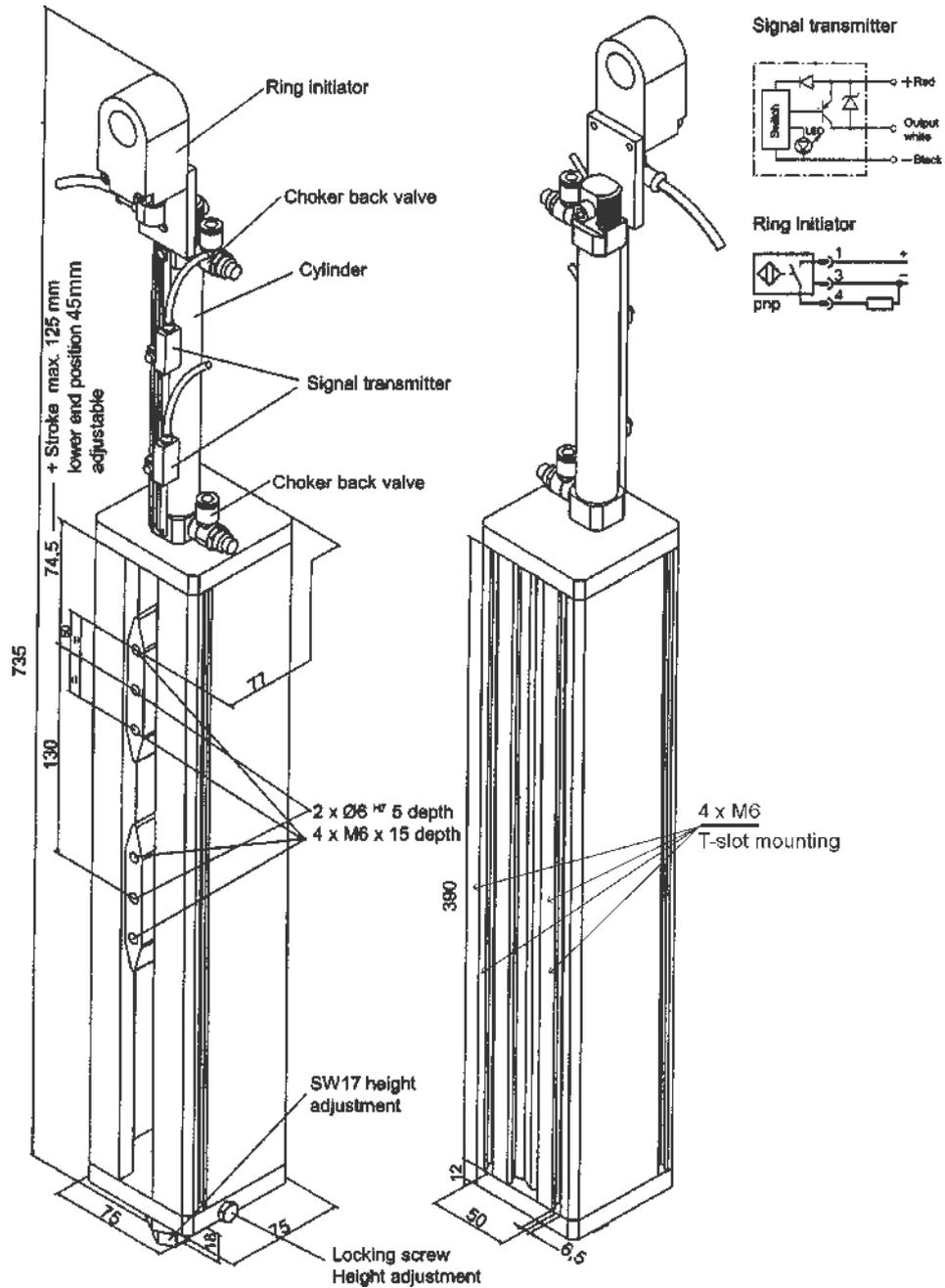
8.3 Accessories

When ordering accessories, please specify serial number and type of welding head.
The serial number is seen on the name plate.

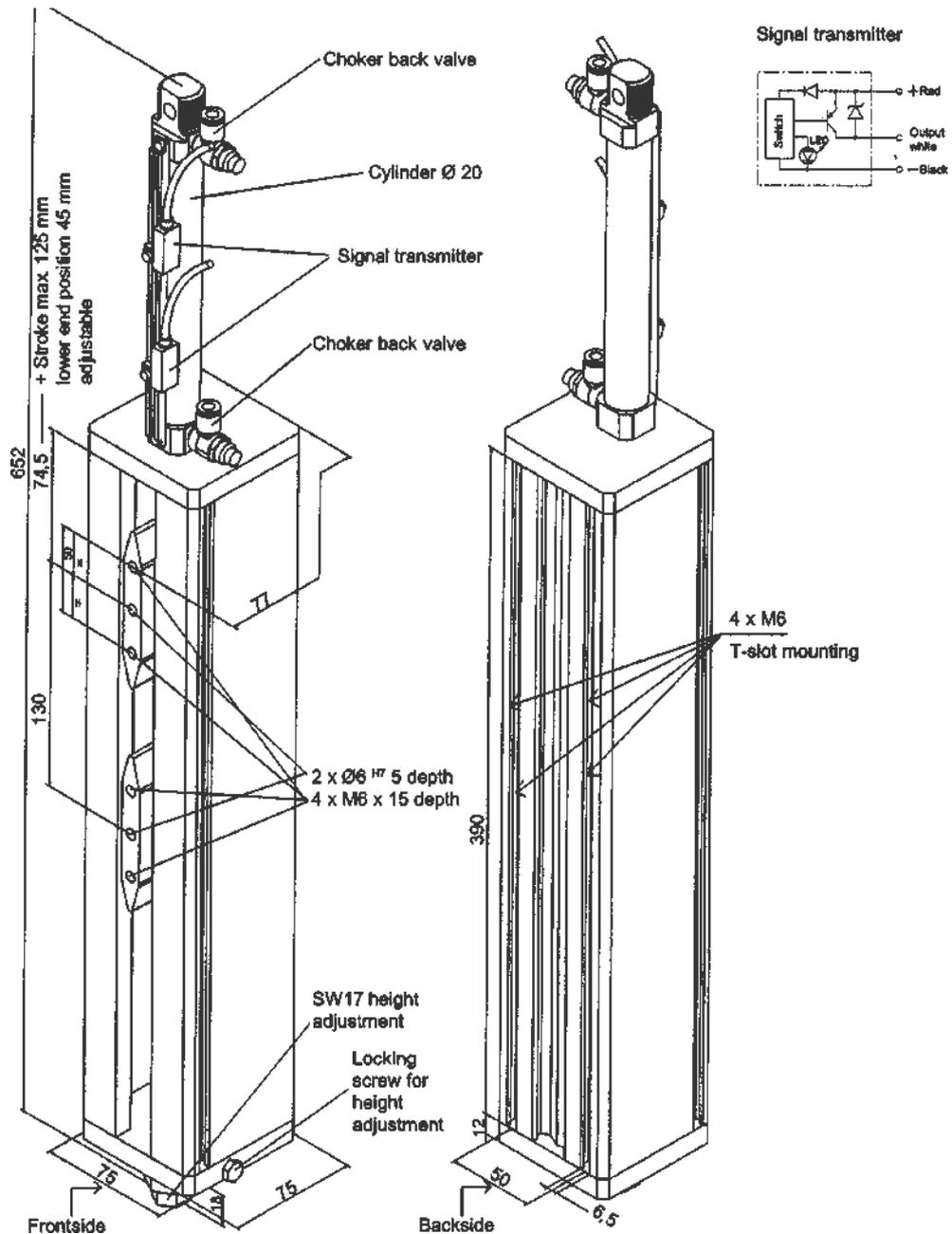
You can order following accessories:

| for | Description | Order No. |
|---|-----------------------------|-------------|
|  | Gas adaptor | 80-07-772A |
| additionally: | Shielding gas tube | 80-08-178A |
|  | | |
|  | Gas adaptor grounded | 80-07-772MA |

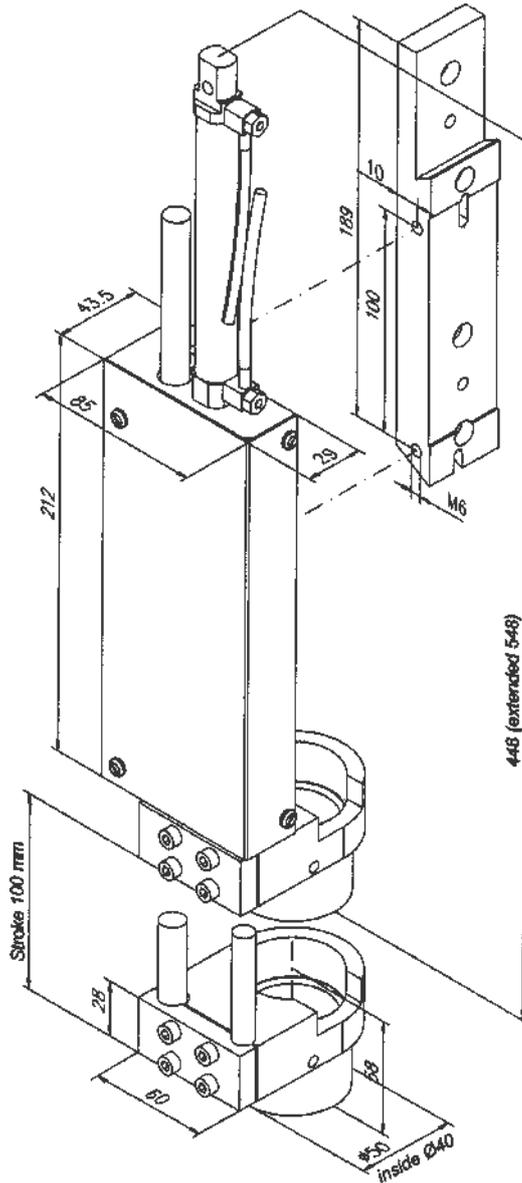
| for | Description | Order No. |
|-----|---|-----------|
| | Working stroke complete with ring initiator | 80-09-750 |

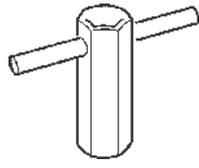
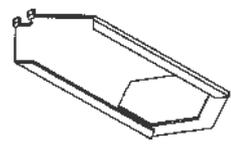
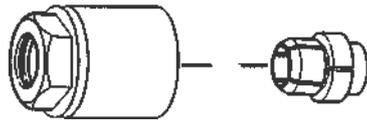
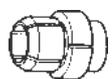


| for | Description | Order No. |
|-----|---|-----------|
| | Working stroke complete without ring initiator | 80-09-760 |



| for | Description | Order No. |
|-----|-------------------------|-----------|
| | Downholder pneumatic | 80-08-702 |

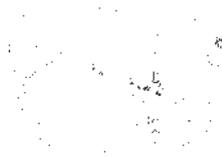


| for | Description | Order No. |
|--|---|---|
| KAH412 | Assortment box | 84-41-312A (Manual) 84-42-312A (VBZ) |
| Contains: Mounting keys Socket wrench SW 17 Pin 2 mm Plunger Pin stop Feeding tube Chuck Guide bushing |  | |
| KAH412 | Socket wrench | 80-40-085 |
| |  | |
| KAH412 | Mounting keys | 80-09-281 |
| |  | |
| | Pin | 80-10-208 |
| |  | |
| KAH412 | Standard chuck adaptor complete | 92-40-053 |
| |  | |
| KAH412 | Adaptor | 80-40-389 |
| |  | |

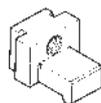
| for | Description | Order No. |
|--|-----------------------------|------------|
| Change into another stud Ø for VBZ-1 fully automatic stud feeder for KAH 412 | Adaptor kit VBZ1A-U4 | |
| | Ø 3 | 94-43-203A |
| | Ø 4 | 94-43-204A |
| | Ø 5 | 94-43-205A |
| | Ø 6 | 94-43-206A |
| | Ø 7,1 | 94-43-271A |
| | Ø 8 | 94-43-208A |



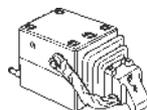
| | | |
|--|-----------------------------|------------|
| | Adaptor kit VBZ3B-U6 | |
| | Ø 3 | 94-43-203B |
| | Ø 4 | 94-43-204B |
| | Ø 5 | 94-43-205B |
| | Ø 5 X-mas tree studs | 94-43-253B |
| | Ø 6 | 94-43-206B |
| | Ø 6 X-mas tree studs | 94-43-263B |
| | Ø 7,1 | 94-43-271B |
| | Ø 8 | 94-43-208B |



| | | |
|---------------------------------|--------------------|-----------|
| PMB-S Pneumatic ground clamp | Clamp PMB-S | 80-40-078 |
|---------------------------------|--------------------|-----------|



| | | |
|----------------------------------|---------------------|-----------|
| PMB-LS Pneumatic ground clamp | Clamp PMB-LS | 80-40-780 |
|----------------------------------|---------------------|-----------|



8.4 Manual and Automatic Equipment Parts

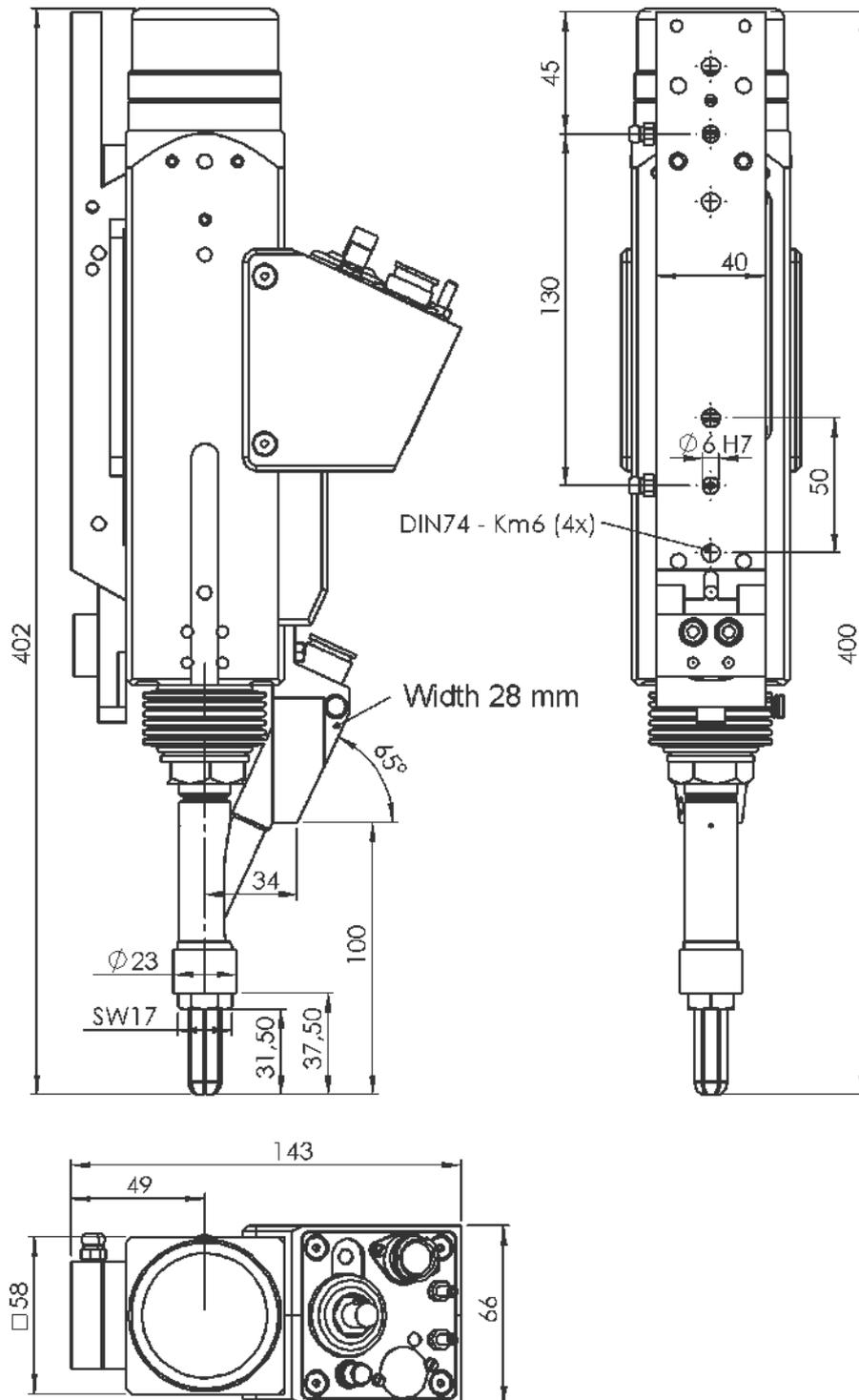
8.4.1 Manual Equipment Part

| Stud size DRM x Length [mm] | Plunger | Pin stop | Guide bushing | Feed tube manual | Chuck |
|--------------------------------|-----------|-----------|---------------|---------------------|-----------|
| 3 x 8 | 84-40-531 | 80-07-782 | 80-07-761 | 80-07-801 | 84-50-003 |
| 3 x 10 | 84-40-531 | 80-07-783 | 80-07-761 | 80-07-801 | 84-50-003 |
| 3 x 12 | 84-40-531 | 80-07-784 | 80-07-761 | 80-07-801 | 84-50-003 |
| 3 x 15 | 84-40-531 | 80-07-785 | 80-07-761 | 80-07-801 | 84-50-003 |
| 3 x 20 | 84-40-561 | 80-07-786 | 80-07-762 | 80-07-802 | 84-50-003 |
| 3 x 25 | 84-40-561 | 80-07-787 | 80-07-762 | 80-07-802 | 84-50-003 |
| 3 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-07-805 | 84-50-003 |
| 3 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-003 |
| 3 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-003 |
| 4 x 8 | 84-40-531 | 80-07-782 | 80-07-762 | 80-07-802 | 84-50-004 |
| 4 x 10 | 84-40-531 | 80-07-783 | 80-07-762 | 80-07-802 | 84-50-004 |
| 4 x 12 | 84-40-531 | 80-07-784 | 80-07-762 | 80-07-802 | 84-50-004 |
| 4 x 15 | 84-40-531 | 80-07-785 | 80-07-762 | 80-07-802 | 84-50-004 |
| 4 x 20 | 84-40-561 | 80-07-786 | 80-07-763 | 80-07-803 | 84-50-004 |
| 4 x 25 | 84-40-561 | 80-07-787 | 80-07-763 | 80-07-803 | 84-50-004 |
| 4 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-07-805 | 84-50-004 |
| 4 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-004 |
| 4 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-004 |
| 5 x 8 | 84-40-531 | 80-07-782 | 80-07-763 | 80-07-803 | 84-50-005 |
| 5 x 10 | 84-40-531 | 80-07-783 | 80-07-763 | 80-07-803 | 84-50-005 |
| 5 x 12 | 84-40-531 | 80-07-784 | 80-07-763 | 80-07-803 | 84-50-005 |
| 5 x 15 | 84-40-561 | 80-07-785 | 80-07-763 | 80-07-803 | 84-50-005 |
| 5 x 20 | 84-40-561 | 80-07-786 | 80-07-765 | 80-07-805 | 84-50-005 |
| 5 x 25 | 84-40-561 | 80-07-787 | 80-07-765 | 80-07-805 | 84-50-005 |
| 5 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-07-805 | 84-50-005 |
| 5 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-005 |
| 5 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-005 |
| 6 x 8 | 84-40-561 | 80-07-782 | 80-07-764 | 80-07-804 | 84-50-006 |
| 6 x 10 | 84-40-561 | 80-07-783 | 80-07-764 | 80-07-804 | 84-50-006 |
| 6 x 12 | 84-40-561 | 80-07-784 | 80-07-764 | 80-07-804 | 84-50-006 |
| 6 x 15 | 84-40-561 | 80-07-785 | 80-07-764 | 80-07-804 | 84-50-006 |
| 6 x 20 | 84-40-561 | 80-07-786 | 80-07-765 | 80-07-805 | 84-50-006 |
| 6 x 25 | 84-40-561 | 80-07-787 | 80-07-765 | 80-07-805 | 84-50-006 |
| 6 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-07-805 | 84-50-006 |
| 6 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-006 |
| 6 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-07-805 | 84-50-006 |
| 7,1 x 10 | 84-40-561 | 80-07-783 | 80-07-765 | 80-07-805 | 84-50-071 |
| 7,1 x 2 | 84-40-561 | 80-07-784 | 80-07-765 | 80-07-805 | 84-50-071 |
| 7,1 x 15 | 84-40-561 | 80-07-785 | 80-07-765 | 80-07-805 | 84-50-071 |
| 7,1 x 20 | 84-40-561 | 80-07-786 | 80-07-766 | 80-07-806 | 84-50-071 |
| 7,1 x 25 | 84-40-561 | 80-07-787 | 80-07-766 | 80-07-806 | 84-50-071 |
| 7,1 x 30 | 84-40-561 | 80-07-788 | 80-07-766 | 80-07-806 | 84-50-071 |
| 7,1 x 35 | 84-40-561 | 80-07-789 | 80-07-766 | 80-07-806 | 84-50-071 |
| 7,1 x 40 | 84-40-561 | 80-07-789 | 80-07-766 | 80-07-806 | 84-50-071 |
| 8 x 10 | 84-40-561 | 80-07-783 | 80-07-765 | 80-07-805 | 84-50-008 |
| 8 x 12 | 84-40-561 | 80-07-784 | 80-07-765 | 80-07-805 | 84-50-008 |
| 8 x 15 | 84-40-561 | 80-07-785 | 80-07-765 | 80-07-805 | 84-50-008 |
| 8 x 20 | 84-40-561 | 80-07-786 | 80-07-766 | 80-07-806 | 84-50-008 |
| 8 x 25 | 84-40-561 | 80-07-787 | 80-07-766 | 80-07-806 | 84-50-008 |
| 8 x 30 | 84-40-561 | 80-07-788 | 80-07-766 | 80-07-806 | 84-50-008 |
| 8 x 35 | 84-40-561 | 80-07-789 | 80-07-766 | 80-07-806 | 84-50-008 |
| 8 x 40 | 84-40-561 | 80-07-789 | 80-07-766 | 80-07-806 | 84-50-008 |

8.4.2 Automatic Equipment Part

| Stud size DRM x Length [mm] | Plunger | Pin stop | Guide bushing | Feed tube VBZ | Chuck |
|--------------------------------|-----------|-----------|---------------|------------------|-----------|
| 3 x 8 | 84-40-531 | 80-07-782 | 80-07-761 | 80-08-161 | 84-50-003 |
| 3 x 10 | 84-40-531 | 80-07-783 | 80-07-761 | 80-08-161 | 84-50-003 |
| 3 x 12 | 84-40-531 | 80-07-784 | 80-07-761 | 80-08-161 | 84-50-003 |
| 3 x 15 | 84-40-531 | 80-07-785 | 80-07-761 | 80-08-161 | 84-50-003 |
| 3 x 20 | 84-40-561 | 80-07-786 | 80-07-762 | 80-08-162 | 84-50-003 |
| 3 x 25 | 84-40-561 | 80-07-787 | 80-07-762 | 80-08-162 | 84-50-003 |
| 3 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-08-165 | 84-50-003 |
| 3 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-003 |
| 3 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-003 |
| 4 x 8 | 84-40-531 | 80-07-782 | 80-07-762 | 80-08-162 | 84-50-004 |
| 4 x 10 | 84-40-531 | 80-07-783 | 80-07-762 | 80-08-162 | 84-50-004 |
| 4 x 12 | 84-40-531 | 80-07-784 | 80-07-762 | 80-08-162 | 84-50-004 |
| 4 x 15 | 84-40-531 | 80-07-785 | 80-07-762 | 80-08-162 | 84-50-004 |
| 4 x 20 | 84-40-561 | 80-07-786 | 80-07-763 | 80-08-163 | 84-50-004 |
| 4 x 25 | 84-40-561 | 80-07-787 | 80-07-763 | 80-08-163 | 84-50-004 |
| 4 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-08-165 | 84-50-004 |
| 4 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-004 |
| 4 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-004 |
| 5 x 8 | 84-40-531 | 80-07-782 | 80-07-763 | 80-08-163 | 84-50-005 |
| 5 x 10 | 84-40-531 | 80-07-783 | 80-07-763 | 80-08-163 | 84-50-005 |
| 5 x 12 | 84-40-531 | 80-07-784 | 80-07-763 | 80-08-163 | 84-50-005 |
| 5 x 15 | 84-40-561 | 80-07-785 | 80-07-763 | 80-08-163 | 84-50-005 |
| 5 x 20 | 84-40-561 | 80-07-786 | 80-07-765 | 80-08-165 | 84-50-005 |
| 5 x 25 | 84-40-561 | 80-07-787 | 80-07-765 | 80-08-165 | 84-50-005 |
| 5 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-08-165 | 84-50-005 |
| 5 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-005 |
| 5 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-005 |
| 6 x 8 | 84-40-561 | 80-07-782 | 80-07-764 | 80-08-164 | 84-50-006 |
| 6 x 10 | 84-40-561 | 80-07-783 | 80-07-764 | 80-08-164 | 84-50-006 |
| 6 x 12 | 84-40-561 | 80-07-784 | 80-07-764 | 80-08-164 | 84-50-006 |
| 6 x 15 | 84-40-561 | 80-07-785 | 80-07-764 | 80-08-164 | 84-50-006 |
| 6 x 20 | 84-40-561 | 80-07-786 | 80-07-765 | 80-08-165 | 84-50-006 |
| 6 x 25 | 84-40-561 | 80-07-787 | 80-07-765 | 80-08-165 | 84-50-006 |
| 6 x 30 | 84-40-561 | 80-07-788 | 80-07-765 | 80-08-165 | 84-50-006 |
| 6 x 35 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-006 |
| 6 x 40 | 84-40-561 | 80-07-789 | 80-07-765 | 80-08-165 | 84-50-006 |
| 7,1 x 10 | 84-40-561 | 80-07-783 | 80-07-765 | 80-08-165 | 84-50-071 |
| 7,1 x 2 | 84-40-561 | 80-07-784 | 80-07-765 | 80-08-165 | 84-50-071 |
| 7,1 x 15 | 84-40-561 | 80-07-785 | 80-07-765 | 80-08-165 | 84-50-071 |
| 7,1 x 20 | 84-40-561 | 80-07-786 | 80-07-766 | 80-08-981 | 84-50-071 |
| 7,1 x 25 | 84-40-561 | 80-07-787 | 80-07-766 | 80-08-981 | 84-50-071 |
| 7,1 x 30 | 84-40-561 | 80-07-788 | 80-07-766 | 80-08-981 | 84-50-071 |
| 7,1 x 35 | 84-40-561 | 80-07-789 | 80-07-766 | 80-08-981 | 84-50-071 |
| 7,1 x 40 | 84-40-561 | 80-07-789 | 80-07-766 | 80-08-981 | 84-50-071 |
| 8 x 10 | 84-40-561 | 80-07-783 | 80-07-765 | 80-08-165 | 84-50-008 |
| 8 x 12 | 84-40-561 | 80-07-784 | 80-07-765 | 80-08-165 | 84-50-008 |
| 8 x 15 | 84-40-561 | 80-07-785 | 80-07-765 | 80-08-165 | 84-50-008 |
| 8 x 20 | 84-40-561 | 80-07-786 | 80-07-766 | 80-08-981 | 84-50-008 |
| 8 x 25 | 84-40-561 | 80-07-787 | 80-07-766 | 80-08-981 | 84-50-008 |
| 8 x 30 | 84-40-561 | 80-07-788 | 80-07-766 | 80-08-981 | 84-50-008 |
| 8 x 35 | 84-40-561 | 80-07-789 | 80-07-766 | 80-08-981 | 84-50-008 |
| 8 x 40 | 84-40-561 | 80-07-789 | 80-07-766 | 80-08-981 | 84-50-008 |

8.5 Dimensional Drawing



8.6 Environmentally Admissible Disposal

- ◆ After repair of the welding gun, dispose replaced parts in an environmentally admissible way.

Used materials:

- Steel
- Nonferrous metals (brass, copper)
- Plastics
- Aluminum

Glossary

| | |
|-------------------------|---|
| Arc: | Electrical discharge at its own between two electrodes under sufficiently high current. Whitish light is emitted. The arc generates very high temperatures. |
| Automatic welding head: | Device to weld welding elements |
| Capacitor: | A component which serves as storage of electrical charge |
| Power unit: | Device to provide electrical energy for stud welding |
| Rectifier: | Electric component transforming alternating current into direct current |
| Stud feeder: | Device for the automatic stud feeding of welding elements |
| Stud welding unit: | Power unit inclusive welding head |
| Thyristor: | Electronic component, contactless switch, which will let the current only pass through if a control pulse is given to the gate (additional electrode) |
| Welding element: | A component, like a stud, bolt, pin, which is welded to the work piece |
| Welding head: | Device to weld welding elements |
| Welding parameters: | Various settings on the gun as well as on the power unit. For example: duration and strength of current during welding process, charging voltage, spring force of the welding head. |
| Work piece: | A component, like a sheet, tube, etc. to which the welding element is fastened |

Regulations and Standards

The regulations and standards are recommendations and don't purport to be completely.

| Standards, regulations | Description |
|------------------------------------|---|
| <u>Stud welding (fundamentals)</u> | |
| DIN EN ISO 13918 | Welding - Studs and ceramic ferrules for arc stud welding |
| DIN EN ISO 14555 | Welding - Arc stud welding of metallic materials |
| DIN EN 1418 | Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials |
| DVS 0901 | Stud welding method for metals - General |
| DVS 0902 | Drawn-arc stud welding |
| DVS 0903 | Capacitor-discharge stud welding with tip ignition |
| DVS 0904 | Instructions for practice - Arc stud welding |
| DVS 2927 | Resistor projection welding and Arc welding of one-sided thick plastics coated thin metal sheets |
| <u>Stud welding (general)</u> | |
| DIN EN ISO 4063 | Welding and allied processes - Nomenclature of processes and reference numbers |
| DIN ISO 857-1 | Welding and allied processes - Vocabulary - Part 1: Metal welding processes |
| DIN EN ISO 14175 | Welding consumables - Gases and gas mixtures for fusion welding and allied processes |
| DIN EN 764-1 | Pressure equipment - Part 1: Terminology - Pressure, temperature, volume, nominal size |
| DIN EN ISO 6947 | Welds - Working positions - Definitions of angles of slope and rotation |

Machine safety

| | |
|-----------------|---|
| 2006/95/EC | Electrical equipment designed for use within certain voltage limits |
| 2004/108/EC | EMC-Guidelines |
| 98/37/EC | Machine guideline (valid until 28.12.2009) |
| 2006/42/EC | Machine guideline (valid from 29.12.2009) |
| DIN EN 60204-1 | Safety of machinery - Electrical equipment of machines - Part 1: General requirements |
| DIN EN 60529 | Degrees of protection provided by enclosures (IP code) |
| DIN EN 60974-1 | Arc welding equipment - Part 1: Welding power sources |
| DIN EN 60974-10 | Arc welding equipment - Part 10: Electromagnetic compatibility (EMC) requirements |

Personal safety and accident prevention

| | |
|------------------|--|
| DIN EN ISO 20345 | Personal protective equipment - Safety footwear |
| DIN EN 12477 | Protective gloves for welders |
| DIN EN 166 | Personal eye-protection - Specifications |
| DIN EN 352-1 | Hearing protectors - General requirements - Part 1: Ear-Muffs |
| BGV A1 | Accident-prevention regulation „Principles of prevention“ |
| BGV A3 | Accident-prevention regulation „Electrical equipment and operating material“ |
| BGV A8 | Accident-prevention regulation „Health and safety signs at work“ |
| BGV B11 | Safety rules “EMC” |
| BGV D1 | Safety rules - welding, cutting and similar processes |



Please note that in your country additional standards and safety conditions (especially rules for accident prevention) may differ from the standards mentioned in this operating manual.

Further Instructions - Tip Ignition

Welding elements, abbreviations, materials, standards, mechanical properties to actual standards

| Stud types | Abbreviations for studs | Material | Material international name | Norm | Mechanical characteristics |
|--|---------------------------|---|------------------------------|-------------------------------|-------------------------------|
| Stud welding with capacitor discharge (TS) | Threaded stud | Steel (S235) 4.8 ¹⁾ copper plated | Mild steel | ISO 898-1 | See ISO 898-1 |
| | Pin (Unthreaded stud) | 1.4301/03 (A2-50) | Stainless steel AISI 304/305 | ISO 3506-1 | ISO 3506-1 |
| | Stud with internal thread | CuZn37 (Ms63) | Brass | EN 12166 | $R_m \geq 370 \text{ N/mm}^2$ |
| | | EN AW-AI99,5 | Aluminum 99,5 | EN 573-3 | $R_m \geq 100 \text{ N/mm}^2$ |
| | EN AW-AIMg3 | Aluminum AIMg3 | EN 12301-2 | $R_m \geq 230 \text{ N/mm}^2$ | |

Further materials on request

¹⁾ weldable

Prestress at installation (tie load) and torque

| Threaded stud | Steel (S235) 4.8 ¹⁾ $\mu = 0,18$ $R_{p0,2} = 340 \text{ N/mm}^2$ | | 1.4301/03 (A2-50) $\mu = 0,18$ $R_{p0,2} = 210 \text{ N/mm}^2$ | | AlMg3 (F23) $\mu = 0,18$ $R_{p0,2} = 170 \text{ N/mm}^2$ | | CuZn37 (Ms63) $\mu = 0,18$ $R_{p0,2} = 250 \text{ N/mm}^2$ | |
|---------------|---|-------------|--|-------------|--|-------------|--|-------------|
| | Prestress at installation (kN) | Torque (Nm) | Prestress at installation (kN) | Torque (Nm) | Prestress at installation (kN) | Torque (Nm) | Prestress at installation (kN) | Torque (Nm) |
| M3 | 1,1 | 0,8 | 0,7 | 0,5 | 0,5 | 0,4 | 0,8 | 0,6 |
| M4 | 1,8 | 1,8 | 1,1 | 1,1 | 1,0 | 0,9 | 1,4 | 1,3 |
| M5 | 3,0 | 3,6 | 1,9 | 2,3 | 1,6 | 1,9 | 2,3 | 2,7 |
| M6 | 4,3 | 6,1 | 2,7 | 3,8 | 2,2 | 3,1 | 3,2 | 4,5 |
| M8 | 8,0 | 15,0 | 4,9 | 9,5 | 4,0 | 7,5 | 6,0 | 11,0 |
| M10 | 13,0 | 30,0 | 7,8 | 19,0 | | | | |

Values correspond with actual standards

¹⁾ weldable

All given values are leads for minimum tensile strength and minimum torque of a weld without permanent deformation of parts to be joined. Parts to be joined must have sufficient wall thickness. Values apply for cold rolled threaded studs with standard thread without surface protection and without thread lubrication. Throughout the entire stud length, at least the stressed cross section must be present. Values apply for indicated yield strengths.

Material combinations

according to the actual standards (select stud material in a way that material of the same kind is welded)

| Stud material | Base material | | | | |
|--------------------------------|---------------------------------|---|----------------------|---|-------------------------------|
| | ISO/TR 15608 Groups 1 - 6, 11.1 | ISO/TR 15608 Groups 1 - 6, 11.1 and galvanized and metal plated steel sheets, max. coating thickness 25 μm | ISO/TR 15608 Group 8 | Copper and unleaded copper alloys, e.g. CuZn37 (CW508L) | ISO/TR 15608 Groups 21 and 22 |
| Steel (S235) 4.8 ¹⁾ | a | b | a | b | -- |
| 1.4301/1.4303 | a | b | a | b | -- |
| CuZn37 | b | b | b | a | -- |
| EN AW-AI99,5 | -- | -- | -- | -- | b |
| EN AW-AIMg3 | -- | -- | -- | -- | a |

Exemplification of welding suitability:
 -- non weldable
 a well suited for any application, e.g. power transmission
 b suitable, limitations with power transmission

Weldability tests of other material combinations on request.

¹⁾ weldable

Further Instructions - Arc Stud Welding

Welding elements, abbreviations, materials, standards, mechanical properties to actual standards

| Stud types | | Abbreviations for studs (ceramic ferrules) | | Material | Norm | Mechanical characteristics | |
|----------------------------------|---|--|---------------------------|---------------------------------|---|----------------------------|---|
| Stud welding with drawn arc (DS) | Drawn arc welding with ceramic ferrule (CF) or shielding gas (SG) | Threaded stud | FD (PF) | Mild steel (4.8 ¹⁾) | ISO 898-1 | see ISO 898-1 | |
| | | Threaded stud with reduced shaft | RD (RF) | | | | |
| | | Pin | UD (UF) | 1.4301/03 (A2-50) | EN ISO 3506-1 | see ISO 3506-1 | |
| | | Pin with internal thread | ID (UF) | | | | |
| | Short cycle welding with drawn arc | Head stud | | SD (UF) | Mild steel (S235J2G3 + C450) | ISO/TR 15608 | R _m ≥ 400 N/mm ² ReH ≥ 235 N/mm ² A ₅ ≥ 15% |
| | | | | | 1.4301/03 (A2-50) | EN 10088-1 | R _m ≥ 500 - 780 N/mm ² Rp0,2 ≥ 350 N/mm ² A ₅ ≥ 25% |
| | | | Threaded stud with flange | FS | Mild steel (4.8 ¹⁾) copper plated | ISO 898-1 | see ISO 898-1 |
| | | Pin with flange | | US | 1.4301/03 (A2-50) | EN ISO 3506-1 | see ISO 3506-1 |
| | | | | | | | |

Further materials on request

¹⁾ weldable

Prestress at installation (tie load) and torque

| Threaded stud | Steel (4.8 ¹⁾) μ = 0,18 R _{p0,2} = 340 N/mm ² | | 1.4301/03 (A2-50) μ = 0,18 R _{p0,2} = 210 N/mm ² | | AlMg3 (F23) μ = 0,18 R _{p0,2} = 170 N/mm ² | | CuZn37 (Ms63) μ = 0,18 R _{p0,2} = 250 N/mm ² | |
|---------------|---|-------------|--|-------------|--|-------------|--|-------------|
| | Prestress at installation (kN) | Torque (Nm) | Prestress at installation (kN) | Torque (Nm) | Prestress at installation (kN) | Torque (Nm) | Prestress at installation (kN) | Torque (Nm) |
| M 6 | 4,3 | 6,1 | 2,7 | 3,8 | 2,2 | 3,1 | 3,2 | 4,5 |
| M 8 | 8,0 | 15,0 | 4,9 | 9,5 | 4,0 | 7,5 | 6,0 | 11,0 |
| M 10 | 13,0 | 30,0 | 7,8 | 19,0 | | | | |
| M 12 | 19,0 | 53,0 | 12,0 | 33,0 | | | | |
| M 16 | 35,0 | 135,0 | 22,0 | 82,0 | | | | |

Values correspond with actual standards

¹⁾ weldable

All given values are leads for minimum tensile strength and minimum torque of a weld without permanent deformation of parts to be joined. Parts to be joined must have sufficient wall thickness. Values apply for cold rolled threaded studs with standard thread without surface protection and without thread lubrication. Throughout the entire stud length, at least the stressed cross section must be present. Values apply for indicated yield strengths.

Material combinations

according to the actual standards (select stud material in a way that material of the same kind is welded)

| Stud material | Base material | | | |
|--|-------------------------------|---------------------------------|------------------------------|-------------------------------|
| | ISO/TR 15608 Groups 1 and 2.1 | ISO/TR 15608 Groups 2.2, 3 to 6 | ISO/TR 15608 Groups 8 and 10 | ISO/TR 15608 Groups 21 and 22 |
| Steel (S235) 4.8 ¹⁾ 16Mn3 | a | b | b | -- |
| 1.4301/03, 1.4401/04, 1.4541, 1.4571 | b/a | b | a | -- |
| EN AW-AlMg3/EN AW-5754 EN AW-AlMg5/EN AW-5019 | -- | -- | -- | b |

Exemplification of welding suitability
 -- non weldable
 a well suited for any application, e.g. power transmission
 b suitable, limitations with power transmission

Weldability tests of other material combinations on request.

¹⁾ weldable

Guarantee Clauses

Please refer to the current “General Terms and Conditions” for the guarantee clauses.

We are not liable for malfunctions which are caused by

- normal wear,
- improper use,
- non-observing the operating manual,
- transport damages.

Any guarantee claim will be cancelled if repair operations are carried out by unauthorized persons.



Warning: Unauthorized interference with the stud welding unit as well as unauthorized alteration of the stud welding unit are prohibited and result in complete cancellation of any guarantee and liability claims against HBS.

Please fill in the serial number:

Serial number automatic welding head:

Serial number power unit:

Serial number welding head:

Serial number stud feeder:

Please indicate the serial numbers in case of enquiries or when ordering spare parts.

EU-Statement of Conformity

Manufacturer: HBS Bolzenschweiss-Systeme GmbH & Co. KG
Felix-Wankel-Strasse 18
Postfach 13 46
85221 Dachau / Germany
Phone +49 (0) 8131 511-0
Fax +49 (0) 8131 511-100

Statement: This is to certify, that equipment listed below is designed and manufactured in conformance to the safety and health regulations.
This statement is invalid if any modifications are done on the equipment without prior written approval by HBS.

Description of equipment: Automatic Welding Head
Type: KAH 412 LA
Order No: 94-37-412
Serial-No:

Applicable EC-guidelines and corresponding standards:

- **Low voltage guideline 2006/95/EC:**
DIN EN 60974-1 Arc welding equipment - Part 1: Welding power sources
- **EMC guideline 2004/108/EC:**
DIN EN 60974-10 Arc welding equipment - Part 10: Electromagnetic compatibility (EMC) requirements
- **Machine guideline 98/37/EC^{*)}:**
DIN EN 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

^{*)} valid until 28.12.2009

- Machine guideline 2006/42/EC, valid from 29.12.2009



Date

Erwin Promoli (General Manager HBS)

Service & Support

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

Repair number
(given by HBS)

Company: _____

Name / Surname: _____

Street: _____

City, State and ZIP: _____

Country: _____

Phone & Fax: _____

E-mail address: _____

Unit / gun type of model: _____

Serial number: _____

Date of purchase: _____

Purchased at distributor: _____

Further descriptions of default: _____

Service & support may be done up to the value of EUR _____ without tender: Yes No

Could you find any damage / burning mark: Yes No

on the cables: Yes No

on chucks: Yes No

Are all plug and screw connections fastened tight *: Yes No

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

Are there any other visual damages (e.g. cracks, dents): Yes No

Have you checked the fuses: Yes No

Default on the display of the power unit:

| ARC | | | | | CD | | | | | |
|-----|--|--|--|--|----|--|--|--|--|--|
| | | | | | | | | | | |
| | | | | | | | | | | |

Which LEDs are burning (please mark with a cross)?

Please e-mail or fax this form to post@hbs-info.de or fax: ++49 - 81 31 - 5 11 - 1 00.
In case a repair is necessary you get the required repair number!

- * See also according operating manual, chapter „Starting-up“
- ** Doesn't light when using a contact welding gun

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