

Working Instructions Translation

Heating element butt welding machine

WIDOS 6100



Keep for further use!

Model:	Heating element butt welding machine
Type:	WIDOS 6100
Serial number, year of construction:	see type lable

Customer Entries

Inventory-No.:

Place of working:

Order of spare parts and after sales service:

Address of manufacturer

WIDOS

W. Dommer Söhne GmbH
Einsteinstrasse 5

D-71254 Ditzingen-Heimerdingen

Phone: ++49 7152 / 99 39 - 0

Fax: ++49 7152 / 99 39 - 40

info@widos.de

<http://www.widos.de>

Address of the subsidiary companies:

WIDOS GmbH

An der Wiesenmühle 15

D-09224 Grüna / Sachsen

Phone: ++49 371 / 8 15 73 - 0

Fax: ++49 371 / 8 15 73 - 20

WIDOS

W. Dommer Söhne AG
St. Gallerstr. 93

CH – 9201 Gossau

Phone: ++41 71 / 388 89 79

Fax: ++41 71 / 388 89 73

Purpose of the document

These working instructions give you information about all important questions which refer to the construction and the safe working of your machine.

Just as we are, you are obliged to engage in these working instructions, as well.

Not only to run your machine economically but also to avoid damages and injuries.

Should questions arise, contact our service team in the factory or in our subsidiary companies.

We will help you with pleasure.

According to our interest to continuously improve our products and working instructions, we kindly ask you to inform us about problems and defects which occur in exercise.

Thank you.

Structure of the working instructions

This manual is arranged in chapters, which belong to the different using phases of the machine. Due to this structure, the searched information can be easily found.



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W. Dommer Söhne GmbH

Einsteinstraße 5

D-71254 Ditzingen-Heimerdingen

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Any changes prior to technical innovations.

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1. Description of the product

This chapter gives important basic information about the product and its prescribed use. All technical details of the machine are put together as a general arrangement.

1.1. Usage and purpose-oriented use

The WIDOS 6100 has been designed for heating element butt welding of pipes and fittings with a diameter range of $\varnothing = 315 - 630\text{mm}$.

(standard diameters: 315 / 355 / 400 / 450 / 500 / 560 / 630mm)

It is a machine for construction sites and particularly designed for the usage on-site, as well as in the workshop.

For this reason, the frame is kept small so that it can be used even under difficult conditions (e.g. ditch).

All use going beyond is not purpose-oriented.

The manufacturer is not responsible for damages caused by misuse.

The risk is held only by the user.

Also part of the purpose oriented use is

- respecting all the indications of the working instructions and
- performing the inspection and maintenance works.

1.2. Safety measures

In case of wrong use, wrong operation or wrong maintenance, the machine itself or products standing nearby can be damaged or destroyed.

Persons being in the endangered area may be injured.

Therefore these working instructions have to be thoroughly read and the corresponding safety regulations must be necessarily adhered to.

1.3. Conformity

The machine corresponds in its construction to the valid recommendations of the European Community as well as to the according European standard specifications.

The development, manufacturing and mounting of the machine were made very carefully.

1.4. Designation of the product

The product is designated by two type labels which are attached at the aggregate and at the basic machine.

They contain the type, the serial number and the year of construction of the machine.

1.4.1. Technical data

1.4.1.1. WIDOS 6100 General data

Material which can be welded:	PP, PE80, PVDF, PE 100
Pipe diameter range:	$\varnothing_{\text{outside}} = 315 - 630 \text{ mm}$
Transport box: (lxwxh):	approx. 1700 x 1560 x 1360 (mm)
Weight:	approx. 150 kg
Weight (without accessories):	500 kg
Fuse:	16 A
Wire cross section:	1.5 mm ²
Emissions	<ul style="list-style-type: none"> - The sound intensity level while using the planer is more than 80 dB(A), wear ear protection! - When using the named pipe materials and when welding below 260°C no toxicant damp arises
Ambient conditions in the welding area	<ul style="list-style-type: none"> - take care for cleanness (no dust at the welding area) - do not weld below 5°C, if necessary preheat - avoid humidity, if necessary use a welding tent - avoid strong sun rays influence - protect from wind, shut the pipe ends

1.4.1.2. Heating element

Power:	6,0 kW
Voltage:	400V (+-10%)
Current:	15 A (+-10%)
Frequency:	50 Hz
Surface:	nonstick-coated
Outside- \varnothing :	684 mm
Weight:	appr. 32 kg
Attached elements:	<ul style="list-style-type: none"> - Electronic temperature control - Control lamps, on/off-switch - Connecting cable with plug

1.4.1.3. Planer

Motor:	Three-phase alternating current motor
Power:	1.1 kW
Voltage:	400 V (+-10%)
Nominal current	3,5 A
Frequency:	50 Hz (+-10%)
Speed of motor:	appr. 140 rpm
Attached elements:	<ul style="list-style-type: none"> - On/off switch - Connecting cable with plug - Locking device
Weight:	appr. 100 kg

1.4.1.4. Hydraulic aggregate

Power:	0,56 Watt
Voltage:	230 V (+-10%)
Nominal current	4,7 A
Frequency:	50 Hz
Displacement of phase:	appr. 18°
Hydraulic oil tank:	appr. 1 L
Insulation system	IP 54
Electromotor and pump:	
Speed:	2720 rpm
Max. working pressure of pump:	appr. 130 bar
Working pressure:	0-130 bar adjustable
Volume velocity:	3,5 L/min
Weight:	appr. 30 kg

1.4.1.5. Basic frame

Reduction inserts, pipe supports:	Optional dimensions
Material frame:	Structural steel
Material reduction inserts:	Aluminium
Max. force ($F=P*A$):	17.3 kN (at $p= 100$ bar)
Cylinder- \emptyset :	60 mm
Piston rod- \emptyset :	50 mm
Length of stroke of cylinder:	300 mm
Weight	appr. 226 kg
Velocity of piston rod:	3,4 cm/s

1.4.1.6. Lift-off device (optional)

Lift capacity:	appr. 100 kg
Weight (complete)	appr. 32 kg

See spare parts list for order numbers and single parts

1.5. Machine overview



1	Hydraulic aggregate
2	Heating element
3	Planer
4	Reception box
5	Basic machine with clamping devices
6	Lift-off device (optional)

1.6. Accessories:

Following tools and accessories are part of the delivery:

1	Tool bag for 10 parts
1	Socket spanner size 27
1	Torx screwdriver T10
1 each	Hexagonal socket screw key short, size 3; 12
1	Hexagonal socket screw key size 7 with T-grip
Optional	<ul style="list-style-type: none"> • Different reduction inserts, • roller stands for the pipes, • transformer 42V, • crane for insertion and removal of heating element and planer

2. Safety rules

The base for the safe handling and the fault-free operation of this machine is the knowledge of the basic safety indications and rules.

- These working instructions contain the most important indications to run the machine safely.
- The safety indications are to be followed by all persons working on the machine.

2.1. Explanation of the symbols and indications

In the working instructions, following denominations and signs are used for dangers:



This symbol means a possibly dangerous situation for the life and the health of persons.

- The disrespect of these indications may have heavy consequences for the health.



This symbol means a possible dangerous situation.

- The disrespect of these indications may cause slight injuries or damages on goods.



This symbol means a possible dangerous situation by moving parts of the machine

- The disrespect of these indications may cause heavy crushings of parts of the body resp. damages of parts of the machine.



This symbol means a possible dangerous situation due to hot surfaces.

- The disrespect of these indications may conduct to heavy burns, respectively to self-ignition or even fire.



This symbol means a possible risk of injury by noises exceeding 80 dB(A).

- Ear protection is obligatory



This symbol gives important indications for the proper use of the machine.

- The disrespect of these indications may conduct to malfunctions and damages on the machine or on goods in the surrounding.



Under this symbol you get user tips and particularly useful information.

- It is a help for using all the functions on your machine in an optimal way and helps you to make the job easier.

The regulations for the prevention of accidents are valid (UVV).

2.2. Obligations of the owner

The owner is obliged only to let persons work at the machine, who

- know about basic safety and accident prevention rules and are instructed in the handling of the machine, as well as who
- have read and understood the safety chapter of this manual and certify this by their signature.

The safety-conscious working of the staff has to be checked in regular intervals.

2.3. Obligations of the worker

All persons who are to work at the machine are obliged before working:

- to follow the basic safety and accident protection rules.
- to have read and understood the safety chapter and the warnings in this manual and to confirm by their signature that they have well understood them.
- to inform themselves about the functions of the machine before using it.

2.4. Measures of organisation

- All equipment required for personal safety is to be provided by the owner.
- All available safety equipment is to be inspected regularly.

2.5. Information about safety precautions

- The working instructions have to be permanently kept at the place of use of the machine. They are to be at the operator's disposal at any time and without effort.
- In addition to the manual, the common valid and the local accident protection rules and regulations for the environmental protection must be available and followed.
- All safety and danger indications on the machine have to be in a clear readable condition.
- Every time the machine changes hands or is being rent to third persons, the working instructions are to be sent along with and their importance is to be emphasized.

2.6. Instructions for the staff

- Only skilled and trained persons are allowed to work at the machine.
- It must be clearly defined who is responsible for transport, mounting and dismounting, starting the operation, setting and tooling, operation, maintenance and inspection, repair and dismounting.
- A person who is being trained may only work at the machine under supervision of an experienced person.

2.7. Dangers while handling the machine

The machine WIDOS 6100 is constructed according to the latest technical standard and the acknowledged technical safety rules. However, dangers for the operator or other persons standing nearby may occur. Also material damages are possible.

The machine may only be used

- according to the purpose-oriented usage
- in safety technical impeccable status

Disturbances, which may affect the safety of the machine must be cleared immediately

2.8. Maintenance, inspection and repair



All maintenance and repair works have to be basically performed with the machine in off position.

During this the machine has to be secured against unauthorized switching on.



Prescribed maintenance and inspection works should be performed in time. The DVS gives the advice of inspection works after 1 year.

For machines with a specially high usage percentage the testing cycle should be shortened .

The works should be performed at the WIDOS GmbH company or by an authorized partner.

2.9. Dangers caused by electric energy



Only skilled persons are allowed to work at electrical appliances!

- The electrical equipment of the machine has to be checked regularly. Loose connections and damaged cables have to be replaced immediately.
- If works at alive parts are necessary, a second person has to assist who can disconnect the machine from the mains if necessary.
- All electric tools (heating element, planer and aggregate) have to be protected from rain and dropping water (if need be use a welding tent).
- According to VDE 0100, the use on construction sites is only allowed with a power distributor with a FI-safety switch.

2.10. Dangers caused by the hydraulics



System parts and pressure hoses should be made pressureless before beginning of any repair works. Even if the machine is switched off, pressure may be in the hydraulic accumulator!

There is a danger of injuring the eyes by hydraulic oil squirting out.

- Damaged hydraulic hoses have to be immediately replaced.
- Make a visual inspection of the hydraulic hoses before each work beginning.
- The hydraulic oil is inedible !

2.11. Specific dangers

2.11.1. Danger of catching clothes by the planer



You can cut yourself or even get bones broken!

- Only wear clothes tight to the body.
- Do not wear rings or jewellery during the work.
- If necessary, wear a hair-net.
- Always put the planer back into the reception box after and before each use.
- Transport the planer at the handle only. Do not touch the surfaces.
- Switch the planer on only for usage.

If the planing pressure is too high, there is the danger that the planer tilts during planing. For that reason do not press the pipe ends stronger than necessary against the planer. If necessary, hold the planer firmly.

2.11.2. Danger of being burnt by heating element, reception box and welding area



You can burn yourself, inflammable materials can be ignited.

The heating element temperature is heated up to more than 250°C !

- Do not touch the surfaces of the heating element.
- Do not leave the heating element unsupervised.
- Take enough safety distance to inflammable materials.
- Do wear safety gloves.
- Always put the heating element back into the reception box after and before each use.
- Transport the heating element at the handle only.

2.11.3. Danger of stumbling over electric / hydraulic wires

- Make sure that no person has to step over the wires.
- Lay the wires in such a way that the danger is kept to a minimum.

2.11.4. Danger of squeezing by clamping devices and guideways



There is a danger of serious injuries: on the one hand between the inner clamping devices and on the other hand between the outer clamping device and the end of the guideway.

- Do not stand or put hands between clamped pipe ends.
- Do not stand or put hands between the inner clamping tools with not yet clamped pipes.
- Do not block opening and closing of the machine slides.

2.11.5. Risk of injury by noises



Noises exceeding 80 dB (A) may occur; during planing it is obligatory to wear ear protection!

2.12. Structural modifications on the machine

- No modifications, extensions or reconstructions may be made on the machine without permission of the manufacturer.
- Machine parts which are not in a perfect condition are to be replaced immediately.
- Only use original **WIDOS** spare and wear parts.
- In case of purchase orders please always state the **machine number!**

2.13. Cleaning the machine

The used materials and tissues are to be handled and disposed of properly, especially:

- when cleaning with solvents
- when lubricating with oil and grease

2.14. Warranty and liability

Fundamentally our "General Sales and Delivery Conditions" are valid.

They are at the owner's disposal latest when signing the contract.

Guarantee and liability demands referring to personal injuries or damages on objects are excluded if they are caused by one or several of the following reasons:

- not using the machine according to the prescriptions
- inexpert transport, mounting, starting, operating, and maintenance of the machine
- running the machine with defective or not orderly mounted safety appliances
- ignoring the information given in this manual
- structural modifications on the machine without permission
- unsatisfactory checking of parts of the machine, which are worn out
- repairs performed in an inexpert way
- In case of catastrophes and force majeure

3. Functional description

Basically, the international and national process guidelines are to be followed !

The plastic pipes are clamped in the clamping devices. Then the front sides of the pipes are cut plane and parallel by means of the **planer** and the misalignment of the pipes is checked.

The cleaned and heated heating element is inserted and the pipes are pressed against the heating element under defined adjusting pressure. This process is called "**adjusting**".

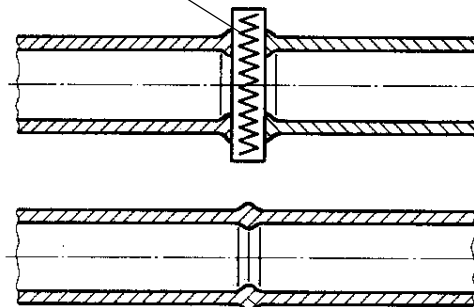
After the prescribed bead height being reached, pressure is reduced, the **heating time** begins. The function of this time is to heat up the pipe ends.

After expiration of the heating time, the slides are opened, the heating element is removed quickly and the pipes are driven together again. The time gap from the removal of the heating element to joining the pipes is called **change over time**.

The pipes are joined under prescribed welding pressure and then cool down under pressure (**cooling time**).

The welded joint can be unclamped, the welding process is finished.

Heating element heats
the pipes up to welding
temperature



Finished welding with
internal and external
bead

4. Operating and indicating elements

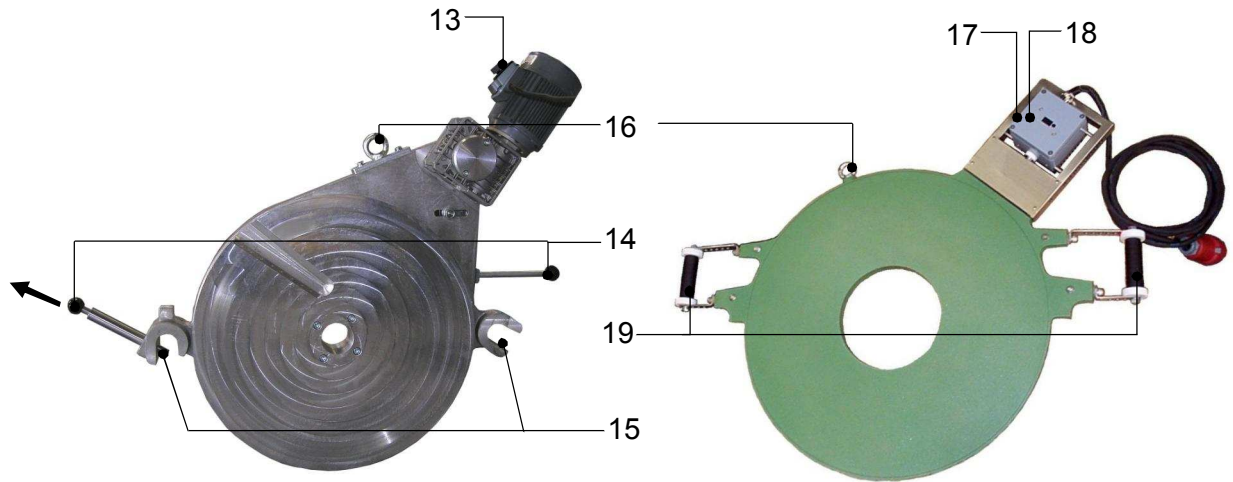
4.1. Elements on the aggregate



No.	Name	Function
7	Pressure gauge	Digital display of the hydraulic pressure
8	Valve lever	Opening the slides. There are 4 different positions: - to the left side : slides close. - in the middle (usual position): the pressure which is currently achieved is kept (also by means of the built-in hydraulic accumulator) - slightly to the right side (position pressureless): a possibly existing pressure is released without moving the slides. Due to the hydraulic accumulator, it takes about 10 s until the pressure is completely released. - to the right side : slides open
9	Setting screw for pressure relief valve	- Limitation of the pressure to the desired value.
10	Hydraulic connection for closing the slides	- Non-dropping quick-acting coupling
11	Hydraulic connection for opening the slides	- Non-dropping quick-acting coupling
12	Screw with oil dipstick	- checking the oil level - oil filler neck

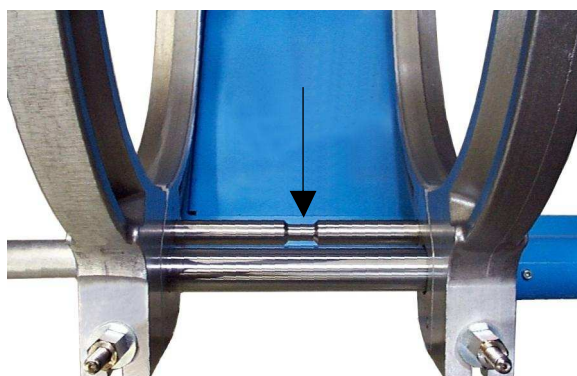
Planer and heating element have to be connected to a power distributor for building sites (400 Volt).

4.2. Elements at planer and heating element



No.	Name	Function
13	On/off switch for planer	- For switching on/off the planer. - Switch off the planer after use.
14	Lever	- For holding the planer when lifting/removing. - Lever can be screwed off.
15	Eye and eye with locking bolt	- locking the planer/ heating element- For holding the planer when lifting/removing. - Lever can be screwed off. in basic machine, (In order to remove the planer, pull locking bolt into arrow direction.
16	Lifting screw	- For lifting / inserting the heating element / planer with the lift-off device.
17	Display of temperature	- Digital display of set heating element temperature. Three different displays are possible. For meaning of the displays please refer to point 5.4 Setting the heating element temperature
18	Thermostat	- For setting the required temperature.
19	Grip	- For holding the heating element when lifting / removing.

4.3. Separating device for heating element



There is a tear-off bar mounted between the movable and the fixed clamping shells on the basic machine. It prevents the heating element from sticking to the heated-up pipe ends. When inserting the heating element take care that it lies in the zone of the throat of the tear-off bar (see arrow).

5. Starting and operating

The instructions of this chapter are supposed to initiate in the operation of the machine and lead during the appropriate starting of the machine.

This includes:

- the safe operation of the machine
- using all the possible options of the machine
- economic operation of the machine

5.1. Safety indications



The machine may only be operated by initiated and authorized persons.

For the qualification, a plastic welding exam can be taken according to DVS and DVGW.

In situations of danger for persons and the machine, the mains plug has to be unplugged immediately.

In case of power failure, there may still be pressure in the hydraulic system.

Therefore release pressure if need be.

After completion of the welding work and during breaks the machine has to be switched off. Further take care that no unauthorized person has access.

Protect the machine from wetness and humidity !

According to VDE 0100, the use on construction sites is only allowed with a power distributor with a FI-security protective switch.



Check the oil level of the hydraulic system before each starting of the control unit in order to avoid damages on the pump. The oil level must be between the two marks at the oil dipstick.

If necessary, add hydraulic oil of the quality HLPD 32.



The heating element surfaces must be clean, especially non greasy, therefore they need to be cleaned shortly before each welding or in case of dirtiness by means of a **fibre-free paper** and a cleaning agent (e.g. PE cleaner or pipe cleaning tissues which are available at the WIDOS company).

The anti-adhesive coating of the heating element must remain undamaged in the working area.



Take care that all hydraulic and electric connections are connected.



Make sure that pump and planer are connected in a way that they turn in right-hand direction.

- Take into account the surrounding conditions:
 - The welding may not be performed under direct sun rays influence.
 - Use a welding umbrella if necessary.
- If the surrounding temperature is under 5°C, measures have to be taken:
 - Use a welding tent or preheat the pipe ends if necessary.

In addition, take measures against rain, wind and dust.

5.2. Connection of hydraulic aggregate with basic machine

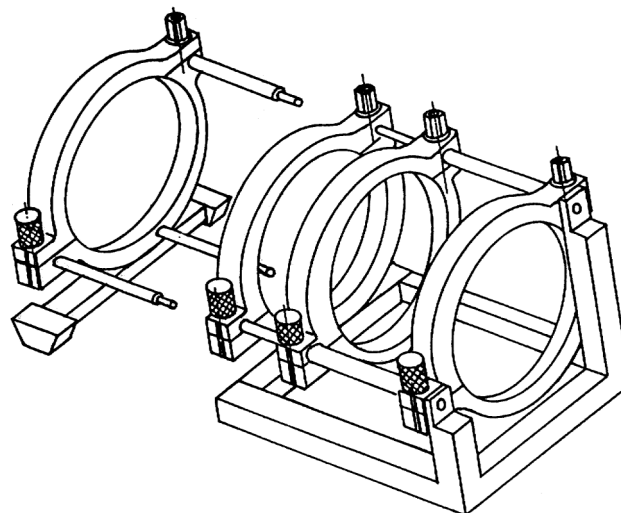
- Connect the aggregate to the mains supply (230 V/50 Hz).
Connect planer and heating element to a power distributor for building sites with 400 V.
- Put the hydraulic hoses of the basic machine into the quick-acting couplings of the hydraulic aggregate.



Lay the hydraulic and electric wires carefully (danger of stumbling)

5.3. Replacing the reduction inserts

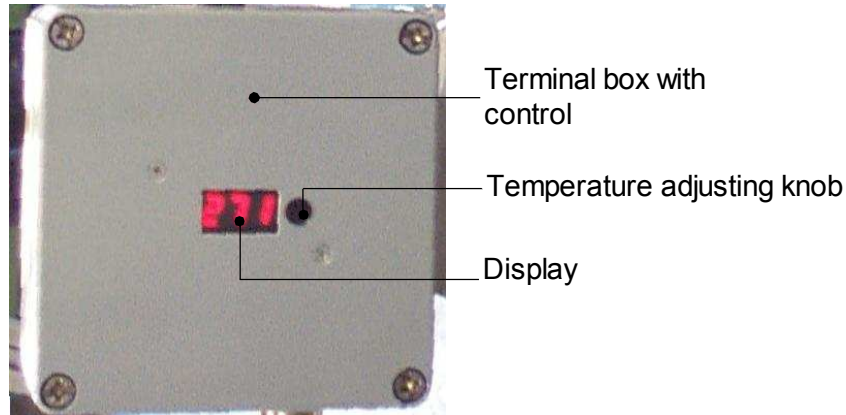
- Unscrew the mounted reduction inserts by means of the provided Allan key.
- Screw the reduction inserts with the corresponding diameter into the clamping devices. Pipes with OD 630 have to be clamped in the basic clamping devices.
- If necessary (e.g. for T-pieces) the outer fixed clamping device can be dismantled by unscrewing the three hexagon socket screws.



Dismantling of the outer fixed clamping device

5.4. Setting the heating element temperature

As soon as the heating element is connected to the mains (400 V / 16A), it starts heating up to the desired temperature. Set the temperature with a screw driver at the adjusting knob.



2 . 2 . 0

Display: DESIRED temperature + blinking points between the numbers.
The heating element is being heated up, the desired temperature is not yet reached. This display disappears after short time, followed by three lines.

- - -

Display: Three lines.
The heating element is being heated up, the desired temperature is not yet reached.

1 8 0

Display: ACTUAL temperature (without blinking points).
Appears as soon as a temperature of > 170 °C is reached and rises continuously to DESIRED temperature. The desired temperature is maintained by a certain pulse-position ratio.

5.5. Welding process

The respectively valid welding prescriptions (ISO / CEN / DVS...) are to be basically followed.



There is the danger of serious bruising.

On the one hand between the inner clamping devices, on the other hand between the outer clamping device and the end of the guide bar.

- Do wear safety gloves as a protection against burning !
- A stop-watch must be available for recording the actual times for heating and cooling.
- A welding table must be available from which the parameters for the pipe dimensions to be welded prescribed by the welding prescriptions may be taken.
- Connect the heating element and set the heating element temperature (see chapter 5.4).
- Screw in the reduction inserts according to the outside diameter of the pipes to be welded.
- Lay the pipes to be welded into the clamping devices, tighten firmly the clamping nuts and align the pipes with respect to each other. In case of long pipe ends, use WIDOS roller stands for that purpose.

- Close the slides, thereby reading the **movement pressure** on the manometer. The movement pressure is displayed exactly when the slide with the clamped pipe passes over into its movement. Subsequently, open the slides again such that the planer fits therebetween.
- Insert the planer between the pipe ends lock it and switch it on; the pressure onto the planer may not exceed 20 bar.



Noises exceeding 80 dB (A) may occur; during planing it is obligatory to wear ear protection!



There is the danger that the planer pulls in clothes ! Do not hold the planer on its front sides in any case.

If the planing pressure is too high, there is the danger that the planer tilts and falls out of the machine during planing. If necessary, hold the planer firmly.

- Move the pipe ends towards one another by means of the valve lever and plane same with a planing pressure between 1 and 15 bar above the movement pressure. Planing must be carried out until a revolving cutting has been formed on both sides.
- Open the slides again by means of the valve lever, switch off planer motor, pull the locking bolt for remove planer and put it into the protection box. Remove the produced cuttings without contacting the worked surfaces
- Close slides.
- Check pipe mismatch and gap on the joining pipe ends. According to DVS 2207, the mismatch on the pipe outer side must not exceed $0.1 \times$ pipe wall thickness, the admissible gap must not exceed 0.5 mm. The mismatch compensation is carried out by further tightening or releasing of the clamping nuts. In case mismatch compensation was carried out, planing must be repeated afterwards.
- The adjustment pressure for the pipe dimension to be welded can be gathered from the welding table. Add the movement pressure. Set the resulting pressure value at the pressure relief valve and check it by actuating the valve lever.
- Open slides again slightly.
- Gather heating time, maximum change over time, cooling time and bead height for the pipe dimension to be welded from the table.
- Move the heating element, which has been cleaned and brought to desired temperature, between the pipes, take care that it lies in the zone of the throat of the tear-off bar (see chapter 4.3).
- Close slides smoothly to the set adjustment pressure. When the prescribed revolving bead height is reached, reduce pressure. For this purpose, move the valve lever to position „pressureless“ until the desired heating pressure is built up (heating pressure = approx. 10% of the adjustment pressure).
- The heating up time starts now. Press the stop-watch and compare the actual time with the nominal time taken from the table.
- After expiration of the heating time, open the slide, remove the heating element as quickly as possible, put it into the protection box and close the slide smoothly. The maximum time frame for this process is predetermined by the value for the change over time taken from the table.

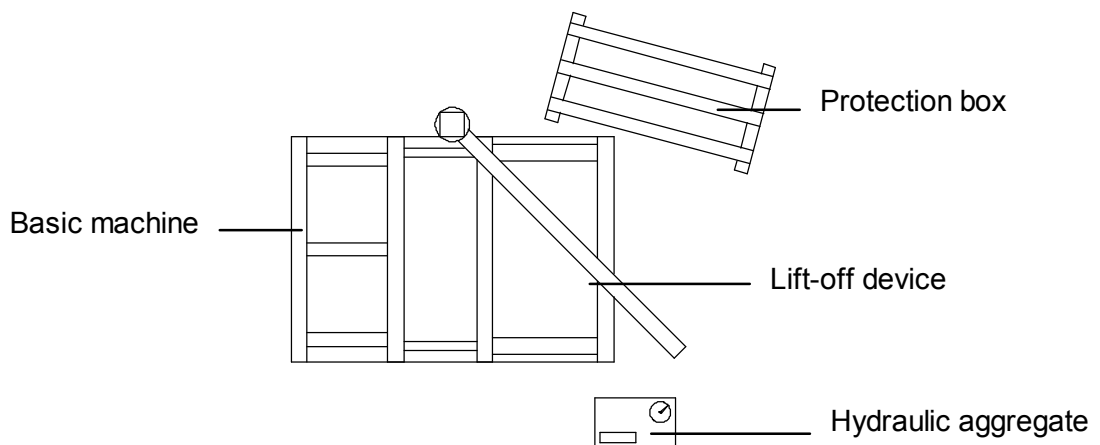
- When the welding pressure is built up, press the stop-watch and keep the control lever for approximately 10s on position „pressure“ so that the hydraulic accumulator can be filled. During the cooling time re-adjust pressure, if necessary (the pressure for cooling is the same as the set adjustment pressure).
- After expiration of the cooling time, release pressure, remove the welded parts and open the slide.

5.6. Lift-off device (optional)

- General description
- Safety rules
- Danger indications
- Starting and maintenance
see the separate documentation (company ABUS).

5.6.1. Mounting of the machine

When mounting the machine, follow the positioning sketch:



5.6.2. Mounting the lift-off device

- Insert the crane jib into the reception at the backside of the basic machine.
- Loosen the screw and the lock washer at the hook at the top of the mast, hang in the chain hoist, tighten again lock washer and screw.
- Connect the chain hoist with the mains (230 V/50 Hz).
- The operation of the lift-off device can be started now (see the separate documentation)

5.6.3. Transport

Dismount the chain hoist from the mast for transportation of the machine.

6. Welding log and tables

Table for PE

Foundation: 2207, 2208 DIN 16932 German association for welding

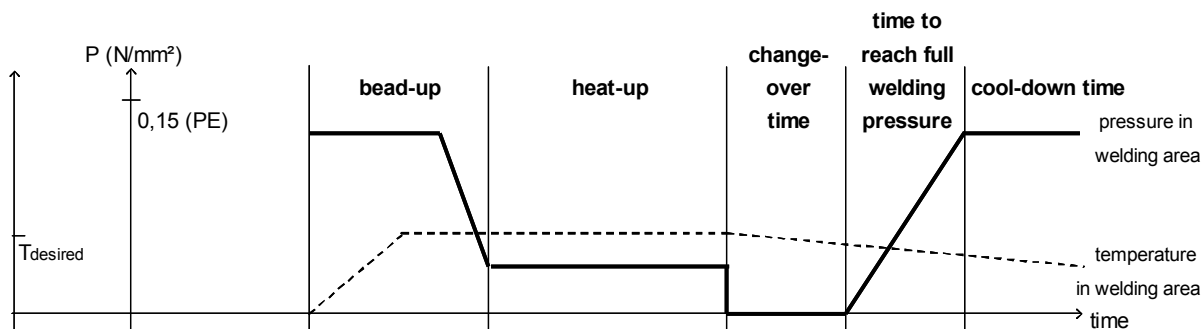
Use for: **6100**

1 bar on manometer: **173 N**

PE 80 The value for heating element temperature is between 200° C - 220° C.
The **smaller** the pipe wall the **higher** the temperature.

PE 100 The standard value for heating element temperature is 220° C.
Increase the change-over time and the welding pressure time at PE 100 as fast as possible !

Additional to the given bead-up force and to the welding force the moving force of the support must be added !



pipe diameter OD [mm]	pipe wall (s) [mm]	SDR	bead-up pressure [bar]	circular bead min. [mm]	heat-up time [s]	max. change-over time [s]	time to reach welding pressure [s]	welding pressure [bar]	cool-down time [min] ①
315	7,7	41	7	1,5	77	6	6	7	11
	9,7	33	9	1,5	97	7	7	9	13
	12,1	26	10	2	121	8	8	10	16
	15,0	21,0	13	2,0	150	9	9	13	19
	17,9	17,6	15	2	179	10	11	15	23
	18,7	17	16	2	187	10	11	16	24
	23,2	13,6	19	2,5	232	11	13	19	29
	28,6	11	23	3	286	13	15	23	35
	35,2	9	27	3	352	15	18	27	43
43,1	7,4	32	3,5	431	18	22	32	52	
355	8,7	41	9	1,5	87	7	7	9	12
	10,9	33	11	1,5	109	8	8	11	15
	13,6	26	13	2,0	136	8	9	13	18
	16,9	21,0	16	2,0	169	9	10	16	22
	20,1	17,6	19	2,5	201	10	11	19	25
	21,1	17	20	2,5	211	11	12	20	26
	26,1	13,6	24	3,0	261	12	14	24	32
	32,2	11	29	3,0	322	14	17	29	39
	39,7	9	35	3,5	397	17	20	35	48
48,5	7,4	41	3,5	485	20	24	41	58	
400	9,8	41	11	1,5	98	7	7	11	13
	12,3	33	13	2,0	123	8	8	13	16
	15,3	26	17	2,0	153	9	9	17	20
	19,1	21,0	20	2,5	191	10	11	20	24
	22,7	17,6	24	2,5	227	11	13	24	28
	23,7	17	25	2,5	237	11	13	25	29
	29,4	13,6	30	3,0	294	13	16	30	36
	36,3	11	36	3,0	363	16	19	36	44
	44,7	9	44	3,5	447	18	23	44	54
54,7	7,4	52	4,0	547	21	27	52	65	

Table for PE

Foundation: ~~2207, 2208 DIN 16932 German association for welding~~

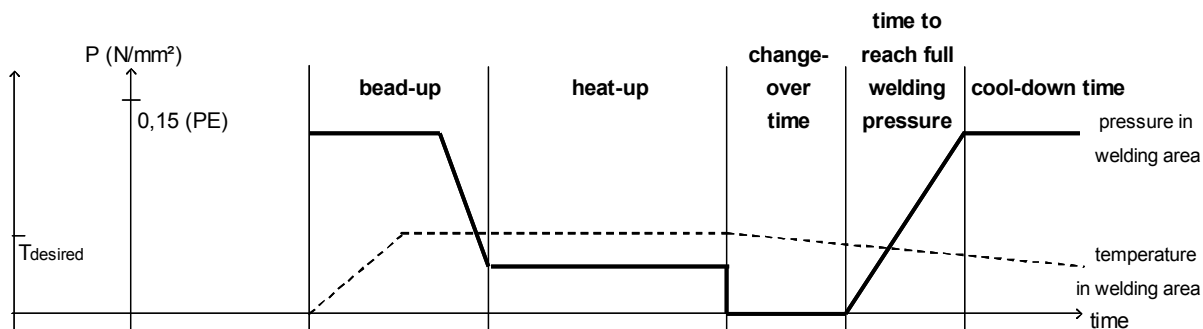
Use for: **6100**

1 bar on manometer: **173 N**

PE 80 The value for heating element temperature is between 200° C - 220° C.
The **smaller** the pipe wall the **higher** the temperature.

PE 100 The standard value for heating element temperature is 220° C.
Increase the change-over time and the welding pressure time at PE 100 as fast as possible !

Additional to the given bead-up force and to the welding force the moving force of the support must be added !



pipe diameter OD [mm]	pipe wall (s) [mm]	SDR	bead-up pressure [bar]	circular bead min. [mm]	heat-up time [s]	max. change-over time [s]	time to reach welding pressure [s]	welding pressure [bar]	cool-down time [min] ①
450	11,0	41	14	1,5	110	8	8	14	15
	13,8	33	17	2,0	138	9	9	17	18
	17,2	26	21	2,0	172	9	10	21	22
	21,5	21,0	26	2,5	215	11	12	26	27
	25,5	17,6	30	2,5	255	12	14	30	31
	26,7	17	31	3,0	267	12	14	31	33
	33,1	13,6	38	3,0	331	15	17	38	40
	40,9	11	46	3,5	409	17	21	46	49
	50,3	9	55	4,0	503	20	25	55	60
500	61,5	7,4	66	4,0	615	23	31	66	71
	12,3	41	17	2,0	123	8	8	17	16
	15,3	33	21	2,0	153	9	9	21	20
	19,1	26	26	2,5	191	10	11	26	24
	23,9	21,0	31	2,5	239	11	13	31	30
	28,4	17,6	37	3,0	284	13	15	37	35
	29,7	17	39	3,0	297	13	16	39	36
	36,8	13,6	47	3,0	369	16	19	47	45
	45,4	11	57	3,5	454	19	23	57	55
560	55,8	9	68	4,0	558	21	28	68	66
	68,3	7,4	81	4,0	683	25	34	81	78
	13,7	41	21	2,0	137	8	9	21	18
	17,2	33	26	2,0	172	9	10	26	22
	21,4	26	32	2,5	214	11	12	32	27
	26,7	21	39	3,0	267	12	14	39	33
	31,7	17,6	46	3,0	317	14	17	46	39
	33,2	17	48	3,0	332	15	17	48	41
	41,2	13,6	59	3,5	412	17	21	59	50
50,8	11	71	4,0	508	20	25	71	61	
62,5	9	85	4,0	625	23	31	85	72	

Table for PE

Foundation: ~~2207, 2208~~ DIN 16932 German association for welding

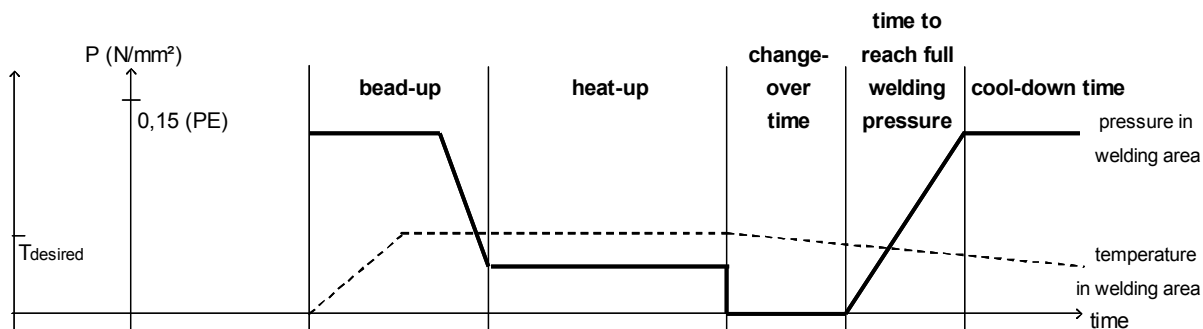
Use for: **6100**

1 bar on manometer: **173 N**

PE 80 The value for heating element temperature is between 200° C - 220° C.
The **smaller** the pipe wall the **higher** the temperature.

PE 100 The standard value for heating element temperature is 220° C.
Increase the change-over time and the welding pressure time at PE 100 as fast as possible !

Additional to the given bead-up force and to the welding force the moving force of the support must be added !



pipe diameter OD [mm]	pipe wall (s) [mm]	SDR	bead-up pressure [bar]	circular bead min. [mm]	heat-up time [s]	max. change-over time [s]	time to reach welding pressure [s]	welding pressure [bar]	cool-down time [min] ^①
630	15,4	41	26	2,0	154	9	9	26	20
	19,3	33	33	2,5	193	10	11	33	24
	24,1	26	40	2,5	241	11	13	40	30
	30,0	21	50	3,0	300	16	16	50	37
	35,7	17,6	58	3,0	357	13	18	58	43
	37,4	17	61	3,5	374	16	23	61	45
	46,3	13,6	74	3,5	463	19	19	74	56
	57,2	11	90	4,0	572	22	29	90	67
70	9	107	107	4,0	700	25	35	107	80

① Remaining under the cool-down time for up to 50% is allowed under the following conditions:

- prefabrication under workshop conditions
- low additional pressure at unclamping
- no additional pressure during further cooling down
- load onto the workpieces only after being completely cooled down

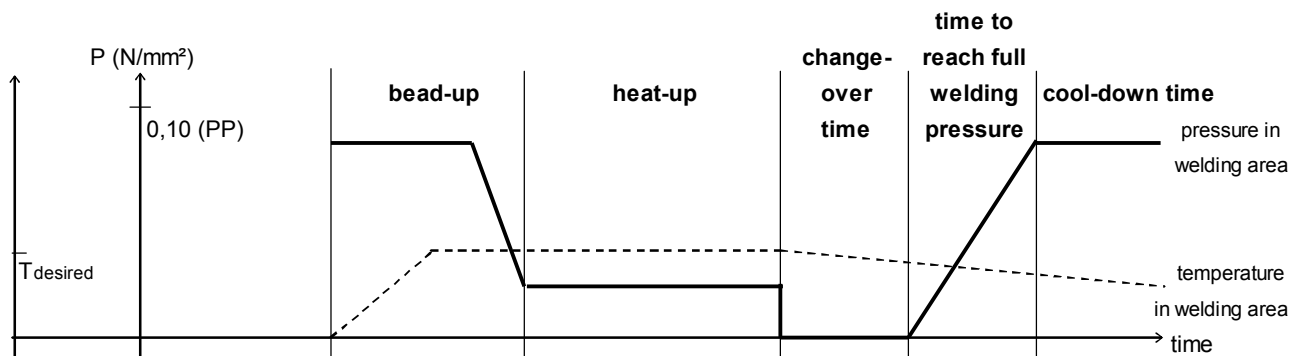
Table for PP

Foundation: 2207, 2208 DIN 16932 German association for welding
 Use for: **6100**

1 bar on manometer: **173 N**

The standard value for heating element temperature is 210° C +/- 10° C.
 The **smaller** the pipe wall the **higher** the temperature.

Additional to the given bead-up force and to the welding force the moving force of the support must be added !



pipe diameter OD [mm]	pipe wall (s) [mm]	SDR	bead-up pressure [bar]	circular bead min. [mm]	heat-up time [s]	max. change-over time [s]	time to reach welding pressure [s]	welding pressure [bar]	cool-down time [min] 1
315	7,7	41	5	1,0	185	6	8	5	13
	9,7	33	6	1,0	213	7	9	6	16
	12,1	26	7	1,0	246	7	11	7	20
	17,9	17,6	10	1,0	317	9	16	10	28
	28,6	11	15	2,0	420	12	24	15	44
355	8,7	41	6	1,0	199	6	8	6	15
	10,9	33	7	1,0	230	7	10	7	18
	13,6	26	9	1,0	264	7	12	9	22
	20,1	17,6	13	1,5	341	9	18	13	32
	32,2	11	19	2,0	448	13	28	19	48
400	9,8	41	7	1,0	214	7	9	7	16
	12,3	33	9	1,0	249	7	11	9	20
	15,3	26	11	1,0	221	7	10	11	17
	22,7	17,6	16	1,5	367	10	20	16	35
	36,3	11	24	2,0	480	14	31	24	54
450	11,0	41	9	1,0	231	7	10	9	18
	13,8	33	11	1,0	267	8	13	11	23
	17,2	26	14	1,0	308	8	15	14	27
	25,5	17,6	20	1,5	395	11	22	20	39
	40,9	11	31	2,5	508	15	35	31	59
500	12,3	41	11	1,0	249	7	11	11	20
	15,3	33	14	1,0	285	8	14	14	25
	19,1	26	17	1,5	331	9	17	17	30
	28,4	17,6	25	2,0	419	12	24	25	43

Table for PP

Foundation: 2207, 2208 DIN 16932 German association for welding

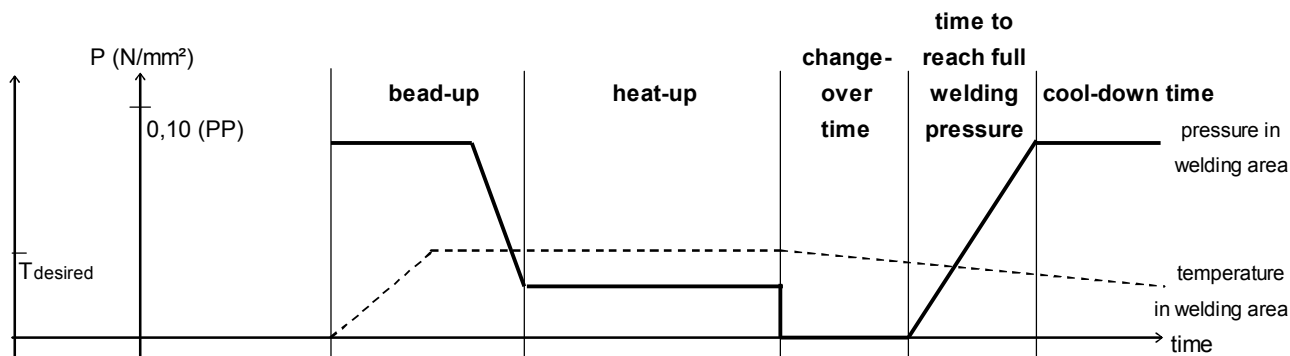
Use for: **6100**

1 bar on manometer: **173 N**

The standard value for heating element temperature is 210° C +/- 10° C.

The **smaller** the pipe wall the **higher** the temperature.

Additional to the given bead-up force and to the welding force the moving force of the support must be added !



pipe diameter OD [mm]	pipe wall (s) [mm]	SDR	bead-up pressure [bar]	circular bead min. [mm]	heat-up time [s]	max. change-over time [s]	time to reach welding pressure [s]	welding pressure [bar]	cool-down time [min] ^①
560	13,7	41	14	1,0	266	7	12	14	22
	17,2	33	17	1,0	308	8	15	17	27
	21,4	26	21	1,5	354	10	19	21	33
	31,7	17,6	31	2,0	444	13	27	31	48
630	15,4	41	18	1,0	286	8	14	18	25
	19,3	33	22	1,5	333	9	17	22	30
	24,1	26	27	1,5	381	10	21	27	37
	35,7	17,6	39	2,0	475	14	31	39	53

① Remaining under the cool-down time for up to 50% is allowed under the following conditions:

- prefabrication under workshop conditions
- low additional pressure at unclamping
- no additional pressure during further cooling down
- load onto the workpieces only after being completely cooled down

7. Maintenance and repair

Goal of the chapter is:

- Keeping the nominal state and the operation capacity of the machine.
- Increasing the efficiency by avoiding non-planned outage.
- Efficient planning of the maintenance works and the maintenance tools.

7.1. Maintenance and inspection, repair



All maintenance and repair works have to be basically performed with the machine in off position.

During this the machine has to be secured against unauthorized switching on.



Prescribed maintenance and inspection works should be performed in time.

The DVS gives the advice of inspection works after 1 year.

For machines with a specially high usage percentage the testing cycle should be shortened.

The works should be performed at the WIDOS GmbH company or by an authorized partner.

7.2. Clamping elements

- For a long service life clean and grease regularly the threaded spindles and the joint parts which are used for clamping the pipes.

7.3. Planer

- Check the stress of the drive chain in the planer and grease it regularly. The cover of the planer can be screwed off by means of the provided socket spanner.
- Do not lay the planer on its blades.
- Check the blades of the planer for sharpness, turn them if necessary (grinded on both sides, max. thickness of the shavings: 0,2 mm !).

7.4. Storage

- The cylindrical waves of the basic machine are to be kept free from dirtiness and need to be covered with a thin oil film if they are not being used.
- Store dry.

7.5. Used hydraulic oil

Only use **HLPD 32**.

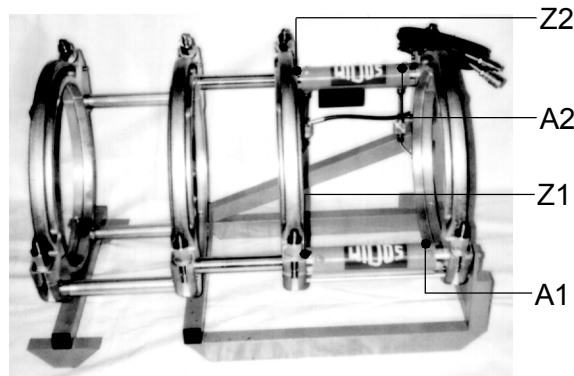
Features: protection against corrosion, resistance to ageing, abrasion-reducing additives, high carrying capacity and particularly water retending.

The hydraulic oil has to be disposed of properly.

7.6. Checking the hydraulic oil level

- Unscrew the red cover screw on the top of the aggregate. Remove the integrated oil dipstick, clean it with a dry tissue and insert it again in the tank by screwing. Remove the oil dipstick again and check the oil level.
- The oil level must be between the two marks. If the oil level is under the lower mark, then hydraulic oil of the quality HLDP 32 must be added.

7.7. Venting the hydraulic cylinders



- Venting the hydraulic cylinder is not required, if
 - the hoses have been disconnected from the quick-action couplings at the control unit because the remaining oil in the hose is being kept by valves and for this reason no air can enter.
- The hydraulic cylinder **must be vented** if
 - there has been too less oil in the tank and air has been attracted.
 - there were leaky spots at the hoses or in the connections.
 - the hoses were unscrewed from the basic machine.
- Eliminate the cause of the air entrance.
- Open the machine completely.
- First unscrew the lower „vent screw (Z1) for closing“ (lefthand side).
- Connect the transparent venting hose and insert it in the collecting vessel of the aggregate.
- Close until there is no more air visible in the venting hose, then tighten again the vent screw.
- Close the machine completely.
- Unscrew the lower „vent screw (A1) for opening“ (righthand side).
- Connect the transparent venting hose and insert it in the collecting vessel of the aggregate.
- Open until there is no more air visible in the venting hose, then tighten again the vent screw.
- When the venting process at the lower vent screws is completed, repeat the process at the upper „vent screw (Z2) for closing“ (lefthand side), as well as at the upper „vent screw (A2) for opening“ (righthand side).



The lower vent screws always have to be vented at first because there is a direct connection between the upper and the lower cylinders.

- If air remains in the lower cylinder, it will ascend in the upper cylinder when pressure is applied.

7.8. Disposal



At the end of the life time, the machine has to be disposed of properly, non-polluting and in accordance with the national laws of waste disposal.

8. Transport

The machine can be transported in two transport boxes or in one packing box.
One transport box contains the basic machine, the aggregate and the reception box with planer and heating element, the other box contains the reduction inserts.

- In each box holders are included which are suitable for each single component in order to avoid slipping.
⇒ Put the components into the box in such a way that they fit in the holders.
- The hydraulic hoses at the basic machine should not be unscrewed (air penetration).
⇒ Make sure that they are not squeezed.
- Handle the machine carefully.
⇒ Do not tilt the aggregate too much. Otherwise there is the danger that oil may come out.
⇒ Protect the machine from heavy chocs.
⇒ Make sure that the box cover is closed correctly.
- During the construction of the transport box a stress was put on a light-weight construction.
⇒ Take much care when using automatic handling and carrying machines.

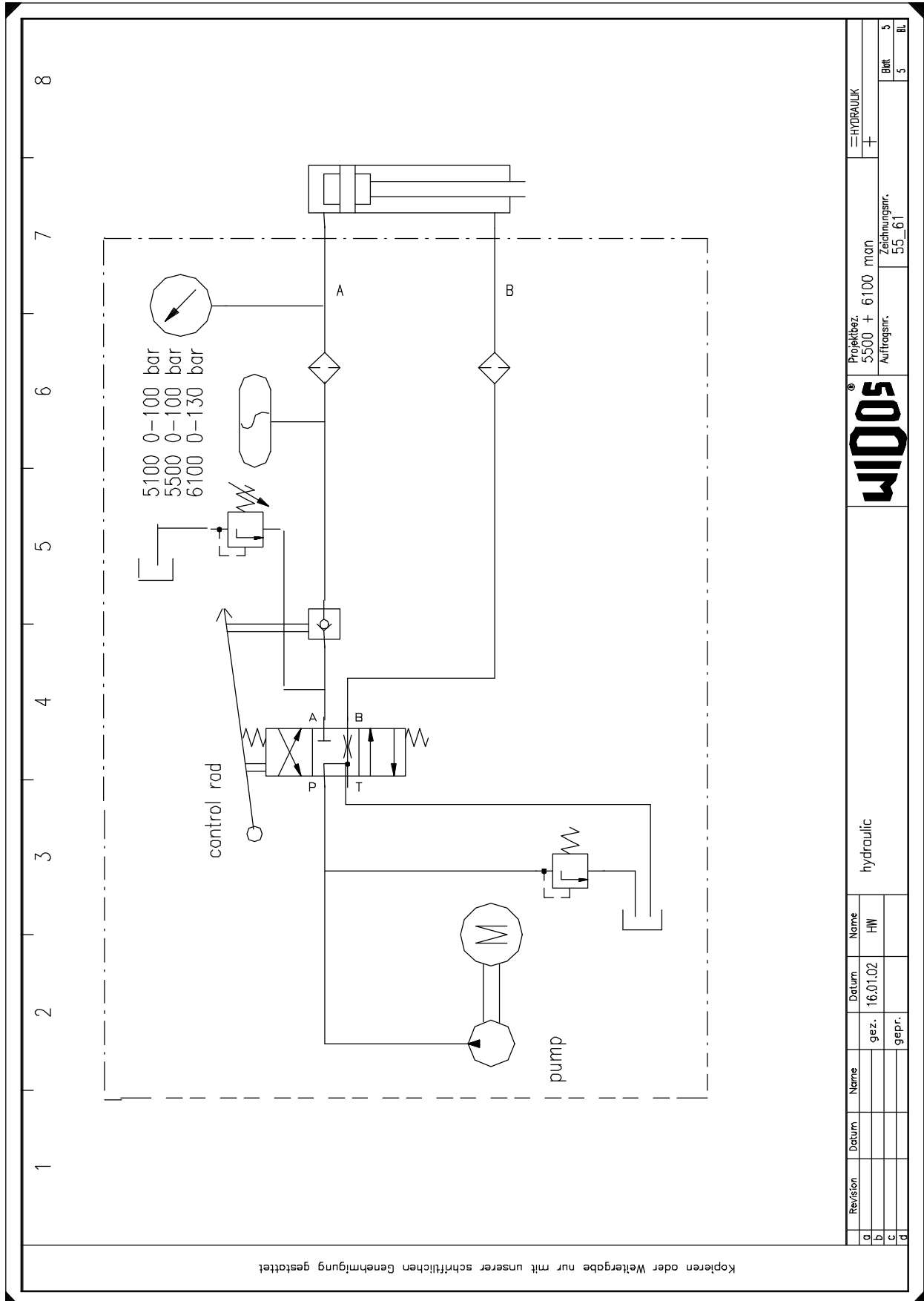


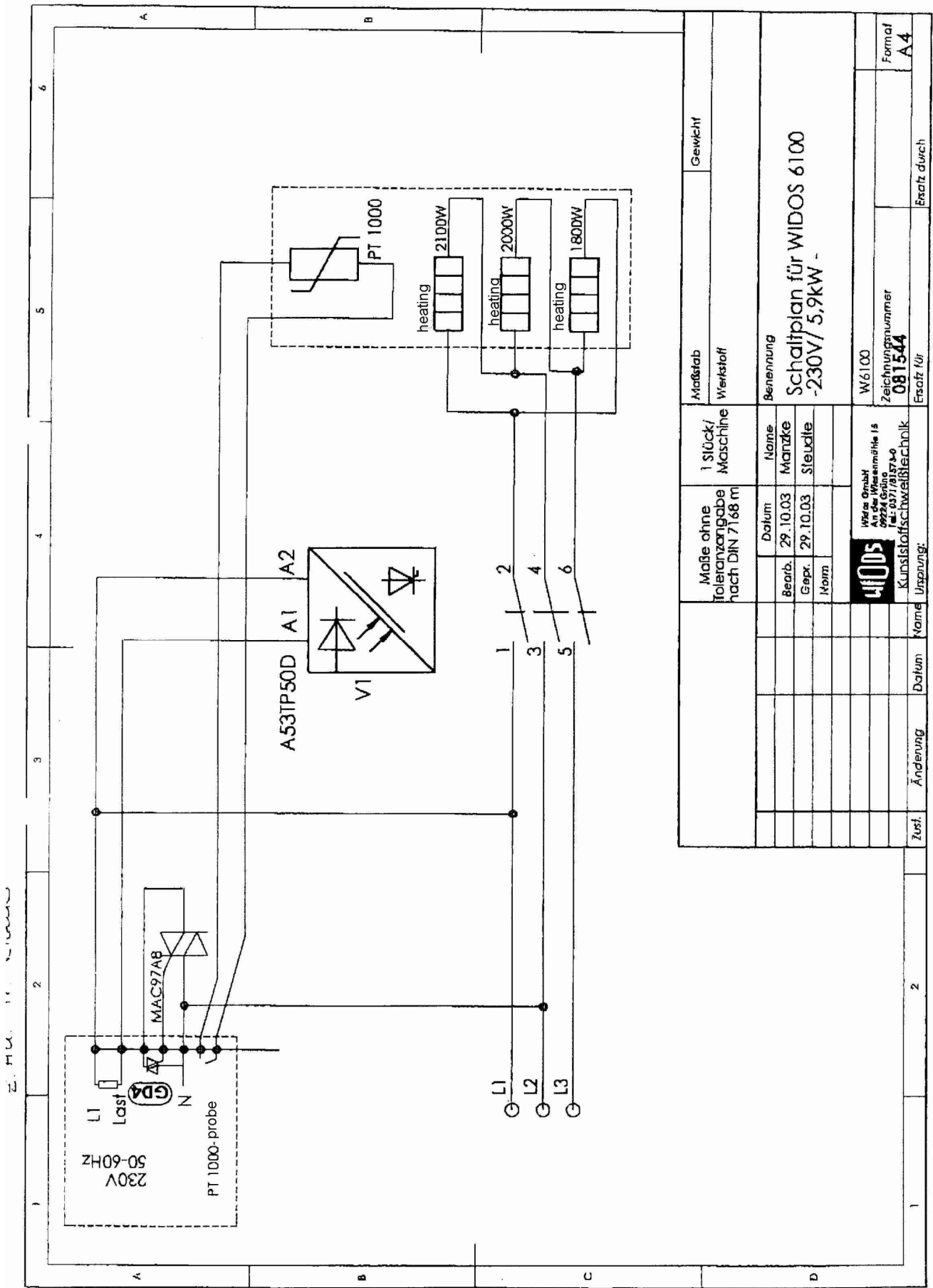
During the transport of the machine there may be cold weldings between the piston rod and the eyes of the planer housing. These spots on the piston rod may damage the sealing.



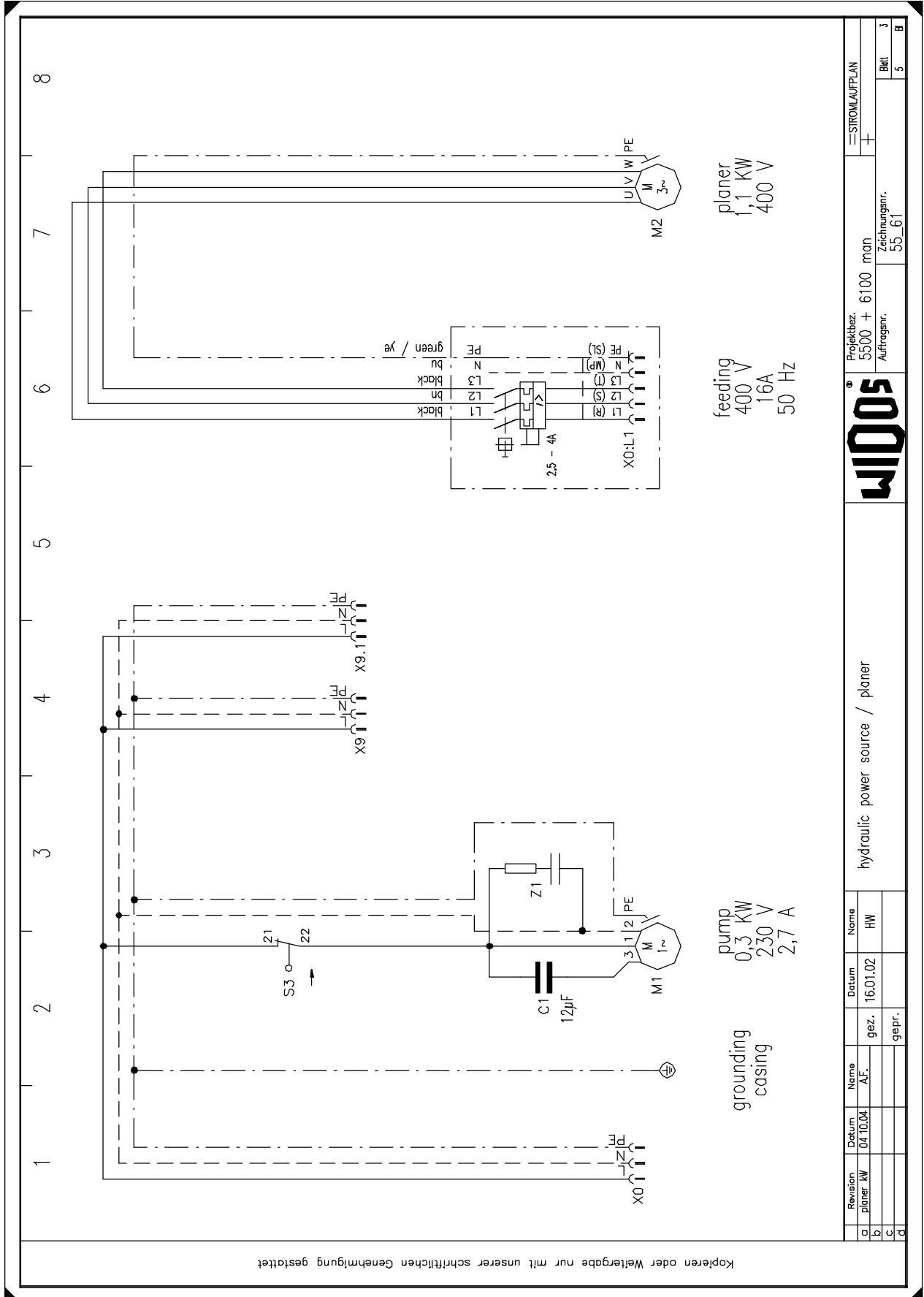
Therefore the eyes must be lubricated with PTFE spray before each transport!

9. Hydraulic and electric diagrams





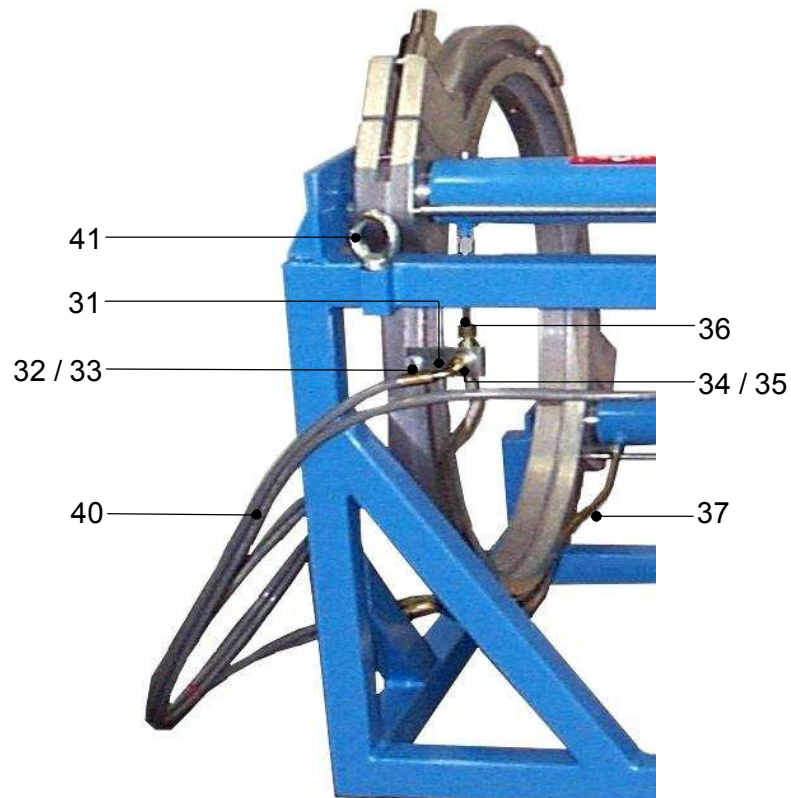
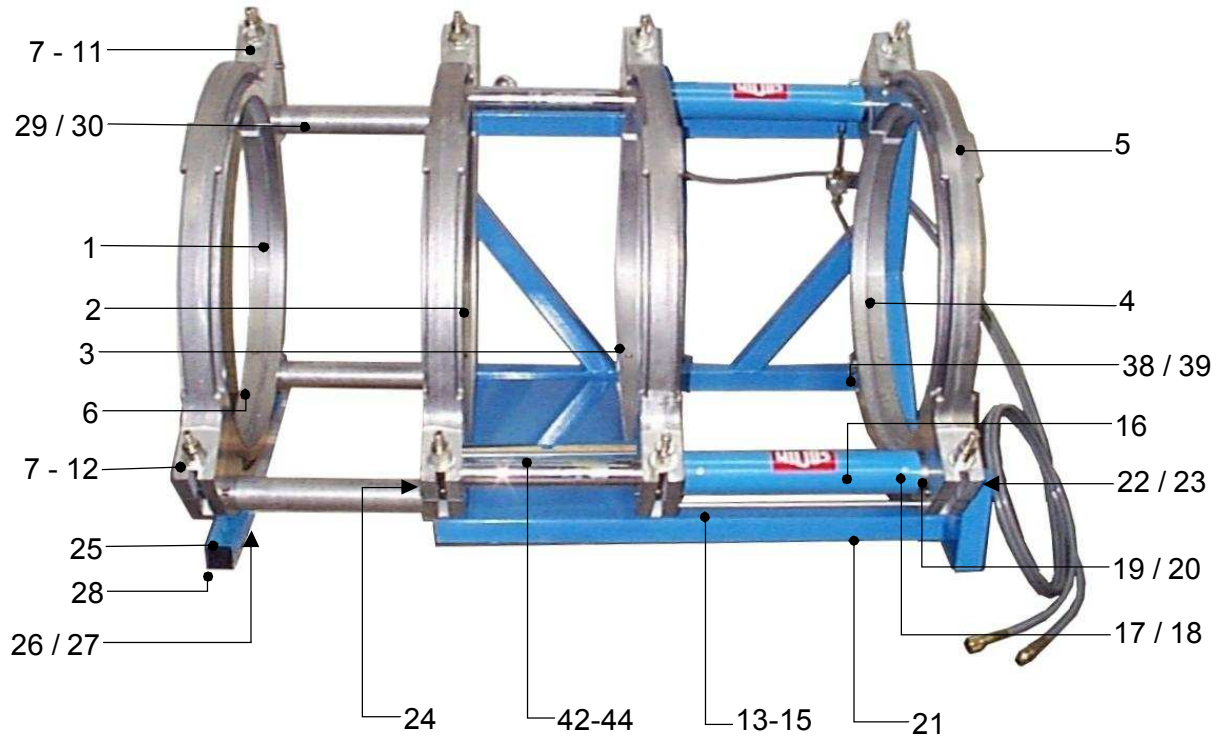
Maßstab	Gewicht
Werkstoff	
Benennung	
Schaltplan für WIDOS 6100	
-230V/ 5,9kW -	
W6100	Formal
Zeichnungsnummer	A4
081544	
Ersatz für	Ersatz durch
1 Stück/ Maschine	
Masse ohne Toleranzangabe nach DIN 7168 m	
Datum	Name
Bearb. 29.10.03	Manzke
Gepr. 29.10.03	Steudte
Norm	
Widos GmbH An der Maschinenstraße 15 42699 Solingen Telefon: +49 212 649-100 Fax: +49 212 649-1010 E-Mail: info@widos.de	
Kunststoffschweißtechnik	
Zust.	Änderung
	Datum
	Name
	Ursprung:



Revision		Datum		Name	
a	plner kW	04.10.04	AF.	16.01.02	HW
b				gez.	gepr.
c					
d					
Projektbez. 5500 + 6100 man				Zzeichnungenr. 55_61	
Auftragsnr. 55_61				Blatt 3	
				5	
				B	
WIDOS					
hydraulic power source / planer					
STROMAUFPLAN					

10. Spare parts list

10.1. Basic machine



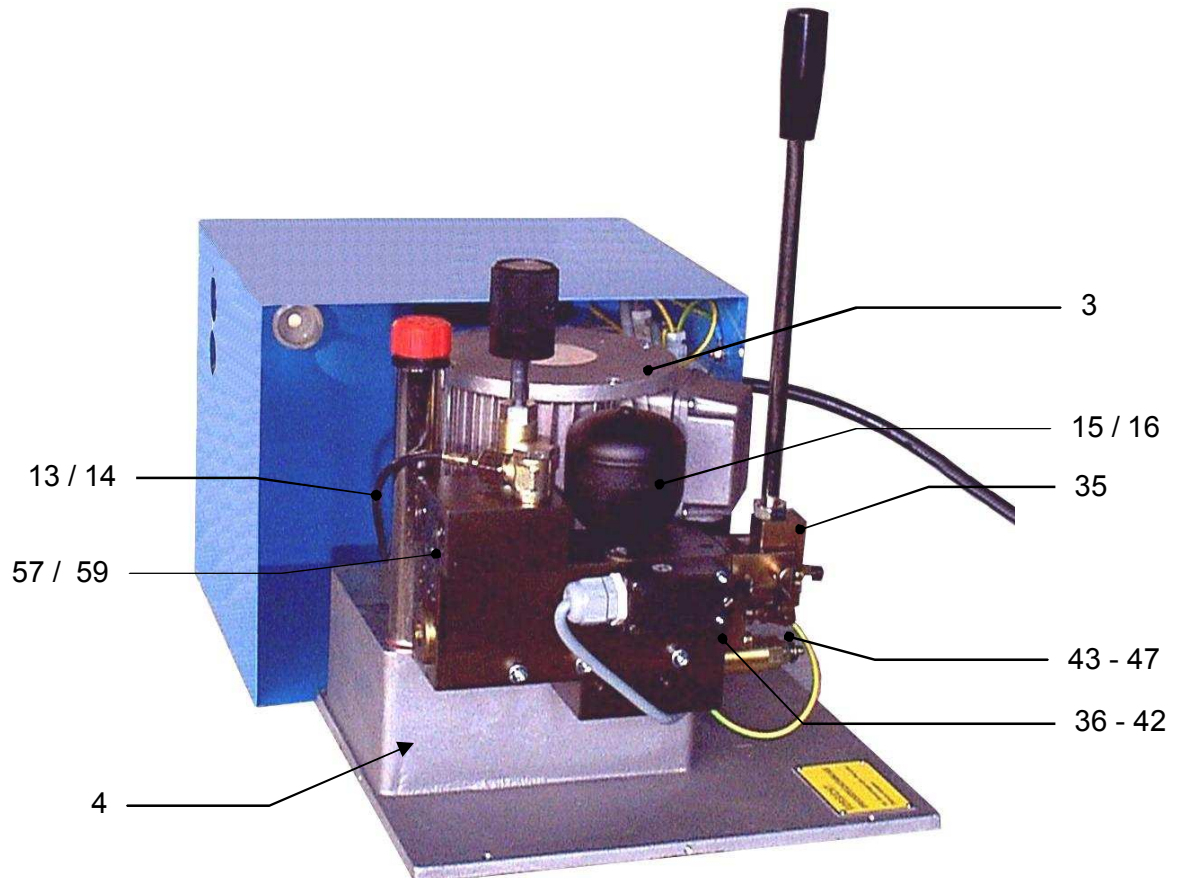
Basic Machine WIDOS 6100

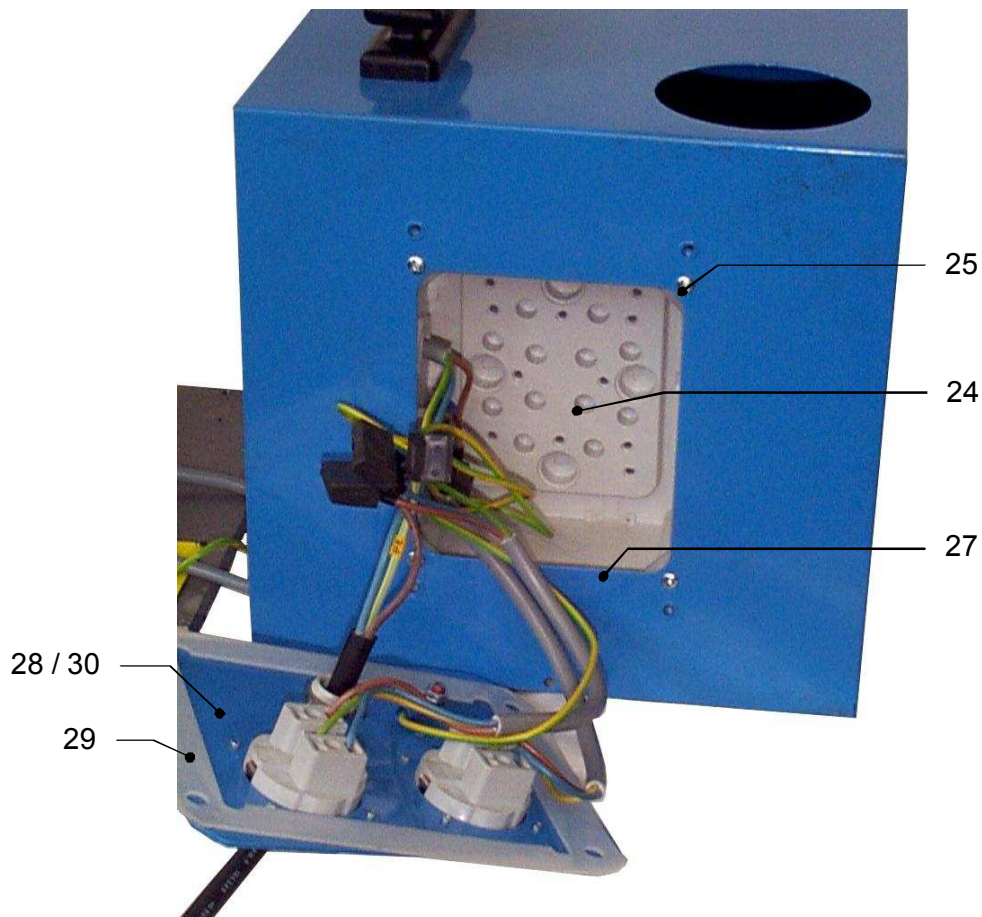
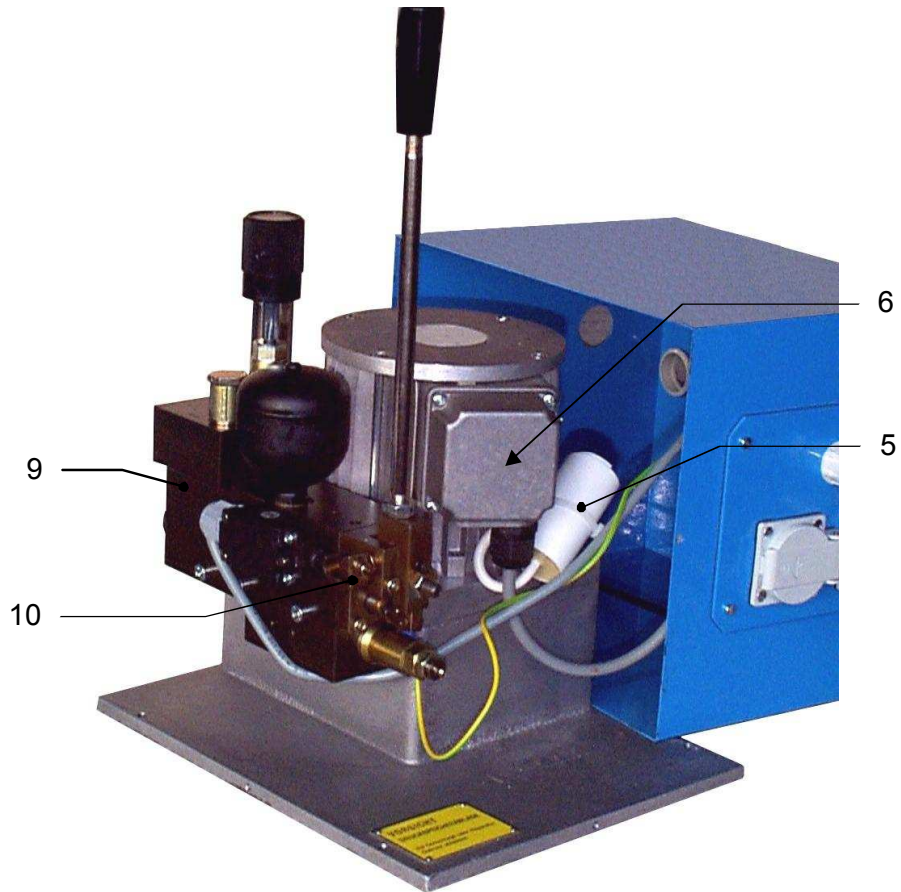
Pos.	Name	Piece	Order no.
1	Outer clamp, fixed	1	082101
2	Inner clamp, fixed	1	082102
3	Inner clamp, movable	1	082103
4	Outer clamp, movable	1	082104
5	Upper clamp	4	082105
6	Thread insert M 10	8	GEW-M10
7	Thread spindle	8	081108
8	Nut	8	071109
9	Pressure disc M 16 DIN 6340	8	6340P
10	Rivet	8	081111
11	Lock washer size 9 DIN 6799	8	6799I
12	Headless pin M 10x12 DIN 916	4	0916J012
13	Tension rod	2	081107
14	Hexagon nut M 12 DIN 934	2	0934L
15	Washer M 12 DIN 125	2	0125L
16	Hydraulic cylinder	2	081106
--	Hydraulic cylinder in exchange	2	081106T
--	Seals for cylinder	2	D081106B
17	Flat-head screw M 6x10 DIN 7991	4	7991F010
18	Ring for sealing 6x9,3x1	4	D6x9,3
19	Pressure disc	2	071133
20	Stop bolt	2	091117
21	Basic frame	1	081118
22	Hexagon screw M 10x30 DIN 933	2	0933J030
23	Washer M 10 DIN 125	2	0125J
24	Flat-head screw M 16x30 DIN 7991	2	7991P030
25	Support	1	081141
26	Pan-head screw M 10x40 DIN 912	3	0912J040
27	Washer M 10 DIN 125	3	0125J
28	Protective cap (50x50x4 mm)	2	J0208
29	Shaft	3	081131
30	Flat-head screw M 20x40 DIN 7991	6	7991T040
31	Holding device for filter	2	093119
32	Washer M 8 DIN 125	4	0125H
33	Hexagon screw M 8x20 DIN 933	2	0933H020
34	Screwed connection GE 8L R3/8"	2	VXGE8L38
35	Filter	2	V092114
36	Hydraulic hose (770 mm)	2	081112
37	Hydraulic hose (300 mm)	2	081113
38	Hinge plate	2	091137
39	Flat-head screw M6x16 DIN 7991	4	7991F016

Basic Machine WIDOS 6100

Pos.	Name	Piece	Order no.
40	Hose bunch	1	VSCHL6100
--	Coupling plug, flat packing	1	VST14
--	Coupling box, flat packing	1	VMU14
41	Lifting screw C-15 M16 D	2	0580P
42	Tear-off bar	1	81516
43	Hexagon screw M 12x15 DIN 933	2	0933L015
44	Washer M 12 DIN 9021	2	9021L
--	Reduction insert OD 315-560	1	0808...*
--	Pan-head screw M 10x40 DIN 7984 (OD 355-500)	8	7984J40X
--	Pan-head screw M 10x35 DIN 7984 (OD 315 / 560)	8	7984J35X
--	Plate "pressure values"	1	SCHM6100
--	Name plate	1	SCHT6100
--	Hydraulic oil	1 l	HLPD35
--	Socket spanner size 27	1	ZRS27
	*) When ordering, please state the dimension of the pipe !		

10.2. Hydraulic aggregate





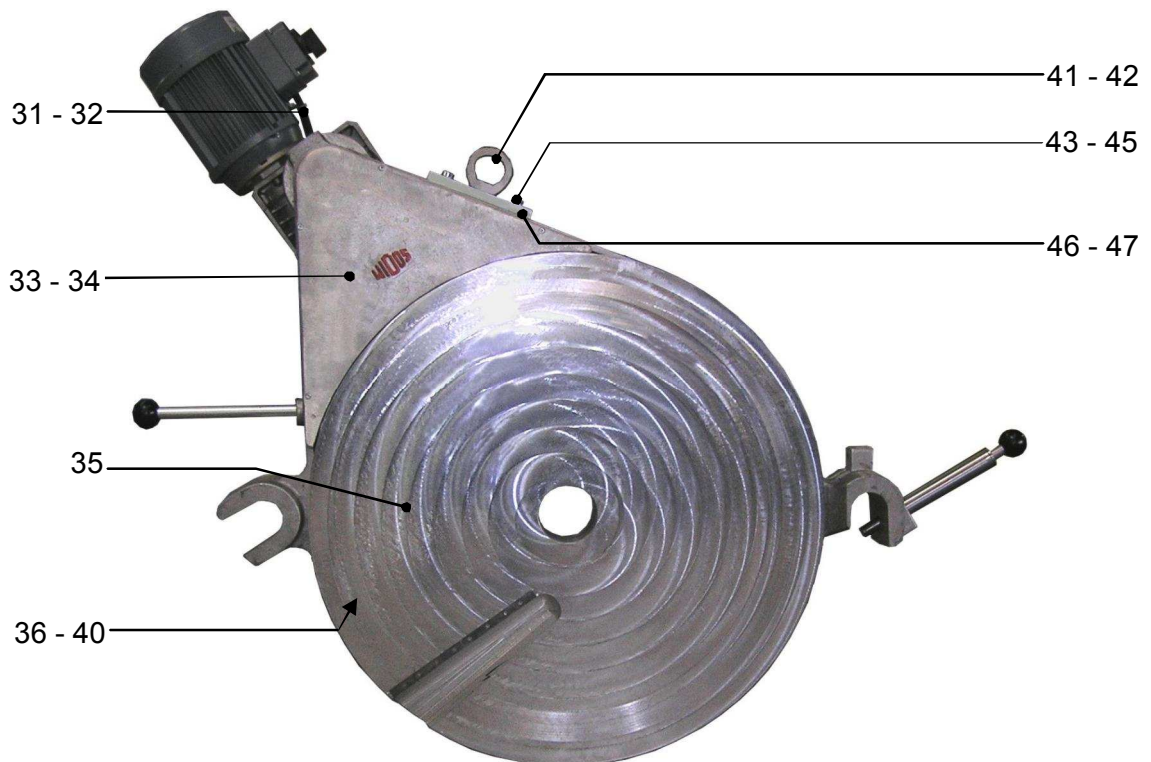
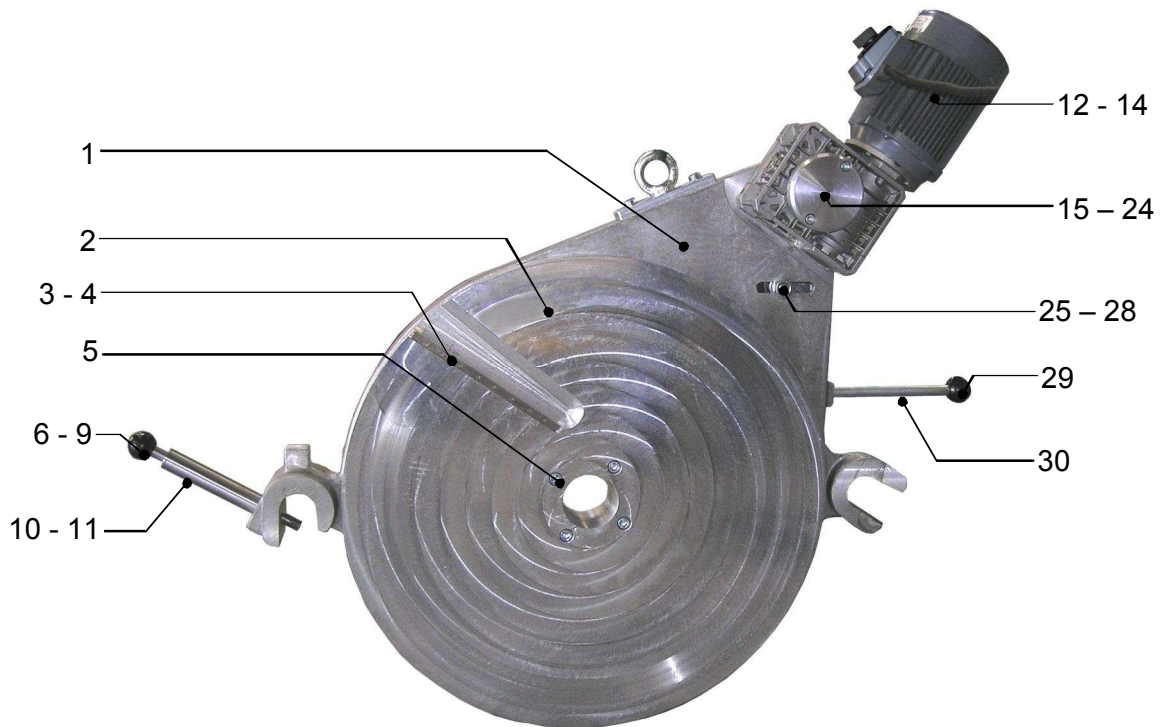
Hydraulic Aggregate WIDOS 6100

Pos.	Name	Piece	Order no.
1	Cover	1	1010021
2	Pan-head screw M4x12 DIN 912	4	0912D012
3	Motor	1	on request
4	Pump 1.9 l	1	102103
5	Capacitor 12 µF	1	EK12220
6	Universal RC - link	1	EE0104
7	Connection cable with plug	1	EK32220
8	Screwed connection PG 13.5	1	EV0113
9	Valve	1	on request
10	Pan-head screw M6x45 DIN 912	4	0912F045
11	Pressure gauge	1	101004D
12	Screwed connection of pressure gauge	1	V042314
13	Mini hose	1	on request
14	Hose screwing	1	101008
15	Accumulator	1	101006
16	Ring for sealing 16x22.7x1.5	1	D16x22,7
17	Coupling box, flat packing	1	VMU14
18	Synthetic cap for VMU14	1	VKM14
19	Coupling plug, flat packing	1	VST14
20	Synthetic cap for VMST14	1	VKS14
21	Ring for sealing 16x22.7x1.5	2	D16x22,7
22	Screwed connection	2	V101024
23	O-ring 19x1,5	2	D19x1,5
24	Distributor box	1	on request
25	Pan-head screw M4x10 DIN 912	2	0912D010
26	Socket	2	EST0701
27	Seal, inside	1	1010024
28	Side part	1	1010022
29	Seal, outside	1	1010023
30	Pan-head tapping screw 3.5 x 20	4	7971C020
31	Valve lever	1	101013
32	Cylinder knob M10	1	101033
33	Bellows	1	101035
34	Plate "Release pressure"	1	SCHD-L
35	Hexagon nut M10 DIN 934	1	0934J
36	Pressure switch	1	on request
37	Pan-head screw M4x25 DIN 84	2	0084D025
38	Angle for pressure switch	1	on request
39	Washer M4 DIN 125	1	0125D
40	Pan-head screw M 4x10 DIN 912	1	0912D010
41	Set screw M5x10 DIN 915	1	0915E010

Hydraulic Aggregate WIDOS 6100

Pos.	Name	Piece	Order no.
42	Bolt	1	101038
43	Adjusting screw	1	101036
44	Hexagon nut M6 DIN 934	3	0934F
45	Plug-in element P83-1/2"x3/16"	1	101043
46	Bearing block	1	on request
47	Pan-head screw M5x45 DIN 912	2	0912E045
48	Control knob for pressure setting	1	101022
49	Bush	1	101047
50	Set screw	1	101050
51	Plate "Pressure values"	1	SCHM4600
52	Oil dipstick	1	101021
53	Hydraulic oil	1 l	HLPD35
54	Filler neck	1	101026
55	Copper ring 14x18x1.5 DIN 7603	1	D14x18
56	Cable bushing Kt21	2	EKT21
57	Leading-in for tubes size 22	2	EKT22
58	Sinter-filter 15x8 41180	2	101045
59	O-ring 16x2	2	D16x2
60	Protective mounting	1	101042
61	Pan-head screw M6x16 DIN 912	4	0912F016

10.3. Planer



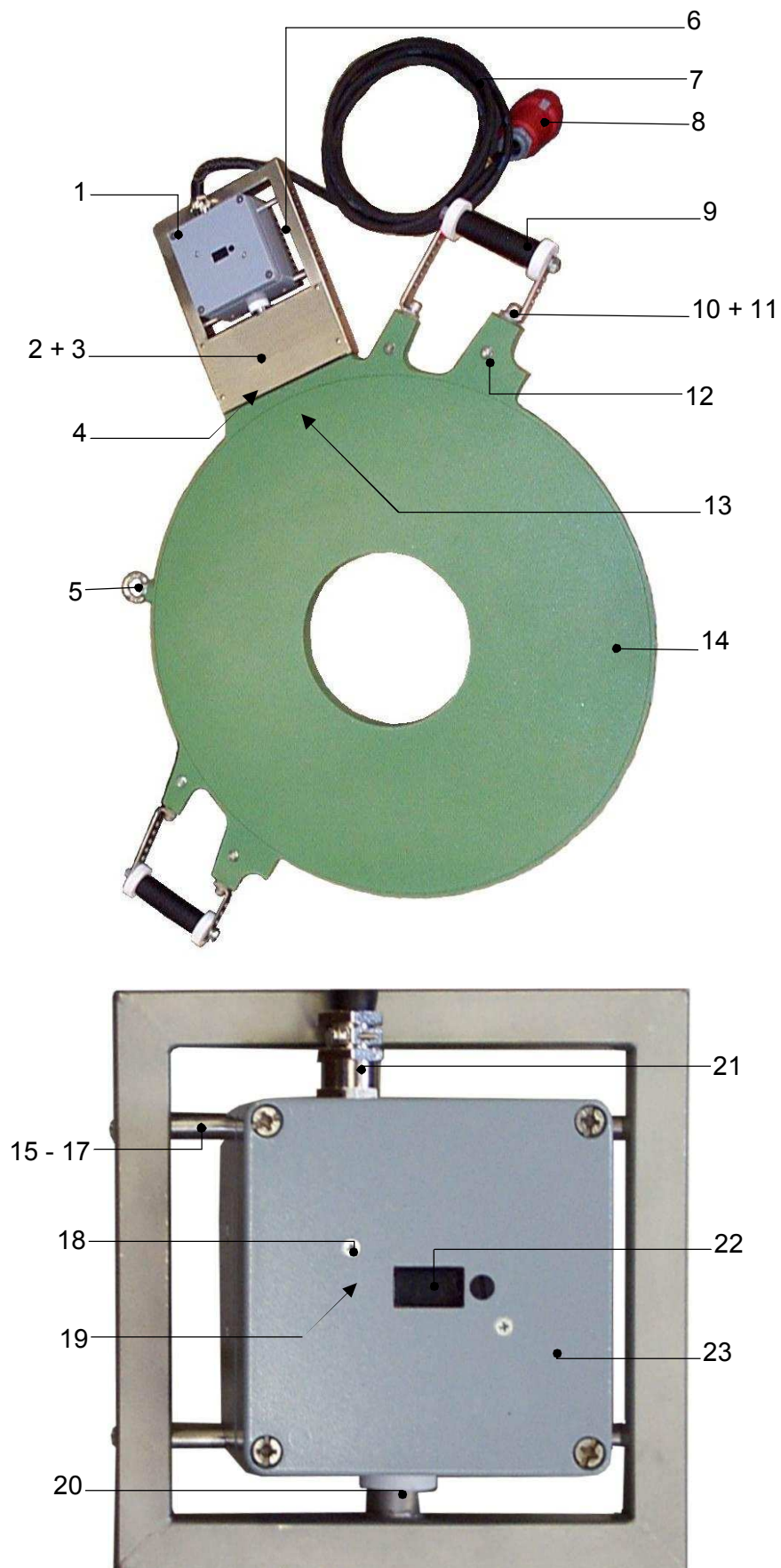
Planer WIDOS 6100

Pos.	Name	Piece	Order no.
1	Fastener for planer	1	0824011
2	Planer disc, right-hand	1	082402
3	Knife	4	MES120
4	Flat-head screw M 3x8 DIN 965	16	0965C008X
5	Pan-head screw M 12x50 DIN 912	4	0912L050
6	Ball button C 40 DIN 319	1	0319C40
7	Locking bolt	1	082422
8	Compression spring R 1342	1	FE042
9	Lock washer Ø 10 DIN 6799	1	6799J
10	Bushing	1	082421
11	Valve nut	1	082423
12	Rotary current gearing motor 1.1 kW	1	ADG11400
13	Switch cupboard	1	ADG1104
14	Switch for geared motor	1	ADG1103
15	Pan-head screw M 8x25 DIN 912	4	0912H025
16	Pan-head screw M 8x20 DIN 912	2	0912H020
17	Washer for gear shaft	1	081414
18	Cover for geared motor	1	0814051
19	Driveshaft KU63	1	824111
20	Dowel spring 8 x 7 x 90 DIN 6885	1	6885H090
21	Dowel spring 8 x 7 x 18 DIN 6885	1	6885H018
22	Disc (front) for geared motor	1	081409
23	Flat-head screw M 8x20 DIN 7991	1	7991H020
24	Chain wheel, small	1	081412
25	Ball bearing 6003ZZ	2	L6003Z
26	Bolt	1	081410
27	Washer M 16 DIN 125	9	0125P
28	Hexagon nut M 16x1.5 DIN 934	1	0934Y
29	Ball button C 40 DIN 319	1	0319C40
30	Handle bar	1	071409
31	Cable H07 RN-F 5x1.5 ² ; 6 m	1	EL02515
32	Phase-inverter plug CEE 16 A, 400 V	1	EST0416
33	Cover	1	081404
34	Pan-head screw M 4x12 DIN 912	4	0912D012
35	Planer disc, left-hand	1	082403
36	Ball bearing	1	L6030
37	Chain wheel, large (1/2", 120 teeth)	1	081413
38	Chain 1/2" x 5/16", 158 rolls	1	K1216
39	Chain joint 1/2"	1	KSCH12
40	Flat-head screw M 10x20 DIN 7991	4	7991J020
41	Lifting eye nut M 16 DIN 582	1	0582P

Planer WIDOS 6100

Pos.	Name	Piece	Order no.
42	Flat-head screw M 16 x 30 DIN 7991	1	7991P030
43	Hexagon nut M 10 DIN 985	2	0985J
44	Washer M 10 DIN 125	2	0125J
45	Pan-head screw M 10x45 DIN 7984	2	7984J045
46	Suspension plate for planer	1	081406
47	Counter plate	1	081407
--	Torx-screw driver	1	TX10

10.4. Heating element



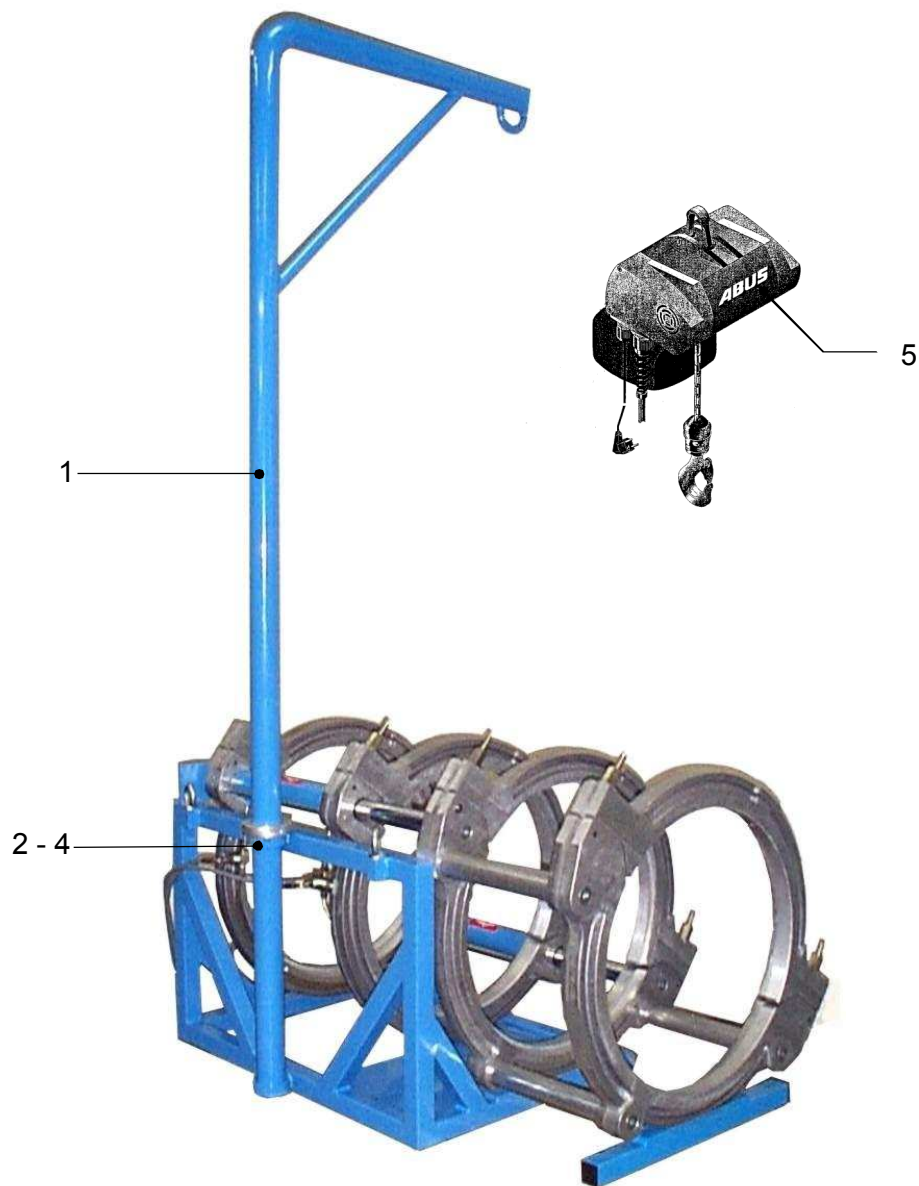
Heating Element WIDOS 6100

Pos.	Name	Piece	Order no.
1	Terminal box	1	071554
2	Cover for terminal box	1	071555
3	Oval-head screw M 3x6 DIN 7985	4	7985C006
4	Insulating piece	1	071556
5	Lifting screw M 12 DIN 580	1	0580L
6	Heat sink	1	on request
7	Cable	1	EL02515
8	Plug	1	EST0116
9	Grip	2	07021
10	Pan-head screw M 10x60 DIN 912	4	0912J060
11	Spring washer B 10 DIN 127	4	0127J
12	Tapped bushing	4	1475045
13	Temperature probe PT 1000	1	H09082
14	Heating element (400 V)	1	H6100E
	Heating plate new	1	HP6100E
	Heating plate in exchange	1	HPT6100E
15	Distance piece	4	081554
16	Tapped bushing	4	081553
17	Pan-head screw M 6x45 DIN 912	4	0912F045
18	Flat-head screw M 3x8 DIN 7991	2	7991C008
19	Controller G4 with triac	1	H0908230D1
20	PTFE - joining piece	1	211505
21	Screwing	1	EV0021
22	Window, tinted	1	H09071
23	Upper and lower part of housing	1	081551

10.5. Protection box

Proection Box WIDOS 6100

Pos.	Name	Piece	Order no.
1	Reception box	1	EIN6100
2	Sheet steel	2	0815201
3	Lifting screw M 16 DIN 580	2	0580P
4	Fitting cap 60x60	4	on request

10.6. Lift-off device

Lift-off Device (optional) WIDOS 6100

Pos.	Name	Piece	Order no.
1	Crane mast	1	on request
2	Limit stop for crane mast	1	081122
3	Grub screw M8x20 DIN 913	2	0913H020
4	Straight pin Ø 6x60 DIN 6325	2	6325F060
5	Jib crane GMC 100.12	1	on request

11. Declaration of conformity

In the sense of the EC guideline, EG-MRL 2006/42/EG

Corporation

WIDOS GmbH
Einsteinstr.5
D- 71254 Ditzingen-Heimerdingen

declares under own responsibility that the product

Plastic Welding Machine
WIDOS 6100

to which this declaration refers corresponds to the following norms and norming documents:

1. DIN EN ISO 12100 – 1 and 2 (substitute for EN 292 parts 1 and 2)
Safety of machines, basic terminology, general guidelines for design
2. DIN EN 60204.1
Electric equipment of industrial machines
3. DIN EN 4413
Safety specifications for fluid technical installations and components
4. EN 60555, EN 50082, EN 55014
Electro-magnetic resistance

The technical documentation is completely available.

The following technical documentation can be examined at the corporation mentioned above:

- testing documents
- other technical documents

Ditzingen-Heimerdingen, 04.02.2010

Dieter Dommer (Manager)