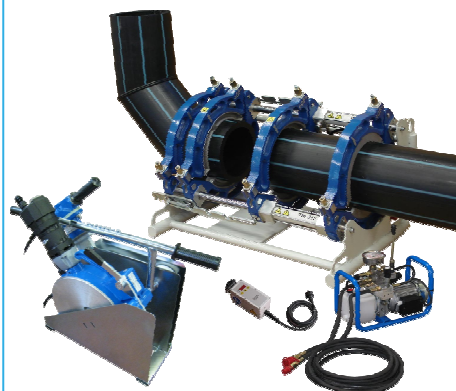


## Operating Instructions

## TM 160/250/315 ECO Butt Fusion Machine





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## 0 About this manual

This manual is valid for TM 160 ECO, TM 250 ECO and TM 315 ECO butt-fusion machines (hereinafter referred to as TM 160/250/315 ECO).

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
 <b>Danger</b>	Imminent accute danger! Failure to comply could result in death or extremely serious injury.
 <b>Warning</b>	Possible accute danger! Failure to comply could result in serious injury.
<b>Caution</b>	Dangerous situation! Failure to comply could lead to injury or damage to property.

## 0.2 Other symbols and notices

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

## 0.3 Abbreviations

Abbr.	Meaning
TM 160	Butt fusion machine d 40–160 mm
TM 250	Butt fusion machine d 75–250 mm
TM 315	Butt fusion machine d 90–315 mm
DVS	Deutscher Verband für Schweißtechnik (German Association of Fusion Technology)
HD-PE	High Density Polyethylene
PE	Polyethylene
PP	Polypropylene
PTFE	Polytetrafluorethylene
D	Pipe outer diameter
ERC	Electronic Remote Control

# 1 Safety instructions

The TM 160/250/315 Butt Fusion Machines are 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 the TM 160/250/315, 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 TM 160/250/315 are to be used exclusively for the fusion of pipes and fittings made of PE, PP. 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 Fischer Omicron after-sales service.
- Use only original Georg Fischer Omicron spare parts and equipment.
- Inspect the TM 160/250/315 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.
- Observe all the regulations, standards and guidelines applicable in your country.

### 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 TM 160/250/315 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 (210 °C)!

Danger of burning hands on the hot heater.

Do not touch the heater when on.

Use the handles on the heater.

---



**Warning**

---

#### **Danger of crushing hands!**

The machine slide moves!

Danger of injury to hands in the moving machine slide!

Do not reach into 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 TM 160/250/315 ECO. 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 TM 160/250/315 ECO 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 TM 160 ECO, TM 250 ECO and TM 315 ECO butt-fusion machines (hereinafter referred to as TM 160/250/315 ECO).

We reserve the right to make the technical changes necessary to improve the TM 160/250/315 ECO which may result in deviations from the illustrations and information contained in this manual.

### 2.2 Range of application

The TM 160/250/315 ECO is designed exclusively for the fusion of thermoplastic plastic pipes, fittings and valves according to the specified dimension range. 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

The copyright for this instruction manual is held by **Georg Fischer Omicron S.r.l.**

This instruction manual is intended for assembly, operation and maintenance personnel. No part of the technical regulations or illustrations contained herein may be reproduced or distributed in any form, used illicitly for competitive purposes or passed on to others.

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## 3 Product identification and description

### 3.1 Product identification

According the directives for machines an identification tag is added to the base machine, showing the following information:

1. Manufacturer
2. Type of machine
3. Serial number
4. Piston area
5. Pipes range
6. Year of manufacture
7. Wheight
8. Barcode



### 3.2 Product description

<p><b>Base Machine</b></p> <ul style="list-style-type: none"> <li>• Hardened and hard chrome-plated guide shafts (1)</li> <li>• Third clamp is adjustable (2)</li> <li>• Pull-Off mechanism for heating element (3)</li> </ul>	
<p><b>Hydraulic unit</b></p> <ul style="list-style-type: none"> <li>• Precision manometer Class 1, scale 0–160 bar (0–100 bar TM 160), diameter 100 mm (1)</li> <li>• Lightweight compact hydraulic unit IP-33, steel protection frame, control lever (2)</li> <li>• Freely adjustable pressure regulator, equalization and fusion pressure can be pre-set (3)</li> <li>• Integrated flexible hoses. Anti-drip, rapid-action coupling with protective caps .</li> </ul>	

<p><b>Heating element</b></p> <ul style="list-style-type: none"> <li>• PTFE-coating</li> <li>• Power multi-cord (4 m) with integrated temperature sensor probe</li> <li>• Thermometer integrated</li> </ul>	
<p><b>Electric planer</b></p> <ul style="list-style-type: none"> <li>• Torque transmission via robust worm-gear device</li> <li>• Self locking device against accidental unhooking (1)</li> <li>• Planer blades sharpened on both sides (2)</li> <li>• Safety micro switch against accidental starting (3)</li> </ul>	
<p><b>Storage Case</b></p> <ul style="list-style-type: none"> <li>• Zinc-coated steel case for transport and storage of both heating element and pipe planer</li> </ul>	
<p><b>Temperature Regulator</b></p> <ul style="list-style-type: none"> <li>• Metal case with microprocessor assisted temperature control</li> <li>• Digital display of current heater plate temperature</li> <li>• Indication of actual status, adjustment of set temperature and offset</li> </ul>	

## 4 Technical specifications

Machine description	Butt-fusion machine to weld thermoplastic pipes PE, PP		
Type	TM 160	TM 250	TM 315
Serial No.	.....	.....	.....
Total piston area	353 mm <sup>2</sup>	510 mm <sup>2</sup>	510 mm <sup>2</sup>
Max. pressure	100 bar	160 bar	160 bar
Type of hydraulic oil	LI 46 SHELL (viscosità 46)	LI 46 SHELL (viscosità 46)	LI 46 SHELL (viscosità 46)
Quantity of hydraulic oil	2,0 l	2,0 l	2,0 l
Noise level	70 dB(A)	70 dB(A)	70 dB(A)
Tension	230 V / 50 Hz	230 V / 50 Hz	230 V / 50 Hz
Performance	1900 W	3070 W	3670 W
Dimension (packaging)	105x68x68 cm	158x83x84 cm	158x83x84 cm

## 5 Transport and assembly

### 5.1 Packaging

A decisive factor in the choice of packaging is the means of transport. Usually 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 machine 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 machine with care.

### 5.3 Intermediate storage

If the machine 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

The Fusion Process described in the following chapters is based on the instruction sheets and guidelines issued by the DVS 2207.

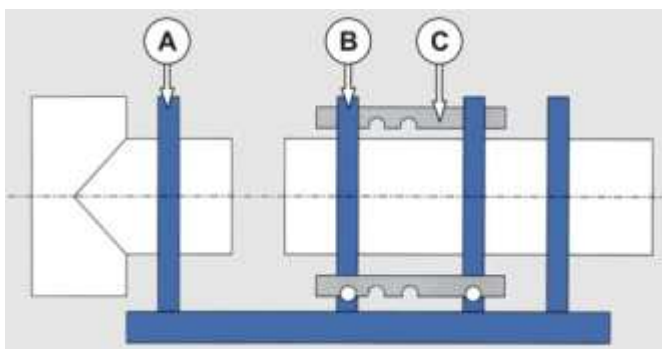
The fusion area should be protected against the influences of weather (humidity, ambient temperature  $<+ 5\text{ }^{\circ}\text{C}$ , extreme direct exposure to sun) with such measures as pre-warming the fusion materials, tents, heating.

For optimal use of the TM 160/250/315 the operating personnel should be specially trained by Georg Fischer. In-depth knowledge of the machine and its components and competence rule out handling errors thereby also preventing faulty fusion joints.

### 6.2 Preparations

The standard configuration of the base machine is prepared to joint pipe to pipe by using 2 clamps to fix each pipe in the base machine. The planer and the heating element is inserted between the two central clamps.

In order to clamp particular constructions or T-pieces or to use a flange adapter, shift the clamping unit B to the required position. Therefore remove the two spacers C (upper and lower on) from the original position, position the clamping unit B and fix it with the two spacers C. The pipe preparation and welding position is now changed, insert the heating element into the pull-off mechanism between A and B.



**Advise**      **Clean the couplings on the base machine and the hoses.**

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

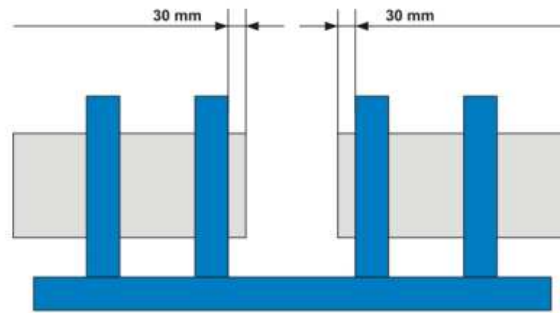
If the hydraulic hoses are not used, seal the couplings with the protective caps. Clean the protective caps first.

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



In order to weld pipes and/or fittings with an outer diameter smaller than the clamp of the base machine, insert matching clamping half shells and fasten them with the screws.

Clamp the components to be jointed in that way, that the pipe/fitting ends reach out at least 30 mm from the clamps in order to perform a proper weld. Make sure they are exactly aligned in the axial direction.



If necessary, the components can be turned or the clamping force changed to achieve a better clamping position.

Adjustable roller supports or a floating suspension assist horizontal movement of the pipes fixed in the carriage.

**Attention** When pipes are positioned into the base machine, close the carriages till the pipes are in contact with themselves. Control the position of the stroke indicator in relation to the red mark (cylinder stroke end). If the indicator is close to the red mark, during the welding procedure no pressure could be transferred into the welding zone! The weld will not perform !! Change the clamping position of the pipes! After planning the pipe ends, the distance between the indicator and the mark has to grant the movement during bead build up, heat soak phase and bead roll over!



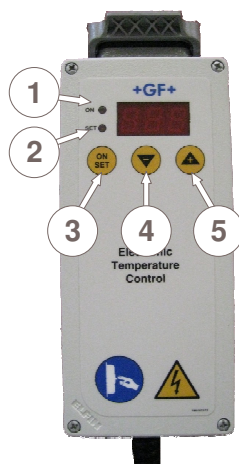
### 6.2.1 Heating Element Temperature Regulator

1. 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.**

2. Connect temperature regulator to the power outlet or power generator.
3. 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.
4. Check the temperature of the heater plate surface with a quick-indication temperature measurement according to the set temperature.



### 6.2.2 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 even heat distribution.**

### 6.2.3 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.

#### 6.2.4 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. 210 °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 (210°C) is therefore 5°C. By setting-up an offset of 5°C the heat dissipations will be compensated.

### 6.2.5 Error messages

The temperature regulator 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
<b>E40</b> 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
<b>E41</b> Resistance interrupted	Circuit of resistance interrupted	Contact service
<b>E90</b> 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.
<b>E98/E99</b> Error of memory		Contact service

## 7 Fusion

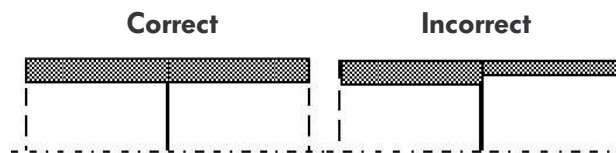
### 7.1 The basics of butt fusion

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.

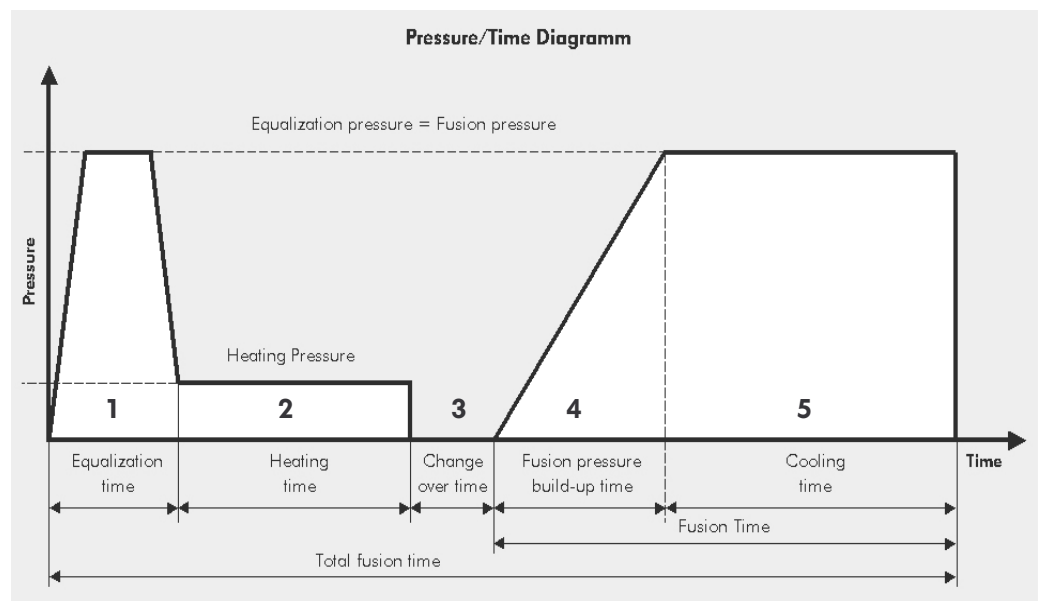
**Attention** Only the same type of materials are to fuse.

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



**Only the same wall thicknesses in the fusion area!**

The equalization pressure (phase 1) and the fusion pressure (phase 5) are identical. The heat soak pressure (phase 2) is significantly lower, but the contact between the pipe/fitting and the heating element needs to be ensured.



## 7.2 The fusion process

### 7.2.1 Calculating drag pressure



**Warning**

#### **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.



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

1. Open the machine to the end position by moving the control lever (2) into open direction "<>".
2. Reduce pressure with the fine-adjustment pressure valve (3) -turn counter-clockwise.
3. Increase pressure with the fine-adjustment pressure valve while simultaneously pulling the control lever in the "close ><" direction (turn clockwise).
4. As soon as the movement of the carriage is even, stop increasing the pressure and read the pressure value on the gauge before the pipe ends are in contact.
- 5.

### 7.2.2 Preparing the fusion surfaces



**Warning**

#### **Danger of cutting hands!**

Sharp planer blades!

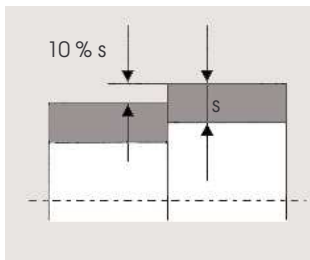
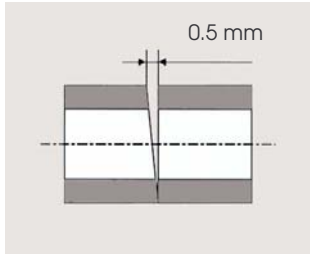
Danger of injury to hands if the planer disk is touched.

Do not touch the rotating planer disk.



1. Open the machine to the end position by moving the control lever into open direction "<>". Check that the distance between the pipe ends is at least as wide as the width of the planer.
2. Insert the planer to the base machine with care . Safety mechanism locks automatically. This prevents the planer unit from jumping out of the machine during planing.
3. Check that the signal lamp is ON, this indicates that the planer is inserted correctly.
4. Start the drill, machine 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.

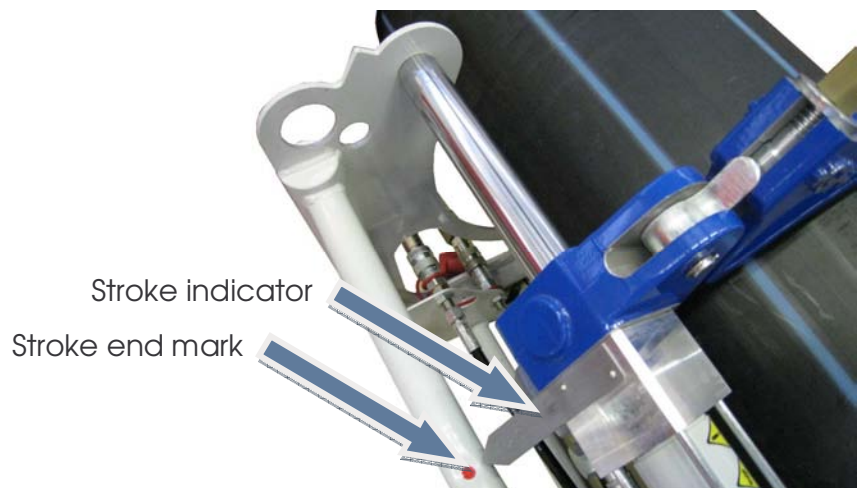
**Caution** Constant high pressure when facing (15-20 bar over dragging pressure), can cause damage on the drive and/or the motor of the facer.



5. Release the pressure to Zero by pulling the control lever half way between 0 position and open "<>". With this procedure the pipe surfaces will not show any offset.
6. Open the machine by pressing "open<>".
7. switch off the planer
  - ▷ Remove the planer out of the machine and place it into the case.
8. Close machine until pipes/fittings touch each other.
9. Check the gap between the pipes: Maximum tolerance of the gap is 0.3 mm ( $d \leq 200\text{mm}$ ), 0.5mm ( $200 < d < 400\text{mm}$ ), 1.0mm ( $d > 400\text{mm}$ ).
10. Check the alignment all around the circumference.
11. The wall offset on the outside may not exceed 10 % of the wall thickness.
12. 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.
13. In this case, the fusion surfaces need to be remachined.
14. 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. industrial alcohol (Tangit KS).

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

**Attention** When the planing phase is finished, close the carriages till the pipes are in contact with themselves. Control the position of the stroke indicator in relation to the red mark (cylinder stroke end). If the indicator is close to the red mark, during the welding procedure no pressure could be transferred into the welding zone! The weld will not perform !! Change the clamping position of the pipes! After planning the pipe ends, the distance between the indicator and the mark has to grant the movement during bead build up, heat soak phase and bead roll over!





### 7.2.3 Calculating of the fusion pressure

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

(e.g. 31 bar\* + 6 bar = 37 bar)

\* for TM 315 and TM 250 HD-PE d 200 mm, SDR 11 see pressure tables

### 7.2.4 Adjusting of the fusion pressure

15. Open the machine.
16. Reduce pressure with the fine-adjustment pressure valve (turn counter-clockwise).
17. Move control lever towards “close ><” position and increase the pressure on the pressure valve (turn clockwise) until clamping carriage moves smoothly.
18. Adjust fusion pressure with the fine adjustment pressure valve as soon as both pipe ends are in contact (turn clockwise, keep control lever in position close).

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

1. Open the machine.
2. Turn the fine-adjustment pressure valve approx. 3 revolutions counter clockwise.
3. Start fusion pressure adjustment again.



### 7.2.5 Fusion process

The PTFE coating of the heating element must be protected from mechanical damage and/or dirt. Heating elements with damaged PTFE-covering has to be replaced. Non-observance affects the quality of the joining.



**Warning**

---

#### **Danger of burning!**

The heater is hot (210 °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 the corresponding welding tables !

#### **EQUALIZATION** (fusion bead created on both sides)

1. Insert 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 move 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 (see corresponding welding table), 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, see corresponding welding table.

### HEAT SOAK

The heat soak pressure has to be kept between "0" zero bar and the corresponding maximum value according to the welding table during the complete heat soak time (phase 2).

### CHANGE-OVER (removing the heating element)

The change-over time should be as short as possible, the maximum spendable time is listed in the welding table.

As soon as the heat soak time is elapsed:

- ▶ Push the control lever into "open <>" position as long as the heating element has no more contact to the pipes. The pipe ends will be separated by the pull off mechanism from the heater plate.
- ▷ Immediately remove the heating element from the machine.

### JOINING (Fusion process)

- ▶ Push the control lever into "close ><", position until the pipes touch each other and the preset fusion pressure is reached. Hold the control lever in this position for approximately 15 seconds, than move the lever into the neutral position smoothly. Keep the pressure value constant for the complete cooling time.

The surfaces to be joined are fused.

- ▷ Place the heating element in the storage case without damaging or contaminating the fusion surfaces.

### COOLING (the fusion joint)

**Attention** The cooling time in the base machine under fusion pressure must always be observed.  
The use of cooling agents is not permitted during cooling. During the cooling

**time the fusion pressure has to be supervised by the operator and if necessary readjusted!**

**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.

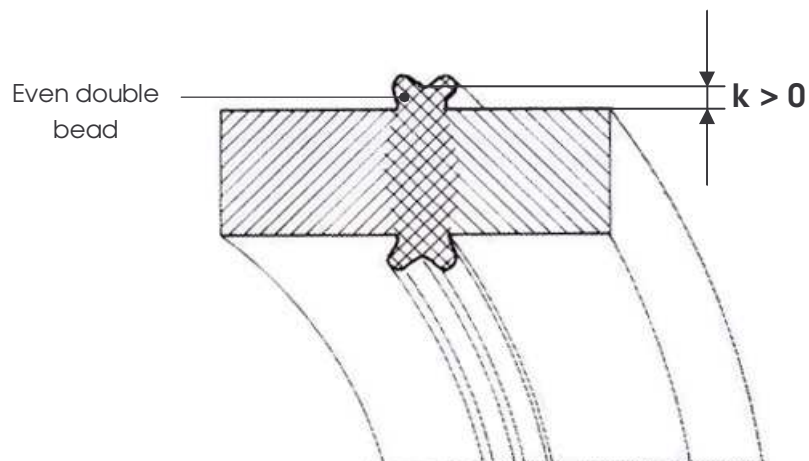
**Caution** **Do not open machine slides.**

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 TM 315/250

Pipe/fitting	PE	Heater temperature	210 °C
Pipe outer diameter	200 mm	Drag resistance	6 bar
Pressure rating	SDR 11	Table value	31 bar
Wall thickness	18.2 mm	Adjustment value on hydraulic unit	37 bar

All pressure, time and temperature values to be taken out from the corresponding welding tables!

**Equalize** with a pressure of 37 bar until a bead height of 2.0 mm results

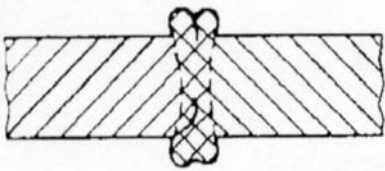
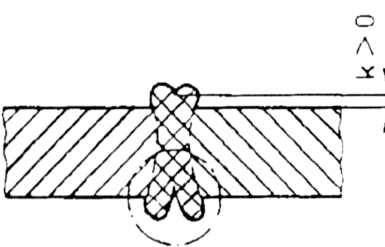
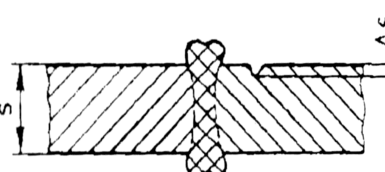
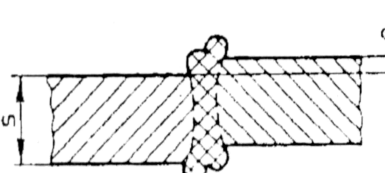
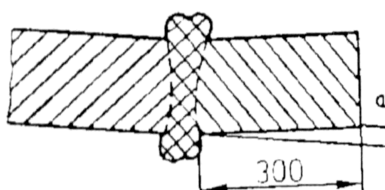
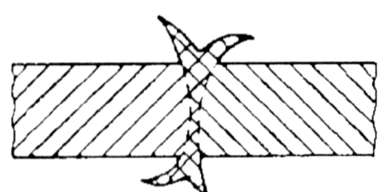
**Heat soak** for 182 sec with a pressure close to 0 bar

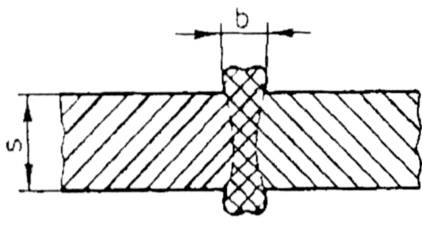
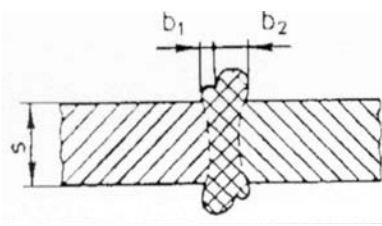
**Change-over** within maximum 10 sec .

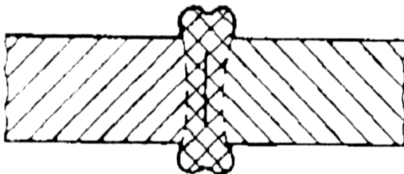

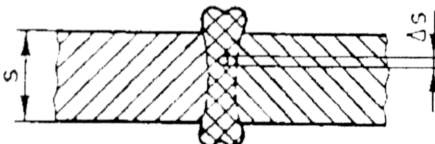
**Join** Within maximum 11 sec.

**Cooling** for minimum 23 min.

## 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: <ul style="list-style-type: none"><li>In the weld</li><li>In base material</li><li>In heat affected zone</li></ul>	Not Permissible	Not Permissible	Not Permissible
	Continuous or local notches length-wise to weld with notch root in base material, caused by, for example: <ul style="list-style-type: none"><li>Insufficient joint pressure</li><li>Warming-up time too short</li><li>Cooling time too short</li></ul>	Not Permissible	Not Permissible	Not Permissible
	Notches in edge of base material, length-wise or cross-wise to weld, caused by, for example: <ul style="list-style-type: none"><li>Clamping tools</li><li>Incorrect transport</li><li>Fault in edge preparation</li></ul>	Locally permissible if ending flat and $\Delta s \leq 0.1s$ but max. 0.5mm	Locally permissible if ending flat and $\Delta s \leq 0.1s$ but max. 1 mm	Permissible if ending flat and $\Delta s \leq 0.15s$ but max. 5mm
	Joint faces are displaced relative to one another or thickness variations are not adjusted	Permissible if $e \leq 0.1s$ but max 2 mm	Permissible if $e \leq 0.15s$ but max 4 mm	Permissible if $e \leq 0.2s$ but max 5 mm
	For example: <ul style="list-style-type: none"><li>Machine fault</li><li>layout fault</li></ul>	Permissible if $e \leq 1 \text{ mm}$	Permissible if $e \leq 2 \text{ mm}$	Permissible if $e \leq 4 \text{ mm}$
	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's only	Not Permissible	Not Permissible	Not Permissible

Feature	Description	Evaluation group		
		I	II	III
External state of joint				
	<p>Welding flash too wide or too narrow over part or all of weld length, caused by, for example:</p> <ul style="list-style-type: none"><li>• incorrect warming-up time</li><li>• incorrect heating-element temperature</li><li>• incorrect joint pressure</li></ul>	See pg.14 DVS 2202-1 guidelines	See pg.14 DVS 2202-1 guidelines	See pg.14 DVS 2202-1 guidelines
	<p>Non angular joint plane, leading to variations in form of welding flash over part or all of weld length, cased by, for example:</p> <ul style="list-style-type: none"><li>• edge preparation faults</li><li>• incorrect welding unit</li></ul>	Permissible if  $b1 \geq 0,7 \times b2$	Permissible if  $b1 \geq 0,6 \times b2$	Permissible if  $b1 \geq 0,5 \times b2$

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: <ul style="list-style-type: none"><li>contaminated joint faces</li><li>oxidized joint faces</li><li>excessive reversal time</li><li>heating element temperature too low</li><li>heating element temperature too high</li></ul>	Not Permissible	Not Permissible	Not Permissible
	Hollow space in joint planes caused by, for example: <ul style="list-style-type: none"><li>Insufficient joint pressure</li><li>Insufficient cooling time</li></ul>	Not Permissible	Not Permissible	Not Permissible
	Isolated, numerous dispersed or locally concentrated pores or inclusions caused by, for example: <ul style="list-style-type: none"><li>Vapour formation during welding</li><li>Contaminated heating element</li></ul>	Permissible if $\Delta s \leq 0.05 \times s$	Permissible if $\Delta s \leq 0.10 \times s$	Permissible if $\Delta s \leq 0.15 \times s$

## 9 Maintenance

The TM 160/250/315 should be checked and cleaned periodically.

Normal care of the machine is limited to periodic cleaning of the outside.

Every 3200 hours of use or after 2 years the complete machine with all components should be maintained and calibrated at a Georg Fischer certified service station.

### 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 TM base machine should be protected with the protective caps.

## 9.3 Hydraulic unit



### Oil level check

Check the hydraulic oil level regularly. If necessary, refill the hydraulic oil according to chapter 4 after .

### Changing the hydraulic oil

**After 3200 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.

#### Caution

**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.

#### Caution

**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.

#### Caution

**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.

#### Caution

**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 TM 160/250/315 machine.**

**example:**

[illegible]

## 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)





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