



ONURFIX®

A 22

Welding Gun

93-20-290



Operating Manual

Customer Service in Germany:

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Dear customer,

Thank you very much for purchasing a welding gun 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 welding gun may differ in some details from the captions in this manual. This has no effect on the operation of the welding gun.

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 gun.

Required user qualification

The welding gun must only be operated by qualified personnel.

- ◆ Let the welding gun only be operated by persons who
 - are qualified through a suitable training according to the current standards for stud welding (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 stud welding unit.
- ◆ Read the entire manual before operating the welding gun.
- ◆ Strictly observe the safety instructions.
- ◆ Before starting up the welding gun, 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 gun 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 gun 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 the Welding Gun"	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 gun. 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 gun 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



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 gun is only allowed with HBS power units, this clause is also part of "use as directed".

The welding gun 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 gun not used as directed. Any risk is carried by the user.

The welding gun 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 gun was manufactured to the latest developments in technology and is regarded as safe to operate (place of operation see section 8.1).

The welding gun A 22 can be connected to the HBS power units ARC 1550, IT 90, IT 130 and IT 2001. 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 gun 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 gun 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 gun can only be checked before starting-up by visual inspection (visible damage).

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

- The welding gun must be stored in a secure place
- The welding gun 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 gun, 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 also observe the operating manual of the power unit to which the welding gun is to be connected 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

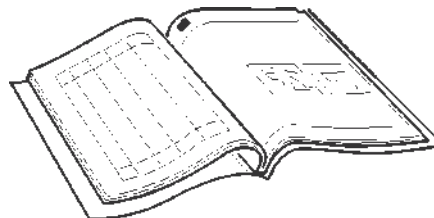
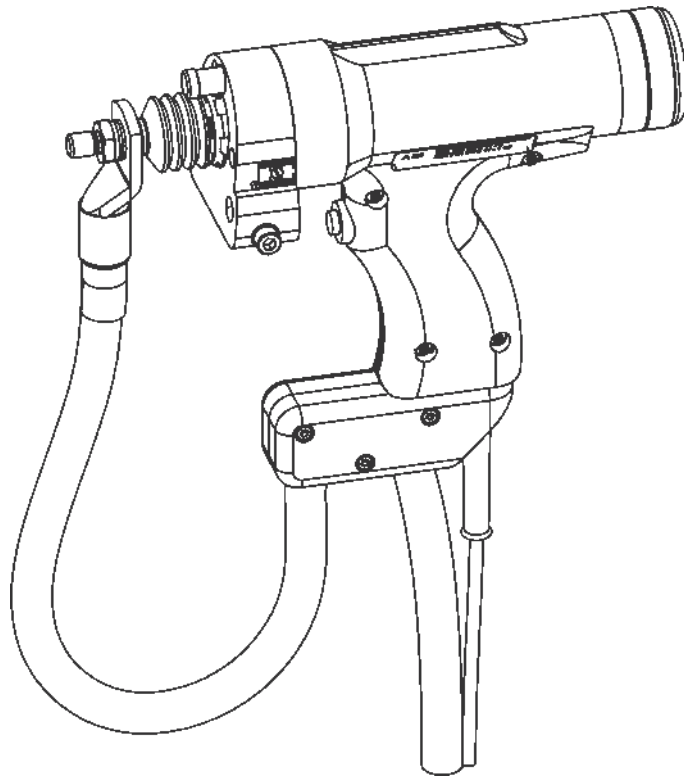
- ◆ Secure the following safety symbols in the area of welding place:



2 Delivery

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

No. of pieces	Part	Type	Order No.
1	Welding gun, cable length 4.85 m	A 22	93-20-290
1	Operating Manual	A 22	BA 93-20-290



3 Starting-up

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

3.1 Requirements of Workplace



The welding gun corresponds with protection class IP 20. It must not be used in a humid environment!



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 to magnetic fields.
- ◆ Work with the welding gun:
 - 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 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.

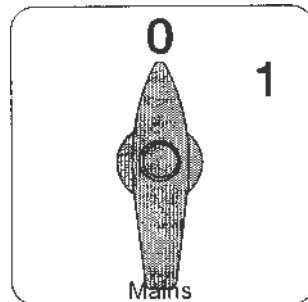


During the actual welding process, you must expect red-hot welding spatters, possibly liquid spatters, a flash, and a loud bang > 90 dB (A). Alert any colleagues who are occupied in the vicinity of the welder. Wear your personal protective equipment according to actual standards (see appendix).

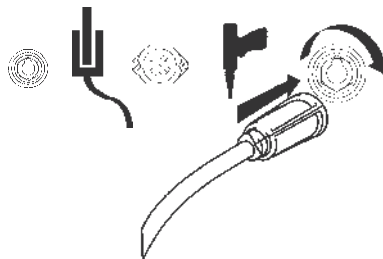
3.2 Connecting the Welding Gun to the Power Unit



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



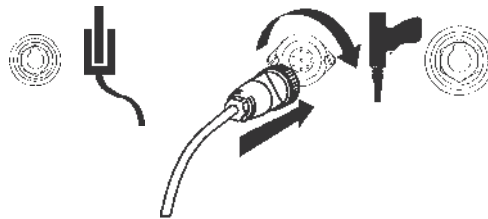
- ◆ Plug the welding cable of the welding gun into the related socket of the power unit.
- ◆ Press-in the plug and twist firmly to the right.





The connection is not secured against working itself loose! Check 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 in the control cable of the welding gun into the appropriate connection on the power unit.



- ◆ Twist the retaining nut of the control cable connector clockwise to secure the connection.

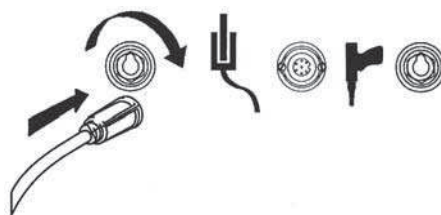


The welding gun cables must not be coiled during welding. Coiled cables work as a coil and may negatively affect the welding result. Before welding, lay out the cables lengthwise.

- ◆ Fix the cables. Strong magnetic fields occur during welding which may cause a movement of the cables. This may cause a slackness of the connections.

3.3 Ground Connection

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

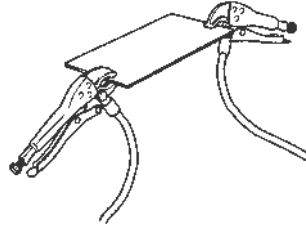


- ◆ Press in the plug and twist firmly clockwise.



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 clamps 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



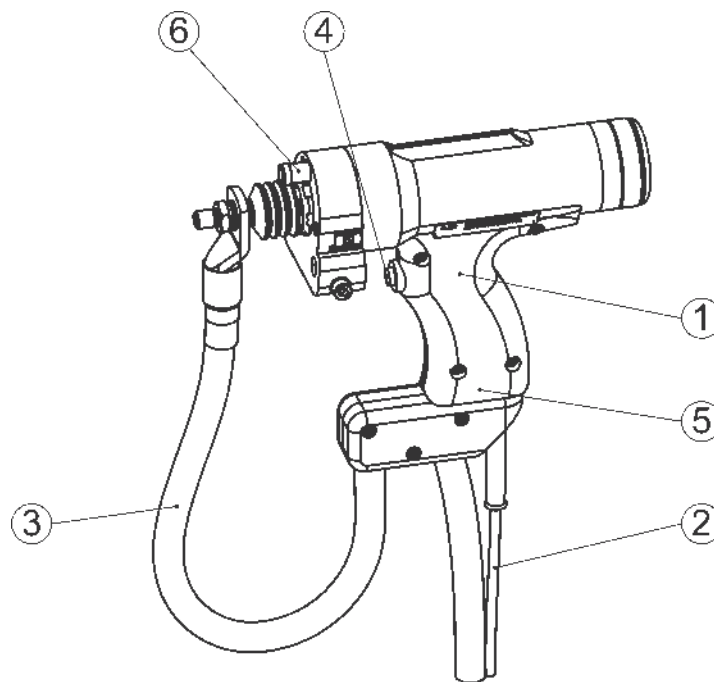
Switch off the power unit. In this way, you avoid any risk of electrical shock.

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

4 Function

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

4.1 Components of the Welding Gun Ceramic



The body of the welding gun consists of a sturdy two-part **plastic housing** (1).

The **control cable** and the **solenoid cable** (2) are connected through the welding gun handle to the welding gun. The **welding cable** (3) is externally connected.

Positioned at the front of the welding gun there is the stud chuck where the welding elements of the welding gun are manually fed.

A tripod with foot piece, where the ceramic ferrule holder is inserted, is used to position the welding gun vertically.

The springy welding elements are projecting out of the ceramic ferrule holder with ceramic ferrule. In this way, they can be positioned above the aluminum ball or the cone.

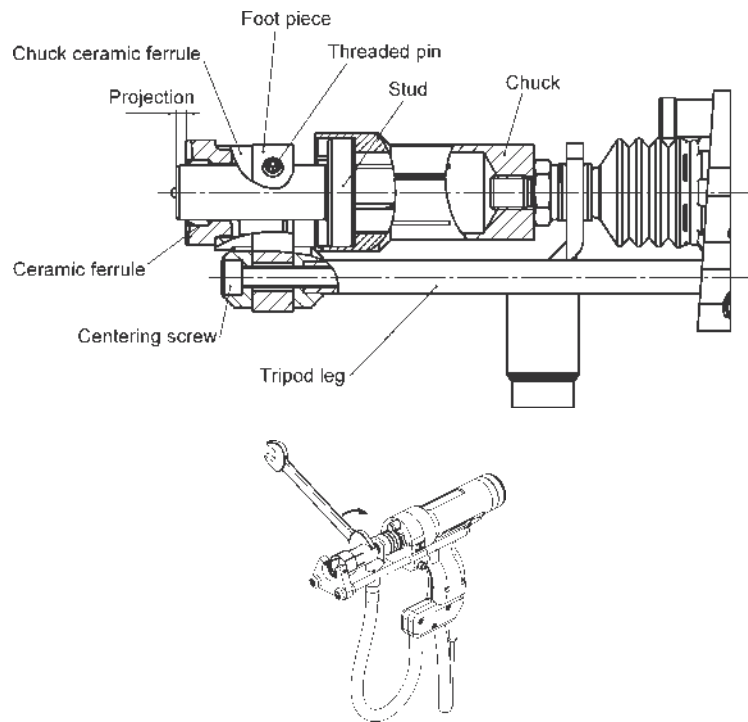
At the front of the welding gun handle, the **welding gun trigger** (4) is installed. It is used to trigger the welding process.

The **serial number** (5) can be found on the welding gun handle.

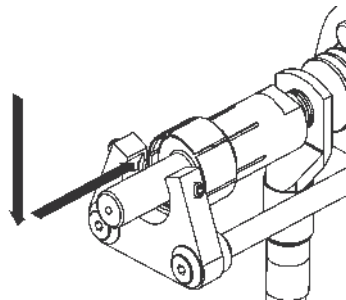
The **screw cap** (6) is used to cover the damper.

4.2 Installation of Chuck and Tripod

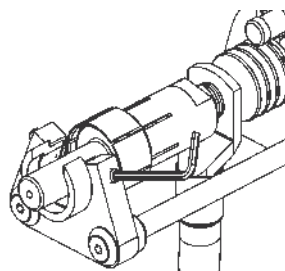
Welding with Ceramic Ferrule



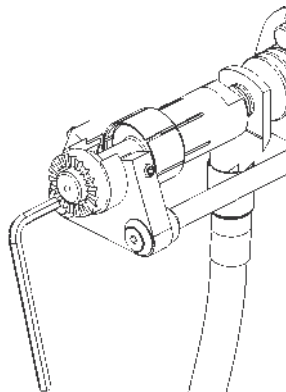
- ◆ Screw the chuck on the thread start of the welding gun and tighten it firmly with a wrench SW 14/17 (accessory).



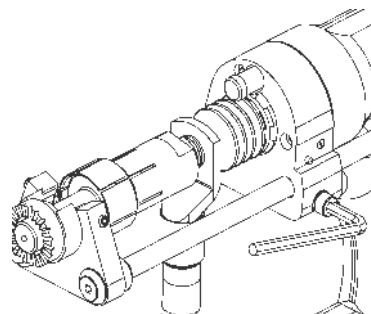
- ◆ Put the stud up to the stop into the chuck.
Attention: The stud must firmly sit in the chuck, otherwise stud and chuck would burn.



- ◆ Put the ceramic ferrule support into the foot plate and tighten it with an Allan key 3 mm (accessory).



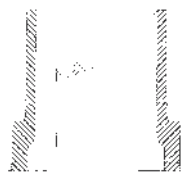
- ◆ Put on the ceramic ferrule. Adjust the foot plate until the stud can be moved in the ceramic ferrule without friction (centered). Tighten the foot plate with an Allan key 5 mm (accessory).



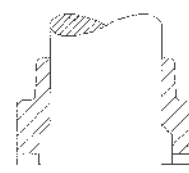
- ◆ Tighten the tripod legs with an Allan screw.

4.3 Adjustment of Plunging Depth (Projection)

The plunging depth characterizes the overlap size which would be achieved by welding element and base material with seated welding gun before welding. This overlap provides the melt for forming the weld collar.



Plunging depth
for studs with conical face



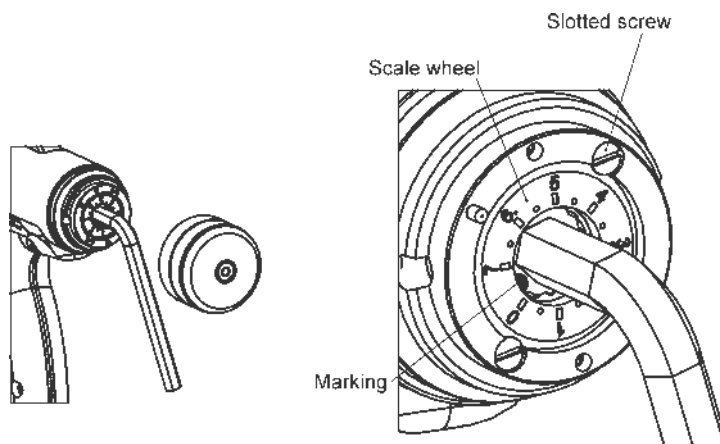
Plunging depth
for studs with plane face

- ◆ Loosen the Allan screw at the welding gun and adjust the plunging depth according to section 5.5.
- ◆ Retighten the Allan screw.

4.4 Adjustment of Lift

- ◆ Screw off the cup at the rear.
- ◆ Now you can adjust the lift distance with an Allan key (size 8) in steps of 0.25 mm by turning it counter-clockwise.
- ◆ Screw on the cup.

Lift distance depends on the diameter of the welding element, the work piece surface (plated sheets) and projection (see section 5.5).



4.5 Adjustment of Lift Scale

- ◆ Screw off the cup at the rear.
- ◆ Now you can screw in the lift up to the stop by turning clockwise.
- ◆ Now you can screw out the lift step by step by turning counter-clockwise. Pushing the button triggers the lift. Repeat this procedure until a lifting motion at the stud is visible.
- ◆ Lock this position with an Allan key (size 8). Slacken both slotted screws. Adjust the scale wheel by turning and setting the zero position onto the marking. Then tighten the slotted screws.
- ◆ Now the scaling 'Lift' is adjusted.

4.6 Adjustment of Hydraulic Damping

A damping of the plunging movement is only required with studs above 14 mm diameter.

- ◆ Screw off the cup of the damper.
- ◆ Set the mark of the regulation screw to the required number using an Allan key (size 2).

Meaning:

0-2 low damping (high plunging speed),

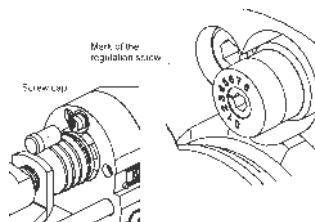
3-5 medium damping and

6-8 high damping (low plunging speed).

Normally, a damping above "2" should not be selected.

A proper speed must be determined via trials. The weld pool should not splash-off during plunging, on the other hand it should form a complete collar around the stud. You should consider that the weight of the stud increases the plunging speed when welding in horizontal position.

When welding in sideway and especially in overhead position, the damping effect must be set lower than in horizontal position - also with larger studs.



There must be no friction between stud and ceramic ferrule, if so, center the foot plate of the welding gun.



When triggering the welding gun key, the welding gun lifts the welding element always by the same lift value, independent from the position of the welding element.

Assignment stud diameter - electrical current - welding time with lift and projection

Example: Diameter 16 mm 1300 A 0.65 s with ceramic ferrule

Optimum parameters for an application may differ from indicated data due to plate thickness, welding position, coatings, type of ceramics ferrules etc.

At first one determines current and welding time based on stud diameter at the welding place, then lift and projection values depending on type of stud tips (to ceramic ferrule or face area). Note the plunging speed!

Example 1: Diameter 16 mm: 1300 A, 0.65 s, flat stud face (with alu-ball): lift 3 mm, projection 3.5 mm = 100 mm/s plunging speed.

(see section 5.5)

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 stud welding unit 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
- 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 stud, chuck, or retaining nut nor any electrically conductive parts in their vicinity. These are all electrically live.

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 electro-magnetically sensitive parts from your body before you start welding. In this way, you avoid the risk of damage by electric shock or 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, which are contaminated with combustible materials like oil, grease, kerosene etc. during welding.

Always wear your personal protective equipment such as:

- 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 gases, 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 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).



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 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

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

The various processes of arc stud welding are distinguished by:

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

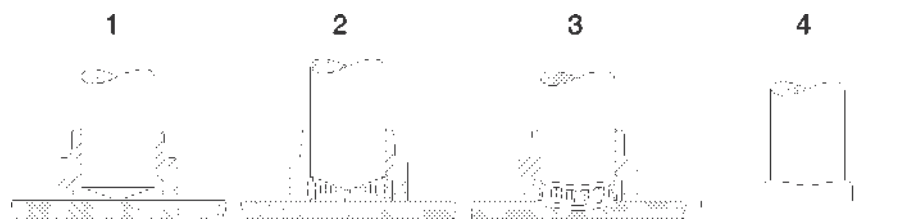
Variations for drawn-arc ignition are described in current standards and regulations (see appendix).

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 stud is mechanically moved to the workpiece. On plunging into the weld pool, the two weld zones join and solidify. The contact of stud and workpiece extinguishes the arc in a short-circuit and the main current is switched off.
- The weld zone solidifies and cools down. The welding element is now welded to the workpiece over its entire cross-section of the welding element (see 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

5.2.1 Drawn-Arc Stud Welding with Ceramic Ferrule

Drawn-arc stud welding with ceramic ferrule is used with welding elements of 3 to 25 mm diameter (preferably above 12 mm diameter) and with welding times of 50 to 2000 ms. It is generally suitable for all welding positions. When stud welding with ceramic ferrule, the welding position is PA (vertical). The major part of all applications applies to this procedure.

The ceramic ferrule (CF)

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



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

Standard welding elements and ceramic ferrules are described in several standards (see appendix). When using concrete anchors or shear connectors the front area can be plane constructed with a small pressed-in aluminum ball.

Studs with cone-shaped front area and aluminum ball



are preferably used with ceramic ferrule.

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. welding time) or on the welding gun (e.g. lift) depends amongst others on

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

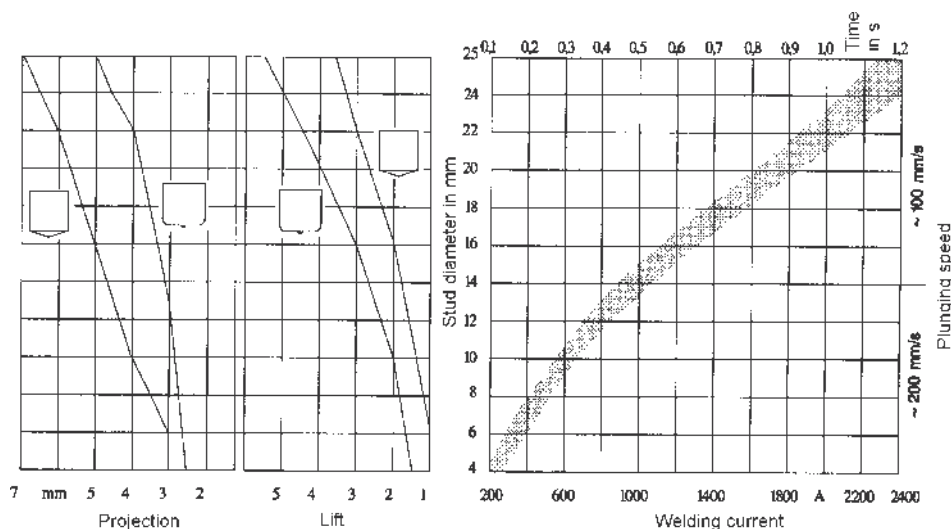
The guidelines should be verified by test welding on the actual material and be changed if necessary. For an assessment of welding results, see sections 5.7 and 5.8.

Determination of welding time



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

Setting power unit and welding gun



Further notes on

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

see appendix and operating manual of the according power unit.

5.6 Welding Procedure



Improper operation of the stud welding unit is LIFE-THREATENING! The stud welding gun must only be operated by qualified personnel (see chapter 1). Observe 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).

- ◆ Insert the welding element into the chuck.

As soon as the power unit is ready for the welding process,

- ◆ place the welding gun vertically against the workpiece,
- ◆ push the welding gun firmly with both hands onto the workpiece until the welding gun support (distance device) is evenly seated on the workpiece,
- ◆ hold the welding gun firmly, still, and straight,
- ◆ take care that you do not touch any metallic part of the welding gun.
- ◆ press the trigger button of the welding gun.

This initiates the welding process.



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 gun straight back from the welding element. If you remove the welding gun 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.


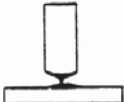





See also actual standards in the appendix “Arc stud welding of metallic materials“, in section irregularities and corrective actions.

5.7.1 Visual Inspection

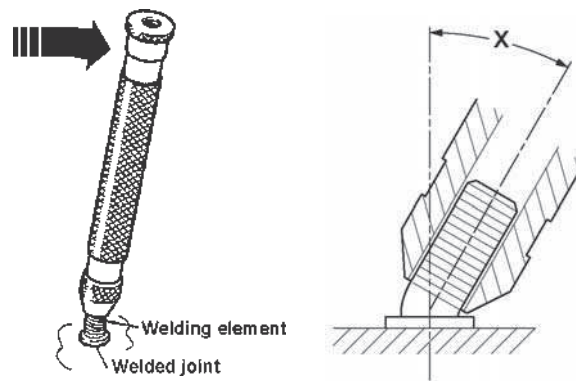
A visual inspection must be carried out with each welding element.

Shape, size, evenness, and color of the weld collar are assessed during a visual inspection. The length of a welded element should be 2 - 3 mm shorter than before welding.

Visual Inspection		
Condition	Possible cause	Corrective actions
Weld collar evenly, shiny, and complete Length of welding element within tolerance after welding 	- Correct parameters	- None
Contraction of weld collar welding element too long 	- Plunging depth or lift too low - Welding energy too high - Ceramic ring not centered correctly	- Increase plunging depth, check lift and centering of the ceramic ring - Decrease current and/or time - Check centering
Weakly developed, uneven weld collar with mat surface Welding element too long 	- Welding energy too low - Ceramic ring is humid	- Increase current and/or time - Rebake ceramic rings in a furnace
Single-sided weld collar Undercut 	- Arc blow effect - Ceramic ring not centered correctly	- See arc blow effect - Check centering
Weld collar low, shiny surface with many spatters Welding element too short 	- Welding energy too high - Plunging speed too high	- Decrease current and/or time - Adjust plunging depth and/or damping factor

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.

- ◆ Bend the welding element with the bending device once by 60°.

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.

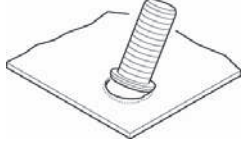
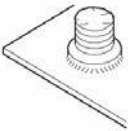
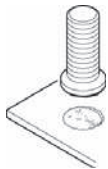
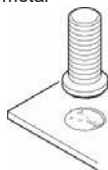
- ◆ Please note the instructions on fault recognition and corrective actions in chapter 5.



You don't need to test all studs. 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 gun for ease of movement.

Bending Test		
Type of fracture	Possible cause	Corrective actions
Base material buckling 	- Correct parameters	- none
Fracture in welding element above weld collar 	- Correct parameters	- none
Fracture in the weld metal Many pores 	- Welding energy too low - Plunging speed too low - Unsuitable stud/base material combination	- Increase welding energy - Increase plunging speed - Replace welding element or workpiece
Fracture in the weld metal Shiny fracture surface 	- Welding time too short	- Increase welding time

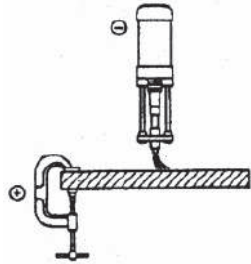
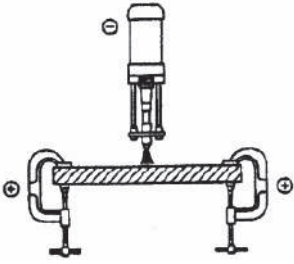
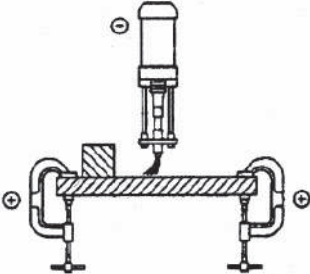
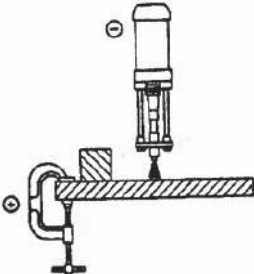
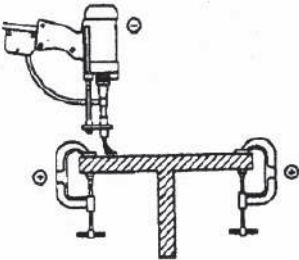
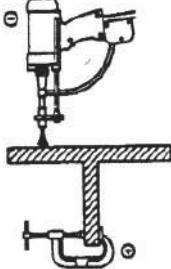
5.7.3 Arc Blow Effect

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 Malfunctions and Corrective Actions

Malfunction	Possible cause	Fault finding	Corrective action	Carried out by
Welding elements not firmly attached	Wrong welding parameters selected	Check charging voltage on power unit	Change adjusted parameters	Instructed personnel
		Check spring force of welding gun	Change adjusted parameters	Instructed personnel
	Plunging speed of welding element too low	Check welding piston and linear bearing that they are smooth running *)	Clean or replace *)	Qualified personnel
		Check damper adjustment	Replace damper	Instructed personnel
Scorchings at welded element	Chuck is worn	Check chuck for possible wear	Replace chuck	Instructed personnel
Welding gun does not weld	Control cable defective (with present contact signal on power unit)	Check control cable for electrical flow at socket (Pin 3 and 4) of the control cable socket with pressed gun trigger *)	In case of no flow : Replace control cable *)	Qualified personnel
		Check micro switch with pressed welding gun trigger for electrical flow *)	In case of no flow : Replace micro switch *)	Qualified personnel
	Ground connection defective (no contact signal on power unit)	Check, whether ground cable is connected to workpiece	Connect ground cable	Instructed personnel
		Check ground cable for electrical flow	In case of no flow : Replace ground cable	Instructed personnel
	Welding current cable defective (no contact signal on power unit)	Check, whether welding current cable is connected to power unit	Connect welding current cable	Instructed personnel
Check welding current cable for electrical flow *)		In case of no flow : Replace welding current cable and/or connection cable *)	Qualified 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!



Danger

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.

Welding elements are mainly manufactured with the cold formed process.

We recommend the following standard welding 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 RD (MR)	Diameter	Length	Chuck ceramic
	M12	25-60 mm	83-50-012
	M16	30-65 mm	83-50-016

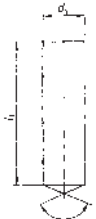
Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

Threaded stud DD (MD)	Diameter	Length	Chuck ceramic
	M12	25-60 mm	83-50-012
	M16	30-65 mm	83-50-016

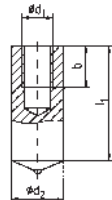
Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

Threaded stud PD (MP)	Diameter	Length	Chuck ceramic
	M12	25-160 mm	83-50-012
	M16	30-160 mm	83-50-016

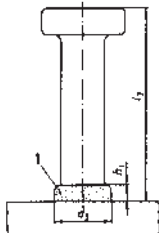
Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

Pin UD (S)	Diameter	Length	Chuck ceramic
	12	20-80 mm	83-50-012
	16	25-80 mm	83-50-016

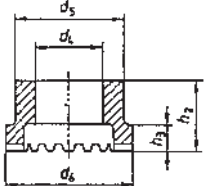
Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

Pin with internal thread MI (ID)	Diameter	Length	Chuck ceramic
	M12	20-50 mm	83-50-012
	M16	20-50 mm	83-50-016

Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

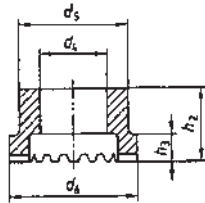
Head stud SD	Diameter	Length	Chuck ceramic
	1/2" (13)	50-175 mm	83-53-012
	5/8" (16)	50-175 mm	83-53-019
	3/4" (19)	50-175 mm	83-53-019
	7/8" (22)	75-200 mm	83-53-022

Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

Ceramic ferrule RF for threaded stud RD	Diameter	Chuck ceramic ferrule
	12	80-31-170
	16	80-31-205

Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

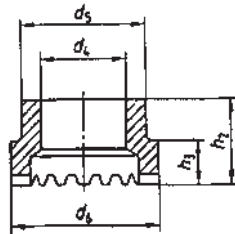
- Ceramic ferrule PF for threaded stud PD Diameter Chuck ceramic ferrule
- Ceramic ferrule UF for pins UD, MI



12	80-31-205
16	80-30-116

Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

- Ceramic ferrule UF for head stud SD Diameter Chuck ceramic ferrule



1/2"	80-30-213
5/8"	80-30-219
3/4"	80-30-219
7/8"	80-30-222

Materials: S235 / St37.3k (4.8) / 1.4301, 1.4303

We look forward to consult you with view to special welding elements and other special materials.

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 E-mail post@hbs-info.com

6 Switching off the Welding Gun

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 stud welding gun against ingress of fluids and foreign bodies.

6.2 Disposal

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

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

7 Care and Maintenance

This chapter shows care and maintenance of the welding gun 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 you start any maintenance operation with the welding gun, always switch the power unit off and disconnect control cable and welding cable from power unit.

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 gun, switch off the connected power unit and disconnect control cable and welding cable from power unit.

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



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

- ◆ 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 gun for possible damage and if properly installed.



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

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

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

8 Appendix

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

8.1 Technical Data

Stud Welding Gun A 22 (damped) for ARC stud welding according to current standards

Welding range	Dia. 14 to 22 mm (dia. 25 mm) (Dia. 9/16" to 7/8" (dia. 1"))
Stud length	10 to 270 mm (0.39" to 10.63") depending on tripod
Stud material	Mild steel or stainless steel
Stud type	Any type or shape (special chucks if required)
Length adjustment	9 mm (0.35") automatic
Stroke	Adjustment range 6 mm (0.24"), (0.25 mm (0.01") steps, arresting)
Damping	Adjustable oil damper
Welding cable	4.85 m, 95 mm ² (15.91', 4/0)
Insulation class	IP 20 (protect against humidity)
Workplace noise level	Up to 90 dB (A) may occur during welding
Operational and storage conditions	According to current standards
Dimension L x W x H	260 x 74 x 220 mm (10.24" x 2.91" x 8.66") without cable, with foot piece
Weight:	2 kg (4.41 lbs) without cable

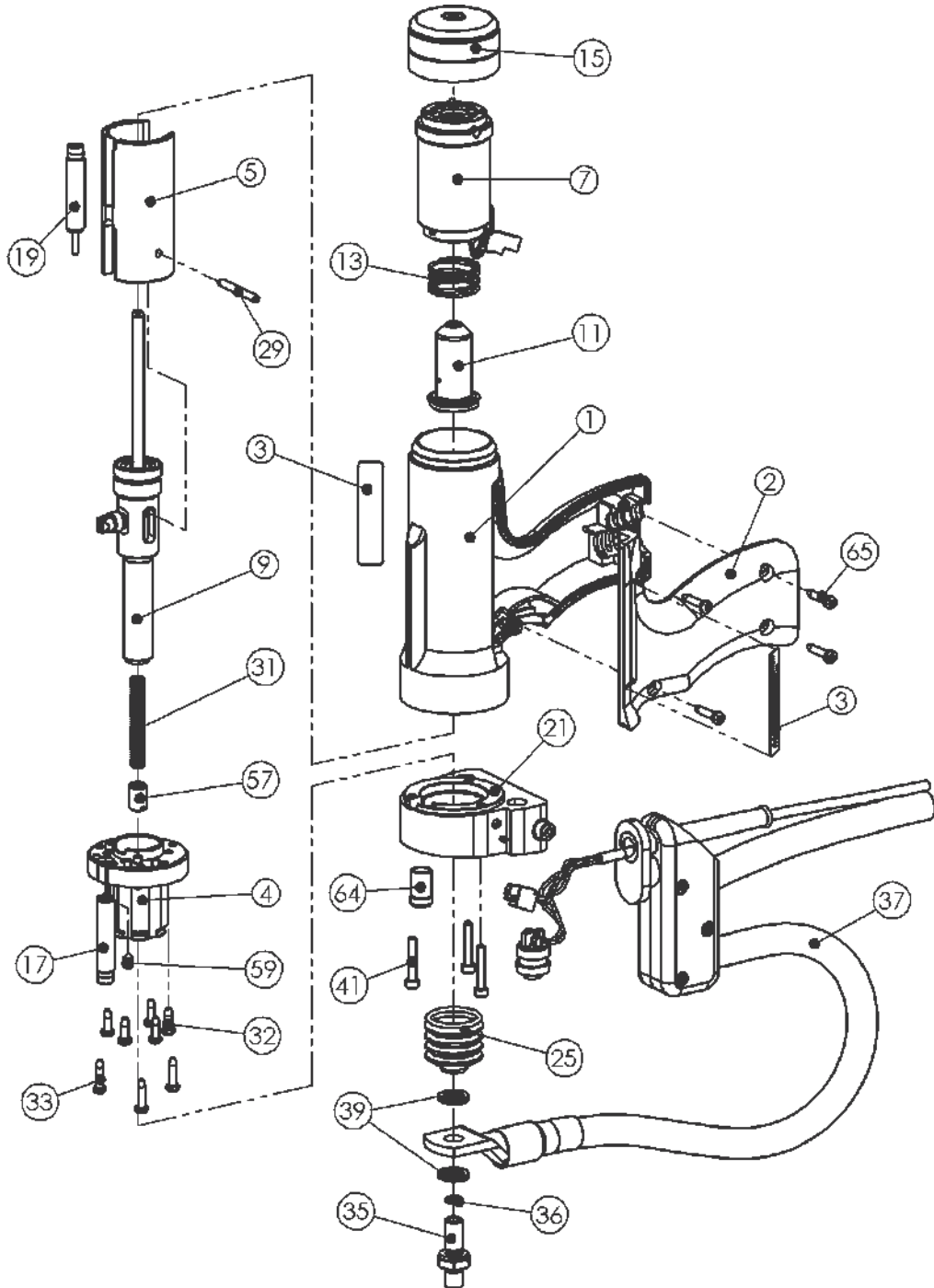
8.2 Spare Parts

Spare part list welding gun type A 22, ceramic (93-20-290)

When ordering spare parts, please indicate order number and type of welding gun.
The type is to be found at the housing.

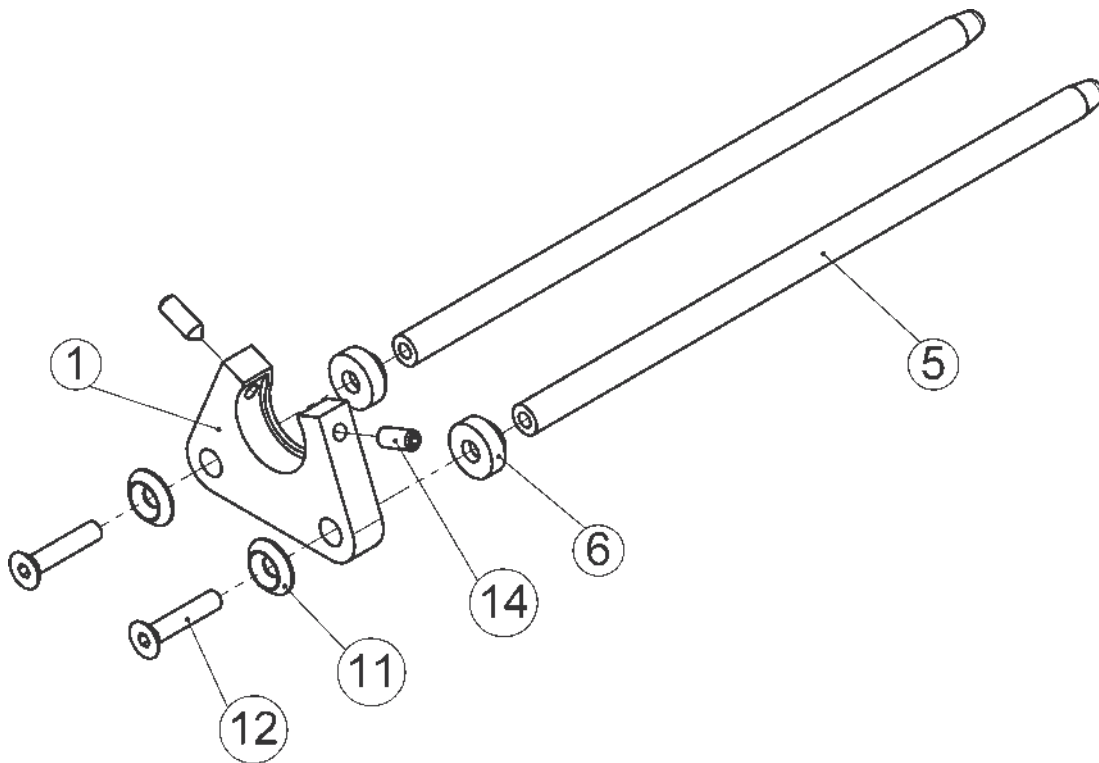
Pos.	Quantity	Order No.	Description
1	1	88-15-914	Basic shell
2	1	88-15-915	Cover shell
3	2	80-10-0669	Sticker A_22
4	1	88-15-917	Bearing support, complete
5	1	88-15-930	Guide tube, complete
7	1	88-15-494	Adjusting mechanism, complete
9	1	88-15-922	Piston complete
11	1	88-15-932	Length compensation, complete
13	1	80-05-540	Pressure spring for length compensation
15	1	88-15-939	Cap, complete
17	1	88-15-943	Plunging damper
19	1	88-15-944	Lift damper
21	1	88-15-941	Stativ support, complete
25	1	80-10-176	Bellows
29	1	80-10-770	Cylindrical pin 4 x 35
31	1	88-17-409	Pressure spring welding
32	5	80-10-0975	Screw Plasfast 4 x 12 / Torx
33	3	80-10-0901	Screw Plasfast 4 x 16 / cross-recess
35	1	88-15-945	Double nipple
36	1	80-11-694	O-ring 7 x 1.5
37	1	88-16-303	Connecting line, complete
39	2	80-10-0902	Locking washer 10
41	3	80-90-109	Screw M4 x 25
57	1	88-15-948	Adjustment screw
59	1	80-90-208	Screw M5 x 8
64	1	88-16-517	Cap shock absorber
65	4	80-10-0956	Screw Plasfast 4 x 20 / cross-recess

Welding gun type A 22, ceramic (93-20-290)



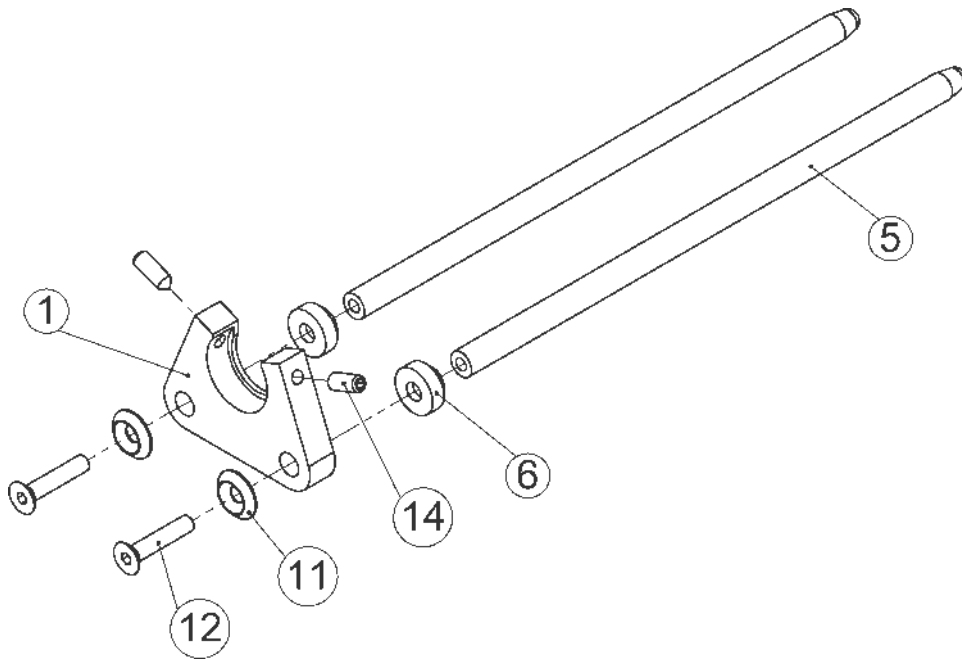
Spare part list ceramic tripod 10 x 240 complete (93-40-041)**for Shear connectors dia. 16 to 22 mm**

Position	Quantity	Order No.	Description
1	1	80-41-028	Foot piece
5	2	80-40-110	Leg 10-240
6	2	80-40-109	Cover plate tripod
11	2	80-10-1035	Cover plate
12	2	80-90-454	Screw M6 x 30
14	2	80-90-116	Screw M6 x 16



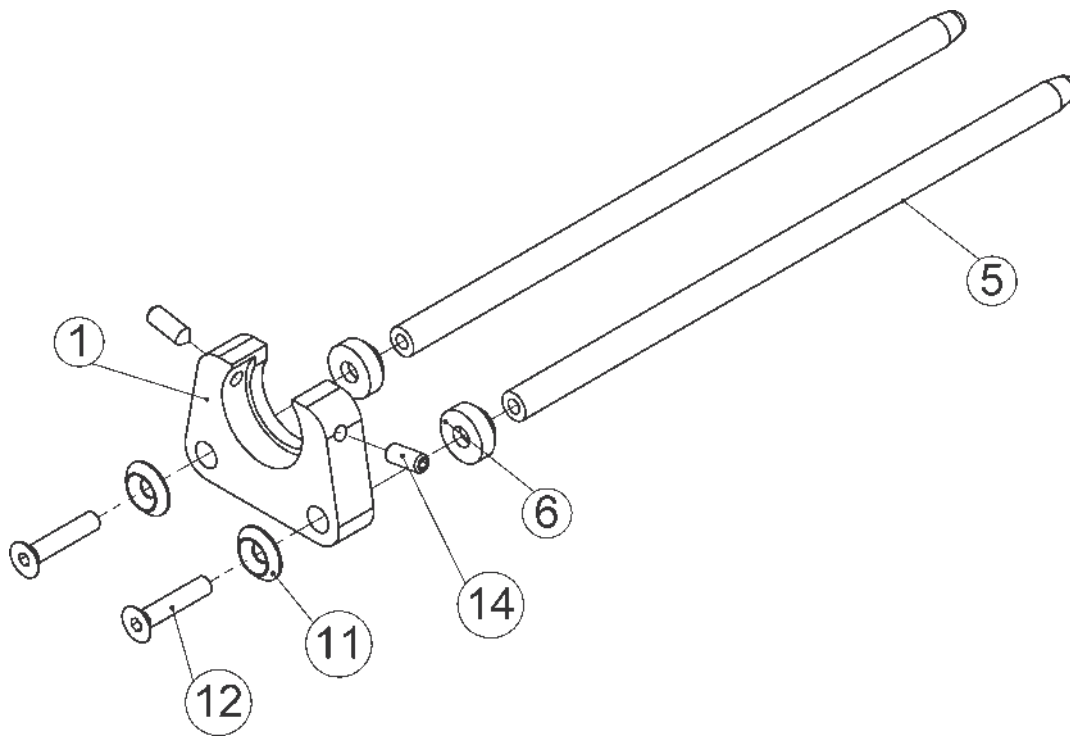
Spare part list ceramic tripod 10 x 390 complete (93-40-074)
for Shear connectors dia. 16 to 22 mm

Position	Quantity	Order No.	Description
1	1	80-41-028	Foot piece
5	2	80-40-493	Leg 10-390
6	2	80-40-109	Cover plate tripod
11	2	80-10-1035	Cover plate
12	2	80-90-454	Screw M6 x 30
14	2	80-90-116	Screw M6 x 16



Spare part list ceramic tripod 10 x 390, A-22/1" complete (93-40-073)

Position	Quantity	Order No.	Description
1	1	88-15-824	Foot piece
5	2	80-40-493	Leg10-390
6	2	80-40-109	Cover plate tripod
11	2	80-10-1035	Cover plate
12	2	80-90-454	Screw M6 x 30
14	2	80-90-116	Screw M6 x 16



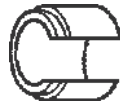
8.3 Accessories

When ordering accessories, please indicate order number and type of welding gun.

for	Description	Order No.
Threaded studs, sleeves with internal thread and pins	<p>Chuck</p> <p>Ø 12 mm e 13 mm Ø 16 mm e 13 mm</p> <p>larger Ø on request</p>	<p>83-50-012 83-50-016</p>
Concrete anchors and head studs	<p>1/2" / Ø 25 mm e 8 mm 5/8", 3/4" / Ø 32 mm e 12 mm 7/8" / Ø 35 mm e 12 mm</p>	<p>83-53-012 83-53-019 83-53-022</p>
Threaded studs, sleeves with internal thread and pins	<p>Chuck ceramic ferrules</p> <p>for stud-Ø Ø 12 mm Ø 16 mm larger Ø on request</p>	<p>80-30-112 80-30-116</p>
From Ø 16 mm upwards other foot plate required		

for Description Order No.

Concrete anchor and head stud

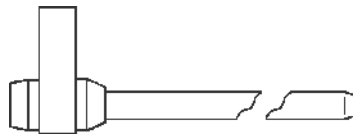


1/2" Ø 13 mm
 5/8" Ø 16 mm
 3/4" Ø 19 mm
 7/8" Ø 22 mm

80-30-213
 80-30-219
 80-30-219
 80-30-222

A 22 (ceramic)

Ceramic tripod complete PSC2



Stud Ø 4 - 12 mm Ø 22 mm
 Stud Ø 16 - 20 mm Ø 28 mm
 Concrete anchor from 5/8" Ø 29 mm

93-40-028
 93-40-040
 93-40-041

Foot piece



Stud Ø 4 - 12 mm Ø 22 mm
 Stud Ø 16 - 20 mm Ø 28 mm
 Stud Ø 5/8" - 7/8" Ø 29 mm

80-40-177
 80-40-201
 80-41-028

8.4 Environmentally Admissible Disposal

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

Used materials:

- Steel
- Non ferrous metals (brass, copper)
- Plastics
- Aluminium

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 gun
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 gun:	Device to weld welding elements
Welding parameters:	Various settings on the welding 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 gun.
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

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)				
	Head stud	SD (UF)	Mild steel (S235J2G3 + C450)		ISO/TR 15608	R _m ≥ 400 N/mm ² ReH _{0.2} ≥ 235 N/mm ² A5 ≥ 15%	
			1.4301/03 (A2-50)		EN 10088-1	R _m ≥ 500 - 780 N/mm ² Rp0.2 ≥ 350 N/mm ² A5 ≥ 25%	
	Short cycle welding with drawn arc	Threaded stud with flange	FS	Mild steel (4.8 ¹⁾) copper plated		ISO 898-1	see ISO 898-1
				US	1.4301/03 (A2-50)		EN ISO 3506-1
			IS				

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⁾ 16Mo3	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.



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.

Please fill in the serial number:

Serial number automatic welding head:

Serial number power unit:

Serial number welding gun:

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: Welding Gun
Type: A 22
Order No: 93-20-290
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



01.03.2008

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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