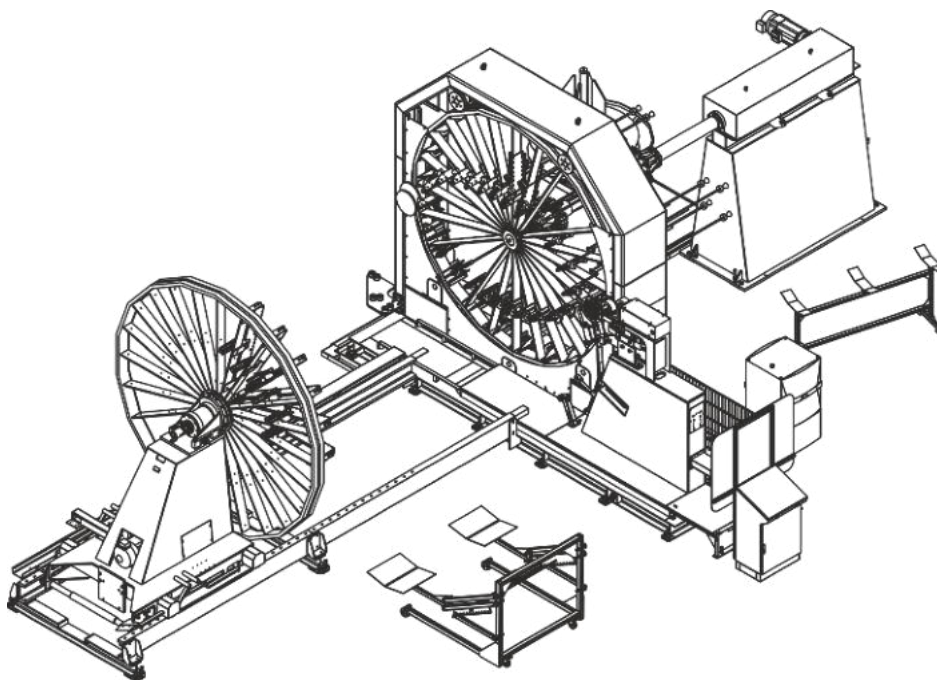


Operating instructions

**Automatic cage welding machine
SMS 220/24 EL**



Read manual before starting any work!

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⚠ These instructions enable the safe and efficient handling of the automatic welding machine SMS 160/24 EL (hereinafter referred to as "machine"). The manual is part of the equipment and must be always kept in the immediate vicinity of the machine and accessible to the personnel.

The personnel must have carefully read and understood these instructions before starting any work. The basic prerequisite for safe working is the observance of all safety instructions and handling instructions given in these instructions. In addition, the local accident prevention regulations and general safety regulations for the area of use of the system apply.

Illustrations in this manual are for basic understanding and may differ from the actual design of the plant.

In addition to these instructions, the instructions for the installed components in the appendix also apply.

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In addition, we are always interested in information and experiences that result from the use of the equipment and can be valuable for the improvement of our products.



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1 Overview

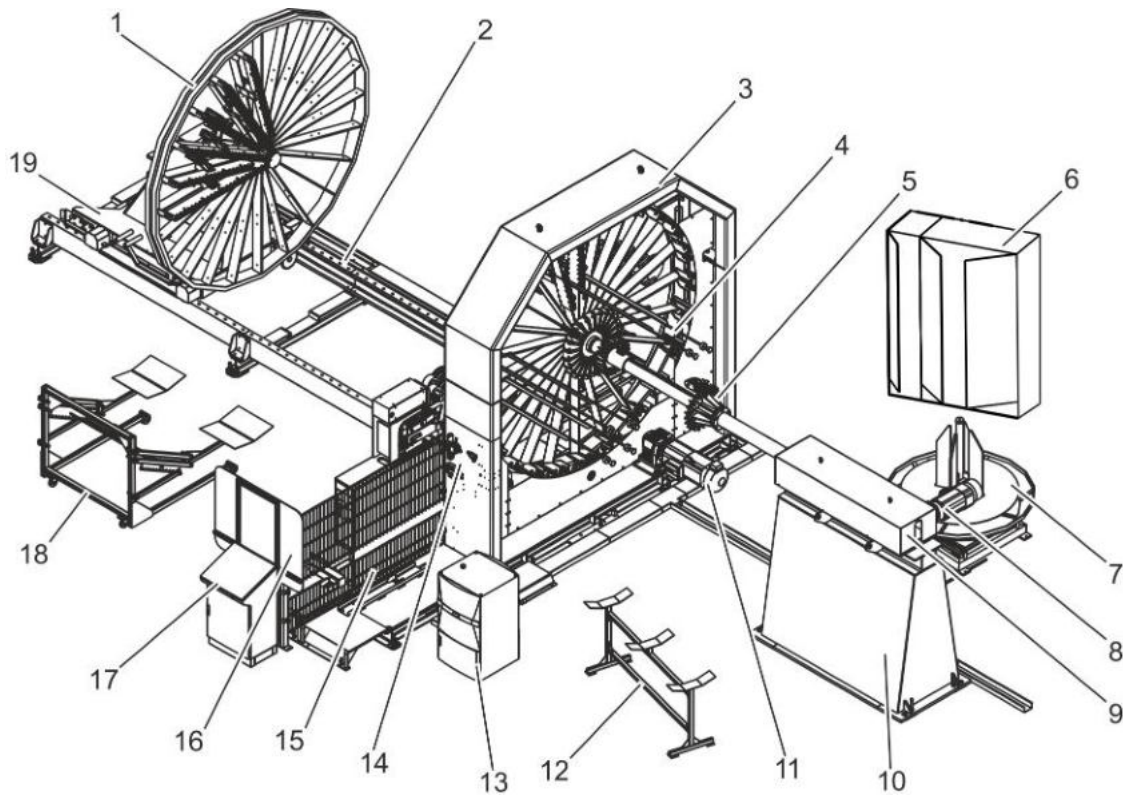


Fig. 1: SMS automatic cage welding machine

- | | |
|--|-----------------------------------|
| 1 Cage pull-out wheel | 11 Main drive |
| 2 Cage pull-out rails | 12 Longitudinal wire holding tray |
| 3 Machine frame | 13 Cooling unit |
| 4 Electrode support wheel with electrode carrier slides. | 14 Pneumatics |
| 5 Chain deflection | 15 Passage barrier |
| 6 Switch and control cabinet | 16 Protective screen |
| 7 Circumferential wire reel stand | 17 Control panel |
| 8 Spreader drive | 18 Cage removal trolley |
| 9 Cover | 19 Cage pull-out |
| 10 Electrode support wheel | |

Overview

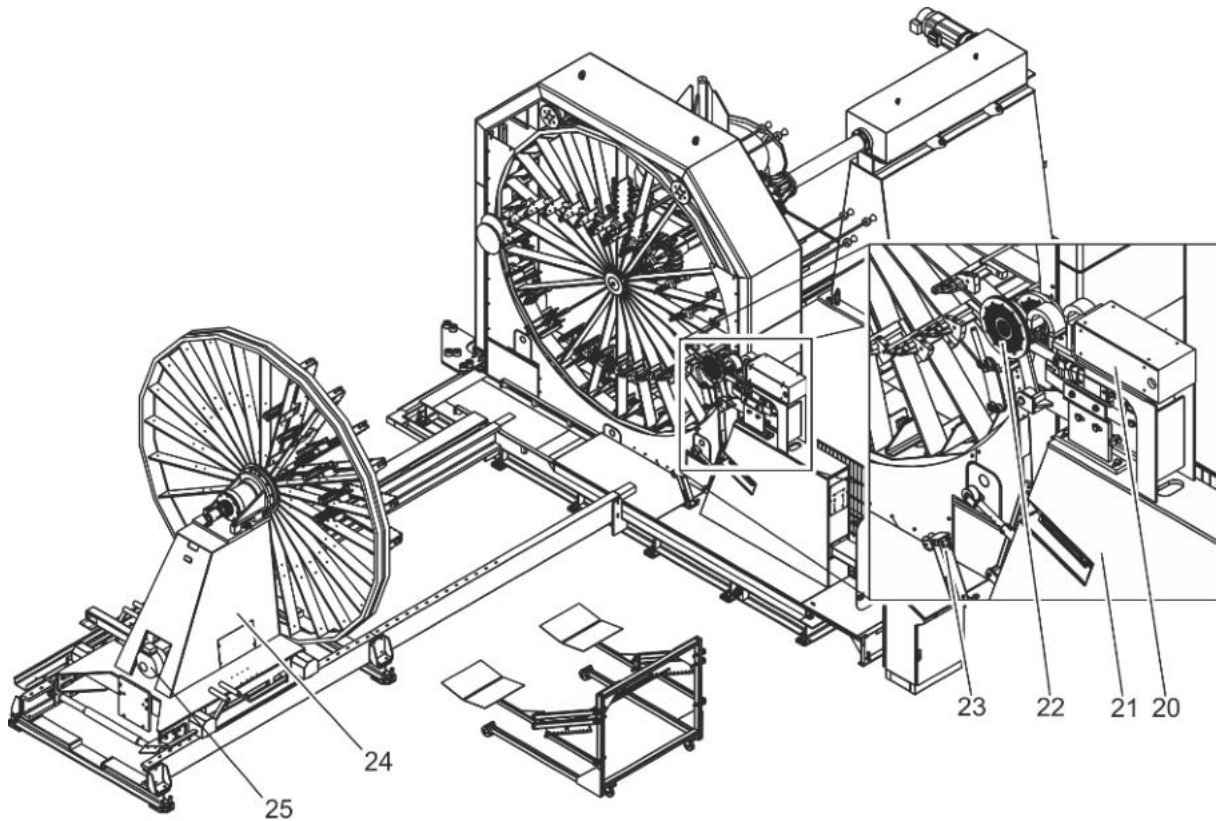


Fig. 2: SMS automatic cage welding machine

- | | |
|-----------------------------|----------------------------------|
| 20 Welding transformer | 23 Circumferential wire clamping |
| 21 Welding support carriage | 24 Cage pull-out |
| 22 Welding head | 25 Cage pull-out wheel drive |

2 Safety

This section provides an overview of all important safety aspects for the protection of persons and for safe and trouble-free operation. Further task-related safety instructions are contained in the sections on the individual life spans.

2.1 Explanation of symbols

Safety instructions

Safety instructions are identified in these instructions by symbols. The safety instructions are introduced by signal words that express the extent of the hazard.

 **DANGER!**

This combination of symbol and signal word indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING!**

This combination of symbol and signal word indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION!**

This combination of symbol and signal word indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTE!

This combination of symbol and signal word indicates a possibly hazardous situation which, if not avoided, may result in property damage.

Tips and recommendations



This symbol highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

**Other markings**

The following markings are used in this manual to highlight instructions for action, results, listings, references, and other items:

Marking	Explanation
1., 2., 3. ...	Step-by-step action instructions
⇒	Results of action steps
↗	References to sections of this manual and to applicable documents
•	Listings without specified order
[Button]	Operating elements (e.g. buttons, switches), display elements (e.g. signal lamps)
"Display"	Screen elements (e.g. buttons, assignment of function keys)

2.2 Intended use

The equipment is used exclusively to produce round or elliptical steel reinforcements using the resistance spot welding process.

Intended use also includes compliance with all the information in these instructions.

Any use of the automatic cage welding machine beyond the intended use or any other use is considered misuse.

Misuse leads to the safety concept of the machine being undermined.

WARNING!

Danger in case of misuse! Incorrect use of the automatic cage welding machine can lead to dangerous situations.

Specifically, refrain from the following uses of the equipment:

- Use of materials other than those approved by the manufacturer.**
- Do not operate the automatic cage welding machine in hazardous areas.**

Claims of any kind for damage due to improper use are excluded.

2.3 Special Hazards

The following section identifies residual risks that have been identified based on a risk assessment.

Observe the safety instructions listed here and the warnings in the other chapters of this manual to reduce health hazards and avoid dangerous situations.

2.3.1 Electric Hazards

Electric Current

⚠ DANGER!

Danger to life due to electric current! There is an immediate danger to life from electric shock when touching live parts. Damage to the isolation or individual components can be life-threatening.

- Only allow work on the electrical system to be carried out by qualified electricians.**
- If the isolation is damaged, switch off the power supply immediately and arrange for repair.**
- Before starting work on active parts of electrical systems and equipment, ensure that they are de-energized for the duration of the work. Observe the 5 safety rules:**
 - Unlock.**
 - Secure against restarting.**
 - Determine the absence of tension.**
- Earth and short-circuit.**
- Cover or fence off adjacent live parts.**
- Never bypass fuses or put them out of operation.**
 - When replacing fuses, observe the correct current rating.**
 - Keep moisture away from live parts. This can lead to a short circuit.**

2.3.2 Dangers due to magnetic fields

Strong magnetic fields

⚠ WARNING!

Danger to life due to strong magnetic fields! Strong magnetic fields can cause serious injuries or even death as well as considerable damage to property.

- People with pacemakers must not be in the vicinity of the unit. The function of the pacemaker could be impaired.**
- People with implants made of metal must not be in the vicinity of the unit. Implants can heat up or be attracted.**

- Keep ferromagnetic materials and electromagnets away from the magnet source. These materials could be attracted and fly around, injuring or killing people. Minimum distance 3 m (9.84 ft).
- Before maintenance work, remove metal objects (jewelry, watches, writing instruments, etc.).
- Do not bring any electronic devices near the magnetic source. These could be damaged.
- Do not bring storage media, credit cards, etc. near the magnetic source. Data can be deleted.

2.3.3 Dangers due to high temperatures

Hot surfaces

⚠ WARNING!

Risk of injury from hot surfaces! Surfaces of the welding and contact roller, the welding transformer and the reinforcements can heat up considerably during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Always wear heat-resistant protective clothing and gloves when working near hot surfaces.
- Before carrying out any work, ensure that all surfaces have cooled down to ambient temperature.

Hot coolant

⚠ WARNING!

Risk of injury from hot coolant! The coolant can reach high temperatures during operation. Skin contact with hot coolant causes severe burns to the skin.

- Before handling the coolant, check whether it is hot. If necessary, allow to cool down.

2.3.4 Mechanical dangers

Suspended loads

⚠ WARNING!

Danger to life due to suspended loads! Coils and reinforcement cages can swing out and fall during lifting. This can cause serious injuries or even death.

- Never step under or into the swivel range of suspended loads.**
- Only move loads under supervision.**
- Use only approved lifting equipment and slings with sufficient load-bearing capacity.**
- Do not use torn or chafed lifting equipment.**
- Do not place lifting equipment such as ropes and belts over sharp edges, do not knot or twist them.**
- Set down the load when leaving the workplace.**

Moving components

⚠ WARNING!

Risk of injury due to moving components! The rotation of the electrode support wheel and the cage pull-out wheel, the movement of the cage pull-out and the welding head as well as the circumferential wire reel can cause severe injuries.

- Do not reach into or handle moving components during operation.**
- Do not open protective fences during operation.**
- Observe the stopping time: Before opening covers, make sure that no components are moving.**
- Wear close-fitting protective work clothing with low tear resistance in the hazardous area.**

Sharp edges and pointed ends

⚠ CAUTION!

Risk of injury from sharp edges and pointed ends! Longitudinal and circumferential wires as well as the reinforcement cages have sharp edges and pointed ends. They can cause abrasions, punctures and cuts on the skin.

- When working near sharp edges and pointed ends, use caution.**
- When in doubt, wear protective gloves.**

2.3.5 Dangers due to energy in pneumatic systems

⚠ WARNING!

Risk of injury from pneumatic energies! Pneumatic energies can cause extremely serious injuries.

Pneumatically driven parts can move unexpectedly.

If individual components are damaged, air can escape under high pressure and damage the eyes, for example.

-Only allow work on the pneumatics to be carried out by trained specialist personnel.

-Before starting work on the pneumatic system, first depressurize it. Pay attention to the pressure accumulator. Also depressurize them completely.

-Do not change the pressure settings beyond the maximum values.

2.3.6 Noise dangers

Noise

⚠ WARNING!

Hearing damage due to noise! The noise level occurring in the work area can cause severe hearing damage.

-Always wear hearing protection when working with the system switched on.

2.3.7 Dangers due to chemical substances

Handling of operating materials

⚠ WARNING!

Danger of poisoning from operating fluids!
Operating fluids such as lubricants contain toxic substances and can cause severe poisoning.
Operating materials have an irritating effect on skin and eyes.

- When handling operating materials such as lubricants, always wear personal protective equipment (protective work clothing, protective gloves).
- Observe the manufacturer's safety data sheets.
- Avoid skin and eye contact with operating materials.
- Do not allow operating fluids to flow out and collect them in a suitable container.

Proposition 65

⚠ WARNING: CALIFORNIA Proposition 65 This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Antifreeze

⚠ WARNING! Health hazard due to antifreeze!
Coolant contains an antifreeze agent which can cause serious damage to health if it comes into contact with the body, is swallowed or inhaled.

- Avoid contact with coolant.
- Do not eat, drink or smoke when handling coolant.
Wash hands before breaks and at the end of work.
- Observe the coolant manufacturer's safety data sheet.
- When handling coolant, wear the personal protective equipment specified in the safety data sheet.

2.3.8 Fire and explosion dangers

Highly flammable substances

⚠ WARNING!

Danger to life in case of fire caused by highly flammable substances! Highly flammable substances, liquids or gases can catch fire and cause severe to fatal injuries.

- Do not smoke inside the danger zone or in the immediate vicinity. Do not handle open light, fire or ignition sources of any kind.**
- Do not store hazardous materials in the vicinity of the machine.**
- Keep suitable extinguishing media (fire blanket, fire extinguisher) ready.**
- Report suspicious substances, liquids or gases to the person in charge immediately.**
- Never use inflammable cleaning agents for cleaning the equipment.**
- In case of fire, stop work immediately. Leave the danger area until the all-clear signal is given and alert the fire department.**

Fire protection

⚠ WARNING!

Risk of injury due to limited or improper fire fighting! If, in the event of a fire, the fire extinguisher is not ready for use or is unsuitable for the specific fire class, serious injuries or even death as well as considerable damage to property may result.

- Make sure that only fire extinguishers suitable for the fire class are available.**
- Check operating state of fire extinguishers every 2 years.**
- Refill the fire extinguisher after each use.**
- Use only extinguishing propellants and spare parts indicated on the fire extinguisher.**
- When in use, observe the safety and operating instructions on the fire extinguisher.**
- In case of use, observe the functional temperature range.**

2.3.9 General dangers in the workplace

Dirt and objects lying around

⚠ WARNING!

Risk of tripping due to dirt and objects lying around!
Dirt and objects lying around are sources of slipping and tripping and can cause considerable injuries.

- Always keep the work area clean.
- Remove items that are no longer needed.
- Mark tripping points with yellow-black marking tape.

Snapping wires

⚠ CAUTION!

Risk of injury due to snapping wires! Incorrect handling of the wires can lead to injuries.

- Always stay beside the wire.
- Approach the cage only from the sides.
- Always use caution during all work.
- Wear personal protective equipment.

2.4 Safety devices

⚠ WARNING!

Danger to life due to non-functioning safety devices!
If safety devices do not function or are disabled, there is a risk of serious injury or even death.

- Before starting work, check that all safety devices are functional and correctly installed.
- Never override or bypass safety devices.
- Make sure that all safety devices are always accessible.

The following safety devices are installed:

Main switch with emergency stop function

The main switch is also designed as an emergency stop switch. Turning the main switch to position "0" stops the machine by immediately switching off the power supply, thus triggering an emergency stop.

⚠ WARNING!

Danger to life due to uncontrolled restarting!
Uncontrolled restarting of the machine can lead to severe injuries or even death.

- Before switching on again, make sure that the cause of the emergency stop has been eliminated and all safety devices are mounted and functional.
- Do not move the main switch back to position "I" until there is no longer any danger.

Light curtains

Light curtains separate hazardous areas. The danger areas within the light curtains must not be entered when the power supply is switched on. Crossing a light curtain causes the system to shut down under emergency stop conditions.

Do not start the system while persons are within the area protected by the light curtains.

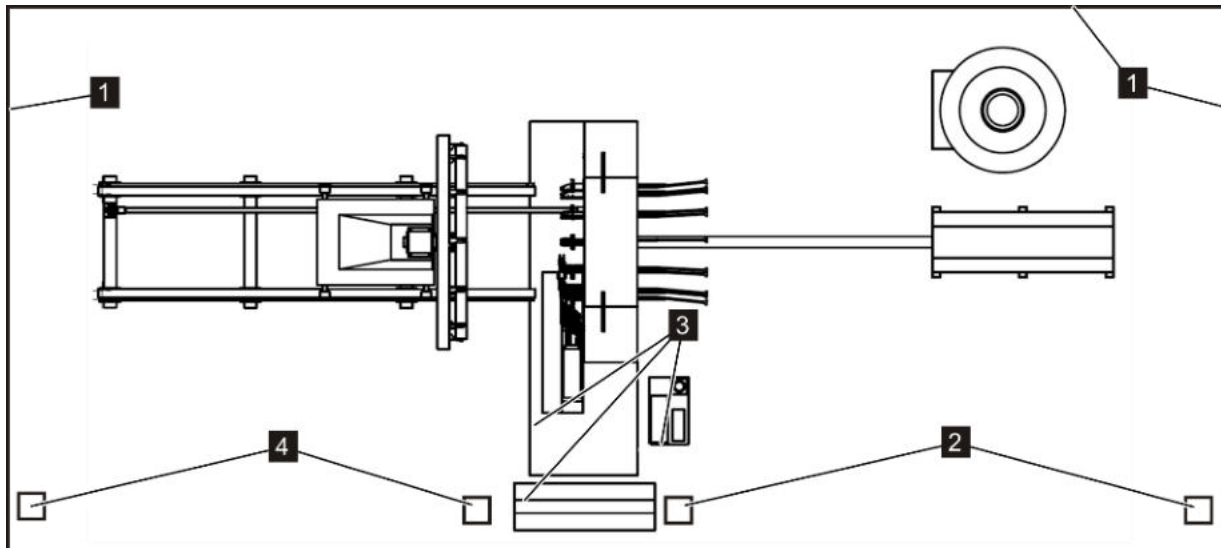


Fig. 3: Safety devices

1 Walls

3 Emergency stop button

2 + 4 Light curtains

If the building in which the machine is operated does not limit access from three sides by its walls (Fig. 3/1), the operator must retrofit suitable protective fences.

2.5 Location of the emergency stop buttons

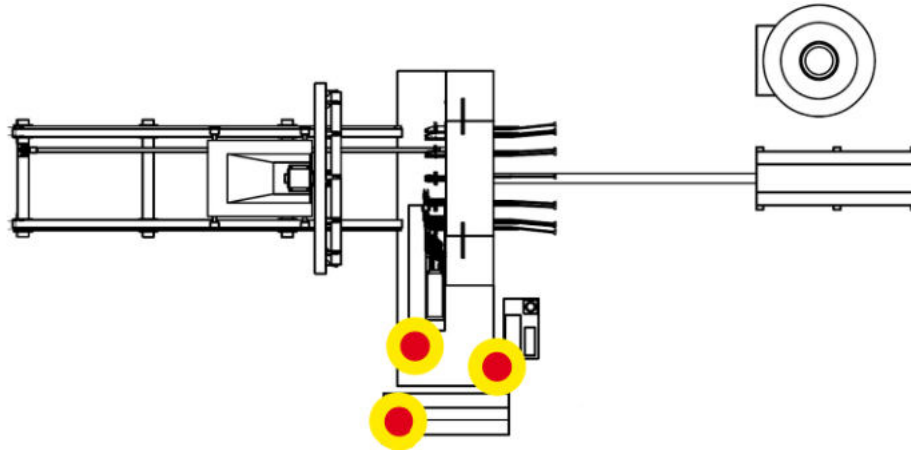
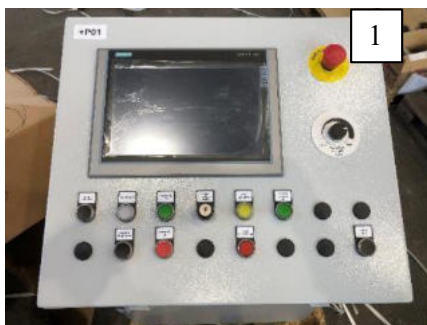
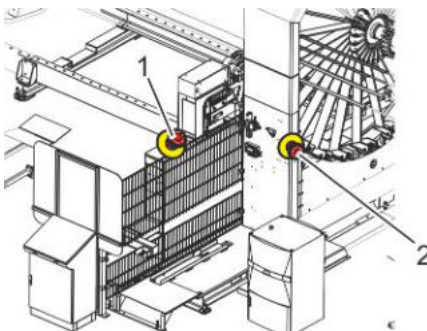


Fig. 4: Location of the emergency stop buttons



An emergency stop button is located on the control panel (Fig. 5/1).

Fig. 5: Control panel



The welding support (Fig. 6/1) and the rear side of the machine frame in the area of the longitudinal wire loading position (Fig. 6/2) are each equipped with an emergency stop button.

Fig. 6: Emergency stop button on support and machine frame

2.6 Working and hazardous areas

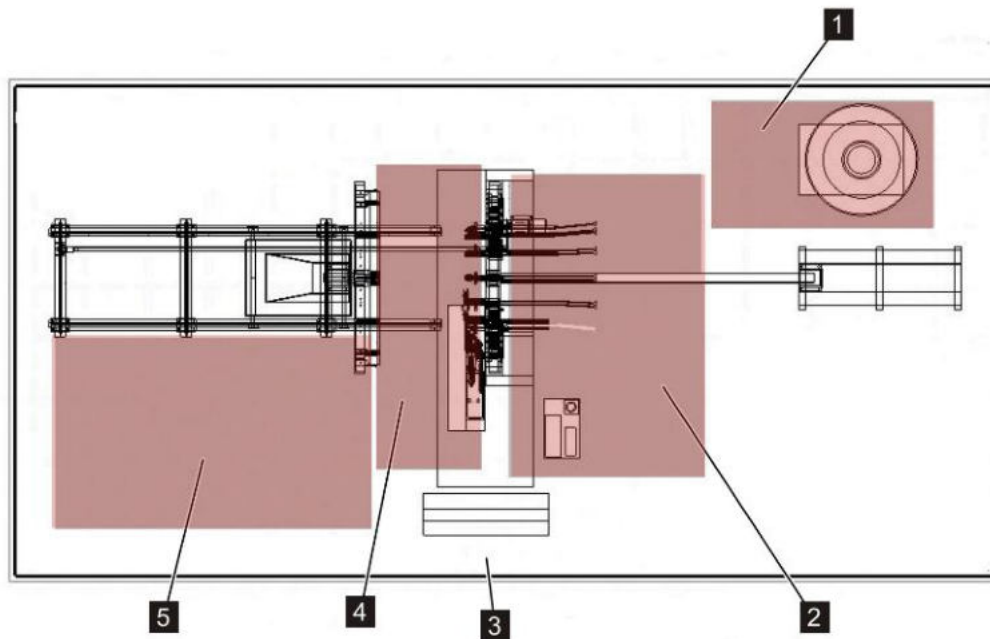


Fig. 7: Working and hazardous areas

- | | | | |
|---|---------------------------------|---|---|
| 1 | Circumferential wire reel stand | 4 | Welding head + circumferential wire guide |
| 2 | Longitudinal wire loading area | 5 | Cage removal zone |
| 3 | Operating terminal | | |

Areas of operation

- Placement of circumferential wire coils (Fig. 7/1)
- Placement of longitudinal wires (Fig. 7/2)
- Switching the automatic system on/off (Fig. 7/3)
- Selection of work program (Fig. 7/3)
- Parameter input (Fig. 7/3)
- Entering new programs (Fig. 7/3)
- Program management (Fig. 7/3)
- Supervision of production (Fig. 7/3)
- Laying of circumferential wire under the welding roller (Fig. 7/4)
- Inserting of circumferential wire (Fig. 7/4)
- Cutting the circumferential wire after manufacturing each cage (Fig. 7/4)
- Removing the cages from the machine (Fig. 7/5)

Hazardous areas

The hazardous areas are highlighted in red in Fig. 7 highlighted in red.

- Environment of the circumferential wire reel stand (Fig. 7/1) during placement work
- Surroundings of the longitudinal wire holding tray (Fig. 7/2) during placement work
- Environment of the electrode support wheel (Fig. 7/2 + 4) during placement and setup work, troubleshooting, maintenance and repair work.
- Close vicinity of the electrode support wheel (Fig. 7/4 + 5) (flying sparks)
- Cage removal zone during cage removal (Fig. 7/5)

2.7 Signage at the place of use

The following symbols and information signs are in the work area. They refer to the close vicinity in which they are placed.

WARNING!

Danger with illegible signage! In the course of time, stickers and signs can become dirty or otherwise unrecognizable, so that hazards cannot be recognized and necessary operating instructions cannot be followed. This results in a risk of injury.

- Maintain all safety, warning, and operating instructions in legible condition at all times.**
- Replace damaged signs or decals immediately.**

2.7.1 Mandatory sign

Follow instructions



Use the so-marked equipment only after reading the instructions.

2.7.2 Prohibition sign

Access for unauthorized persons prohibited



Only persons authorized by the operator may enter the hazardous area.

Prohibition for persons with pacemaker



Strong electromagnetic or magnetic fields are to be expected around this sign, which may interfere with pacemakers or render them inoperable.

Persons wearing a pacemaker must not approach equipment marked with this symbol.

2.7.3 Warning signs

Magnetic field



Magnetic fields are not dangerous to humans per se, but strong magnetic fields can erase audio tapes, magnetic tapes, data storage devices or magnetic strips on check and ID cards.

Alternating magnetic fields can heat up metallic bodies very strongly because of eddy currents. This also applies to jewelry, such as gold rings or watches.

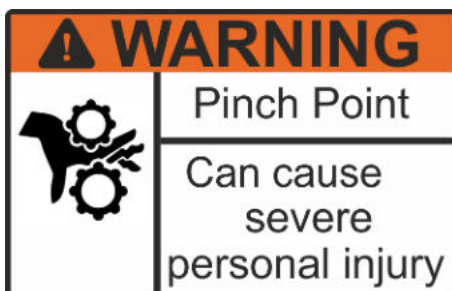
Keep metallic objects away from the marked areas.

Hot surface



Hot surfaces, such as hot machine parts, containers or materials, but also hot liquids, are not always perceptible. Do not touch these without protective gloves.

Danger of drawing-in



Only work on the feed points when the machine is at a standstill. As long as the machine is moving, there is a risk of injury.

Hand injury



Keep your hands away from places that carry this warning sign.

There is a risk that the hands can be crushed, pulled in or otherwise injured.

2.8 Securing against restarting

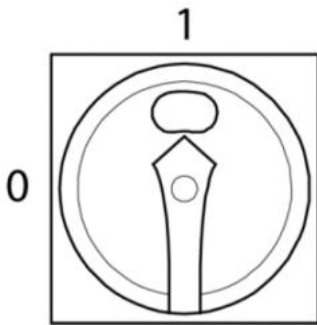
⚠ WARNING!

Danger to life due to unauthorized or uncontrolled restarting! Unauthorized or uncontrolled restarting of the system can lead to serious injuries or even death.

-Before switching on again, make sure that all safety devices are mounted and functional and that there is no danger to persons.

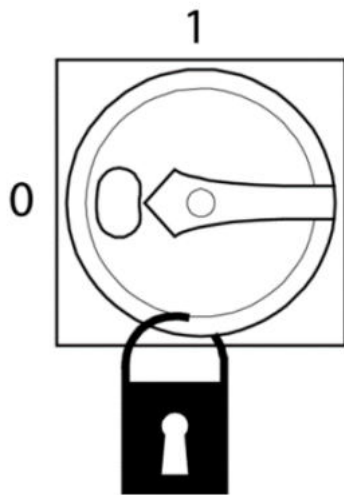
-Always follow the procedure described below for securing against restarting.

Securing against restarting



1. Switch off the power supply. To do this, move the main switch to position "0".

Fig. 8: Main switch



2. Secure the main switch with a lock.
3. Have the key to the lock kept by a responsible employee.

Fig. 9: Secure main switch

2.9 Behavior in the event of fire and accidents

Preventive measures

- Always be prepared for fire and accidents!
- Keep first aid equipment (first aid kit, blankets, etc.) and fire extinguishing equipment in working order and within easy reach.
- Familiarize personnel with accident reporting, first aid and rescue equipment.
- Keep access routes clear for emergency vehicles.



Measures in the event of fire and accidents

- Immediately trigger emergency stop by emergency stop device.
- If there is no danger to own health, rescue persons from the danger zone.
- If necessary, initiate first aid measures.
- Alert fire department and/or rescue service.
- In case of fire: If there is no danger to own health, fight fire with fire extinguishing equipment and continue fire fighting until the fire department arrives.
- Inform the responsible person.
- Clear access routes for emergency vehicles.
- Instruct rescue vehicles.

2.10 Responsibility of the operator

Operator

The operator is the person who operates the machine for commercial or economic purposes or who makes it available to a third party for use and who bears the legal product responsibility for the protection of personnel or third parties during operation.

Operator duties

The equipment is used in the commercial sector. The operator of the equipment is therefore subject to the legal obligations for occupational safety.

The following applies in particular:

- The operator must inform himself about the applicable occupational health and safety regulations and, in a risk assessment, additionally determine hazards that result from the special working conditions at the place of use of the equipment. He must implement these in the form of operating instructions for the operation of the equipment.
- During the entire period of use of the equipment, the operator must check whether the operating instructions he has prepared correspond to the current status of the regulations and, if necessary, adapt them.
- The operator must clearly regulate and define the responsibilities for installation, operation, troubleshooting, maintenance and cleaning of the equipment.
- The operator must ensure that all persons handling the equipment have read and understood these instructions. Furthermore, he must train the personnel at regular intervals and inform them about the dangers.
- The operator must provide the personnel with the required protective equipment and issue binding instructions for the wearing of the required protective equipment.
- The operator must ensure that the maintenance intervals described in these instructions are observed.
- The operator must have all safety devices checked regularly for functionality and completeness.

2.11 Personnel qualifications

2.11.1 Qualifications

The various tasks described in this manual place different demands on the qualifications of the persons entrusted with these tasks.

⚠ WARNING!

Danger if persons are insufficiently qualified!
Insufficiently qualified persons cannot assess the risks when handling the equipment and expose themselves and others to the risk of serious or fatal injuries.

- All work must be carried out by qualified personnel only.**
- Keep insufficiently qualified persons out of the work area.**
- Only persons who can be expected to perform this work reliably are permitted to perform any work. Persons whose ability to react is affected, e.g. by drugs, alcohol or medication, are not permitted to work on this equipment.**

The personnel qualifications listed here for the United States are adapted from the descriptions of occupational qualifications in the Occupational Outlook Handbook, 2010-11 Edition published by the United States Department of Labor, Bureau of Labor Statistics.

This guidance identifies the qualifications of the individuals listed below for the various tasks:

Operative

The operative has been instructed by the operator about the tasks assigned to him and possible dangers in case of improper behavior. The operative may only perform tasks that go beyond operation during normal operation if this is specified in these instructions and the operator has expressly entrusted him with this task.

Quality assurance specialist

Based on their professional training, knowledge and experience as well as knowledge of the relevant standards and regulations, the quality assurance specialist is able to analyze and assess the quality of the material and the welds.

Trained professionals

The trained personnel has at least 3 - 4 years of professional experience in the field of special work on the equipment. It was also specially trained by apilion machines + services GmbH and can prove this in the form of a certificate. The training has the following contents:

- Technical handling of the equipment
- Dangers emanating from the equipment
- Processes of special maintenance work and the hazards they pose

This means that the trained specialist personnel can carry out the work assigned to them and can recognize and avoid possible dangers independently. The trained personnel is specially trained for the working environment of the equipment and is informed by the operator about dangers.

Qualified electrician

Based on his training, knowledge and experience as well as knowledge of the relevant standards and regulations, the qualified electrician is able to perform the following work on electrical systems in a professional and safe manner:

- Plan and connect electrical systems based on circuit and wiring diagrams.
- Assembling cables and connecting electrical components
- Analyze, measure and test electrical systems and functions
- Carrying out safety tests on electrical systems, components and devices
- Troubleshooting of electrical systems

The qualified electrician can independently identify and avoid hazards associated with this work.

Instructed person

The instructed person was demonstrably instructed in a briefing by the operator about the tasks assigned to him and possible dangers in case of improper behavior.

2.11.2 Unauthorized persons

⚠ WARNING!

Danger to life for unauthorized persons due to hazards in the danger and work area! Unauthorized persons who do not meet the requirements described here are not aware of the dangers in the work area. Therefore, there is a risk of serious injury or even death for unauthorized persons.

- Keep unauthorized persons away from the danger and work area.**
- If in doubt, approach persons and direct them out of the danger and work area.**
- Stop work as long as unauthorized persons are in the danger and work area.**

2.11.3 Instruction

The operator must instruct the personnel on a regular basis. For better follow-up, an instruction log with the following minimum contents must be created:

- Instruction date
- Name of the instructed
- Contents of the instruction
- Name of the instructor
- Signatures of the instructed and the instructor

2.12 Personal protective equipment

Personal protective equipment is used to protect persons from impairment of safety and health at work.

The personnel must wear personal protective equipment during the various works on and with the equipment, which is referred to separately in the individual sections of this manual.

Description of the personal protective equipment

The personal protective equipment is explained below:



Protective work clothing

Protective work clothing is close-fitting work clothing with low tear resistance, with tight sleeves and without protruding parts. It is mainly used to protect against flying sparks and against being caught by moving machine parts. Do not wear rings, chains or other jewelry. Persons with long hair must wear a hair net.



Hearing protection

Hearing protection to protect against hearing damage.



Face shield

Face shield to protect the eyes and face from flames, sparks or embers, and hot particles or exhaust fumes.



Heat resistant protective gloves with arm protection

The protective gloves are used to protect the hands and forearms from contact heat when touching high-temperature components.



Safety goggles

The safety goggles are used to protect the eyes from flying parts and liquid splashes.



Protective gloves

Protective gloves are used to protect hands from friction, abrasions, punctures or deeper injuries, as well as from contact with hot surfaces.



Safety helmet

Safety helmets protect the head against falling objects, swinging loads and bumping into stationary objects. Long hair must be worn under the helmet.



Safety shoes

Safety shoes protect feet from bruising, falling parts and slipping on slippery surfaces.

2.13 Spare parts

⚠ WARNING!

Risk of injury due to the use of incorrect spare parts!
The use of incorrect or faulty spare parts can cause danger to personnel as well as damage, malfunctions or total failure.

- Use only genuine manufacturer's spare parts or spare parts approved by the manufacturer.**
- Always contact the manufacturer if anything is unclear.**



Loss of warranty

Use of non-approved spare parts will void the manufacturer's warranty.

Spare parts can be obtained from authorized dealers or directly from the manufacturer. For contact details, see page 2.

The spare parts list can be found in the appendix.

2.14 Environmental protection

NOTE !

Danger to the environment due to incorrect handling of environmentally hazardous substances! Incorrect handling of environmentally hazardous substances, especially incorrect disposal, can cause considerable damage to the environment.

-Always observe the instructions below on handling and disposing of environmentally hazardous substances.

-If environmentally hazardous substances are accidentally released into the environment, take appropriate measures immediately. In case of doubt, inform the competent authority about the damage and ask for suitable measures to be taken.

The following environmentally hazardous substances are used:

Cooling water with antifreeze Cooling water and antifreeze contain toxic substances. They must not be released into the environment. Disposal must be carried out by a specialist disposal company.

Hydraulic oil Hydraulic oil is toxic and harmful to the environment. The utmost care and caution is required when handling hydraulic oil. Always follow the instructions on the container and the manufacturer's safety data sheet. Instruct personnel regularly about possible dangers. Disposal must be carried out by a specialist disposal company.

Lubricants Lubricants such as greases and oils contain toxic substances. They must not be released into the environment. Disposal must be carried out by a specialist disposal company.

3 Structure and function

3.1 Overview

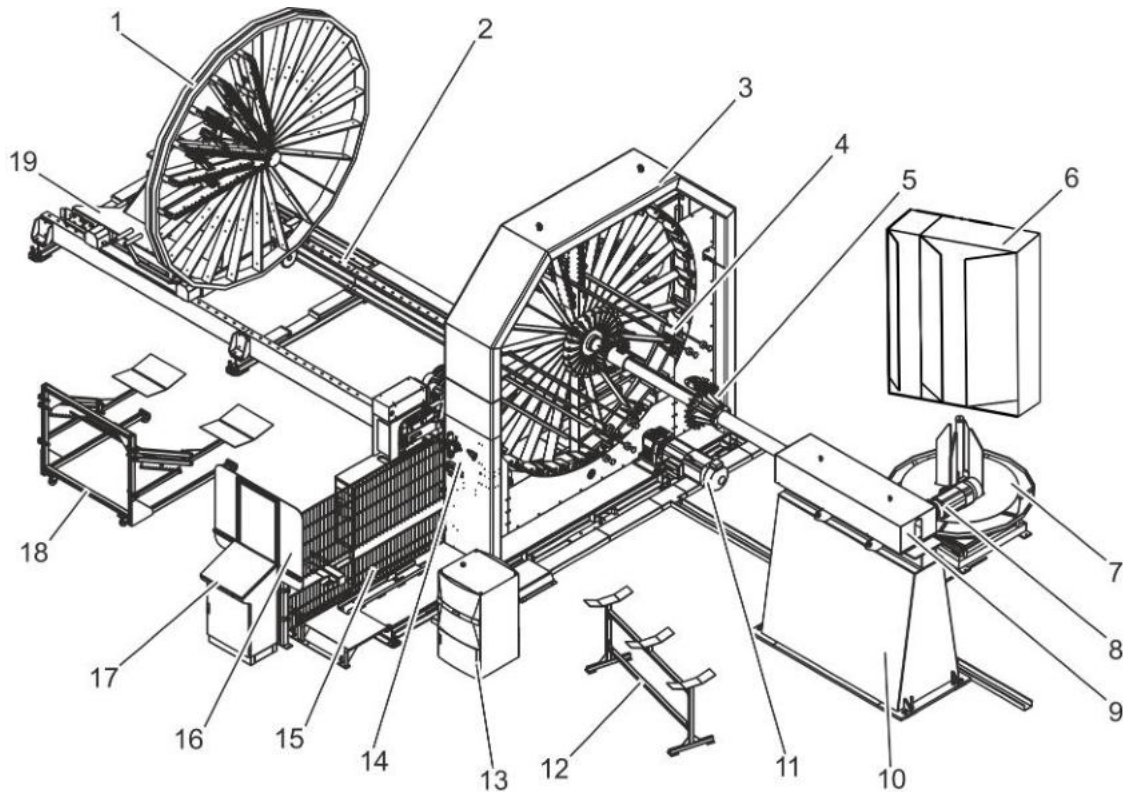


Fig. 10: SMS automatic cage welding machine

- | | |
|--|-----------------------------------|
| 1 Cage pull-out wheel | 11 Main drive |
| 2 Cage pull-out track | 12 Longitudinal wire holding tray |
| 3 Machine frame | 13 Cooling unit |
| 4 Electrode support wheel with electrode carrier slides. | 14 Pneumatics |
| 5 Chain deflection | 15 Passage barrier |
| 6 Switch and control cabinet | 16 Protective screen |
| 7 Circumferential wire reel stand | 17 Control panel |
| 8 Spreader drive | 18 Cage removal trolley |
| 9 Cover | 19 Cage pull-out |
| 10 Electrode support wheel | |

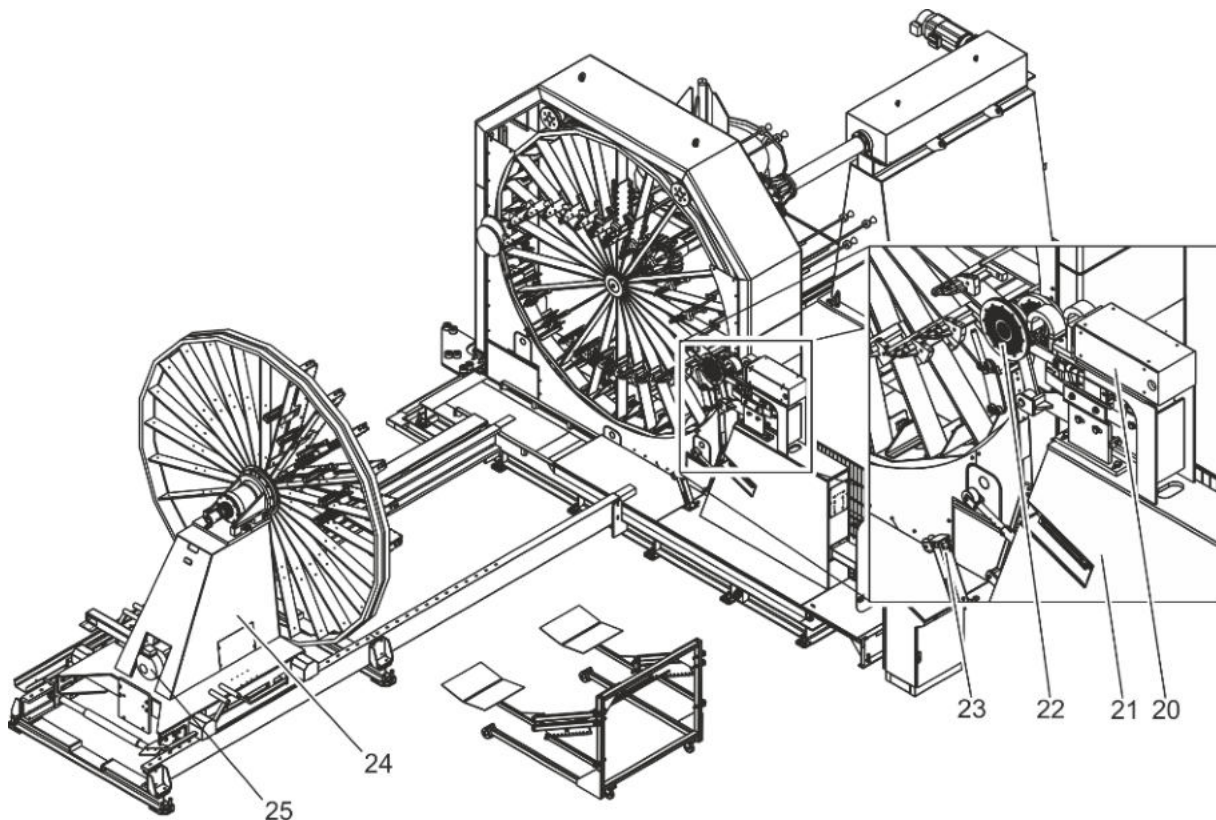


Fig. 11: SMS automatic cage welding machine

- | | |
|-----------------------------|----------------------------------|
| 20 Welding transformer | 23 Circumferential wire clamping |
| 21 Welding support carriage | 24 Cage pull-out |
| 22 Welding head | 25 Cage pull-out wheel drive |

3.2 Brief description

The SMS 160/24 EL automatic welding machine is a machine to produce round or elliptical reinforcements.

Pre-cut longitudinal wires are manually inserted into the wire guide tubes and pushed through the electrode support wheel and the electrode carrier slides (Fig. 10/4) to the cage pull-out wheel. There they are clamped in place.

The electrode carrier slides (Fig. 10/4) are radially adjustable. They are used to adjust the diameter or the elliptical shape of the reinforcement.

The circumferential wire is pulled from the circumferential wire reel stand (Fig. 10/6) through the wire guide under the welding roll of the welding head (Fig. 10/22), which is

mounted on the welding support carriage (Fig. 10/21).

The circumferential wire is welded to the longitudinal wires on the electrode carrier slides (Fig. 10/4) by resistance spot welding.

The electrode support wheel with the electrode carrier slides (Fig. 10/4) rotates during operation within the machine frame. This causes a pull on the circumferential wire, which draws it off the circumferential wire coil from the circumferential wire reel stand (Fig. 10/7).

The cage pull-out wheel (Fig. 10/1) rotates synchronously with the electrode support wheel (Fig. 10/4) and moves along the cage pull-out track (Fig. 10/2) away from the electrode support wheel. This draws the longitudinal wires through the electrode support wheel. The circumferential wire pitch depends on the speed of this movement.

When changing the diameter within the reinforcement, for example to produce sockets, the electrode support wheel (Fig. 10/4) changes its diameter. Synchronously to the electrode support wheel, the welding support carriage (Fig. 10/21) moves away from the electrode support wheel.

After completion of a reinforcement, it is pulled out of the machine by the pull-out wheel (Fig. 10/1) and is manually removed from the machine with the cage transport trolley or a suitable lifting device.

3.3 Assembly description

3.3.1 Spreader drive

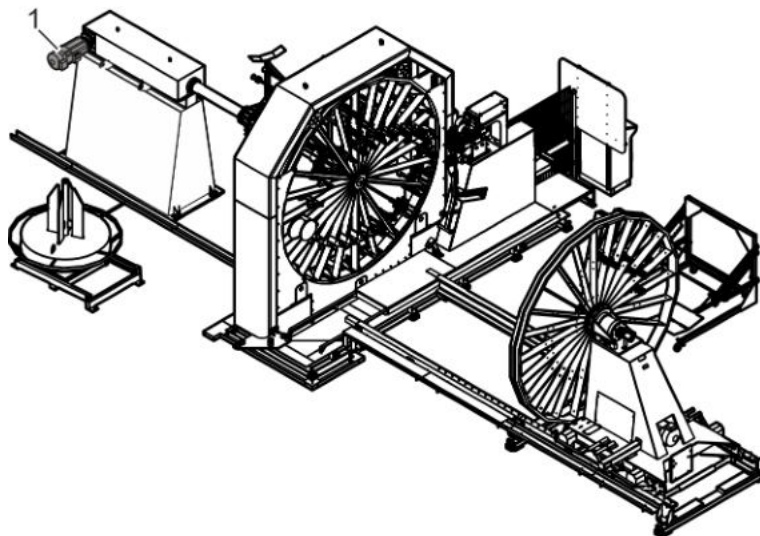


Fig. 12: Spreader drive

The spreader drive (Fig. 12/1) is used to move the electrode carrier slides radially within the electrode support wheel.

A change in the diameter of the reinforcement is achieved by changing the position of the electrode carrier slides.

3.3.2 Longitudinal wire holding tray

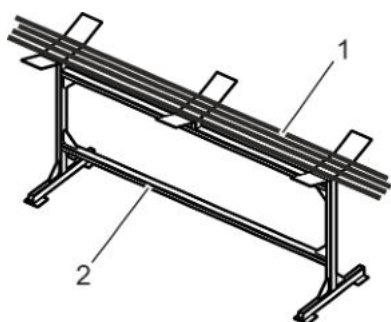


Fig. 13: Longitudinal wire holding tray

The longitudinal wire holding tray (Fig. 13/2) is used to hold the cut-to-length longitudinal wires (Fig. 13/1).

The longitudinal wires for feeding the machine are taken from it.

3.3.3 Electrode support wheel

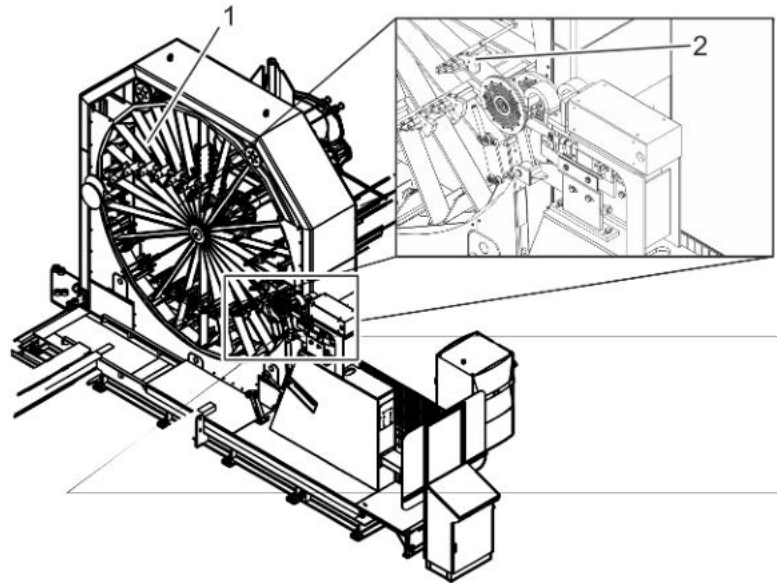


Fig. 14: Electrode support wheel

The rotating electrode support wheel (Fig. 14) consists of a spoked wheel (Fig. 14/1) on which the electrode carrier slides (Fig. 14/2) are mounted. The electrode carrier slides can be automatically adjusted radially to set the desired cage diameter.

To set an elliptical cage diameter, the electrode carrier slides must be manually pre-positioned for the elliptical shape.

On the electrode carrier slides, the circumferential wire is welded to the longitudinal wires.

3.3.4 Welding support

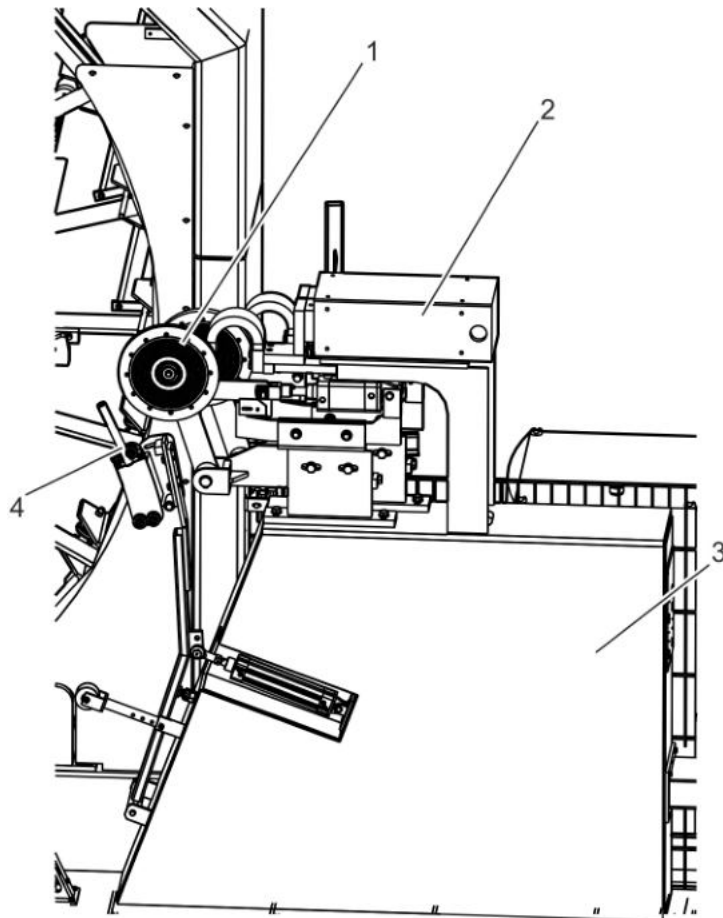
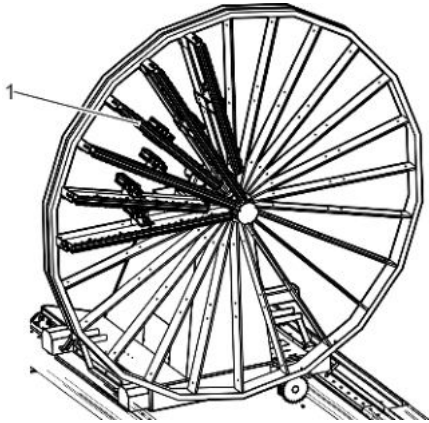


Fig. 15: Welding support

On the welding support carriage (Fig. 15/3), the welding transformer (Fig. 15/2), the welding head (Fig. 15/1) and the circumferential wire guide (Fig. 15/4) are mounted.

When the cage diameter changes, the welding support is automatically moved to the corresponding cage diameter.

3.3.5 Cage pull-out wheel with longitudinal wire clamping

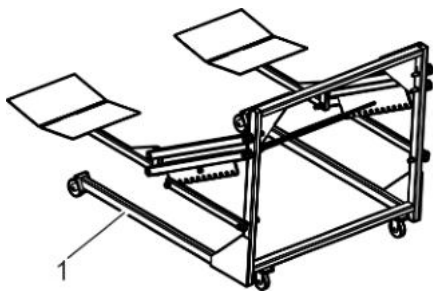


The cage pull-out wheel (Fig. 16) pulls the reinforcement cage out of the electrode support wheel.

The clamping units of the longitudinal wire clamping (Fig. 16/1) are attached to this wheel.

Fig. 16: Cage pull-out wheel

3.3.6 Cage removal trolley



The cage removal trolley (Fig. 17/1) is used to remove the cages from the welding machine.

Fig. 17: Cage removal trolley

3.3.7 Control panel



Fig. 18: Control panel

The control panel (Fig. 18) contains the command and control devices required to operate the machine.

3.4 Connections

3.4.1 Electrical connection

The connection to the main line is in the switch and control cabinet.

3.4.2 Pneumatic connection

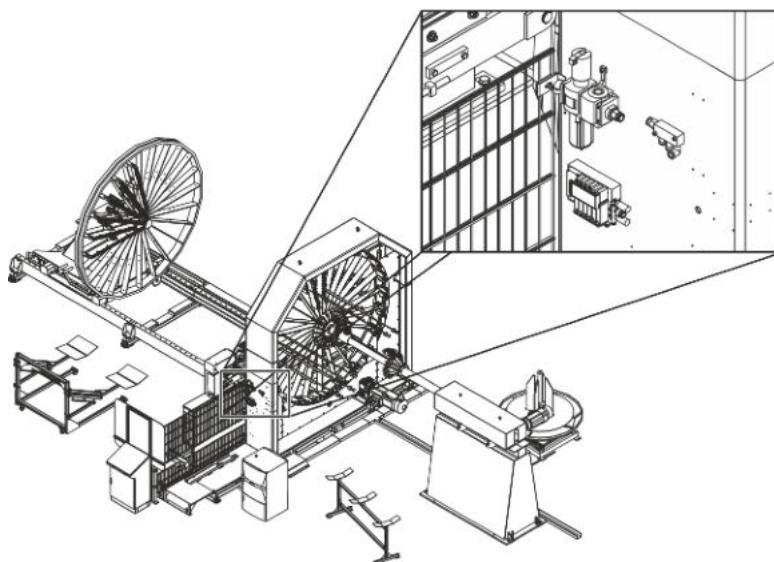


Fig. 19: Compressed air connection

The compressed air connection (Fig. 19/1) is located on the side of the machine frame.

3.5 Controls

3.5.1 Control panel

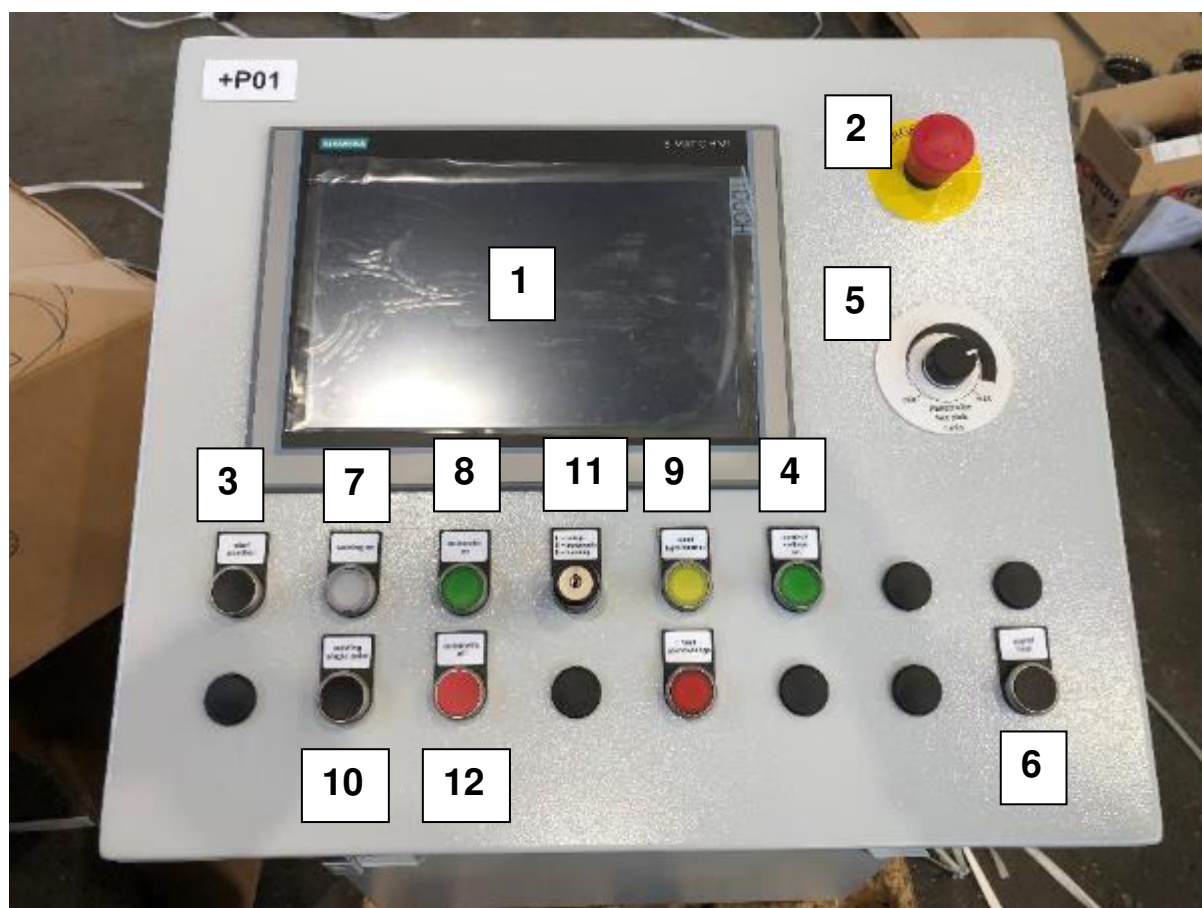


Fig. 20: Control panel

Structure and function

Position	Naming	Function
1	Operation Panel	Machine settings
2	Emergency stop button [Emergency stop]	Triggers emergency stop. Switches off system and control voltage. To restart unlock emergency stop button and acknowledge error message by "ACK" operating keys on the Operation Panel.
3	Pushbutton [<i>start position</i>]	Moves welding support carriage to start position
4	Illuminated pushbutton [<i>control voltage on</i>]	Switch on control voltage
5	Speed controller [<i>face plate u/min</i>]	Potentiometer for setting the current speed (rpm). When driving elliptical cages, the max. speed is limited.
6	Pushbutton [<i>bell</i>]	Bell, currently only manual operation
7	Illuminated button [<i>welding on / off</i>]	Switching the welding on/off After interrupting the automatic mode, the welding must be switched on again.
8	Illuminated pushbutton [<i>automatic on</i>]	Start machine in automatic mode
9	Light button [<i>reset light barrier desk</i>]	Acknowledgement of the interruption of the light curtains on both sides
10	Pushbutton [<i>single point</i>]	Start single spot welding. only possible after switching on welding.
11	Selector switch [<i>Setup/Auto / semi-auto</i>]	Operation mode selector switch
12	Pushbutton [<i>automatic off</i>]	Stops the automatic operation

The control panel (Fig. 20) contains all the pushbuttons and switches required to operate the machine, an emergency stop button and an operating panel. The individual control elements are directly labeled with the respective function.

3.5.2 Control buttons on the welding support carriage



The buttons located on the welding support carriage have the functions:

- Release circumferential wire brake (Fig. 21/1)
- Retract cage pull-out (Fig. 21/2)

Fig. 21: Control buttons on the welding support carriage

Frame of electrode support wheel

3.5.3 Control buttons in the longitudinal wire placement area



In the longitudinal wire placement area there is:

- An emergency stop button (Fig. 22)

Fig. 22: Control button in the longitudinal wire placement area

3.5.4 Foot switch in the longitudinal wire placement area



To facilitate loading, the electrode support wheel is slowly rotated step by step when the *[Foot switch]* is pressed.

Fig. 23: Foot switch wire placement area

3.5.5 Foot switch in the longitudinal wire placement area



When removing the reinforcement cage, the wire clamp of the cage pull-out wheel is opened by pressing the *[Foot switch]* Fig. 24.

Fig. 24: Foot switch cage removal area



3.6 Operating modes

3.6.1 Automatic mode

The production of the reinforcement cages takes place in automatic ("auto") mode.

3.6.2 Manual operation

The "manual" operating mode is used to set up the automatic cage welding machine and for troubleshooting and maintenance.

3.6.3 Reference mode

The automatic cage welding machine must be referenced again after each disconnection of the supply voltage (PLC)

3.6.4 Teach mode

The automatic cage welding machine requires a teach-in after each recipe change.

3.7 Accessories

Wire cutter

The pneumatically operated wire cutter is an optional extra.

4 Transportation, packing and storage



Installation and initial commissioning are carried out exclusively by the manufacturer's employees or by persons authorized by the manufacturer.

Nevertheless, it may happen that operatives or maintenance personnel of the operator are entrusted with the handling of packages during installation and further use. In doing so, it is essential to observe the instructions listed below.

4.1 Safety instructions for transport

Suspended loads

⚠ WARNING!

Danger to life due to suspended loads! Loads can swing out and fall during lifting operations. This can cause serious injuries or even death.

- Never step under or into the swivel range of suspended loads.**
- Only move loads under supervision.**
- Use only approved lifting equipment and slings with sufficient load-bearing capacity.**
- Do not use torn or chafed lifting equipment.**
- Do not place lifting equipment such as ropes and belts on sharp edges and corners, do not knot or twist them.**
- Set down the load when leaving the workplace.**

Off-centered center of gravity

⚠ WARNING!

Risk of injury from falling or tipping packages! Packages may have an off-centered center of gravity. If the hooking is incorrect, the package may tip and fall. Falling or tipping packages can cause serious injuries.



- Observe the markings and information on the center of gravity on the packages.
- When transporting by crane, attach the crane hook so that it is directly above the center of gravity of the package.
- Carefully lift the packing piece and observe whether it tilts. If necessary, change the hooking point.

Improper transport

NOTE !

Material damage due to improper transport!
Improper transport can cause transport pieces to fall or tip over. This may result in considerable material damage.

- When unloading the packings on delivery and during internal transport, proceed carefully and observe the symbols and instructions on the packaging.
- Use only the intended attachment points.
- Do not remove the packaging until shortly before assembly.

4.2 Transport inspection

Check the delivery for completeness and transport damage immediately upon receipt.

In case of externally visible transport damage, proceed as follows:

- Do not accept delivery or accept it only with reservations.
- Note the extent of damage on the transport documents or on the carrier's delivery bill.
- Initiate complaint.



Complain about any defect as soon as it is detected. Claims for damages can only be asserted within the applicable complaint periods.

4.3 Transportation

Personal protective equipment

Wear the following protective equipment for all transport work:

- Protective work clothing
- Safety shoes
- Protective gloves
- Safety helmet

Transport of packings by crane

Packings that have lifting eyes can be transported directly with a crane under the following conditions:

- The crane and lifting equipment must be designed for the weight of the packings.
- The operative must be authorized to operate the crane.

Hooking

1. Attach ropes, belts or multipoint hangers to the marked hooking points.
2. Ensure that the package hangs straight, if necessary observe off-centering of center of gravity.
3. Start transport.

Hooking points



The hooking points are marked with a hook symbol (Fig. 25/1).

Fig. 25: Hooking points



4.4 Packing

About the packing

The individual packages are packed according to the expected transport conditions. Only environmentally friendly materials have been used for packaging.

The packaging is intended to protect the individual components from transport damage, corrosion and other damage until assembly. Therefore, do not destroy the packaging and remove it only shortly before assembly.

Handling of packaging materials

Dispose of packaging materials in accordance with applicable laws and local, state, and federal regulations.

NOTE !

Danger to the environment due to incorrect disposal! Packaging materials are valuable raw materials and can in many cases be reused or sensibly processed and recycled. Incorrect disposal of packaging materials can be hazardous to the environment.

- Dispose of packaging materials in an environmentally friendly manner.**
- Obey local, state and federal disposal regulations. If necessary, order a specialist company for the dispose.**

4.5 Storage

Storage of the packages

Store packages under the following conditions:

- Do not store outdoors.
- Store in a dry and dust-free place.
- Do not expose to aggressive media.
- Protect from sunlight.
- Avoid mechanical shock.
- Storage temperature: 15 to 35 °C
- Relative humidity: max. 60 %.
- In case of storage longer than 3 months, regularly check the general condition of all parts and the packaging. If necessary renew the preservation.



Under certain circumstances, the packages may contain storage instructions that go beyond the requirements specified here. These must be observed accordingly.

5 Installation and initial commissioning



Installation and initial commissioning are carried out exclusively by the manufacturer's employees or by persons authorized by the manufacturer.

⚠ WARNING!

Danger to life due to incorrect installation and initial startup! Errors during installation or initial startup can lead to life-threatening situations and cause considerable damage to property.

- Allow installation and initial commissioning to be carried out exclusively by the manufacturer's employees or by persons authorized by the manufacturer.**
- Consult the manufacturer even in the event of subsequent changes of location.**
- Refrain from unauthorized installation and location changes.**

Installation and initial commissioning



Requirements for the installation site

- The equipment may only be operated in a dust-free, dry atmosphere inside a building.
- The installation site must be levelled.
- The floor must be resistant to liquids and solvents.
- The safe standing of the equipment must be guaranteed.
- A power supply of 400 V three-phase current.
- A pneumatic supply with an operating pressure of at least 6 bar.
- The equipment must be easily accessible and walkable from all sides.
- There must be sufficient free space (approx. 1 m) around the equipment for carrying out maintenance work.
- The equipment must be installed in such a way that it is not exposed to external heat sources (e.g. direct sunlight).
- The equipment must not be used in potentially explosive atmospheres.
- There must be no corrosive atmosphere at the installation site.
- The equipment must not be subjected to vibrations.
- Sufficient lighting is available.
- Escape routes and rescue equipment must be freely accessible.
- Fire protection measures must be in place.

Preparations

The requirements for the installation site regarding

- the dimensions, strength and stability of the foundations
- the dimensions and weights of the entire plant
- the type and quantity of fastening material required
- the type of power supply lines
- the climatic conditions required for operation

have been transmitted to the operator in advance.

The operator is responsible for meeting these requirements.



6 Operation

6.1 Safety instructions for operation

Personal protective equipment

Wear the following protective equipment during all operation work:

- Protective work clothing
- Safety shoes
- Protective gloves
- Safety helmet
- Hearing protection
- Face shield

Improper operation

WARNING!

Risk of injury due to improper operation! Improper operation can lead to serious injuries and considerable damage to property.

-Carry out all operating steps in accordance with the information and notes in these instructions.

-Before starting work, observe the following:

-Make sure all covers and safety devices are installed and functioning properly.

-Make sure that there are no persons in the danger zone.

-Never override or bypass safety devices during operation.

-Pay attention to order and cleanliness in the work area! Loose components and tools lying on top of or around each other are sources of accidents.

-Never store highly flammable substances near the equipment or use them as cleaning agents.

-If necessary, use only approved climbing aids to cut the reinforcements.



6.2 Activities before use

Damage and defects

1. Before starting production, check the equipment for visible damages and/or defects.
2. Report damage and/or defects to the foreman immediately! If necessary, shut down the equipment immediately.
3. Switch off the main switch and secure it with a padlock against being switched on again.
4. Check whether the longitudinal wire holding tray is sufficiently loaded with material. If necessary, replenish wires.
5. Check whether the circumferential wire reel is sufficiently loaded with material. If necessary, place new wire coil on the reel (*chapter 6.5 "Replenishing of circumferential wire reel" on page 78*).

Check safety devices

Check all safety devices for correct function before starting production:

- Safety light barriers in the longitudinal wire placement area and in the cage removal area
- Emergency stop button of the operator terminal
- Emergency stop button on the support
- Emergency stop button in the placement area
- Safety limit switches of additionally installed protective fences if present

If one of these devices is malfunctioning, do not turn on the equipment. Notify the foreman.

6.2.1 Lubrication of welding and contact roller

⚠ CAUTION! Risk of burns on hot welding and contact rollers! Touching the welding head components can lead to burns.

- | | |
|-----------------------|---|
| Personnel: | • Operative |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Hearing protection • Protective gloves • Safety shoes |

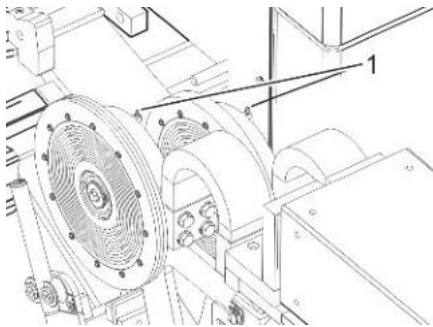


Fig. 26: Welding and contact roller

1. Before starting, check if the welding head is hot by holding your hand approximately 2 inches (5 cm) from the welding roller.
2. Put on protective gloves.
3. Wear protective work clothing and safety shoes.
4. If necessary, allow the welding head to cool down.
5. In manual mode, move the support to an easily accessible position using the *[Support smaller]* or *[Support larger]* button.
6. Switch off the equipment and secure it against being switched on again.
7. Connect grease gun to grease nipples (Fig. 26/1).
8. Operate the grease gun and turn the roller at the same time.
9. Remove grease gun.
10. Wipe off excess grease.

6.2.2 Checking electrode carrier slides

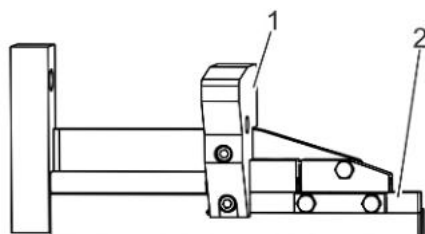


Fig. 27: Electrode carrier Slide

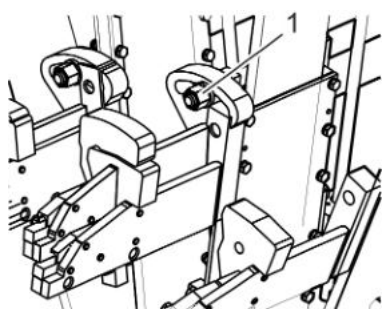


Fig. 28: Electrode carrier slide attachment

1. In manual mode, move the electrode carrier slides to an easily accessible position using the *[Spread smaller]* or *[Spread larger]* button.
2. Switch off the system and secure it against being switched on again.
3. Check wire guide (Fig. 27/2) and the contact bridge (Fig. 27/1) for wear (visual inspection); if necessary, have them replaced by a specialist.
4. Check all screw connections (Fig. 27) for tightness using an open-end wrench or ring wrench and an Allen key and tighten if necessary.
5. Check screw connection (Fig. 28/1) with an open-end wrench or ring wrench and tighten if necessary.

6.2.3 Checking pressure at pneumatic spring element

Before starting work and several times a day, check the pressure of the pneumatic spring element.

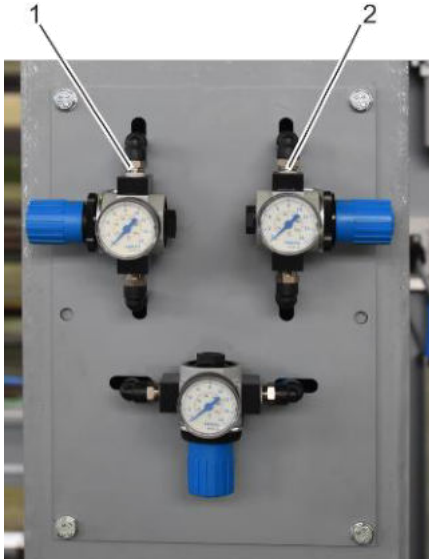


Fig. 29: Pressure setting of the spring element

1. Check the pressure for the welding roller cylinder on the left pressure reducer (Fig. 29/1).
The correct pressure is between 2.0 and 4.0 bar (29 and 58 psi). In case of deviations:
2. Set the correct pressure by turning the pressure reducer.
3. Check the pressure for the contact roller cylinder on the pressure gauge of the right-hand pressure reducer (Fig. 29/2).
The correct pressure is between 1.5 and 2.5 bar (22 and 36 psi).
4. Set the correct pressure by turning the pressure reducer.

6.2.4 Checking contact pressure between current transmission and welding roller

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none"> • Operative |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Hearing protection • Protective gloves • Safety shoes |

1. **⚠ CAUTION!** Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

Before starting, check if the weld head is hot by holding your hand approximately 2 inches (5 cm) from the welding roller.

2. Put on protective gloves.
3. Wear protective work clothing and safety shoes.
4. If necessary, allow the welding head to cool down.
5. Before starting work, apply contact pressure between current transmission (Fig. 30/3) and welding roller (Fig. 30/2).

The cup springs must be adjusted so that the force of the hands is just sufficient to turn the roller. If necessary:

6. Adjust the contact pressure by tightening the screw on the pressure star (Fig. 30/1).
7. Check wear of the current transmission (Fig. 30/3).
8. Check the groove in the welding roller (Fig. 30/2).

The groove must not be deeper than half the diameter of the circumferential wire currently being processed.

If the values are out of the permitted range, do not switch on the system. Notify the foreman.

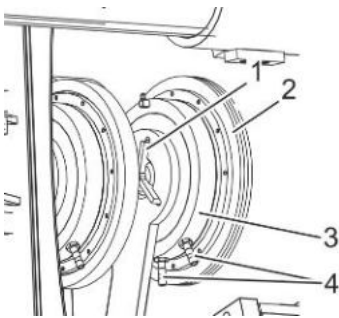


Fig. 30: Current transmission

6.2.5 Checking screw connections of the current-carrying parts of welding head.

Personnel:

- Operative

Protective equipment:

- Protective work clothing
- Hearing protection
- Safety goggles
- Protective gloves
- Safety shoes

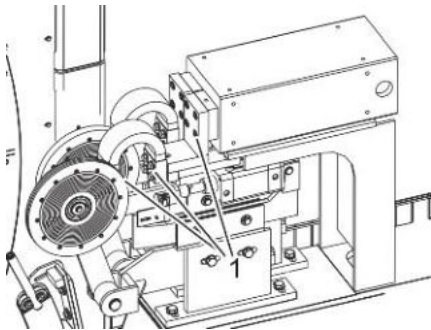


Fig. 31: Current carrying parts of the welding head

1. **▲ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.**

Before starting, determine if the weld head is hot by holding your hand approximately 2 inches (5 cm) from the weld roller.

2. Put on protective gloves.
3. Wear protective work clothing and safety shoes.
4. If necessary, allow the welding head to cool down.
5. In manual mode, move the support to an easily accessible position using the [Support smaller] or [Support larger] button.
6. Switch off the system and secure it against being switched on again.
7. Before starting work, check the screw connections (Fig. 31/1) for tight fit, tighten if necessary.

▲ WARNING! Risk of injury from flying metal chips and welding slag! When cleaning the area around the welding head with compressed air, flying metal chips and welding slag can cause severe eye injuries, which can lead to blindness, and cuts of the skin.

-Wear protective work clothing, gloves, goggles.

8. Remove metal chips and welding slag from the area with compressed air.
9. Wipe off excess grease.

6.2.6 Checking circumferential wire guide and insert circumferential wire

▲ CAUTION! Cutting injuries at sharp wire ends and welding points! When touching the wire ends and welding points, sharp edges and tips can cause cuts.

- Wear protective gloves and protective work clothing.
- Use caution.

1. **▲ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.**

Before starting, determine if the welding head is hot by holding your hand approximately 2 inches (5 cm) from the weld roller.

2. Put on protective gloves.
3. Wear protective work clothing and safety shoes.
4. If necessary, allow the welding head to cool down.

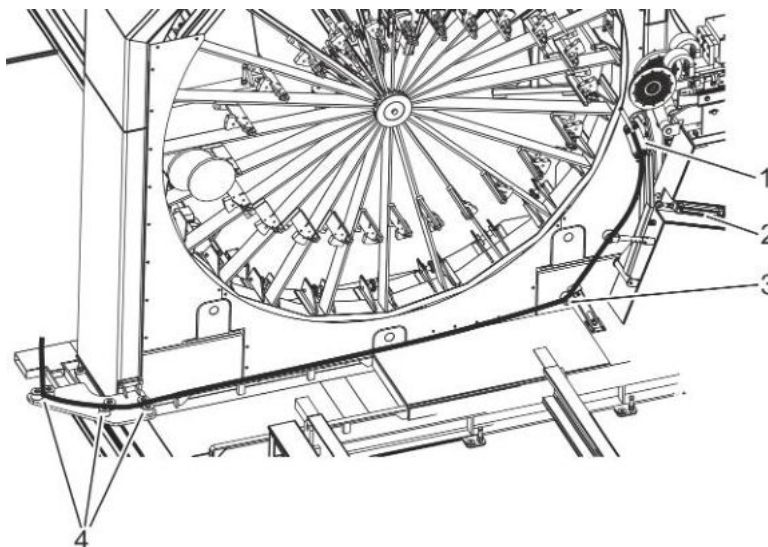


Fig. 32: Circumferential wire guide

5. Check the deflection rollers (Fig. 32/1 + 3 + 4) for function.

6. Adjust the deflection rollers (Fig. 32/1 + 3) to the required cage radius.



Fig. 33: Pressure regulator of the circumferential wire guide

7. Spring action of the cylinder (Fig. 32/2) for the swivel arm on the pressure regulator (Fig. 33/1):

Turn to the right to increase the pressure.

Turn to the left to lower the pressure.

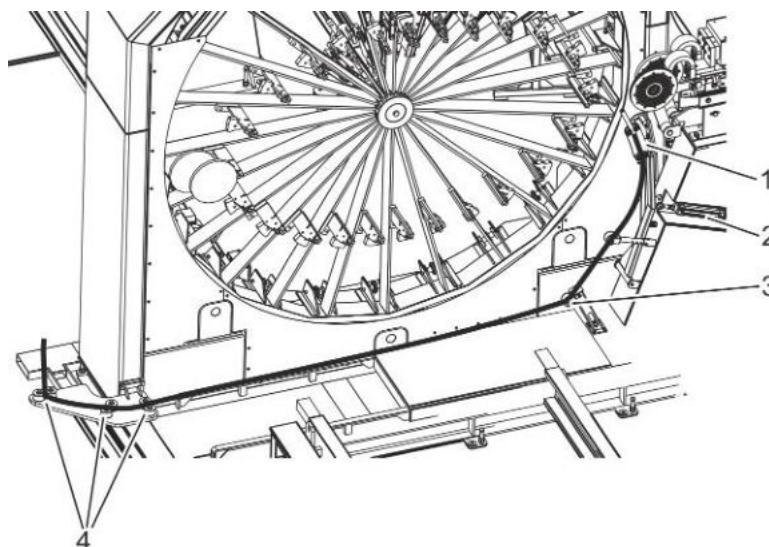


Fig. 34: Circumferential wire guide

8. Insert the circumferential wire through the deflection rollers (Fig. 32/1 + 3 + 4).

The following table contains the guide values for the pressure to be set for different wire diameters.

Wire diameter in mm (in inch)	Pressure in bar (psi)
5 (0.197)	1 (14.5)
6 (0.236)	1,38 (20)
7 (0.276)	1,75 (25)
8 (0.315)	2,13 (31)
9 (0.357)	2,5 (36)

6.2.7 Checking the circumferential wire reel brake

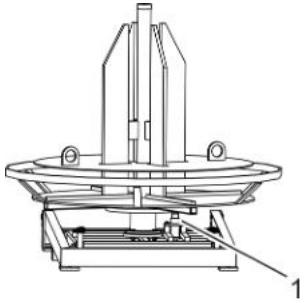


Fig. 35: Brake of the circumferential wire reel

The brake (Fig. 35/1) is set correctly when the reel does not rotate without external force. The reel moves when turned by hand and stops after a short delay when released.

1. Switch the system to automatic mode.
2. Observe how the circumferential wire lays on the longitudinal wires.

If the circumferential wire does not bend over the longitudinal wires (no polygonal deformation), the setting is correct.

3. If the reinforcement shows polygonal deformation, stop and turn off the system. Notify the foreman.

6.2.8 Checking the zero-initiator for function

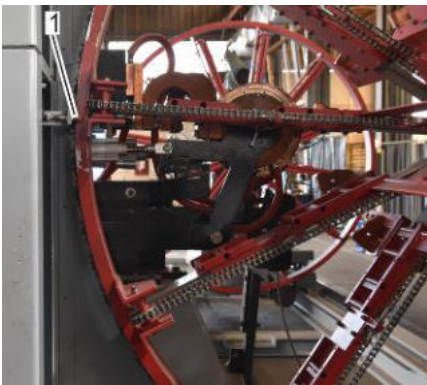


Fig. 36: Reference-initiator

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Hearing protection
- Protective gloves
- Safety helmet
- Safety shoes

1. Switch off the system and secure it against being switched on again.
2. Use a metal tool to check the contact of the reference-initiator (Fig. 36/1) on the electrode support wheel for function.
3. Go to control panel and acknowledge light curtain alarm.

6.2.9 Checking function and clamping pressure of the wire clamp



Fig. 37: Control panel

Personnel: • Operative

1. Switch on the system.
2. Set the selector switch to Manual.
3. Move cage pull-out carriage to a clearly visible position on control panel (Fig. 37).
4. Close wire clamps on the Control Panel (Fig. 37) and visually check whether all wire clamps (Fig. 38) are closed.

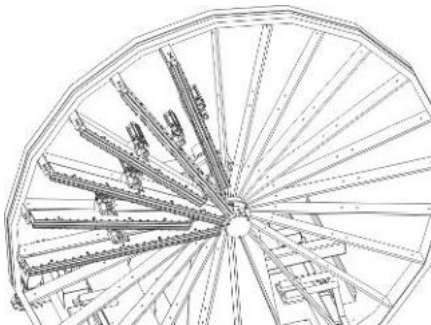


Fig. 38: Wire clamps

6.3 Switching on

1. Make sure that all emergency stop buttons (↗ *chapter 2.5 "Location of the emergency stop buttons" on page 27*) are not actuated. Otherwise, pull out the emergency stop button and acknowledge.
2. Switch on the main switch.
3. Use the *[Control voltage on]* button (Fig. 39/4) to switch on the control voltage.
4. Press the *[Acknowledge light barriers]* button (Fig. 39/9).



Fig. 39: Control panel

⇒ The machine is ready for operation. The machine must be referenced for automatic operation.

5. Before starting work, check the screw connections (Fig. 31/1) for tight fit, tighten if necessary.

⚠ WARNING! Risk of injury from flying metal chips and welding slag! When cleaning the area around the welding head with compressed air, flying metal chips and welding slag can cause severe eye injuries, which can lead to blindness, and cuts of the skin.

-Wear protective work clothing, gloves, goggles.

6. Remove metal chips and welding slag from the area with compressed air.
7. Wipe off excess grease.

6.4 Replenishing of longitudinal wire holding tray

Suspended loads

⚠ WARNING!

Danger to life due to suspended loads!

Reinforcement steel bundles can swing out and fall during lifting. This can cause serious injuries or even death.

- Never step under or into the swivel range of suspended loads.
- Only move loads under supervision.
- Use only approved lifting equipment and slings with sufficient load-bearing capacity.
- Do not use torn or chafed lifting equipment such as ropes and belts.
- Do not place lifting equipment such as ropes and belts over sharp edges, do not knot or twist them.
- Set down the load when leaving the workplace.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Hearing protection
- Face shield
- Safety helmet
- Safety shoes

NOTE! Material damage and operational malfunctions due to unstraightened wires!

Incorrectly straightened wires make it more difficult to load the machine and require higher draw forces when pulling the wires out of the electrode support wheel. This may result in the wires being torn out of the wire clamps and the reinforcement cannot be manufactured to the end. Crooked wires lead to increased wear of the wire guide tubes and wire guides.

- Use only perfectly straightened wires.

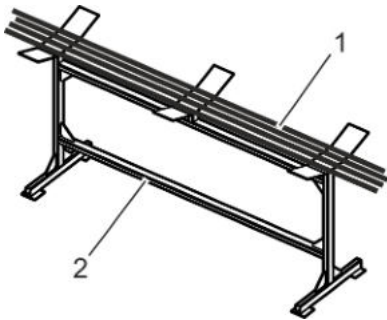


Fig. 40: Longitudinal wire holding tray

1. Place the new wire bundle on the stand (Fig. 40/2).

⚠ CAUTION! Risk of injury due to spring-back strapping and wire ends! Spring-back strapping and wire ends can cause cuts and punctures.

- Stand to the side of the strapping when opening.
- Maintain sufficient distance to the wire ends.
- Wear personal protective equipment.

2. Open and remove the strapping of the wire bundle.

6.5 Replenishing of circumferential wire reel

Suspended loads

⚠ WARNING!

Danger to life due to suspended loads! Wire coils can swing out and fall during lifting. This can cause serious injuries or even death.

- Never step under or into the swivel range of suspended loads.
- Only move loads under supervision.
- Use only approved lifting equipment and slings with sufficient load-bearing capacity.
- Do not use torn or chafed lifting equipment such as ropes and belts.
- Do not place lifting equipment such as ropes and belts over sharp edges, do not knot or twist them.
- Set down the load when leaving the workplace.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Hearing protection
- Face shield
- Protective gloves
- Safety helmet
- Safety shoes

NOTE! Material damage and operational malfunctions due to random wound coils! Randomly wound coils can inhibit the wire pull-off and lead to high pull-off forces, which can cause damage or operational malfunctions.

-Use only perfectly level-wound coils.



Fig. 41: Wire coils

1. Lift off the reel cover with lifting gear and lay aside safely.
2. Lift the wire coil onto the reel in the correct unwinding sense using a hoist and position it correctly.
3. Put back-on the reel cover to the reel with a hoist and secure it.

⚠ CAUTION! Risk of injury due to snapping-back strapping and wire ends! Snapping-back strapping and wire ends can cause cuts and punctures.

-Stand aside of the strapping when opening.

-Maintain sufficient distance to the wire ends.

-Wear personal protective equipment.

4. Cut the strapping (Fig. 41/1) and remove it completely from the coil.
5. Pull out the beginning of the wire, cut it straight and insert it through the wire guide rollers to the welding roller.

6.6 Setting the diameter range of the reinforcement

Personnel: • Operative

The cage welding machine produces reinforcements whose diameters are within the range specified in the technical data.

This range is subdivided. To switch between the cage diameter ranges, the electrode carrier slides and wire guide tubes are repositioned.

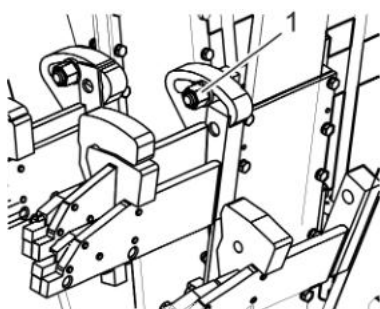


Fig. 42: Electrode carrier slide

1. In manual mode, move the electrode carrier slides to an easily accessible position.
2. Switch off the system and secure it against being switched on again.



Perform the following actions on each electrode carrier slide:

3. Loosen the hexagon head screws (Fig. 42/1), remove the electrode carrier slide and the wire guide tube.
4. Move the wire guide tube to the position required to produce the desired cage diameter.
5. Fasten the electrode carrier slide with the hexagon head screw. Tighten the screws firmly.
6. Switch on the machine and select and load the new reinforcement type on the operator panel in the Program Manager.
7. Press the [start position] key to bring the machine into the start position.



When manufacturing reinforcement cages with a socket, make sure that the diameters of the shaft and the socket are both within the same selected range!

6.7 Adjusting the welding pressure on the spring element



The pneumatic spring element maintains the correct pressure of the welding and contact rollers during welding.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Hearing protection
- Protective gloves
- Safety helmet
- Safety shoes

1. Switch the system to manual mode.
2. Move the cage pull-out back so that there is a free space of at least 1m (3ft) between the cage pull-out wheel and the welding support carriage.
3. Move the welding support carriage outwards so far that the circumferential wire can be placed under the welding roller.

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

-Before starting work, check whether the welding head is hot.

-Wear protective work clothing, protective gloves and safety shoes.

-If necessary, allow the welding head to cool down.

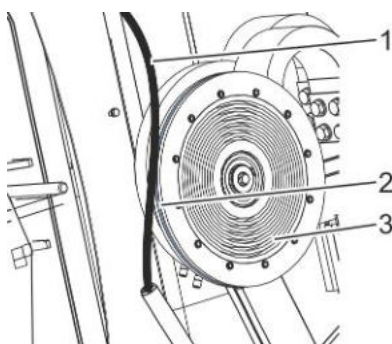


Fig. 43: Welding roller

4. Lay the circumferential wire (Fig. 43/1) into the groove (Fig. 43/2) of the welding roller (Fig. 43/3).

Operation

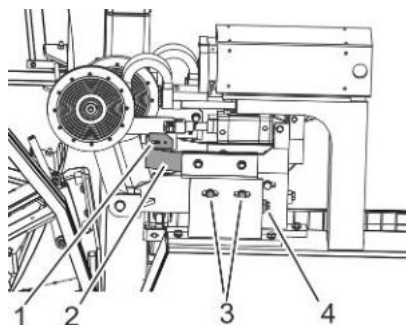


Fig. 44: Cylinder stroke adjustment

5. Advance the welding support until the operating point of the contact roller is reached. (Air gap 2.5-4mm).

Insert the required wire combination and move in the welding roller.



The air gap between the swivel arm (Fig. 44/1) and its limit stop (Fig. 44/2) must be approx. 2.5 - 4 mm (0.1"-0.2").

If the gap is too large or too small, proceed as follows:

6. Move back welding support carriage by approx. 50 mm (2 inches) and retract welding roller.
7. Loosen screws (Fig. 44/3) and adjust distance with adjusting screw (Fig. 44/4).
8. Forward welding support carriage and move out welding roller.

Make sure that the circumferential wire is correctly positioned in the groove of the welding roller and is in contact with the first longitudinal wire.

Repeat steps 5 to 7 until a correct air gap of 2.5 – 4mm (0.1 – 0.15 in.) is reached

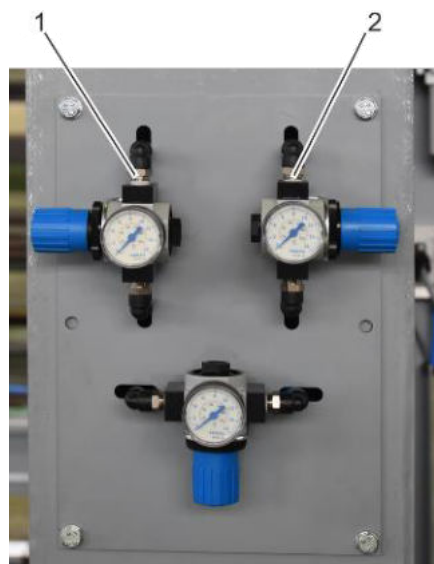


Fig. 45: Pressure regulators

9. Adjust the contact pressure of the welding roller with the left pressure regulator (Fig. 45/1), the contact pressure of the contact roller with the right pressure regulator (Fig. 45/2) between 2.5 and 4 bar (29 and 58 psi) depending on the thickness of the circumferential wire.
10. Check the circumferential wire position in the circumferential wire guide and on the electrode carrier slide and readjust if necessary.

6.8 Start automatic mode



Fig. 46: Control panel

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Hearing protection
- Protective gloves
- Safety helmet
- Safety shoes

1. Switch on the system.
2. Press the [control voltage on] illuminated button (Fig. 46/4)
⇒ Control voltage is switched on.

3. Run through reference.



Each time the program is changed or the machine is switched between round and elliptical, the machine must be ran again through teach-in.

4. Load recipe (cage parameters)

⇒ Machine is now ready for Auto- / Semi-Auto functions.

5. Switch on welding by pressing key Fig. **Fehler! Verweisquelle konnte nicht gefunden werden.**6/7.
6. Set [Setup/Auto/Semi-Auto] selector switch (Fig. 46/11) to [Semi-Auto].
7. Move machine to start position using the [Start Position] key (Fig. 46/3).
8. Insert the circumferential wire (Fig. 47/1) into the groove (Fig. 47/2) of the welding roller (Fig. 47/3).

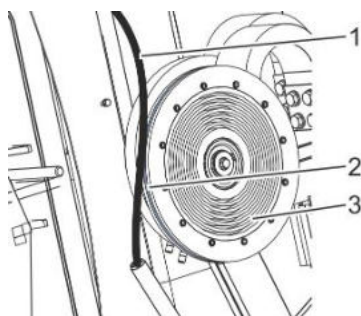


Fig. 47: Welding roller



Make sure that the circumferential wire is correctly positioned in the groove of the welding roller and is in contact with the first longitudinal wire.



9. Load machine with longitudinal wires, see page 83 (Chapter 6.9).

10. Go to the control panel and acknowledge the light curtain on the console with the *[reset light barrier]* button (Fig. 46/9).

11. Press *[Automatic on]* pushbutton (Fig. 46/8).

⇒ The welding support carriage moves to its start position. Make sure that the circumferential wire does not jump off the welding roller. If the circumferential wire jumps off the welding roller, the process must be aborted and restarted.

After that, the cage pull-out carriage moves to the start position (0mm) and the longitudinal wire clamps close.

Thereafter the first welding spot can be set manually and the cage production started.

⇒ When the cage is ready, it must be removed. After that, the cage production can be started again.



The maximum speed of the machine at 100% is 20 rpm. This value depends on the cage size and is controlled via the speed controller [face plate rpm] (Fig. 46/5). For elliptical cages, the speed is limited to 10 rpm.

Remove cage



Fig. 48: Control button for welding support

The machine gives feedback that the cage is ready to be removed.



Make sure that the circumferential wire is cut far enough above the welding roller so that the remaining end of circumferential wire stays safely under the welding roller for the next cage

12. Cut off the circumferential wire above the welding roller.

13. Press the button *[removal position]* (Fig. 48).

⇒ The cage pull-out moves a little further back.

14. Push the cage removal trolley under the cage or attach suitable lifting equipment to the cage.

15. Press the foot switch in the cage removal zone

⇒ The longitudinal wire clamps open and the cage can be removed.

16. Leave cage removal zone, acknowledge light barrier and press *[start position]*

⇒ The machine moves back and cage production can be re-started.

(continue with step 9. *Loading longitudinal wires*)

6.9 Placement of longitudinal wires

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Hearing protection
- Face shield
- Protective gloves
- Safety helmet
- Safety shoes

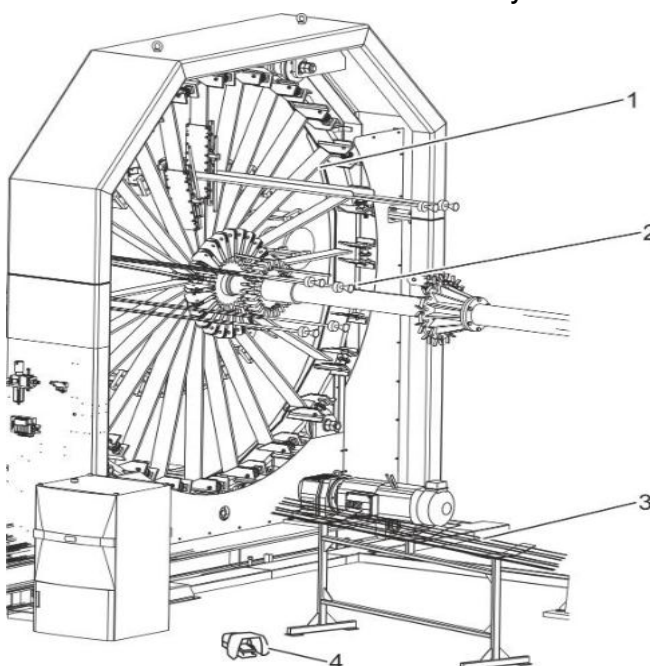


Fig. 49: Placement of longitudinal wires

17. Insert the longitudinal wires (Fig. 49/3) individually into the wire guide tubes (Fig. 49/2) until they reach the wire clamp at the cage pull-out wheel.
18. Press the *[Foot switch]* (Fig. 49/4).
19. The electrode support wheel (Fig. 49/1) rotates until the *[Foot switch]* (Fig. 49/4) is released and the next welding spot is reached.
5. Repeat steps 2 to 4 until all wire guide tubes are loaded.

6.10 Setting speed of electrode support wheel

Personnel: • Instructed person

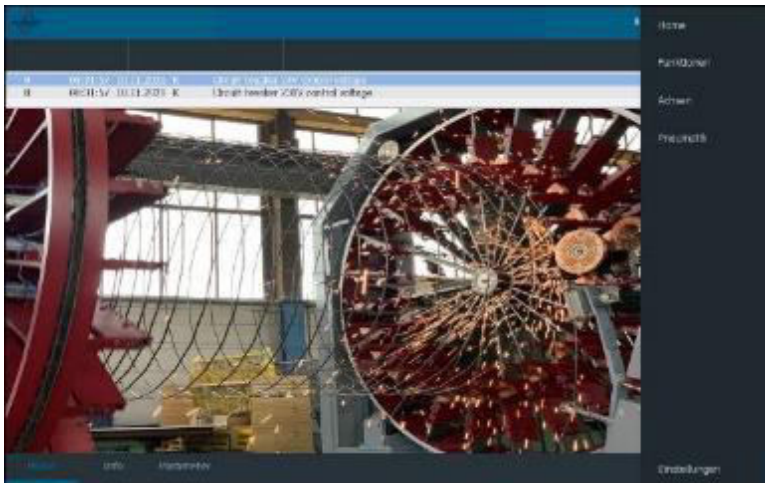


1. The speed of the electrode support wheel (*machine rpm*) is adjusted via the potentiometer [*face plate 1/min*] at the control panel (Fig. 50/5).

Fig. 50: Control panel

6.11 Settings on the operator panel (HMI)

6.11.1 Start menu



After switching on the equipment, the start menu appears on the screen.

1. To reach the desired menu item, press the respective key.

Fig. 51: Start menu operator panel(HMI)



6.11.2 Settings on the operator panel (HMI)

For normal operation, the system requires the following settings:

- Number of welding spots per electrode support wheel revolution
- All slopes
- All lengths
- Electrode support wheel speeds
- Welding power

They are entered on the operator panel.

These parameters are combined in programs. They can be called up via the program number and the program name.

The memories are zero-voltage safe, which means that the data is retained after a power failure or after regular shut-down of the machine.

NOTE !

Material damage due to data loss!

Commercial software reformats the special formatting of the memory card and results in data loss.

-Never insert the memory card into a computer equipped with commercially available software.

NOTE !

Damage due to improper handling of the controller!

Insufficient knowledge of the control system can lead to conditions for which the system was not designed.

-Read the controller manufacturer's manual carefully.

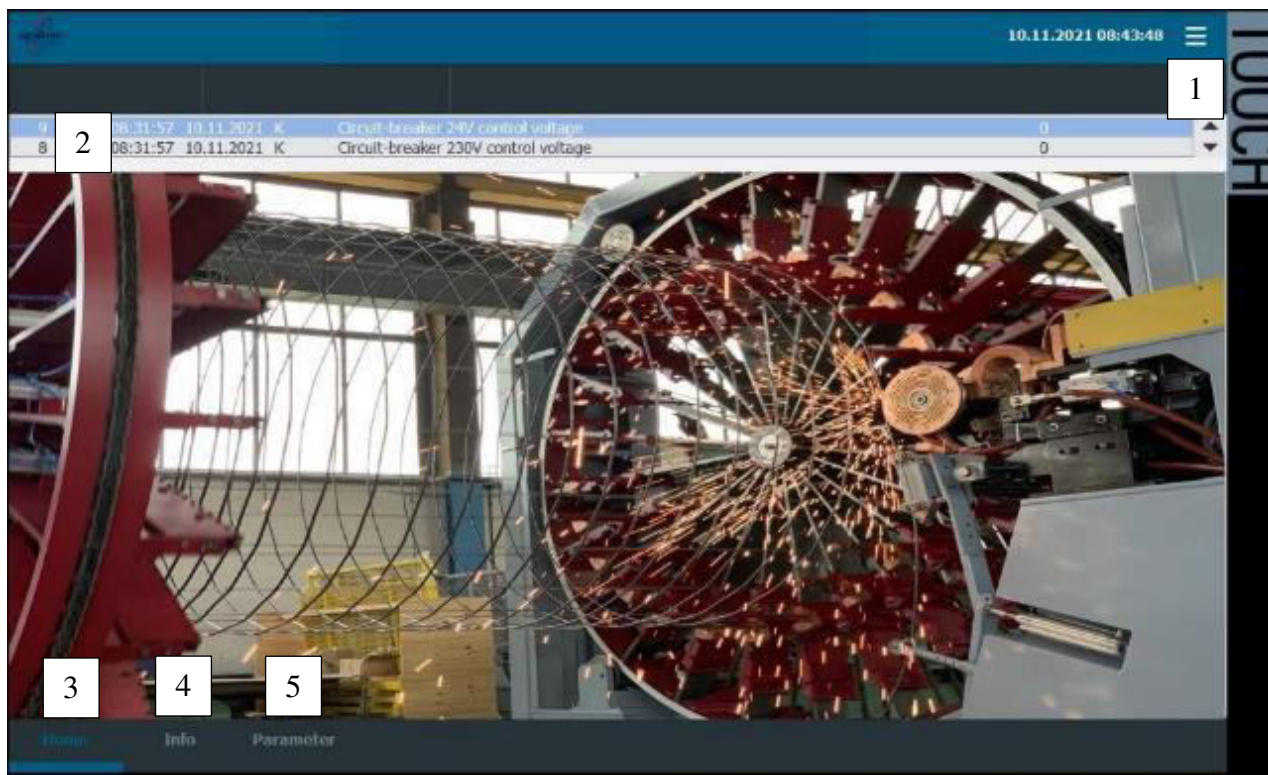
-Always follow the manufacturer's instructions when making any changes within the controller.

6.11.2.1 Possible reinforcements

The following reinforcement cages can be produced:

- with one diameter ⇒ cylindrical cage
- with two diameters ⇒ cage with socket or reduced spigot end on one cage end
- Cage with socket and reduced spigot end
- with an elliptical shape ⇒ pure elliptical cage
- with two diameters ⇒ elliptical cage with socket or reduced spigot end on one cage end
- with three diameters ⇒ elliptical cage with socket and reduced spigot end

6.11.3 Home screen



1.	Settings	2.	Errors and Messages
3.	Home Screen	4.	Info Screen
5.	Cage and welding parameters		

Fig. 52: Home Screen

(1) Global access to the different functions of the plant, the axis control and the HMI.

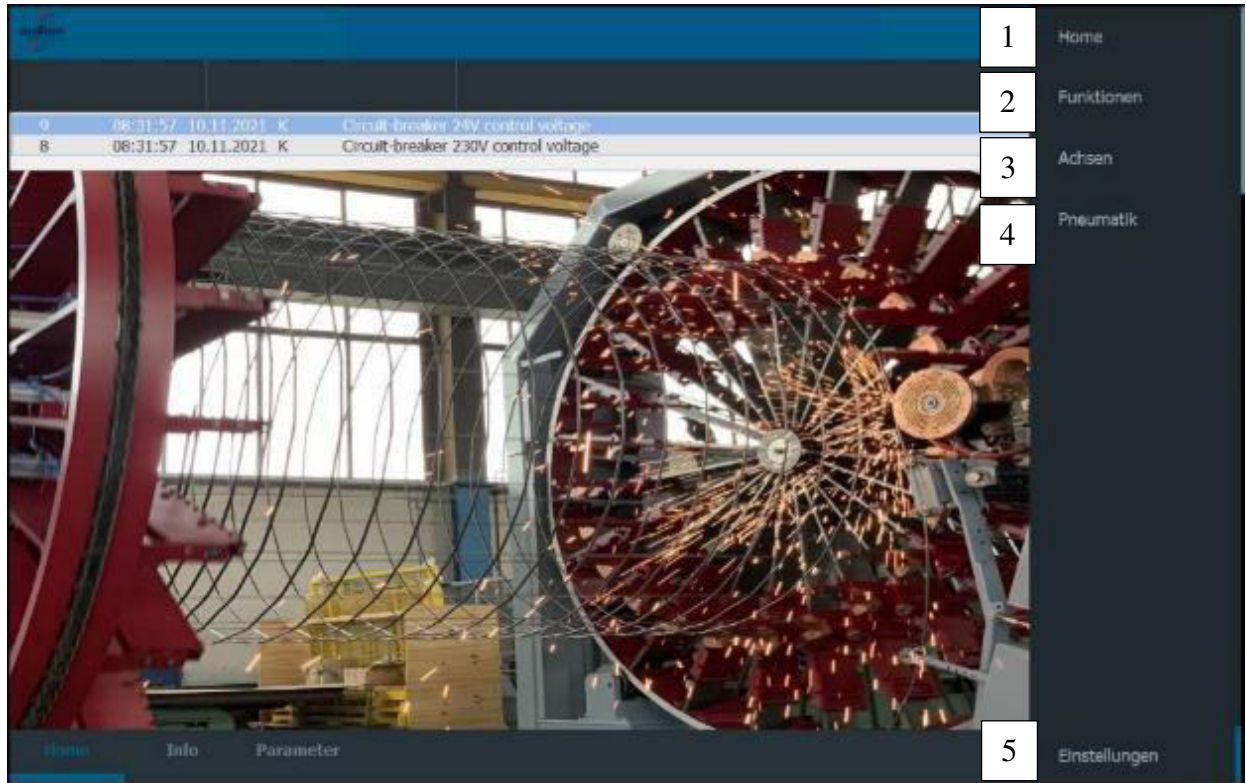
(2) Display of the last two messages. By tapping on the lines, the entire message list is displayed.

(3) Shows “Home” button in the entire visualization. With this button it is always possible to return to this view.

(4) Info button shows the current data of the cage production.

(5) Change of the parameters of the currently selected cage.

6.11.4 Home Menu



1.	Home	2.	Menu machine functions
3.	Axis control and settings	4.	Pneumatics control and settings
5.	HMI Settings		

Fig. 53: Home menu

(1) Shows home screen.

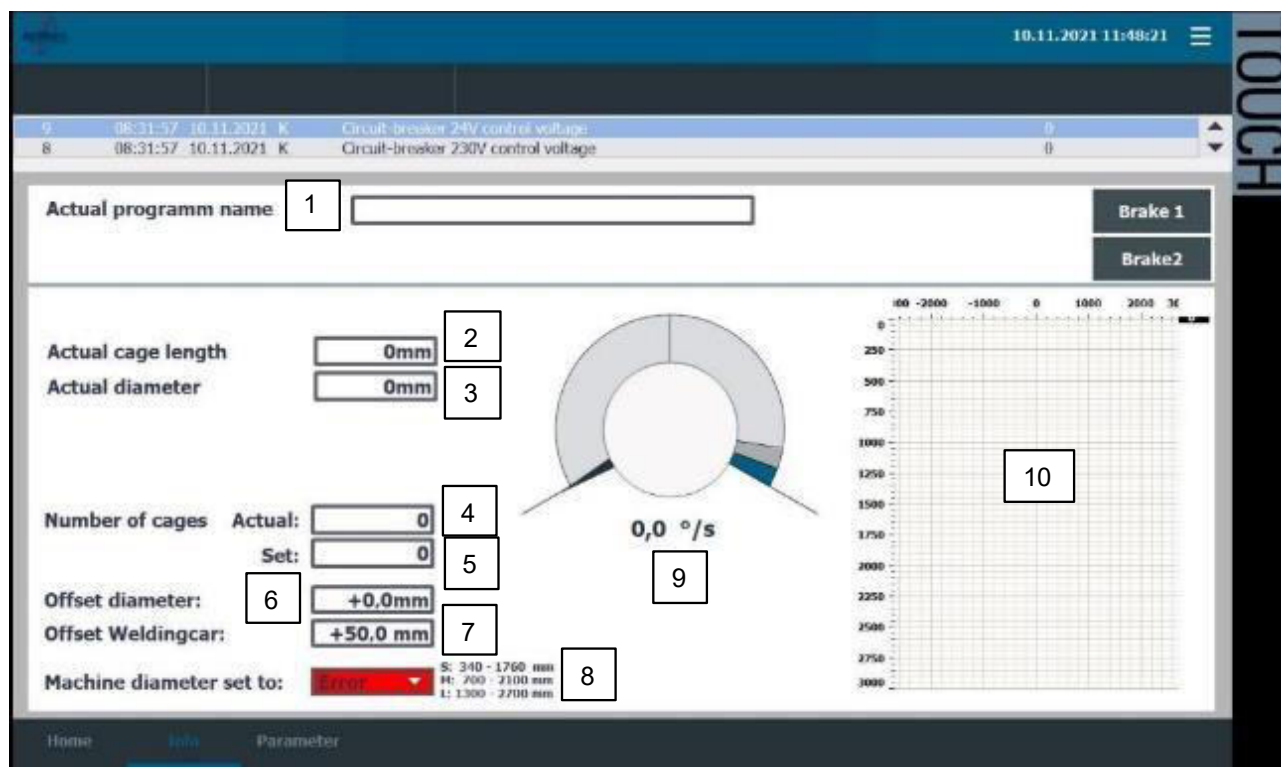
(2) Menu of the machine functions, such as referencing or synchronizing the drives.

(3) Menu of axes and drives. Here the axes can be set and moved manually, for example.

(4) Menu of pneumatics. Manual controls of the system can be made there.

(5) Change of settings that affect the screen itself or, for example, activates the cleaning function.

6.11.5 Info Screen



1.	Currently selected program	2.	Current cage length
3.	Current cage diameter	4.	Number of currently manufactured cage
5.	Number of cages to be manufactured	6.	Offset of cage diameter
7.	Offset welding support carriage	8.	Selected diameter range
9.	Current machine speed	10.	Progress of currently made cage

Fig. 54: Info screen

(1) Shows program name of current cage set in the cage parameters.

(2) Shows the current cage length of the cage currently in production.

(3) Shows the current diameter of the spread or cage.

(4) Shows the number of the currently manufactured cages

(5) Number of cages to be manufactured.

By tapping on (4) or (5) the numbers can be changed.

When the actual value reaches the set value, the machine stops.

(6) Changing the diameter offset. A correction of the measured cage can be carried out.

(7) Changing the offset of the welding carriage. The distance between the welding and contact rollers and the electrode carrier slides can be changed.

Depending on the cage diameter and position of the electrode carrier slides, a diameter range must be selected (8).

This allows the machine to recognize the position of the electrode carrier slides.

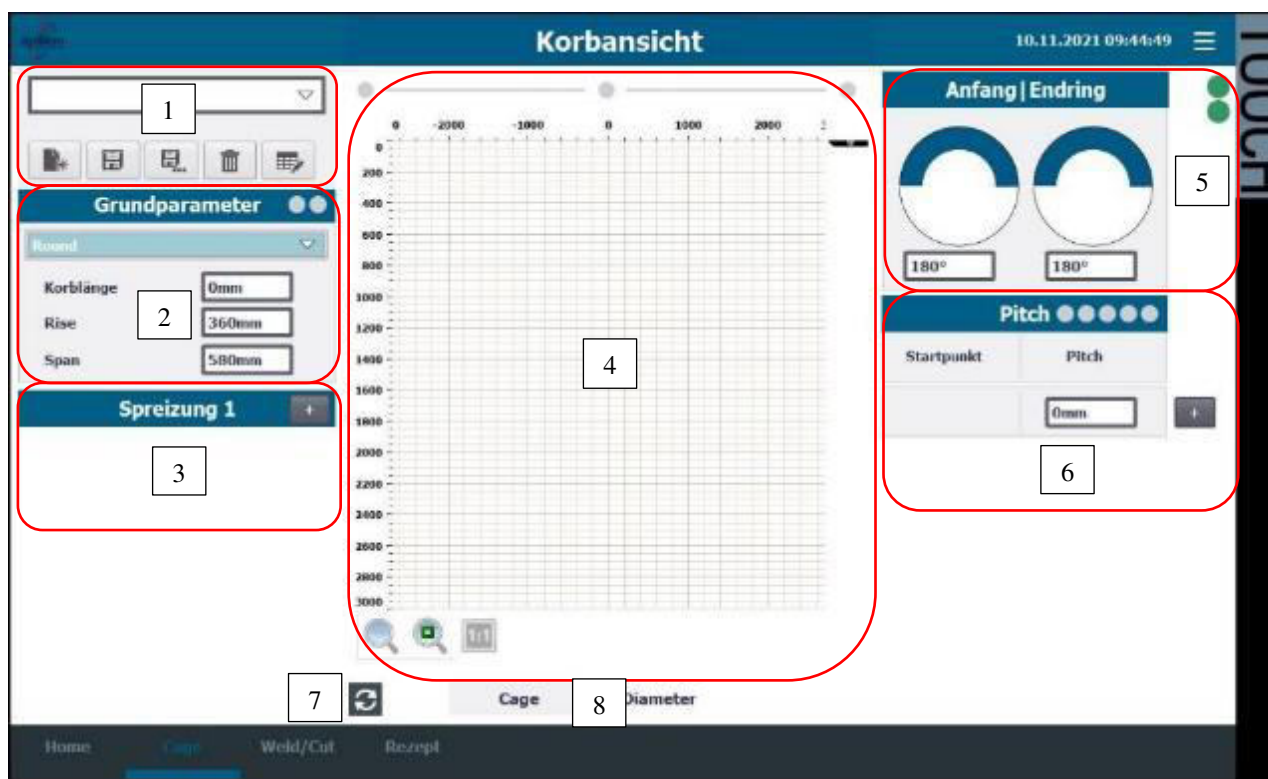
The cage diameter ranges are:

- Small: 340mm to 1760mm
- Medium: 700mm - 2100mm
- Large: 1300mm - 2700mm

(9) Shows the current speed (rpm) of the electrode support wheel in degrees per second.

(10) Shows the progress of the current cage in process.

6.11.6 Cage parameters



1.	Recipe selection	2.	Basic parameters
3.	Selection and settings of spreading	4.	Image of entered cage
5.	Settings of Start/End ring of cage	6.	Selection and settings of pitch between circumferential wire windings
7.	Aktualisieren des Korbabbilds	8.	Selection cage image or cage section

Fig. 55: Cage parameters

(1) Setting new cage, selecting or changing a cage previously produced or entered.

(2) Entering of the basic parameters of the cage, cage length and diameter, elliptical cages and their different diameters.

(3) Selecting and entering of various spreads.

(4) Shows an image of the cage to be produced (after pressing (7)).

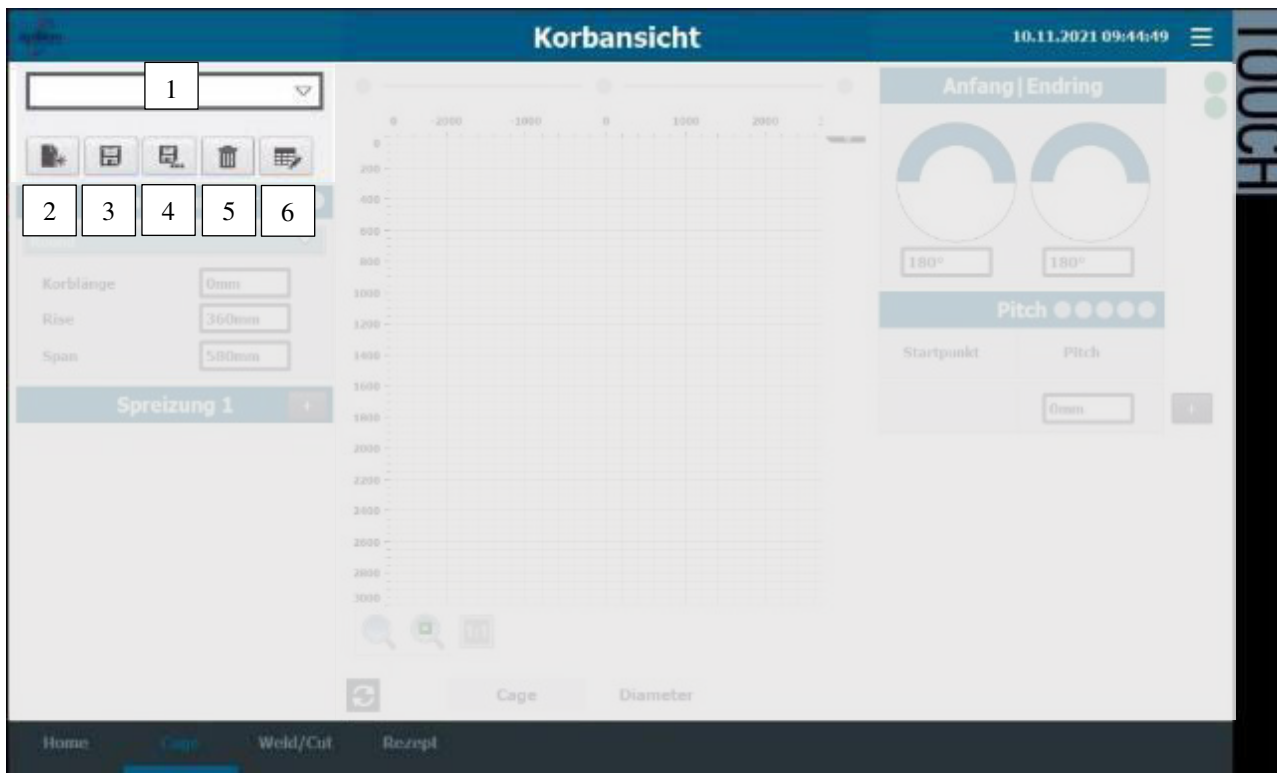
(5) Determines the start and end rings completeness.

(6) Selecting and entering different pitches between circumferential wire windings.

(7) Shows a digital image of the entered cage.

By selecting cage or diameter (8) it is possible to switch between the image (4) of the cage or, in case of elliptical cages, of the diameter.

6.11.7 Input and Selection of cage recipes



1.	Selection of recipes	2.	New recipe
3.	Save recipe	4.	Save recipe as ...
5.	Delete recipe	6.	Rename recipe

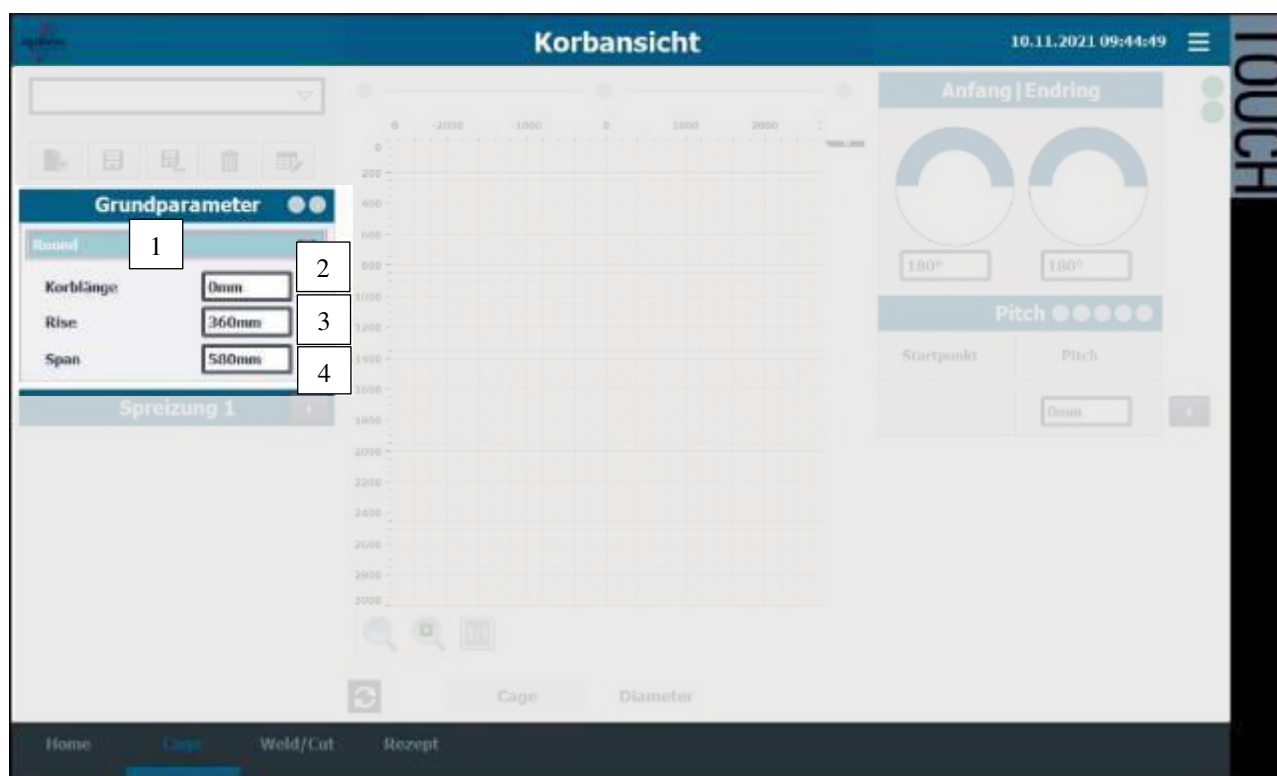
Fig. 56: "Cage recipes" menu

By pressing the field (1) a recipe name can be entered or by pressing the arrow key a recipe can be selected.

Operation

- (2) Creates new recipe.
- (3) Saves new recipe or changed recipe.
- (4) Saves currently entered recipe with a different recipe name.
- (5) Deletes selected recipe that is no longer needed.
- (6) Changes the currently selected recipe.

6.11.8 Entering of basic cage parameters



1.	Cage shape selection (round/elliptical or ASTM)	2.	Entering cage length
3.	Input value of rise (X) (round/elliptical/ASTM)	4.	Input value of span (Y) (round/elliptical/ASTM)

Fig. 57: "Basic cage parameters" menu

- (1) Selection of the basic shape of the cage. Select if a cage is round, elliptical or manu-

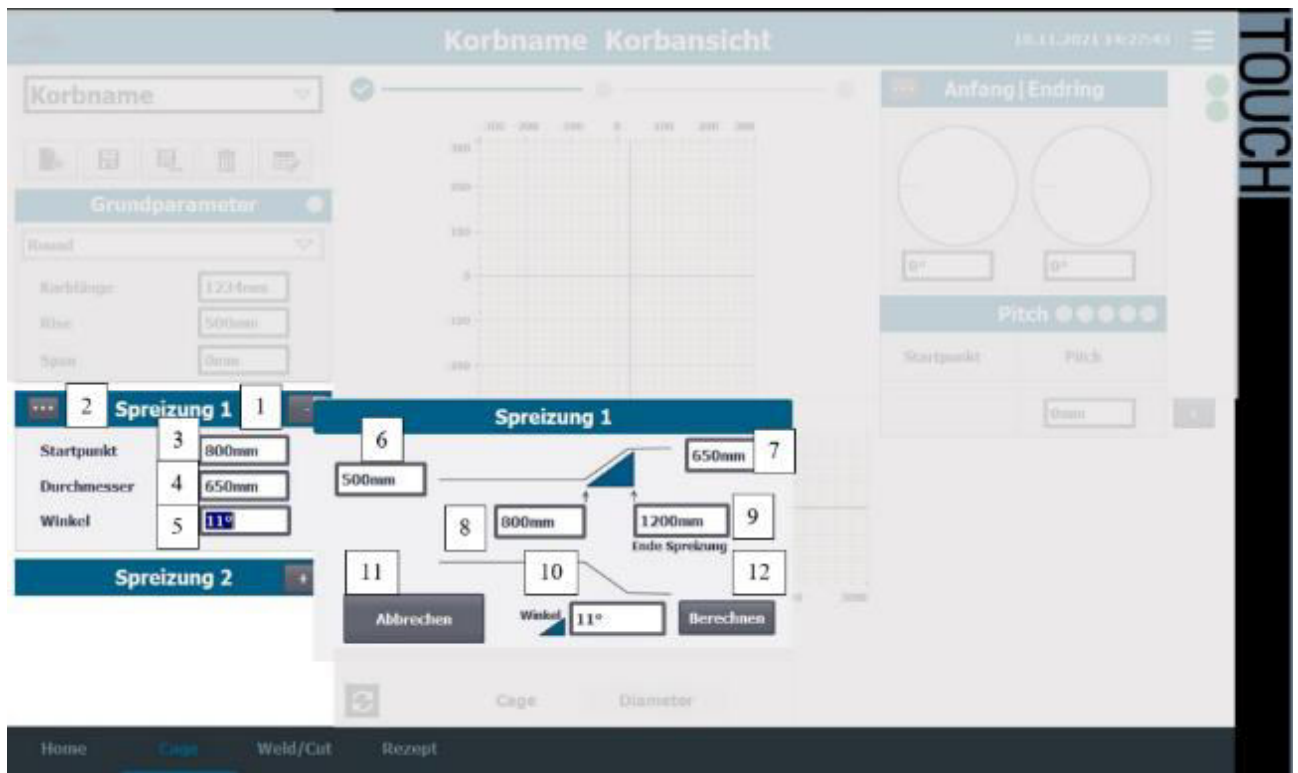
factured according to ASTM.

(2) Defines the cage length by entering the cage length in millimeters.

(3) Entering the start diameter X for the rise.

(4) Entering the start diameter Y for the span.

6.11.9 Setting of Spread



1.	Entering Spread 1	2.	Calculation of Angles
3.	Starting Point Spread	4.	Final Diameter of Spread
5.	Angle of Spread	6.	Initial Diameter of chosen Spread
7.	Final Diameter of chosen Spread	8.	Initial Starting Point of chosen Spread
9.	Final Point of chosen Spread	10.	Computed Angle of Spread
11.	Abort Calculation	12.	Calculate Angle of Spread

Fig. 58: "Setting of Spread" menu

Operation



(1) "+" opens menu of the respective spread, "-", closes menu.

If the spread menu is closed with "-", the entered values are set to 0.

(2) opens a calculation tool for the angle of spread, here the entries made can be checked and the angle of spread can be calculated.

The maximum spread angle that can be produced is 21°.

(3) Entering starting point of spread. This is then also displayed when the calculation tool is opened on (8).

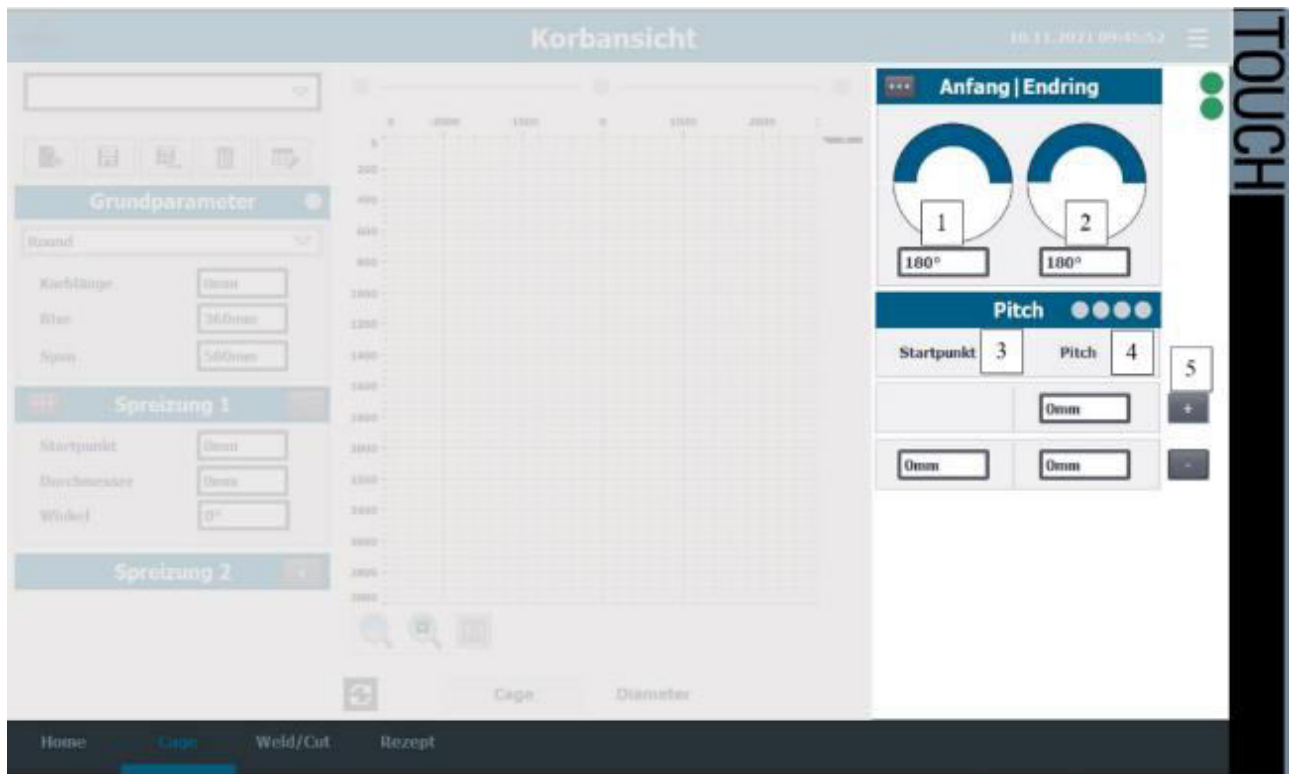
(4) Entering desired final diameter of spread. This is then also displayed on (7) when the calculation tool is opened.

(5) Entering desired angle of spread. If the angle is unknown, but the end of the spread is known, the end of the spread can be entered in (9) and calculated via (12).

(6) Shows the diameter before spreading. The example in the picture shows 500mm, this is the start diameter in this case which was entered in the basic parameters. If the calculation tool for spread 2 is opened, the final diameter of spread 1 is displayed on (6).

(11) Aborts the calculation and closes tool.

6.11.10 Setting of Start- and End Ring



1.	Angle of Start Ring	2.	Angle of End Ring
3.	Starting Point of Pitch of Circumferential Wire	4.	Value of Pitch
5.	Opens menus of different Pitches		

Fig. 59: "Setting of Start- End Ring" menu

(1) and (2), Entering of angles of the start ring and end ring from 0° till 360°. The display above the value shows to what extent the start/end ring encloses the cage.

Note: Values near 360° can cause the circumferential wire windings to be superimposed and welded together.

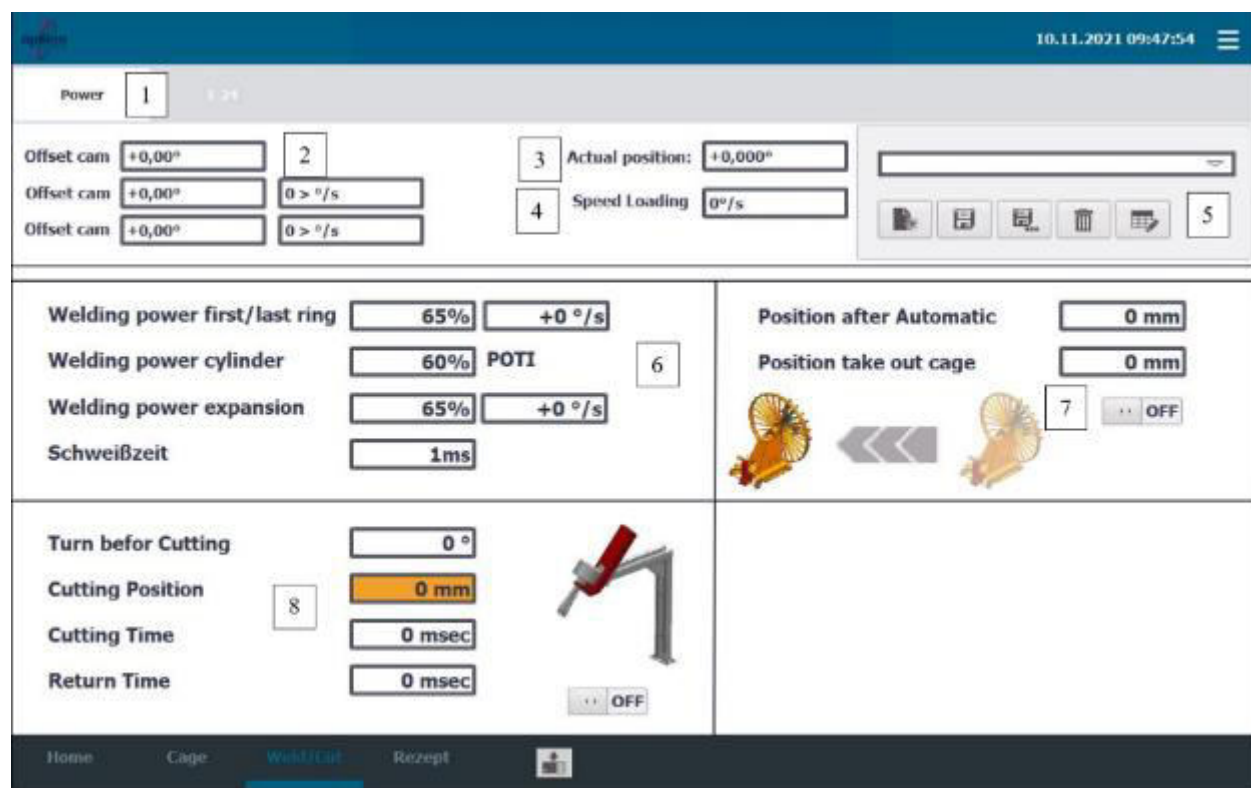
(3) Entering the starting point of the respective pitch of the circumferential wire windings. Up to five different pitches are possible. The first pitch has no start point to be entered as this corresponds to the beginning of the cage.

(4) Entering the pitch of the circumferential wire windings. Values up to about 200mm are possible here depending on the cage diameter.

(5) If several pitches of circumferential wire windings are to be entered or deleted, this can be done using the "+" or "-" keys.

Operation

6.11.11 Settings of Welding, Circumferential Wire Cutter and Cage removal Device



1.	Setting of offset of Welding Spots	2.	Offset of all Welding Spots
3.	Current Position of Electrode support Wheel	4.	Angular Speed during Loading
5.	Recipes	6.	Setting of Welding Power
7.	Positionen of Cage removal	8.	Settings of Circumferential wire Cutter

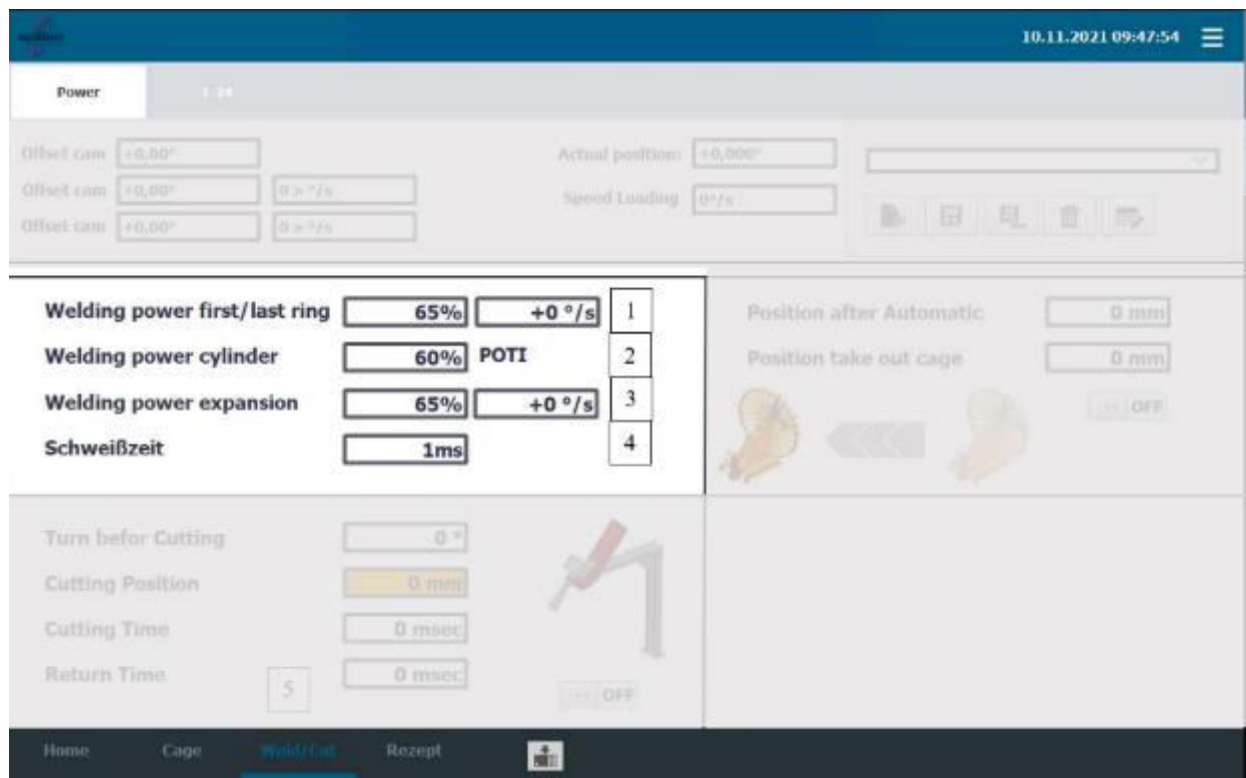
Fig. 60: "Setting of Welding, Circumferential wire cutter, Cage removal" menu

- (1) Switching between the "Power" and "1-24" tabs (spot weld setting).
- (2) Setting of offset for the defined welding spots. The first offset is valid from speed 0. For the following offsets, the speed from which this offset is valid can be specified.
- (3) Shows the actual position of the electrode support wheel (0-360°).
- (4) Setting the angular speed of the main wheel during loading of the longitudinal wires.
- (5) Recipe display, see chapter 6.11.7.
- (6) Settings of the welding, see chapter 6.11.12.

(7) Cage removal positions, see chapter 6.11.13

(8) Optional circumferential wire cutter, see chapter 6.11.14

6.11.12 Settings of Welding Power



1.	Welding power Start-/End Ring and angular speed	2.	Welding power cage cylinder
3.	Welding power Spread and angular speed	4.	Welding time

Fig. 61: "Setting of Welding power" menu

(1) Setting the welding power during the start and end ring. Usually, the welding is a little stronger here than in the center part of the cage. The 2nd field is used to set the speed.

(2) Setting the welding power in the cage barrel. The speed is set on the potentiometer of the control panel.

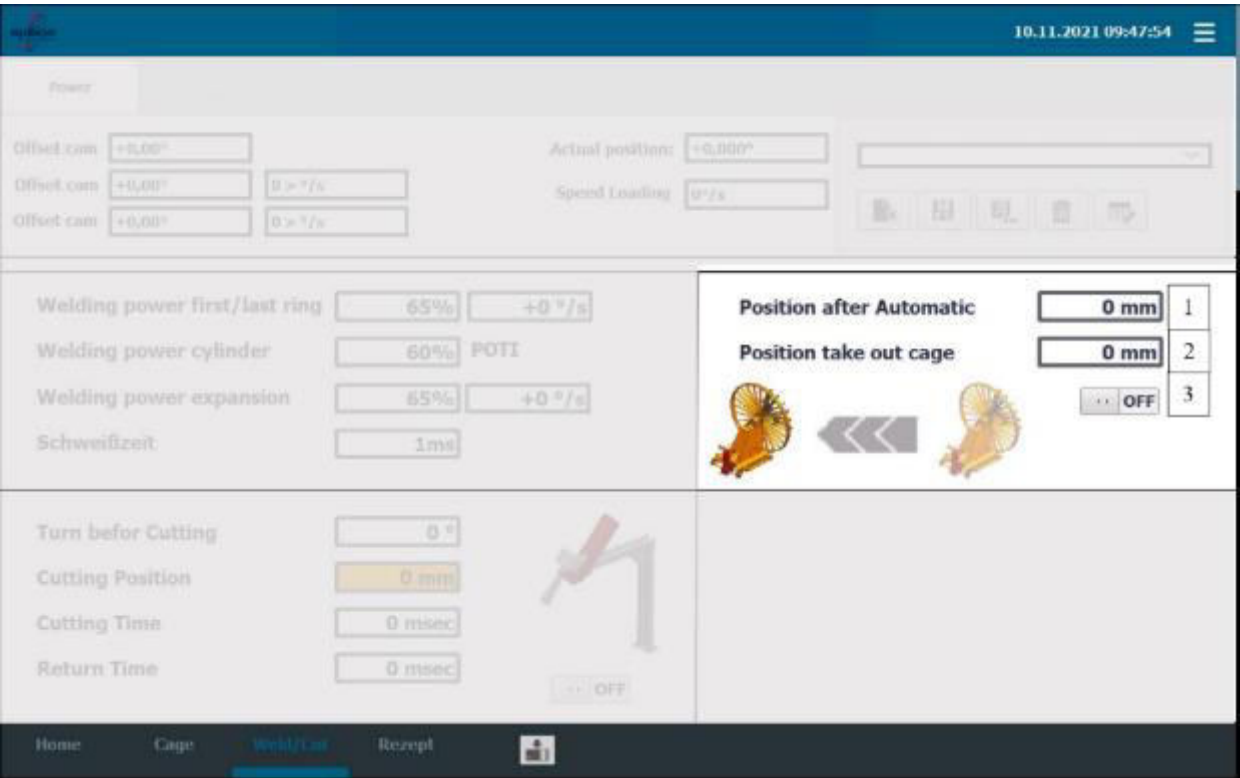
(3) Setting the welding intensity during spreading. Normally, the welding strength in this field is slightly higher than in the straight part of the cage. Field 2 is used to set the speed.

Operation



(4) Setting of the welding time, the welding time can be extended in steps of 20ms. The length of the welding spot depends on how fast the cage is produced. If the feed rate of the cage is high, it is possible that contact breaks may occur if the welding time is set too long.

6.11.13 Position of Cage removal



1.	Position after the end of automatic production	2.	Position of cage removal
3.	Activate/deactivate automatic drive out		

Fig. 62: "Cage removal" menu

(1) Path the cage pull-out carriage travels after the end of automatic cage production (circumferential wire cut off) when activating the removal position.

Calculation of the position:

$$\begin{array}{rcl} \text{Cage length} + \text{position after end of automatic} & = & \text{position} \\ 3000\text{mm} \quad + \quad 300\text{mm} & = & \mathbf{3300\text{mm}} \end{array}$$

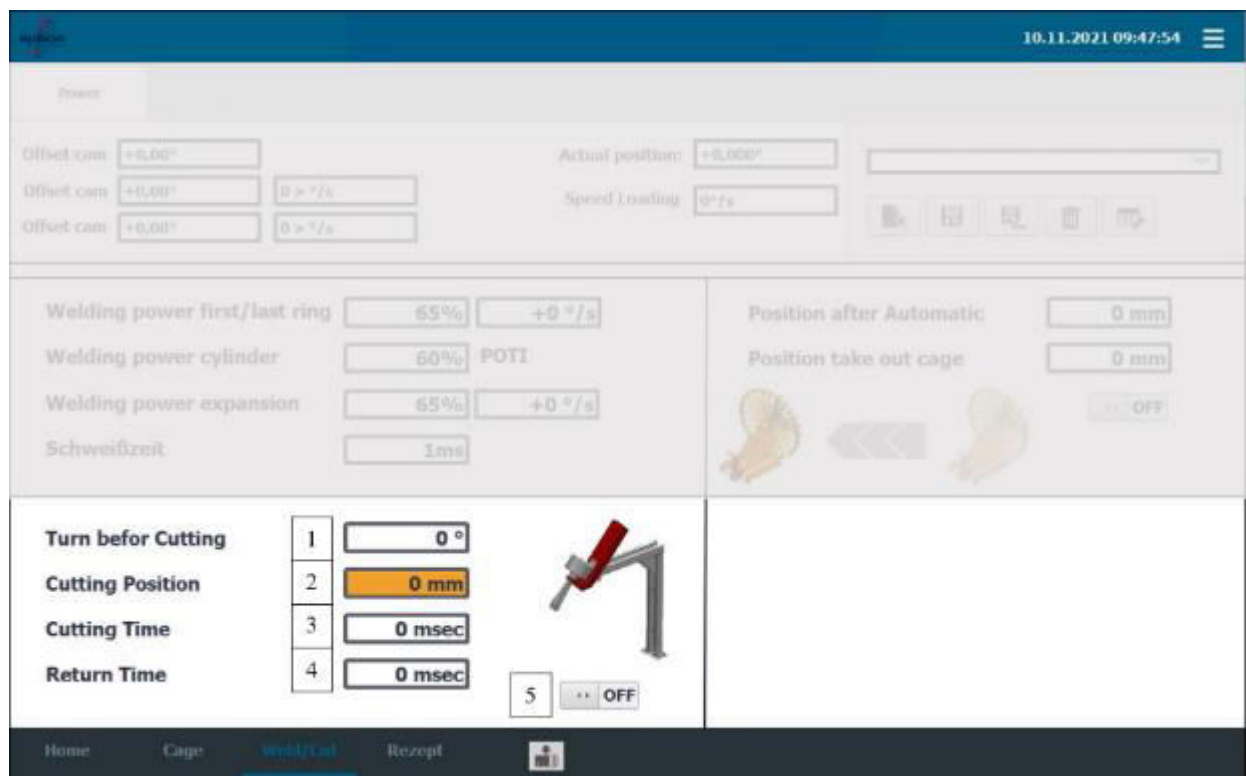
(2) Path the cage pull-out carriage travels when activating the end position.
(activated with the foot pedal)

Calculation of the position:

Cage length + position after end of automatic + position cage removal = **position**
 3000mm + 300mm + 500mm = **3300mm**

(3) Deactivates/activates the automatic return to the cage removal position when the automatic circumferential wire cutter option is active and has successfully cut the circumferential wire. Automatic return is not possible without the circumferential wire cutter.

6.11.14 Settings of Circumferential wire cutter in Automatic mode



1.	Turn of cage before cutting	2.	Cutting position of pneumatic cylinder
3.	Cutting time	4.	Opening time of cutter blades
5.	Switch on/off automatic cutting		

Fig. 63: "Automatic cutter" menu

(1) Setting the number of degrees the electrode support wheel continues to rotate after the last welding spot to enable the shear blades to enter.

(2) Setting the travel of the cutter.

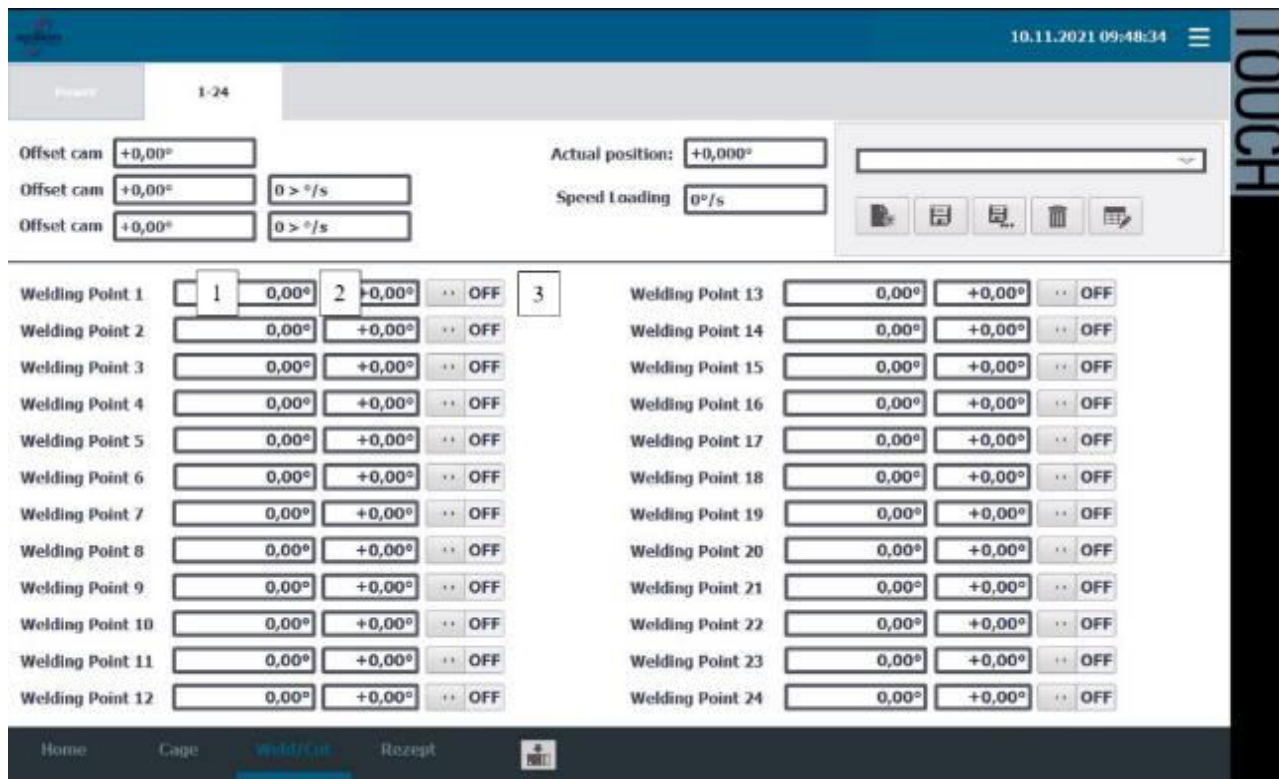
(3) Setting the cutting time to cut the circumferential wire.

Operation

(4) Setting the time which the shear blades need to return to the home position.

(5) Activates/Deactivates the automatic circumferential wire shear function.

6.11.15 Settings of individual welding spots



Welding Point	Position	Offset	Switch
Welding Point 1	0,00°	+0,00°	OFF
Welding Point 2	0,00°	+0,00°	OFF
Welding Point 3	0,00°	+0,00°	OFF
Welding Point 4	0,00°	+0,00°	OFF
Welding Point 5	0,00°	+0,00°	OFF
Welding Point 6	0,00°	+0,00°	OFF
Welding Point 7	0,00°	+0,00°	OFF
Welding Point 8	0,00°	+0,00°	OFF
Welding Point 9	0,00°	+0,00°	OFF
Welding Point 10	0,00°	+0,00°	OFF
Welding Point 11	0,00°	+0,00°	OFF
Welding Point 12	0,00°	+0,00°	OFF
Welding Point 13	0,00°	+0,00°	OFF
Welding Point 14	0,00°	+0,00°	OFF
Welding Point 15	0,00°	+0,00°	OFF
Welding Point 16	0,00°	+0,00°	OFF
Welding Point 17	0,00°	+0,00°	OFF
Welding Point 18	0,00°	+0,00°	OFF
Welding Point 19	0,00°	+0,00°	OFF
Welding Point 20	0,00°	+0,00°	OFF
Welding Point 21	0,00°	+0,00°	OFF
Welding Point 22	0,00°	+0,00°	OFF
Welding Point 23	0,00°	+0,00°	OFF
Welding Point 24	0,00°	+0,00°	OFF

1.	Positions of the individual welding spots	2.	Offset of the individual welding spots
3.	Switch on/off individual welding spot		

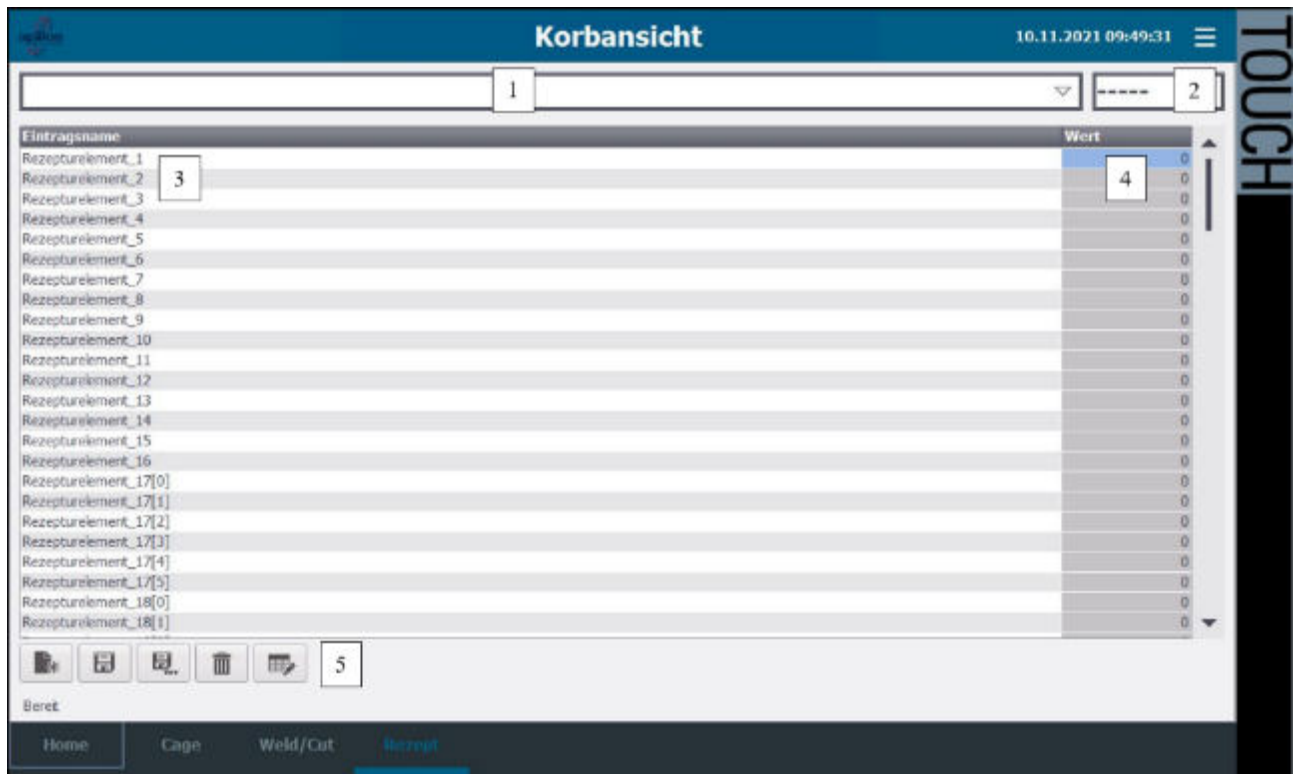
Fig. 64: "Individual welding spots" menu

(1) Defining the offset of the welding position of the cam controller. Up to 24 welding spot positions can be defined.

(2) Shifting individual welding spot position to eliminate mechanical tolerances and improve the timing of the welding spot.

(3) Activate/Deactivates welding spot. By deactivating, welding is no longer performed at this position and the function "Next welding spot" will not stop at this position.

6.11.16 Recipe management



1.	Recipe designation	2.	Number of recipe
3.	Overview of recipe elements	4.	Value of individual recipe element
5.	Recipe control		

Fig. 65: "Recipe management" menu

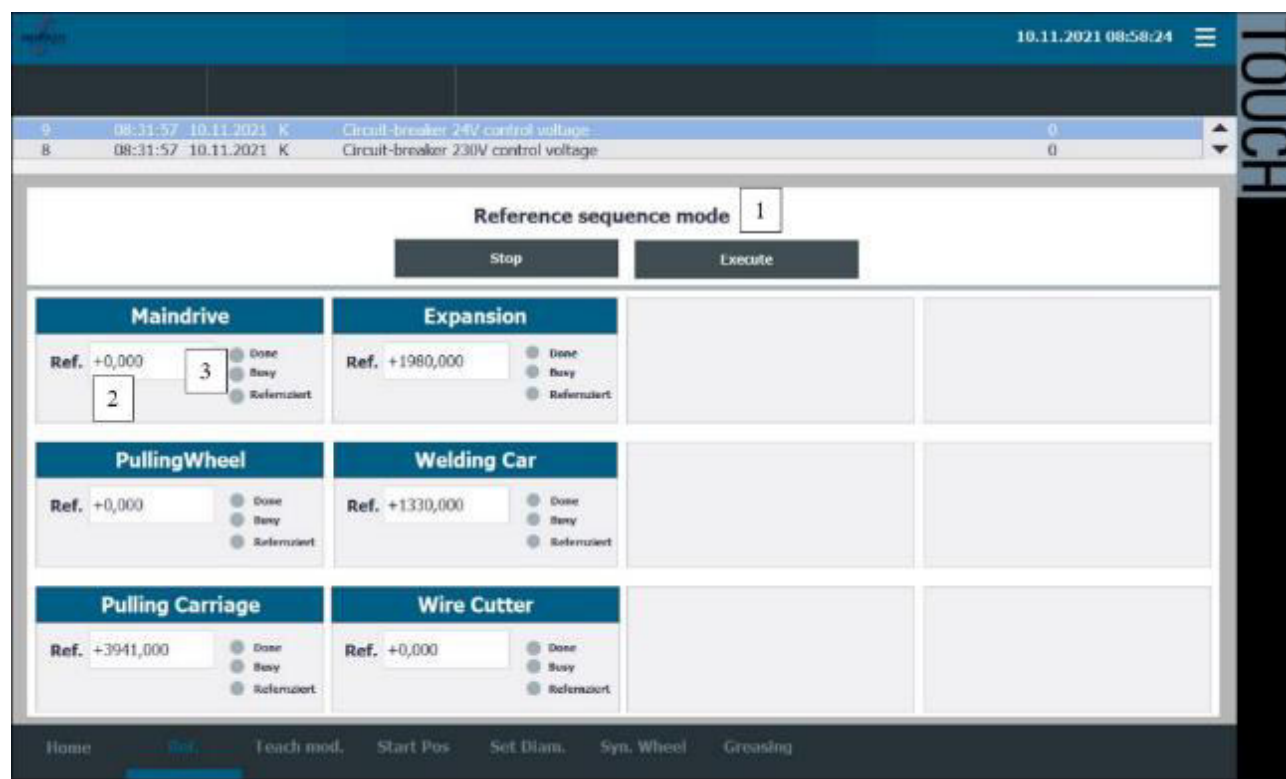
(1) Name of the currently selected recipe. Other recipes can be selected with the drop-down list.

(2) Shows the number of the recipe.

(3) Lists all variables that are stored in the recipe in a table. In the tabs "Cage" and "Weld/Cut" the variables are shown individually for the value input. (4) shows the values of the variables.

(5) See chapter 6.11.7.

6.11.17 Referencing mode



1.	Start/Stop of referencing mode	2.	Value to which the drive references
3.	Status of respective drive		

Fig. 66: "Referencing mode" menu

(1) Starts/Stops selected function. The function is started with the [Execute] key; this is only possible if the operating mode selector switch is set to semi-automatic and the light barriers are acknowledged. The function is stopped with [Stop] or the Automatic Off pushbutton on the operators panel. Breaking the light barrier also stops the function.

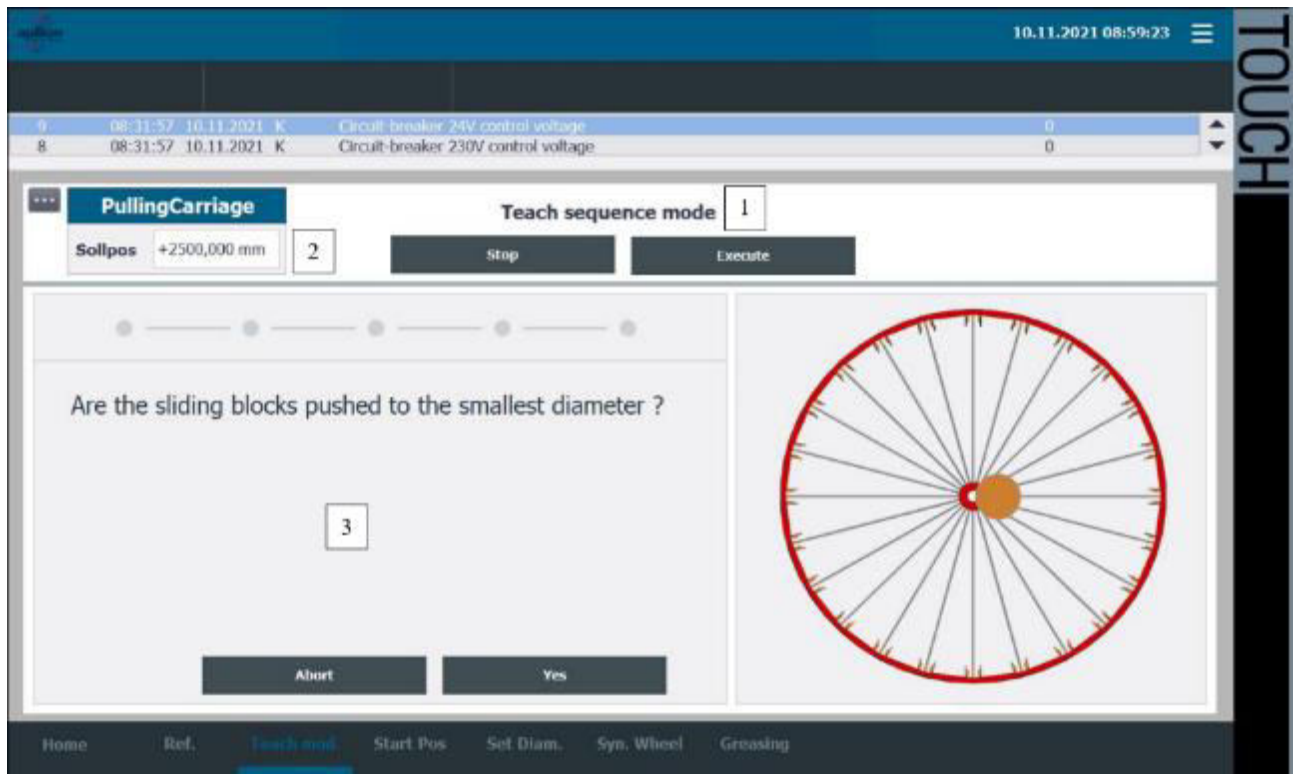
(2) Entering the reference position of the actuator.

(3) Status of the individual actuator.

Busy = referencing is being executed

Done = referencing is finished

6.11.18 Teach-mode



1.	Start/Stop teach-mode	2.	Target position of cage pull-out carriage in teach-mode
3.	Instructions for teach-mode		

Fig. 67: "Teach-mode" menu

(1) Starts/Stops selected function. The function is started with the Execute key; this is only possible if the operating mode selector switch is set to Semi-Automatic. The function is stopped with Stop or the Automatic Off pushbutton on the operator panel.

(2) Defines the position of the cage pull-out carriage during the teach-in, the cage pull-out wheel should have enough distance to the electrode support wheel so that work can be conducted in this area without any risk.

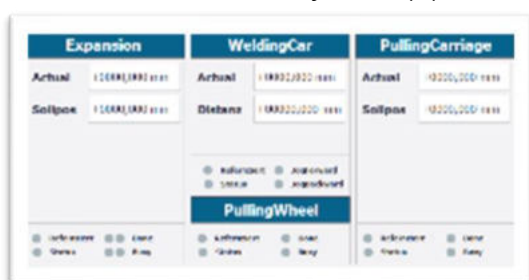
(3) Shows all the necessary steps for the teach-in.

1. Query whether all electrode carrier slides have been pushed inwards.
The cage pull-out carriage moves to the position indicated in entry field (2).

Operation



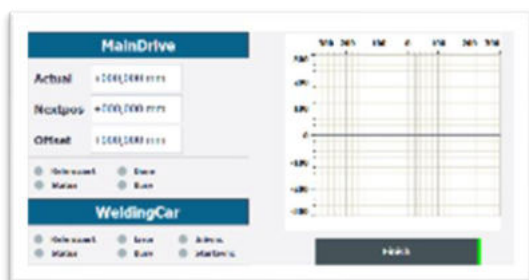
2. Spreader moves to the new diameter; cage pull-out wheel is decoupled from the electrode support wheel and the cage pull-out carriage continues to move to its position indicated in entry field (2).



3. Welding support carriage moves to the start position of the new cam profile as soon as [Next] is confirmed. (the offset must be set to 0.0mm for this).



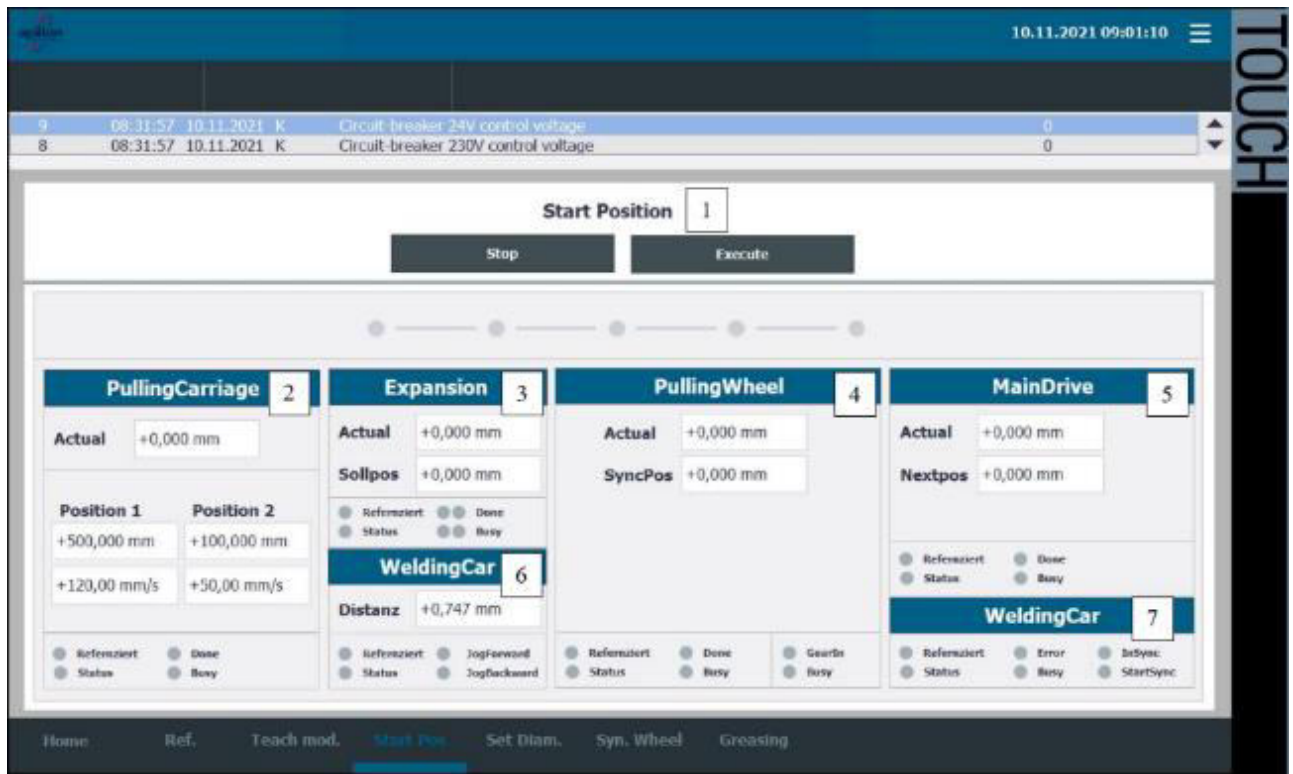
4. In this step, the electrode support wheel can be moved to the next welding spot using the foot pedal on the loading side. The welding support carriage moves along the new cam profile.



5. End Teach-in with "Finish"



6.11.19 Start Position



1.	Start/Stop moving to Start position	2.	Status cage pull-out carriage and entering of Start positions
3.	Status of Spread	4.	Status cage pull-out wheel
5.	Status electrode support wheel	6.-7.	Status welding support carriage

Fig. 68: "Start position" menu

(1) Start/Stop of the selected function. The function is started with the [Execute] key; this is only possible if the operating mode selector switch is set to Semi-Automatic and the light barrier on the cage removal side is acknowledged. The function is stopped with [Stop] or the [Automatic Off] pushbutton on the operator panel. Breaking of the light barrier on the cage removal side also stops the function.

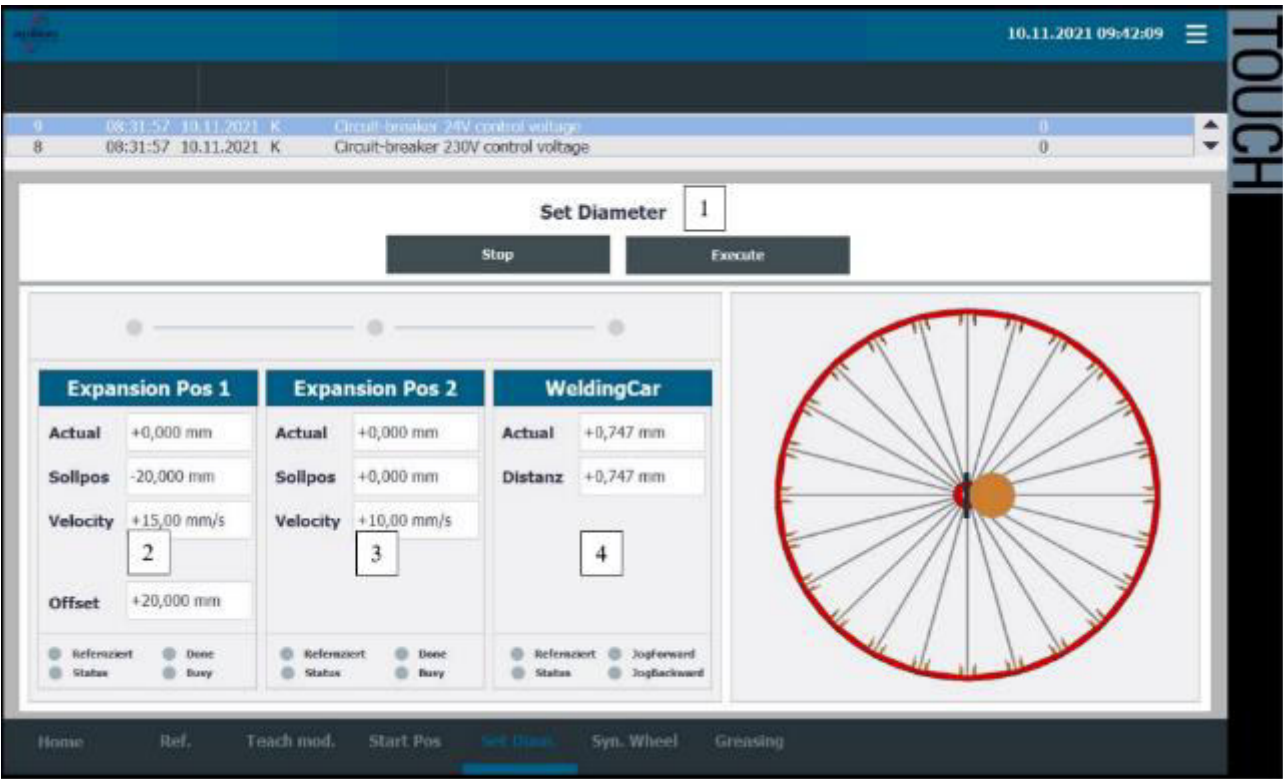
(2) Shows the current position and the status of the cage pull-out carriage. The 2 following positions of the cage pull-out carriage can also be set:

The first position indicates from which distance the diameter must be reached and the cage pull-out wheel must be synchronous to the electrode support wheel. If these 2 conditions are not met, the cage pull-out carriage stops and only moves to the second position when the spread and cage pull-out wheel are in correct position. The second position determines the ultimate start position.

(3-7) Shows the status of the individual motors.



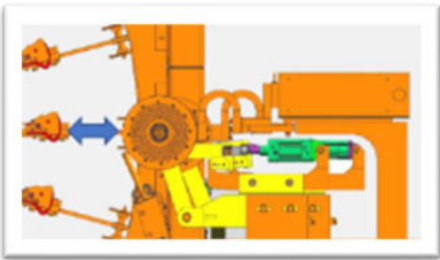
6.11.20 Setting Cage Diameters



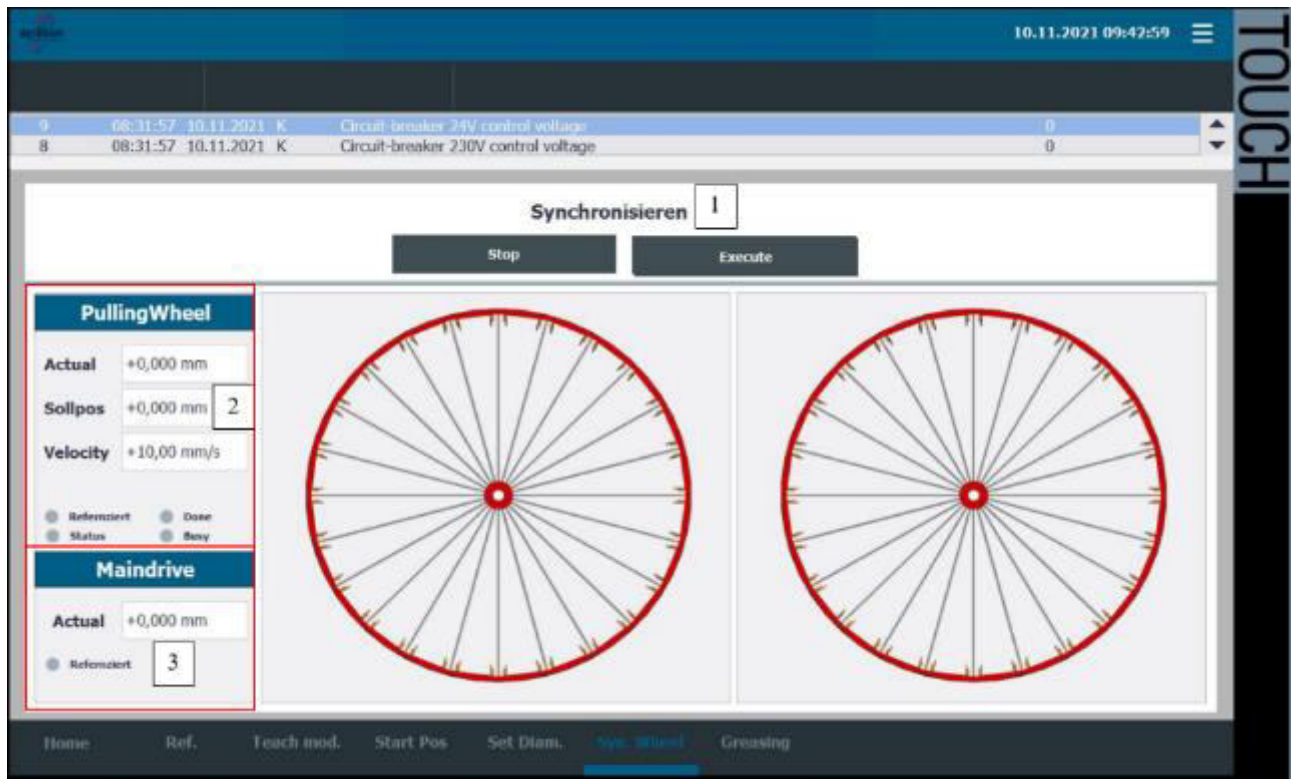
1.	Start/Stoppen of „Set Diameter“ function	2.-3.	Status Spread
4.	Status welding support carriage		

Fig. 69: "Setting cage diameter" menu

- (1) Start/Stop of the selected function. The function is started with the [Execute] key; this is only possible if the operating mode selector switch is set to Semi-Automatic and the light barrier on the cage removal side is acknowledged. The function is stopped with [Stop] or the [Automatic Off] pushbutton on the operator panel. Breaking of the light barrier on the cage removal side also stops the function.
- (2-3) Shows the status of the spreading during the diameter change. The speed of position 1 and 2 can be set. To tension the chains, position 1 is smaller than position 2 by the set offset.
- (4) Shows the status of the welding support carriage. This value refers to the distance between contact roller to contact bridge.



6.11.21 Synchronizing electrode support wheel and cage pull-out wheel



1.	Start/Stop Synchronizing function	2.	Input values for synchronizing cage pull-out wheel
3.	Current Position of electrode support wheel		

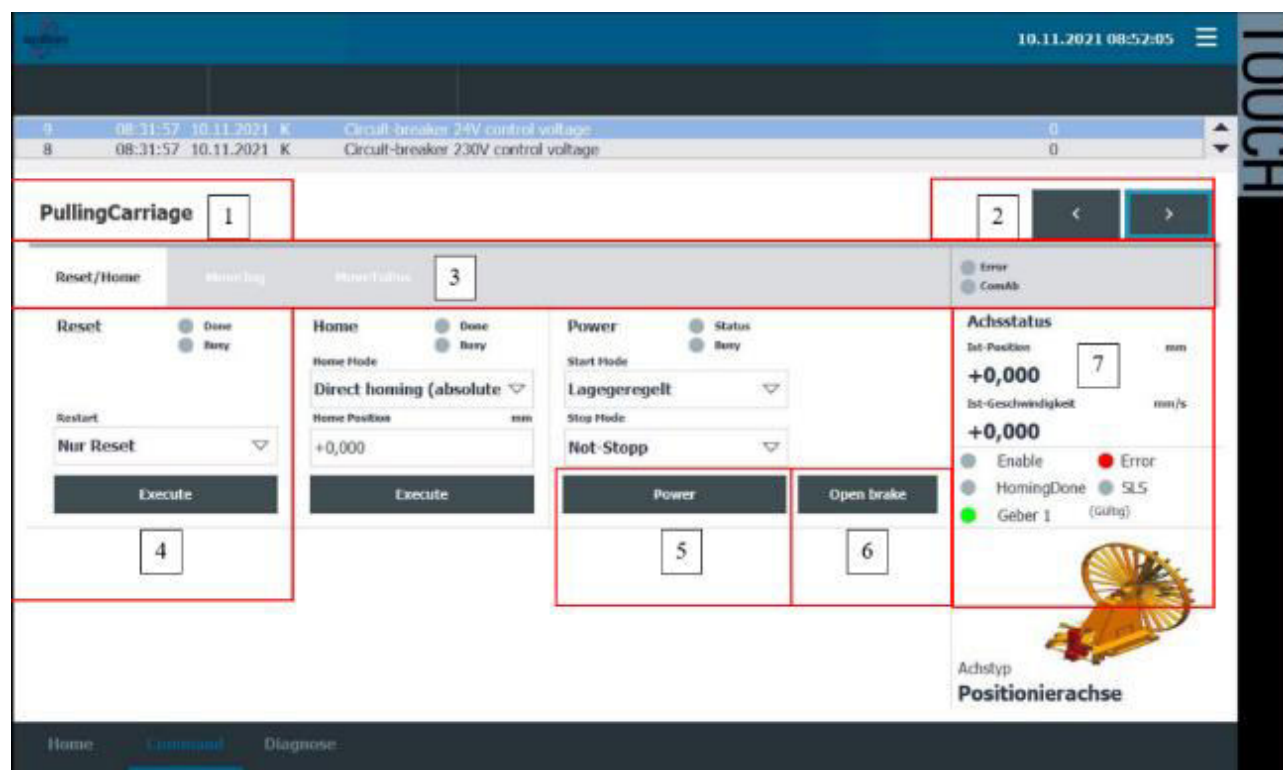
Fig. 70: "Synchronizing wheels" menu

(1) Start/Stop of the selected function. The function is started with the [Execute] key; this is only possible if the operating mode selector switch is set to Semi-Automatic and the light barrier on the cage removal side is acknowledged. The function is stopped with [Stop] or the [Automatic Off] pushbutton on the operator panel. Breaking of the light barrier on the cage removal side also stops the function.

(2) – (3) Status and positions of the cage pull-out wheel and electrode support wheel, which are needed during synchronization.

6.11.22 Left blank

6.11.23 Operating the axis controls



1.	Name of Axis	2.	Switch between axis
3.	Select menu of axis functions	4.	Reset of axis
5.	Switch on/off of drive	6.	Brake control
7.	Status of axis		

Fig. 71: "Axis controls" menu

(1) Name of the selected axis, keys (2) can be used to switch between the axes.

There are 5 functions for the axes, but they cannot be used by every axis. Enabled for the user are tab 1 and 2.

The following functions are usually only needed during commissioning or for diagnosis.

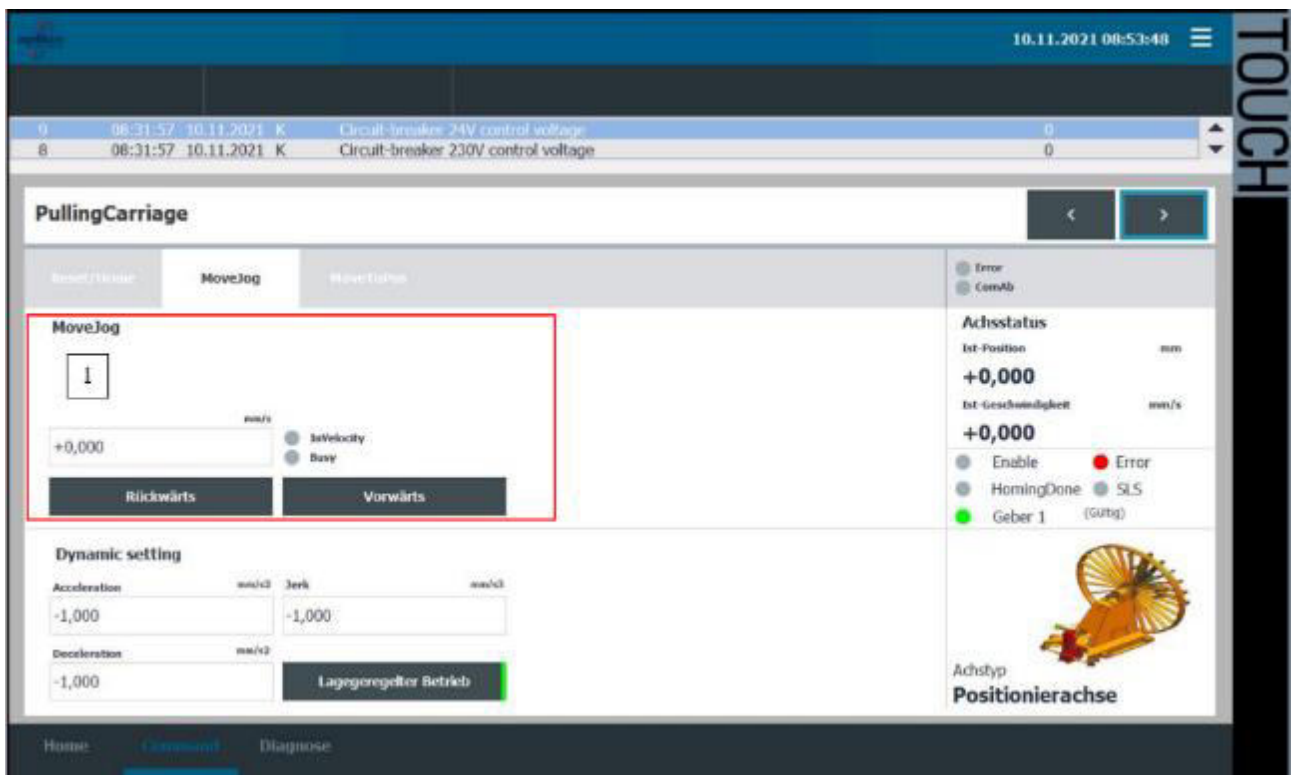
(4) Resets the axis in case of an error, this can also be done with the [Acknowledge] button on the operator panel. If the axis shows a severe error, normal reset is not sufficient. After the error has been detected and corrected via the diagnostics, the axis can be restarted using the drop-down menu (Restart).

e.g. If both HW limit switches are triggered, the axis recognizes this as a non-permitted error. In this case a "Reset only" is not sufficient and the axis must be restarted with "Restart".

!!! After a restart, "Reset only" must be set again, otherwise the axis will be restarted with each error acknowledgement!!!!

- (5) Enables/Disables the axis in the setup mode.
- (6) Manually opens the holding brake of the motor.
- (7) Shows the current axis status (position, speed, status).

6.11.24 MoveJog command - jog mode of the axes



1.	Manual operation of axes		
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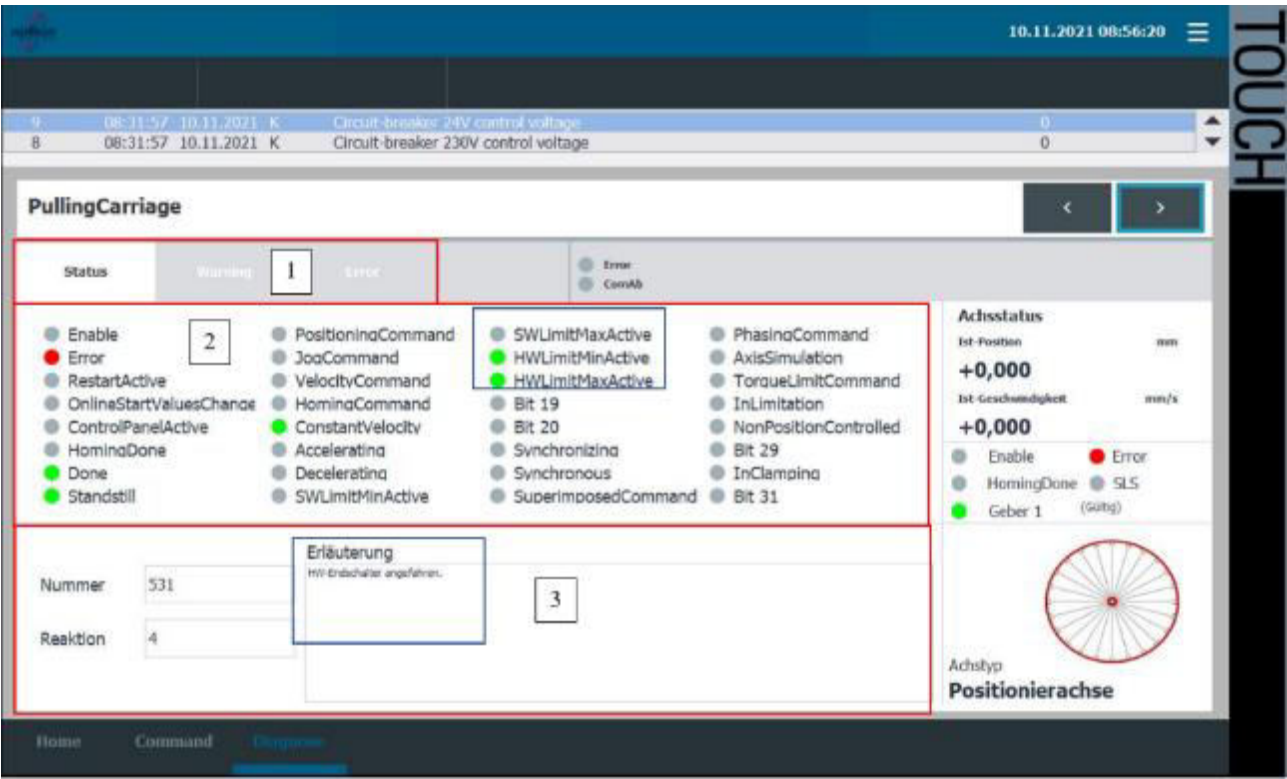
Fig. 72: "Jog mode axis" menu

(1) Shows the control of the axis. Manual operation (MoveJog) is only possible in setup mode.

The moving speed is entered and the axis moved in the respective directions with the 2 keys.



6.11.25 **Diagnosis menu**

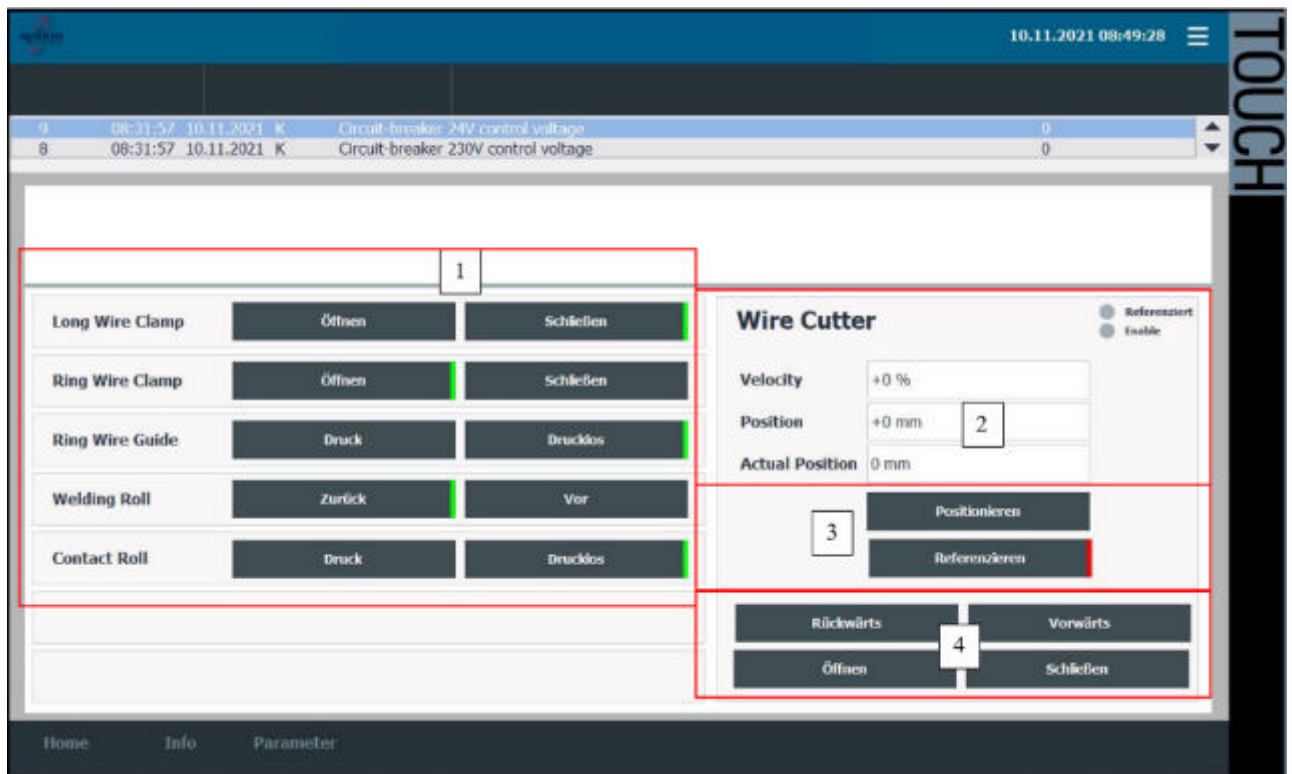


1.	Diagnosis menu	2.	Overview diagnosis
3.	Explanation of faults and warnings		

Fig. 73: “Diagnosis” menu

- (1) Control of the diagnosis menu; there are 3 tabs:
- Status
 - Warning
 - Error
- (2) Diagnosis overview
- (3) Explanation of diagnosis in text. Shown for example a tripped hardware limit switch (marked blue).

6.11.26 Manual pneumatic control



1.	Manual control of the individual valves	2.	Settings of the linear axis of the automatic circumferential wire cutter
3.	Moving commands for (2)	4.	Manual control of the automatic circumferential wire cutter

Fig. 74: "Manual pneumatic control" menu

(1) Manual control of the various valves, such as for the longitudinal wire clamps. The green indicator bar shows which valve is already controlled.

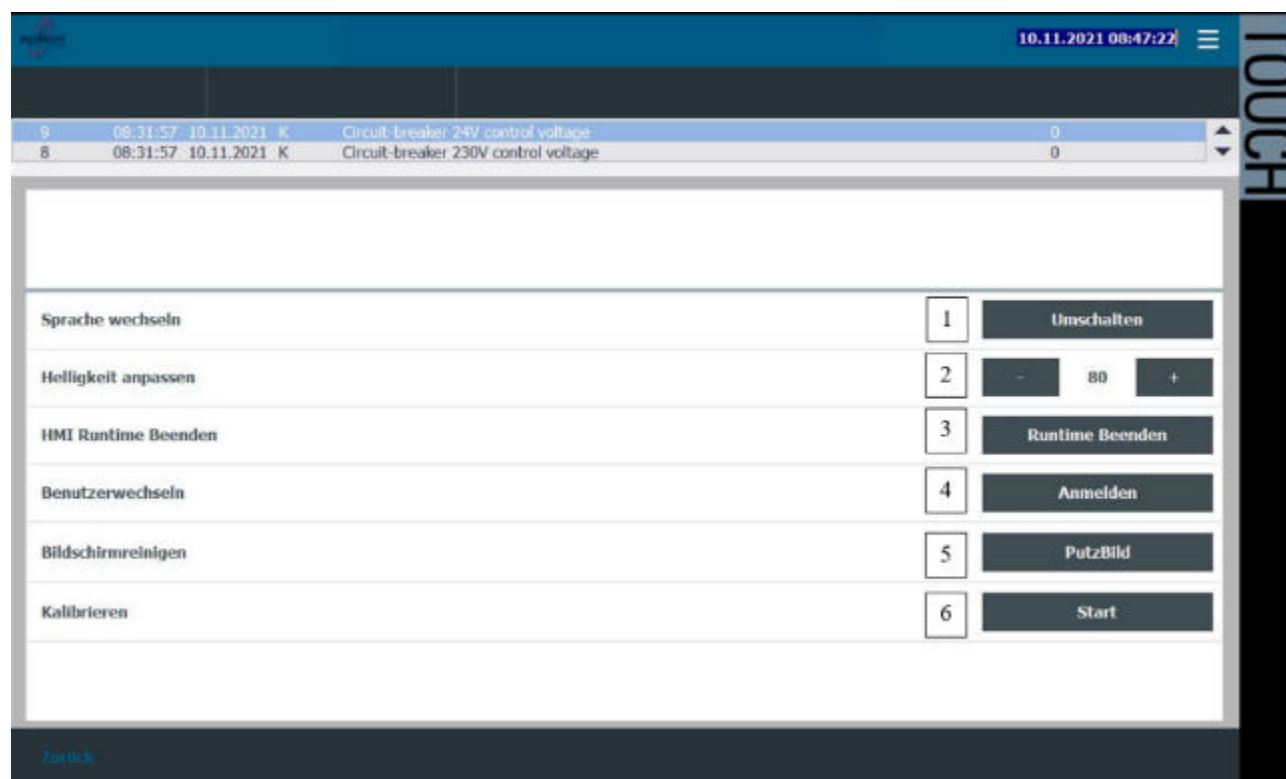
(2) Entering settings for the automatic circumferential wire cutter:

- Speed during positioning
- Position to be moved to
- Current position of the cutter

(3) Activates the positioning or the referencing of the cutter. During positioning, the key must remain pressed until the desired position is reached.

(4) Manual operation of the automatic circumferential wire cutter.

6.11.27 Screen menu and settings



1.	Language selection	2.	Brightness HMI
3.	End Runtime	4.	User administration
5.	Clean screen	6.	Calibrate screen

Fig. 75: "Screen & Settings" menu

(1) Switches through the stored languages.

(2) Adjustment of the brightness of the screen (pressing the "+" or "-" button).

(3) Exits the runtime of the visualization. (Only necessary if something has to be changed in the operating system).

(4) Changing the user. This can be necessary, if the current user does not have the necessary access rights to the system.

If the screen is dirty, the screen can be locked for 20 seconds by pressing (5).
Locked. Do not use solvents or strong cleaning agents to clean the screen.

(6) Opens the calibration mode of the screen. This is necessary if touches on the screen are no longer detected correctly or are no longer recognized by the system at the correct position.

6.12 Switch off

6.12.1 Regular power off



Fig. 76: Switch cabinet

1. Remove reinforcement from machine.
2. Switch off the main switch (Fig. 76).

6.12.2 Emergency shutdown

In hazardous situations, movements of components must be stopped as quickly as possible and the power supply must be switched off.

In an emergency, proceed as follows:

1. Immediately trigger emergency stop by emergency stop device.
2. If there is no danger to own health, rescue persons from the danger zone.
3. If necessary, initiate first aid measures.
4. Alert fire department and/or rescue service.
5. Inform the person responsible at the place of use.
6. Switch off the machine and secure it against being switched on again.
7. Clear access routes for emergency vehicles.
8. Instruct rescue vehicles.



6.13 Activities after use

1. Switch off the system.
2. Padlock the main switch.
3. Remove the key.
4. Keep keys safe.
5. If present, close the protective fences.
6. Clean up the surroundings of the plant.

7 Maintenance

7.1 Safety instructions for maintenance

Personnel

The maintenance work described under here can be carried out by the operative, unless otherwise indicated. In the case of multiple entries, the operator must decide whom to commission with the work.

Some maintenance work may only be carried out by specially trained personnel or exclusively by the manufacturer; this is indicated separately in the description of the individual maintenance work.

Work on the electrical system may only be carried out by qualified electricians.

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety helmet
- Safety shoes



Further protective equipment that must be worn for certain work is referred to separately in the warnings in this chapter.

Electric current

⚠ DANGER!

Danger to life due to electric current! There is an immediate danger to life from electric shock when touching live parts. Switched-on electrical components can perform uncontrolled movements and lead to serious injuries.

-Before starting work, switch off the electrical supply and secure it against being switched on again.

⚠ WARNING! Risk of injury due to improperly performed maintenance work! Improper maintenance can lead to severe personal injury or property damage.



- Ensure sufficient assembly clearance before starting work.
- Pay attention to order and cleanliness at the assembly site! Loose components and tools lying on top of or around each other are sources of accidents.
- If components have been removed, ensure correct assembly, reinstall all fasteners and observe bolting torques.

Environmental protection

Observe the following notes on environmental protection during maintenance work:

- At all lubrication points that are supplied with lubricant by hand, remove the leaking, used or excess grease and dispose of in accordance with applicable local, state and federal regulations.
- Collect drained liquids in appropriate containers and dispose of in accordance with applicable local, state, and federal regulations.

7.2 Maintenance plan

The following sections describe the maintenance work required for optimum and trouble-free operation.

If regular inspections reveal increased wear, shorten the required maintenance intervals in accordance with the actual signs of wear.

For questions regarding maintenance work and intervals, contact the manufacturer,

see ↗ *"Customer service" on page 4.*



Maintenance

Interval	Maintenance work	Personal
Once a month or every 160 operating hours	Lubricate the spindle of the support (↻ <i>page 135</i>)	Trained professionals Operative
	Lubricate the drive chain of the spindle drive (↻ <i>page 138</i>)	Trained professionals Operative
	Check and clean contact surfaces of the welding transformer connections (↻ <i>page 127</i>)	Qualified electrician
Once per shift	Checking the weld quality (↻ <i>page 129</i>)	Quality assurance specialist
	Check contact pressure between power supply and welding or contact roller (↻ <i>page 70</i>)	Operative
	Check the screw connections of the live parts on the welding head (↻ <i>page 71</i>)	Operative
	Check safety devices (↻ <i>page 66</i>)	Operative
	Check circumferential wire reel brake (↻ <i>page 74</i>)	Operative
	Check circumferential wire guide (↻ <i>page 72</i>)	Operative
	Check function and contact pressure of wire clamping (↻ <i>page 75</i>)	Operative
Once a week or every 40 operating hours	Cleaning the heat exchanger (↻ <i>page 129</i>)	Operative
	Check coolant level (↻ <i>page 132</i>)	Operative
	Check pneumatic lines (↻ <i>page 132</i>)	Trained professionals
	Check diameter adjustment chains in electrode support wheel (↻ <i>page 133</i>)	Trained professionals
	Lubricate the spindle nut of the spreader (↻ <i>page 137</i>)	Operative

Maintenance

	Lubricate rotating chain Spindle wheel and rotating chain pull-out wheel (↗ page 140)	Trained professionals Operative
	Lubricate the gear wheels of the cage pull-out carriage (↗ page 136)	Operative
	Checking the energy supply chain (↗ page 132)	Operative
	Perform resistance measurement of welding roller - ground (↗ page 130)	Qualified electrician
Annually or every 1920 operating hours	Maintain air conditioner (↗ page 130)	Trained professionals
	Clean the cooling system (↗ page 130)	Trained professionals
	Check the condition of the complete electrical equipment (↗ page 131)	Qualified electrician
	Check the couplings and gearboxes of the motors (↗ see supplier documentation in the appendix).	Trained professionals
	Replace gearbox oil (↗ see supplier documentation in the appendix).	Trained professionals
	Check all holding and service brakes (↗ see supplier documentation in the appendix).	Trained professionals
Several times a day or each time the circumferential wire is replenished	Lubricate welding and contact roller (↗ page 67)	Operative
	Check pressure at pneumatic spring element (↗ page 69)	Operative

7.3 Cleaning

7.3.1 Cleaning of heat exchanger

Hot surfaces

⚠ WARNING!

Risk of injury from hot surfaces! Surfaces of components can heat up strongly during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Always wear heat-resistant protective clothing and gloves when working near hot surfaces.**
- Before carrying out any work, ensure that all surfaces have cooled down to ambient temperature.**

⚠ WARNING!

Risk of injury from flying metal chips and welding slag! When cleaning the area around the welding head with compressed air, flying metal chips and welding slag can cause serious eye injuries, which can lead to blindness, and cuts to the skin.

- Wear protective work clothing, gloves and goggles.**

Personnel:

- Instructed person

Protective equipment:

- Face shield

Clean the heat exchanger of the cooling unit once a week or every 40 operating hours.

Do not use a water hose, high-pressure cleaner or steam cleaner for cleaning!



Fig. 77: Cooling unit

1. Switch off the system and secure it against being switched on again.
2. Clean the heat exchanger with compressed air.
3. After cleaning, perform a visual inspection of the following components:
 - Water hoses
 - Electrical cables

Report any damage to hoses and/or electrical wiring to the foreman. Do not switch on the system.

7.3.2 Cleaning of cooling system

Personnel: • Instructed person

Annually or every 1920 operating hours clean cooling system and replace coolant.

⚠ WARNING! Risk of injury from hot surfaces and operating fluids! Contact with hot components and liquids can cause burns.

-Always wear protective clothing and gloves when working near hot components.

-Before starting any work, make sure that all components and fluids have cooled down to ambient temperature.

1. Switch off the system and secure it against being switched on again.
2. Unscrew the filling opening of the water tank.

▲ WARNING! Health hazard due to antifreeze!

Coolant contains an antifreeze agent which can cause serious damage to health if it comes into contact with the body, is swallowed or inhaled.

-Avoid contact with coolant.

-Do not eat, drink or smoke when handling coolant.

Wash hands before breaks and at the end of work.

-Refer to the coolant manufacturer's safety data sheet.

-When handling coolant, wear the personal protective equipment specified in the safety data sheet.

3. Connect draining hose to the drain valve.
4. Hang free end of the hose into a suitable collection container.
5. Open drain valve. Drain tank.
6. Collect coolant in container and dispose of in accordance with local laws and regulations.



7.4 Checking the level of the coolant

⚠ WARNING!

Danger of poisoning from antifreeze! Swallowing or inhaling antifreeze can lead to life-threatening poisoning.

- Work with antifreeze may only be carried out by instructed persons.
- Wear protective gloves.
- If swallowed, seek medical attention immediately.

Check the coolant level once a month or every 160 hours of operation.

⚠ WARNING! Risk of injury from hot operating fluids! Operating materials can reach high temperatures during operation. Skin contact with hot operating materials causes severe burns to the skin.

- Always wear heat-resistant protective clothing and gloves when working with operating materials.
- Before carrying out any work with operating fluids, check whether they are hot. If necessary, allow to cool down.

1. Switch off the system and secure it against being switched on again.

⚠ WARNING! Risk of injury from hot surfaces! Surfaces of components can heat up strongly during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Always wear heat-resistant protective clothing and gloves when working near hot surfaces.
- Before carrying out any work, ensure that all surfaces have cooled down to ambient temperature.

2. Unscrew the filling opening of the water tank.
3. If necessary, top up with clean water, adding the required amount of antifreeze if necessary.
4. Screw on the tank cap.

7.5 Checking contact surfaces of the welding transformer

Check the contacts between welding transformer and current supplies every three months or 480 operating hours.

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none"> • Qualified electrician |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Heat resistant protective gloves with arm protection • Safety helmet • Safety shoes |

Hot surfaces

⚠ WARNING! Risk of injury from hot surfaces!

Surfaces of components can heat up strongly during operation. Skin contact with hot surfaces causes severe burns to the skin.

-Always wear heat-resistant protective clothing and gloves when working near hot surfaces.

-Before carrying out any work, ensure that all surfaces have cooled down to ambient temperature.

1. Use the *[Support larger]* or *[Support smaller]* button to move the welding transformer to an easily accessible position.
2. Switch off the system and secure it against being switched on again.

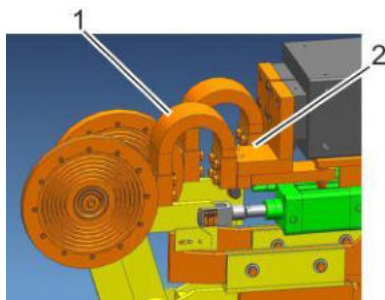


Fig. 78: Secondary connections of the welding transformer

3. Unscrew the copper angle (Fig. 78/2) from the welding transformer and check the contact surfaces.
4. Unscrew current supply (Fig. 78/1) from copper angle (Fig. 78/2) and check contact surfaces.
5. Disconnect current supply (Fig. 78/1) from water-cooled current supply and check contact surfaces.
If the contact surfaces show slight burn-in marks (not deeper than 1 mm (0.04 inch)): Grind surfaces flat.
If the contact surfaces show larger burn-in marks: Replace defective parts.
6. Connect current supply (Fig. 78/1) to water-cooled current supply.
7. Screw the current supply to the copper angle (Fig. 78/2).
8. Screw copper angle (Fig. 78/2) to the welding transformer.

7.6 Checking of welding power

Check the welding performance several times a day.

⚠ CAUTION! Cutting injuries at sharp wire ends and welding spots! When touching the wire ends and welding spots, sharp edges and tips can cause cuts.

-Wear protective gloves and protective work clothing.

-Use caution.

Personnel:	• Quality assurance specialist
Protective equipment:	• Protective work clothing • Protective gloves • Safety helmet • Safety shoes

Evaluate welding performance based on welding results.

1. Tear apart a weld.

With good welding performance, the weld shows a welding lens after tearing apart: Material in the form of a cone with a diameter and depth of at least 1 mm (0.04 inch) has torn out of one of the wires.

If the welding performance is insufficient, the welded joints will either loosen already under the influence of internal stresses in the reinforcement cage or at low stresses due to external influences.

7.7 Checking the isolation of the welding roller

Once a week or every 40 hours of operation, check the isolation of the welding roller.

Hot surfaces

▲ WARNING! Risk of injury from hot surfaces!

Surfaces of components can heat up strongly during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Always wear heat-resistant protective clothing and gloves when working near hot surfaces.**
- Before carrying out any work, ensure that all surfaces have cooled down to ambient temperature.**

Personnel:

- Qualified electrician

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes

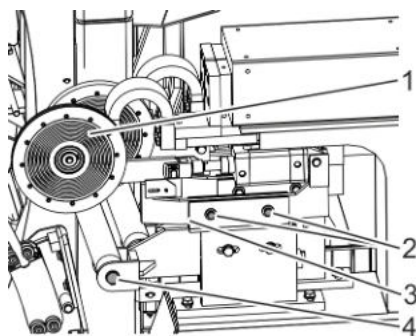


Fig. 79: Checking isolation of the welding roller

1. Switch off the system and secure it against being switched on again.
2. Use an ohmmeter to measure the resistance between the welding rollers (Fig. 79/1) and a grounded point (e.g. subframe of welding support).
3. If the measured result is below 0.5 MΩ, clean the welding head from scale and measure the resistance again.
4. If necessary, replace the insulating sleeves and insulating plates (Fig. 79/2 - 4).

7.8 Checking of electrical equipment

Once a year or every 1920 hours of operation, check all electrical equipment.

Personnel: • Qualified electrician

- 1.** Check all electrical screwed and plugged connections in the control cabinet.
- 2.** Check the isolation of all electrical cables in the control cabinet.
- 3.** Check correct grounding of the housing and the doors of the control cabinet.
- 4.** Check the condition of the electrical cables and their routing in the area between the control cabinet and the system components.
- 5.** Check isolation and fastening of all cables laid inside the system.
- 6.** Check all electrical connections of the components located in the system.

7.9 Checking of the cable drag chains

Once a week or every 40 hours of operation, check the cable drag chains of the support and cage pull-out carriage.

Personnel:

- Qualified electrician



Fig. 80: Cable drag chain

1. Switch off the system and secure it against being switched on again.
2. Visually inspect the links of the cable drag chains (Fig. 80/1) by visual inspection for damage.
3. Visually inspect the hoses in the cable drag chain (Fig. 80) for damage and breaks.
4. Visually inspect the electrical cables in the cable drag chain (Fig. 80) for damage to the isolation.

7.10 Checking of pneumatic lines

Check the pneumatic lines once a week or every 40 hours of operation.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes

1. Visually check all pneumatic lines:
 - the supply line to the maintenance unit
 - the inlet and outlet lines on the valve block
 - the lines to all drip oil reservoirs
 - Lines to the cylinders
 - Line to the rotary feedthrough between the cage pull-out carriage and the cage pull-out wheel.

If damage is found, do not turn on the equipment. Notify the foreman.

7.11 Checking of the diameter adjustment chains in the electrode support wheel

Check the chains once a week or every 40 hours of operation.

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none"> • Instructed person |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Protective work clothing • Protective gloves • Safety shoes |

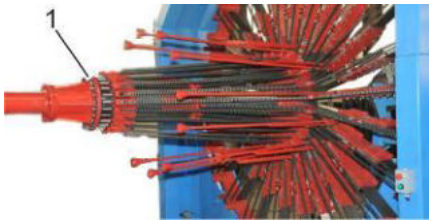


Fig. 81: Electrode support wheel chains

1. Switch off the system and secure it against being switched on again.
2. Check chains (Fig. 81) by visually inspection for sagging and/or damage.
3. Visually inspect the deflection rollers of the chains.

If the chains need to be retightened:

4. Loosen the lock nut of the clamping spindles (Fig. 81/1).
5. Tighten the tensioning nut of the chains to a torque of 25 Nm (18.5 lb ft).
6. Tighten the lock nut again.



7.12 Lubrication

⚠ CAUTION! Material damage due to too much lubricant! Electrically or pneumatically operated grease guns supply too much lubricant, which may enter areas where it causes damage.

-For lubrication via grease nipples, use only manually operated grease guns.

7.12.1 Overview of lubricants and lubrication points

Lubrication point	Lubricant
Contact and welding rollers	Multipurpose high pressure grease Ceran WR2
Welding support carriage spindle	Lithium-set High Pressure Grease
Gears cage pull-out carriage	Gear spray
Swivel arm of roller electrodes	Lithium-set High Pressure Grease
Drive chains main drive, circumferential chain of electrode support wheel	Chain spray
Ball bearing cage pull-out wheel drive	Lithium-set High Pressure Grease

7.12.2 Lubrication of spindle of the welding support

Lubricate the welding support spindle once a month or every 160 hours of operation.

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none">• Instructed person |
| Protective equipment: | <ul style="list-style-type: none">• Protective work clothing• Protective gloves• Safety shoes |



Fig. 82: Welding support spindle

1. Use the [- X] key on the operating terminal to move the electrode carrier slides to the smallest possible diameter.
2. At the operating terminal, use the [- U] key to move the welding support as far as possible towards the machine center. Make sure that the welding head does not damage the electrode carrier slides.
3. Switch off the system and secure it against being switched on again.
4. Unscrew the cover over the spindle (Fig. 82/1) of the welding support.
5. Clean spindle (Fig. 82/1) from old grease.
6. Apply new grease with a brush to the spindle (Fig. 82/1)
7. Re-attach the cover plate.

7.12.3 Lubrication of gears of the cage pull-out carriage

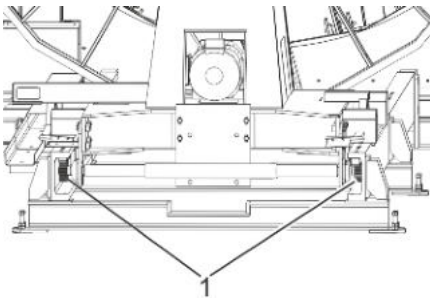
Lubricate the gears once a week or every 40 hours of operation.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety goggles
- Safety shoes



1. Move the cage pull-out carriage to a position where the two gears of the drive can be reached comfortably.
2. Switch off the system and secure it against being switched on again.
3. Lubricate the teeth of the gears (Fig. 83/1) with gear spray.

Fig. 83: Drive cage pull-out carriage

7.12.4 Lubrication of spindle gear and bearing housing of spreader drive

Lubricate the spreader spindle nut once a week or every 40 hours of operation.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety helmet
- Safety shoes

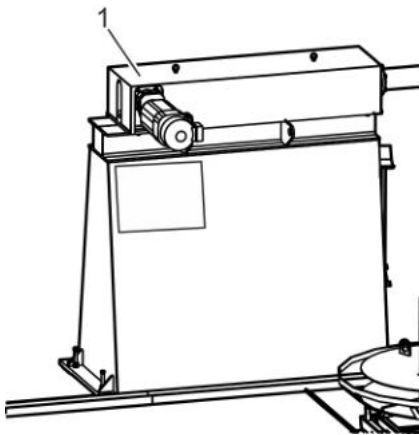


Fig. 84: Spreader drive

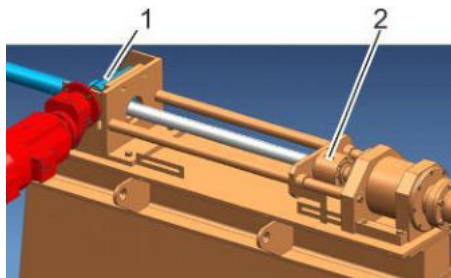


Fig. 85: Spindle gear drive

1. Switch off the system and secure it against being switched on again.
2. Remove the cover (Fig. 84/1) of the drive.
3. Connect the grease gun to the grease nipples (Fig. 85/1 + 2).
4. Press in lubricant until it exits between spindle and spindle nut.
5. Remove the grease gun.
6. Wipe off excess lubricant and dispose of in an environmentally friendly manner.

7.12.5 Lubrication of drive chain of the main drive

Once a month or every 160 hours of operation, lubricate the drive chain of the main drive.

⚠ WARNING! Risk of injury due to pull-in! When lubricating the drive chain of the main drive, serious injuries can be caused by pulling the limbs in between the gears.

-Do not hold any limbs in the danger zone.

-Before manual operations in the danger zone, switch off the system and secure it against being switched on again.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes



1. Switch off the system and secure it against being switched on again.
2. Wipe off old grease and dirt from the chain (Fig. 86/1).
3. Spray drive chain (Fig. 86/1) with chain spray.
4. Clean the area around the chain and drive from lubricant deposits caused by spray mist.

Fig. 86: Main drive

7.12.6 Lubrication of drive chain of the cage pull-out wheel

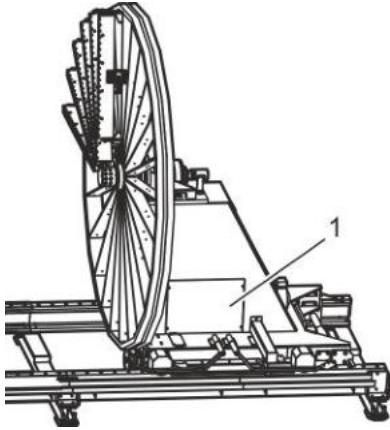


Fig. 87: Cover of the cage pull-out wheel drive

Once a month or every 160 hours of operation, lubricate the pulling wheel drive chain.

⚠ WARNING! Risk of injury due to pull-in! When lubricating the drive chain of the cage pull-out wheel drive, serious injuries can be caused by the limbs being pulled in between the toothed wheels.

-Do not hold any limbs in the danger zone.

-Before manual intervention in the danger zone, switch off the system and secure it against being switched on again.

Personnel:

- Instructed person

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes

1. Switch off the system and secure it against being switched on again.
2. Remove cover (Fig. 87/1) on the cage pull-out carriage.
3. Wipe off old grease and dirt from the chain (Fig. 88/1).
4. Spray drive chain (Fig. 88/1) with chain spray.
5. Clean the area around the chain and drive from lubricant deposits caused by spray mist.
6. Attach cover (Fig. 87/1) on the cage pull-out carriage.

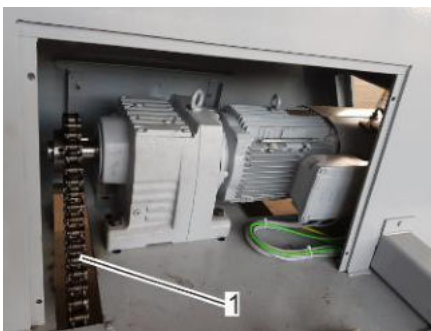


Fig. 88: Cage pull-out wheel drive

7.12.7 Lubrication of circumferential chain of electrode support wheel and cage pull-out wheel

Once a week or every 40 hours of operation, lubricate the circumferential chain of the electrode support wheel and the cage pull-out wheel.



2 people are needed for this work.

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none"> • 2 Instructed persons |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Protective gloves • Safety shoes |

The circumferential chains of the electrode support wheel and cage pull-out wheel must be lubricated manually.

Lubrication of the circumferential chain of the cage pull-out wheel

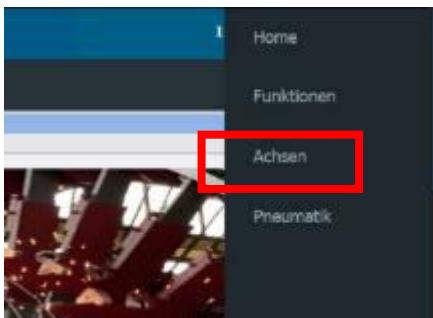
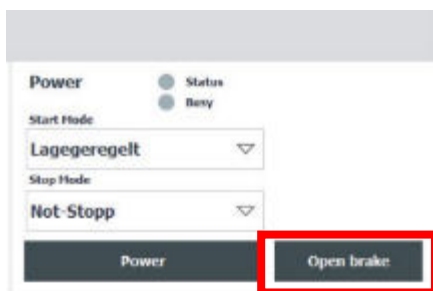


Fig. 89: Control panel

1. Set key-switch to [Setuo]
2. Switch to the setting page of the cage pull-out wheel.



3. In the pulling wheel settings, open brake to enable manual turning of the cage pull-out wheel.

Fig. 90: Settings – cage pull-out wheel

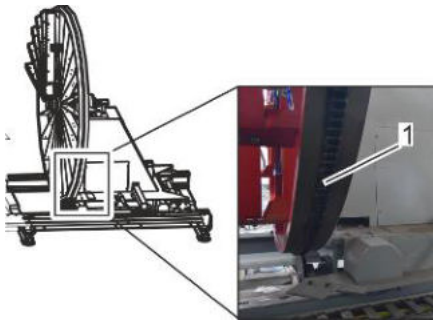


Fig. 91: Lubricate circumferential chain

4. At the same time, hold the spray can against the rotating chain of the cage pull-out wheel (Fig. 91/1) until the wheel has completed one entire revolution.
5. In the cage pull-out wheel settings, close brake!!

Lubrication of circumferential chain of the electrode support wheel

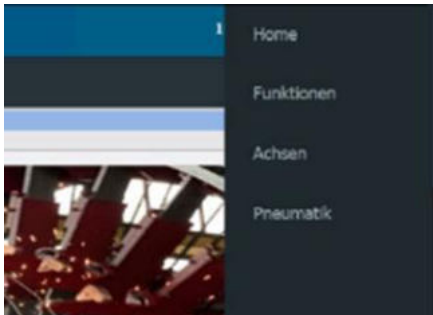


Fig. 92: Control panel

1. Set key switch to [Setup]
2. Switch to the setting page of the drawing wheel.

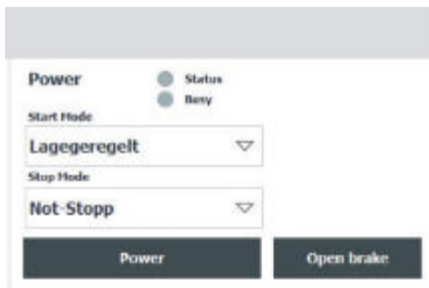


Fig. 93: Move main wheel

3. In the drawing wheel settings, open the brake to be able to turn the drawing wheel by hand.
4. At the same time, hold the spray can against the rotating chains of the drawing wheel (Fig. 91/1) until the machine has completed one complete revolution.
5. In the settings of the drawing wheel the brake Close!!!



7.13 Measures after maintenance has been performed

After completing the maintenance work and before switching on the machine, carry out the following steps:

- 1.** Check all previously loosened screw connections for tightness.
- 2.** Verify that all previously removed guards and covers are properly reinstalled.
- 3.** Ensure that all tools, materials and other equipment used have been removed from the work area.
- 4.** Clean the work area and remove any substances that may have escaped, e.g. liquids, processing material or similar.
- 5.** Make sure that all safety devices of the machine are working properly.

8 Maintenance and repair

8.1 Welding head overview

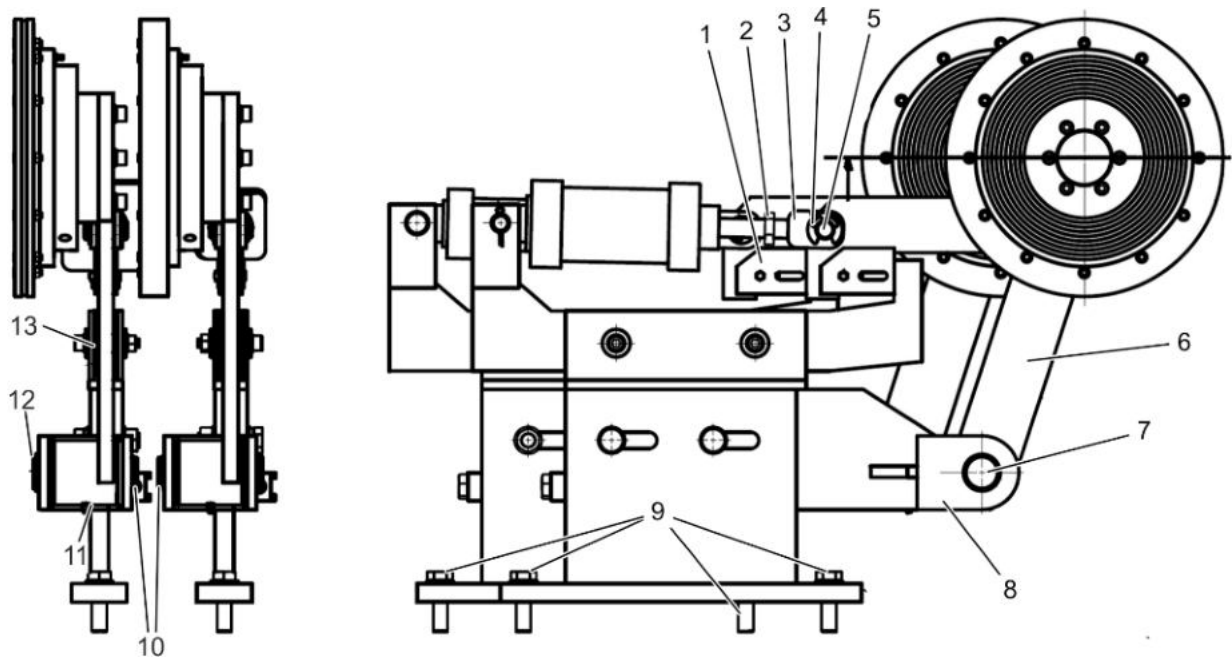


Fig. 94: Welding head

- | | | |
|---------------------|-------------------|-------------------|
| 1 Stop block | 6 Swivel arm | 10 Isolating disk |
| 2 Lock nut | 7 Bolt | 11 Bolt |
| 3 Rod clevis | 8 Arm | 12 Flange bushing |
| 4 Bolt locking clip | 9 Mounting screws | 13 Circlip |
| 5 Headbolt | | |

8.2 Disassembly and replacement of welding head

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

-Before starting work, check whether the welding head is hot.

-Wear protective work clothing, protective gloves and safety shoes.

-If necessary, allow the welding head to cool down.



To overhaul the welding head and to replace wear parts, remove the welding head completely or partially.

- Personnel:
- Trained professionals
- Protective equipment:
- Protective work clothing
 - Protective gloves
 - Safety shoes

1. Use the *[Support smaller]* or *[Support larger]* key to move the welding head to an easily accessible position.
2. Switch off the system and secure it against being switched on again.

⚠ WARNING! Risk of injury from hot surfaces and operating fluids! Contact with hot components and liquids can cause burns.

-Always wear protective clothing and gloves when working near hot components.

-Before starting any work, make sure that all components and fluids have cooled down to ambient temperature.

Secure the welding head against falling with a belt and crane.

⚠ WARNING! Health hazard due to antifreeze! Coolant contains an antifreeze agent which can cause serious damage to health if it comes into contact with the body, is swallowed or inhaled.

-Avoid contact with coolant.

-Do not eat, drink or smoke when handling coolant. Wash hands before breaks and at the end of work.

-Refer to the coolant manufacturer's safety data sheet.

-When handling coolant, wear the personal protective equipment specified in the safety data sheet.

Remove cooling water hoses.

3. Unscrew current supplies from current transmission.
4. Unscrew mounting screws (Fig. 94/9), lift off the welding head with lifting equipment and place it safely.
5. After maintenance or repair, place welding head, align and re-tighten screws (Fig. 94/9).
6. Attach cooling water hoses.
7. Screw current supplies to power transmission.



Complete remove of the welding head from the machine is not necessary for all work. Particularly when working on the easily accessible side of the welding roller, partial disassembly is often sufficient.

8.3 Dismantling swivel arm

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

- Before starting work, check whether the welding head is hot.
- Wear protective work clothing, protective gloves and safety shoes.
- If necessary, allow the welding head to cool down.

To overhaul the electrode set, it is usually sufficient to remove the swivel arms.

- | | |
|-----------------------|----------------------------|
| Personnel: | • Trained professionals |
| Protective equipment: | • Protective work clothing |
| | • Protective gloves |
| | • Safety shoes |

1. Use the [Support smaller] or [Support larger] key to move the welding head to an easily accessible position.
2. Switch off the system and secure it against being switched on again.



⚠ WARNING! Risk of injury from hot surfaces and operating fluids! Contact with hot components and liquids can cause burns.

-Always wear protective clothing and gloves when working near hot components.

-Before starting any work, make sure that all components and fluids have cooled down to ambient temperature.

3. Secure the swivel arm against falling with a belt.

⚠ WARNING! Health hazard due to antifreeze! Coolant contains an antifreeze agent which can cause serious damage to health if it comes into contact with the body, is swallowed or inhaled.

-Avoid contact with coolant.

-Do not eat, drink or smoke when handling coolant.

-Wash hands before breaks and at the end of work.

-Refer to the coolant manufacturer's safety data sheet.

-When handling coolant, wear the personal protective equipment specified in the safety data sheet.

4. Remove cooling water hoses.
5. Unscrew current supplies from current transmission.
6. Remove bolt locking clip (Fig. 94/4).
7. Pull out headbolt (Fig. 94/5).
8. Remove circlip (Fig. 94/13).
9. Pull out bolt (Fig. 94/7) and lift off swivel arm (Fig. 94/6) together with electrode set using lifting gear.
10. After maintenance or repair, assemble the swivel arm and secure the bolts with the lock washer and circlip.
11. Attach cooling water hoses.
12. Screw current supplies to power transmission.

8.4 Replacing the wear ring of the welding or contact roller electrode

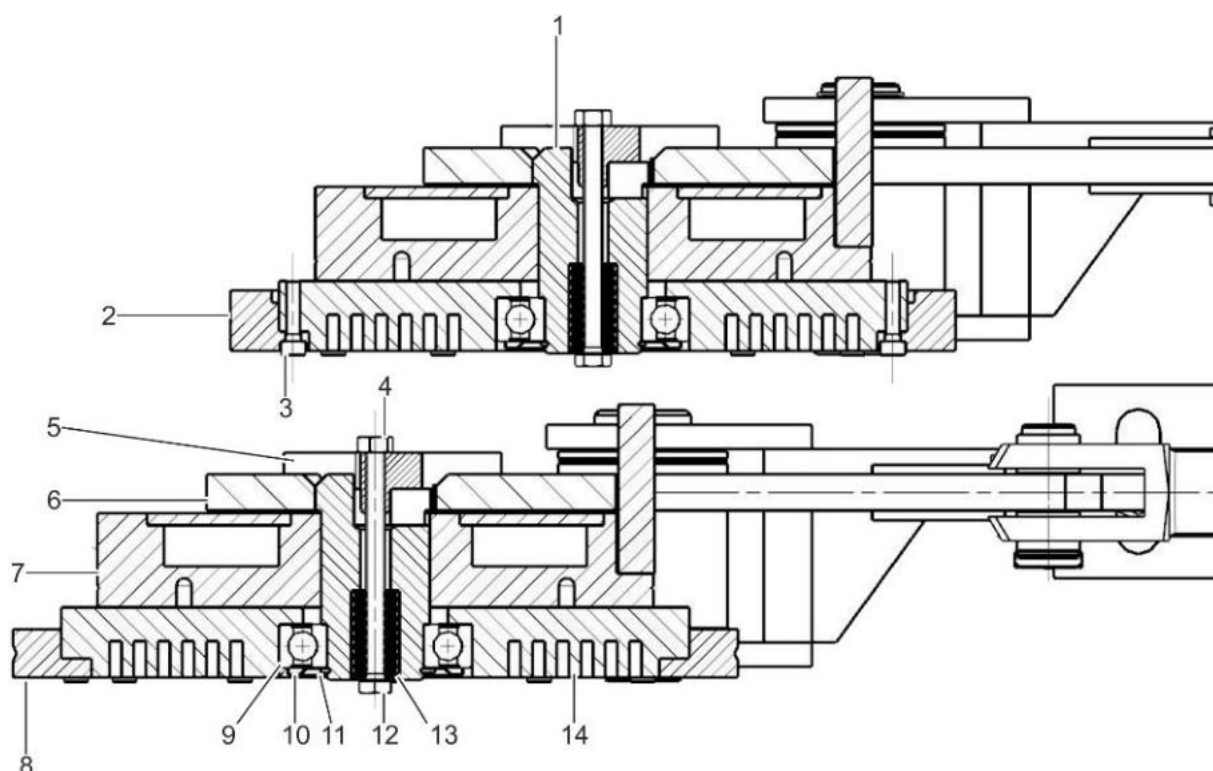


Fig. 95: Set of electrodes

- | | |
|----------------------------|----------------------------|
| 1 Bolt | 8 Welding roller wear ring |
| 2 Contact roller wear ring | 9 Deep groove ball bearing |
| 3 Screw | 10 Nilosring |
| 4 Nut | 11 Circlip |
| 5 Pressure star | 12 Pressure screw |
| 6 Swivel arm | 13 Cup spring pack |
| 7 Current transmission | 14 Base body |



⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

- Before starting work, check whether the welding head is hot.**
- Wear protective work clothing, protective gloves and safety shoes.**
- If necessary, allow the welding head to cool down.**

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none">• Trained professionals |
| Protective equipment: | <ul style="list-style-type: none">• Protective work clothing• Protective gloves• Safety shoes |

1. Disassemble swivel arm (Fig. 94/6) as described in [chapter 8.3 "Dismantling swivel arm" on page 145](#).
2. Loosen screws (Fig. 95/3).
3. Remove wear ring (Fig. 95/2 or/and Fig. 95/8) from the base body (Fig. 95/14).
4. Clean the contact surface between wear ring and base body.
5. Place the new wear ring on the base body (Fig. 95/14) and check for a snug fit.
6. Screw wear ring (Fig. 95/2 or/and Fig. 95/8) to the base body (Fig. 95/14) with screws (Fig. 95/3).
7. Attach swivel arm (Fig. 94/6) to the welding head.

8.5 Overhauling of base body and current transmission

⚠ CAUTION!

Danger of burns on hot welding and contact roller!
Touching the welding head components can lead to burns.

- Before starting work, check if the welding head is hot by holding your hand approximately 2 inches (5 cm) from the weld roller.
- Put on protective gloves.
- Wear protective work clothing and safety shoes.
- If necessary, allow the welding head to cool down.

- | | |
|-----------------------|----------------------------|
| Personnel: | • Trained professionals |
| Protective equipment: | • Protective work clothing |
| | • Protective gloves |
| | • Safety shoes |

8.5.1 Overhauling current transmission



Fig. 96: Current transmission

1. Disassemble swivel arm (Fig. 94/6) as described in [chapter 8.3 "Dismantling swivel arm" on page 145](#) on page.
2. Circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
3. Remove base body (Fig. 95/14) and wear ring (Fig. 95/2 and/or Fig. 95/8) from the bolt (Fig. 95/1).
4. Remove the current transmission (Fig. 95/7) from the bolt.
5. Turn the worn surface (Fig. 96) of the current transmission line flat again.

The surface must be finished at the end of processing.



The surface may be turned down to the wear limit at the most. The wear limit is marked with an external groove.

6. Put current transmission (Fig. 95/7) onto the bolt (Fig. 95/1).

7. Put on base body (Fig. 95/14) with wear ring (Fig. 95/2 and/or Fig. 95/8) onto the bolt (Fig. 95/1) and secure with circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
8. Attach swivel arm (Fig. 94/6) to the welding head.

8.5.2 Overhauling base body of roller electrodes

1. Disassemble swivel arm (Fig. 94/6) as described in *chapter 8.3 "Dismantling swivel arm" on page 145 on page*.
2. Remove wear ring (Fig. 95/2 and/or Fig. 95/8) as described in *section 8.4 "Replacing the wear ring of the welding or contact roller electrode" on page 147* from the base body (Fig. 95/14).
3. Remove circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
4. Remove base body (Fig. 95/14) from the bolt (Fig. 95/1).

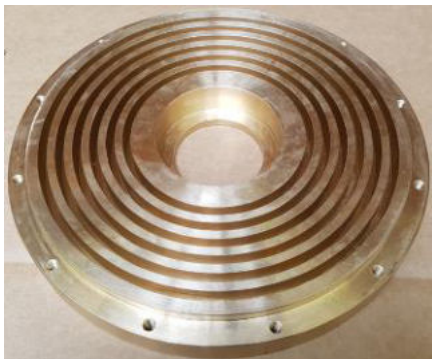


Fig. 97: Base body

5. Turn the worn surface (Fig. 97) of the base body flat again.
The surface must be finished at the end of processing.
The surface may be turned down by a maximum of 3 mm, otherwise the base body (Fig. 95/14 and Fig. 97) must be replaced.
6. Screw wear ring (Fig. 95/2 and/or Fig. 95/8) to base body (Fig. 95/14) with screws (Fig. 95/3).
Check for a snug fit.
7. Re-attach base body (Fig. 95/14) with wear ring (Fig. 95/2 and/or Fig. 95/8) onto the bolt (Fig. 95/1) and secure with circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
8. Attach swivel arm (Fig. 94/6) to the welding head.

8.5.3 Replacement of current transmission and base body**Replacing current transmission***Fig. 98: Current transmission*

1. Disassemble swivel arm (Fig. 94/6) as described in [chapter 8.3 "Dismantling swivel arm" on page 145](#) on page.
2. Remove circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
3. Remove base body (Fig. 95/14) from the bolt (Fig. 95/1).
4. Replace the current transmission (Fig. 98).
5. Put current supply (Fig. 95/6) onto the bolt (Fig. 95/1).
6. Re-attach base body (Fig. 95/14) onto the bolt (Fig. 95/1) and secure with circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).

Replacing base body*Fig. 99: Base body*

1. Remove wear ring (Fig. 95/2 and/or Fig. 95/8) as described in [section 8.4 "Replacing the wear ring of the welding or contact roller electrode" on page 147](#) from the base body (Fig. 95/14).
2. Remove base body (Fig. 95/14) from the bolt (Fig. 95/1).
3. Replace the base body (Fig. 99).
4. Screw wear ring (Fig. 95/2 and/or Fig. 95/8) to base body (Fig. 95/14) with screws (Fig. 95/3).
Check for a snug fit.
5. Re-attach the base body (Fig. 95/14) onto the bolt (Fig. 95/1) and secure with circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
6. Attach swivel arm (Fig. 94/6) to the welding head.



8.6 Replacing pressure star

The pressure star can be replaced on either the welding or contact electrode side.

- | | |
|-----------------------|--|
| Personnel: | <ul style="list-style-type: none">• Trained professionals |
| Protective equipment: | <ul style="list-style-type: none">• Protective work clothing• Safety goggles• Protective gloves• Safety shoes |

1. Use the *[Support larger]* or *[Support smaller]* key to move the welding head to an easily accessible position.
2. Switch off the system and secure it against being switched on again.

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

-Before starting work, check whether the welding head is hot.

-Wear protective work clothing, protective gloves and safety shoes.

-If necessary, allow the welding head to cool down.

3. Remove nut (Fig. 95/4) of pressure screw (Fig. 95/12)
4. Unscrew the pressure screw (Fig. 95/12).
5. Replace pressure star (Fig. 95/5) by a new pressure star.
6. Screw in the pressure screw (Fig. 95/12) and tighten until the roller can just be turned with one hand.

8.7 Change of cup spring pack

The cup spring pack can be replaced individually on the welding or contact electrode side.

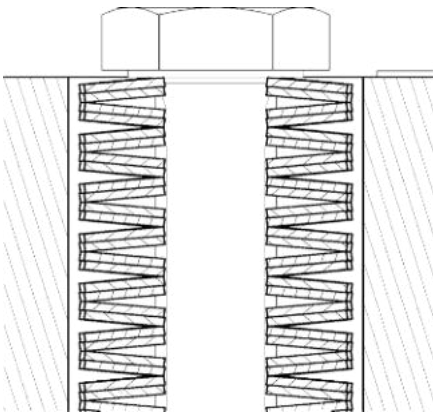


Fig. 100 Cup spring pack

Personnel:

- Trained professionals

Protective equipment:

- Protective work clothing
- Safety goggles
- Protective gloves
- Safety shoes

1. Use the *[Support larger]* or *[Support smaller]* key to move the welding head to an easily accessible position.
2. Switch off the system and secure it against being switched on again.

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

-Before starting work, check whether the welding head is hot.

-Wear protective work clothing, protective gloves and safety shoes.

-If necessary, allow the welding head to cool down.

3. Remove nut (Fig. 95/4) of pressure screw (Fig. 95/12) remove
4. Remove the pressure star (Fig. 95/5) and unscrew the pressure screw (Fig. 95/12).
5. Replace cup spring pack (Fig. 95/13) with a new cup spring pack (48 pieces per pack).



The cup springs are always arranged in pairs.

6. Screw in pressure screw (Fig. 95/12) and tighten until the roller can just be turned with one hand.

8.8 Replacement of deep groove ball bearing or isolating bushing

- Protective equipment:
- Protective work clothing
 - Protective gloves
 - Safety shoes

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

-Before starting work, check whether the welding head is hot.

-Wear protective work clothing, protective gloves and safety shoes.

-If necessary, allow the welding head to cool down.

1. Use the *[Support larger]* or *[Support smaller]* key to move the welding head to an easily accessible position.
2. Switch off the system and secure it against being switched on again.
3. Disassemble swivel arm (Fig. 94/6) as described in ↗ *chapter 8.3 "Dismantling swivel arm" on page 145 on page.*
4. Remove the circlip (Fig. 95/11) and Nilos ring (Fig. 95/10) to remove the electrode set from the swivel arm.
5. Open nut (Fig. 95/4) and release the spring tension by loosening the pressure screw (Fig. 95/12) to release the tension.
6. Remove the deep groove ball bearing (Fig. 95/9) from the base body (Fig. 95/14) using a suitable tool.
7. Insert new deep groove ball bearings (Fig. 95/9) into the base body (Fig. 95/14).
8. Place the base body (Fig. 95/14) onto the bolt (Fig. 95/1) and secure with circlip (Fig. 95/11) and Nilos ring (Fig. 95/10).
9. Re-attach swivel arm (Fig. 94/6) to welding head.

8.9 Pneumatic spring element

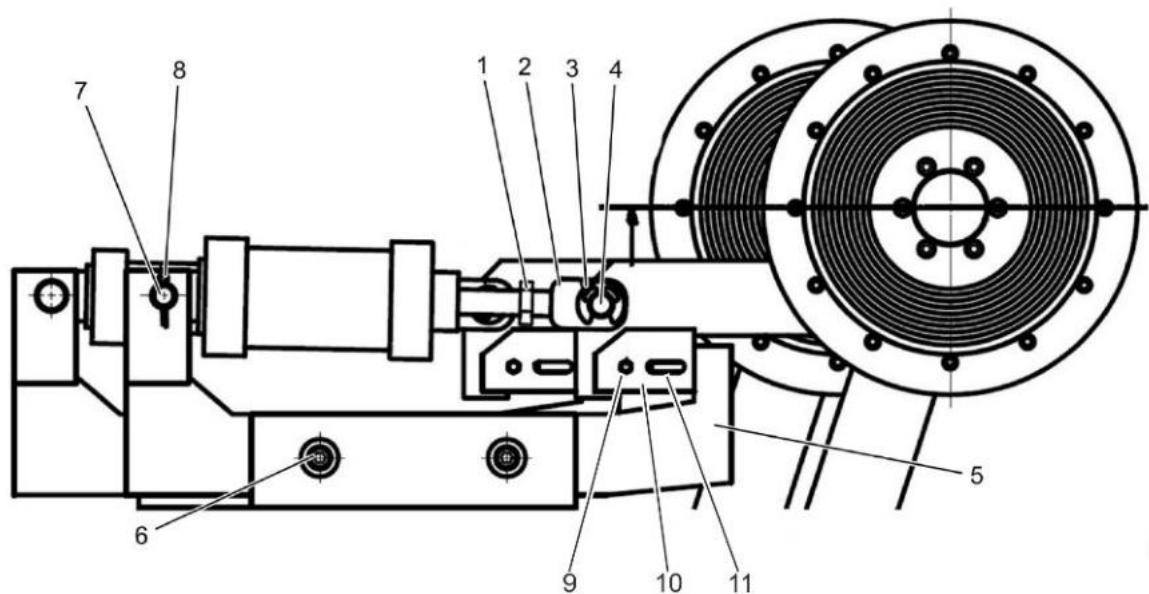


Fig. 101: Spring element

- | | |
|---------------------|-----------------|
| 1 Lock nut | 7 Bolt |
| 2 Rod clevis | 8 Circlip |
| 3 Bolt locking clip | 9 Screw |
| 4 Head bolt | 10 Stop block |
| 5 Stroke limitation | 11 Checking tap |
| 6 Nut | |

During operation, the pneumatic cylinders, which are attached to the swivel arms of the contact and welding roller, are under pressure.

The air pressure applied to the cylinder of the contact roller presses the contact roller onto the contact bridges of the electrode carrier slides, via which the welding current is transmitted.

The applied air pressure at the cylinder of the welding roller generates the welding pressure at the crossing point between the longitudinal and circumferential wires.

8.9.1 Correct welding head settings

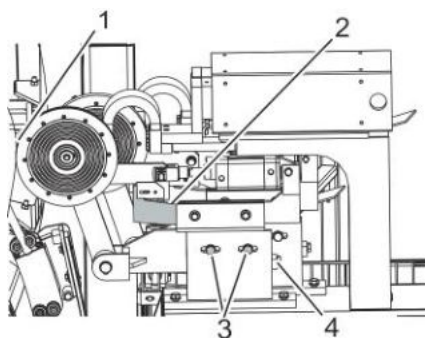
To avoid damage to electrode carrier slides or excessive deformation of the circumferential wire, the gap between stop block and stroke limitation viewed through the checking tap must be set correctly and the contact pressure of the cylinders must be correct.

▲ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

- Before starting work, check whether the welding head is hot.
- Wear protective work clothing, protective gloves and safety shoes.
- If necessary, allow the welding head to cool down.

8.9.2 Correct stroke limitation

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none"> • Quality assurance specialist |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Safety goggles • Protective gloves • Safety shoes |



1. Loosen screws (Fig. 102/3) loosen.
2. Limit the stroke (Fig. 102/2) with the screw (Fig. 102/4) until the gap in the checking tap (Fig. 101/11) is 3-5mm (0.12 - 0.2 inch).

Fig. 102: Welding arm



If the welding roller is pressed in too far, this produces polygonal deformations of the circumferential wire.

8.9.3 Setting of welding pressure

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none"> • Quality assurance specialist |
| Protective equipment: | <ul style="list-style-type: none"> • Protective work clothing • Safety goggles • Protective gloves • Safety shoes |

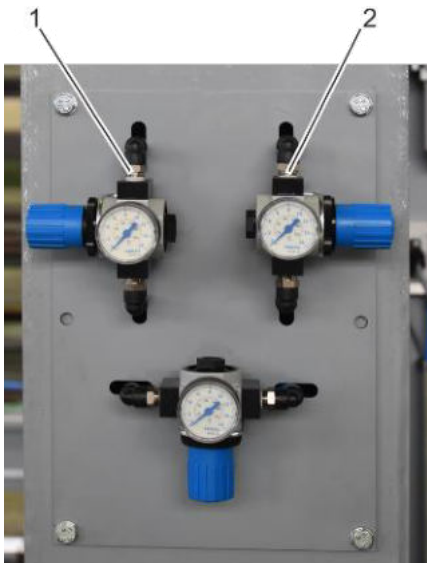


Fig. 103: Pressure regulator on welding support

1. Adjust the pressure of the contact roller with the pressure regulator mounted on the back of the welding support (Fig. 103/2) between 2.0 and 2.5 bar (29 and 36 psi).
2. Adjust the pressure of the welding roller with the pressure regulator mounted on the back of the welding support (Fig. 103/1) between 2.0 and 2.5 bar (29 and 36 psi).



The thicker the circumferential wire, the higher the contact pressure of the welding roller must be set.

8.10 Replacing the cylinders of the pneumatic spring element

⚠ CAUTION! Risk of burns on hot welding and contact roller! Touching the welding head components can lead to burns.

-Before starting work, check whether the welding head is hot.

-Wear protective work clothing, protective gloves and safety shoes.

-If necessary, allow the welding head to cool down.



- Personnel:
- Trained professionals
- Protective equipment:
- Protective work clothing
 - Safety goggles
 - Protective gloves
 - Safety shoes
1. Use the *[Support larger]* or *[Support smaller]* key to move the welding head to an easily accessible position.
 2. Switch off the system and secure it against being switched on again.
 3. Remove the pneumatic hoses from the cylinder.
 4. Remove locking clip (Fig. 101/3).
 5. Remove the head bolt (Fig. 101/4).
 6. Remove circlip (Fig. 101/8).
 7. Remove bolt (Fig. 101/7).
 8. Remove cylinder.
 9. Remove connection fittings for pneumatic hoses from the old cylinder and screw them into the new cylinder.
 10. Install new cylinder.
 11. Insert bolt (Fig. 101/7).
 12. Reattach circlip (Fig. 101/8).
 13. Insert head bolt (Fig. 101/4).
 14. Reattach locking clip (Fig. 101/3).
 15. Connect pneumatic hoses to the cylinder.

8.11 Replacement of rod clevis

Personnel:

- Trained professionals

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes

1. Remove cylinder as described in *chapter 8.10 "Replacing the cylinders of the pneumatic spring element" on page 157* (steps 1 to 8)
2. Loosen lock nut (Fig. 101/1).
3. Unscrew rod clevis (Fig. 101/2).
4. Screw the new rod clevis onto the piston rod.
5. Re-tighten lock nut (Fig. 101/1).
6. Mount cylinder as described in *chapter 8.10 "Replacing the cylinders of the pneumatic spring element" on page 157* (steps 9 to 15).

8.12 Replacement of wear parts of the electrode carrier slide

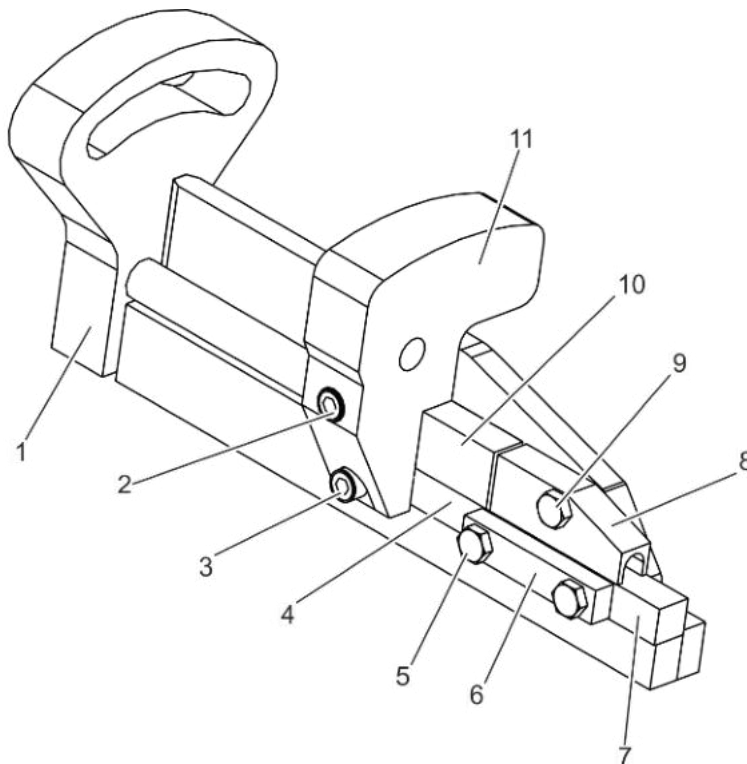


Fig. 104: Electrode carrier slide

- | | |
|--------------------------------|---------------------------|
| 1 Electrode carrier slide body | 7 Wire guide front bottom |
| 2 Screw | 8 Wire guide front top |
| 3 Screw | 9 Screw |
| 4 Wire guide rear bottom | 10 Wire guide rear top |
| 5 Screw | 11 Contact bridge |
| 6 Contact tab | |

Cuts

⚠ CAUTION! Cutting injuries at sharp wire ends and welding spots! When touching the wire ends and welding spots, sharp edges and tips can cause cuts.

-Wear protective gloves and protective work clothing.

-Use caution.

Hot surfaces

⚠ WARNING!

Risk of injury from hot surfaces! Surfaces of components can heat up strongly during operation. Skin contact with hot surfaces causes severe burns to the skin.

-Always wear heat-resistant protective clothing and gloves when working near hot surfaces.

-Before carrying out any work, ensure that all surfaces have cooled down to ambient temperature.

8.12.1 Dismantling electrode carrier slide

Personnel:

- Trained professionals

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes

1. Use the *[Faceplate left]* or *[Faceplate right]* button to move the electrode carrier slides to an easily accessible position.
2. Switch off the system and secure it against being switched on again.
3. Remove longitudinal and circumferential wire.
4. Loosen fastening screws (Fig. 105/1) and remove the electrode carrier slide.

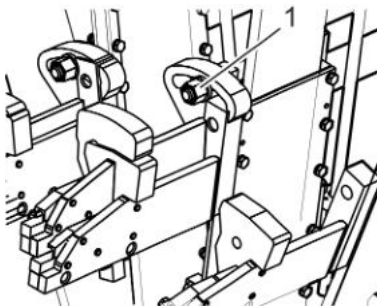


Fig. 105: Electrode carrier slide attachment



8.12.2 Change of contact bridge

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none">• Trained professionals |
| Protective equipment: | <ul style="list-style-type: none">• Protective work clothing• Protective gloves• Safety shoes |
1. Dismantle the electrode carrier slide as described in the *chapter 8.12.1 "Dismantling electrode carrier slide" on page 161* page.
 2. Remove screws (Fig. 104/2 + 3).
 3. Replace contact bridge (Fig. 104/11).
 4. Fasten with screws (Fig. 104/2 + 3) to attach the contact bridge to the electrode carrier slide.
 5. Mount the electrode carrier slide with the fastening screws.

8.12.3 Replacement of upper wire guide

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none">• Trained professionals |
| Protective equipment: | <ul style="list-style-type: none">• Protective work clothing• Protective gloves• Safety shoes |
1. Dismantle the electrode carrier slide as described in the *chapter 8.12.1 "Dismantling electrode carrier slide" on page 161* page.
 2. Remove screw (Fig. 104/9).
 3. Replace wire guide (Fig. 104/8).
 4. Use the screw (Fig. 104/3) to fasten the wire guide to the electrode carrier slide.

8.12.4 Replacement of lower wire guide

- Personnel: ,
- Trained professionals
- Protective equipment:
- Protective work clothing
 - Protective gloves
 - Safety shoes

1. Dismantle the electrode carrier slide as described in the *chapter 8.12.1 "Dismantling electrode carrier slide" on page 161* page.
2. Remove screws (Fig. 104/5) and, if necessary, loosen screw (Fig. 104/9).
3. Replace wire guide (Fig. 104/7).



The wire guide can be turned and flipped over before final replacement is required.

4. Re-tighten wire guide (Fig. 104/7) with the screws (Fig. 104/5) and the screw (Fig. 104/9) if it has been un-tightened.
5. Mount the electrode carrier slide with the fastening screws.

8.13 Replacing of wear parts of the cage pull-out wheel

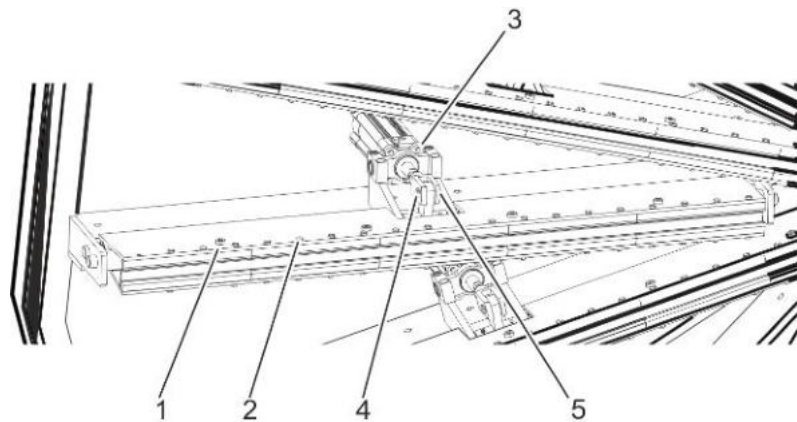


Fig. 106: Longitudinal wire clamp

- 1 Screw
- 2 Clamp segment
- 3 Screw
- 4 --
- 5 Spring bolt

8.13.1 Replacing clamp segments

- | | |
|-----------------------|---|
| Personnel: | <ul style="list-style-type: none">• Trained professionals |
| Protective equipment: | <ul style="list-style-type: none">• Protective work clothing• Protective gloves• Safety shoes |

1. Use the *[Spindle right]* button to rotate the wire clamp to an easily accessible position.
2. Switch off the system and secure it against being switched on again.
3. Loosen screws (Fig. 106/1) and replace clamping segments (Fig. 106/2).
4. Fasten clamping segments (Fig. 106/2) with screws (Fig. 106/1).

8.13.2 Replacement of cylinders of wire clamps

Personnel:

- Trained professionals

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes

1. Use the [*Spindle right*] button to rotate the wire clamp to an easily accessible position.
2. Switch off the system and secure it against being switched on again.
3. Pull off the pneumatic hoses from the cylinder.
4. Fold out spring bolt (Fig. 106/5).
5. Remove spring bolt (Fig. 106/5).
6. Loosen screws (Fig. 106/3).
7. Remove and replace cylinder.
8. Screw in and tighten screws (Fig. 106/3).
9. Insert and secure spring bolt (Fig. 106/5).
10. Connect pneumatic hoses to the cylinder.



8.14 Measures after maintenance and repair

After completing the maintenance work and before switching on the machine, carry out the following steps:

- 1.** Check all previously loosened screw connections for tightness.
- 2.** Verify that all previously removed guards and covers are properly reinstalled.
- 3.** Ensure that all tools, materials and other equipment used have been removed from the work area.
- 4.** Clean the work area and remove any substances that may have escaped, e.g. liquids, processing material or similar.
- 5.** Make sure that all safety devices of the machine are working properly.

9 Interference

The following chapter describes possible causes of malfunctions and the work to be done to eliminate them.

If errors occur more frequently, shorten the maintenance intervals in accordance with the actual operational load.

In the event of malfunctions that cannot be remedied by the following instructions, call the *"Customer service"* on page 4.

9.1 Safety instructions for troubleshooting

Personnel

- The troubleshooting work described here can be performed by the operative unless otherwise indicated.
- Some work may only be carried out by specially trained personnel or exclusively by the manufacturer; this is indicated separately in the description of the individual faults.
- Work on the electrical system may only be carried out by qualified electricians as a matter of principle

Protective equipment:

- Protective work clothing
- Protective gloves
- Safety shoes



Further protective equipment to be worn for certain work is referred to separately in the warnings in this chapter.

Electric current

⚠ DANGER!

Danger to life due to electric current! There is an immediate danger to life from electric shock when touching live parts. Switched-on electrical components can perform uncontrolled movements and lead to most severe injuries.

-Before starting work, switch off the electrical supply and secure it against being switched on again.

⚠ WARNING! Risk of injury due to improper troubleshooting! Improper troubleshooting can lead to severe personal injury or property damage.

- Ensure sufficient assembly clearance before starting work.**
- Pay attention to order and cleanliness at the assembly site! Loose components and tools lying on top of or around each other are sources of accidents.**
- If components have been removed, ensure correct assembly, reinstall all fasteners and comply with tightening torques.**

Behavior in the event of malfunctions

Basically:

1. Determine the cause of the malfunction.
2. If troubleshooting requires work to be carried out in the hazardous area, switch off system and secure against being switched on again.
3. Immediately inform the person responsible for the site about the malfunction.
4. Depending on the type of malfunction, it can either be repaired only by an authorized specialist or by yourself.

9.2 Display fault/error messages

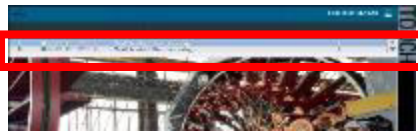


Fig. 107: Displaymessages

All fault/error messages can be displayed here until they are acknowledged with the "Acknowledge" button on the panel.

Always the last 2 messages are shown. By tapping on the line the whole List of messages is shown.



Fig. 108: List of messages

Interference

9.3 Fault list

9.3.1 Fault indications on the operator panel

Message	Possible cause	Troubleshooting	Remedy by
The LS reset button flashes	Light curtain was passed through.	Check the danger zone. Acknowledge alarm by pressing the "reset light barrier" key.	Operative
	Obstacle between the transmitter and receiver.	Remove obstacle.	Operative
	Transmitter and receiver are not correctly aligned with each other.	Correct adjustment.	Trained professionals
	Cable or connector defective.	Replace cable or plug.	Qualified electrician
	Light curtain defective.	Replace light curtain.	Qualified electrician
Fault 1: emergency stop triggered	Emergency stop is pressed	Reset and acknowledge at the operation panel with "ACK".	Operative
Fault 2: fault SEW-PLC	Fault in the SEW control system	Reset and acknowledge at the operation panel with "ACK".	Operative
Fault 3: Limit switch contact roll	Welding support carriage moved too far inward, spread moved too far or other program selected and electrode carrier slides not brought into position	Move welding support carriage outwards or reduce spread	Operative

**Interference**

	Position of limit switch incorrect	Correct the position of the limit switch	Qualified electrician
	Cable or connector defective.	Replace cable or plug.	Qualified electrician
Fault 11: no diameter set	No cage diameter entered.	Enter diameter and re-load program into PLC.	Operative
Fault 12: air pressure to low	Compressed air in the machine's pneumatic system too low.	Check the compressed air supply to the machine or set the air pressure in the hidden parameters.	Operative
Fault 13: circuit breaker 230V	Motor circuit breaker, circuit breaker 4Q11, 4F41 or 4F71 damaged	Replace motor circuit breaker, circuit breaker 4Q11, 4F41 or 4F71.	Qualified electrician
Fault 14: circuit breaker 24V	Circuit breaker 6F61 or 6F81 damaged	Replace 6F61 or 6F81 circuit breaker.	Qualified electrician
Fault 15: Limit switch wire coil	Limit switch of the reel carriage actuated.	Eliminate inhibition of the wire feed line. (Untangle w of the coil.)	Operative
	Cable defective.	Replace cable.	Qualified electrician
Fault 17: welding transformer over-temp. 23T11	Cooling system damaged, welding power entered incorrectly.	Check cooling system, replace if necessary, check welding performance. Slow down the machine.	Qualified electrician
Fault 18: cooling unit protection tripped 25Q11	Supply voltage error or motor protection switch defective.	Check supply voltage and motor protection switch, and replace if necessary.	Qualified electrician



Interference

Fault 19: Alarm cooling unit 25G11	Malfunction in the cooling unit.	Proceed according to the error list in the operating manual of cooling unit.	Qualified electrician Trained professionals
Fault 20: Movieaxis over-temperature	Braking resistor too hot or cable of the braking resistor defective.	Check braking resistor and replace if necessary.	Qualified electrician
Fault 21: Movieaxis supply module protection tripped	Supply voltage error or motor protection switch defective.	Check supply voltage and motor protection switch and replace if necessary.	Qualified electrician
Fault 33: main drive over-temperature	Main drive too hot or main drive cable defective.	Check main drive and replace if necessary.	Qualified electrician
Fault 34: Main drive fan protection tripped 16Q61	Supply voltage error or motor protection switch defective.	Check supply voltage and motor protection switch and replace if necessary.	Qualified electrician
Fault 35: Main drive fault movieaxis	Disruption of the SEW Movieaxis	Proceed according to the error list in the SEW Movieaxis operating instructions.	Qualified electrician Trained professionals
Fault 36: pulling wheel over-temperature	Cage pull-out wheel drive too hot or cable of cage pull-out wheel drive defective.	Check the drive of the cage pull-out wheel and replace if necessary.	Qualified electrician
Fault 37: pulling wheel fan protection tripped 17Q61	Supply voltage error or motor protection switch defective.	Check supply voltage and motor protection switch, and replace if necessary.	Qualified electrician

**Interference**

Fault 38: pulling wheel fault moviaxis	Disruption of SEW Moviaxis.	Proceed according to error list in SEW Moviaxis operating instructions.	Qualified electrician Trained professionals
Fault 39: pulling carriage fan protection tripped 18Q61	Supply voltage error or motor protection switch defective.	Check supply voltage and motor protection switch, and replace if necessary.	Qualified electrician
Fault 40: pulling carriage over-temperature	Cage pull-out carriage drive too hot or cable of pull-out carriage drive defective.	Check the drive of the cage pull-out carriage and replace it if necessary.	Qualified electrician
Fault 41: pulling carriage limit switch	Limit switch approached and machine moves arbitrarily after acknowledgement	Check limit switch, replace if necessary.	Operative
Fault 42: pulling carriage fault moviaxis	Disruption of the SEW Moviaxis	Proceed according to error list in SEW Moviaxis operating instructions.	Qualified electrician Trained professionals
Fault 43: expansion over-temperature	Spreader drive too hot or cable of spreader drive defective.	Check spreader drive and replace if necessary.	Qualified electrician
Fault 44: expansion fan protection tripped 19Q61	Supply voltage error or motor protection switch defective.	Check supply voltage and motor protection switch, and replace if necessary.	Qualified electrician
Fault 45: expansion limit switch	Limit switch approached, machine moves arbitrarily after acknowledgement.	Check limit switch and replace if necessary.	Operative

Interference

Fault 46: expansion fault moviaxis	Disruption of the SEW Moviaxis	Proceed according to error list in SEW Moviaxis operating instructions.	Qualified electrician Trained professionals
Fault 47: welding car limit switch	Limit switch approached, machine moves arbitrarily after acknowledgement.	Check limit switch and replace if necessary.	Operative
Fault 48: welding car fault moviaxis	Disruption of SEW Moviaxis.	Proceed according to error list in SEW Moviaxis operating instructions.	Qualified electrician Trained professionals
Message 209: no program loaded	Program not loaded, or program not selected.	Load program into PLC, or select program and load into PLC.	Operative
Message 210: value for baseposition is wrong	Incorrect value entered for the home position of the spreader or the welding support carriage.	Check the value of the home position of the spreader and the welding support carriage.	Operative
Message 211: value for loadingposition is wrong	Incorrect value entered for the home position of the cage pull-out carriage.	Check the value of the home position of the cage pull-out carriage.	Operative
Message 212: Axis are not references	Axes not referenced after switching on the main switch and before start of production	Reference axes.	Operative
Message 213: number of cages reached	The number of specified cages to produce was achieved.	Start new production.	Operative

**Interference**

Message 214:
Automatic is
blocked

The conditions of
automatic operation
are not fulfilled.

Check conditions of au-
tomatic operation: Cir-
cumferential wire guide
closed, circumferential
wire brake closed, con-
tact roller pressed on and
cooling unit switched on.

Operative

Interference

9.3.2 Reinforcement production

Malfunction	Caused by	Troubleshooting	by
Circumferential wire jumps out of the groove	Guide arm not adjusted correctly.	Readjust the guide arm.	Operative
Poor welding	Machine speed too high.	Set the machine speed according to the table ↗ <i>Chapter 6.10 "Setting speed of electrode support wheel" on page 87.</i>	Operative
	Welding pressure not correct.	Setting the welding pressure ↗ <i>chapter 6.7 "Adjusting the welding pressure on the spring element" on page 81).</i>	Operative
	Welding power not correct.	Increase welding current ↗ <i>chapter 6.10 "Setting speed of electrode support wheel" on page 87.</i>	Operator
	Groove of the welding electrode too deep.	Remove the welding electrode, rework the groove and install the welding electrode ↗ <i>chapter 8 "Maintenance and repair" on page 143).</i>	Trained professionals
	Wire guides too worn.	Replacing parts ↗ <i>chapter 8 "Maintenance and repair" on page 143).</i>	Trained professionals
	Loose electrode carrier slides.	Re-tighten the fastening screws of the electrode carrier slides ↗ <i>chapter 8 "Maintenance and repair" on page 143).</i>	Operative
	No or poor contact.	Check all contact surfaces of the welding current connections and current transmissions. Retighten the fastening screws and, if necessary, clean the contact surfaces.	Qualified electrician

Welding head becomes too hot	Insufficient cooling.	Check cooling water flow. If the flow is too low, clean the cooling water system ↗ <i>chapter 7.10 "Checking of pneumatic lines" on page 132</i>).	Trained professionals
	Machine speed too high.	Set the machine speed according to the table ↗ <i>chapter 6.10 "Setting speed of electrode support wheel" on page 87</i>).	Operative
	Welding pressure not correct.	Setting the welding pressure ↗ <i>chapter 6.7 "Adjusting the welding pressure on the spring element" on page 81</i>).	Trained professionals
	Welding power not correct.	Reduce welding current ↗ <i>chapter 6.10 "Setting speed of electrode support wheel" on page 87</i> and ↗ <i>chapter 6.7 "Adjusting the welding pressure on the spring element" on page 81</i>). The welding power must be set so that the spot weld still holds well, but the wire cross-section does not shrink by more than approx. 20 % due to penetration.	Operative
	Contact parts not properly lubricated.	Lubricate contact parts with multi-purpose high-pressure grease Ceran WR2.	Operative



9.4 Commissioning after corrected malfunction

After fixing the malfunction, carry out the following steps to recommission the machine/device:

- 1.** If they have been triggered, reset emergency stop devices.
- 2.** Acknowledge the error message on the control unit.
- 3.** Ensure that there are no persons in the danger zone.
- 4.** Start according to the instructions in the  "Operation" chapter.

10 Dismantling and disposal

After the equipment has reached the end of its service life, it must be dismantled and disposed of in an environmentally friendly manner.

10.1 Safety instructions for disposal

- Personnel:
- Trained professionals
 - Qualified electrician

Electrical system

⚠ DANGER!

Danger to life due to electric current! There is a danger to life in case of contact with live components. Switched-on electrical components can perform uncontrolled movements and lead to most severe injuries.

-Switch off and disconnect the electrical supply before starting disassembly.

Improper disassembly

⚠ WARNING!

Risk of injury due to improper disassembly! Stored residual energies, edged components, points and corners on or in the equipment or on the required tools can cause injuries.

-Provide sufficient space before starting work.

-Be careful when handling sharp-edged components.

-Pay attention to order and cleanliness at the workplace! Loose components and tools lying on top of or around each other are sources of accidents.

-Dismantle components properly. Observe the partially high dead weight of the components. Use lifting gear if necessary.

-Secure the components so that they do not fall or tip over.

-Consult the manufacturer if anything is unclear.



10.2 Disassembly

Before starting the disassembly:

- Switch off the system and secure it against being switched on again.
- Physically disconnect entire power supply from system, discharge stored residual energy.
- Remove operating and auxiliary materials as well as residual processing materials and dispose of in an environmentally compatible manner.

Then clean the assemblies and components properly and disassemble them in compliance with the applicable local occupational health and safety and environmental protection regulations.

10.3 Disposal

Unless a take-back or disposal agreement has been made, disassembled components should be recycled:

- Scrap metals.
- Hand over plastic parts for recycling.
- Sort and dispose of remaining components by material!

NOTE !

Danger to the environment due to incorrect disposal! Danger to the environment may arise due to incorrect disposal.

-Electrical scrap, electronic components, lubricants and other auxiliary materials should be disposed of by authorized specialist companies.

-When in doubt, obtain information on environmentally sound disposal from local, state or federal municipal authorities or special waste management companies.



11 Technical data

11.1 Dimensions and weight

General

Specification	Value	Unit
Total weight	22000 (48,500)	kg (lbs)
Length	14 (46)	m (ft)
Wide	8 (26)	m (ft)
Height	4 (13)	m (ft)

Technical data**Weights**

Specification	Value	Unit
Total machine frame	5220 (11,500)	kg (lbs)
Lower machine frame	4600 (10,140)	kg (lbs)
Upper machine frame	620 (1,370)	kg (lbs)
Electrode support wheel	3110 (6,860)	kg (lbs)
Frame electrode support wheel	2550 (5,622)	kg (lbs)
Shaft electrode support wheel	1400 (3,090)	kg (lbs)
Cage pull-out wheel	4500 (9,920)	kg (lbs)
Sub-frame of cage pull-out wheel	2300 (5,070)	kg (lbs)
Drive shaft cage pull-out wheel	63 (139)	kg (lbs)
Frame for wire reel	300 (660)	kg (lbs)
Longitudinal wire holding tray	30 (66)	kg (lbs)
Cage removal trolley	600 (1,323)	kg (lbs)
Control panel	440 (970)	kg (lbs)
Cooling unit	240 (530)	kg (lbs)



11.2 Main electrical connection

Specification	Value	Unit	
Voltage	3 x 480	V	60 Hz
Current consumption	3 x 250	A	60 Hz
Maximum current consumption	600	A	for 0.1 s
Power consumption	100	kVA	
Power consumption, maximum	300	kVA	for 0.1 s
Fuse	360	A	slow

11.3 Main drive Electrode support wheel and cage pull-out wheel

Specification	Value	Unit
Weight	2x 155 (2x342)	kg (lbs)

Technical data**11.3.1 Helical geared motor with brake**

Specification	Value	Unit	
Voltage	254 - 266 /440 - 460	VAC	60 Hz
Rated current	23,5/13,6	A	
Power	7,5 (10)	kW (HP)	
Protection class			IP 44
Braking torque	110 (81.2)	Nm (lb ft)	
Total gear ratio	8,22/ ∞		
Output torque	330 (243.4)	Nm (lb ft)	
Speed	1774/216	1/min	

11.4 Cage pull-out wheel drive

Specification	Value	Unit
Weight	200 (441)	kg (lbs)

**Technical data****11.4.1 Bevel gear motor with brake**

Specification	Value	Unit	
Voltage	254 - 266 /440 - 460	VAC	60 Hz
Rated current	12,4 / 7,2	A	
Power	4 (5.36)	kW (HP)	
Protection class			IP 64
Braking torque	55 (40,56)	Nm (lb ft)	
Total gear ratio	123,93		
Output torque	2680 (1,976.6)	Nm (lb ft)	
Speed	1769/14	1/min	

11.5 Spreader drive

Specification	Value	Unit
Weight	72 (159)	kg (lbs)

Technical data**11.5.1 Helical geared motor without brake**

Specification	Value	Unit	
Voltage	254 - 266 /440 - 460	VAC	60 Hz
Rated current	16,40/9,5	A	
Power	5,5 (7.37)	kW (HP)	
Protection class			IP 64
Total translation	2,4		
Output torque	71 (52,3)	Nm (lb ft)	
Speed	1768/737	1/min	

11.6 Drive welding support carriage

Specification	Value	Unit
Weight	22 (48.50)	kG (lbs)

11.6.1 Servo motor without brake

Specification	Value	Unit	
Voltage	400	VAC	Max. permis. freqcy. 375 Hz
Rated current	87/14,1	A	
Protection class			IP 65
Total gear ratio	4/∞		
Output torque	200 (147.5)	Nm (lb ft)	
Speed	4500/1125	1/min	



11.7 Welding transformer

Specification	Value	Unit	
Primary voltage	480	V	60 Hz
Primary current	600	A	60 Hz
Secondary voltage	7/8/9/10	V	60 Hz
Secondary current	16	n/a	60 Hz
Short-circuit voltage	8	%	
Power	100	kVA	
ED (duty factor)	50	%	
cos ϕ	0,9		

11.8 Cooling system

Specification	Value	Unit	
Voltage	460	VAC	60 Hz
Power	4,1 (5.9)	kW (HP)	
Refrigerant medium	R134a		
Water quantity	30 (7.92)	Liters (gal)	
Weight	125 (276)	kg (lbs)	

Technical data**11.9 Operating conditions****11.9.1 Environment**

Specification	Value	Unit
Temperature range	15-43 (59-109)	°C (°F)

11.9.2 Operating time

Specification	Value	Unit
Maximum operating time without interruption	24	Hours



11.10 Performance data

11.10.1 Machine data of the automatic cage welding machine

Specification	Value	Unit
Reinforcement diameter	340 - 2700 (13.4 - 106.3)	mm (inch)
max. inner elliptical diameter	1750 (68.9)	mm (inch)
Number of longitudinal wires	12/24	
Diameter of the longitudinal wires	5 - 10 (0.197 - 0.393)	mm (inch)
Circumferential wire diameter	5 - 10 (0.197 - 0.393)	mm (inch)
Max speed of electrode support wheel with 24 longitudinal wires	27	1/min
Speed with elliptical arrangement (cages)	15	1/min
Pitch of the circumferential wire	20 - 200 (0,787 - 7,874)	mm/winding (inch/winding)
Socket angle	0 - 21	°
Max. Length of reinforcement	3000 (118)	mm (inch)

Technical data**11.10.2 Circumferential wire coil**

Specification	Value	Unit
outer diameter	940 (37)	mm (inch)
inside diameter	550 (21.5)	mm (inch)
Height	520 (20.5)	mm (inch)
Weight	1500 (3,300)	kg (lbs)

11.11 Steel grade

The reinforcement wire must be suitable for resistance spot welding and comply with grade BST B500B according to DIN 488 or ASTM A 82 with the following properties:

Specification	Value	Unit
Yield strength	500 (65)	N/mm ² (ksi)
Tensile strength	550 (75)	N/mm ² (ksi)
Elongation at break	min. 8	%
Carbon content max.	0,15	%



Technical data

11.12 Emissions

Specification	Value	Unit
Acoustic emission	> 85	dB(A)

11.13 Operating supplies

Operating material	Type
Multipurpose high pressure grease	Ceran WR2
Lithium set EP grease	SHELL Alvania EP
Gear spray	SHELL Cardium Fluid C
Antifreeze	Ethylene glycol
Coolant	Tap water (antifreeze)

11.14 Identification plate



Fig. 109: Identification plate

The identification plate (Fig. 109) is located on the side of the machine frame (always on the side of the control panel) and shows the following information:

Manufacturer

Type

Factory number

Year of manufacture

CE marking



Further markings and type plates are attached to the equipment and machine parts of the sub-suppliers. Their designs correspond to their own standards.



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