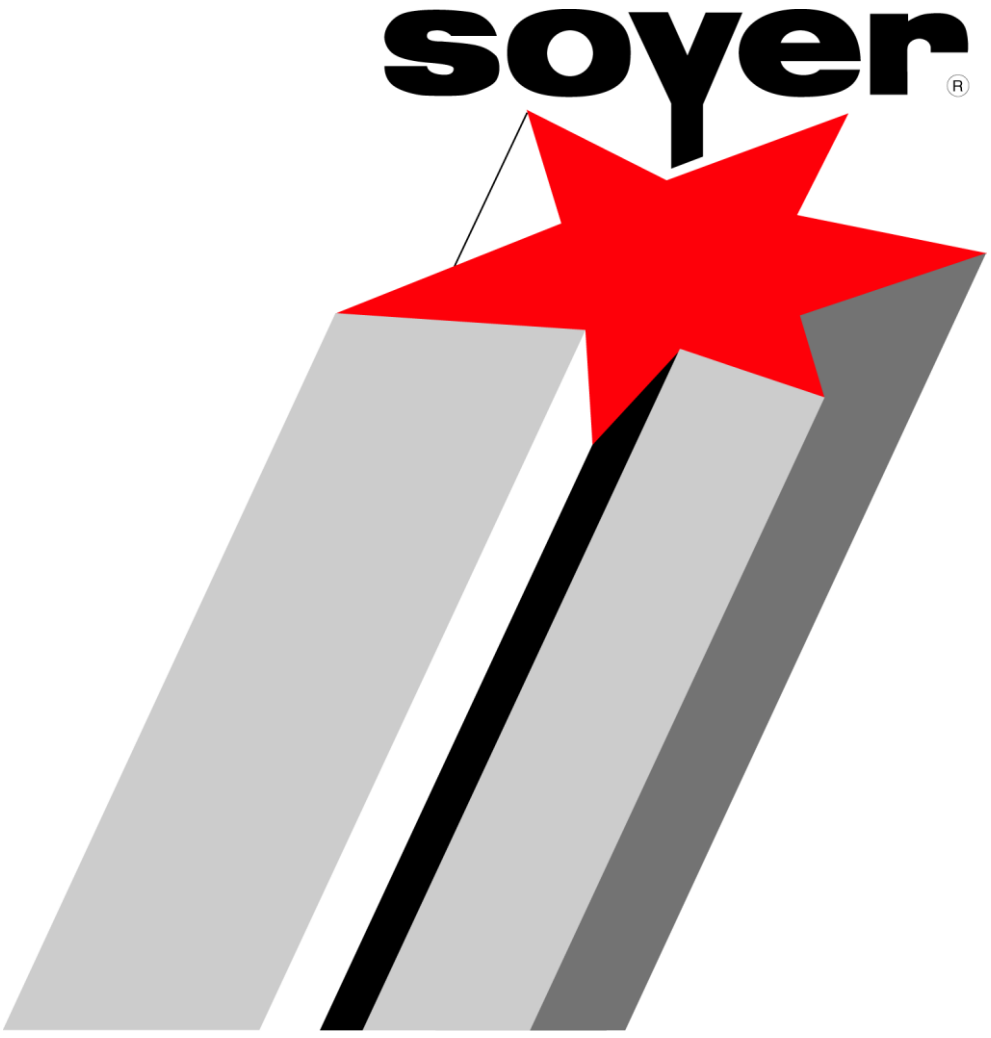
Operating Instructions

BMK-8 U
BMK-12 W
Stud Welders



Operating Instructions

BMK-8 U
BMK-12 W
Stud Welders

Serial number*

Stud welder BMK- _____

Please enter your type of stud welder and serial number here, so that these data are immediately available if you need service support.

Survey of stud welder types

Order no.	Code designation	Note
P01315	BMK-8 U	Standard device 3 x 230 up to 500 V power supply
P01331	BMK-12 W	Standard device (3 x 400 V power supply)
P01332	BMK-12 W automatic	Standard device (3 x 400 V power supply) and automatic set for stud reload
P01333	BMK-12 W universal	Special device (3 x 230 up to 500 V power supply)
P01334	BMK-12 W universal automatic	Special device (3 x 230 up to 500 V power supply) and automatic set for stud reload
P01337	BMK-12 W / C	Special device (3 x 400, 460, 600 V power supply)

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www.soyer.de

Congratulations on purchasing a SOYER stud welder. You have made an excellent choice. Your SOYER stud welder was specially developed for the high-speed fastening of SOYER welding studs in compliance with **DIN EN ISO 13 918** on metallic workpieces.

Our devices have been tested with regard to safety requirements and correspond to the currently valid European and national guidelines. Proof of conformity has been established and the manufacturer is in possession of the corresponding documents.

FOR YOUR SAFETY

Read all of these operating instructions prior to start-up. Please follow all safety precautions as well as all chapters of these operating instructions before starting to weld. Non-compliance with the safety precautions can result in serious personal injuries or death.

SOYER® is a registered trade mark of Heinz Soyer Bolzenschweißtechnik GmbH.

We have verified that the contents of this pamphlet correspond to the hard- and software described. Deviations, however, cannot be excluded so that we cannot warrant for absolute compliance.

The illustrations contained in this instruction manual may vary in some details from your product. This, however, has no influence on the handling of the machine.

The data in this documentation have been verified regularly and necessary corrections will be incorporated in future impressions. Any suggestions for improvement will be appreciated.

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CE Declaration of Conformity

We herewith declare that the machine described in the following and the version available on the market correspond in design and construction to the safety and health requirements of the listed guidelines and standards. Any unauthorised modification to this machine automatically annuls this declaration.

Designation of machine	:	**Stud welding device**
Machine type	:	**BMK-12W** **BMK-12W automatic** **BMK-12W universal** **BMK-12W universal automatic**
Machine no.	:	_____
Applicable EU directives	:	RoHS Directive (2011/65/EU) Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU)
Applied harmonised standards, in particular	:	EN 60 974-1:2018 + A1:2019 EN 60 974-10:2016
Applied national standards	:	DGUV Regulation 1
Date	:	01 February 2021
Producer's signature	:	_____
Signer's function	:	Managing Director

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Appendix A /

1 Safety precautions

These safety precautions are for your safety.

General safety instructions
Become trained and read and follow all safety precautions listed below as well as all chapters of this manual before starting to weld.
Non-compliance with the safety precautions can result in personal injuries or death.

Only qualified persons are allowed to install, operate and maintain the equipment.

Keep away children and juveniles under the age of 16 years from the equipment.

WARNING
It is prohibited to open the stud welder.
The service personnel are required to meet special qualifications.
Our after-sales service has adequately trained personnel, suitable service equipment and the means to carry out all necessary works.

Warning of electromagnetic fields
Keep sufficient distance from electronic devices. When stud welding, highly intensive electromagnetic fields are created which may permanently damage these devices (e.g. television sets, airbags).

Ensure that the welding equipment is not operated near electronically sensitive life-supporting equipment, such as in intensive care units in hospitals.

Persons with pacemakers must neither operate the stud welding equipment nor stay near it while it is running.

Electric shock can cause death
Prevent electric shock by insulating your body from work and ground. Stand on dry insulating material and wear rubber soled shoes.

Be sure power source is properly connected to the ground system of the power supply.
Inspect all cables including power cord for damage, wear or bare wiring. Immediately replace damaged or worn cables.

Always ensure the correct supply voltage in accordance with the data plate. Never connect the stud welder to a power supply network with incorrect supply voltage.

Always disconnect the mains cable from the mains supply before starting any cleaning works. Only trained and appropriately qualified personnel are allowed to carry out works at the electric mains supply and welding system.

Do not touch live electrical parts with bare hand. Wear dry, hole-free insulating gloves.

Do not wear rings, watches or electrically conductive jewellery.

Keep the work area, studs, stud holders, guns, cables, power source as well as your clothes dry.

Fumes and gases can cause damage to your health
Fumes and suspended matters may be generated during welding. Beware of fumes detrimental to health, particularly when using surface treated materials. If possible, only weld in rooms which are higher that 3 m. Please also observe the safety regulations applicable for your country.

Do not breathe fumes and gases. Use adequate ventilation in the work area to remove fumes and gases.

Welding can cause fire and explosions
Welding sparks and heat from flames and arcs can cause fires. Have a portable fire extinguisher handy for immediate use. Be sure you are trained for properly using it.

When welding, do not wear clothes soiled with easily combustible substances such as oil, grease and paraffin oil etc.

Comply with the fire regulations and do not weld, for instance, in hazardous locations.

Pay attention to flammable objects at the welding place. All flammable materials and liquids, such as oil, fuel, etc. must be removed prior to the start of work.

Electronic equipment (e.g. airbags) and the use of explosive substances for fuel supply require further safety precautions when carrying out welding operations on cars. Appropriate information can be obtained from the trade associations or the car manufacturers.

Skin and eye protection
Arc rays and welding spatters can injure eyes and skin.

Wear safety glasses with side shields and protective goggles with correct shade of filter to protect your eyes from welding spatters and flashes of light that are generated during the welding process.

Wear gauntlet gloves made of leather and non-combustible closed working clothes such as heavy long-sleeve shirts, cuffless pants and safety shoes.

Wear a leather apron to protect your clothes from welding spatters.
Keep sleeves and collars buttoned and remove open pockets from the front side of your clothing.

We recommend using ear protection. Some welding and working processes may generate loud noises.

Movable parts can cause injury
Beware of movable parts such as fans. Keep hair, hands, loose clothing, and any tools away from the air apertures.

1.1 Description of reference signs in the operating instructions

The non-observance of safety instructions such as pictographs and warning words can cause damage to persons. The safety instructions of this manual describe the following:

Safety instructions

Danger!	Immediate hazards which could result in serious personal injuries or loss of life.
Warning!	Potential hazards which could result in serious personal injuries or loss of life.

Caution!	Potential hazards which could result in minor personal injuries.
Caution!	Beware of property damage

Note!	Potential detrimental situation which may cause damage to the product or to an object surrounding it.
Important!	Instructions for application and other useful information facilitating the proper use of the product.

Safety symbols

The following pictographs for warnings, bans and decrees are used in this manual:

 Ban for persons with pacemakers	 Ban (only in combination with an additional safety symbol)	 Do not touch Housing is current-carrying	 Fire extinguisher
 Warning of a danger spot	 Beware of dangerous electric voltage	 Beware of electromagnetic field	 Beware of movable parts
 General ban (only in combination with an additional safety symbol)	 Beware of inflammable substances	 Beware of explosive substances	
 Eye protection required	 Protective clothing required	 Ear protection required	 Protective gloves required

General instructions are marked with the hand symbol.

1.2 Staff qualification and training

The staff responsible for operation, maintenance, inspection and assembly must have the respective qualification for carrying out these works. Field of responsibility, competence and the supervision of staff have to be exactly regulated by the user. If your personnel do not have the necessary knowledge, they have to be trained and instructed. If necessary, this can be done by the manufacturer/supplier on behalf of the user. Furthermore, the user must ensure that the contents of the operating instructions are fully understood by the staff.
The society of welding institutes (GSI: Gesellschaft der Schweißtechnischen Institute mbH) offers the appropriate training courses for your personnel.
For information on branches, please refer to website http://www.dvs-ev.de.

1.3 Dangers in the case of non-compliance with safety instructions

The non-compliance with safety instructions may not only endanger persons, but also the equipment and its environment. Any non-compliance with safety instructions may result in a complete loss of damage claims.
Non-compliance with safety instructions may have the following consequences:
• Failure of important system functions
• Failure of prescribed methods for maintenance
• Danger of persons through electric, mechanic, thermal and acoustic influences

1.4 Before starting to weld...

• Check the state of all cables and cable connections before starting to weld.
• Immediately replace defective cables and cable connections.
• Ensure that the air apertures of the housing are not covered. Heat accumulation may damage the stud welding device.

1.5 Working with the stud welding equipment

• Comply with all accident prevention regulations which apply to the operation of your welding device.
If an accident happens,
• switch off the welding device and disconnect it from the mains supply and
• call a doctor.

1.6 Inadmissible operating methods

Limit values
Working safety of the stud welding equipment supplied can only be guaranteed when the system is used in accordance with its purpose. The limit values indicated in the chapter “Technical data” must never be exceeded.

1.7 Stopping the stud welder

• Switch off the main switch of the stud welder
• Disconnect the mains plug from the socket.
• Disconnect
- the control cable
- the welding cable
- the earth cables

from the stud welder.

• Disconnect gas supply and compressed-air supply from the stud welder, if connected.

• Roll up the cables without buckling them.

• Make sure stud welder can not be used by unauthorized persons.

• Check welding cable and connections of the stud welder for damage such as burn-off, mechanical wear etc. and have damaged parts replaced by the SOYER customer service.

2 General

2.1 The following should be principally observed...

With this stud welder you have purchased a product which

• is state-of-the-art technology
• fully complies with the current safety requirements and
• enables successful working

Before installing the stud welder, please observe the following:

• Store the operating instructions in a place accessible to every operator.

• Ensure that the respective operator has read and understood the operating instructions prior to installation. Each operator should confirm this per signature.

• Prevent the stud welder being operated by unauthorized personnel.

• Only trained personnel may operate the stud welder.

• Call a doctor in case of an accident.

2.2 Application

The BMK-8 U / BMK-12 W SOYER stud welders for short-cycle drawn arc welding allow SOYER threaded studs made of plain steel, stainless steel and heat-resistant steel as per **DIN EN ISO 13918** to be welded on different workpieces (sheets, tubes, steel girders etc.).
Usually round pins with or without thread are welded. You may also weld fasteners with different cross-sectional shapes. For this purpose, however, special stud holders and ceramic ferrules or gas shrouds are required.

With the BMK-8 U / BMK-12 W SOYER stud welders it is also possible to weld studs of other metallic materials than steel. It is, however, necessary to first carry out experimental welds and to inspect them.

2.3 Marketing and service

If you have any questions regarding the operation of the BMK-8 U / BMK-12 W stud welders, retrofits for special applications or if you require service, please contact your responsible service office or the following address:

Heinz Soyer Bolzenschweißtechnik GmbH
Inninger Straße 14
D-82237 Wörthsee
Telephone +49 8153-885-0 Telefax +49 8153-8030

www.soyer.de info@soyer.de

2.4 Information on the documentation

The following operating instructions are supplied with the BMK-8 U / BMK-12 W stud welders:

• Operating instructions for BMK-8 U / BMK-12 W **Order no. P00220**

2.4.1 Information on operating instructions

Legal relationship
We draw your attention to the fact that the contents of these operating instructions are neither part of any former or existing arrangement, pledge or legal relationship nor are designed for modifying the latter. All obligations of Heinz Soyer Bolzenschweißtechnik GmbH result from the respective contract of purchase which also comprises the complete and generally valid warranties. These contractual warranty terms are neither extended nor restricted by the implementation of these operating instructions.

CAUTION
Do not carry out any actions on the stud welding equipment without specifically knowing the operating instructions or the respective part. Ensure that only qualified personnel familiar with the operating instructions and the necessary technical activities (training!) operate the system.

2.4.2 Conduct in the case of malfunctions

If malfunctions occur, first try to detect and eliminate the causes according to the "Troubleshooting" list in chapter 9 of these operating instructions. In all other cases, please contact our service department.

If you require our service, please make sure that you supply us with the following information:

- Customer number
- Serial number
- Stud and workpiece material
- Product designation / options
- Year of construction
- Stud dimensions

This information will help us both to save time and unnecessary costs, e.g. caused by delivering the wrong spare parts.

3 Description of stud welder

3.1 Short-cycle drawn arc stud welding technology

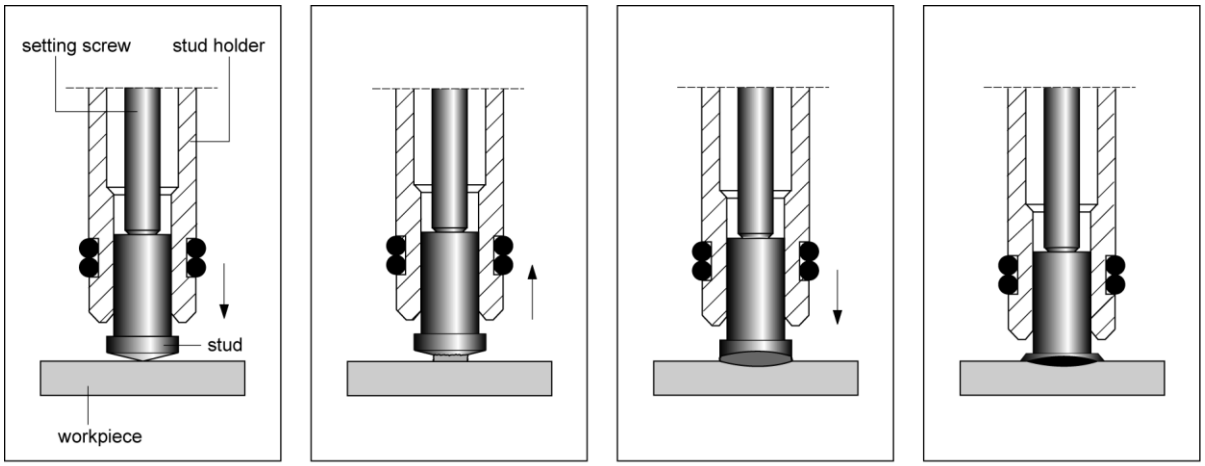

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Illustration 1: Short-cycle drawn arc stud welding technology

The BMK-8 U / BMK-12 W SOYER stud welders run according to the principle of short-cycle drawn arc stud welding.
A d.c. power supply provides the welding current. For detailed information, please refer to the following regulations:
• DIN EN ISO 14555, "Arc welding of metallic materials"
• DVS Information Sheet 0902, "Drawn arc stud welding"

1. When welding, the stud is positioned on the workpiece.
2. The preweld current is ignited and the stud is lifted off the workpiece.
3. The subsequent ignition of the main current creates a molten pool between stud and workpiece.
4. The stud immerses in the liquid molten pool and the material solidifies.

This method allows manual, semi-automatic and fully automatic inseparable welding of threaded studs, pins, tapped studs, insulating pins, special studs and many other fasteners made of steel, CrNi steel, heat-and acid-resisting steel with the workpieces. Conditionally it is also possible to weld nickel and titanium depending on the respective requirements. Standard studs for drawn arc and capacitor discharge welding in compliance with DIN EN ISO 13918 can be welded without requiring any auxiliary aids. The application of shielding gas or ceramic ferrules is recommended for studs with a diameter of more than 6 mm to prevent pore formation and to optimise the formation of bulges.

The standard BMK-8U / BMK-12W stud welders are suitable for operation with shielding gas and ceramic ferrules. A d.c. power supply provides the welding current. The weld duration can be selected. Owing to the low penetration depth of about 0.4 mm, this method can be applied from a sheet thickness of 0.6 mm on. It guarantees particularly safe, uniform and reproducible stud welded joints without high requirements to setting accuracy and stud tip quality. Application is especially recommended for workpieces with difficult surface characteristics, e.g. oil, grease, zinc and other galvanic treatments as well as rolling scale, electroconductive priming coats, forging scale, oxide films, etc. The ratio of minimum sheet thickness and stud diameter amounts to 1:8.

IMPORTANT INFORMATION
Ensure that the surface is electroconductive.
Grind hot galvanized parts.

The following welding methods are possible when using the BMK-8U / BMK-12W SOYER stud welders:

• Short-cycle drawn arc stud welding without shielding gas and ceramic ferrules.
• Drawn arc stud welding using ceramic ferrules as auxiliary aid.
• Drawn arc stud welding using shielding gas as auxiliary aid.

Preferably use shielding gas as auxiliary aid. The use of ceramic ferrules as auxiliary aid, however, is necessary when carrying out particularly critical welding works as e.g. welding works during which the gun has to be held in a horizontal position or above the head.

3.2 Stud welding

The PH-3N stud welding gun with control cable and shielding gas equipment is the standard gun to be connected to the BMK-8U / BMK-12W stud welders. These operating instructions only refer to the BMK-8U / BMK-12W stud welders.

For information regarding the stud welding guns to be used and their setting, please refer to the respective operating instructions.

3.2.1 Short-cycle drawn arc welding with shielding gas

With this method, a gas mixture containing 82% of Argon and 18% of CO_2 (e.g. Corgon®18*) is used as auxiliary aid.
This shielding gas protects the welding point from the atmosphere and simultaneously supports the weld pool. Moreover, it ensures a concave fillet weld upset formation with a blank metallic surface, thus reducing the risk of corrosion and obtaining an improved dynamic behaviour of the welded joint.

An accurate bulging, to scale or in a calibrated or reproducible type, is not possible when welding with shielding gas without using any auxiliary aid. Stud welding with shielding gas can be carried out at much shorter intervals as no ceramic ferrules have to be fitted and removed in each welding process.

*) Corgon®18 is a gas mixture of Linde AG in D-82049 Höllriegelskreuth

3.2.2 Short-cycle drawn arc welding with ceramic ferrules

The ceramic ferrule fulfils the following functions:

• It centres the electric arc.
• It protects the welding point from the atmosphere.
• It ensures the exact formation of the weld upset.
• It prevents too rapid cooling of the weld pool.
• It partially protects against spraying sparks.

To ensure a perfect and accurate weld upset, each stud requires a ceramic ferrule matching its diameter and shape. After every welding process, the ceramic ferrule must be knocked down and replaced by a new one. Usually this method allows you to weld in any position.

IMPORTANT INFORMATION
Ensure ceramic ferrules are absolutely dry.

3.3 Construction of the BMK-8U / BMK-12W stud welders

The BMK-8U / BMK-12W stud welders have a handy, compact and robust design.
The carrying handles on the top of the housing allow easy transport so that the stud welders can be used at different work places.

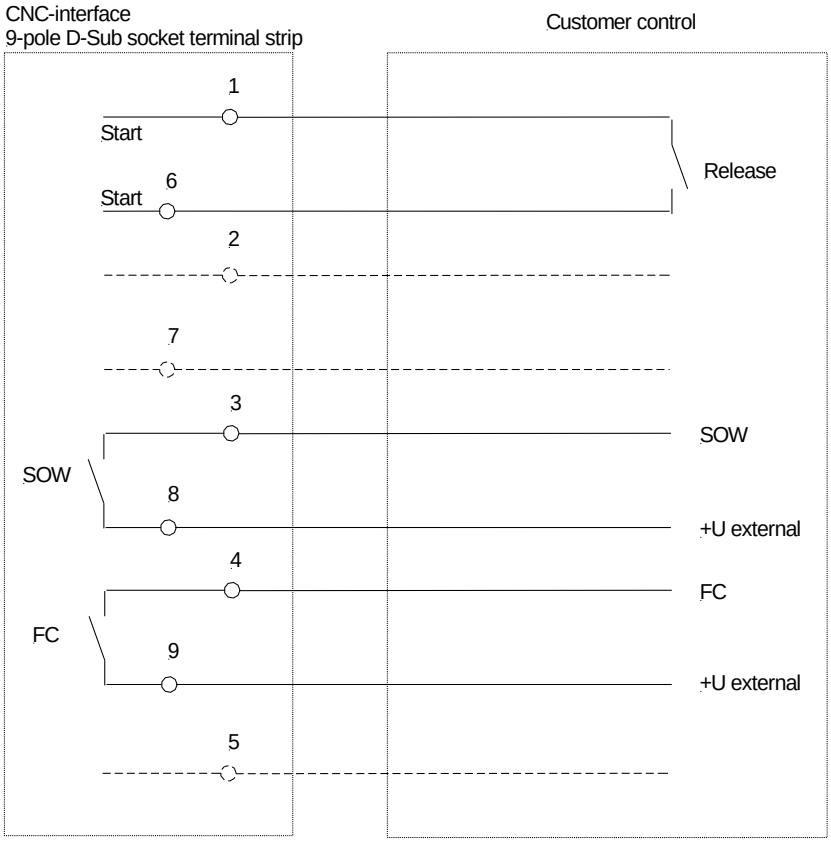
3.4 Technical data

Designation	BMK 8 U	BMK 12 W
Welding process	Short-cycle drawn arc stud welding	
Welding range for SOYER threaded studs, DIN EN ISO 13918	M3 – RD 10 or. 2 – 9 mm	M3 – RD 12 or. 2 – 11 mm
Material	Steel, stainless steel and heat-resistant steel (aluminium conditionally depending on respective requirements	
Source of current	Transformer / Rectifier	
Welding current	600 A	800 A
Welding time	1 up to 1000 ms	
Welding sequence	15 – 30 studs/min with M3 up to 3 studs/min RD 10	15 – 30 studs/min with M3 up to 3 studs/min RD12
Standard gun	PH-3N stud welding gun	
Power supply	CEE 16 A (3P + protective earth conductor) 3 x 400 V 50/60 Hz 3 x 230, 3 x 440 or 3 x 500 V 50/60 Hz possible	CEE 32 A (3P + protective earth conductor) **3 x 400 V 50/60 Hz** (standard) 3 x 230, 3 x 440, 3 x 460, 3 x 500 or 3 x 600 V 50/60 Hz possible, depending on the special type (OPTION)
E-constant current	0.3 A / phase	
E-constant power	200 VA	
E-peak current	45A / phase with 3 x 400 V (short-time operation)	60A / phase with 3 x 400 V (short-time operation)
Open-circuit power	76 V / DC	
System of protection	IP21	
Fuse element at front panel	F1 = 0.315 A slow-blow F2 = 2 A slow-blow (with 400V mains supply) F2 = 3.15 A slow-blow (with 230 V mains supply)	
Interfaces	Feeder interface: 15-pole socket CNC interface: 9-pole socket RS 232 interface: 9-pin plug (no function)	
Compressed air supply	max. 6 bar (compressed air only with optional automatic set)	
Shielding gas supply	max. 4 – 5 l/min.	
Dimensions	360 x 325 x 500 (w x h x d)	
Weight*	41 kg	48 kg
Colour	RAL 5009 azure	
Subject to technical changes		

** Slight deviations are possible depending on accessories.*

3.5 BMK-12 W interfaces

3.5.1 CNC interface



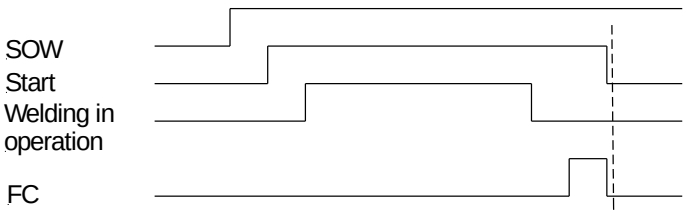
Terminology:

SOW Stud on workpiece
Shows contact between stud and workpiece. Contact is necessary to start welding process via the starting signal.

Start Contact releases the welding process.

EP(FC) End of welding process
Contact is closed after welding to show the end of this specific welding process (new welding process can be started now).

Timing diagram:



4 Installation of stud welder

The top of the BMK-8U / BMK-12 W stud welders is equipped with two plastic carrying handles.

CAUTION
These handles are intended for transport by hand only. Never pull ropes through these handles to lift the stud welder by means of a crane to the installation site. The stud welder would become instable and might tilt from its original position. As a result the handles could rip and the system would fall on the ground.

- Only install the stud welder on an even surface. The anti-vibration pads located on the bottom of the welding equipment guarantee its anti-skid position and serve as vibration dampers.
- Although the stud welder is resistant to environmental influences, it should be protected against dampness and dust.
- Please pay particular attention to the bearing strength of the workshop furniture and ensure a safe and stable position of the welding equipment.

- Make sure there is sufficient free space around the air apertures, otherwise the excess temperature safety mechanism will respond and interrupt the welding process. This state, represented as "Transformer overheated, please wait", is shown alternately with the current operation mode on the display.

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Only when this information is no longer shown on the display, is it possible to continue the welding operation.

- Install the stud welder close to the welding location.
- Ensure correct connected loads for electrical connections:

The stud welder has a four-core connecting cable: 3 phases + protective earth conductor. Please also refer to “Technical Data”.
Make sure mains socket and welding system are properly grounded.

- Please observe that additional extension cables cause a voltage drop, possibly leading to system disturbances.
- When welding with shielding gas, make sure the gas cylinder is installed safely in its admissible, accident-proof installation device.

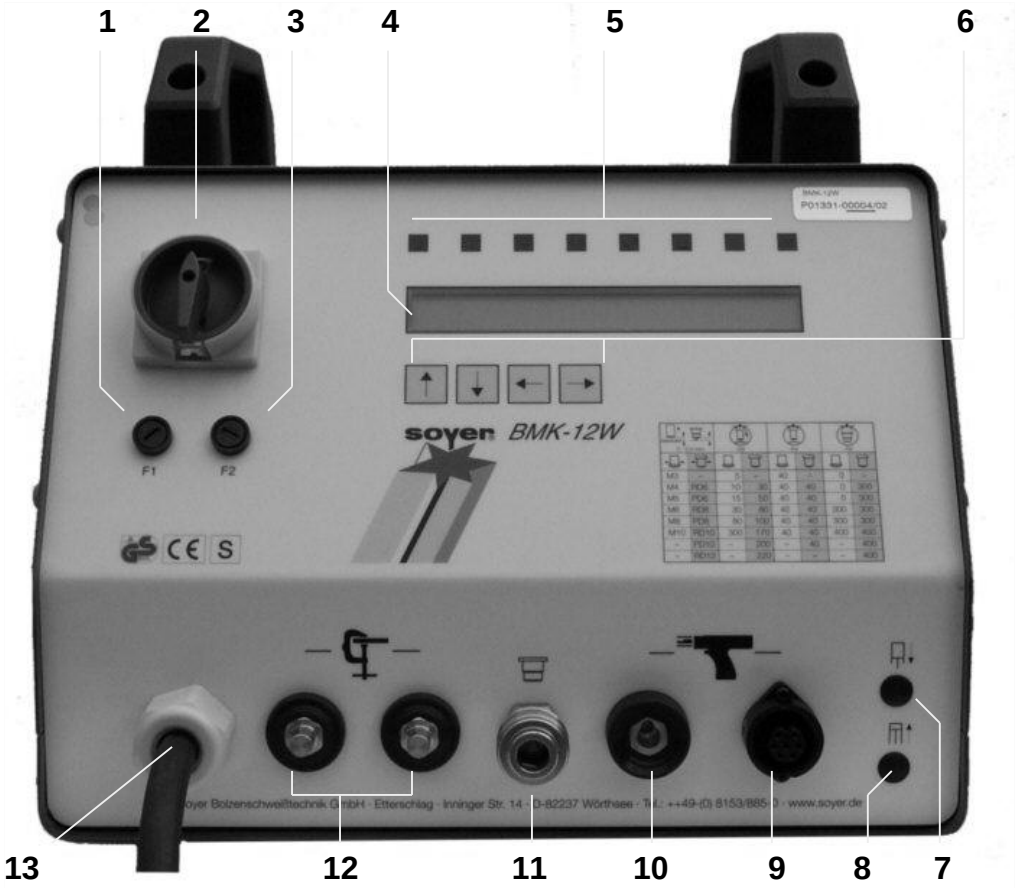
CAUTION
The gas cylinder must be protected against tilting when being installed vertically. It must not be installed in a horizontal position since the gas cylinder connection and/or manometer could be easily damaged.

- Ensure sufficient ventilation of the working room when operating the welding system.

NOTE
The housing of the stud welder corresponds to safety class IP 21. Please observe that this system of protection is not suitable for being operated or transported in the rain.

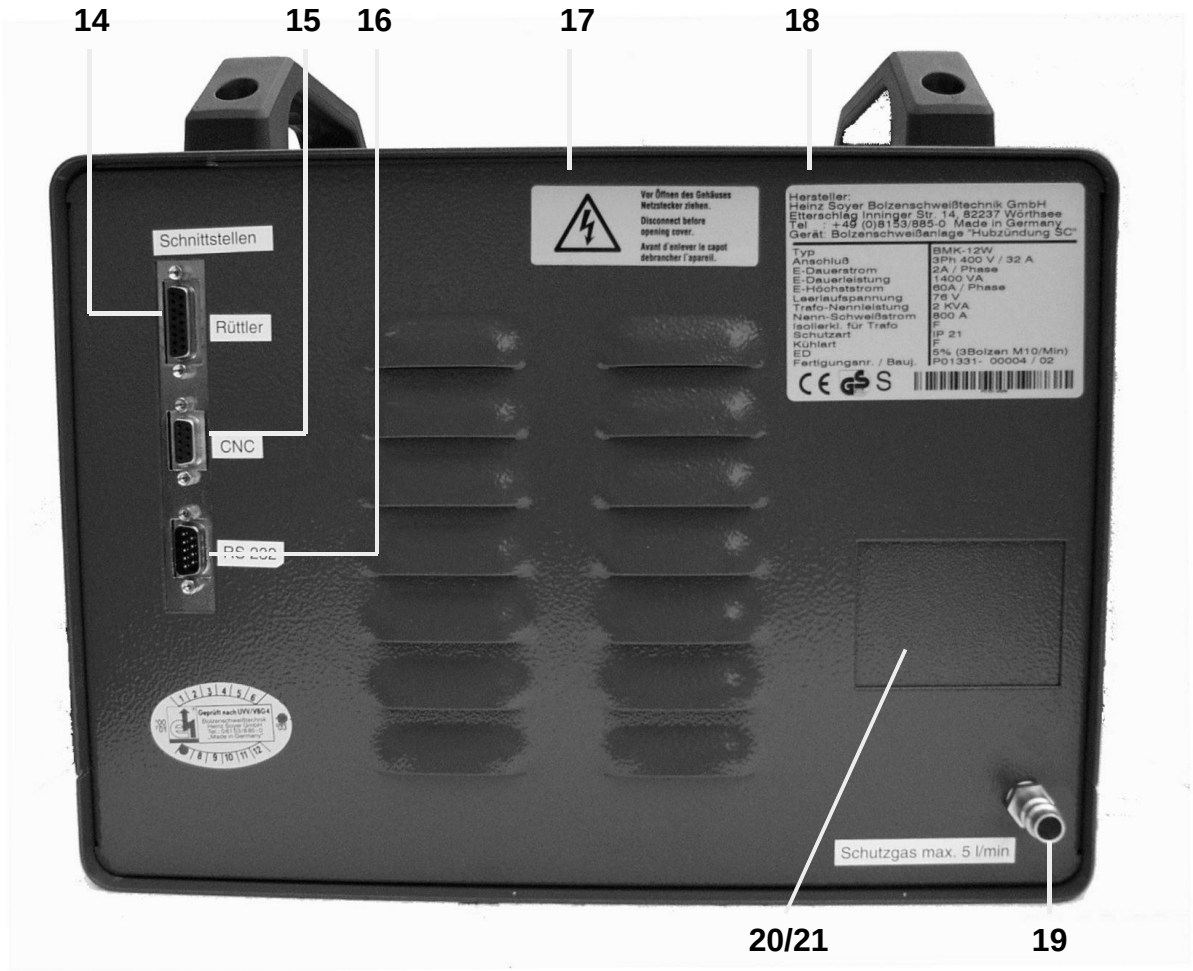
5 Start-up

5.1 Front and rear view



Front view of BMK-8U / BMK-12 W (above illustration of BMK-12W corresponds to BMK-8U)

1 • **Fuse element F1**
2 • **Main switch** **(switch stud welder on)**
3 •**Fuse element F2**
4 • **LCD display**
5 • **Indicator lamps for function control**
6 • **Function keys for setting the welding parameters**
7 • **Air function "forward"** (option)
8 • **Air function "backward"** (option)
Connection for welding guns or heads with automatic stud feed
9 • **Control cable connection**
10 • **Welding cable socket**
The control cable connection and the welding cable socket serve to connect the stud welding guns or heads to the stud welder.
11 • **Gas connection socket**
Before welding with shielding gas, connect the gas hose of the welding gun or head to the gas connection socket.
12 • **Earth cable connectors**
The earth cable connectors serve to connect the earth clamps to the stud welder.
13 • **Mains cable**
The mains cable is a four-core (3P + PE), highly flexible connecting cable for connecting the stud welder to the mains supply.



Rear view of BMK-8U / BMK-12 W

14 **15-pole connecting socket / feeder interface (OPTION)**
The feeder interface serves to connect the feeder control to the stud welding device.

15 **9-pole connecting socket / CNC interface (OPTION)**
The CNC interface serves to be connected with an external control system to control the stud welding process.

16 **9-pin connector, interface RS 232 (OPTION)**
This interface serves to be connected with an external control system.

17 **Danger sign**

18 **Type plate**

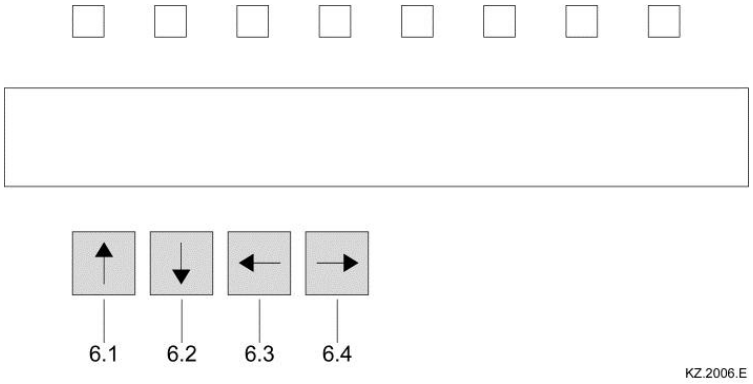
19 **Shielding gas connector**
This connection serves to supply the stud welder with gas by means of a pressure reducer. The admissible gas flow value ranges between 4 and 5 l/min.

20/21 **Compressed-air supply connection (OPTION)**
This connection serves to supply the stud welder with compressed air and to connect the compressed air lines of the feeder control to the stud welder. The admissible supply pressure amounts to a maximum of 7bar.

5.1.1 Operating elements

• Main switch
Use the main switch to turn the stud welder on and off.

• Function keys for setting the welding parameters
The BMK-8U / BMK-12 W stud welders have 4 function keys on the front panel for setting the welding parameters:



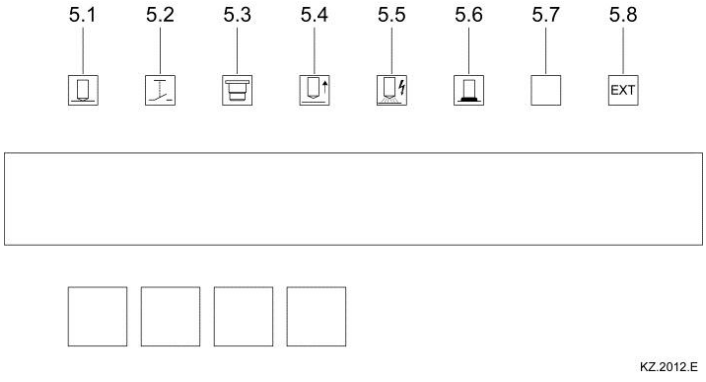
6.1 Function key “arrow up”
6.2 Function key “arrow down”
6.3 Function key “arrow left”
6.4 Function key “arrow right”

• Function keys "arrow up/down"
Modification of selected parameters (flashing symbol in display)

• Function keys "arrow left/right"
Selection of parameters to be modified (shifting of the flashing symbol to the left or right).

5.1.2 Display elements

• Indicator lamps
The indicator lamps show the respective operating states.



5.1 LED “Stud on Workpiece”
5.2 LED “Release”
5.3 LED “Gas valve open”
5.4 LED “Lift”
5.5 LED “Main Current”
5.6 LED “Final Contact”
5.7 LED (no function)
5.8 LED (no function)

When switching the equipment on, the 8 LEDs light up for a short period to check proper operation.

☞	If not all LEDs light up when starting the system, please contact your service partner.

5.1.3 • LCD display

The first line of the display shows the designation of the parameters to be set. The second line shows the set value. When the parameter designation is flashing, you may change its value by using the keyboard.

After switching the stud welder on, the following may appear on the display, e.g.:

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Explanation of operating modes / parameters:

• MODE
Operation mode set. It is possible to set four different operation modes:

1- OP
Operating state which must be set for normal welding operation.

2- PRE
Preweld current test

3- LIFT
Lift test

4- GAS
Gas test

• MCT
Main current time. Period of time set between 1 and 1000 milliseconds.

• PCT
Preweld current time. Period of time set between 40 and 1000 milliseconds.

• GPT
Gas preflow time. Period of time set between 0 and 9900 milliseconds during which the shielding gas valve is open before welding and remains open after welding. Set "0" when welding without shielding gas.

• RLT
Reload time. Period of time set between 0 and 9900 milliseconds during which the blow air valve remains open to allow stud feed from the universal feeder to the welding gun/welding head.
Set “0” to switch off the automatic reload.

5.1.4 Symbols

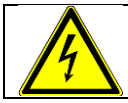
Symbol	Designation	Function
	Electrical energy	Main switch for switching stud welder on and off.
	LED "Stud on Workpiece"	LED lights up when earth terminal of stud welder is connected and stud touches the workpiece.
	LED "Release"	LED lights up when pressing release switch of welding gun or welding head.
	LED "Gas valve open"	LED lights up with shielding gas valve being open.
	LED "Lift"	LED lights up with lifting magnet of welding gun being activated.
	LED "Main current"	LED lights up when main current is started.
	LED "Final contact"	LED lights up after welding, with release switch being pressed.
	LED "External"	LED lights up when stud welder is operated by remote control via the serial interface (RS232) (not yet in use).
	Function key "ALTER PARAMETERS"	Upward alteration of the selected parameters (represented blinking in the display).
	Function key "ALTER PARAMETERS"	Downward alteration of the selected parameters (represented blinking in the display).
	Function key "SELECT PARAMETERS"	Selection of parameters to be changed (displacement of blinking symbol to the left).
	Function key "SELECT PARAMETERS"	Selection of parameters to be changed (displacement of blinking symbol to the right).
	Air function "forward"	Air supply for stud welding gun/welding head with automatic operation (OPTION).
	Air function "backward"	Air supply for stud welding gun/welding head with automatic operation (OPTION).
	Gas supply	Gas supply for welding gun/welding head, coupler socket KD - 1/4.
	Earth	Marks earth cable connector to be connected with earth cable.
	Gun	Marks control and welding cable sockets to be connected with welding gun.

5.1.5 Fuses (items 1 and 3, chapter 5.1)

The BMK-8U / BMK-12 W stud welders are protected by the following fuses:

- Fuse F1 0.315 A slow-blow
- Fuse F2 2 A slow-blow (with 400V up to 500V) or 3.15 AT with 230V

CAUTION
Should it become necessary to replace fuses, only use fuses with the specified electrical values. Oversized fuses could either cause defects on the electrical system or a fire.



WARNING
Disconnect the mains plug from the mains supply when replacing fuses.

5.1.6 Earth connection

• Attach earth cable to earth cable connectors and lock by turning to the right until stop.

• Attach earth clamps to workpiece.

Ensure optimum contact with workpiece. Owing to the high welding current, an unbalanced current distribution may cause a magnetic blow effect on the arc, i.e. the arc for welding the stud is asymmetrical. This is shown by an irregular course of the weld collar on the side of the stud. The welding results are unsatisfactory and not reproducible.

For this reason, you should attach the earth clamps to the workpiece in such a manner that the welding gun is positioned as close as possible to the centre of the connecting route of both earth clamps. This guarantees a current distribution around the stud that is balanced to the largest possible extent and satisfactory welding results.

Difficult areas are welds on the edge of the workpiece or considerable differences in material thickness, i.e. the material thickness varies by a few millimetres or additional material is welded or riveted to the metal. This also includes stud welding on profile sections.

To ensure good welding results, carry out several test welds under different conditions. For example, simply change the position of the earth clamps or turn the welding gun.

You may determine the symmetry and quality of the arc during the preweld current test and then optimise them by combining earth connection and gun position accordingly.

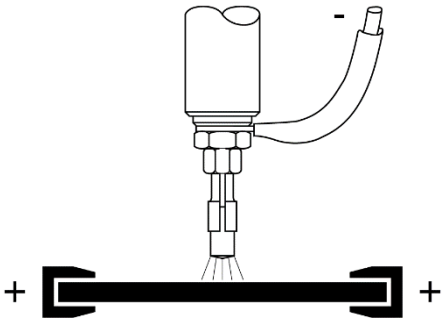
Please ensure that the contact areas of the earth clamps are always kept clean and do not oxidize, otherwise high transition resistances could occur that may result in a considerable reduction of the rated welding current.

In addition, make sure that the earth clamps are clamped securely to the workpiece and the earth cables as well as the gun cable are securely connected to the stud welder. This prevents high transition resistances and arc losses on the clamps or plug-in connections which in turn would result in poor welds.

Examples for various earth connections and possible effects:

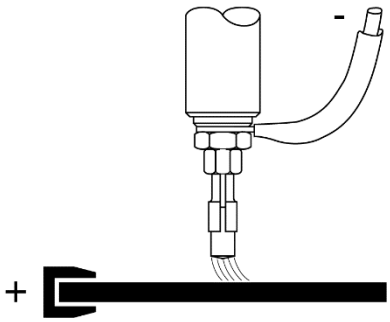
Balanced earth connection

Ideal condition: The stud is located in the centre of both earth connections

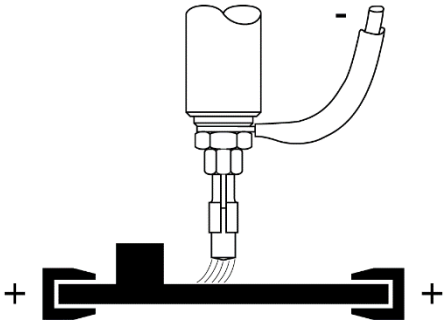


Unbalanced earth connection

Arc is deflected to the side where there is less current density



Additional masses disturb arc symmetry



5.1.7 Connection of stud welding gun

• Connect welding cable of welding gun to the welding cable socket and lock it by turning to the right until stop.

• Insert control cable into control cable connection and tighten with sleeve nut.

• Please also refer to the information given in the operating instructions for the welding guns.

5.1.8 Mains supply

• Compare the power data (supply voltage / current consumption) on the type plate with the data (supply voltage / fuse protection) of your power supply network.

Always comply with the correct supply voltage as indicated on the type plate. Never connect the stud welder to a power supply with the wrong supply voltage.

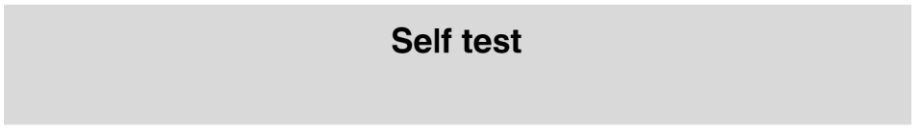
• Connect mains cable (item 13, chapter 5.1) to power supply using the CEE plug (standard 3 x 400V~, 32A-CEE plug).

DANGER
Only connect stud welder to approved CEE sockets.
Standard connection = 3 x 400 V + protective earth conductor. If need be, have an expert in electrics check if the socket is earthed.

5.2 Adjustment of operation modes

5.2.1 Starting the stud welder

After switching the stud welder on, the 8 LED lamps (items 5.1 - 5.8, chapter 5.1.2) light up for a short period. The stud welder carries out a self test which is shown on the LCD display (item 4, chapter 5.1).



KZ.0033.E

The stud welder is locked during the self test and it is impossible to operate it or to enter data.
After the self test has been carried out successfully, the stud welder automatically sets the parameters which were last set.

5.2.2 Operation modes / parameters

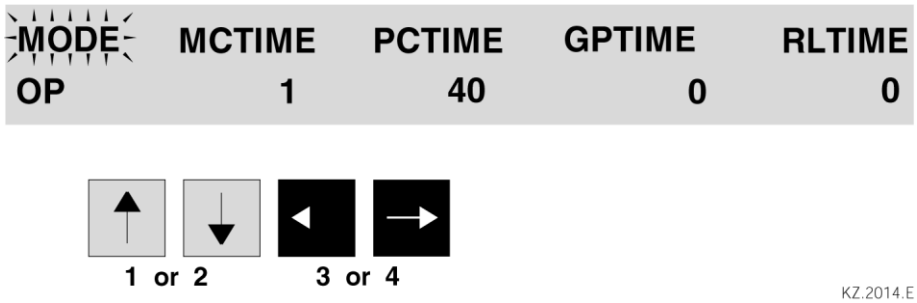
Press the function key "arrow right" or "arrow left" **(3 or 4)** to select the parameters. Only the parameter designation which is flashing on the display can be set by means of the function keys **(1 or 2)**.

The four different operating modes which may be set are also listed in chapter 5.1.3.

5.2.2.1 Operating mode "OP" (operating state)

The operating mode "OP" allows normal welding operation with the welding parameters set.
In the case of an excessive welding sequence, the welding operation is temporarily interrupted to avoid overheating of the stud welder.

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set operating mode "OP".



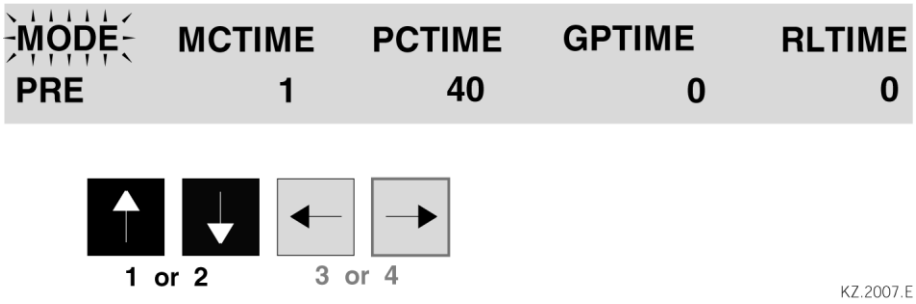
KZ.2014.E

5.2.2.2 Operation mode "PRE" (preweld current test)

The adjustment "PRE" (preweld current test) enables you to carry out welds by means of the set parameters without application of main current and serves to control the gun or head adjustment and to test performance. During this operation mode, an arc is generated with low current when the gun or welding head is positioned on the closed circuit (workpiece connected with earth) and the gun switch is pressed (or when a signal is given via the interface). This is helpful to check the symmetry of the arc or whether preweld current is flowing.

CAUTION
Protective goggles are required to carry out this test. Please also refer to the safety instructions.

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set operation mode "PRE".



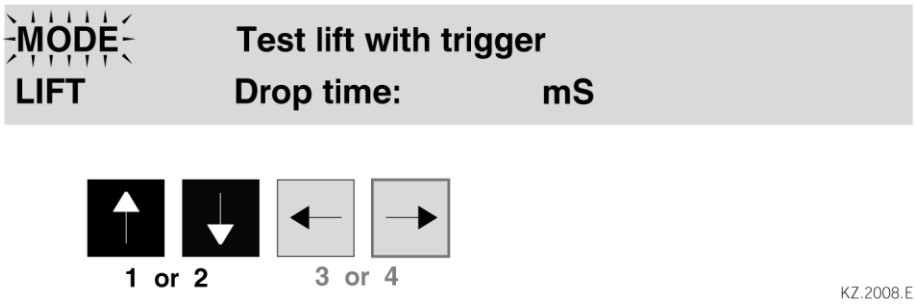
• Position the gun or welding head on the workpiece.

• Press the trigger of the gun/welding head or give a triggering signal via the CNC interface. After the preset period of gas flow has expired, the stud will be lifted off the workpiece. A small arc is generated the duration of which corresponds to the selected pre-current and main current period.

5.2.2.3 Operation mode "LIFT" (lift test)

This operation mode enables you to adjust and check the lift of the gun or welding head. For further information, please refer to the operating instructions of the welding gun or welding head.

• Use the function key "arrow up" or "arrow down" **(1 or 2)** to set operation mode "LIFT".

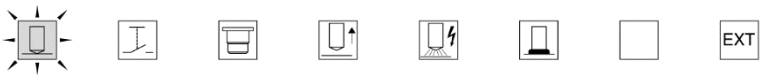


• Insert a stud into the gun or welding head.

• Check the immersion depth of the stud and/or set it according to the operating instructions of the welding gun or welding head.

CAUTION
Ensure once again that the operation mode is set to "LIFT" and comply with the safety instructions.

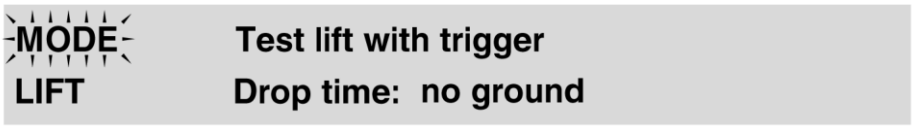
• Position gun or welding head on workpiece. The LED "Stud on workpiece" lights up.



• Press the trigger of the gun or the welding head or give a triggering signal via the CNC interface. The stud is lifted off the workpiece as long as the triggering signal is there. After a maximum of 4 seconds, however, the lift test will be interrupted to protect the magnet. There is no welding current during this period of time.

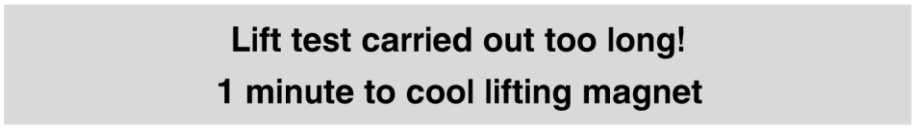
• If necessary, check and correct the height of lift according to the prescribed standard values for the welding gun or welding head (please refer to the table for welding parameters in chapter 6.2).

If the lift test is carried out on a workpiece which is connected to the earth connection of the stud welder, the drop time will be shown in milliseconds on the display. If the workpiece is not connected to the earth connection, "no ground" appears on the display.



KZ.2009.E

Do not activate the release too often in short intervals, as this would cause the thermo safety mechanism protecting the lifting magnet to react and the current supply for the magnet to be interrupted. This condition is displayed as follows:

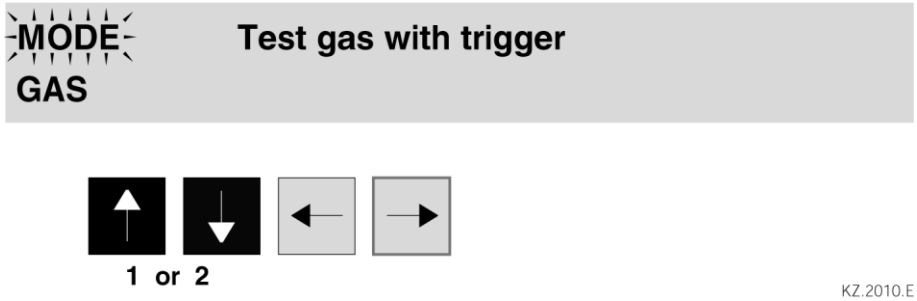


KZ.0026.E

5.2.2.4 Operation mode "GAS" (gas test)

This operation mode checks whether the shielding gas flows through the gas shroud of the welding gun or welding head. As long as a triggering signal is there, shielding gas flows out of the gas shroud on the welding gun or welding head. This enables you to rinse the gas lines with shielding gas before starting to weld.

• Select the operation mode "GAS" with the function key "arrow up" or "arrow down" **(1 or 2)**.



KZ.2010.E

• Connect gas supply

• The gas valve may be activated by
- the trigger of the welding gun or welding head
- an active start signal at the CNC interface

5.3 Special functions

With the BMK-8U / BMK-12 W stud welders you can call additional special functions:

☞	Start dealing with the special functions when you are familiar with the basic functions of the stud welder. This manual describes the software version V1.8. Older stud welder types possibly do not dispose of all special functions described below.

The stud welder must be switched off when calling special functions. In order to call the respective special functions you have to press certain function key combinations and keep them pressed when starting the stud welder. Switch off the stud welder by means of the main switch to terminate the special functions.

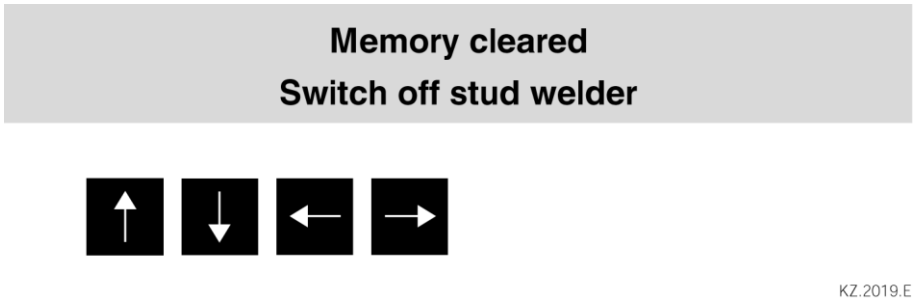
5.3.1 Special function "Erasing the working storage"

This special function serves as "RESET function" e.g. for eliminating troubles or starting the stud welder the first time. All settings of the working storage are erased by using this function.
To erase the working storage, please proceed as follows:

• Simultaneously press "arrow up", "arrow down", "arrow right" and "arrow left" keys and keep them pressed.

• Switch stud welder on with main switch.

• Stop pressing "arrow up", "arrow down", "arrow right" and "arrow left" keys.



• Switch off stud welder with main switch and switch on again.

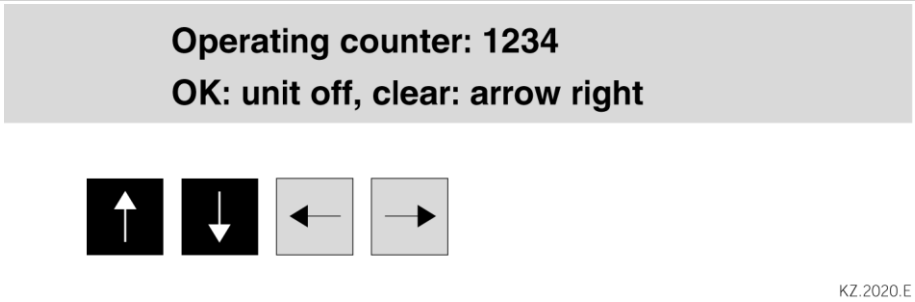
5.3.2 Special function "Display of operating counter"

This special function serves to display the operating counter and the equipment number.

• Simultaneously press "arrow up" and "arrow down" keys and keep them pressed.

• Switch stud welder on with main switch.

• Stop pressing "arrow up" and "arrow down" keys.



KZ.2020.E

• The operating counter can be reset to "0" by pressing the function key "arrow right".

5.3.3 Special function "Setting the type of feeder and its functions"

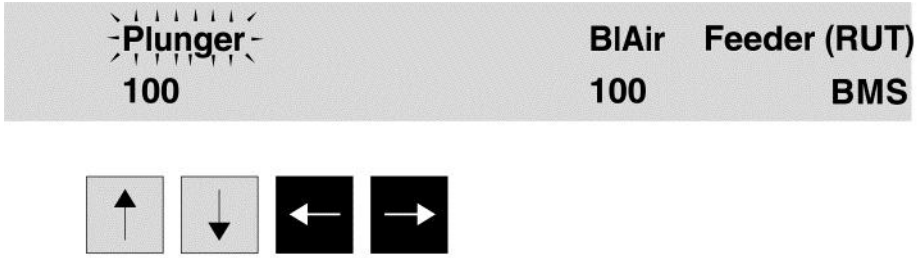
With automatic operation, these special functions serve to adapt the control to the feeder (parameter 1-4, only with BMK feeder). The type of feeder connected can be set by means of parameter 5.

To call this special function, please proceed as follows:

• Simultaneously press "arrow right" and "arrow left" keys and keep them pressed.

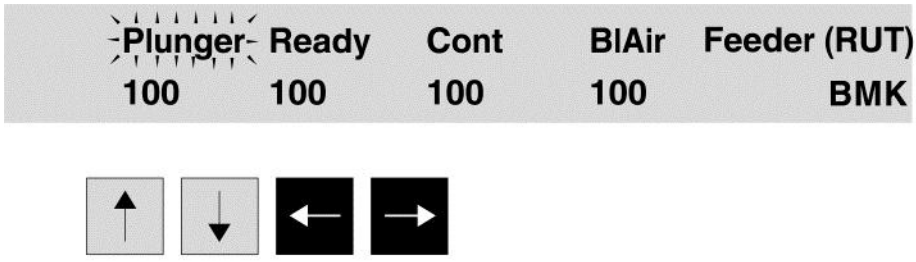
• Switch stud welder on with main switch.

• Stop pressing "arrow right" and "arrow left" keys.



KZ.2025.E

Display when setting feeder type "BMS"



KZ.2021.E

Display when setting feeder type "BMK"

The parameters "Plunger", "Ready", "Cont." and "BlAir" may be selected in 100 ms-steps.
The parameters may be horizontally selected by using the function keys "arrow left" and "arrow right".

Explanation of parameters

• Piston

This parameter serves to adjust the post-blow time of the stud feed blow air beyond the standard measure when the pushing piston in the welding gun/welding head has moved forward to press the stud out of the stud holder. A longer time setting is required when welding e.g. above the head to achieve a trouble-free stud reload. The post-blow time can be set between 100 ms and 2000 ms.

• Ready (only possible with "Feeder BMK" function in conjunction with a BMK feeder)

- With UVR-300 feeder: This parameter serves to adjust the waiting period of the hexagonal barrel in the feeding position with simultaneous post-vibration of studs. Depending on the type of feeder, a basic setting between 500ms and 1000ms is recommended.
- With UVR-250 feeder: This parameter serves to adjust the after-run period of the feeder when the light barrier has detected a stud in the stud escapement.

• Cont. (only possible with "Feeder BMK" function in conjunction with a BMK feeder)

This parameter serves to adjust the post-vibration period of the feeder to fill the outlet rail when a stud has been brought in blow-off position. The after-vibration period can be set between 100ms and 2000ms.

• BlAir

This parameter serves to adjust the delay time of the stud feed blow air after the injection piston in the welding gun/welding head has moved back. After the set delay time, the stud feed blow air is activated. This is necessary e.g. in the case of a short stud feed hose. The delay time can be set between 100ms and 2000ms.

• Feeder (RUT)

This parameter serves to adjust the feeder type connected. UVRBMS and UVRBMK can be set as feeder types.

5.3.4 Special function "Selection of language. Display of software version number"

This special function serves to select different languages and to display the version number of the software. The languages available are indicated on the display.
For calling this function, please proceed as follows:

• Simultaneously press the "arrow up" and "arrow right" keys and keep them pressed.

• Switch stud welder on with main switch.

• Stop pressing the function keys.

KZ.2022.E

• Follow the instructions on the display.

5.3.5 Special function "Setting the feeder operation"

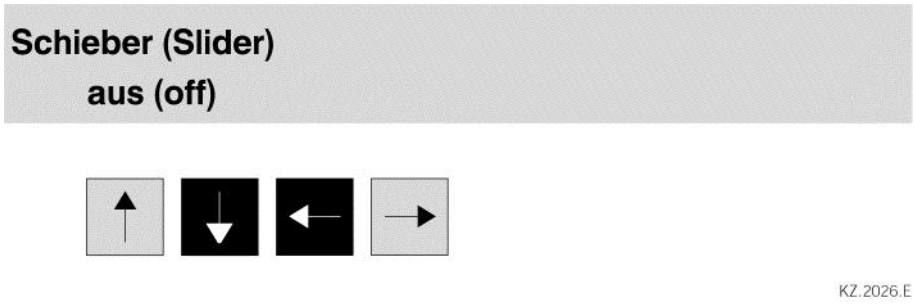
This special function serves as a help for setting the feeder operation when the stud welder is equipped with an optional automatic set.

For calling this special function, please proceed as follows:

• Simultaneously press "arrow down" and "arrow left" keys and keep them pressed.

• Switch stud welder on with main switch.

• Stop pressing function keys.



KZ.2026.E

Display when setting feeder type "BMS"

or:

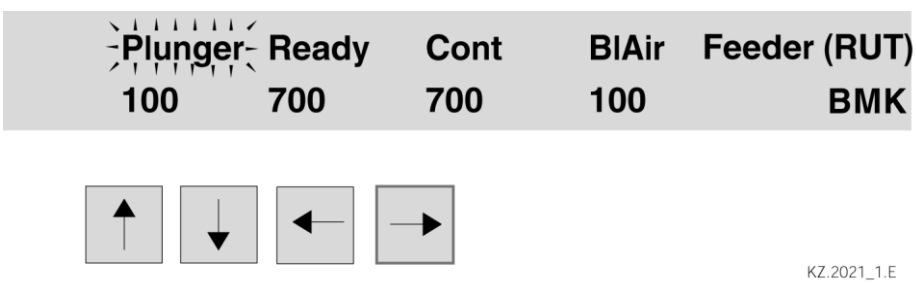
KZ.2023.E

Display when setting feeder type "BMK"

By using the function keys "arrow left" or "arrow right" you can move the slider in the feeder's stud escapement to the left or right end position and thereby check the setting. During this process, the operating states of possibly existing sensors are displayed as "on" or "off". For further information, please refer to the operating instructions of your universal feeder.

Basic setting for BMK feeder

When using a BMK feeder, we recommend the following basic setting. Please note that these values will be deleted when using the "RESET function" e.g. in troubleshooting.



KZ.2021_1.E

5.3.6 Extended special functions

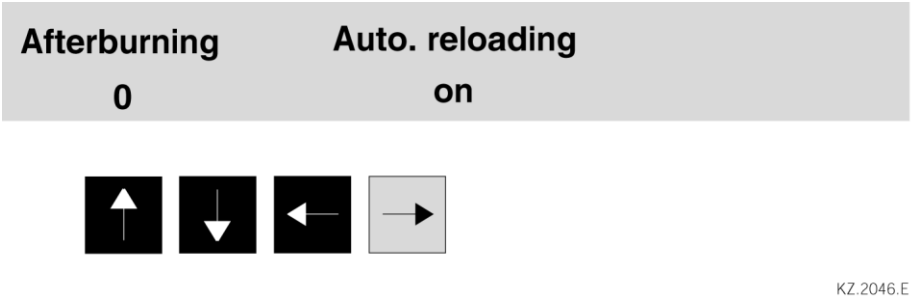
NOTE
These special functions are set by our customer service, if required. Do not alter any parameters without specifically knowing the procedure.
Should you require any further information, please contact the SOYER customer service responsible for your area or Heinz Soyer Bolzenschweißtechnik GmbH.

To call this special function, please proceed as follows:

• Simultaneously press "arrow up", "arrow down" and "arrow left" keys and keep them pressed.

• Switch stud welder on with main switch.

• Stop pressing function keys.



KZ.2046.E

• PAC (Post-Arc Current)

Adjustable from 0 (basic setting) to 500 milliseconds

The post-arc current time serves to extend the main current at the end of the welding process. Depending on the respective welding task, this special function allows the weld quality to be improved.

CAUTION
Please observe that the extension of the post-arc current time may increase the thermal stress on the stud welding equipment which could result in the operating temperature exceeding its maximum value.

• Auto. load

The basic function of automatically reloading studs can be deactivated here.

Possible parameters: "on" = basic setting or "off"

The studs are automatically reloaded when removing the welding gun or welding head from the welded stud after completion of the welding process. This function can be deactivated by means of the "off" parameter. The stud reload process must then be activated again by either pressing the trigger of the gun/welding head or by actuating the start contact of the CNC interface.

6 Operation

6.1 Standard operation

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

6.1.1 Setting welding parameters for standard welding operation

NOTE
The applicable accident prevention and safety regulations have to be complied with when operating the stud welder.

• Switch the main switch on

The stud welder carries out a self test. After the self test has been carried out successfully, the display shows the setting last used.

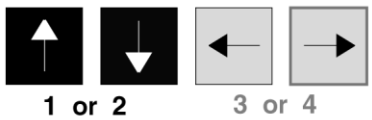
KZ.2013.E

• Set the necessary parameters for your welding task. For doing so, please refer to the standard values indicated in the list "Welding parameters".

6.1.1.1 MCTIME (main current time)

• Select function "MCTIME" by pressing either function key "arrow left **(3)** or "arrow right" **(4)**.

• Select the corresponding value for the main current time from 1 - 1000 ms in 1 ms-steps by pressing function key "arrow up" **(1)** or "arrow down" **(2)**.



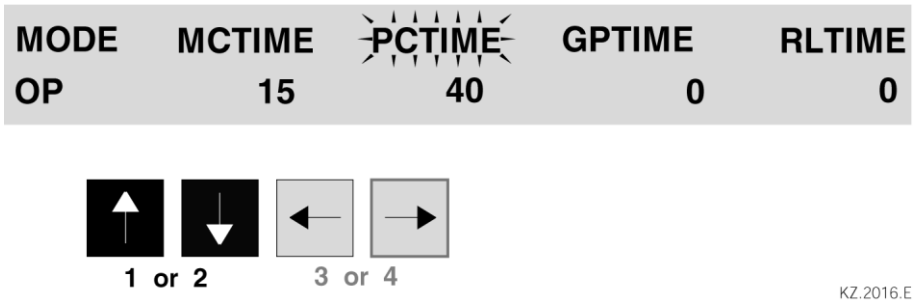
KZ.2015.E

The main current times for the most important stud dimensions are represented in tabular form in chapter 6.2 "Welding parameters for welding operation"

6.1.1.2 PCTIME (pre-current time)

• Select function "PCTIME" by pressing either function key "arrow left" **(3)** or "arrow right" **(4)**.

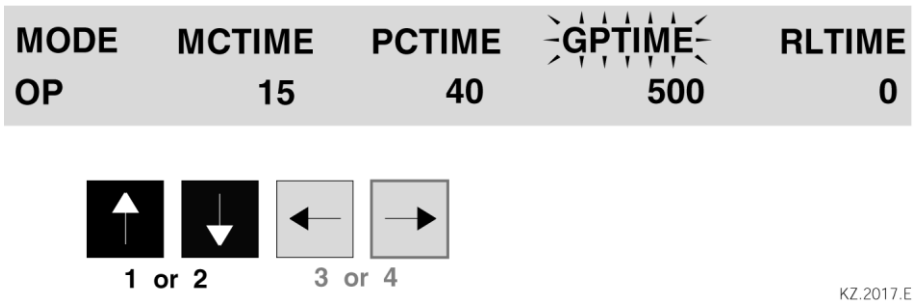
• Select the corresponding value for the pre-current time from 40 - 1000 ms in 20 ms-steps by pressing either function key "arrow up" **(1)** or "arrow down" **(2)**.



6.1.1.3 GPTIME (Gas preflow time)

The gas preflow time is the period of time, during which the shielding gas valve is open before starting the welding process and remains open after the welding process has been completed. Set value "0" when welding without shielding gas.

• Select function "GPTIME" by pressing either function key "arrow left" **(3)** or "arrow right" **(4)**.
• Select the corresponding value for the gas preflow time from 0 - 9900 ms in 100 ms-steps by pressing function key "arrow up" **(1)** or "arrow down" **(2)**.

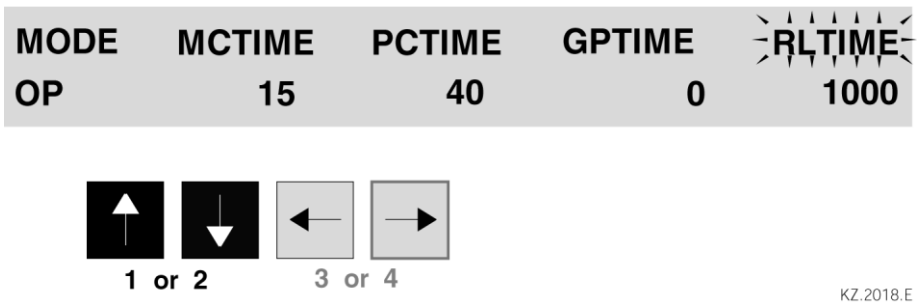


6.1.1.4 RLTIME (reload time)

The reload time is the period of time the blast air valve requires for transporting the stud from the universal feeder to the welding gun or welding head. The longer the blast air hose is, the higher you have to set the reload time correspondingly. If automatic reload is not required, set value "0". The reload time can only be used in connection with optional "automatic operation" (feeder connection).

• Select function "RLTIME" by pressing either function key "arrow left" **(3)** or "arrow right" **(4)**.

• Select the corresponding value for the reload time from 0 - 9900 ms in 100 ms-steps by either pressing function key "arrow up" **(1)** or "arrow down" **(2)**.



• If you are not satisfied with the welding results, you may change the set welding parameters at any time.

6.2 Welding parameters for welding operation

NOTE
The set welding parameters influence the reproducibility and quality of the welding results to a large extent. The parameters depend on the size of the studs and the material properties. The values indicated in the tables are standard values which are exclusively valid for studs supplied by SOYER. They may vary depending on the type of workpiece, the workpiece thickness, the surface condition of the workpiece and on environmental conditions (e.g. low outdoor temperatures). The settings of the welding gun or welding head influence the welding parameters as well.

Random samples should be taken during any production process to ensure constantly good welding results (see DIN EN ISO 14 555, "Arc welding of metallic materials")

Table for BMK-8U

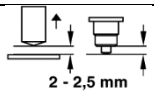
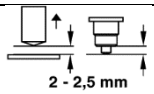
 2 - 2,5 mm		 ms		 ms		 ms	
							
Ø 2	Ø 3	5	5	40	40	0	0
M3	RD 6	10	70	40	40	0	300
M4	PD 6	30	90	40	40	0	300
M5	RD 8	50	165	40	40	300	300
M6	PD 8	110	190	40	40	300	300
---	RD 10	--	250	40	40	400	400

Table for BMK-12W

 2 - 2,5 mm		 ms		 ms		 ms	
							
M3		5		40		0	
M4	RD 6	10	30	40	40	0	300
M5	PD 6	15	50	40	40	0	300
M6	RD 8	30	80	40	40	300	300
M8	PD 8	80	100	40	40	300	300
M10	RD 10	300	170	40	40	400	400
	PD 10		200		40		400
	RD 12		220				400

When using stud diameters exceeding 6 mm, we recommend the application of shielding gas or ceramic ferrules in order to prevent pore formation and to optimise bulging.

6.2.1 Minimum sheet thickness when welding with drawn arc operation

Observance of the minimum sheet thickness prevents the plate from being burnt through during the welding process.

Method	Weld time	Stud dia.	Welding current in ampere	Weld pool protection	Minimum sheet thickness
Drawn arc stud welding with ceramic ferrule or shielding gas	> 100 ms	3 up to 25 mm	300 up to 3000	CF	¼d, but 1 mm min.
	> 100 ms	3 up to 16 mm	300 up to 3000	SG	⅛d, but 1 mm min.
Short-cycle drawn arc stud welding	≤ 100 ms	3 up to 12 mm	up to 1500	NP, SG, CF	⅛d, but 0.6 mm min.
Capacitor discharge drawn arc stud welding	< 10 ms	3 up to 10 mm	up to 3000	NP, SG	1/10d, but 0.5 mm min.

CF = ceramic ferrule, SG = shielding gas, NP = no weld pool protection

6.3 Important information for standard welding operation (stud welding)

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

NOTE
The applicable accident prevention and safety regulations must be complied with when operating the stud welder.

DANGER
Persons with pacemakers must not operate the stud welding equipment. They must not stay in the vicinity of the stud welder being operated.

DANGER
Never touch stud or stud holder during the welding process. These components are current-carrying!

• Position the welding gun or welding head on the workpiece and press the trigger. The welding process will be started with the parameters set. The LED "Final contact" indicates the end of the welding process.

• Do not move the welding gun or welding head during welding. Wait until the welding process has been completed before removing the welding gun or head vertically from the welded stud. For further information, please also refer to the operating instructions of your welding gun or welding head.

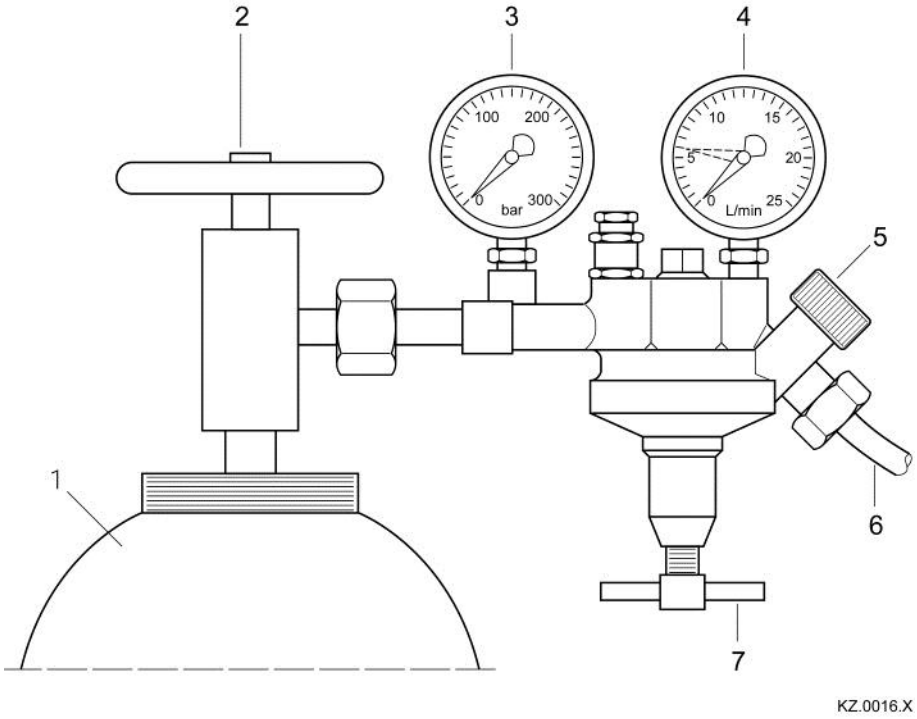
• After completion of the welding process, the welding gun or welding head should be held in position for about 5 seconds to allow solidification of the molten metal.

6.4 Welding operation with shielding gas

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

NOTE
The applicable accident prevention and safety regulations must be complied with when operating the stud welder.

6.4.1 Preparation of gas supply



Example for gas supply. Deviations are possible depending on the manufacturer

1 Gas cylinder
2 Hand wheel (left = open, right = closed)
3 Manometer for indicating the gas cylinder's pressure
4 Flow meter
5 Shut-off valve
6 Gas supply hose
7 Control cock for gas flow rate
Screwing in increases the flow
Screwing out decreases the flow

• Connect gas supply hose and gas hose of pressure reducing valve to the stud welder. (Pressure reducing valve is not included in delivery).

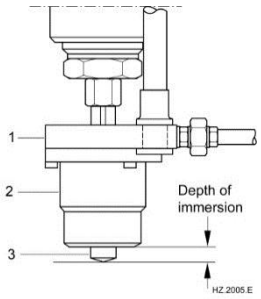
• Open hand wheel (item 2) of gas cylinder.

• Open shut-off valve (item 5).

• Use control cock (item 7) to set shielding gas flow rate to a maximum of 4 - 5 l/min.

6.4.2 Instructions for welding with shielding gas

• Set the parameters required for your welding task according to the table.



1 Foot plate
2 Gas shroud
3 Welding stud

Illustration: Stud welding with shielding gas

Set gas flow rate to a value between 4 and 5 l/min. If the value is too high, the arc is extinguished, if the value is too low, the protective function of the gas is reduced. Welding results are poor in both cases.

• Insert a stud into the welding gun or welding head.

DANGER
Never touch stud or stud holder during the welding process. These components are current-carrying.

• Position welding gun or welding head vertically on the workpiece when welding.

• Press the trigger.

• When welding with shielding gas, the welding point is rinsed during the welding process as well as before and after welding for the period adjusted.

The LED "Gas valve open" indicates that the gas valve is activated.

The LED "Final contact" indicates that the welding process is completed.

6.5 Welding operation with ceramic ferrules

The measures mentioned in the "Start-up of stud welder" chapter have already been performed.

1 Foot plate
2 Ceramic ferrule
3 Welding stud

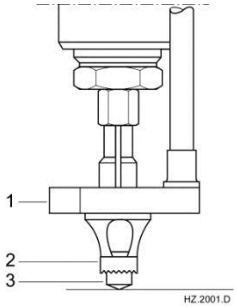


Illustration: Stud welding with ceramic ferrule

Welding operation with ceramic ferrules is only possible when using SOYER drawn arc welding studs, types PD, MD, RD, UD and SD, similar to DIN EN ISO 13 918.

6.5.1 Instructions for welding with ceramic ferrules

• Start the stud welder as described in chapter 5.

• Only use ceramic ferrules which are absolutely dry and do not show any flaws.

• Only use ceramic ferrules which match the type and size of the studs.

• Start by carrying out test welds in order to achieve optimum welding results. If necessary, modify the prescribed welding parameters.

• Insert stud into stud holder until stop.

• Make sure stud is centred in the ceramic ferrule holder.

• Place ceramic ferrule on ceramic ferrule holder.

• Position the welding gun in such a way that the centre of the stud points exactly toward the marked welding point.

- Make sure that the gun does not tilt, i.e. that the ceramic ferrule is positioned evenly on the workpiece.
- Start welding process. The LED "Final contact" lights up after completion.
- After completion of the welding process, the welding gun or welding head should be held in position for about 5 seconds to allow solidification of the molten metal.
- Remove gun vertically to prevent widening and damaging of the stud holder.
- Knock off ceramic ferrule from the welded area.

7 Quality control

7.1 General

Provided that the SOYER stud welding system is properly used and the materials are appropriately selected, the strength of the welding joint (welding zone) will always be stronger than that of the stud or base material.
The following tests are carried out in general practice:

•Visual inspection
•Bend test

Please also refer to the following standard

• **DIN EN ISO 14555** Arc welding of metallic materials

or DVS information sheets

• DVS 0902 Drawn arc stud welding
• DVS 0904 Practical information – Arc stud welding

7.2 Demands on the company

The company must employ a technical supervisor responsible for welding matters, as well as qualified operating personnel for stud welding.

7.3 Test execution

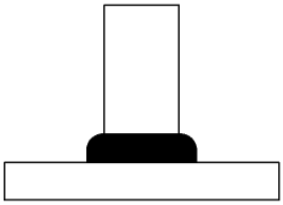
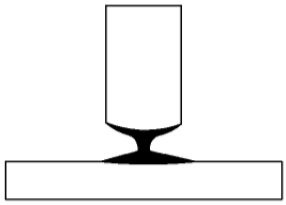
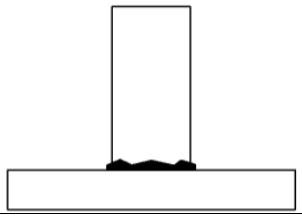
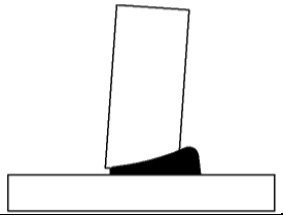
7.3.1 Production of samples

The dimensions of the test piece must be sufficient to carry out all tests. The thickness of the test piece must be the same as used in later production. Use the same welding positions and edge distances as on the component to be welded later. If it is possible and sensible from an economical point of view, use parts that are identical to those used in later production.

Comply with the minimum sheet thickness as per DIN EN ISO 14 555.

7.3.2 Visual inspection

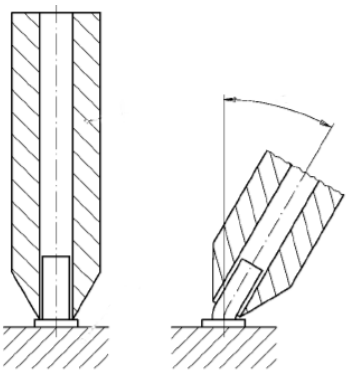
The visual inspection serves as a rough check for major defects. The uniformity of the weld is assessed.

	Good weld quality. Optimum setting. Regular, bright and complete collar.
	Poor weld quality e.g. caused by excessive welding energy or insufficient plunge or lift. Reduced diameter weld. Partial weld.
	Poor weld quality e.g. caused by insufficient welding energy or humid ceramic ferrules. Reduced and irregular collar.
	Poor weld quality, e.g. caused by arc blow, tilted or unsteady welding position of welding gun. Stud flange is not completely welded and shows visual defects. Weld undercuts are visible.

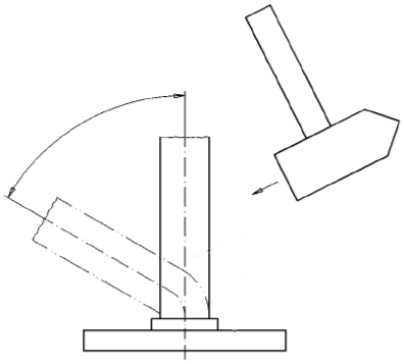
7.3.3 Bend test

The bend test is a simple work test which serves to roughly check the setting values selected. The welding zone is subjected to undefined tension, pressure and bending. A minimum of 3 studs is welded and bent by means of a tube that is slipped over the stud. The test is successful when no superficial fissure or fracture is detected in the welding zone.

> In drawn arc and short-cycle drawn arc operation with ceramic ferrule or shielding gas, the stud should be bent 60° from its axis.



Bend test with tube placed upon the stud



Bend test with hammer

7.3.4 Tensile test

The tensile test serves to test the metallic bond of the stud with the base metal. At least 3 studs are welded and then axially loaded by means of an appropriate tension device until they break. If the customer demands that a certain percentage of the welded studs should be tested with a specific test load in production, a tension device with load indicator should be used.
If the stud breaks outside the welding zone, the test is regarded as successful.
If it breaks within the welding zone, an examination of the fractured surface helps to find out the appropriate changes of the welding conditions. The setting values must be modified and the test repeated.

Note

Numerous special accessories are optionally available for perfectly testing SOYER stud welded joints:

BP-1 SOYER Bend Testing Device for non-destructive stud testing to support quality assurance procedures

DMS-1 SOYER Torque Wrench for non-destructive stud testing to support quality assurance procedures

For further information, please contact our parent company or the customer service responsible for your area or visit our website at www.soyer.de.

8 Maintenance

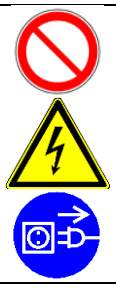
8.1 Important instructions

The stud welder is constructed in such a way that only a minimum of maintenance is required. The interior of the stud welder should, however, be cleaned by a specialist at regular intervals depending on the environmental conditions at the location of use.

WARNING
It is prohibited to open the stud welder.

The service personnel are required to meet special qualifications
Our after-sales service has adequately trained personnel, suitable service equipment and the means to carry out all necessary works.

8.2 Important instructions for all service works



DANGER

Always disconnect the mains cable from the mains supply before starting any repair, maintenance or cleaning works.

Always disconnect the connecting plug from the mains supply socket before opening the housing of the stud welder. Only trained and appropriately qualified personnel are allowed to carry out works at the electric mains supply and welding system.

NOTE
Only use original SOYER ®spare parts.

8.3 Cleaning

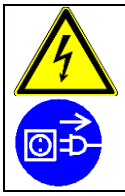
Cleaning should be carried out once a week depending on how soiled the stud welder is.
Please pay particular attention to foreign substances in and around the air apertures in the housing.

8.3.1 Detergents

Almost every detergent without corrosive or acidic substances is suitable for cleaning purposes. However, please observe the manufacturer's specifications on the detergent you intend to use.

8.4 Replacement of components

Defective components may only be replaced by trained SOYER servicemen. Perfect function of your stud welder can only be guaranteed when original SOYER spare parts are used.



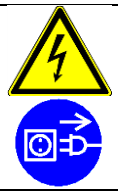
CAUTION
Disconnect the mains cable from the mains supply and disconnect the shielding gas and compressed-air supplies before replacing any components. Electric and electronic components may only be replaced by the SOYER ® customer service or by trained and appropriately qualified personnel.

CAUTION
Should it become necessary to replace fuses, only use fuses with the prescribed electrical values. Oversized fuses could either cause defects on the electrical system or a fire.

DANGER
Disconnect the mains plug from the mains supply when replacing fuses.

9 Troubleshooting

The following list of errors, their causes and remedies is designed to help you eliminate any trouble immediately on the spot. If it is difficult or impossible to eliminate the trouble, please contact the SOYER customer service responsible for your area or Heinz Soyer Bolzenschweißtechnik GmbH.



DANGER
Always disconnect the mains cable from the socket and the shielding gas and compressed-air supplies from the connections of the stud welder before starting any repair, maintenance or cleaning works.

CAUTION
Electric and electronic components may only be replaced by the SOYER ® customer service or by trained and appropriately qualified personnel.

9.1 Malfunctions

Error	Cause → Elimination
Main switch does not remain in position "1".	One or several phases have failed. → Check mains supply fuses.
	Fuse F2 is defective. → Replace defective fuse.
System is switched on, but does not function.	Mains supply is defective. → Check mains supply fuses.
	Fuse of stud welder is defective. → Replace defective fuse.
There is no arc even though system is ready for operation.	Control of stud welder or welding gun is defective. → Call SOYER customer service.
	Stud is too loose in stud holder. → Press stud holder together or tighten it.
System does not weld, no or only poor sparking.	System is not switched on or not connected to mains supply. → Connect system to mains supply and switch on. When working with drawn arc and short-cycle drawn arc operation, the main switch must remain in position "1". When switching the system on, the LEDs shortly light up.
	Operating mode is set to PRE, LIFT, GAS → Set operating mode to "OP".
	Welding cable, control cable or gas hose are not connected properly or are damaged. → Connect cables/hose properly or check for damage. Replace if necessary.
	Connecting plug or socket of stud welder is burnt down. → Have plug or socket replaced by SOYER customer service.
	Both earth cables are not properly connected or not connected at all, or earth clamps are not attached to the workpiece. → Connect earth cables; attach earth clamps to the workpiece.
	Welding points and/or earth connection points at the workpiece are not blank. → Prepare workpiece and studs accordingly.
	Height of lift and/or depth of immersion are not adjusted correctly. →Refer to the operating instructions of the welding gun to set the height of lift and depth of immersion correctly.
	Gas flow rate is set too high, i.e. higher than 5 l/min (arc is extinguished). → Set gas flow rate to the maximum value of 4-5 l/min.
	Stud is tilted in ceramic ferrule and does not lift. → Ensure gun is vertically positioned on workpiece. Centre ceramic ferrule and stud holder.
Stud thread scorched.	Stud holder worn → Replace stud holder.
No shielding gas flow during welding process.	Gas cylinder is not or not properly connected to the system and/or valve or shut-off valve are not open. → Connect gas cylinder as per chapter 6.4.1 and/or open valve or shut-off valve.
	Time for gas flow duration is set to "0" → Set gas flow duration to the desired preflow time.

	Gas flow rate is set too low. → Set gas flow rate to 4-5 l/min by means of the control cock.
	Solenoid valve in stud welder is soiled or defective. → Deaerate solenoid valve, clean it and/or have it replaced by SOYER customer service.
Stud does not lift, neither preweld current nor main current arc is generated, even though LED "Stud on workpiece" lights up.	Height of lift is not correctly set. → Set height of lift in accordance with the operating instructions of your stud welding gun.
	Control of stud welder or welding gun is defective. (Stud does not lift, even though height of lift is correctly set). → Contact SOYER customer service.
Stud lifts, preweld current is initiated, but main current is not ignited.	Operating mode (chapter 5.2.2.1) is set to position "PRE". → Set operating mode to position "OP".
	Preweld current arc breaks. → Clean or grind workpiece surface.
	Lift is too high. → Set lift in accordance with the operating instructions for your welding gun or welding head.
	Gas pressure is too high. → Set gas flow rate to 4-5 l/min by means of the control cock.
Varying welding results.	Welding energy not correctly adjusted. → Adjust welding energy.
	Cable connections too loose. Transition resistances are generated. → Check all cable connections and earth clamps for tight fit.
	Stud too loose or not fully inserted into stud holder until stop. → Insert stud into stud holder until stop. Replace stud holder, if necessary.
	Magnetic blowing action. Arc is forced into a certain direction. → Alter fixture of earth clamps, place iron parts on the edges and/or rotate welding gun.
	Height of lift and/or depth of immersion are incorrectly set. → Refer to the operating instructions of your welding gun to set the height of lift or depth of immersion correctly.
	You have used low-quality studs with inaccurate dimensions or poor surface finish. → Only use SOYER® welding studs as per DIN EN ISO 13 918.
	Welding time and/or gas flow incorrectly set. → Reset welding time and/or gas flow as per chapter 6.2.
	Parent metal not suitable for welding. → Use suitable material combinations.
Single-fillet bulging at equal points.	Bulging is caused by magnetic blow effect. The arc is forced into a certain direction. → Alter fixture of earth clamps, place iron parts on the edges and/or rotate welding gun.
Intensive sparking, stud flange almost molten down.	Time too long. → Readjust time for main current duration according to the table.
Stud not welded with total flange surface, deficient weld joint strength.	Time too short. → Readjust time for main current duration according to the table.
	Poor earth connection → Check earth cables and earth clamps for tight fit, tighten if necessary.
	Workpiece surface too soiled. → Clean workpiece surface.

	Stud face deformed. → Use new welding studs.
	Stud projection over stud holder incorrectly set. → Set distance between stud holder and stud face to 2-3 mm
	Welding gun in tilted position. → Ensure that all three gun legs are simultaneously and evenly positioned on the workpiece.
	Lift not correctly set. → Set lift correctly.
Main switch returns to position "0".	Stud lift not correctly set. → Set stud lift in accordance with the operating instructions for the welding gun. Switch stud welder on.
	You have pulled off the welding gun from the workpiece while main current has been flowing. → Switch stud welder on again.
	Insufficient mains supply, i.e. supply voltage below value required for welding operation. → Connect stud welder without extension cable to mains supply. If you need to use an extension cable, use one having a higher cable core cross-section.
	Arc breaks as gas pressure is too high. → Set gas pressure to the prescribed value.
	Workpiece surface is poorly electroconductive - arc breaks. → Abrase surface.
LED "Transformer overheated, pls. wait" lights up.	There is not enough free space around the stud welder. → Make space available to eliminate heat accumulation.
	Excessive welding sequence. → Please observe the admissible welding sequence.
LED "Lift test carried out too long" lights up.	You have activated the lifting magnet too long or too often when testing the lift. →Wait until the coil in the welding gun has cooled down.

10 Transport and storage

The BMK-8 U / BMK-12 W stud welders are robustly designed and have a two-piece metal housing with front and rear panel. Owing to electronic components it should be ensured, however, that transport is free from vibrations.

Both stud welders have two carrying handles on their top for easy transport and mobile use within short distances.

CAUTION
The carrying handles are intended for transport by hand only. Never pull ropes through these handles to lift the stud welder by means of a crane to the installation site. The welding unit would become instable and might tilt from its original position. As a result the handles could rip and the welding system would fall on the ground.

The GW-1 and GW-2 SOYER tool and gear wagons are the optimum solution for properly storing welding guns, cables, studs and conversion kits (optional equipment).

NOTE
Prevent unauthorized use of the stud welding systems by children and unqualified personnel.
After long system standstill, we recommend having the stud welding system checked by SOYER® customer servicemen prior to start-up.

The housing of the BMK-8 U / BMK-12 W stud welders corresponds to safety class IP 21. Please observe that this system of protection is not suitable for being operated or transported in the rain

11 Terms of warranty

We warrant for this equipment for a period of 12 months in the case of commercial, professional or equivalent use. When repairs are necessary, we guarantee to undertake them in our factory in Etterschlag. Parts subject to wear and tear are excluded.

Any claim to a warranty will be forfeited if damage is caused by improper operation, or if repairs or interferences have been made by unauthorized personnel, or whenever accessories and spare parts have been used which do not match our equipment.

We cannot guarantee the perfect function of the stud welder and the quality of welded joints if welding studs acquired from another company are used.

12 List of standards and guidelines

• 2014/35/EU	Directive on Low Voltage
• 2014/30/EU	Directive on Electromagnetic Compatibility
• EN 60974–1	Arc welding equipment - welding current sources
• EN 60974–10	Arc welding equipment - EMC requirements
• DVS Information Sheet 0901	Arc stud welding of metallic materials
• DVS Information Sheet 0902	Drawn arc stud welding
• DVS Information Sheet 0903	Capacitor discharge stud welding with tip ignition
• DVS Information Sheet 0904	Practical information – Arc stud welding
• EN 14555	Arc welding of metallic materials
• EN 13918	Studs and ceramic ferrules for arc welding
• DGUV Regulation 1	Principles of prevention
• 2006/42/EC	Machinery Directive
• EN 12100–1	Safety of machinery – Basic terminology, systems engineering
• EN 12100–2	Safety of machinery – Technical principles and specifications
• EN 60204–1	Electric equipment of machinery, general requirements

Notes:

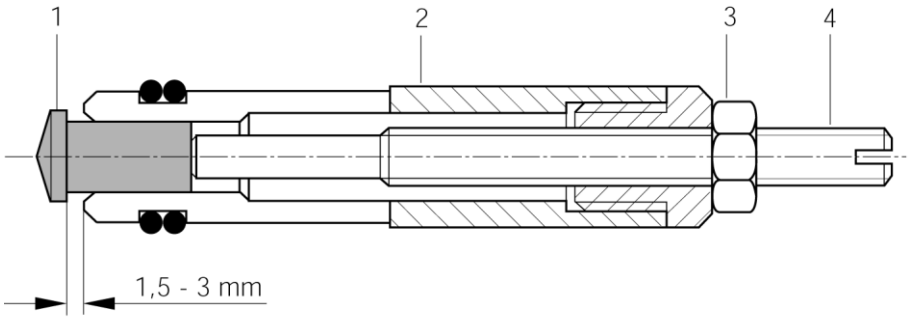
Appendix A / Short-cycle drawn arc stud welding

1 Adjustment of stud welding gun

1.1 Standard stud holder

The stud holders of the PH-3N, PH-3, PK-3 and PK-0K stud welding guns are identical in construction. When using long welding studs with the short type PK-0K welding gun, however, it is necessary to shorten the stud holders' stop screw (4) correspondingly.

> For PK-3 and PK-0K guns, use the standard stud holder with adjusting screw, having a length of 45 mm! Ensure that the maximum stud length does not exceed 35 mm!
>
> For PH-3 and PH-3N guns, use the standard stud holder with adjusting screw, having a length of 73 mm!
> Ensure that the maximum stud length does not exceed 60 mm.



1 Stud
2 Stud holder
3 Lock nut
4 Stop screw

Different stud holders are required for different stud diameters.

Adjust the stud holder as follows:

• Loosen lock nut (3)

• Insert stud (1) into stud holder.
The top edge of the stud flange must project for about 1.5 mm from the front edge of the stud holder.

> For studs that are longer than 15 mm, enlarge the projection. This helps to reduce wear and tear of the stud holder.
>
> The stud must come into contact with the stop screw (4).

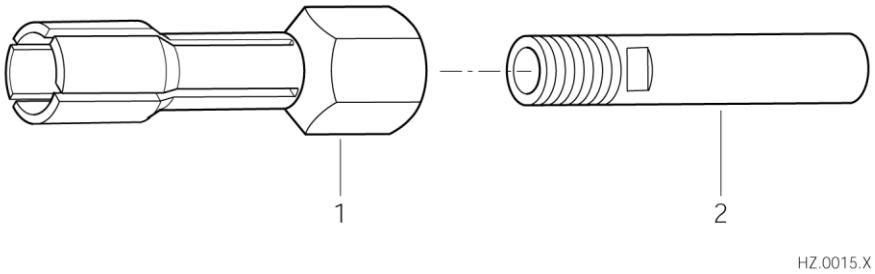
• Adjust stop screw (4) in the stud holder by turning it until the distance from the top edge of the stud flange to the front edge of the stud holder is 1.5 mm.

• Secure stop screw (4) by means of lock nut (3)

1.2 Stud holder for drawn arc operation

The PH-3N, PH-3 and PK-3 stud welding guns can be equipped with a stud holder for drawn arc operation when studs with a diameter of more than 6 mm are to be welded.

The stud holder is screwed on an adapter piece and can be installed into the PH-3 and PK-3 stud welding guns like the standard stud holder.



The stud holder must be screwed on the adapter piece tightly. When the screwed connection is not tight enough, these parts could be damaged by scorching during the welding process.

Drawn arc stud holders are especially suitable for operation with ceramic ferrules. However, ensure a minimum stud length.

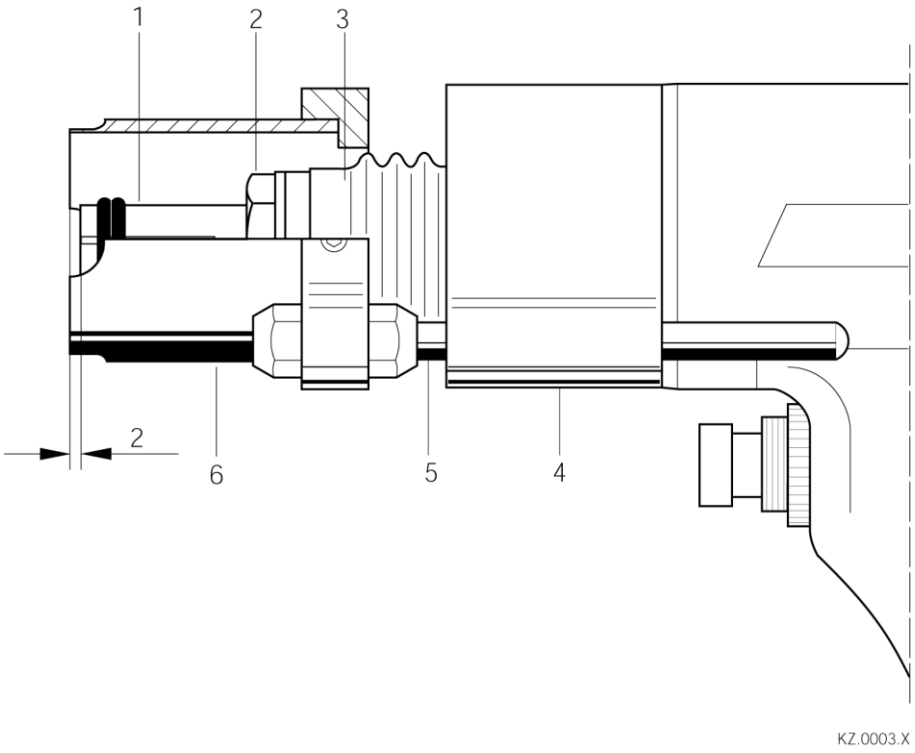
Ensure a minimum stud length when welding with ceramic ferrules:
Minimum stud length = Height of ceramic ferrule + 15 mm,
e.g. ceramic ferrule for MR10 stud = 10 mm high + 15 mm =
minimum stud length of 25 mm.

NOTE
Check to see if the stud holder is tightly screwed after installing it, otherwise there is a risk of scorching during the welding process.

1.3 Installation of stud holder into stud welding gun

DANGER
Switch off the welding system before starting any installation works (mains switch must be in "off" position).

The PH-3 and PK-3 stud welding guns are provided with a standard stud holder. The illustration below shows how to install the standard stud holder into the PK-3 stud welding gun with support tube.
The standard PH-3 stud welding gun uses a gas shroud instead of a support tube (6).
The description of installation refers to PH-3, PH-3N and PK-3 stud welding guns.



1 Stud holder
2 Sleeve nut
3 Spring piston
4 Allen screws
5 Support
6 Support tube

How to install the stud holder:

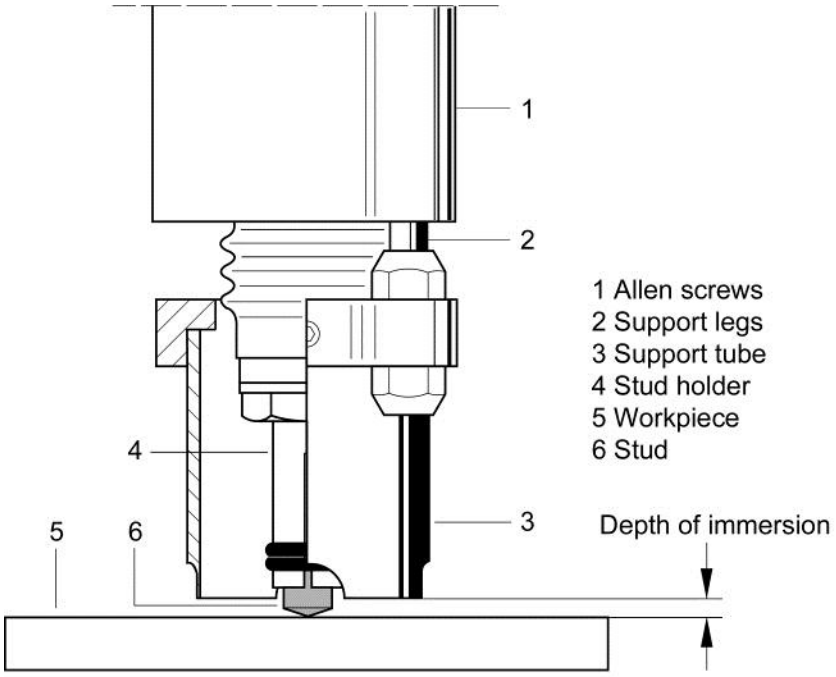
- Loosen sleeve nut (2) by means of socket wrench SW 17
- Insert stud holder (1) into spring piston (3) until stop
- Tighten stud holder (1) with sleeve nut (2)
- Loosen Allen screws to move support (5) and support tube (6) in such a way that the stud holder face (1) is 2 mm behind the support tube face (6)
- Tighten Allen screws (4)

1.4 Adjusting the depth of immersion

DANGER
Switch off stud welder to adjust depth of immersion.

The stud must come into contact with the adjusting screw of the standard stud holder.

The depth of immersion is the distance the stud projects over the end of the ceramic ferrule, the gas shroud or the support tube. When placing the welding gun on the workpiece, the stud is pushed back this distance. During welding, the stud will immerse up to this length into the liquid weld pool on the workpiece. The process of adjusting the depth of immersion is the same for both welding with shielding gas and ceramic ferrules. The depth of immersion always depends on the stud diameter.

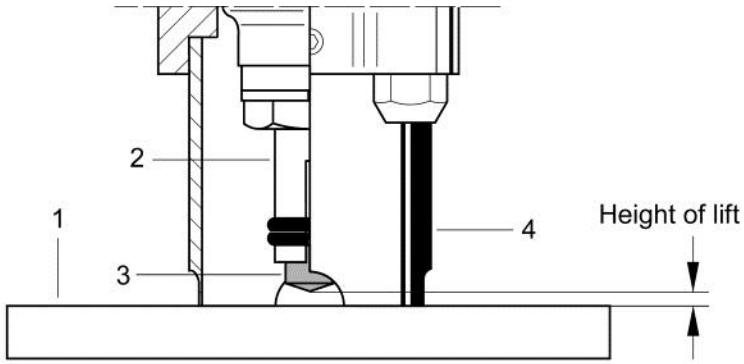


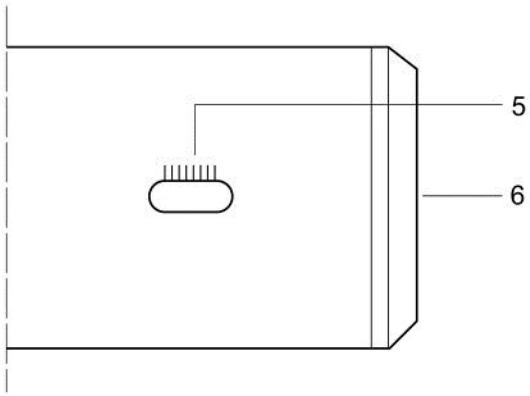
How to adjust the depth of immersion:

- Insert the relevant stud (6) into stud holder (4) until stop
- Loosen both Allen screws (1)
- Move support legs (2) until the required depth of immersion is obtained
- Tighten Allen screws (1)

1.5 Adjusting the height of lift

The height of lift is the distance the stud is lifted from the workpiece during the welding process. This distance is required for igniting the arc. Determination and adjustment of the lift is the same for welding with both support tube and ceramic ferrules. The height of lift always depends on the stud diameter.





1 Workpiece
2 Stud holder
3 Stud
4 Support tube
5 Lift scale
6 Adjusting screw

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How to determine the height of lift

• Adjust function "lift test" at the stud welder.
• Place welding gun on the workpiece
• Press gun switch. Stud holder (2) and stud (3) are lifted from workpiece (1). The lift is adjusted with the help of the adjusting screw (6) located at the back of the welding gun

How to adjust the height of lift

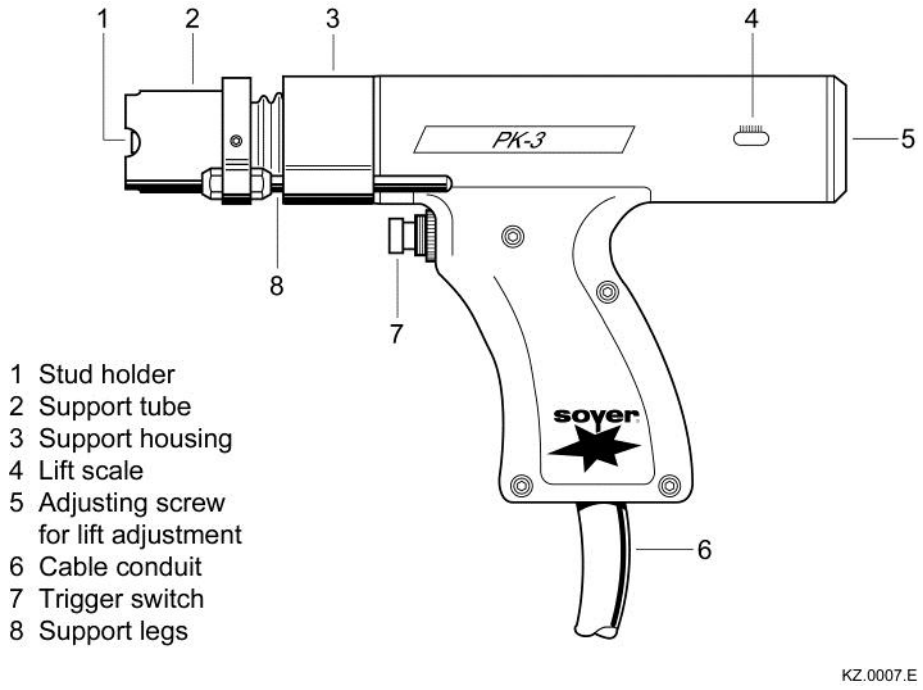
• Insert screwdriver into the groove of adjusting screw (6) located at the back of welding gun and adjust by turning the screwdriver to the left or to the right, until the required height of lift is obtained. Turning to the left increases the height of lift, turning to the right decreases the height of lift. One turn of the adjusting screw corresponds to approx. 1 mm. After adjustment, check the height of lift and correct, if necessary.

☞	With the PH-3N stud welding gun, the height of lift can be adjusted by turning the end cap (6) at the rear of the welding gun to the left or to the right. Tools are not required.

2 Start-up

2.1 Total view

The illustration below shows standard PK-3 stud welding gun for short-cycle drawn arc operation. A large range of equipment is available.



1 Stud holder
2 Support tube
3 Support housing
4 Lift scale
5 Adjusting screw for lift adjustment
6 Cable conduit
7 Trigger switch
8 Support legs

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2.2 Connecting stud welding gun to stud welder

Use the gun cable and control cable to connect the stud welding gun to the stud welder

• Insert connector of stud welding gun's welding cable into the relevant jack at the stud welder
• Insert connector of stud welding gun's control cable into the relevant jack at the stud welder.
• Insert gas supply connector of stud welding gun into the relevant jack at the stud welder (only with optional shielding gas equipment).

2.3 Operation

• Connect stud welder to earth

• Adjust stud welding gun as described in Appendix A, Chapter 1

• Connect stud welder to mains supply

• Adjust parameters at stud welder according to welding studs to be used

• For standard operation, insert welding stud into stud holder

• Position stud welding gun on workpiece and press trigger switch

For further information regarding connection and operation, kindly refer to the operating instructions of your stud welder.

Before starting your work, carry out some experimental welds and test them to find out the optimum adjustment.

Samples have to be taken during production to ensure constantly good welding results.

2.4 Welding parameters

For welding parameters, kindly refer to the operating instructions of your stud welder.

3 Spare parts / Wear parts

3.1 Accessories for inert-gas-shielded arc welding

Abbildung Illustration	Artikel Nr. Order code	Menge Quantity	Bezeichnung Designation	Gewicht in kg Weight in kg	
	F01633	1	Schutzgasglocke SGL-2 Aluminium *SGL-2 gas shroud, aluminium*	0,06	
	F01631	1	Schutzgasglocke Aluminium *Gas shroud aluminium* SGL-1	0,063	
	F02477	1	Schutzgasglocke Messing *Gas shroud, brass* SGL-2	0,183	
	F02476	1	Schutzgasglocke Messing *Gas shroud, brass* SGL-1	0,189	
SGL-1: innerer / *inside* Ø: 22 mm; äußerer / *outside* Ø: 30 mm **SGL-2**: innerer / *inside* Ø: 28 mm; äußerer / *outside* Ø: 34 mm					
	F02329	1	Stativgrundplatte *Support base plate* *SGL-1 Ø22mm*	0,054	
	F01997	1	Stativgrundplatte *Support base plate* SGL-2 Ø28mm	0,051	

Abbildung Illustration	Artikel Nr. Order code	Menge Quantity	Bezeichnung Designation	Gewicht in kg Weight in kg	
 Bolzenhalter Stud holder	F01190	1	M6	0,025	
	F01191	1	M8	0,028	
	F01192	1	M10	0,03	
	F01193	1	M12	0,045	
	F02123	1	Adapterstück M10 *Adapter piece M10*	0,025	
	F02000/FA	2	Massekabel mit Gripzange, komplett für BMK-10/12 *Earth cable with locking pliers, complete for BMK-10/12*	1,426	
	F01666/FA	2	Massekabel mit Zwinge für BMK/BMH-16 *Earth cable with screw clamp for BMK/BMH-16*	1,4	
	P00070	1	Zusatz Gasanschluss *Additional gas supply equipment*	0,19	
	M01446	1	Einmaulschlüssel Gr. 17 *Single-head wrench (size 17)*	0,062	
	M01549	1	Inbus-Schlüssel Gr. 2 *Allen wrench (size 2)*	0,002	
	M01441	1	Inbus-Schlüssel Gr. 3 *Allen wrench (size 3)*	0,005	

3.2 Ceramic ferrule welding accessories for BMK-8/10/12

Abbildung Illustration	Artikel Nr. Order code	Menge Quantity	Bezeichnung Designation	Gewicht in kg Weight in kg	
	F03768	KR6	Keramikringhalter *Ceramic ferrule holder*	0,013	
	F03769	KR8-10	Keramikringhalter *Ceramic ferrule holder*	0,013	
	F03770	KR12	Keramikringhalter *Ceramic ferrule holder*	0,018	
	F02115	1	Stativgrundplatte für Keramikring von KR6 bis KR10 *Support base plate for ceramic ferrules from KR6 to KR10*	0,04	
	F02114	1	Stativgrundplatte für KR12 *Support base plate for KR12*	0,033	
	F01252	2	Stativstangen-buchse, vorne verzinkt *Support leg bushing, zinc-coated at the front*	0,005	

3.3 Additional accessories

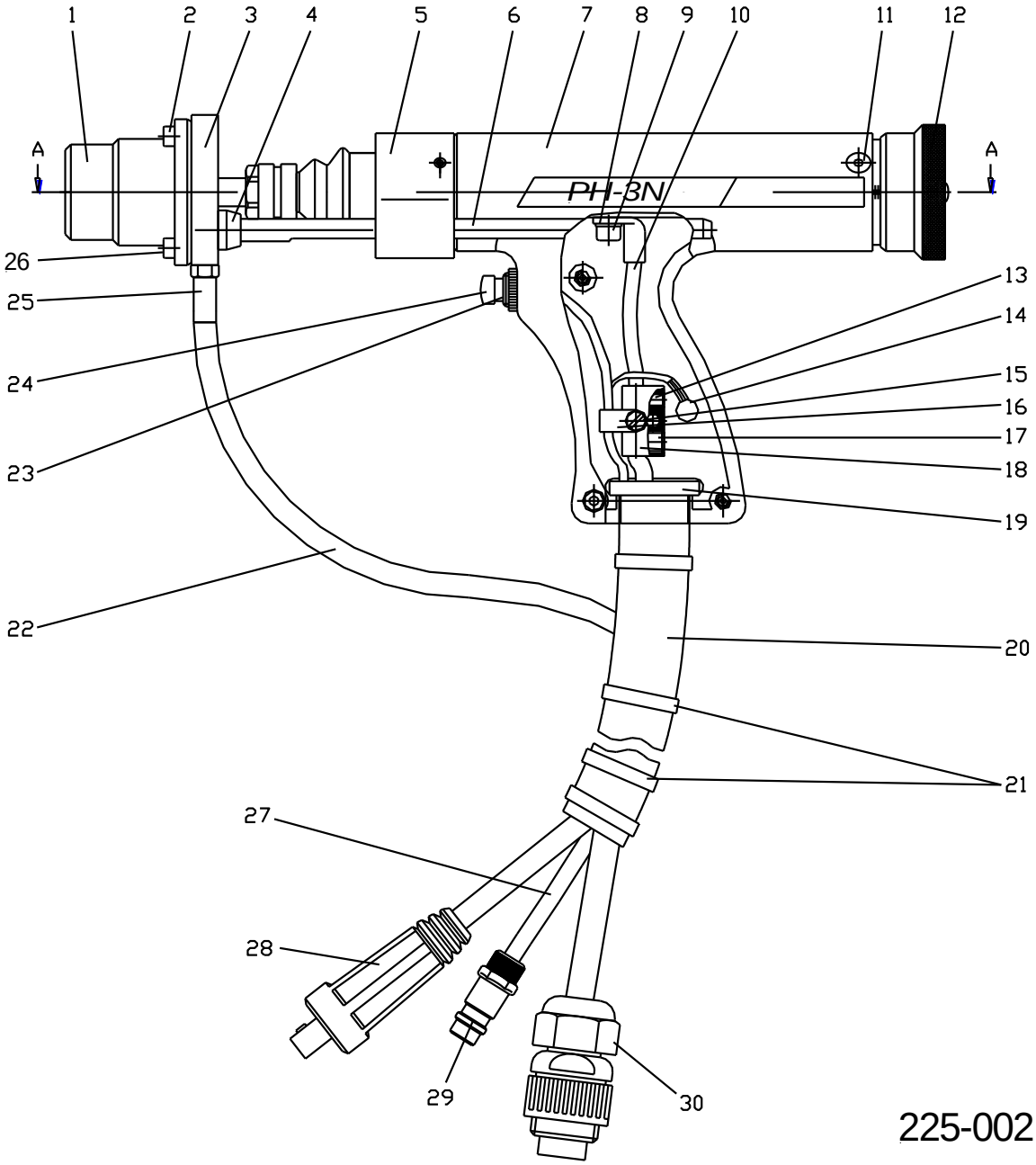
Abbildung Illustration	Artikel Nr. Order code	Menge Quantity	Bezeichnung Designation	Gewicht in kg Weight in kg	
	M01444	1	Rohrsteck-schlüssel *Tubular hexagon box wrench* DIN896B	0,133	
 Stativstange Support leg	F01719	2	170mm	0,06	
	F03780	2	200 mm	0,07	
	F03166	2	250 mm	0,088	
	F03781	2	300 mm	0,106	
	F03782	2	400 mm	0,143	
	F03717/FA	1	Verlängerung Pistolenkabel 3 m *Extension gun cable 3 m*	2,180	
	F03748/FA	1	Verlängerung Pistolenkabel 5 m *Extension gun cable 5 m*	3,407	
 Bolzenhalter *Stud holder*	F01160	1	M3 x 70	0,033	
	F01163	1	M4 x 70	0,033	
	F01167	1	M5 x 70	0,034	
	F01171	1	M6 x 70	0,034	
	F04995	1	Ø7,1mm	0,035	
	F01175	1	M8 x 70	0,036	
	F01619 +F02123 +F01375	1 +1 +1	Adapter für Spitzenzündungs-bolzenhalter *Adapter for CD stud holders*	0,061	
	F02660	1	Zentrierwerkzeug *Centring tool*	0,151	

3.4 Spare parts list for PH-3N stud welding gun

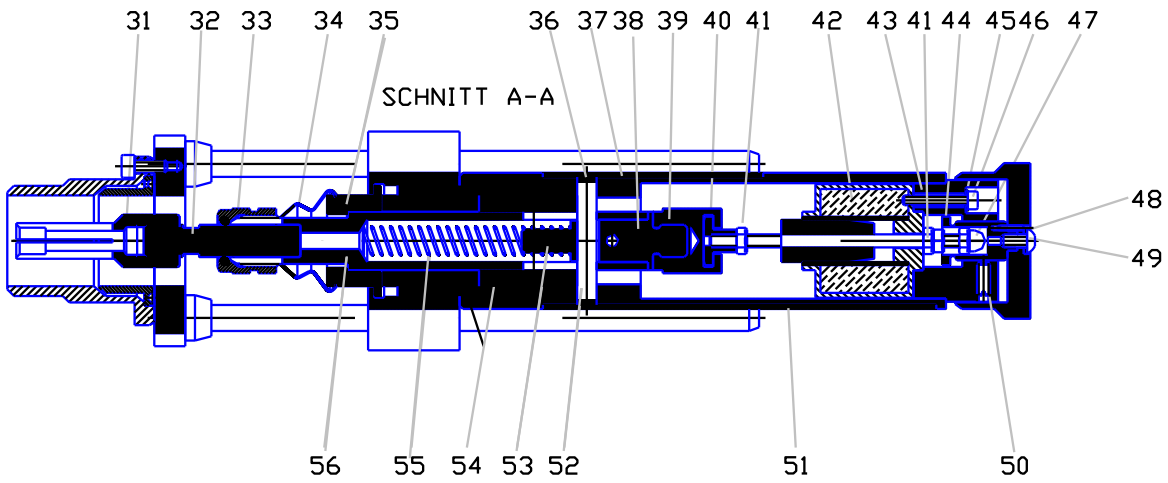
Item No.	Qty.	Designation	Order No.
X	X	PH-3N stud welding gun, complete	P02241
1	1	Gas shroud SGL 2	F01633
2	3	Cheese-head screw M4 x10 DIN912	***
3	1	Base plate for support	F01997
4	2	Support leg bushing	F01255
5	1	Support retainer, complete	F03791/FA
6	2	Support leg, 170 mm	F01719
7	1	Gun housing, complete	F03873/FA
8	1	Spring washer M5 DIN127A	***
9	1	Cheese-head screw M5x10 DIN912	***
10	1	Ground wire, complete	F02720/FA
11	3	Flat-head screw M4x8 DIN7991	M01563
12	1	End cap	F04034
13	1	Grub screw 5x8 DIN916	***
14	1	Varistor 120 volt	E01341
15	1	Cheese-head screw M4x10 DIN84	***
16	1	Cable clip, white	E02858
17	1	Grub screw 8x8 DIN916	***
18	1	Strain relief	F03012
19	1	Bend protection	E02854
20	3 m	Fabric tube	M01390
21	4	Cable fastener 100/25	E02072
22	0.35 m	Silicone tube 8x2.0	M01396
23	1	Push button, 1 pole	E02103
24	1	Cap, red	E02104
25	1	Shielding gas valve	M01443
26	2	Cheese-head screw M5x20 DIN912	***
27	3.5 m	Pneumatic tube	M01049
28	1	Gun cable, complete	F01026/FA
28.1	(1)	Welding cable plug SKM 25	E01963
29	1	Coupler plug	M01304
30	1	Control cable, complete	F03080/FA-E
30.1	(1)	Control cable plug	E01948
31	1	Stud holder M 6	F01190
	(1)	Stud holder M 8	F01191
	(1)	Stud holder M 10	F01192
	(1)	Stud holder M 12	F01193
32	1	Adapter M 10	F02123
33	1	Sleeve nut	F01375
34	1	Bellows	F02857
35	1	Bellows retainer	F03886
36	2	Insulator	F04039
37	1	Gun label, address	M01601
38	1	Insulator	F04040
39	1	Connection piece for piston	F04037
40	1	Connection piece for magnet	F04038
41	3	Hexagon nut M4 DIN934	***

Item No.	Qty.	Designation	Order No.
42	1	Lift magnet with armature	E03654
43	1	Holding device for magnet	F04036
44	1	Lift adjuster	F04035
45	3	Spring washer M3 DIN127A	***
46	3	Cheese-head screw M3x20 DIN912	***
47	1	Acorn nut M4 DIN6797A	***
48	1	Tooth lock washer M4 DIN6797A	***
49	1	Fillister head screw M4x8 DIN ISO 7380	***
50	3	Spring thrust piece M4x10	***
51	1	Gun label for PH-3N	M03596
52	1	Straight pin 6m6x36 DIN6325	***
53	1	Spring guide for piston	F03879
54	2	Bushing with recirculating ball bearing	F03888
55	1	Pressure spring	F03880
56	1	Working piston	F03887
***	1	Screw kit comprising items: 2/8/9/13/15/17/26/41/45/46/47/48/49/50/52	F04662/FA

3.5 Illustration of PH-3N stud welding gun (main view)



3.6 Illustration of PH-3N stud welding gun (section of gun body)



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