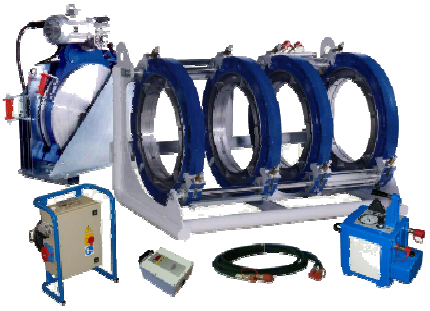
Operating Instructions

KL 630
Butt Fusion Machine



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GEORG FISCHER
PIPING SYSTEMS

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Table of contents

0 About this manual

The warning notices, symbols and their meanings as used in this manual are explained below to help you quickly understand the format of this instruction manual and how to use the machine safely.

0.1 Warning notice

Warning notices are used in this manual to inform you of possible injuries or damage to property. Please read them and always abide by these warnings!

Symbol	Meaning
 **Danger**	Imminent accute danger! Failure to comply could result in death or extremely serious injury.
 **Warning**	Possible accute danger! Failure to comply could result in serious injury.
Caution	Dangerous situation! Failure to comply could lead to injury or damage to property.

0.2 Other symbols and notices

Symbol	Meaning
Attention	Mandatory: you must observe this regulation
Advise	Suggest: This notice contains especially important information

0.3 Abbreviations

Abbr.	Meaning
KL 630	Butt fusion machine d 315–630 mm
ERC	Electronic Remote Control (temperature regulator)
DVS	Deutscher Verband für Schweisstechnik (German Association of Fusion Technology)
HD-PE	High Density Polyethylene
PE	Polyethylene
PP	Polypropylene
PVDF	Polyvinylidene fluoride
PTFE	Polytetrafluorethylene
d	Pipe outer diameter

1 Safety instructions

The KL 630 Butt Fusion Machine (hereinafter referred to as KL 630) is designed according to the latest standards of technology. Using it for purposes other than those described in this manual may cause injury to the operator or to others. It may also cause damage to the machine or other equipment.

Any person in the company, who is involved in the assembly, disassembly, reassembly, installation, operation or maintenance (inspection, maintenance work, repair work) of theKL 630, must have read and understood the complete instruction manual, and in particular Section 1 on "Safety instructions".

It is recommended that the user has this confirmed in writing.

Thus:

- The machine should only be used when in perfect working order.
- Always follow the safety instructions.
- Complete documentation should be kept in the vicinity of the machine.

1.1 Proper use

The KL 630 is to be used exclusively for the fusion of pipes and fittings made of PE, PP and PVDF. Any other use is not permitted.

1.2 General safety measures

- Use only the materials and dimensions specified in this manual. Other materials may only be used after consulting Georg Fische Omicron after-sales service.
- Use only original Omicron spare parts and equipment.
- Inspect the KL 630 daily for visible signs of damage or defects. Have damage or defects repaired immediately.
- Any work on the electrical equipment may only be done by a specialist.

1.3 Working with safety in mind

"Make your contribution to safety in the workplace."

- Report any deviations from normal operation immediately to the person in charge.
- Always keep safety in mind while working.

For your own personal safety as well as for the safe and optimal handling of the machine, the KL 630 must be installed correctly.

Connect hydraulic hoses to and from the machine only when the hydraulic unit is shut off and not under pressure (observe manometer).

Warning

Danger of cutting hands!

The planer blades are sharp!

Danger of cutting hands on the planer disk.

Do not touch the rotating planer disk.

Warning

Danger of burning!

The heater is hot (220 °C)!

Danger of burning hands on the hot heater.

Do not touch the heater when on.

EN 407 321XXX

Danger of burning!

▶ Use the handles on the heater.

To move the heater, use the gauntlets! (**EN 407 321XXX**)

Warning

Danger of crushing hands!

The machine slide moves!

Danger of injury to hands in the moving machine slide!

Do not reach inside the machine when moving to the end positions.

1.4 Disposal

Shavings and used hydraulic oil should be disposed of properly.

Observe all the regulations, standards and guidelines applicable in your country.

Separate collection of electronic and electrical waste (from the equipment) has to be ensured through appropriate systems.

Note:

The here below symbol indicating separate collection for electrical and electronic equipment according to 2002/96/CE WEEE directive (Waste Electrical and Electronic Equipment).

2 General

2.1 Introduction

This instruction manual was written for those persons responsible for the operation and care of the KL 630. It is expected and assumed that such persons have read, understood and will abide by the manual in its entirety.

Only with the knowledge contained in this manual can faults on the KL 630 be prevented and trouble-free operation be ensured. It is therefore imperative that the responsible persons are familiar with this manual.

We recommend that this manual be read carefully prior to putting the machine in operation, as we are not liable for any damage or interruptions in operation resulting from failure to comply with this manual.

Should problems nevertheless arise, please contact directly **Georg fischer Omicron s.r.l.** or the nearest service representative.

This manual applies only to the KL 630.

We reserve the right to make the technical changes necessary to improve the KL 630 which may result in deviations from the illustrations and information contained in this manual.

2.2 Range of application

The KL 630 is designed exclusively for the fusion of plastic pipes, fittings and valves in the dimension range d 315–630 mm. Any other use is not authorized. The manufacturer cannot be held liable for damages resulting from unauthorized use; the user bears sole responsibility.

2.3 Copyright

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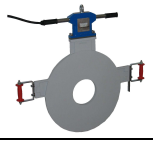
3 Product design, equipment

3.1 KL 630 Versions

All KL 630 versions are included in this operating manual. In the following table are located all the components and technical features for each version.

	Descrizione	TOP-1	TOP-2
	Base machine 230 Kg	✓	✓
	Pipe planer 400 V3~ - 1500 W – 4 A 102 Kg	✓	✓
	Pipe planer 230 V3~ - 1500 W – 7 A 102 Kg	**upon request**	
	Electronic heating element 400 V3~ – 8000 W – 11,5 A 39 Kg	✓	✓
	Electronic heating element 230 V3~ – 8000 W – 20 A 39 Kg	**upon request**	
	Metal storage case	✓	✓
	Hydraulic unit type Hydromat 230 V~ – 1,5 kW – 10 A 31 Kg	✓	✓
	Couple of flexible hoses	✓	✓
	Electric power box 400V3~ – 11000 W – 26 A 16,2 Kg g	✓	
	Electric power box 230V3~ – 11000 W – 36 A 30 Kg	**upon request**	
	Temperature remote controller 400 V3~ – 8000 W max – 16 A max 3,2 Kg		✓

3.2 Standard equipment

- **Base machine** (**TOP1, TOP2**)
  - Hardened and hard chrome-plated guide shafts
  - Third clamp is adjustable
  - Automatic detachment device for heating element
  - Tool and wrench set

- **Hydraulic unit type HYDROMAT** (**TOP 1, TOP2**)
  - Cast-aluminium body, joystick control.
  - Precision manometer Class 1, scale 0–160 bar, diameter 100 mm
  - Freely adjustable pressure regulator, equalization and fusion pressure can be pre-set.
  - Pressure retention valve by joystick
  - Anti-drip, rapid-action coupling with protective caps

- **Electronic heating element type PSO** (**TOP1, TOP2**)
  - PTFE-coating
  - Power multi-cord with wire probe integrated (4 m)
  - Electronically controlled heating element by elecric power box or remote controller.

- **Electric planer** (**TOP1, TOP2**)
  - Chain drive
  - Planer blades sharpened on both sides
  - Locking device against accidental unhooking
  - Safety microswitch against accidental starting

- **Electric power box** (**TOP1**)
  - Made of sheet-steel and protected by a painted tubular frame.
  - All functional and safety components are contained inside: electronic thermostat, relay and differential switch
  - Versions: 230V 3~, 400V 3~

- **Three phase Temperature remote control** (**TOP1, TOP2**)
  - Metal case with Microprocessor assisted remote control
  - Digital display, status indicators, temperature and offset adjustments
  - Versions: only 400V 3~

- **Hydraulic hose package** (**TOP1, TOP2**)
  - With anti-drip, rapid-action couplings

- **Metal Storage case** (**TOP1, TOP2**)
  - Zinc-coated steel case for transport and storage of both heating element and pipe planer

4 Technical specifications

Mod.:	Voltage	Power (max.)	Weight (packaging excluded)
KL 630 Top1	400V 3~	11000 W – 26 A	486 kg
KL 630 Top1	230V 3~	11000 W – 36 A	490 kg
KL 630 Top2	400V 3~	11000 W – 26 A	461 kg

The features of each single component are indicated on 3.1 chapter.

4.1 Characteristic data

The followings characteristic data are common for all the versions:

Machine description:

Plastic butt fusion machine	
Machine type	KL 630
Machine no.	.....
Total piston area	1413 mm^2
Maximun pressure	160 bar
Oil type	LI 46 SHELL (viscosity 46)
Oil quantity	2l
Noise level	70 dB(A)
Packaging type	Wooden crate 116Kg
Packaging	148x138x123cm

5 Transport and assembly

5.1 Packaging

A decisive factor in the choice of packaging is the means of transport. Normally, the machine and all the accessories are delivered in a cardboard box on a pallet or wooden case upon request.

5.2 Sensitivity

Special care must be taken when transporting the KL 630 in order to prevent damage from impact or improper loading and unloading.

All movable parts must be fixed in place.

Transport insurance should be provided for according to the type and duration of transport. Condensation due to large temperature fluctuations and sharp jolts during shipment should be avoided.

Please handle the KL 630 with care.

5.3 Intermediate storage

If the KL 630 is not used immediately upon delivery, the machine must be stored in a safe place and properly covered.

5.4 Scope of delivery

The contents (number of transport crates, pallets, packages) and their condition should be checked immediately upon receipt. Any damage and/or missing parts should be noted right away on the bill of lading and reported to **Georg Fischer Omicron S.r.l.** without delay.

6 Fusion preparation

6.1 General information

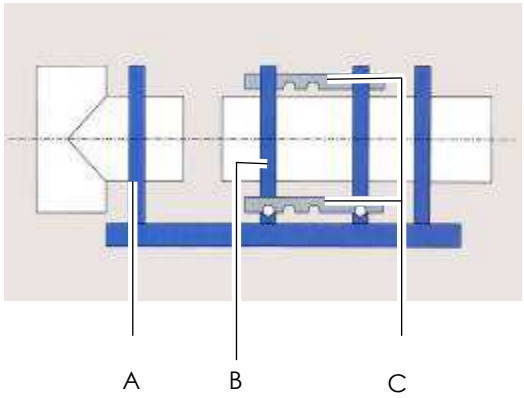
Chapter 6, Fusion Preparation, and Chapte 7.2, The Fusion Process, are based on the instruction sheets and guidelines issued by the DVS.

The fusion area should be protected against the influences of weather (humidity, ambient temperature <+ 5 °C, extreme direct exposure to sun) with such measures as pre-warming the fusion materials, tents, heating.

For optimal use of the KL 630, operating personnel should be specially trained by Omicron. In-depth knowledge of the machine and it´s components and competence rule out handling errors thereby also preventing faulty fusion joints.

6.2 Preparations

The base machine normally is ready for pipes butt-fusion joints. If required to clamp a big T-pieces or to use a flange adapter, move clamping unit B and fix it with the two spacers C. Set planer and heater in between clamping unit A and B.



Clean the couplings on the machine and the hoses.

Connect the hydraulic hoses to the machine and to the hydraulic unit.

If the hydraulic hoses are not used, seal the couplings with the protective caps. Clean the protective caps first.

Replace the heater if the PTFE -coating is damaged. Failure to comply could impair the quality of the fusion weld.

6.3 TOP1 version preparations

1. Connect hydraulic unit, planer and heater to the control box.
2. Connect control box to the power outlet.

Caution **Check the voltage!!**

3. Main power (2) switch on. Control lamp (4) turns white.
4. Set temperature controller (1) to the correct fusion temperature. For guidelines, see the fusion tables in Chapter 7.5.
5. Push heater switch (3). Switch turns green when heater on.

   Light on controller turns red during heating and starts blinking when setting temperature is reached.

Advise **Before beginning with the first fusion, we recommend waiting approx. 10 minutes after the set fusion temperature has been reached to allow for even heat distribution.**

6. Check the fusion surfaces with a quick-indication temperature measurement device for the set temperature.

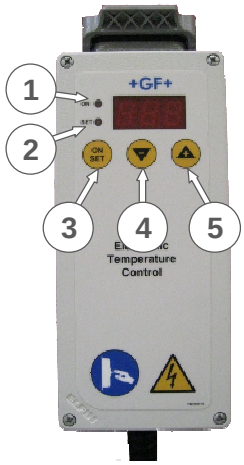
6.4 TOP2 versions preparations

1. Connect hydraulic unit and planer to the power outlet or power generator.
2. Connect Heating element to the temperature regulator

Caution **Check the voltage!**

The generator has to be started before connecting the consumer and must supply a constant output tension! Any sudden changes could compromise the correct welding result and/or damage the control.

3. Connect temperature regulator to the power outlet or power generator.
4. After the temperature regulator is connected to the power supply, the current heating element temperature is shown on the display. The LED (1) is ON and indicates the correct connection of the heating element. If the temperature probe is damaged or the signal is interrupted or the heating element is not connected properly, the display will show the error "tc, E40". In that case you have to disconnect the power supply from the regulator and connect the heating element.
5. Check the temperature of the heater plate surface with a quick-indication temperature measurement according to the set temperature.



6.4.1 Functions of the temperature regulator

The LED (1) is permanent ON when the power is connected and the display is showing the current heating element temperature. When flashing the temperature is regulated at the set point.

The LED (2) is ON when the set temperature is indicated on the display

Button (3) provides to switch ON and OFF the regulator, access to adjust the set temperature and is used to confirm data.

Button (4) to decrease the value (set-point, offset)

Button (5) to increase the value (set-point, offset)

Button (5) and (3) together allows the adjustment of the offset

Advise **Before beginning with the first fusion, we recommend waiting approx. 10 minutes after the set fusion temperature has been reached to allow for even heat distribution.**

6.4.2 Heating element temperature adjustment

After the heating element is connected and the temperature regulator is supplied with power, push the button **"ON SET"** (3) for about 5-6 seconds. The LED 2 starts flashing, indicating that the programming mode is activated, the display indicates the last adjusted set point.

To change the value of the set point use the buttons UP (5) and DOWN (4), the value is changing immediately. To confirm the set point press **"ON SET"** (3) or wait for approximately 10 seconds and the display will change automatically to the indication of the current heating element temperature.

Advise After the connection to the power supply, the unit of measurement (°C or F) is shown for few seconds. When it is shown, by pushing "ON SET" (3) + DOWN (4) together, you can change the unit of measurement (°C – F). Enter into the menu and change the unit of measurement using the buttons UP (5) and DOWN (4). Press "ON SET" (3) to confirm.

Advise The range of set temperature is from 100°C to 270°C

Any mistake occurred in the temperature set up can be corrected repeating the set up procedure.

6.4.3 Temperature offset adjustment

Such adjustment is basically a calibration of the actual temperature detected by the heating element probe (displayed on the temperature regulator) in respect of the actual temperature measured on the surface of the heater plate.

In order to set-up the temperature offset, the programming mode should be activated by pressing together the buttons **(5)** and **(3)** for about 5–6 sec. LED (1) and (2) starts flashing and the display shows the value of the preset offset value.

By pressing the button **(5)** or (4) the value could be increased or decreased, the range is between +/- 25°C.

Advise If the difference between the measured temperature on the heater plate surface and the displayed temperature on the temperature regulator is out of the range +/- 25°C, please contact your next service station.

With (5) the value of the offset will be confirmed.

Example: offset calibration.

Connect the temperature regulator to the heating element and to the power supply. Set up the heating element temperature, i.e. 220 °C and wait until approximately 10 minutes for even temperature distribution on the heater plate. Supposing that the measured actual temperature of the heating element is 205°C. The difference with the set-up temperature (220°C) is therefore 5°C. By setting-up an offset of 5°C the heat dissipations will be compensated.

6.4.4 Error Message of the temperature regulator

The ERC controls different possible errors or difficulties concerning the connections and the power supply. As soon as an error occurs the ERC is providing the corresponding error message on the display. To clear the message the ERC has to be switched OFF and ON.

Following the list of error messages with a description, possible causes and solutions.

Error code	Possible causes	Solution
E40 Heater plate missing	Heating element not connected	Check if the heating element is connected correctly, switch Off and On the unit again
	Sensor circuit interrupted	Contact service
E41 Resistance interrupted	Circuit of resistance interrupted	Contact service
E90 Push button pressed during starting the ERC	During the start up of the ERC, one or more buttons are activated	Check if one or more buttons damaged or active. Restart the ERC.
E98/E99 Error of memory		Contact service

7 Fusion

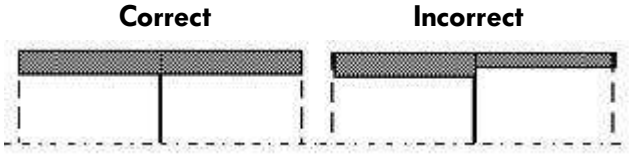
7.1 The basics of butt fusion

For butt fusion with a heating element, the parts to be joined (pipe/pipe, pipe/fitting or fitting/fitting) are heated to fusion temperature in the fusion area and are fused under pressure without the use of additional materials.

The heating element butt fusion joint must be done with a controllable equalization pressure. See pressure/time tables, Chapter 7.5

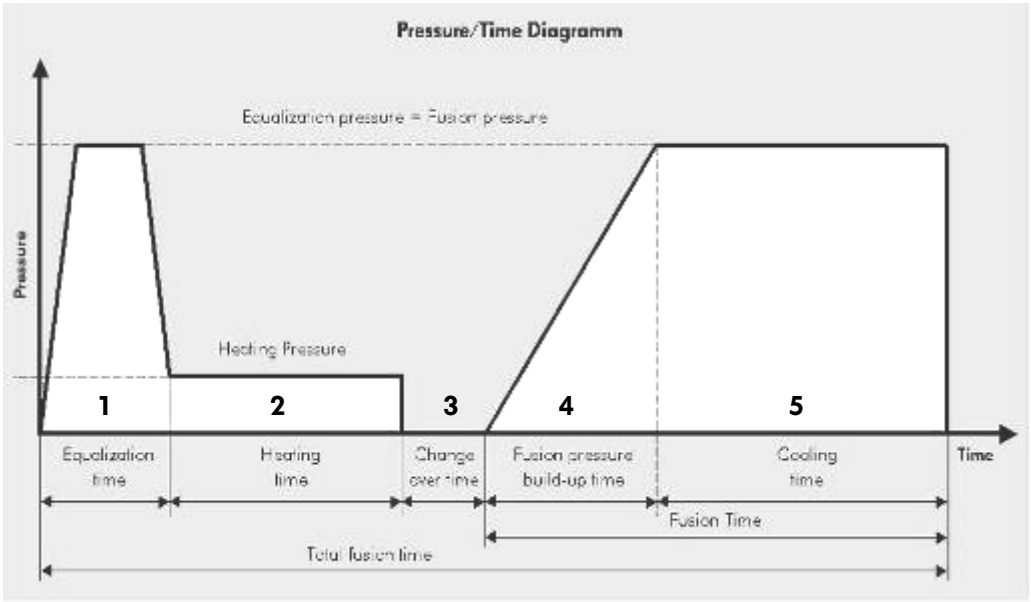
Attention **Only the same type of materials is to fuse.**

The wall thicknesses in the fusion area need to be the same.



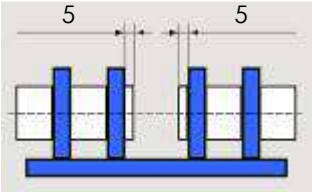
Only the same wall thicknesses in the fusion area!

Equalization- and fusion pressure are identical. The heat soak pressure is significant lower, but the contact between the pipe/fitting and the heating element needs to be ensured.



7.2 The fusion process

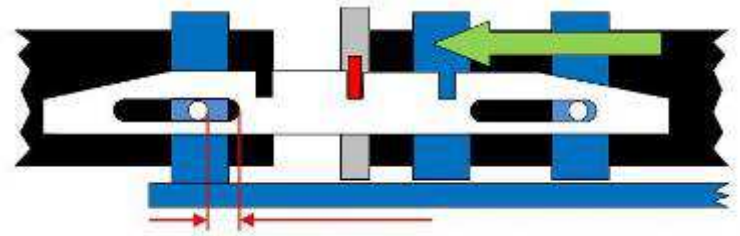
In order to weld pipes and/or fittings d < 630 mm, insert matching clamping half shells and fasten them with the screws.



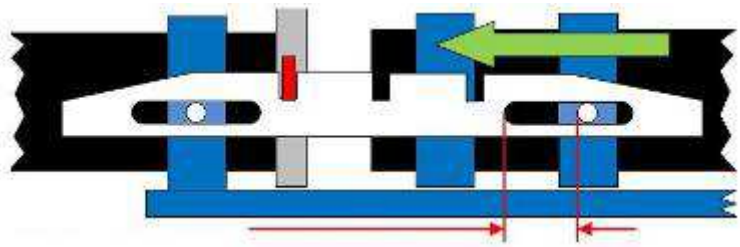
Clamp pipe/pipe, pipe/fitting or fitting/fitting in the clamping element. Pipe and/or fitting ends need to reach out at least 5 cm from the pipe clamps in order to perform a proper weld. Make sure they are exactly aligned in the axial direction.

Warning

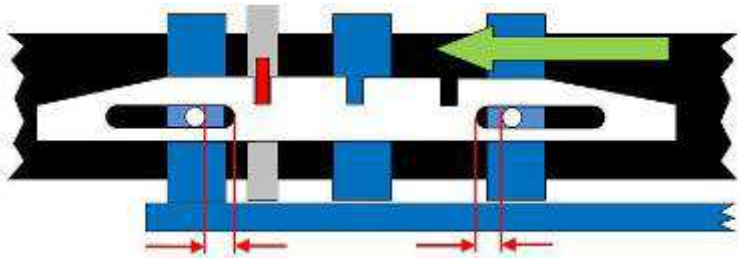
Here below some recommendations in order to avoid damages to the heating element when it is working in combination with the pulling off mechanism:



Must be a gap here during the complete carriage stroke when moved pipe is in contact with the heating plate.



Must be a gap here during the complete carriage stroke when the steady pipe is in contact with the heating plate.



<u>Gap must be 20 mm</u> on both sides at final working position!

If necessary, the pipes/fittings can be turned or the clamping force changed with the knurled handles to achieve a better clamping position.

Adjustable roller supports or a floating suspension assist horizontal movement of the pipes clamped in the slide.

7.2.1 Calculating drag pressure

Pericolo

Danger of crushing hands!

Machine slide moves!

Danger of injury in the moving machine slide!

When moving to the end positions do not reach into the machine.

adjustment pressure valve

The machine drag pressure must be calculated before each new fusion!

1. Open machine to stop.
2. Reduce pressure with the fine-adjustment pressure valve (turn counter-clockwise).
3. Increase pressure with the fine-adjustment pressure valve while simultaneously pulling control lever in the “close ><” direction (turn clockwise).
4. Check the movement pressure on the manometer. As soon as the machine slide moves evenly.

7.2.2 Calculating of the fusion pressure

Attention **The fusion pressure is the sum of the "table value + movement pressure"**

(e.g. 44 bar* + 7 bar = 51 bar)

* for HD–PE d 400 mm, SDR 11see Chapter 7.5, Time/Pressure diagram

7.2.3 Adjusting of the fusion pressure

5. Open the machine.
6. Reduce pressure with the fine-adjustment pressure valve (turn counter-clockwise).
7. Move control lever towards "close ><" position and increase pressure on the pressure valve (turn clockwise) until clamping carriage moves smoothly.
8. Adjust fusion pressure with the fine adjustment pressure valve as soon as both pipe ends are in contact (turn clockwise) (par. 7.7.2).

If the fusion pressure is set too high, re-adjust:

1. Open the machine.
2. Turn the fine-adjustment pressure valve approx. 3 revolutions to the left.
3. Start fusion pressure again and set as described above.

7.2.4 Preparing the fusion surfaces

Warning

Danger of cutting hands!

Sharp planer blades!

Danger of injury to hands if the planer disk is touched.

Do not touch the rotating planer disk.

"Emergency Stop" function!

By pressing the "Emergency Stop" button, power to the planer motor is immediately interrupted. The planer motor can be started by pressing the white toggle switch.

1. Open the machine.
2. Insert planer.
3. **Snap in the safety lock.**

   This prevents the planer unit from jumping out of the machine during planing.

4. Plane the facing surface of pipes/fittings until shavings are turned out in ribbons which are the same width as the pipe wall thickness. The max. planer pressure is 10 bar above the drag resistance.

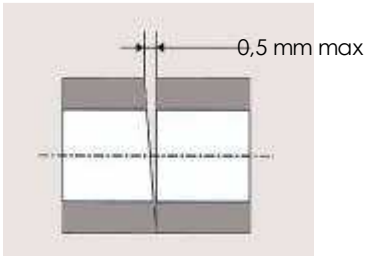
Caution **Constant high pressure when facing (15-20 bar over dragging pressure), can cause damage on the drive and/or the motor of the facer.**

5. Switch facer off. Remove facer of the machine and place in the case.

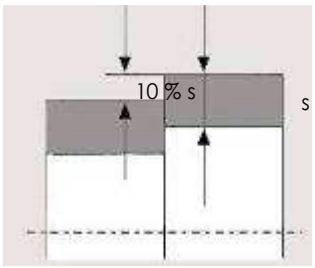
Attention **To make sure the gap and the wall offset are in order, both sides must always be planed!**

6. lose machine until pipes/fittings. Touch each other. Maximum tolerance of the gap is 0.5 mm:

Outside diameter mm	**Gap max.** mm
Up to 200	0,3
200 ÷ 400	0,5
over 400	1



7. Check the alignment at the same time.
8. The wall offset on the outside may not exceed 10 % of the wall thickness.



9. If it is larger, the pipe/fitting can be turned or the clamping force on the inner clamping units can be changed to achieve a better clamping position.
10. In this case, the fusion surfaces need to be remachined.
11. Remove shavings which have fallen into the pipe e.g with a brush. Before each fusion, the fusion surfaces must be cleaned with lint-free paper and grease-free cleaner, e.g. trichloroethylene or industrial alcohol (Tangit KS).

Attention **Never touch the fusion surfaces with your hand after cleaning!**

7.2.5 Fusion process

The PTFE coating of the heating element must be protected from mechanical damage and/or dirt.

Suggest **Heating element with demaged PTFE -covering has to be replaced. Non-doservance affects the quality of the joining, see Chapter 9.1**

Warning

Danger of burning!

The heater is hot (220 °C)!

Danger of burning hands on the hot heater.

Do not touch the heater when on.

Use the handles on the heater.

For fusion parameters, see Chapter 7.4.

EQUALIZATION (fusion bead created on both sides)

1. Swivel the heating element into the machine.
2. Move the parts to be joined together, push the control lever in the "close ><" direction..
3. Until the preset pressure has been reached, remain in this position and hold 15 sec..
4. Slowly put the control lever back to 0 position.

Equalization pressure = fusion pressure

RELEASE (reduction of equalization pressure after formation of the fusion bead)

1. After formation of the equalization bead around the entire pipe circumference (check fusion chart chapter 7.5), move control lever towards "open <>" (lever position: halfway between neutral and fully open) until pressure on manometer shows nearly 0.

Caution **Do not open the machine!**

Pipes have to keep contact with the heating element.

2. Start timer with preset heat soak time.

Suggest **Use a Timer to check the correct heating time.**

HEAT SOAK (of the fusion material)

For PE: 10 x wall thickness in mm
For PP: Interpolate the intermediate values.
For PVDF: 10 x wall thickness in mm plus 40 sec.

The heat soak pressure is kept constant by the hydraulic system while the heat soak time.

CHANGE-OVER

Attention **The change-over time should be as short as possible.**

When the heat soak has ended:

- Push the control lever in the "open <>" direction.

- Immediately remove the heating element from the machine.

Suggest **Place the heating element in the storage case without damaging or contaminating the fusion surfaces.**

JOINING (Fusion process)

Push joystick in "close ><" position until pipes touch each other and the preset fusion pressure is reached. Hold this position for 15 sec. Then slowly return the joystick in to 0 -position.

The surfaces to be joined are fused.

COOLING (The fusion joint)

After the fusion pressure has been reach, keep the pressure for the all cooling time.

Attention **The cooling time must always be observed.**

The use of cooling agents is not permitted during cooling!

RELEASING (the hydraulic system)

Warning

Danger of bruising!

Release the pressure of the hydraulic system before opening the clamping stations.

Move control lever towards "open <>" (lever position: halfway between neutral and fully open) until pressure on manometer shows nearly 0.

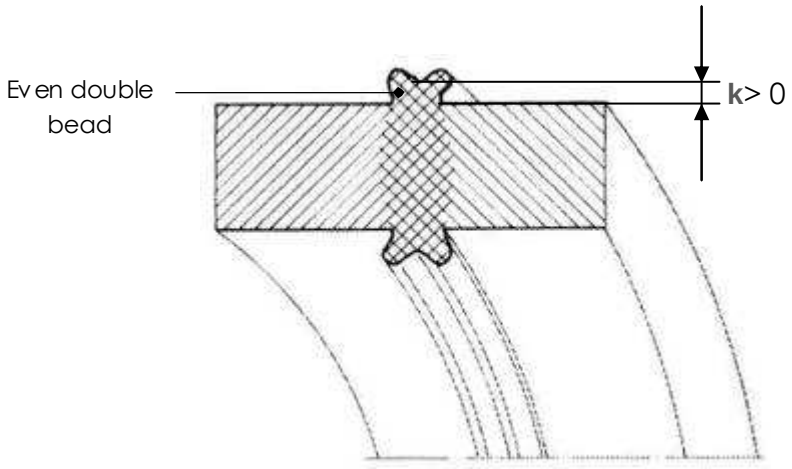
Caution **Do not open machine slides.**

Open clamping station before removing welded pipes/fittings.

Caution **All fusion joints must have cooled completely before the pressure test is performed. This is generally the case approx. 1 hour after the last fusion operation.**

7.3 Visual check of welding bead

Immediately after removing the welded pipes/fittings visually check the part for correct cultivated double bead and the k-value.



7.4 Example

Pipe/fitting	PE100	Heater temperature	220 °C
Pipe outer diameter	400 mm	Drag resistance	7 bar
Pressure rating	SDR 11	Table value	44 bar
Wall thickness	36.3 mm	Adjustment value on hydraulic unit	51 bar

Equalize with a pressure of 51 bar until a bead height of 3.0 mm results (column 1)

Heat soak for 363 sec with a pressure of 0.01 N/mm² (column 2)

Change-over within max. 16 sec (column 3)

Join for max. 19 sec (column 4)

Cooling for 44 min (column 5)

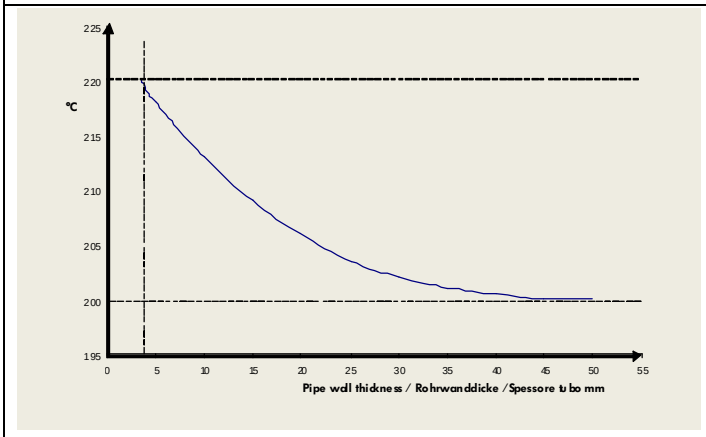
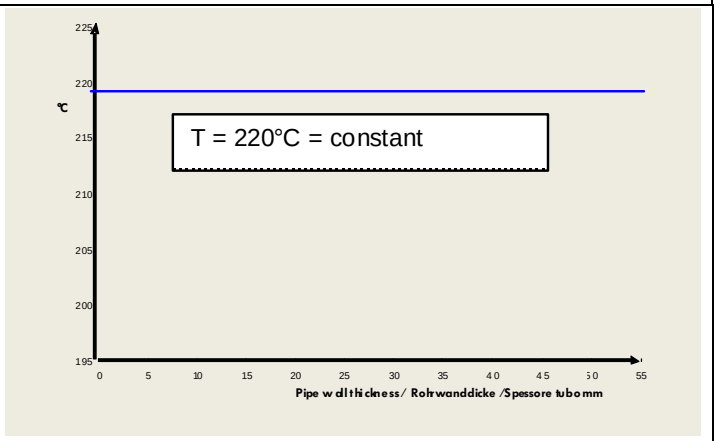
7.5 Fusion data

Heating element butt fusion of PE

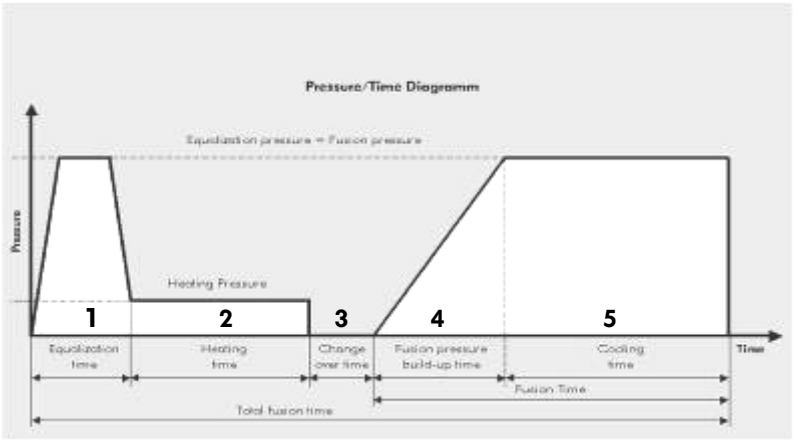
Fusion table/DVS 2207/1 guidelines

	1	2	3	4	5
Nominal wall thickness	**Equalize** Bead height on heating element after equalization (equalization at 0.15N/mm²)	**Heat soak** Heat soak time = 10 x wall thickness (heat soak at 0.01 N/mm²)	**Change-over**	**Join** Time until max pressure reached	**Cooling** Cooling time at fusion pressure p = 0.15 N/mm² ± 0.01
mm	mm (min.value)	sec	sec (max. time)	sec	min (min.value)
Fino a 4.5	0.5	45	5	5	6
4.5 – 7.0	1.0	45 – 70	5 – 6	5 – 6	6 – 10
7.0 – 12.0	1.5	70 – 120	6 – 8	6 – 8	10 – 16
12.0 – 19.0	2.0	120 – 190	8 – 10	8 – 11	16 – 24
19.0 – 26.0	2.5	190 – 260	10 – 12	11 – 14	24 – 32
26.0 – 37.0	3.0	260 – 370	12 – 16	14 – 19	32 – 45
37.0 – 50.0	3.5	370 – 500	16 – 20	19 – 25	45 – 60
50.0 – 70.0	4.0	500 – 700	20 – 25	25 – 35	60 – 80

Curve for standard values for heater temperatures in relation to pipe wall thickness

HD-PE (PE 80)	PE 100
	

Process steps for heating element butt fusion



Heating element butt fusion of PE

Time/Pressure tables according to DVS 2207/1

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	7.7	8.7	9.8	11.0	12.3	13.7	15.4
	Fusion surface	mm²	7434	9465	12013	15171	18846	23513	29735
S 20	Equalization/fusion pressure	bar	8	10	13	16	20	25	32
	Bead height	mm	1.5	1.5	1.5	1.5	2.0	2.0	2.0
SDR 41	Heating pressure	bar	1	1	1	1	2	2	2
	Heat soak time	sec	77	87	98	110	123	137	154
	Change-over time	sec	6	6	7	8	8	8	9
	Pressure build-up time	sec	6	6	7	8	8	8	9
	Cooling time	min	11	12	13	15	16	18	20

Heating element butt fusion of PE

Time/Pressure tables according to DVS 2207/1

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	9.7	10.9	12.3	13.8	15.3	17.2	19.3
	Fusion surface	mm²	9304	11783	14981	18911	23298	29330	37028
	Equalization/fusion pressure	bar	10	13	16	20	25	31	39
S 16	Bead height	mm	1.5	1.5	2.0	2.0	2.0	2.0	2.5
SDR 33	Heating pressure	bar	1	1	1	2	2	2	3
	Heat soak time	sec	97	109	123	138	153	172	193
	Change-over time	sec	7	8	8	8	9	9	10
	Pressure build-up time	sec	7	8	8	9	10	10	11
	Cooling time	min	13	15	16	18	20	22	24

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	12.1	13.6	15.3	17.2	19.1	21.4	24.1
	Fusion surface	mm²	11514	14587	18491	23387	28856	36210	45874
	Equalization/fusion pressure	bar	12	15	19	25	31	38	49
S 12.5	Bead height	mm	2.0	2.0	2.0	2.0	2.5	2.5	2.5
SDR 26	Heating pressure	bar	1	1	2	2	2	3	4
	Heat soak time	sec	121	136	153	172	191	214	241
	Change-over time	sec	8	8	9	9	10	10	11
	Pressure build-up time	sec	8	9	10	10	11	12	13
	Cooling time	min	16	18	20	22	24	27	30

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	14.4	16.2	18.2	20.5	22.8	25.5	28.7
	Fusion surface	mm²	13599	17243	21830	27661	34181	42819	54215
	Equalization/fusion pressure	bar	14	18	23	29	36	46	58
S 10.5	Bead height	mm	2.0	2.0	2.0	2.5	2.5	2.5	3.0
SDR 22	Heating pressure	bar	1	1	2	2	3	4	4
	Heat soak time	sec	144	162	182	205	228	255	287
	Change-over time	sec	9	9	9	10	11	12	13
	Pressure build-up time	sec	9	10	11	12	13	14	15
	Cooling time	min	19	21	23	26	28	31	35

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	15.0	16.9	19.1	21.5	23.9	26.7	30.0
	Fusion surface	mm²	14137	17951	22856	28943	35748	44733	56549
	Equalization/fusion pressure	bar	15	19	24	31	38	48	60
S 10	Bead height	mm	2.0	2.0	2.5	2.5	25.	3.0	3.0
SDR 21	Heating pressure	bar	1	2	2	2	3	4	4
	Heat soak time	sec	150	169	191	215	239	267	300
	Change-over time	sec	9	9	9	10	11	12	13
	Pressure build-up time	sec	9	10	11	12	13	14	15
	Cooling time	min	19	22	24	27	30	33	37

Heating element butt fusion of PE

Time/Pressure tables according to DVS 2207/1

	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	17.9	20.1	22.7	25.5	28.4	31.7	35.7
	Fusion surface	mm²	16707	21148	26907	34007	42077	52613	66654
	Equalization/fusion pressure	bar	18	22	29	36	45	56	71
S 8.3	Bead height	mm	2.0	2.5	2.5	2.5	3.0	3.0	3.0
SDR 17.6	Heating pressure	bar	1	2	2	3	3	4	5
	Heat soak time	sec	179	201	227	255	284	317	357
	Change-over time	sec	10	10	11	12	13	14	15
	Pressure build-up time	sec	11	12	13	14	15	17	19
	Cooling time	min	23	25	28	31	35	39	43

	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	18.7	21.1	23.7	26.7	29.7	33.2	37.4
	Fusion surface	mm²	17407	22133	28018	35507	43881	54946	69628
	Equalization/fusion pressure	bar	18	23	30	38	47	58	74
S 8	Bead height	mm	2.0	2.5	2.5	3.0	3.0	3.0	3.5
SDR 17	Heating pressure	bar	1	2	2	3	3	4	5
	Heat soak time	sec	187	211	237	267	297	332	374
	Change-over time	sec	10	10	11	12	13	14	16
	Pressure build-up time	sec	11	12	13	14	15	17	19
	Cooling time	min	24	26	29	33	36	41	45

	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	23.2	26.1	29.4	33.1	36.8	41.2	46.3
	Fusion surface	mm²	21268	26968	34230	43352	53551	67150	84903
	Equalization/fusion pressure	bar	23	29	36	46	57	71	90
S 6.3	Bead height	mm	2.5	3.0	3.0	3.0	3.0	3.5	3.5
SDR 13.6	Heating pressure	bar	2	2	3	3	4	5	7
	Heat soak time	sec	232	261	294	331	368	412	463
	Change-over time	sec	11	12	13	14	16	18	19
	Pressure build-up time	sec	11	14	15	17	19	21	23
	Cooling time	min	29	32	36	40	45	50	55

Heating element butt fusion of PE

Time/Pressure tables according to DVS 2207/1

	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	28.6	32.2	36.3	40.9	45.4	50.8	57.2
	Fusion surface	mm²	25733	32654	41476	52566	64839	81265	102932
	Equalization/fusion pressure	bar	27	35	44	56	69	86	109
S 5	Bead height	mm	3.0	3.0	3.0	3.5	3.5	4.0	4.0
SDR 11	Heating pressure	bar	2	3	3	4	5	6	8
	Heat soak time	sec	286	322	363	409	454	508	572
	Change-over time	sec	13	14	16	17	18	20	22
	Pressure build-up time	sec	15	17	19	21	23	25	27
	Cooling time	min	35	39	44	49	55	60	67

	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	35.2	39.7	44.7	50.3	55.8	62.5	–
	Fusion surface	mm²	30941	39325	49894	63161	77869	97684	–
	Equalization/fusion pressure	bar	33	42	53	67	83	104	–
S 4	Bead height	mm	3.0	3.5	3.5	4.0	4.0	4.0	–
SDR 9	Heating pressure	bar	2	3	4	5	6	7	–
	Heat soak time	sec	352	397	447	503	558	625	–
	Change-over time	sec	15	17	18	20	22	23	–
	Pressure build-up time	sec	18	20	23	25	28	31	–
	Cooling time	min	43	48	54	60	66	73	–

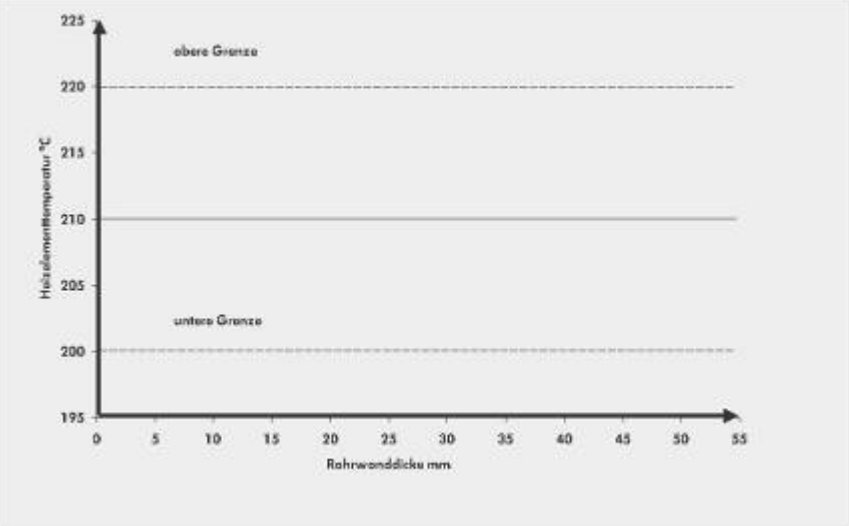
	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	43.1	48.5	54.7	61.5	68.3	–	–
	Fusion surface	mm²	36816	46701	59338	75061	92630	–	–
	Equalization/fusion pressure	bar	39	50	63	80	98	–	–
S 3.2	Bead height	mm	3.5	3.5	4.0	4.0	4.0	–	–
SDR 7.4	Heating pressure	bar	3	4	4	6	7	–	–
	Heat soak time	sec	431	485	547	615	683	–	–
	Change-over time	sec	18	20	22	23	25	–	–
	Pressure build-up time	sec	22	25	27	31	35	–	–
	Cooling time	min	52	58	65	72	78	–	–

Heating element butt fusion of PP

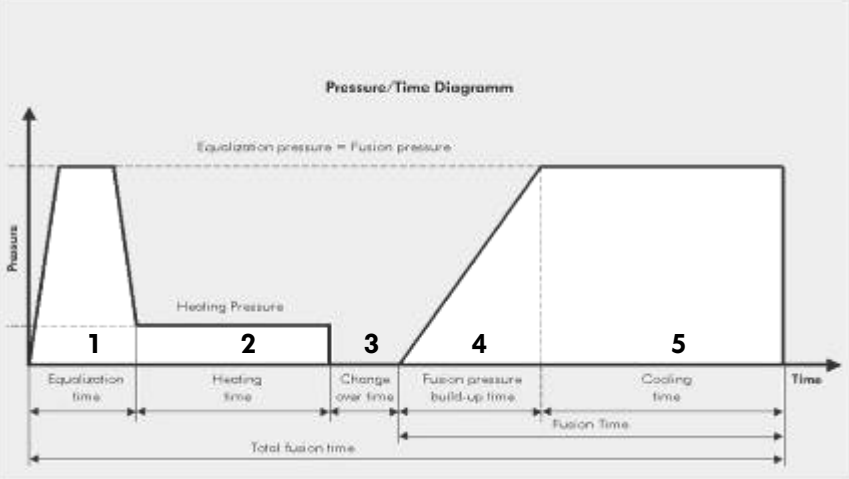
Fusion table/DVS 2207/11 guidelines
Heating element temperature 210 °C ± 10 °C

	1	2	3	4	5
Nominal wall thickness mm	**Equalize** Bead height on the heating element after equalization time (equalization at 0.10 N/mm²) mm (min.value)	**Heat soak** (heat soak ≈ 0.01 N/mm²) S	**Change-over** S (max. time)	**Join** Time until max pressure reached S	**Cooling** Cooling time at fusion pressure (p = 0.10 N/mm² ± 0.01) min (min.value)
Fino a 4.5	0.5	up to 135	5	6	6
4.5 – 7.0	0.5	135 – 175	5 – 6	6 – 7	6 – 12
7.0 – 12.0	1.0	175 – 245	6 – 7	7 – 11	12 – 20
12.0 – 19.0	1.0	245 – 330	7 – 9	11 – 17	20 – 30
19.0 – 26.0	1.5	330 – 400	9 – 11	17 – 22	30 – 40
26.0 – 37.0	2.0	400 – 485	11 – 14	22 – 32	40 – 55
37.0 – 50.0	2.5	485 – 560	14 – 17	32 – 43	55 – 70

Curve for standard values for heater temperatures



Process steps for heating element butt fusion



Heating element butt fusion of PP

Time/Pressure tables according to DVS 2207/11

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	7.7	8.7	9.8	11.0	12.3	13.7	15.4
	Fusion surface	mm²	7434	9465	12013	15171	18846	23513	29735
S20	Equalization/fusion pressure	bar	5	7	8	11	13	17	21
SDR 41	Bead height	mm	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Heating pressure	bar	1	1	1	1	1	2	2
PN 2.5	Heat soak time	sec	185	199	214	231	249	266	286
	Change-over time	sec	6	6	7	7	7	8	8
	Pressure build-up time	sec	6	8	9	10	11	12	14
	Cooling time	min	13	15	16	18	20	22	25

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	9.7	10.9	12.3	13.8	15.3	17.2	19.3
	Fusion surface	mm²	9304	11783	14981	18911	23298	29330	37028
S 16	Equalization/fusion pressure	bar	7	8	11	13	16	21	26
SDR 33	Bead height	mm	1.0	1.0	1.0	1.0	1.0	1.0	1.5
	Heating pressure	bar	1	1	1	1	2	2	3
PN 3.2	Heat soak time	sec	213	230	249	267	285	308	333
	Change-over time	sec	7	7	7	7	8	8	9
	Pressure build-up time	sec	9	10	11	13	14	15	17
	Cooling time	min	16	18	20	23	25	27	30

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	12.1	13.6	15.3	17.2	19.1	21.4	24.1
	Fusion surface	mm²	11514	14587	18491	23387	28856	36210	45874
S 12.5	Equalization/fusion pressure	bar	8	10	13	17	20	26	33
SDR 26	Bead height	mm	1.0	1.0	1.0	1.0	1.5	1.5	1.5
	Heating pressure	bar	1	1	1	2	2	3	3
PN 4	Heat soak time	sec	246	264	285	308	331	354	381
	Change-over time	sec	7	7	8	8	9	9	10
	Pressure build-up time	sec	11	12	14	15	17	19	21
	Cooling time	min	20	23	25	27	30	33	37

	Pipe outer diameter		315	355	400	450	500	560	630
	Wall thickness	mm	17.9	20.1	22.7	25.5	28.4	31.7	35.7
	Fusion surface	mm²	16707	21148	26907	34007	42077	52613	66654
S 8.3	Equalization/fusion pressure	bar	12	15	19	24	30	37	47
SDR 17.6	Bead height	mm	1.0	1.5	1.5	1.5	2.0	2.0	2.0
	Heating pressure	bar	1	2	2	2	3	4	5
PN 6	Heat soak time	sec	317	341	367	395	419	444	475
	Change-over time	sec	9	9	10	11	11	12	13
	Pressure build-up time	sec	16	18	20	22	24	27	31
	Cooling time	min	28	32	35	39	43	48	53

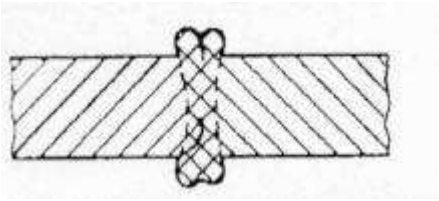
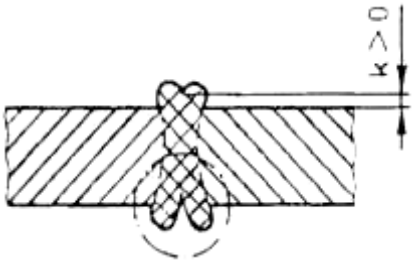
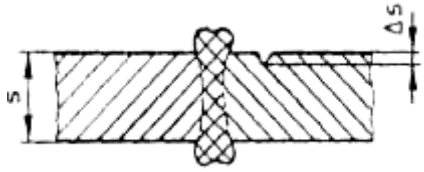
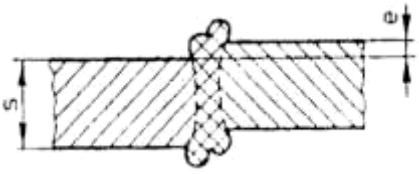
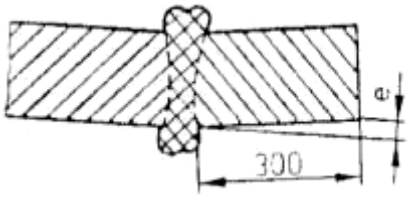
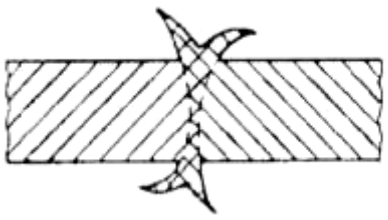
Heating element butt fusion of PP

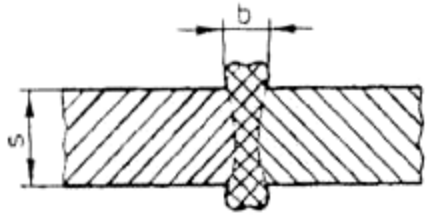
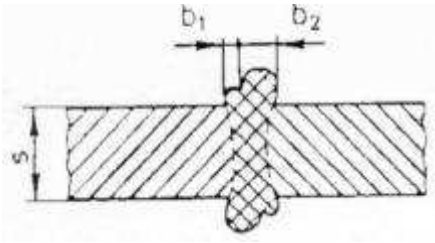
Time/Pressure tables according to DVS 2207/11

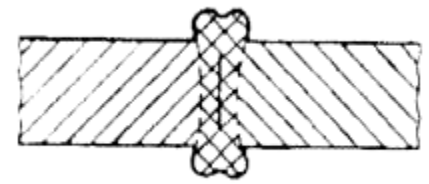
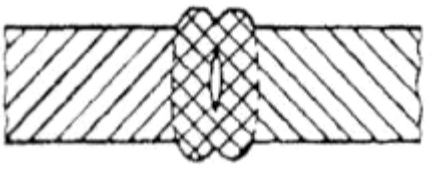
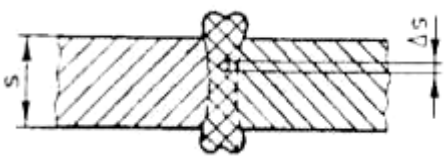
	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	28.6	32.2	36.3	40.9	–	–	–
	Fusion surface	mm²	25733	32654	41476	52566	–	–	–
S 5	Equalization/fusion pressure	bar	18	23	29	37	–	–	–
SDR 11	Bead height	mm	2.0	2.0	2.0	2.5	–	–	–
	Heating pressure	bar	2	2	3	4	–	–	–
PN 10	Heat soak time	sec	420	448	480	508	–	–	–
	Change-over time	sec	12	13	14	15	–	–	–
	Pressure build-up time	sec	24	28	32	35	–	–	–
	Cooling time	min	44	48	54	60	–	–	–

	Pipe outer diameter		**315**	**355**	**400**	**450**	**500**	**560**	**630**
	Wall thickness	mm	43.1	48.5	–	–	–	–	–
	Fusion surface	mm²	36816	46701	–	–	–	–	–
S 3.2	Equalization/fusion pressure	bar	26	33	–	–	–	–	–
SDR 7.4	Bead height	mm	2.5	2.5	–	–	–	–	–
	Heating pressure	bar	3	3	–	–	–	–	–
PN 16	Heat soak time	sec	520	555	–	–	–	–	–
	Change-over time	sec	15	17	–	–	–	–	–
	Pressure build-up time	sec	37	42	–	–	–	–	–
	Cooling time	min	62	68	–	–	–	–	–

8 Failure analysis

Feature	Description	Evaluation group		
		I	II	III
External state of joint				
	Cracks running length-wise or cross-wise to weld. They may be located: • In the weld • In base material • In heat affected zone	Not Permissible	Not Permissible	Not Permissible
	Continuous or local notches length-wise to weld with notch root in base material, caused by, for example: : • Insufficient joint pressure • Warming-up time too short • Cooling time too short	Not Permissible	Not Permissible	Not Permissible
	Notches in edge of base material, length-wise or cross-wise to weld, caused by, for example: • Clamping tools • Incorrect transport • Fault in edge preparation	Locally permissible if ending flat and Δs ≤ 0.1s but max. 0.5mm	Locally permissible if ending flat and Δs ≤ 0.1s but max. 1 mm	Permissible if ending flat and Δs ≤ 0.15s but max. 5mm
	Joint faces are displaced relative to one another or thickness variations are not adjusted	Permissible if ≤0.1s but max 2 mm	Permissible if ≤0.15s but max 4 mm	Permissible if ≤0.2s but max 5 mm
	For example: • – Machine fault • – layout fault	Permissible if e ≤1 mm	Permissible if e ≤ 2 mm	Permissible if e ≤ 4 mm
	Excessive and sharp edged welding flash over part all of weld length or weld girth due to wrong welding parameters, especially caused by an excessive joint pressure with polyolefin only	Not Permissible	Not Permissible	Not Permissible

Feature	Description	Evaluation group		
		I	II	III
External state of joint				
	Welding flash too wide or too narrow over part or all of weld length, caused by, for example: • incorrect warming-up time • incorrect heating-element temperature • incorrect joint pressure	See pg.14 DVS 2202-1 guidelines	See pg.14 DVS 2202-1 guidelines	See pg.14 DVS 2202-1 guidelines
	Non angular joint plane, leading to variations in form of welding flash over part or all of weld length, caused by, for example: • edge preparation faults • incorrect welding unit	Permissible if b1≥ 0,7xb2	Permissible if b1≥ 0,6xb2	Permissible if b1≥ 0,5xb2

Feature	Description	Evaluation group		
		I	II	III
Internal state of joint				
	No fusion or incomplete fusion on joint faces, over part or the whole of weld cross-section caused by, for example: • contaminated joint faces • oxidized joint faces • excessive reversal time • heating element temperature too low • heating element temperature too high	Not Permissible	Not Permissible	Not Permissible
	Hollow space in joint planes caused by, for example: • Insufficient joint pressure • Insufficient cooling time	Not Permissible	Not Permissible	Not Permissible
	Isolated, numerously dispersed or locally concentrated pores or inclusions caused by, for example: • Vapor formation during welding • Contaminated heating element	Permissible if Δs ≤ 0.05 x s	Permissible if Δs ≤ 0.10 x s	Permissible if Δs ≤ 0.15 x s

9 Maintenance

The KL 630 should be checked and cleaned periodically.

Normal care of the KL 630 is limited to periodic cleaning of the outside.

9.1 Replacement of worn parts

- **PTFE coating of the heating element:**

  Clots, cracks or other damage:

  – heating element needs to be recoated.

  – send the heating element to the nearest service center or to the manufacturer.

- **Planer blades:**

  The planer blades on the planer should be replaced periodically. For order number see spare parts list.

Caution **Danger of injury!**

Danger of cutting if the planer blades, which are sharp on both sides, are touched.

9.2 Hydraulic system

- The hydraulic connections on the machine and on the hydraulic unit need regular cleaning.
- When not in use, the hydraulic connections on the KL 630 and on the hydraulic unit should be protected with the protective caps.

9.3 Hydraulic unit

Oil tank ECO1, ECO2

- **Oil level check**

  Check the hydraulic oil level regularly. If necessary, refill the hydraulic oil according to Chapter 4.1.

- **Changing the hydraulic oil**

  After 3000 operating hours hydraulic oil need to be changed.

To replace the hydraulic oil, proceed as follows:

1. Make sure that the hydraulic pressure is on zero level by checking the pressure gauge. If necessary, discharge all pressure completely.
2. Place the Hydraulic unit in a position higher than floor level (on a table for example). Remove the cap on the tank.
3. Insert a flexible hose of a suitable length into the tank and discharge all oil by creating an appropriate depression in the hose, for example: by using a suitably sized syringe.

Attention **do not create depression by sucking on the hose directly with the mouth as this could lead to swallowing oil.**

4. Waste oil must be collected in an appropriate container and eliminated in the correct manner according to current legislation.

Attention **Do not dispose of waste oil in the environment: danger of pollution.**

5. It is forbidden to pour off the oil by placing the unit on a slope. Proceed according to the instructions above only.

Attention **danger of tipping and falling.**

6. Fill the tank with new oil up to the indicated level (max. 2 liters). This oil must respect the required characteristics.

Attention **To replace the oil, it is strongly advisable to use oils with characteristics that are the same or better than those described in the technical characteristics. Make sure that oil replacement is performed in a clean area. Take care not to contaminate the oil with water, dirt and/or foreign matter. Any foreign residue present in the hydraulic oil will provoke serious damage to the control unit and/or the welding machine.**

We recommend having a service booklet to record maintenance work for each KL 630 machine.

example:

Date	Service	Repair	Comments
15.09.2003	Georg Fischer Omicron		Everything OK
25.10.2003	Georg Fischer Omicron	Heating element	Cable replaced

10 Customer Service

There is a separate spare parts list for ordering replacement parts.

If repairs are necessary, please contact your local representative.

Please indicate the following information:

- Customer name.
- Product description
- Machine type (code)
- Machine no. (see type plate)
- Spare part no. (see spare parts list).

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