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**Operating Manual**  
**KÖCO-Compact Stud Welding Equipment**  
**ELOTOP 510**

**KÖCO Stud Welding Guns**

**CLASSIC**

**SK 14 from no. 10000**

**SK 14-ISO from no. 17200**

**SK 14 short**

**SK 15**

**K 22**

This operating manual has the part-no. 399-0541-000. It is a translation of the original document.



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## UKCA-Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the

manufacturer:                      Köster & Co. GmbH  
Spreeler Weg 32  
58256 Ennepetal  
Germany, North Rhine Westphalia

**Product Type:**                      **stud welder**  
Product Model:                      **ELOTOP 510**  
Serial Number:                      18100475 -

The object of the declaration described above is in conformity with the essential requirements and other relevant requirements of the:

**Supply of Machinery (Safety) Regulations 2008 (S.I. 2008/1597)**

**Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)**

**Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)**

Standards applied:

EN 60204-1 „Safety of machinery - Electrical equipment of machines - Part 1: General requirements“  
EN IEC 60974-1 „Arc welding equipment - Part 1: Welding power sources“  
EN 60974-10 „Arc welding equipment - Part 10: Electromagnetic compatibility (EMC)“

This declaration of conformity loses its validity if the product is converted or modified without consent.

**Authorized person for compiling the relevant technical documentation**

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Ennepetal, 01.01.2023      Dr. Torben Schmitz, Managing Director



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## Original-EG-Konformitätserklärung

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der

Hersteller: Köster & Co. GmbH  
Spreeler Weg 32  
D-58256 Ennepetal

**Bezeichnung der Maschine:** Bolzenschweißgerät  
Serien- / Typenbezeichnung: Reihe ELOTOP 510  
Seriennummer: 18100475 -

Der oben beschriebene Gegenstand der Erklärung erfüllt die einschlägigen Harmonisierungsrechtsvorschriften der Union:

<b>2006/42/EG</b>	Maschinenrichtlinie
<b>2014/30/EU</b>	Elektromagnetische Verträglichkeit (EMV-Richtlinie)
<b>2011/65/EU</b>	Beschränkung der Verwendung bestimmter gefährlicher Stoffe (RoHS-Richtlinie)

Harmonisierte Normen, die zugrunde gelegt wurden:

EN 60 204-1 „Elektrische Ausrüstung von Maschinen“  
EN 60 974-1 „Sicherheitsanforderungen für Einrichtungen zum Lichtbogenschweißen“  
EN 60 974-10 „Elektromagnetische Verträglichkeit (EMV), Produktnorm für Lichtbogenschweißeinrichtungen“

Sonstige technische Spezifikationen, die angewendet wurden:  
DGUV Vorschrift 1

Diese Konformitätserklärung verliert ihre Gültigkeit, wenn das Produkt ohne Zustimmung umgebaut oder verändert wird.

### Bevollmächtigter für die Zusammenstellung der relevanten technischen Unterlagen

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Ennepetal, 01.01.2023     Dr. Torben Schmitz, Geschäftsführer



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# 1 Introduction

Dear User,

With the KÖCO Stud Welding Equipment ELOTOP 510 you have purchased an appliance of superior quality. It has been constructed according to latest technical principles and complies with all technical regulations and requirements in force at the time of delivery. To achieve trouble-free operation at all times we recommend that you observe the following instructions:

- Before starting-up carefully read through the complete manual and make sure that anyone on your staff handling or operating the appliance has also read and understood the instructions.
- The safety instructions must be followed at all times.
- Store this manual in a safe place, with easy access for anyone operating the appliance.
- The appliance may only be operated by sufficiently qualified personnel.
- Secure the machine against use by unauthorized persons.
- Have a trained electrician inspect the mains connection for correct fusing and earthing.
- If any malfunctions occur which you cannot remedy yourself, call our after-sales service.
- In case of accidents call for proper medical help, and if necessary, notify accident insurers and/or local trade supervision authorities.

## 1.1 Information for the User

This manual for your KÖCO stud welding equipment ELOTOP 510 and the stud welding gun system CLASSIC contains all instructions, necessary for safe operation of the equipment during stud welding, and for the assessment of welding results. All information supplied is given to the best of our knowledge, but without accepting any liability on our part. In particular, we cannot accept any responsibility for welding suitability of workpieces, nor for the suitability of the stud welding process for certain applications. In all of these cases responsibility for welding results rests with the user.

We shall be glad to assist you with any questions you may have concerning particular applications or remedies for malfunctions. Any suggestions on your part towards improving this operating manual will also be welcome.

## 1.2 Safety Instructions

The KÖCO stud welding equipment ELOTOP 510 and the stud welding gun system CLASSIC is designed for use in drawn-arc stud welding only. It must not be used for any other purpose. In particular, welding under water is strictly prohibited, nor is it permissible under any circumstances to use the appliance for thawing up frozen water pipes.

### 1.2.1 Personal Safety

ELOTOP stud welding equipment and the stud welding gun system CLASSIC are approved for welding under increased electrically hazardous conditions, according to EN 60974-1. For his own safety, the operator must wear protective clothing during welding, which includes the following:

- Dry, insulating shoes
- Non-flammable, dry (free of inflammable substance), close-fitting working clothes (leather apron)
- Leather gloves
- Safety goggles with an adequate degree of protection
- A special helmet with neck protection while engaged in overhead welding
- No metallic jewellery (rings, chains, etc.) nor watches may be worn during welding.

- 
- During the welding process, persons wearing heart pace-makers must be kept at a safe distance from the appliance and the welding cables, because the strong magnetic fields could endanger their lives.
  - In addition to the above, all normal accident prevention regulations must be observed.

### 1.2.2 Operational Safety of the Equipment

- **For the mains connection only a suitable mains plug or a fixed mains connection may be used.** The installation of a fixed mains connection (including fitting of the mains plug) may only be carried out by a trained electrician.
- **All cable insulation must be in perfect condition.** Cables with defective insulation must be replaced immediately. Welding cables may carry high currents. At points subject to bending, for example where the cable enters the handle of the welding gun, there is always a risk of the cross-section being gradually reduced due to breakage of individual wires. When subjected to a high pulsed current, a cable thus weakened may suddenly arc over and burn out. This means a risk of burns to the operator, and of inflammable objects nearby being ignited.
- **All parts of the housing must be firmly attached.** Operation with an open housing is not permissible, because then there is no protection against touching live parts, and effective ventilation is also prevented.
- **The insulating legs must be in perfect condition.** If these legs are removed in order to install the equipment in a fixed position, alternative insulation must be provided between the workpiece and the housing. If an electric connection between the workpiece and the housing exists during welding, this may, in case of malfunction, destroy the protective earth-line of the equipment.
- **The interior of the appliance must be kept clean.** Especially when working in dusty surroundings, dust will collect on parts of the equipment. Therefore, the housing should be opened at regular intervals (only after first disconnecting the mains plug) and the dust blown out. This is vital in the case of metallic dust, because it can lead to short circuits and thus cause damage to the components. Do not aim the jet of air at any PCB's, but remove the dust from these with a vacuum cleaner.
- **Sufficient cooling.** The cooling air is taken in at the bottom and blown out at the rear side. Provide sufficient facilities of air ventilation. Do not cover the ventilation openings.
- **The welding gun must be in perfect condition.** All connections in the welding circuit must be tight. Make sure that the chuck is firmly seated on the adapter screw and that the stud is firmly seated in the chuck. Otherwise contact scorching may result. Do not operate the gun without rear cap. For adequate protection against welding splashes and smoke the bellows protection must always seal perfectly.
- **Electrical safety:** Before opening the appliance always disconnect it from power supply by pulling out the mains plug, making sure that it is not possible to switch it on unintentionally. Prevent moisture or foreign substances from entering the power source. If this happens, the appliance must immediately be disconnected from the mains power supply. The appliance should also be inspected by a qualified specialist at regular intervals, especially following any malfunction. Make sure that all markings remain visible!

### 1.2.3 Safety When Working

- Do not operate the equipment in areas of fire or explosion danger. Remove all inflammable objects from the surroundings!
- Keep in mind that welding splashes are likely to ignite inflammable objects, for example cleaning rags soaked with oil, grease or solvent, or packing materials, even at several metres' distance!
- In case of doubt check with the security officer in charge and obtain his release before commencing work!
- Make sure that the operating site has sufficient ventilation!
- Do not weld without air extraction on any workpieces which may release substances dangerous to health, such as coating materials, zinc, nickel, chromium or cadmium!



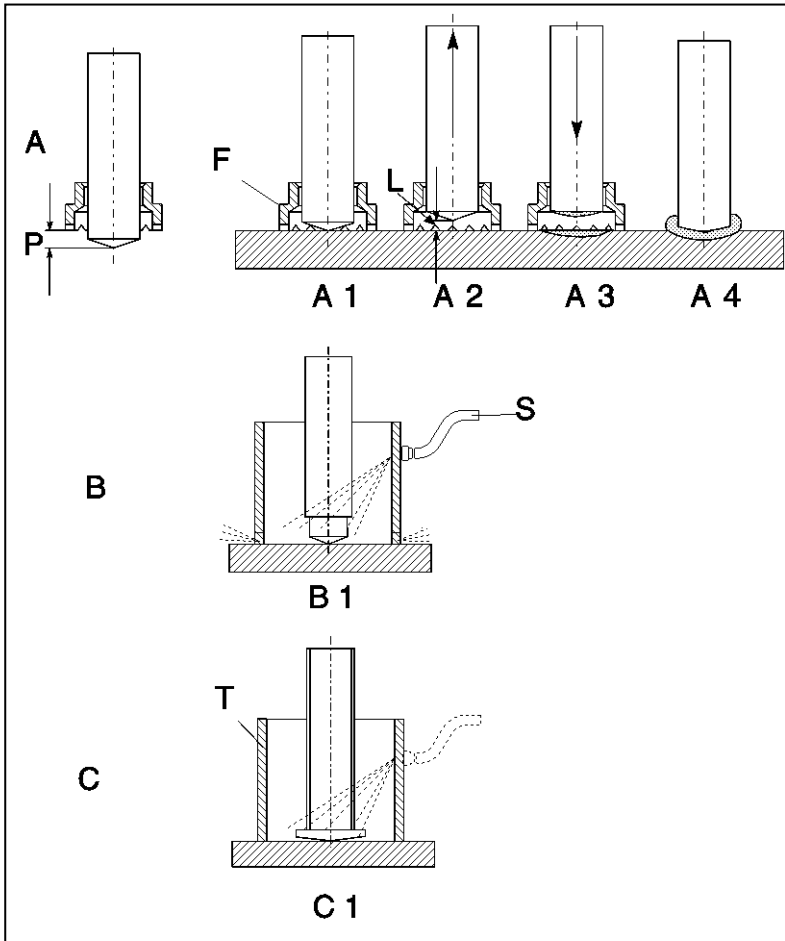
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- Do not carry out welding on hollow objects which contain, or have contained, inflammable liquids or gases, or which are under pressure, or inside which a dangerous level of pressure can be generated by welding heat!
  - The heat generated by welding may lead to the release of gases or vapours which are dangerous to health or even explosive. Specialized knowledge is required for this kind of work. Do not carry out such operations unless you possess the necessary knowledge!
  - Keep at a safe distance from any equipment which might be affected by magnetic fields, such as EDP installations (computers), cards with magnetic strips, or timepieces (wrist-watches).
  - Do not weld on the same workpiece (welding potential) simultaneously with other types of welding machines, especially those working with different poles or frequency (alternating current), or welding equipment with high voltage ignition, because this can adversely affect or damage the control unit of the stud welding appliance.
  - Ensure that a flawless safe welding circuit is generated. The earthing cables should be firmly clamped onto the workpiece. If this is not possible or not desirable, make sure that there are no parts in contact with the welding circuit which can be damaged or destroyed by the welding current, such as crane hooks, anti-friction bearings, clamps with layers of partly insulating material, screws or bolts. Especially dangerous is the destruction of protective conductors in other electric appliances when they come into contact with the welding current.
  - Whenever the appliance must be placed on sloping ground, secure it against tipping over or rolling downhill.
  - For transporting the equipment, use only the parts specially provided for this purpose. The handles of the appliance are also designed for transport by crane.
  - While setting up or adjusting the welding gun, unintentional triggering of the gun pushbutton must be avoided, either by turning off the power switch or by disconnecting the control cable plug from the flange socket on the power source.



## 2 Drawn Arc Stud Welding

Drawn-arc stud welding is used for the welding of metallic parts, generally of cylindrical shape, onto metallic workpieces. For this purpose, a DC power source and a mobile device, the welding gun, are required. Depending on the type of welding-pool protection and welding time range used, the appropriate process may be stud welding with a ceramic ferrule, stud welding with with shielding gas, or short-cycle stud welding, either with or without shielding gas.

The welding procedure is illustrated below:



### Explanation:

A: Stud welding with ceramic ferrule

F: Ceramic Ferrule

P: Protrusion

L: Lift

A 1: The stud contacts the workpiece.

A 2: The stud is lifted off under current flow and thus the arc ignited.

A 3: The drawn arc melts the tip of the stud and the portion of the workpiece directly beneath it. At the end of welding time the stud is pressed (plunged) into the molten part of the workpiece.

A 4: The melt solidifies, resulting in a firm cross-sectional weld. The ceramic ferrule is then removed.

B: Stud welding with shielding gas. (B 1 equivalent to A 1)

S: Shielding gas supply

C: Short-cycle stud welding with or without shielding gas (C 1 equivalent to A 1)

T: Supporting tube

Figure 1: Drawn-arc stud welding procedure



## 2.1 Technical Data on ELOTOP Power Source 510

Technical data	ELOTOP 510
Stud welding with ceramic ferrule, weldable stud range $\varnothing$ (mm)	3 – 8 (M 10r)
Short-cycle stud welding, weldable stud range $\varnothing$ (mm)	3 – 6 (with shielding gas 3 to 8)
Stud welding with shielding gas, weldable stud range $\varnothing$ (mm)	3 - 10
Welding current (A)	400
Stepless time adjustment range (ms)	20 - 460
Max. weld rate in studs/min. for ... stud $\varnothing$ (mm)	15 / 3 4 / 8
Input voltage, three-phase 50/60 Hz (V)	400
Alternative input voltages (V)	Option
Mains plug 400 V (A)	32
Mains cable 4-pole, 400 V (m/mm <sup>2</sup> )	5/2,5
Time-lag fuse for 230/400 V (A)	35/16
Input performance at 400 A welding current (kVA)	29
Max. welding cable length at 70 mm <sup>2</sup> 1)	10 m
Input voltage tolerance (%)	-15/+6
Class of protection	IP 23
Cooling	F
Housing dimensions (L x W x H) mm	375 x 220 x 360
Weight (app. kg)	25

**Operating under increased electrical hazard permissible, CE-labelling according to EN 60974-1**

1) Any extension of mains cables or welding cables will reduce the welding current. The user should therefore investigate which cable lengths still ensure sufficient welding quality.

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## 2.2 The Power Source

The power source consists of a 3-phase transformer, a rectifier, a thyristor module and an electronic control. All ELOTOP power source models can be supplied with alternative nominal voltages.

Operation at undervoltage will lead to reduced welding current. Depending on circumstances, it may be necessary to shorten the extension cables, to ensure satisfactory welding quality. If the input voltage drops below minus 15%, the appliance can no longer be operated.

Especially in case of a weak power supply the load-voltage may drop considerably below the no-load-voltage, Therefore the voltage should be measured during the welding process in case of doubt.

When welding with 400 V input, the primary current is approximately 12% of the welding current.

Example: welding current 450 A = primary current abt. 54 A.

The mains must be capable of supplying the primary current with minimum fluctuation to voltage. Since the flow of current is only short (max. 460 msec) mains fuses of considerably reduced rating may be used, provided, of course, that they operate with sufficient time-lag. Quick acting fuses (including safety cut-out switches) may prevent operation of the appliance.

Fuses with lower ratings than indicated under table 2.1 may be used if less than the full capacity of the power source is required in operation.

An overvoltage of 15% should not be exceeded, since otherwise iron losses in the transformer will cause overheating.

## 2.3 The Welding Gun

In drawn-arc stud welding the welding gun is used to generate the arc between stud and workpiece, and to unite the two welding pools at the end of welding time.

There is a choice of two different concepts. The gun **K 22** has an automatic length adjustment facility, i.e. maintenance of the pre-selected lift is guaranteed independent of protrusion, variation of stud lengths within normal tolerance and minor deviations from the vertical position of studs in relation to the workpiece. However, in case of very short welding cycles (below 100 ms) the necessary coupling does not react fast enough. Therefore we recommend the **SK 14 and SK 15** guns without length adjustment especially for short-cycle stud welding. It should be used for studs with only very minor variations in length and where there are no changes in the positioning of the gun.

The gun SK 14-ISO is different from the gun SK 14 as there is no adjustable lift stop. That is why the total piston stroke of app. 4 mm is permanently available. The gun SK 14-ISO is recommended for welding insulation pins (see figure 24). The SK 14-short

In stud welding, lift and protrusion are important parameters. In most cases they can be selected to fit stud diameters, according to chart 3. The position of the weld or the type of surface on the workpiece may necessitate some adjustments. In such cases, optimal settings should be obtained through test welds.

The length of lift is the vital factor in determining the form of metal melting at the tip of the stud. In case of major deviation from optimal values, cavities may form in the welding pool. Moreover, if the lift is too small, an increase in the number of droplet short circuits will destabilize the welding process. The protrusion (see figure 4) will determine the form of the welding collar around the welded stud. In some cases, especially when welding onto a vertical wall, settings other than those listed may be selected. If the plunge is too shallow, this will lead to pores and undercuts in the weld zone. If it is too deep, the welding pool will splash out to the side or upwards with the risk of blockage to the downward movement of the stud. The setting of protrusion is described in Section 3.2.9.



## 2.4 Technical Data on KOCO Stud Welding Guns

Technical Data	SK 14 (short)	SK 14-ISO	SK 15	K 22
Stud welding with ceramic ferrule Weldable stud range Ø (mm)	4 - 12	4 - 12	4 - 12	4 - 14
Short cycle stud welding Weldable stud range Ø (mm)	3 - 12	3 - 12	3 - 12	6 - 12
Stud welding with shielding gas Weldable stud range Ø (mm)	3 - 12	3 - 12	3 - 12	3 - 16
Adjustable hydraulic damping of piston, for studs from abt. 14 mm Ø	–	–	–	○
Lifting ring system with length adjustment	–	–	–	●
Adjustment of stud length variations up to ... (mm)	–	–	–	8
Standard support by ... legs	2	2	2	2
Lifting range from...to (mm)	0 – 4.5	-	-	1 – 4.5
Input voltage of lifting coil (V=)	60 - 90	60 - 90	60 - 90	60 - 90
Welding cable (m/mm <sup>2</sup> )	5/35	5/35	5/35	2/50
Welding cable plug (mm <sup>2</sup> )	35	35	35	50/70
Control cable plug 4-pole	●	●	●	●
Control cable (m/mm <sup>2</sup> )	5/4x1,0	5/4x1,0	5/4x1,0	2/4x1,0
Length (excluding chuck) (mm)	190 (165)	190	205	175
Body diam. app. (mm)	50	50	50	60
Height (including handle) (mm)	150	150	150	165
Weight (excluding connection cables) app. (kg)	0.9	0.9	1.0	1.3

● = Standard      ○ = optional    – = not available

## 2.5 Setting Guidelines for stud welding

The settings given in chart 3 have been tested for welds on **clean metallic surfaces** and standard type studs in **downhand position (PA)**. Under different conditions (other welding position, or oily, scaly or primer-coated surfaces) the optimal settings must be determined by test welds. With coated surfaces, it may be necessary to considerably increase lift and welding time. How to set the guns SK 14 and K 22 can be found in chapter 3.2.

**Chart 3: Recommended settings for typical welding studs**

Type of stud and dimension	Welding time	Lift	Protrusion K 22	Weld pool protection
Insulation pin 3 mm Ø	30	1.5	2-3	No protection
Threaded stud M 4 with flange	20	1.5	2	No protection
Threaded stud M 5 with flange	30 / 40	1.5	2	Without / with shielding gas
Threaded stud M 6 with flange	60 / 60	1.5	2	Without / with shielding gas
Threaded stud M 8 with flange	100 / 120	1.5	2	Without / with shielding gas
Threaded stud M 6 (Typ D)	90	1.5	2	Ceramic ferrule
Threaded stud M 8 (Typ R)	90	1.5	3	Ceramic ferrule
Threaded stud M 8 (Typ P)	130	1.5	3	Ceramic ferrule
Threaded stud M 8 (Typ D)	150	1.5 - 2	3	Ceramic ferrule
Threaded stud M 10 (Typ P)	350	1.5 - 2	3	Ceramic ferrule

Before starting a series of welds, test welds according to EN ISO 14555 should be carried out. For details refer to DVS-Technical bulletins 0902 and 0904.

## 2.6 Material requirements

### General remarks

In principle, all materials suitable for fusion welding are also suitable for drawn arc stud welding. However, for some sensitive varieties of steel there is a certain risk that they may harden and become brittle by the quick heating and cooling processes involved. If two different materials are welded together (for example carbon steel with stainless steel) a new alloy will result which may be resistant to further shaping. Because of the short welding time, clean surfaces are essential for good welding results. For further details refer to Literature (see section 13). So-called "free cutting" steels are generally not suitable for stud welding. In practice, combinations according to chart 4 have proved satisfactory.

Chart 4: Recommended material combinations for drawn arc stud welding

Stud material	Parent metals	
		Non-alloy steels up to app. 0,24% C, for example S235, S355, 16Mo3
Non-alloy steels up to app. 0,18% C, e.g. S235, 4.8, 16Mo3	Highly suitable, including for force transfer	For stud welding with ceramic ferrule only limited suitability for force transfer For short cycle stud welding well suited
Stainless Austenite steels, such as 1.4301, 1.4401, 1.4541, 1.4571	For stud welding with ceramic ferrule only limited suitability for force transfer well suited for up to 12 mm Ø with shielding gas For short cycle stud welding well suited	Highly suitable, including for force transfer <sup>1)</sup>

1) In fully Austenite steels attention should be paid to the relatively high risk of hot cracks.

In addition to the material combinations listed above, heat- and scale-resistant studs may also be welded, in special cases also aluminium studs. For material combinations not previously tested, welding suitability must be determined through appropriate test welds. (For further details, refer to section 13, Literature).

## 3 Working with the stud welding equipment

### 3.1 Requirements before starting-up

1. Ensure adequate power supply, according to instructions under section 2.2.
2. The power connection must be earthed according to regulations.
3. The housing of the welding power source must not have any electrical contact with the workpiece. Make sure that the insulating supporting legs are in perfect condition!
4. Make sure that the welding power source is standing firm in a vibration-free, dry area!
5. Make sure that there is sufficient cooling! The circulation of air must not be restricted in any way.
6. Operating the equipment in a fire or explosion danger area is prohibited. In case of doubt obtain a release for the welding operation from the security officer in charge.
7. Keep a safe distance from any objects which may be affected by strong magnetic fields, such as EDP installations! Make sure that persons wearing a heart pace-maker do not come close to the welding cables!
8. Shielding gas bottles must be secured against falling over.

### 3.2 Starting-up of the welding gun

1. While setting up or adjusting the welding gun, unintentional triggering of the gun pushbutton must be avoided, either by turning off the power switch or by disconnecting the control cable plug from the flange socket on the power source.
2. Screw the desired chuck on to the adapter screw of the gun, slightly tightening it with an Allan key.
3. Using the counter-sink screws and washers supplied, attach the two legs to the desired footplate. Initially, do not tighten the screws.
4. Insert the desired ceramic ferrule grip (when welding with a ceramic ferrule) or the supporting tube (in case of short cycle welding or welding with shielding gas) into the footpiece, pushing it to the stop. Secure the ceramic ferrule grip or the supporting tube with the screws at the sides of the footplate.
5. Insert a suitable stud into the chuck, pushing it up to the stop.
6. Slide the footplate with the legs in the clamping guides of the gun, so that the tip of the stud reaches approximately the same height as the ceramic ferrule grip or the supporting tube.
7. Move the footpiece until the stud is centrally seated in the bore of the ceramic ferrule grip or the supporting tube (see figure 2). Then tighten the counter-sink screws of the footplate.

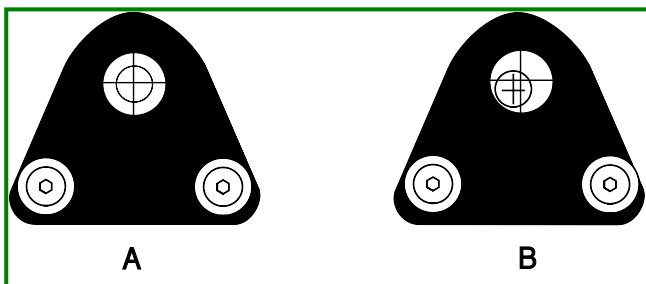


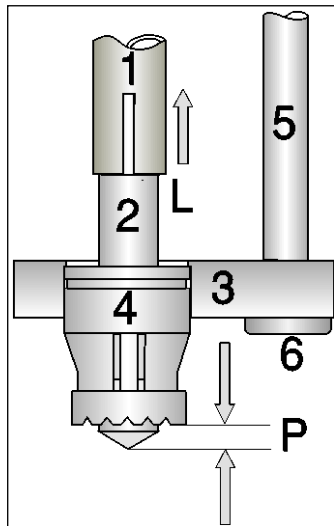
Figure 2: Centering of the footplate

#### Explanation:

A: Correct centering of the footplate

B: Inaccurate centering of the footplate will cause blockage of the plunging movement of the stud.

8. **Only when welding with a ceramic ferrule:** Place a suitable ceramic ferrule into its grip. Check the centering of the footpiece by manually pulling back the piston of the gun and then slowly releasing it again. The stud should then move forward without pushing the ceramic ferrule out of its guide. If the ceramic ferrule is pushed out, loosen the footpiece and improve its centering.
9. Slide the footpiece with the legs in the damping guides until the correct protrusion is reached, see chart 3. Figure 3 shows a diagram of the supporting device.

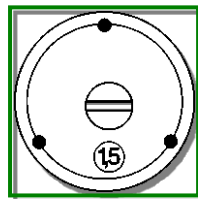


Explanation:

- 1: Chuck
- 2: Stud
- 3: Footplate
- 4: Ferrule grip
- 5: Leg
- 6: Screw
- L: Lift
- P: Protrusion

**Figure 3: Diagram of the gun setup**

10. **Setting of the lift (except series SK 14):** Open the rear cap of the gun. Behind it there is an adapter screw for adjusting the lift in steps of 0.5 mm. (figure 4). **Do not set any in-between values!** Select lift settings according to chart 3.



**Figure 4: Selecting the lift (except SK 14)**

11. **Setting of the lift (only SK 14):** A set screw with a view box is mounted on the rear of the gun (fig.5). The figure displayed in the view box is a measuring quantity for calculating the piston stroke. The piston stroke is always 1 mm more than the figure displayed. This ensures that even if the minimum of 1 mm is set, a lift can still be carried out as long as the protrusion is not set too high. The SK 14 gun has a rigid piston; therefore the figure shown in the view box is equal to the lift only if the protrusion is set at exactly 1 mm. The actual lift



---

(length of the drawn arc) must therefore be calculated as follows:

$$\text{Lift} = \text{value displayed} + 1 \text{ mm} - \text{protrusion}$$

The lift can only be adjusted in 0.5 mm steps. **Do not try to set any intermediate values!** Follow the instructions according to chart 3 when setting the lift.



**Figure 5: Setting of the lift (SK 14, SK 14 short and SK 15)**



---

### 3.3 Starting-up of the Power Source

1. Insert the mains plug into the socket and lock it into position using the lock ring (if available).
2. Connect the ground cable to the ground socket of the welding power source and the workpiece. The connection points on the workpiece must be bright metal. Lock the welding cable plugs by turning them to the right (clockwise) to the stop
3. Connect the welding and control cables of the welding gun to the corresponding sockets of the power source, using a welding cable extension if necessary. Lock the welding cable plugs by turning them to the right (clockwise) to the stop.

**Note:** In most cases, the stud is connected to the minus pole and the workpiece to the plus pole. In certain cases, especially when welding non-ferrous metals, reversed polarity may improve the welding results. The power source is suitable for welding with either polarity.

4. Switch on the welding power source at its power switch. The green pilot lamp will light up and the fan will start to operate.

### 3.4 Selecting of settings

The welding time is selected using the arrow keys between 20 and 460 ms. The last displayed time is stored after switching off.

The shielding gas operation is switched on or off using the "Gas" button. The LED located above the "Gas" button indicates the switching status. The switching state is, as well as the selected welding time, stored when the power is turned off.

### 3.5 Welding

Place the prepared gun on the workpiece so that the whole base of the ceramic ferrule or supporting tube touches the surface of the workpiece. In so doing, the piston is pushed back by the length of the protrusion, and the tension spring is tightened.

Now press the trigger, holding the gun completely still during welding, until the welding pool has cooled down.

Then lift off the gun from the welded stud, keeping it straight (i.e. in the axial direction of the stud) and turning it clockwise. If it is not lifted off straight, this may open out the gripping jaws of the chuck and prevent a sufficiently tight grip on the next stud to be welded, or the chuck can get loose from the adaptor screw.

Next, check the weld (by visual test and possibly other tests according to EN ISO 14555) and adjust the settings if necessary.

Test welds should always be carried out prior to starting a series of welds.

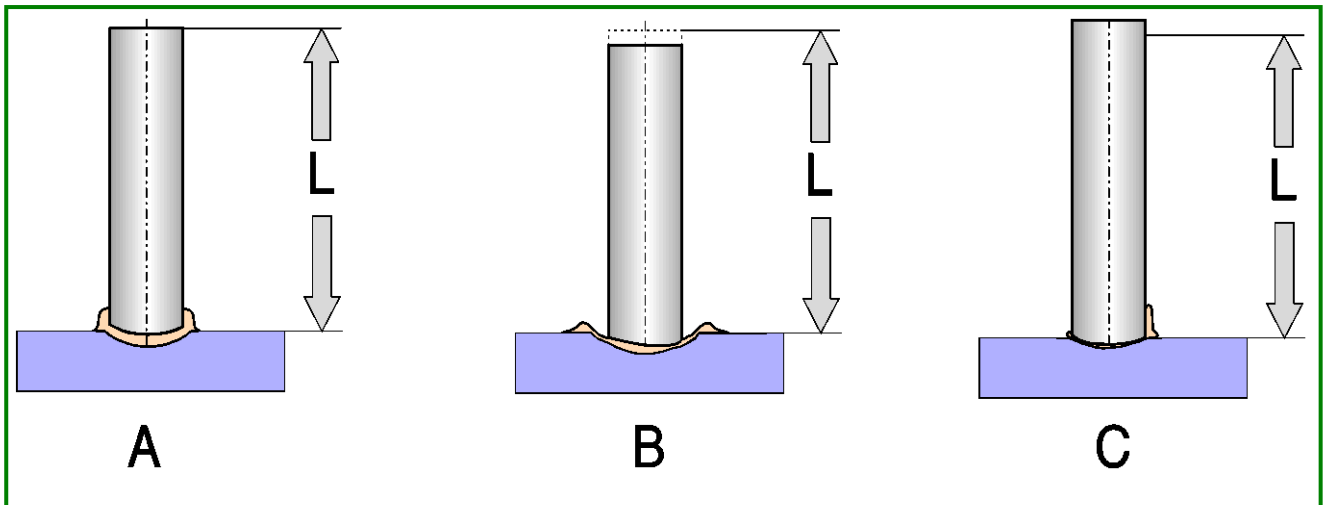
### 3.6 Weld Testing

For testing a stud weld, there are several different methods available:

#### 1. Visual test:

A good weld will have an closed, even weld collar with a shiny blue-gray surface, not dull or porous. This applies only for welds with ceramic ferrule or under shielding gas.

The welded stud will have its nominal length  $\pm 1$  mm.

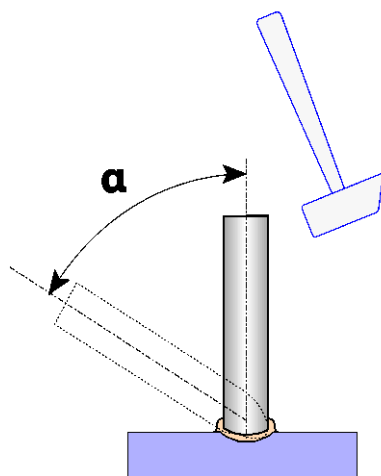


**Figure 6: Assessment of visual examination**

Explanation: Nominal length of stud  
 A: Good weld  
 B: Energy too high  
 C: Energy too low

A frequent fault is a so-called plunging impediment. It occurs whenever the plunging movement of the stud is cut short and the stud comes to a halt above the welding pool (see chart 5, figure 4). In case of only a minor impediment the plunging of the stud may not be stopped, but delayed. In this case a "cold weld" with an incomplete connection may result, without any faults showing on the outside (see chart 5 figure 5). Therefore the final assessment of a weld should never be made on the basis of visual tests alone, without mechanical tests being carried out as well.

**2. Bend test:** A flawless weld will withstand bending by an angle of up to 60° without any cracks in the welding zone. This does not apply for studs designed for heat transfer (made from heat-resistant steel) and for studs with non-uniform cross section. The bend test is carried out to check the suitability of both the selected settings and the combination of materials welded together.

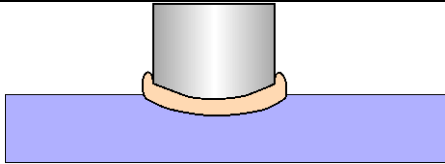
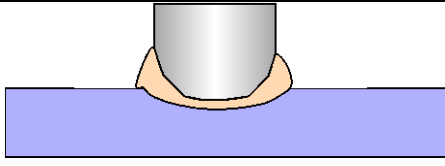
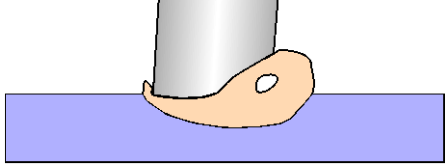
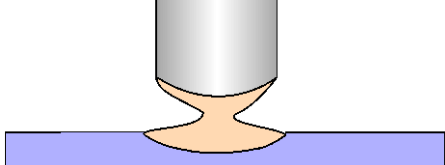
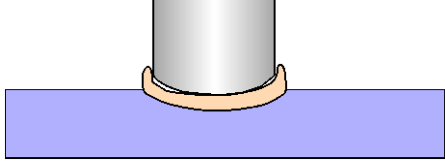


Bending by  $\alpha = 60^\circ$  with a hammer or an affixed pipe (for leverage). Result satisfactory, if the welding zone or the heat affected zone shows no cracks or breakages.

**Figure 7: Carrying out a bend test**

Chart 5 illustrates the assessment of welding results.

**Chart 5: Assessment of stud welds**

Appearance	Remarks
	Good weld with ceramic ferrule
	Good weld with shielding gas
	Lopsided melting because of arc-blow effect. This can be remedied by adjusting the earth clamps, by providing compensating masses at the rim, or by turning the gun (if the welding cable is on the outside). A large lift and welding without ceramic ferrule will increase the blowing effect.
	Impediment to the plunging of the stud. Possible causes: 1. Friction between stud and ceramic ferrule due to inaccurate centering of the footplate or welding splashes (energy too high) 2. Droplet short-circuits between the stud and the workpiece due to too low lift setting 3. Defective gun or damping set too high.
	Impediment to the plunging of the stud (cold plunging). The fault can only be recognized by mechanical testing; If bent only by a small angle, the stud will break off at the welding zone. At the edge of the stud and the welding zone blank spots are visible (lack of fusion). Possible causes: As given above
Further details about testing and assessment of stud welds are available from Literature, chapter 13.	

### 3.7 Maintenance of the Welding Power Source

Prior to any maintenance operation, the mains plug must be disconnected. In case of a fixed connection the voltage must be cut off, and the cut-off switch secured against unintentional switching on. The housing must not be opened unless the voltage is cut off.

Especially when working in a dusty environment, a layer of dust may accumulate on component parts, which may hinder the cooling process and thus cause overheating inside the appliance. Moreover it reduces the resistance of insulating materials and, in connection with moisture, may lead to malfunction of the controls. Therefore the housing should be opened at regular intervals to blow out the dust. This is especially important in the case of metallic dust, which may lead to short-circuiting and damage to components. Do not aim the jet of air at pc boards, but remove the dust from these with a vacuum cleaner.

The power source must not be cleaned with a water jet (e.g. high pressure cleaning appliance). Do not use any detergents containing solvents, as these may destroy the coating or plastic components of the appliance.

There must not be any electrical connection between the metal housing of the power source and an earthed



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workpiece. Therefore make sure that the insulating legs are in perfect condition if the ground has any conducting connection with the workpiece.

### **3.8 Maintenance of the Welding Gun**

The welding gun is an electrical tool which must be kept perfectly insulated. In case of any damage to its body or cables, welding must be discontinued at once. Do not use water jets or solvents for cleaning. Protect the gun against moisture. Should it ever become wet, it must be well dried before being used again.

Chucks, ceramic ferrule grips, footpieces, etc. are expendable parts and must be replaced after high melting loss (scorching). For optimal current transmission the chuck must have sufficient gripping strength. If, in spite of being tightened, the jaws no longer have sufficient grip, the chuck must be replaced. Scorching marks on the thread tips in threaded studs are a sign of insufficient gripping strength.

The rear cap of the gun K 22 may only be removed for setting the lift. Above all, welding must never take place without the rear cap. The domed cap nut serves to fasten the lifting solenoid und must not be loosened by the operator.

Keep in mind that the stud, chuck and adapter screw are all subject to welding voltage in relation to the workpiece. Therefore, during the entire welding process, keep a safe distance from parts of the workpiece where no welding is intended, and from studs already welded.

### **3.9 Maintenance of Welding and Control Cables**

The insulation of all cables, plugs and sockets must be kept in perfect condition. Because of the strong currents involved, all connections in the welding circuit must be tight; otherwise there is a risk of scorching. All points where cables are frequently moved, for example cable entry points, are special danger areas. There, the cross-section may be reduced through breakage of individual wires, which may lead to the remainder of the wires breaking as well and suddenly arcing over. Therefore always check cables and replace faulty parts before starting work.

Protect cables, especially connection points, against moisture. Do not clean cables with water jets or solvents.

### **3.10 Calibration**

Stud welding equipment, which is used in the legally regulated area, e.g. in construction, or for work in which quality requirements according to ISO 3834-2 are agreed, must be calibrated at fixed intervals. In general, the calibration interval is 1 year. More details can be found in DVS code of practice 3009 and in DVS Guideline 0714. After repairs that replace components that affect the amount of welding current, the length of welding time or the lift of the gun, recalibration is required in any case.



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### 3.11 Shutting-Down

After termination of welding the power switch must first be turned off. In case of interruption for any length of time, the appliance should also be disconnected from the mains (i.e. by pulling out the plug). Never use the mains plug in lieu of a switch, i.e. before disconnecting it, the power switch must be turned off first.

### 3.12 Waste Disposal

Your KÖCO stud welding equipment contains valuable materials and must therefore not be disposed of together with household waste or by any other uncontrolled method.

We are registered with the “Stiftung Elektro-Altgeräte Register ® (EAR)” (Registry of Disused Electrical Appliances Foundation) under the registration number

**WEEE-Reg.-Nr. DE 70903619**

and will take back any appliance delivered by us from 2005 onwards free of charge for correct disposal in compliance with the relevant legislation, if such appliances are delivered to us carriage free.

## 4 Remedies for Malfunctions

### 4.1 Error signals at the Power Source

The following errors are indicated at the front panel of the power source:

- 4.1.1 “E01”: Excessive current or short circuit in the control cable
- 4.1.2 “E02”: Over heating: The yellow LED below the green LED lights up. Keep the power source switched on (fan operating) to minimize cooling time. Welding may be resumed as soon as the yellow LED has turned itself off.
- 4.1.3 “E03”: Failure of one phase: In addition to the green LED, the red LED below the yellow LED lights up.
- 4.1.4 Lack of mains voltage supply: The green LED is not lit up. Check the mains fuses, mains cable, mains plug for damages (to be carried out only by a qualified specialist!)

### 4.2 Other Malfunctions

In the following chart, some malfunctions are described which can be recognized and remedied by qualified personnel with relative ease. In case you cannot solve these problems yourself, please contact our agent in your neighbourhood or our customer service department. It is important that you give us details of the type and series number of your appliance, as well as an exact description of the malfunction.

Malfunction	Cause	Remedy
Piston of the gun does not react to triggering.	Faulty connection in the control cable to the gun	First connect the gun directly to the power source and trigger it once more. If the malfunction does not occur again, the fault is in the control cable extension. If the malfunction occurs again: Check the gun with an Ohm-Meter. Normal resistance of the coil is app. 20 Ω. (SK 14 app. 38 Ω). The magnet is connected to points 1 and 2, the trigger to 3 and 4 (standard) or to 2 and 3 (special model). If the fault is still not remedied, the plug and socket connections should be checked next.
	The piston of the gun has got stuck.	Try to move the piston by hand. There must not be any unusual friction. In the K 22 to K 26 guns the total range of piston movement is app. 15 mm, in the SK 14 app. 5 mm
	Magnetic coil under continuous current	Turn off the power source, then switch it back on, watching the piston of the gun (Do not trigger it). The piston must remain still. If the magnet attracts it immediately, there is a defect in the control. Note: the magnetic coil will burn out if kept continuously under current even for a short time!



<b>Malfunction</b>	<b>Cause</b>	<b>Remedy</b>
Faulty welding result in spite of correctly set welding parameters	Surface of the workpiece oily, greasy, rusty, zinc-coated or painted, etc.	Clean the surface of the workpiece in the welding area and at the ground connection points. The best results are obtained on bright metal surfaces. On zinc-coated parts, only welding without ceramic ferrule (short cycle stud welding) will produce satisfactory results.
	Mains or welding circuit voltage too low	Make sure that permissible cable length and correct diameter are chosen.
Welding results unreliable (sometimes good, sometimes bad)	Function of gun irregular	After operating the gun for a longer period, time deviations in the lift will increase. Generally, it will be below the selected setting. This means an increase in the number of droplet short-circuits and splashes. Because of the lower voltage in the arc, the energy remains below the desired level. Have the gun repaired by our customer service.
	Arc blow due to complex geometry of the workpiece	For details about measures to reduce the blowing effect refer to section 13 (literature).
	Lift (arc length) too small	Increase lift (arc length) to obtain less droplet short circuits and smoother welding process.
Welding time is cut short when the trigger button is released during welding	When connecting the control cable, the positions of two lines (No. 2 and No. 3) were reversed.	Connect cables correctly. Please note: When the trigger button is held down throughout welding time, this malfunction will not occur, however the trigger will be subjected to considerable electrical strain. If the trigger button is released during welding, this will immediately interrupt the welding process. When cables are correctly connected, the welding process will not be influenced by how long the trigger is held (provided it is held for at least app. 0.5 sec.)
Ignition failure during piston lift-off	Interruption of the pilot arc through inadequate contact with the tip of the stud	Make sure that the tip of the stud is in direct contact with the workpiece. This kind of malfunction frequently occurs during welding of headed studs with grain marks, whenever there is insufficient contact between the aluminium tip and the workpiece.
Unusually early power source cut-out because of overheating	Fan does not function.	Check Fuse F3.
Unusually strong heating up at some points of the welding circuit	Reduction of cross-section through partial wire breakage, scorching at loose connections	Stop welding immediately! Replace cables!  Tighten all connections within the welding circuit!



## 5 Pictures of the Power Sources ELOTOP

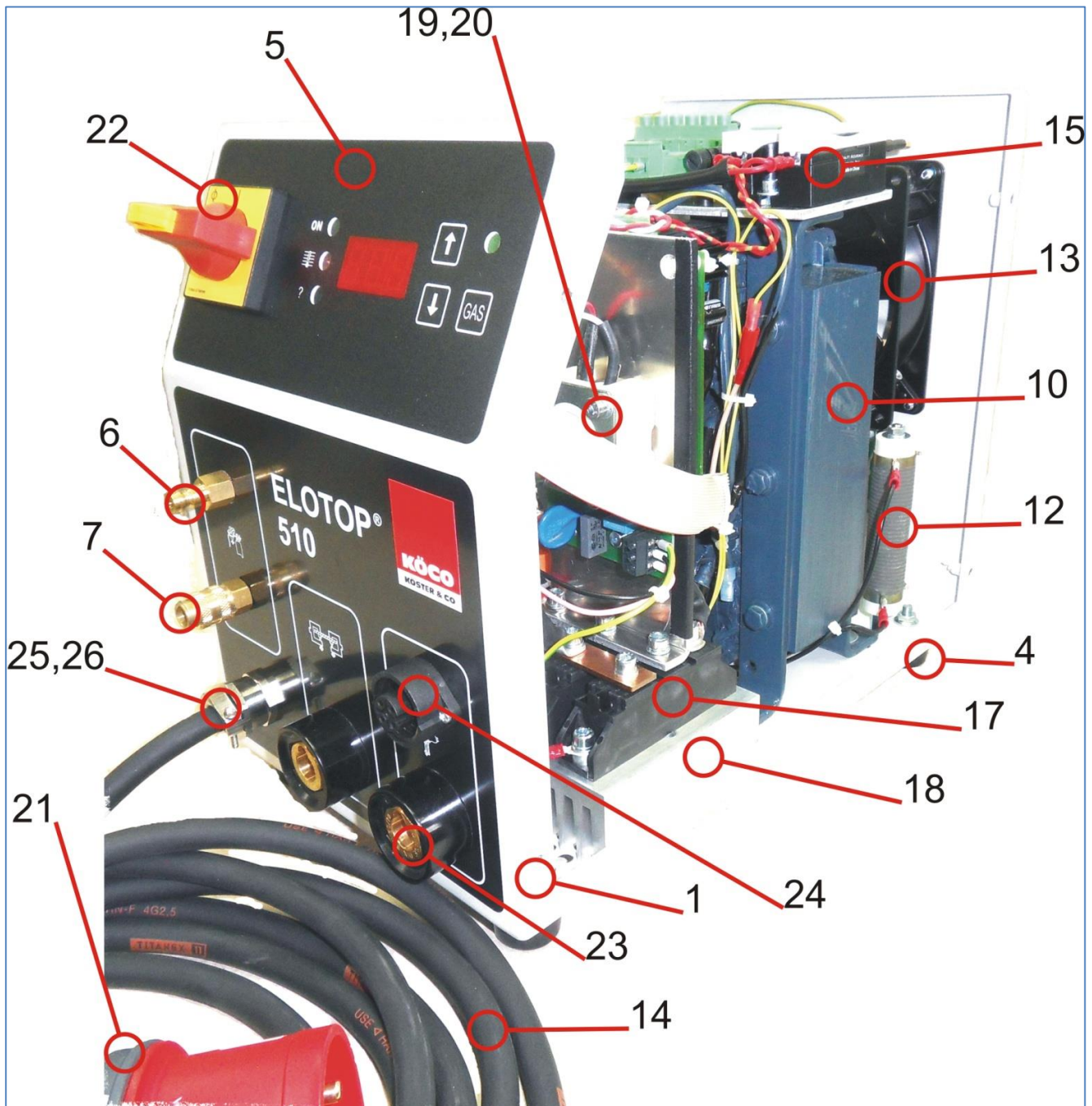


Figure 8: Front view ELOTOP 510

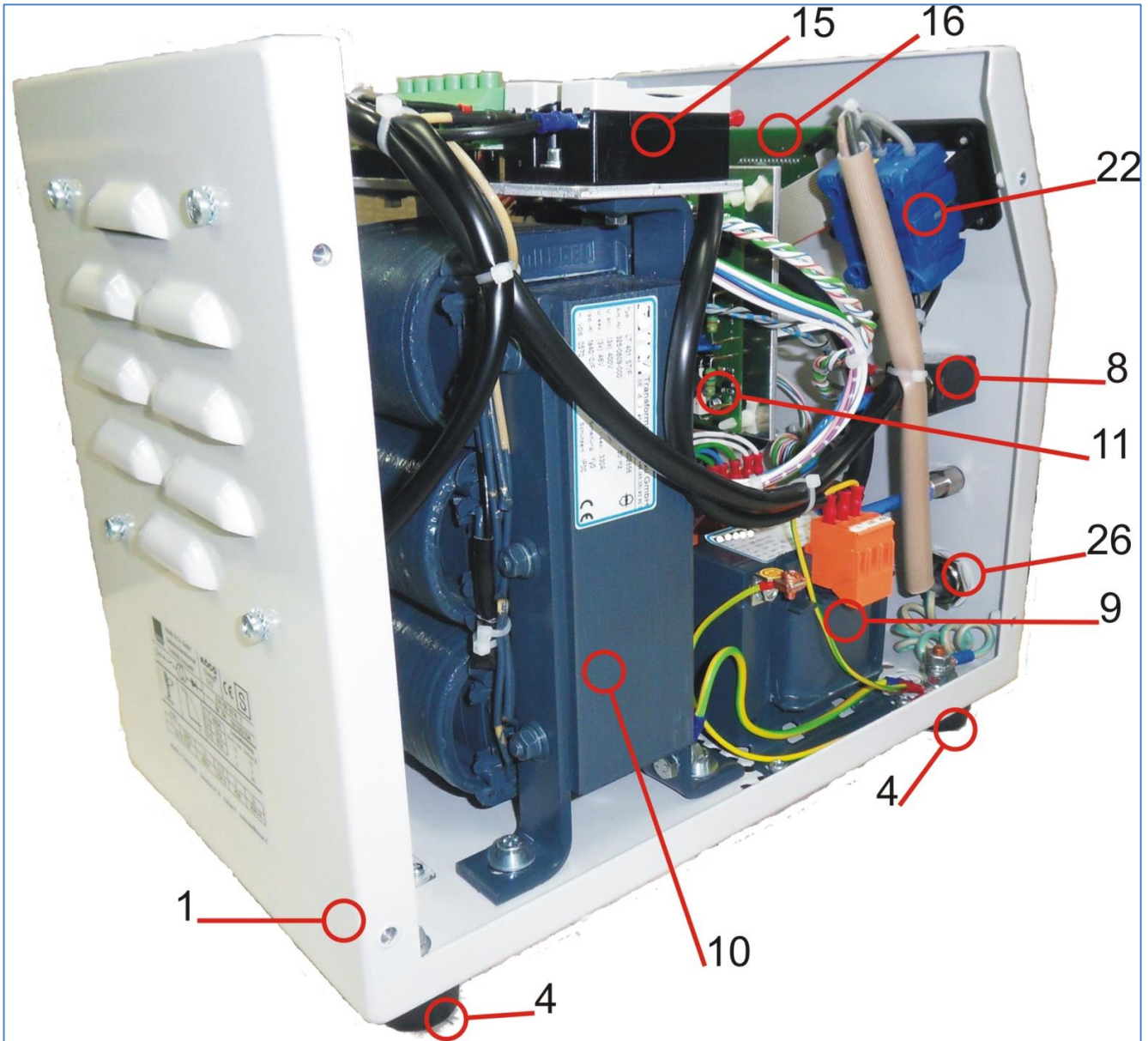


Figure 9: Rear view of ELOTOP 510

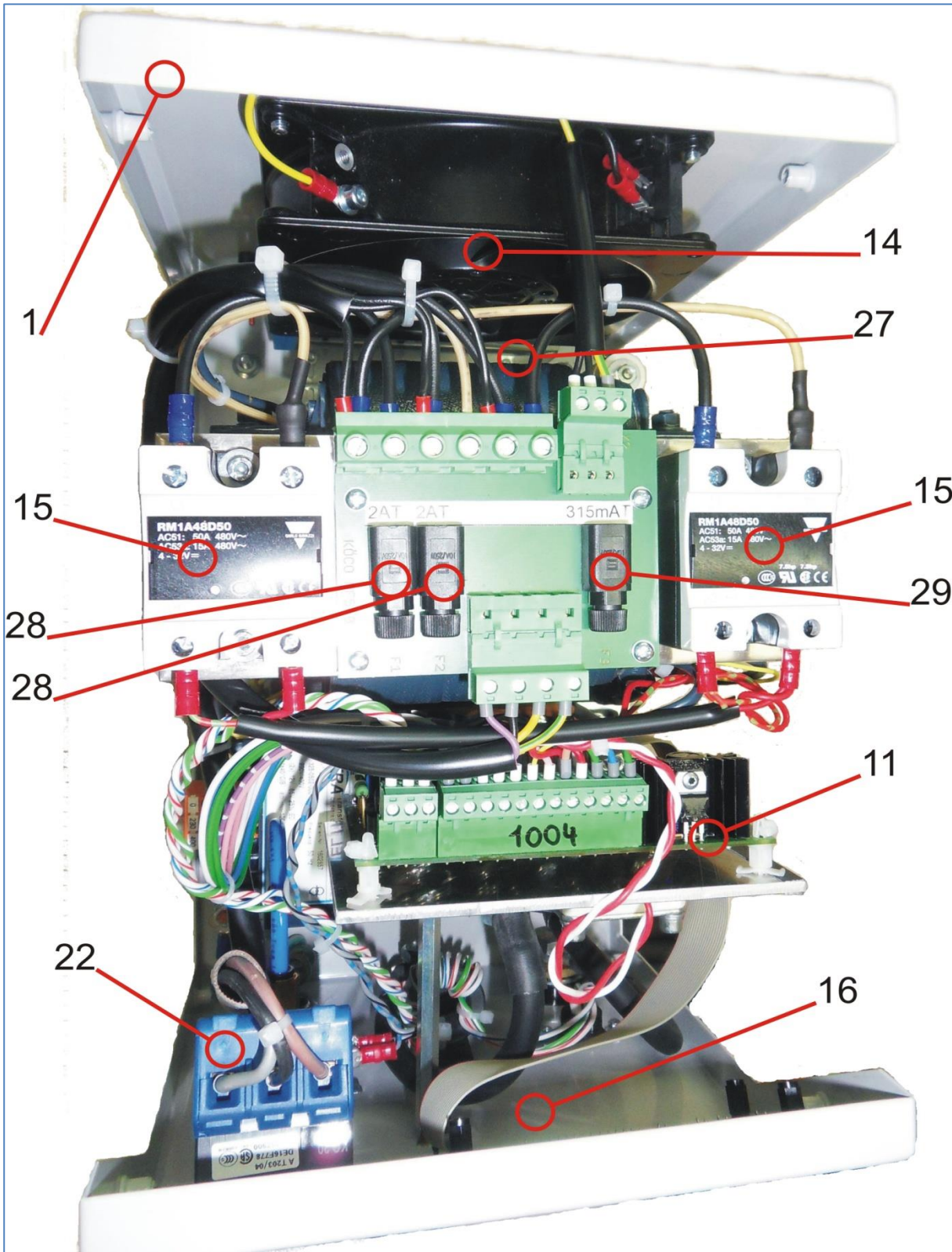


Figure 10: View from above



## 6 Spare Parts for Welding Power Source ELOTOP 510(-ISO)

Pos.	Designation	Part No.		
		230 V	400 V	460 V
1	Frame	320-0800-000	320-0800-000	320-0800-000
2	Handle	320-0050-000	320-0050-000	320-0050-000
3	Hood	320-0801-000	320-0801-000	320-0801-000
4	Plastic leg	320-0263-000	320-0263-000	320-0263-000
5	Front foil	399-0040-000	399-0040-000	399-0040-000
6	Shielding gas connection plug (to pressure	323-0029-000	323-0029-000	323-0029-000
7	Shielding gas connection socket (to gun)	323-0016-000	323-0016-000	323-0016-000
8	Magnetic valve for shielding gas (without fit-	323-6001-000	323-6001-000	323-6001-000
9	Control transformer	325-0502-000	325-0502-000	325-0575-000
10	Power transformer	325-0610-000	325-0609-000	325-0612-000
11	Control board	330-5326-000	330-5326-000	330-5326-000
12	Pilot arc resistor	325-0005-000	325-0005-000	325-0005-000
13	Fan	325-0531-000	325-0531-000	325-0531-000
14	Mains cable	317-5085-000	317-5084-000	317-5084-000
15	Solid state relay	325-0600-000	325-0001-000	325-0001-000
16	Operating panel	330-5327-000	330-5327-000	330-5327-000
17	Diode module	325-0003-000	325-0003-000	325-0003-000
18	Heat sink	320-0223-000	320-0223-000	320-0223-000
19	Thyristor	325-0678-000	325-0678-000	325-0678-000
20	Clamping hood	325-0679-000	325-0679-000	325-0679-000
21	Mains plug CEE 5-pole 16 A (510) / 32 A		325-0420-000	
22	Mains switch	325-0313-000	325-0030-000	325-0030-000
23	Welding cable socket 1-pole	325-0017-000	325-0017-000	325-0017-000
24	Flange socket 4-pole	325-0079-000	325-0079-000	325-0079-000
25	Mains cable gland PG 16	325-0485-000	325-0485-000	325-0485-000
26	Counter nut	325-0481-000	325-0481-000	325-0481-000
27	Safety switch board	330-5153-000	330-5153-000	
28	Fuse F1 and F2	325-0394-000	325-0391-000	325-0391-000
29	Fuse F3	325-0187-000	325-0187-000	325-0187-000

## 7 Pictures of Stud Welding Guns CLASSIC

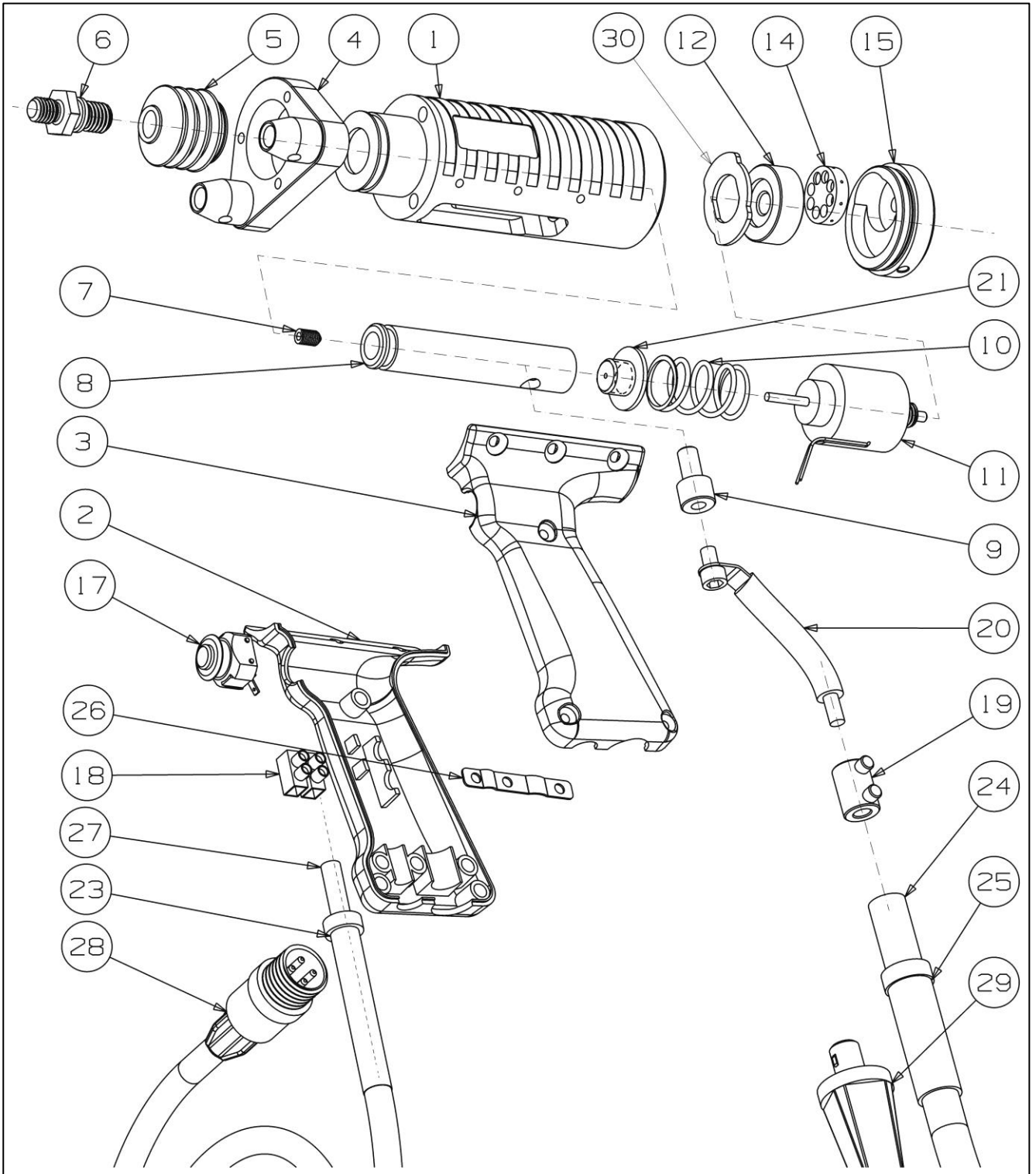


Figure 11: Exploded view of gun SK 14

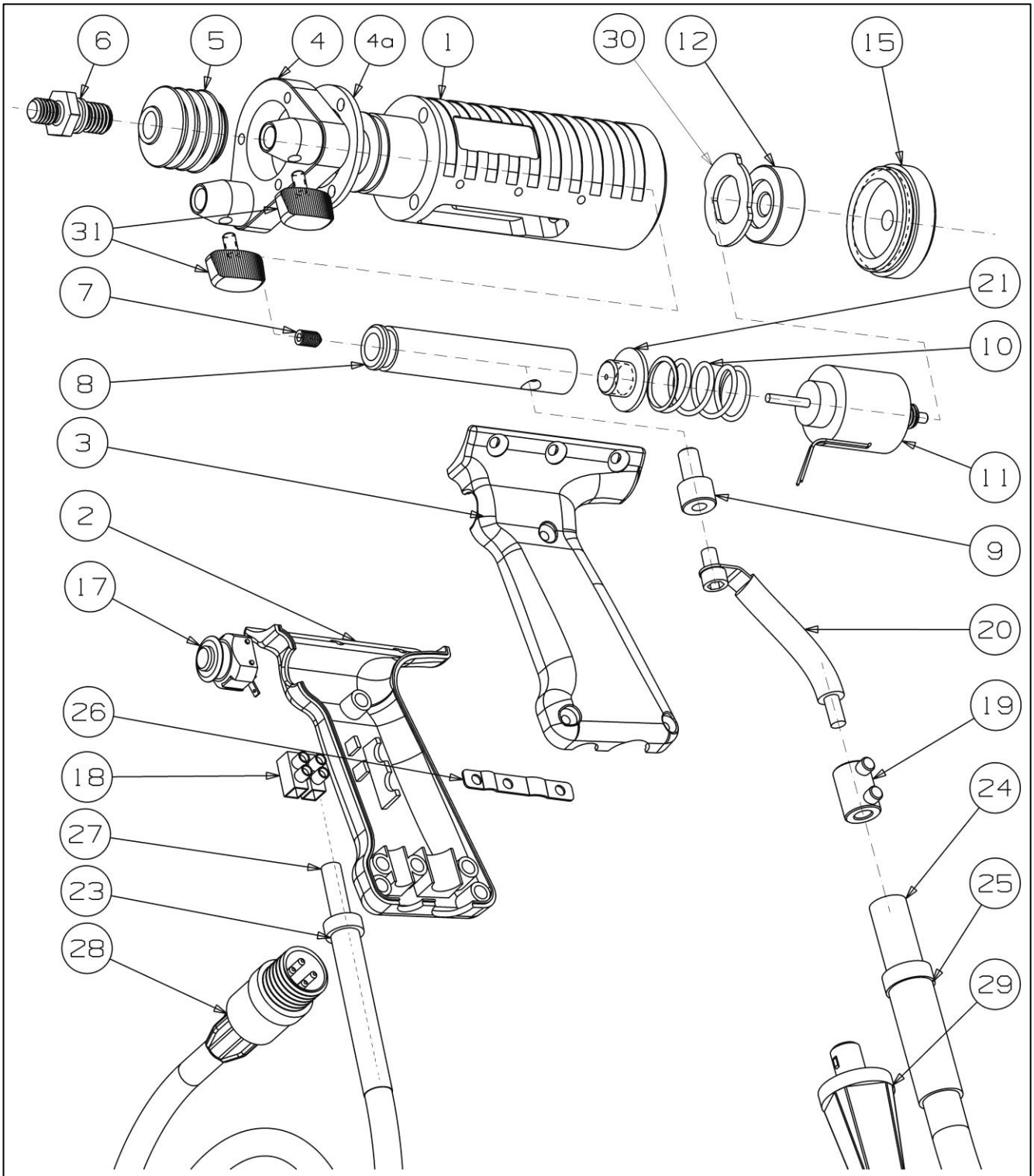


Figure 12: Exploded view of gun SK 14-ISO

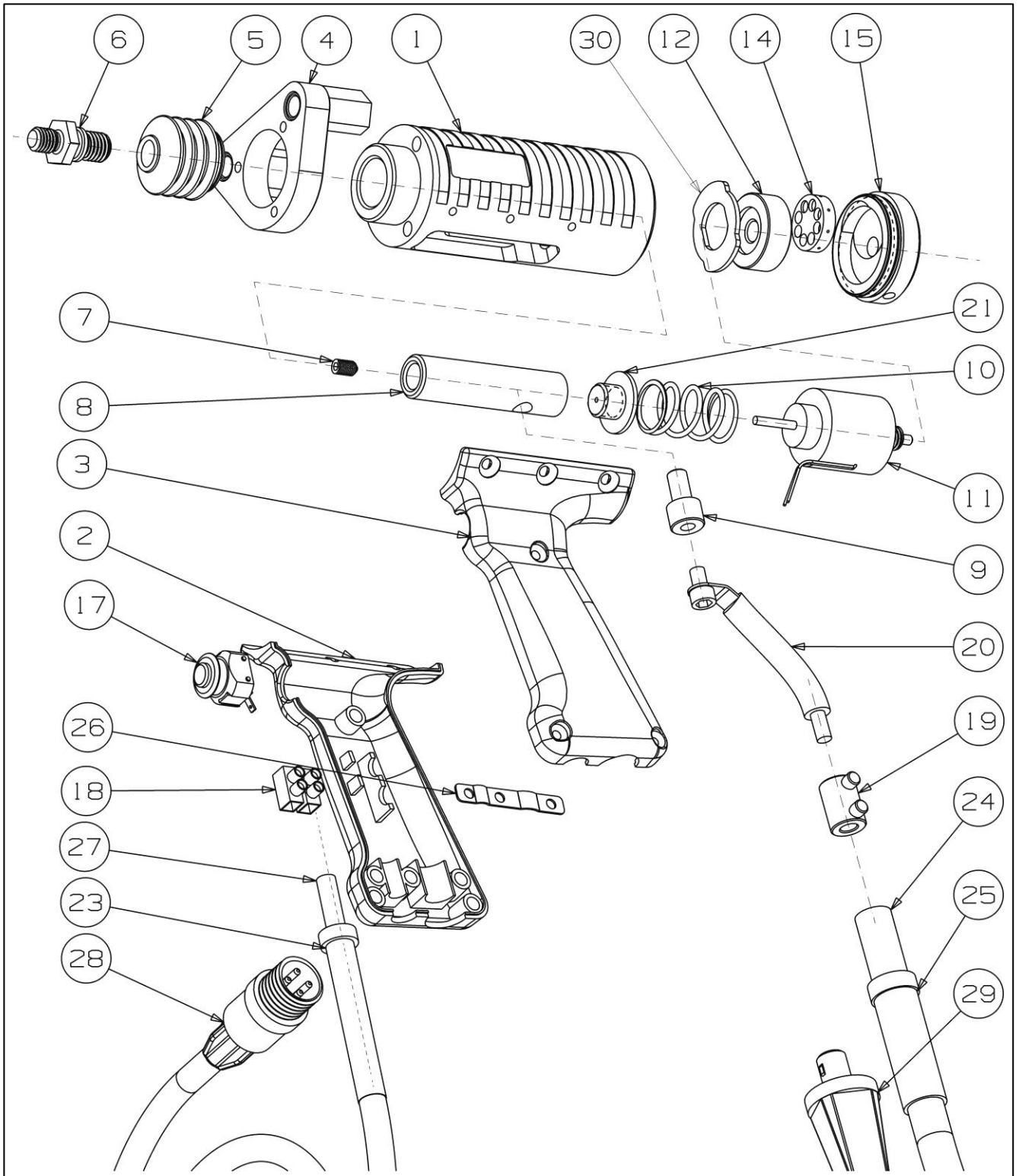


Figure 13: Exploded view of gun SK 14 short

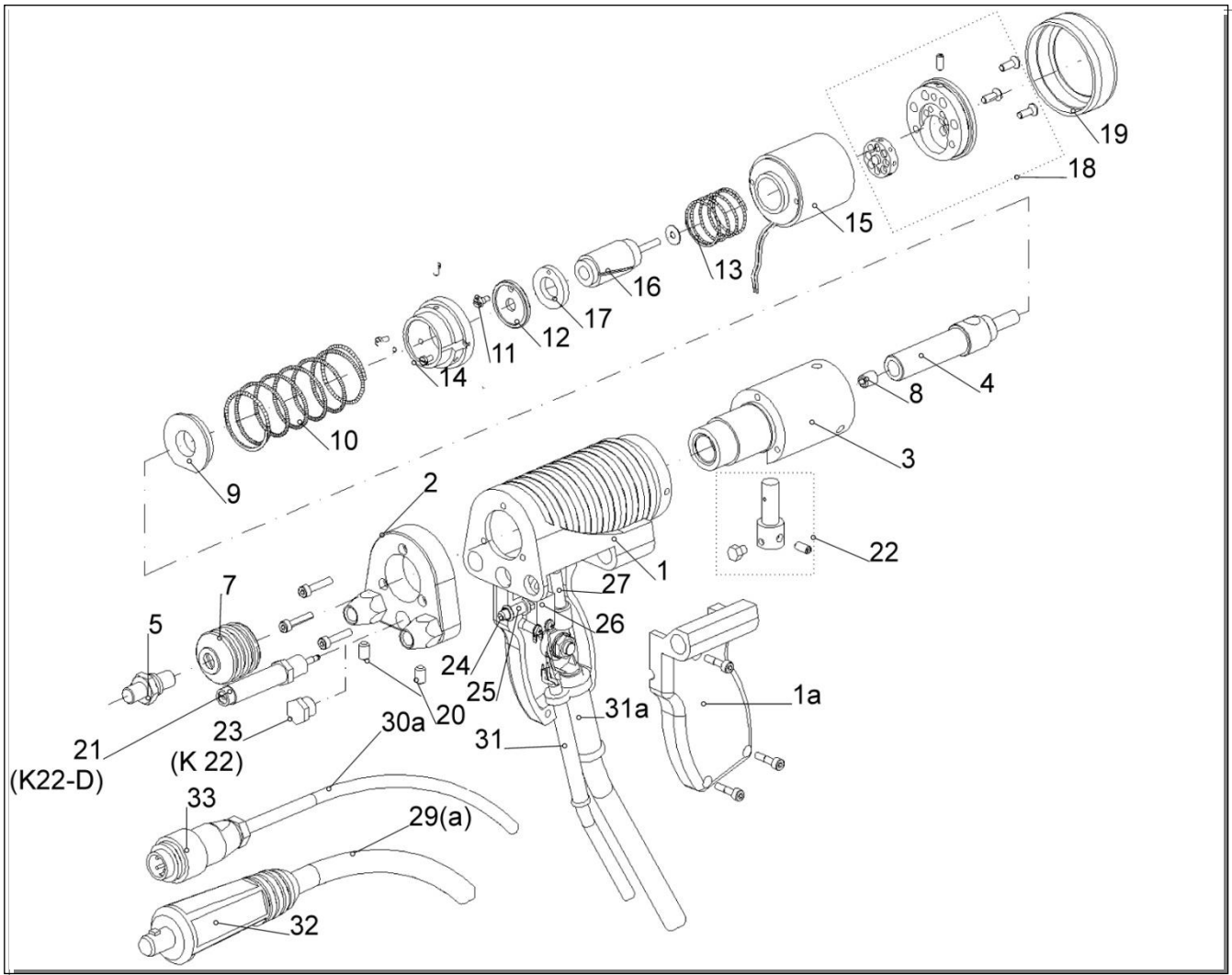


Figure 14: Exploded view of gun K 22 with option K 22-D





## 8 Spare Parts for Stud Welding Guns CLASSIC

### 8.1 Spare parts list gun SK 14, SK 14-ISO, SK 14 short and SK 15

Item	Description	Part-no.			
		SK 14	SK 14-ISO	SK 14 short	SK 15
1	welding gun body	322-0601-000	322-0601-000	322-0604-000	322-0605-000
2	lower gun handle <sup>1</sup>	322-0597-000	322-0597-000	322-0597-000	322-0597-000
3	upper gun handle <sup>1</sup>	322-0596-000	322-0596-000	322-0596-000	322-0596-000
4	flange plate	322-6106-000	322-6109-000	322-6113-000	322-6106-000
4a	spacer ring		322-0554-000		
5	bellows	322-0098-000	322-0098-000	322-0098-000	322-0098-000
6	adaptor screw	322-0113-000	322-0113-000	322-0113-000	322-5127-000
7	setscrew M 6 x 8	322-0220-000	322-0220-000	322-0220-000	322-0220-000
8	piston for chuck M 12 x 1	322-0576-000	322-0576-000	322-0603-000	322-0603-000
9	coupling bolt	329-0050-000	329-0050-000	329-0050-000	329-0050-000
10	compression spring	322-0594-000	322-0594-000	322-0594-000	322-0609-000
11	magnet	329-0022-000	329-0022-000	329-0022-000	329-0080-000
12	spacer sleeve	322-0598-000	322-0598-000	322-0598-000	322-0598-000
14	stop disc	322-0120-000		322-0120-000	322-0120-000
15 <sup>2</sup>	rear cap		322-0086-000		
15 <sup>3</sup>	lift adjustment case	322-0579-000		322-0579-000	322-0579-000
17	push button	329-0031-000	329-0031-000	329-0031-000	329-0031-000
18	lustre terminal	325-0655-000	325-0655-000	325-0655-000	325-0655-000
19	cable connector	329-0025-000	329-0025-000	329-0025-000	329-0025-000
20	welding cord	317-5113-000	317-5113-000	317-5113-000	317-5113-000
21	screwed flange	322-0097-000	322-0097-000	322-0097-000	322-0643-000
23	gland for control cable	325-0261-000	325-0261-000	325-0261-000	325-0261-000
24	welding cable 35 mm <sup>2</sup> , 5 m, without plug	317-0067-000	317-0067-000	317-0067-000	317-0067-000
25	connection gland for welding cable	325-0567-000	325-0567-000	325-0567-000	325-0567-000
26	double clamp hose	325-0681-000	325-0681-000	325-0681-000	325-0681-000
27	control cable, 4 x 1 mm <sup>2</sup> , 5.2 m, without plug	329-5233-000	329-5233-000	329-5233-000	329-5233-000
28	control plug, 4-pole	325-0240-000	325-0240-000	325-0240-000	325-0240-000
29	welding cable plug, 35 mm <sup>2</sup>	325-0236-000	325-0236-000	325-0236-000	325-0236-000
23 – 25, 27 – 29	cable connection set 5 m, 35 mm <sup>2</sup>	329-5243-000	329-5243-000	329-5243-000	
30	anti twist device	322-0599-000	322-0599-000	322-0599-000	322-0640-000
31	wing screw		322-0631-000		

<sup>1</sup> Viewed from the assembling or disassembling position

<sup>2</sup> Applies to SK 14-ISO

<sup>3</sup> Applies to SK 14, SK 14 short and SK 15



## 8.2 Spare parts list gun K 22

Pos.	Designation	Part Number
1	Gun body	322-6051-000
1a	Handle cover	322-0075-000
2	Mounting plate with guide bushes	322-6045-000
3	Piston cylinder	322-6085-000
4	Piston	322-0109-000
5	Adapter screw	329-0026-000
7	Bellows	322-0098-000
8	Threaded bolt	322-0108-000
9	Spring guide	322-0125-000
10	Main tension spring	322-0083-000
11	Lifting ring pin	322-0200-000
12	Lifting ring	322-0201-000
13	Tension spring	322-0202-000
14	Lifting ring housing	322-0203-000
15	Magnetic coil	329-0033-000
16	Magnet core	329-0034-000
17	Anchoring disk	322-0204-000
18	Lift setting system	322-6088-000
19	Rear cap	322-0079-000
20	Setscrew M 6 x 8	322-0206-000
22	Damper stop	322-0118-000
23	Locking screw	322-0040-000
24	Switch pins	322-0103-000
25	Switch pin bearing	322-0104-000
26	Trigger	329-0030-000
27	Welding cord	329-5220-000
29	Welding cable, 2 m, 50 mm <sup>2</sup> with protective conduit	329-5216-000
29a	Welding cable 2 m, 50 mm <sup>2</sup> with plug and protective conduit	329-5217-000
30	Ready-to-connect control cable, 2,3 m, 4 x 1 mm <sup>2</sup>	329-5218-000
30a	Ready-to-connect control cable, 2,3 m, 4 x 1 mm <sup>2</sup> with plug	329-5219-000
31	Bending protector for control cable	325-0261-000
31a	Bending protector for welding cable	325-0567-000
32	Welding cable plug 35/50 mm <sup>2</sup>	325-0234-000
33	Control cable plug 4-pole	325-0240-000
	Complete connection cable set 2 m, 50 mm <sup>2</sup>	329-5214-000
	Complete connection cable set 5 m, 50 mm <sup>2</sup>	329-5201-000
	Complete connection cable set 7,5 m, 50 mm <sup>2</sup>	329-5202-000

## 9 Pictures of Cables

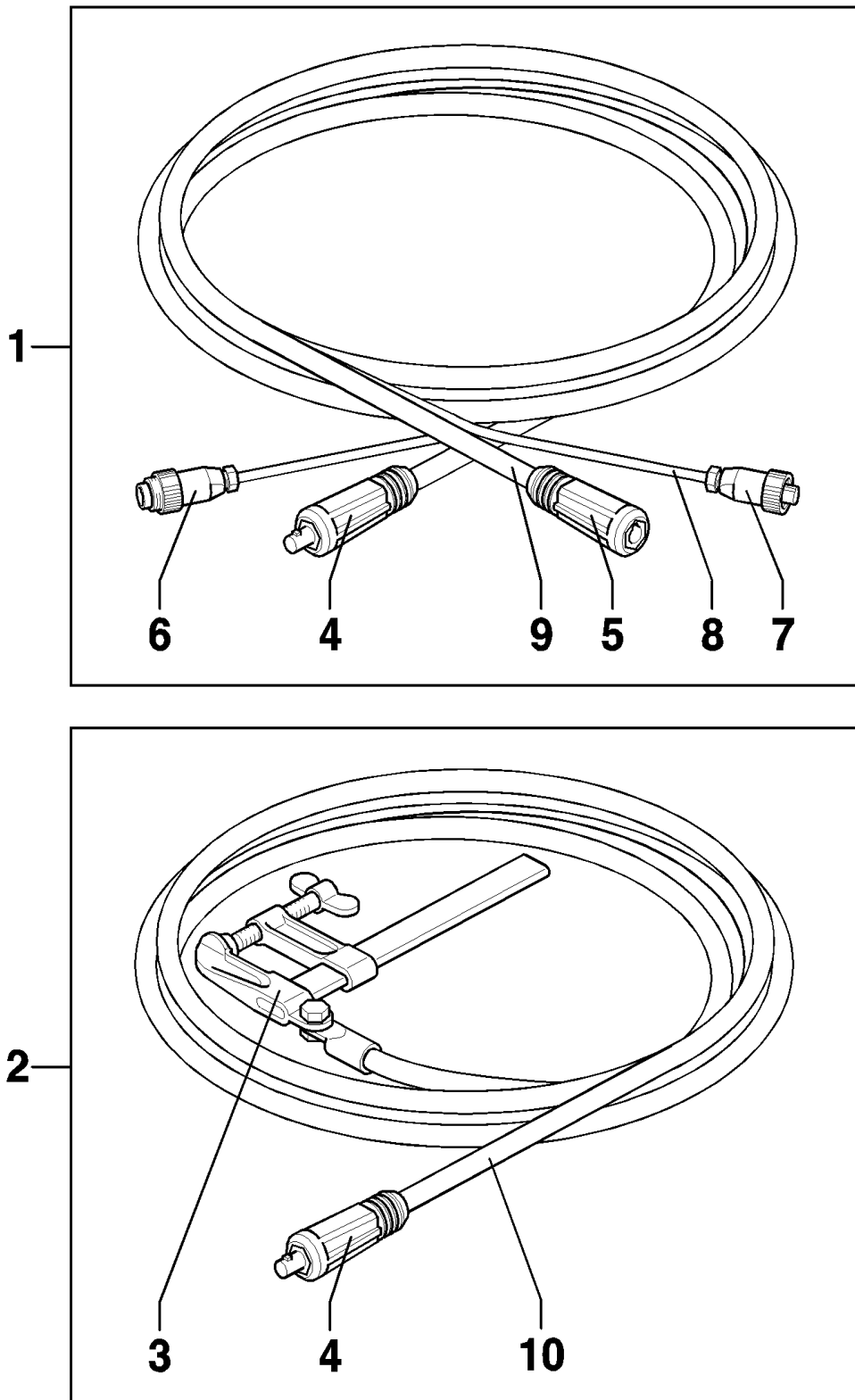


Figure 14: Welding cable extension and ground cable



## 10 Cable Spare Part List

Pos.	Designation	Part No.
1	Welding and control cable extensions 10 m, 50 mm <sup>2</sup> (complete set) <sup>1)</sup>	317-5015-000
1	Welding and control cable extensions 10 m, 70 mm <sup>2</sup> (complete set) <sup>1)</sup>	317-5010-000
2	Pair of earth cable 10 m, 70 mm <sup>2</sup> with pole clamp (complete set) <sup>1)</sup>	317-5031-000
3	Pole clamp, jaws width 200 mm	325-0174-000
4	Welding cable plug 35/50 mm <sup>2</sup>	325-0234-000
4	Welding cable plug 50/70 mm <sup>2</sup>	325-0505-000
5	Welding cable socket 35/50 mm <sup>2</sup>	325-0233-000
5	Welding cable socket 50/70 mm <sup>2</sup>	325-0237-000
6	Control cable plug 4-pole	325-0240-000
7	Control cable socket 4-pole	325-0348-000
8	Control cable 10 m, 4 x 1.0 mm <sup>2</sup> including fittings	317-0065-000
9	Welding cable, 70 mm <sup>2</sup> (sold by metre)	317-0070-000
10	Earth cable 10 m, 70 mm <sup>2</sup> , with protective conduit	317-0066-000

1) Extension cables with lengths according to customer's choice are available upon request.

# 11 Schematic Circuit Diagram

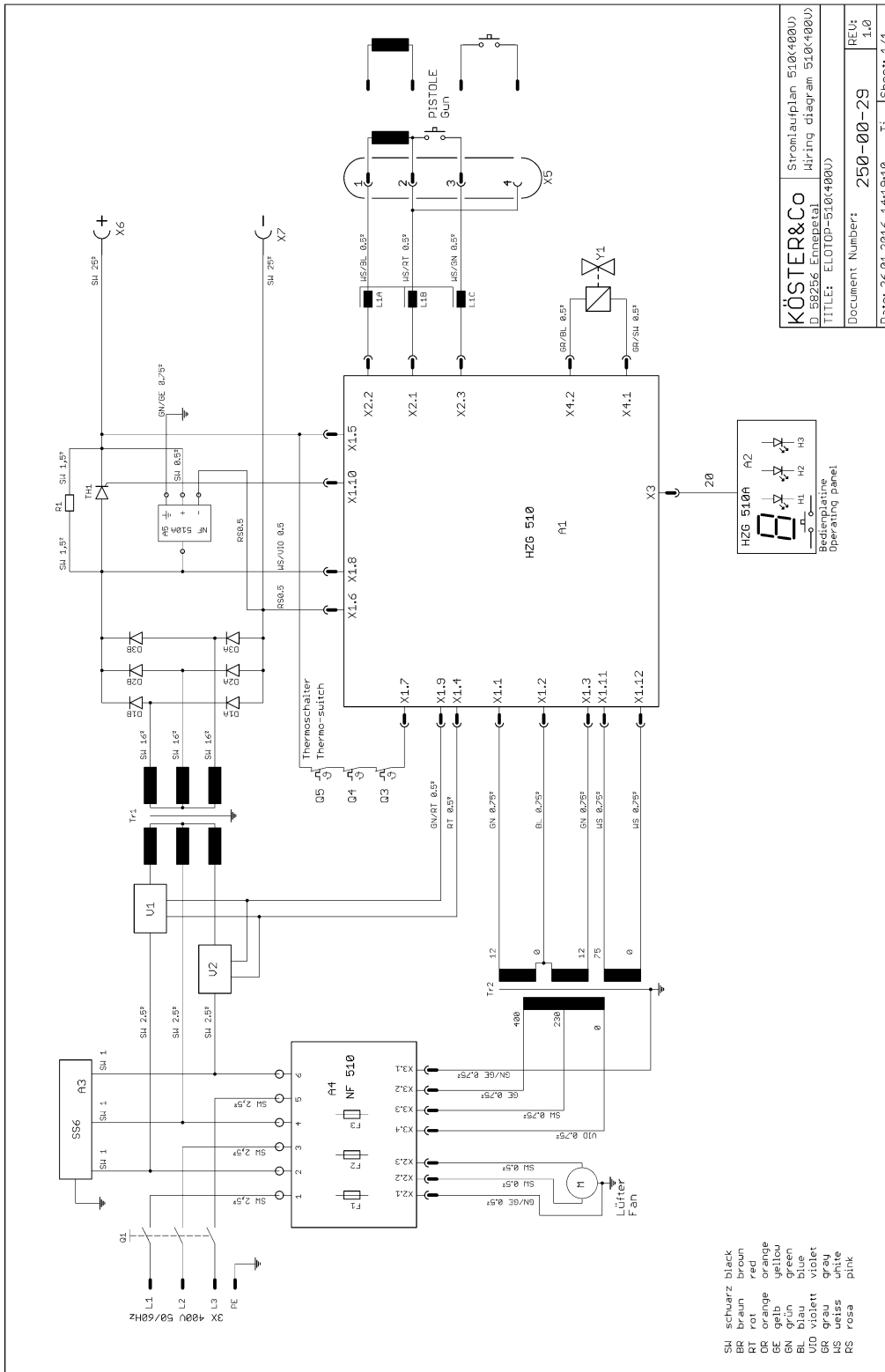


Figure 16: Schematic circuit diagram ELOTOP 510 (version 400 V)

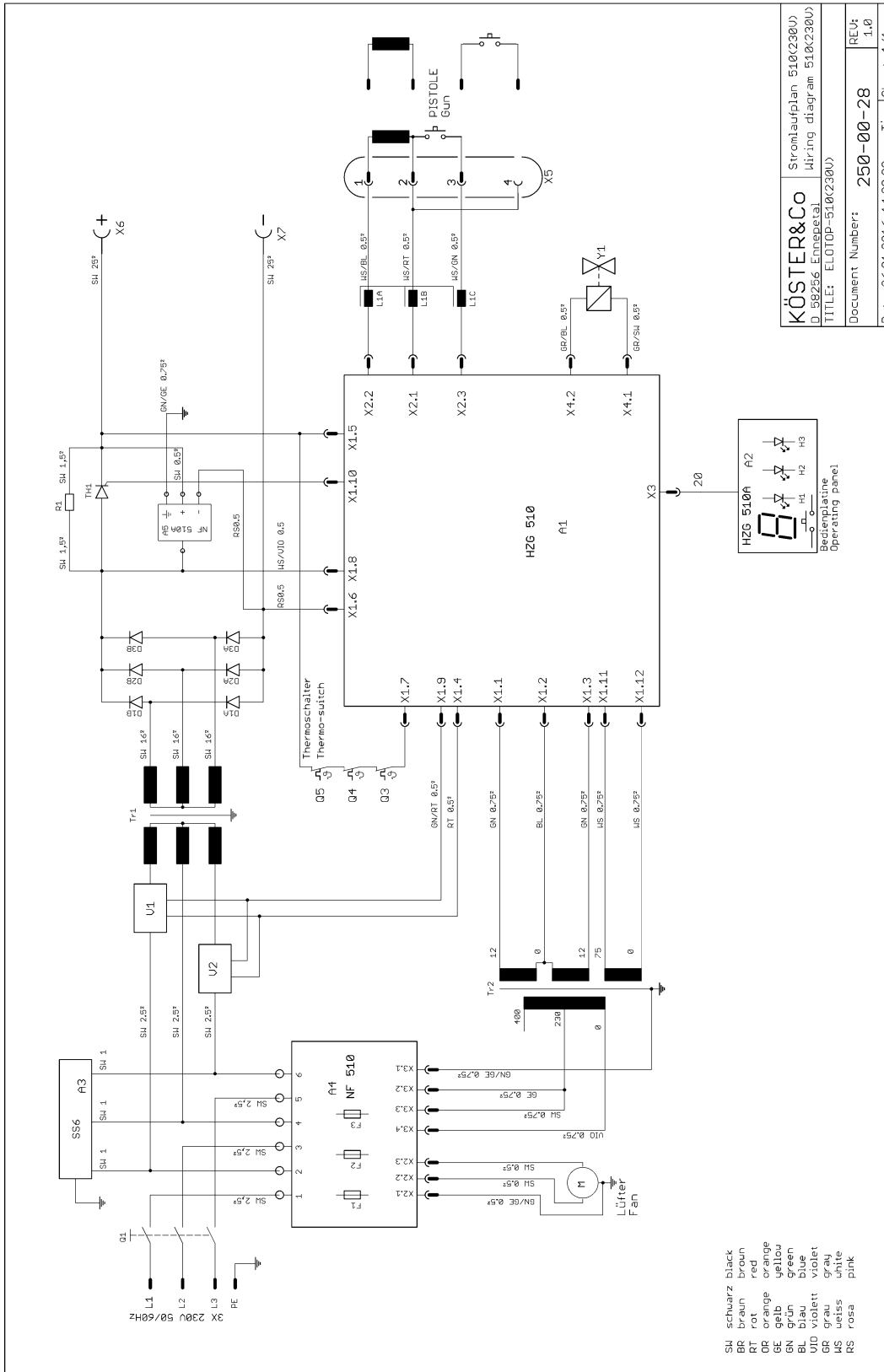
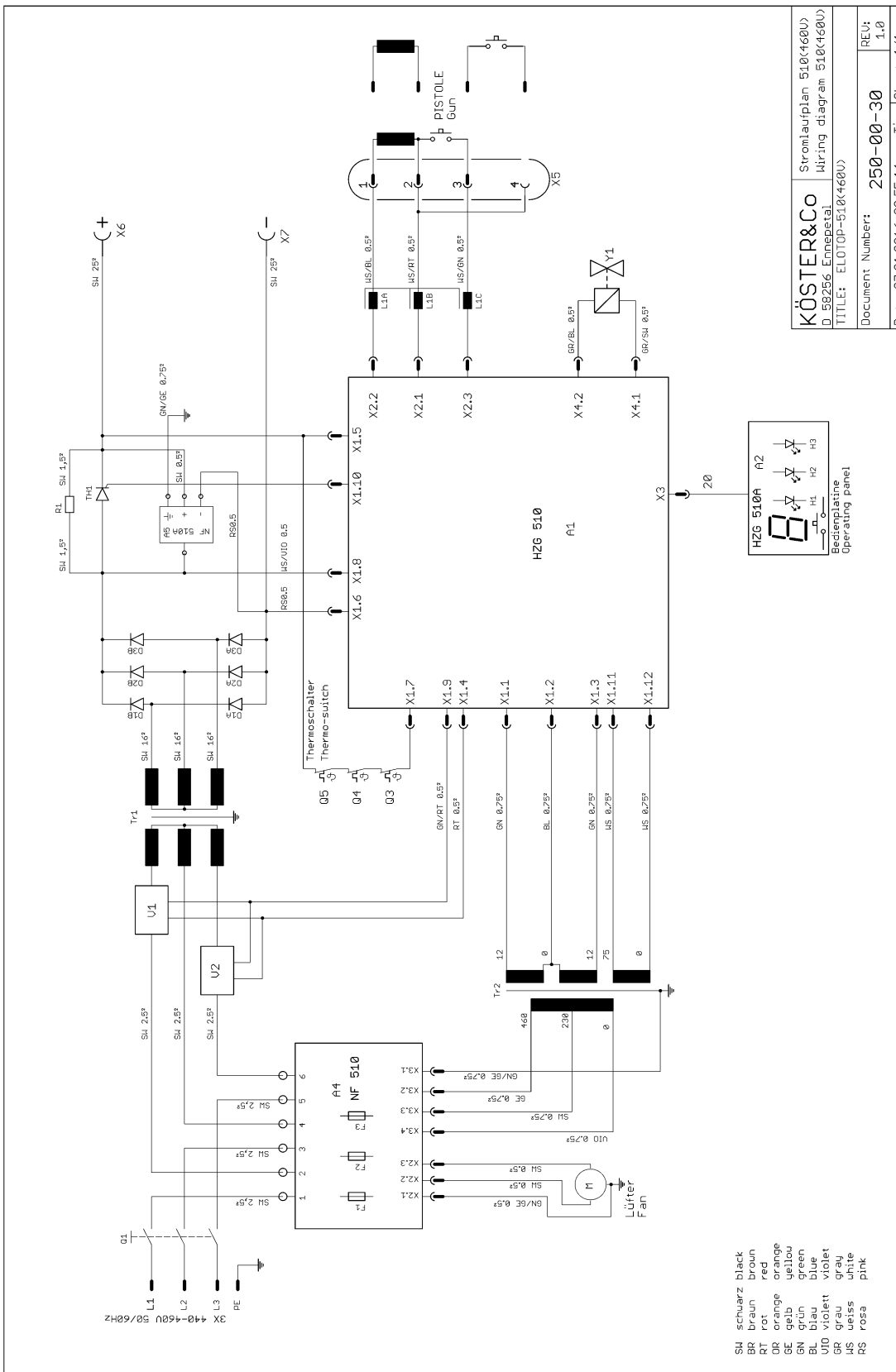


Figure 17: Schematic circuit diagram ELOTOP 510 (version 230 V)



<b>KÖSTER&amp;Co</b>	Stromlaufplan 510(460V)
D. 58256 Ennepetal	Kirring diagram 510(460V)
TITLE: ELOTOP-510(460V)	
Document Number: 250-00-30	REV: 1.0
Date: 27.01.2016 08:55:14	Ti. Sheet: 1/1

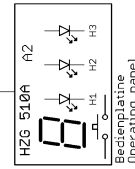


Figure 18: Schematic circuit diagram ELOTOP 510 (version 460 V)

## 12 Accessories

### 12.1 Gun accessories for gun K 22

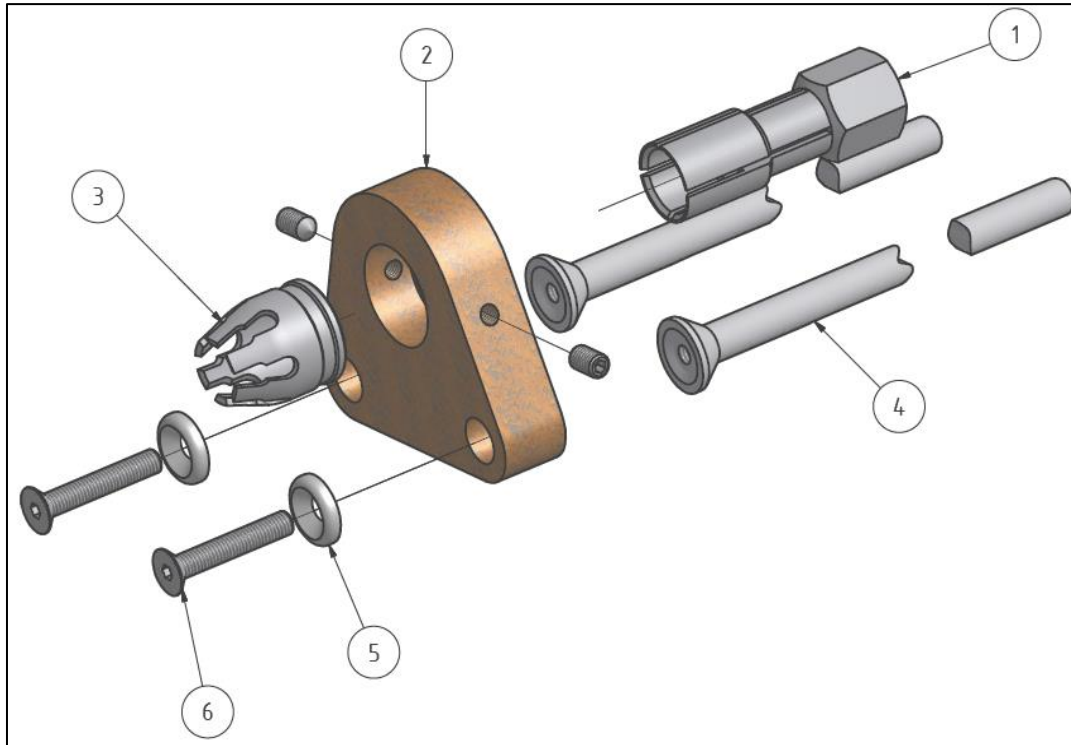


Figure 19: Gun accessories for threaded studs, tapped studs and plain pins

Type P	Type D	Type R	Chuck Pos. 1	Ferrule grip Pos. 3	Foot plate Pos. 2
M 4 x > 20	M 4 x > 20		350-0002-000	355-0001-000	360-0101-000
M 5 x > 20	M 5 x > 20		350-0003-000	355-0002-000	
M 6 x > 16	M 6 x > 16	M 6 x > 16	350-0004-000	355-0002-000	
M 6 x > 20	M 6 x > 20	M 6 x > 20	350-0005-000	355-0002-000	
M 8 x > 16	M 8 x > 16	M 8 x > 16	350-0006-000	355-0003-000	
M 8 x > 20	M 8 x > 20	M 8 x > 20	350-0007-000	355-0003-000	
M 10 x > 16	M 10 x > 20	M 10 x > 20	350-0008-000	355-0004-000	
M 10 x > 20	M 10 x > 25	M 10 x > 25	350-0009-000	355-0004-000	
M 12 x > 16	M 12 x > 20	M 12 x > 20	350-0010-000	355-0005-000	
M 12 x > 25	M 12 x > 25	M 12 x > 30	350-0011-000	355-0005-000	





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Stud length up to (mm)			Required length of legs (mm)	Part No. Pos. 4
K 22 and K 22-D	K 24	K 26		
140	90	70	240	370-0240-000
200	150	130	300	370-0300-000
300	250	230	400	370-0400-000
400	350	330	500	370-0500-000
500	450	430	600	370-0322-000
600	550	530	700	370-0323-000
<b>Washer Pos. 5</b>				370-0055-000
<b>Screw with hexagon socket Pos. 6</b>				322-0372-000

For studs below 10 mm diameter and lengths  $L > \text{app. } 6 \times \text{diam.}$  chucks with deeper grip length are recommended. Further information upon request.

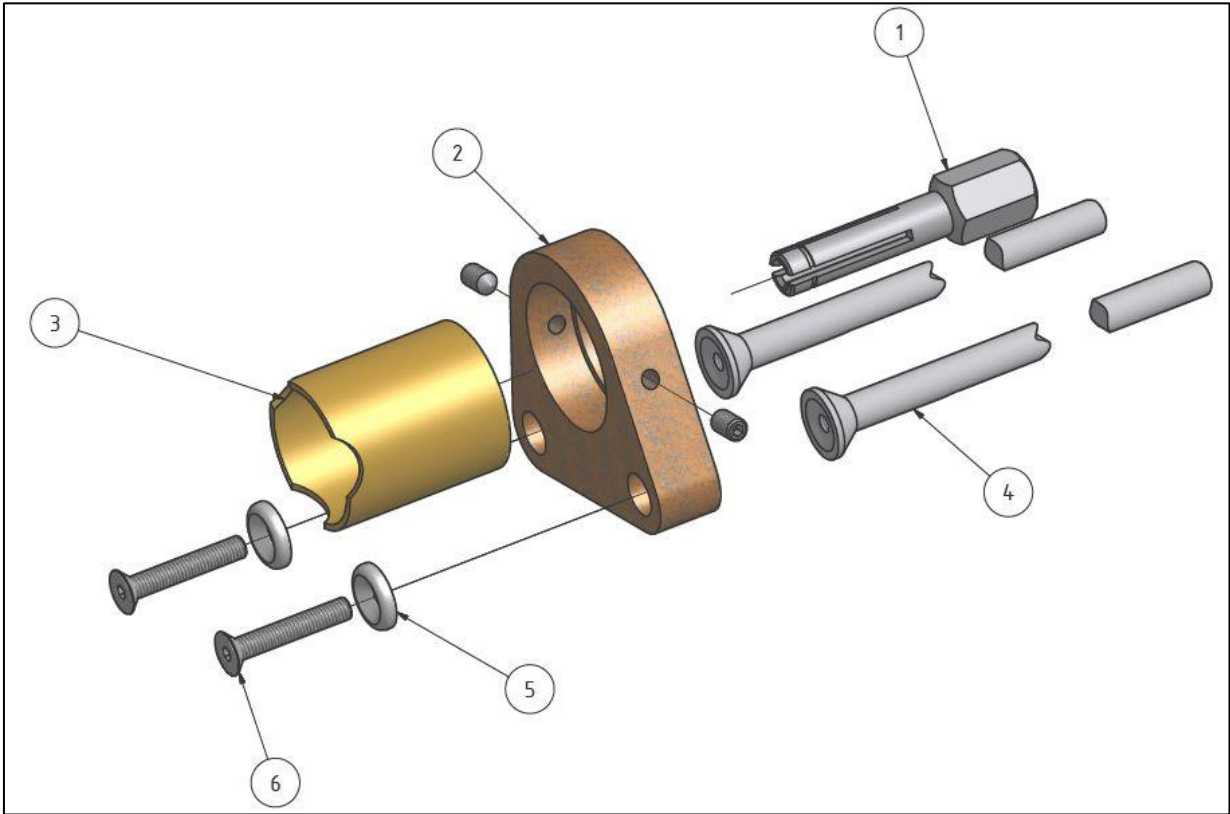
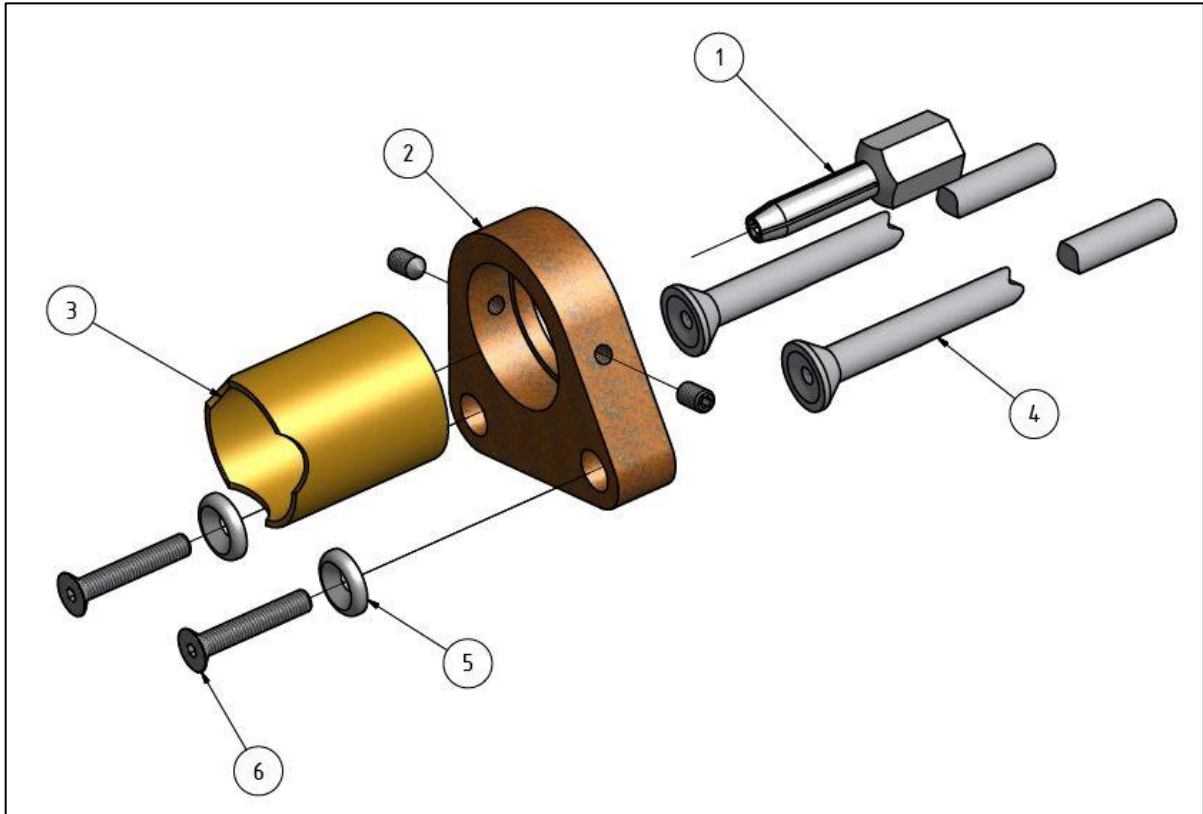


Figure 20: Gun accessories for Insulation pins

Stud dimension	Chuck Pos. 1	Foot plate Pos. 2	Supporting tube Pos. 3
from 3 x 35	350-0086-000 (Steel) 350-0087-000 (Copper)	370-0103-000	370-0167-000
from 4 x 35	350-0088-000 (Steel)		
from 5 x 35	350-0089-000 (Steel)		
Stud length up to (mm)	Required length of legs (mm)	Part-No. Pos. 4	
Gun K 22			
140	240	370-0240-000	
200	300	370-0300-000	
300	400	370-0400-000	
400	500	370-0500-000	
500	600	370-0322-000	
600	700	370-0323-000	
<b>Washer pos. 5</b>		370-0055-000	
<b>Screw with hexagon socket pos. 6</b>		322-0372-000	



**Figure 21: Gun accessories for short cycle stud welding without shielding gas**

Stud diameter d	Chuck Pos. 1	Foot plate Pos. 2	Leg Pos. 4	Supporting tube Pos. 3
3	350-0001-000	360-0103-000	370-0240-000	370-0167-000
4	350-0002-000			
5	350-0003-000			
6	350-0005-000			
8	350-0007-000			
10	350-0009-000			
<b>Washer Pos. 5</b>			370-0055-000	
<b>Screw with hexagon socket Pos. 6</b>			322-0372-000	

For studs with lengths  $L > \text{app. } 6d$  chucks with deeper grip length are recommended. Further information upon request.

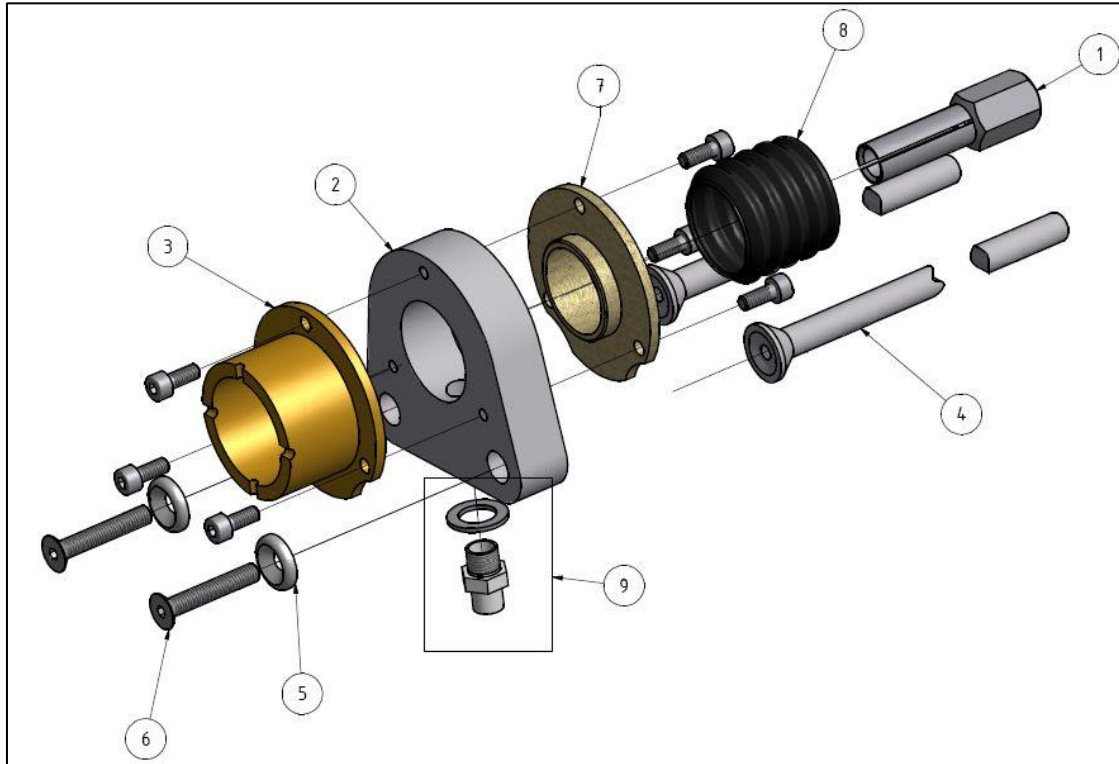


Figure 22: Gun accessories for Stud welding with shielding gas (Gun K 22)

Stud diameter d	Chuck Pos. 1	Foot plate with 3 socket head cap screws M 4 x 10 Pos. 2	Leg Pos. 4	Supporting tube with 3 socket head cap screws M 4 x 10 Pos. 3
5	350-0003-000	322-0011-000	370-0240-000	322-0225-000
6	350-0005-000			
8	350-0007-000			
10	350-0009-000			
12	350-0011-000			
<b>Washer Pos. 5</b>			370-0055-000	
<b>Screw with hexagon socket Pos. 6</b>			322-0372-000	
<b>Circlip ring with 3 socket head cap screw M 4 x 10 Pos. 7</b>			324-0042-000	
<b>Bellows Pos. 8</b>			322-0098-000	
<b>Gas plug with seal Pos. 9</b>			323-0017-000	

For studs with lengths  $L > \text{app. } 6d$  chucks with deeper grip length are recommended. Further information upon request.

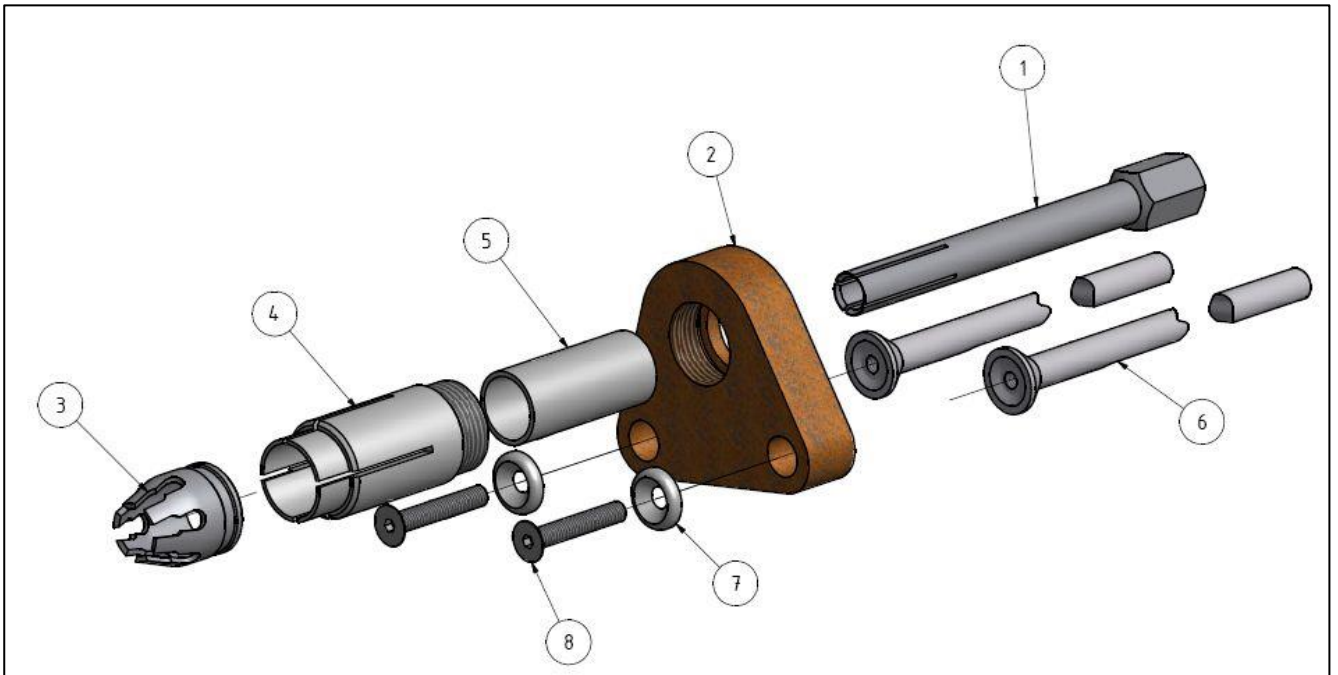
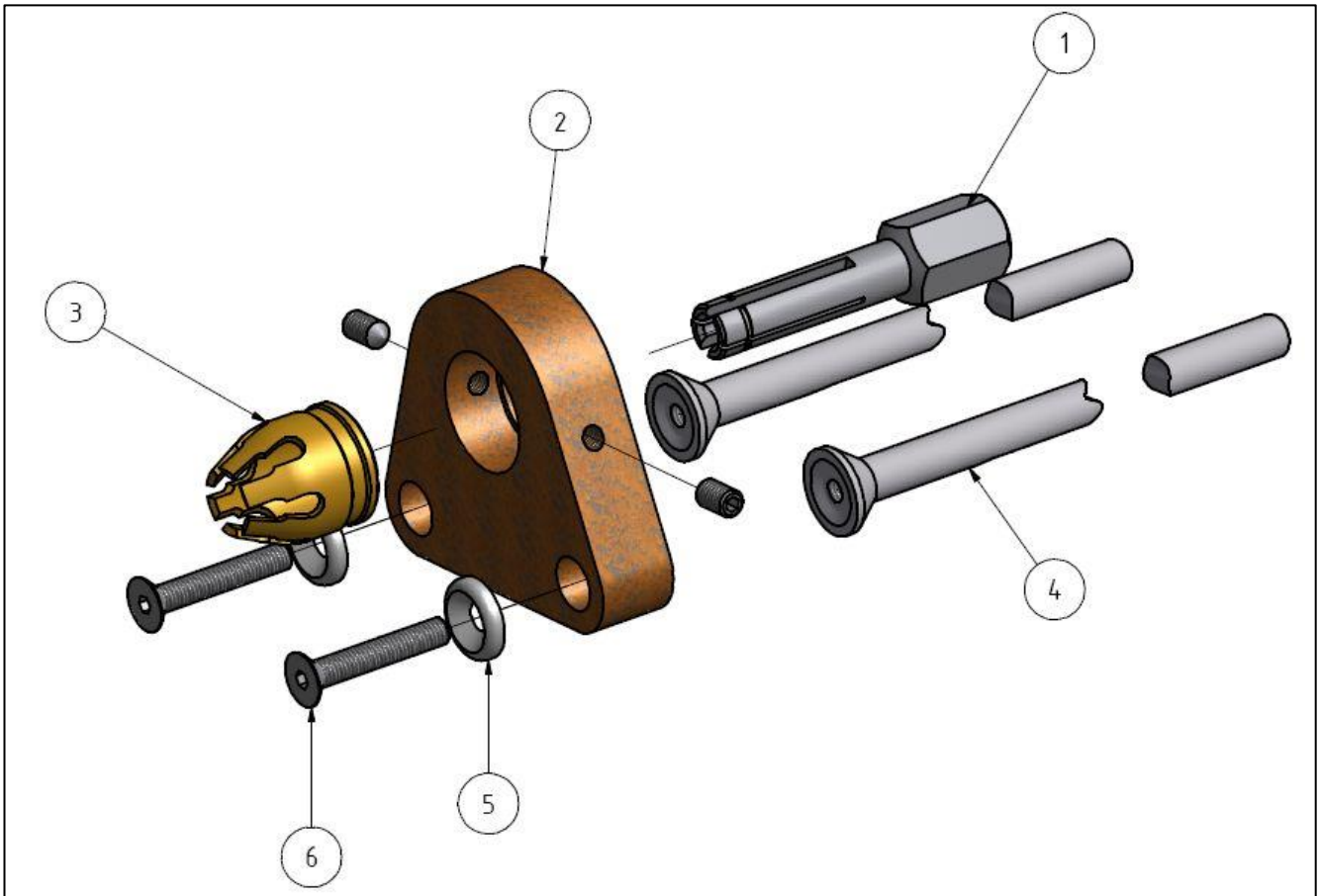


Figure 23: Gun accessories for grid fastening

Dimension	Chuck Pos. 1	Ferrule grip Pos. 3	Supporting tube Pos. 4	Insulating tube Pos. 5	Foot plate Pos. 2
M 6 x > 20	350-0033-000	355-0002-000	370-0158-000	370-0159-000	360-0110-000
M 6 x > 60	350-0005-000				
M 8 x > 20	350-0034-000	355-0003-000			
M 8 x > 60	350-0007-000				
M 10 x > 25	350-0035-000	355-0004-000			
M 10 x > 60	350-0009-000				
M 12 x > 30	350-0036-000	355-0005-000			
M 12 x > 60	350-0016-000				
<b>Washer Pos. 7</b>			370-0055-000		
<b>Screw with hexagon socket Pos. 8</b>			322-0372-000		
<b>Leg 240 mm Pos. 6 (max. stud length 150 mm)</b>			370-0240-000		



**Figure 24: Gun accessories for welding of Fibrefix-pins Ø 5, Length L**

Chuck Pos. 1	Foot plate Pos. 2	Ferule grip Pos. 3	Leg Pos. 4
350-0100-000	360-0101-000	355-0002-000	370-0240-000 370-0300-000 370-0400-000 370-0500-000 Up to L = 160 mm Up to L = 220 mm Up to L = 320 mm Up to L = 420 mm
Washer Pos. 5			370-0055-000
Screw with hexagon socket Pos. 6			322-0372-000

## 12.2 Gun accessories for gun SK 14, SK 14-ISO and SK 14 short

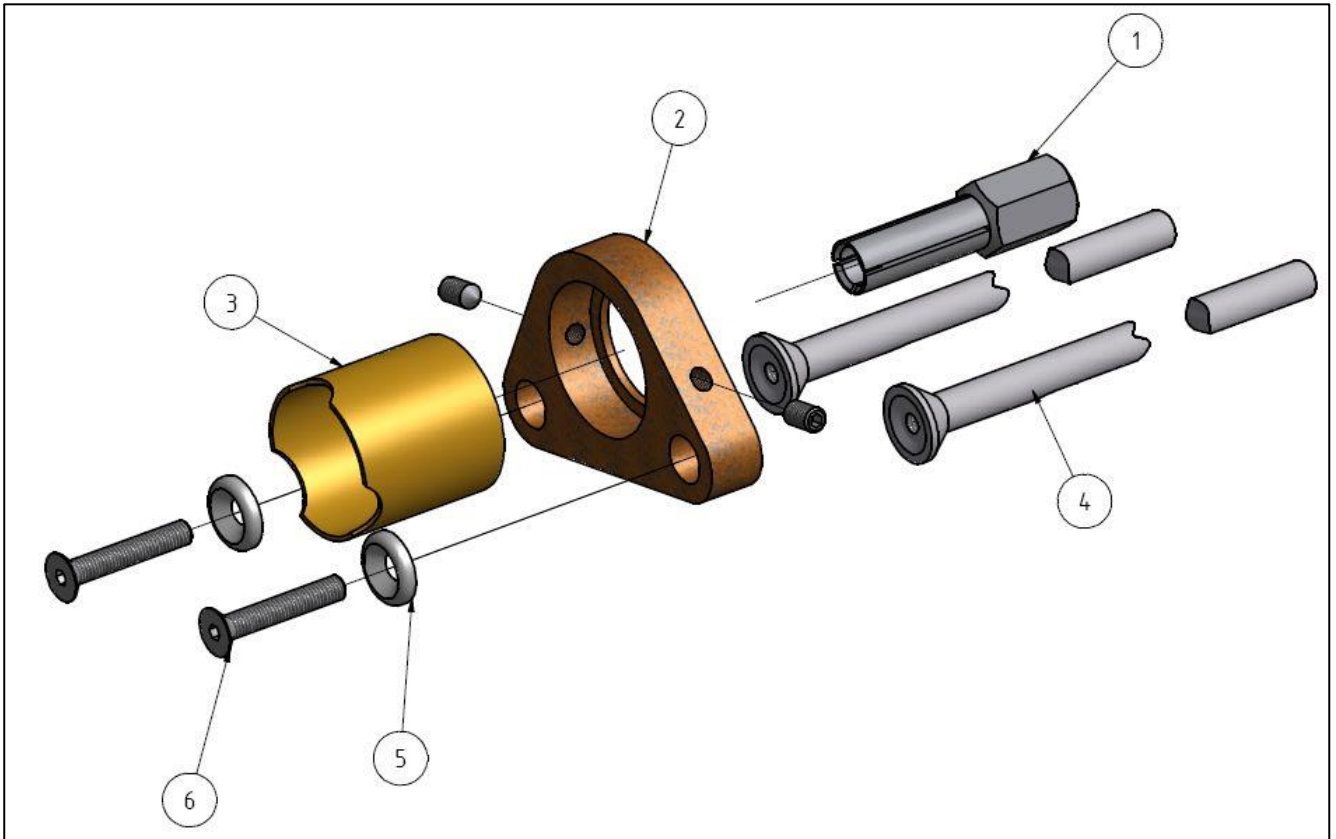
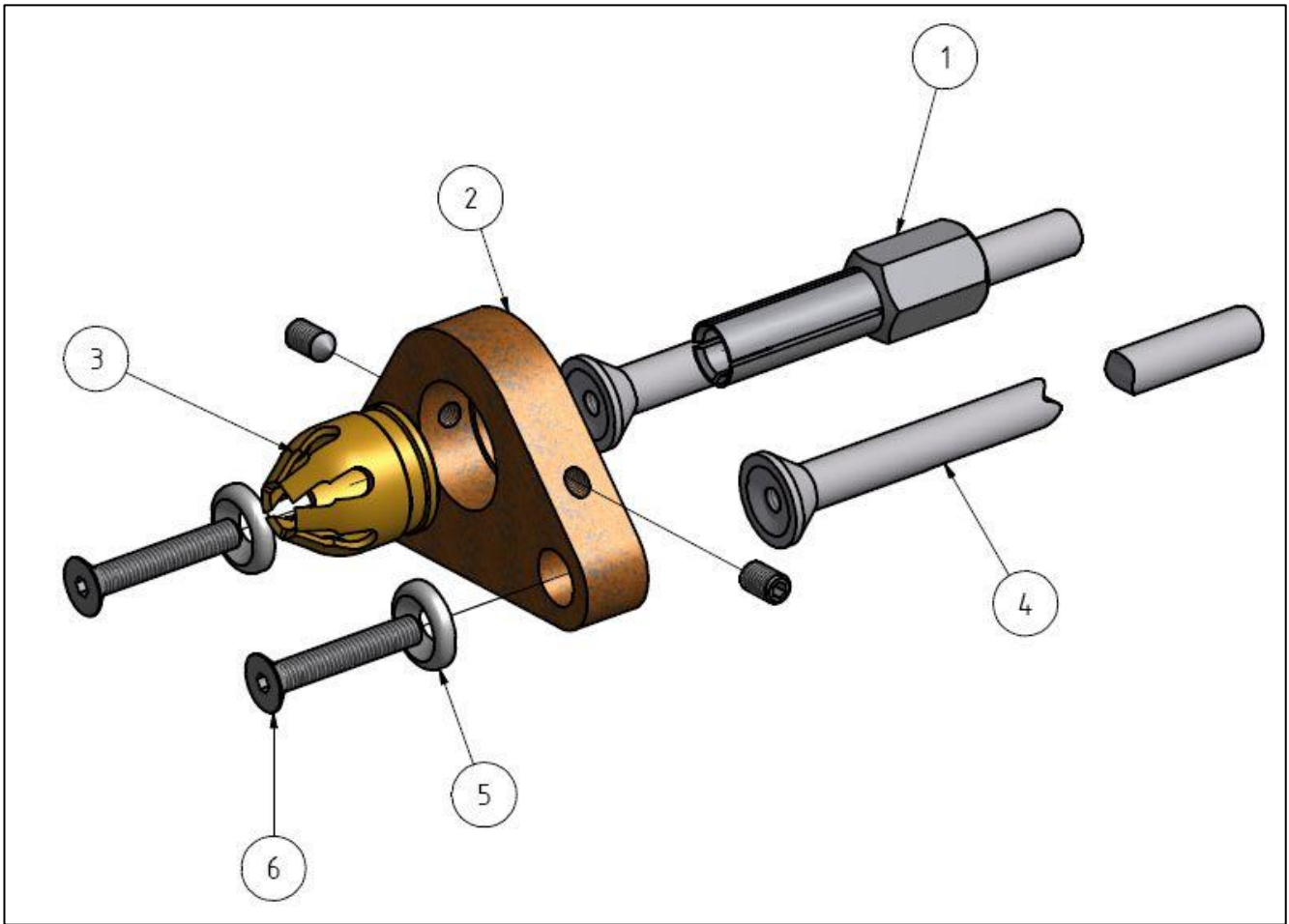


Figure 25: Gun accessories for short-cycle stud welding without shielding gas (gun SK 14)

Stud dimension (D x L)	Chuck Pos. 1	Foot plate Pos. 2	Leg Pos. 4	Supporting tube Pos. 3
Ø 3 x > 8	350-0001-000	360-0012-000	370-0240-000	360-0335-000
Ø 4 x > 8	350-0002-000			
Ø 5 x > 10	350-0003-000			
Ø 6 x > 10	350-0005-000			
Ø 8 x > 10	350-0006-000			
Ø 8 x > 15	350-0007-000			
<b>Washer Pos. 5</b>			370-0055-000	
<b>Screw with hexagon socket Pos. 6</b>			322-0372-000	

For studs with lengths  $L > \text{app. } 6d$  chucks with deeper grip length are recommended. Further information upon request.



**Figure 26: Gun accessories for threaded studs and plain pins (SK 14 with ceramic ferrule)**

Type P	Type D	Type R	Chuck Pos. 1	Ferrule grip Pos. 3	Foot plate Pos. 2
M 4 x > 16	M 4 x > 16		350-0002-000	355-0001-000	360-0013-000
M 5 x > 16	M 5 x > 16		350-0003-000	355-0002-000	
M 6 x > 16	M 6 x > 16	M 6 x > 16	350-0004-000	355-0002-000	
M 6 x > 20	M 6 x > 20	M 6 x > 20	350-0005-000	355-0002-000	
M 8 x > 16	M 8 x > 16	M 8 x > 16	350-0006-000	355-0003-000	
M 8 x > 20	M 8 x > 20	M 8 x > 20	350-0007-000	355-0003-000	
M 10 x > 16	M 10 x > 20	M 10 x > 20	350-0008-000	355-0004-000	
M 10 x > 20	M 10 x > 25	M 10 x > 25	350-0009-000	355-0004-000	
<b>Leg Pos. 4</b>		370-0240-000			
<b>Washer Pos. 5</b>		370-0055-000			
<b>Screw with hexagon socket Pos. 6</b>		322-0372-000			



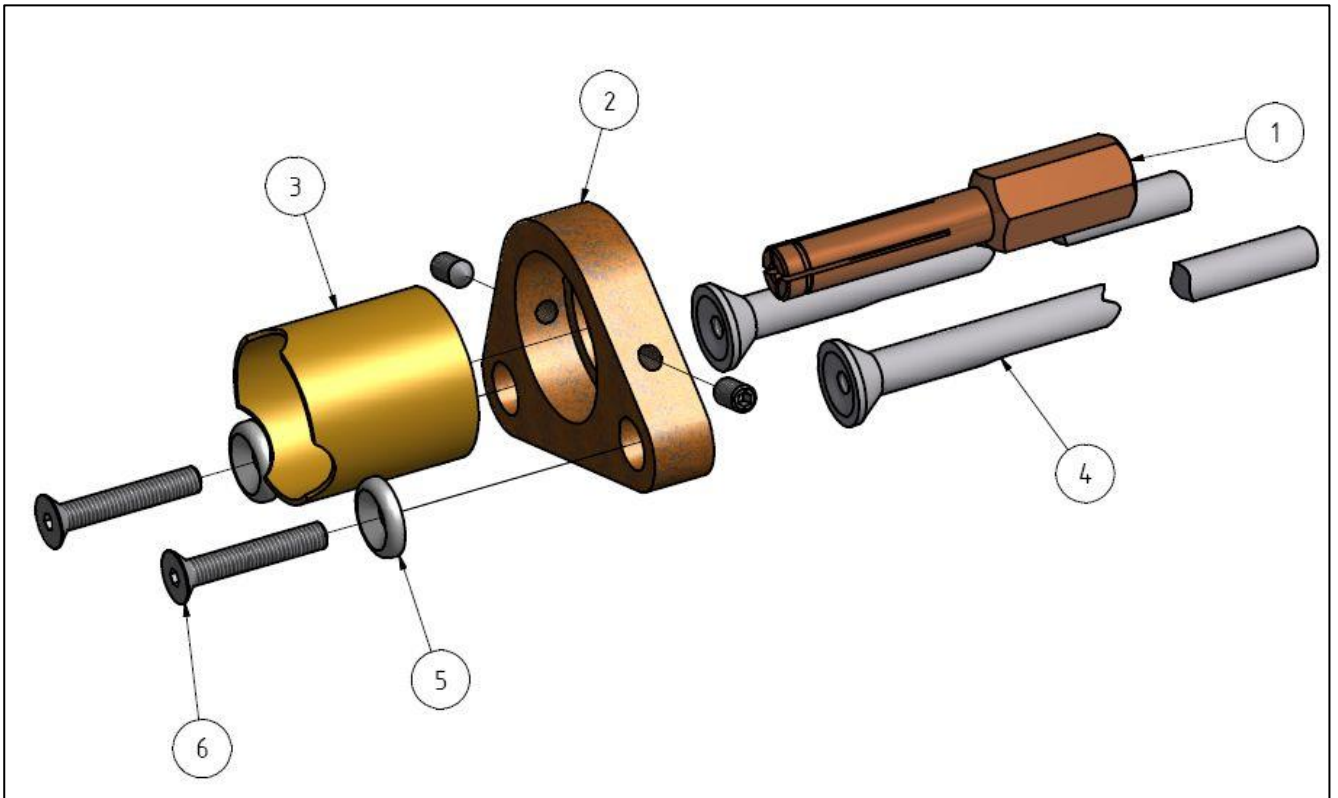


Figure 27: Gun accessories for insulation pins (gun SK 14 and SK 14-ISO)

Stud dimension	Chuck Pos. 1	Foot plate Pos. 2	Supporting tube Pos. 3
from 3 x 35	350-0086-000 (Steel) 350-0087-000 (Copper)	360-0012-000	360-0335-000
from 4 x 35	350-0088-000 (Steel)		
from 5 x 35	350-0089-000 (Steel)		
Stud length up to (mm)	Required length of legs (mm)	Leg Pos. 4	
140	240	370-0240-000	
200	300	370-0300-000	
300	400	370-0400-000	
400	500	370-0500-000	
500	600	370-0322-000	
600	700	370-0323-000	
<b>Washer pos. 5</b>		370-0055-000	
<b>Screw with hexagon socket pos. 6</b>		322-0372-000	

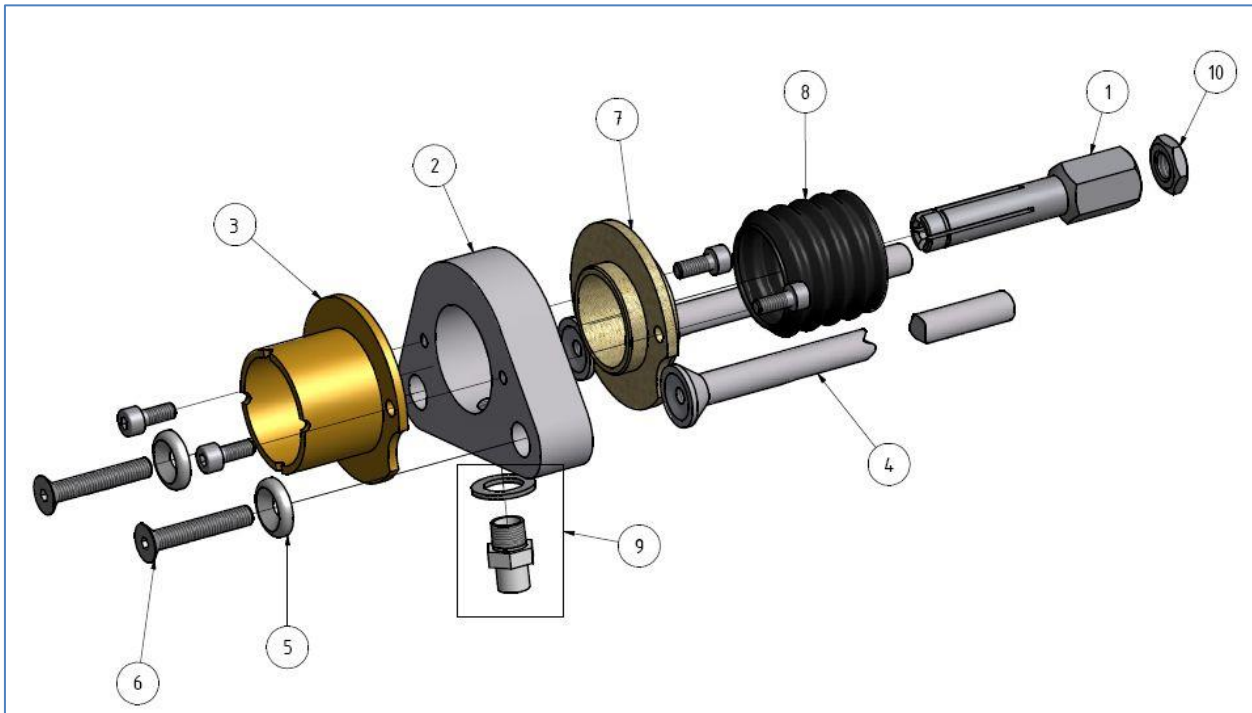


Figure 28: Gun accessories for stud welding with shielding gas (gun SK 14)

Stud diameter d	Chuck Pos. 1	Foot plate with 2 socket head cap screws M 4 x 10 Pos. 2	Leg Pos. 4	Supporting tube with 2 socket head cap screws M 4 x 10 Pos. 3
5	350-0003-000	324-0048-000	370-0240-000	324-0049-000
6	350-0005-000			
8	350-0007-000			
10	350-0009-000			
<b>Washer Pos. 5</b>			370-0055-000	
<b>Screw with hexagon socket Pos. 6</b>			322-0372-000	
<b>Circlip ring with 2 socket head cap screws M 4 x 10 Pos. 7</b>			324-0047-000	
<b>Bellows Pos. 8</b>			322-0098-000	
<b>Gas plug with seal Pos. 9</b>			323-0017-000	
<b>Nut M 10 flat Pos. 10</b> (required for stud length < 16 mm)			322-0378-000	

For studs with lengths  $L > \text{app. } 6d$  chucks with deeper grip length are recommended. Further information upon request.

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## 13 Literature

EN ISO 14555 "Drawn arc stud welding of metallic materials"

EN ISO 13918 "Studs and Ceramic Ferrules for Drawn Arc Stud Welding"

DVS-Technical bulletin 0901 "Stud Welding Procedures for Metals – Overview"

DVS-Technical bulletin 0902 "Drawn Arc Stud Welding"

DVS-Technical bulletin 0903 "Stud Welding With Tip Ignition"

DVS-Technical bulletin 0904 "Drawn Arc Stud Welding – Practical hints"

Trillmich, R. and Welz, W.: "Stud Welding – Principles and Applications", DVS-Media, english edition, vol. 12, Düsseldorf 2016