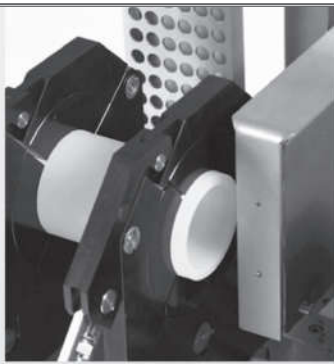


HÜRNER



HÜRNER
SCHWEISSTECHNIK

Bedienungsanleitung • User's Manual • Manuel utilisateur

Manual 160

*Inliegende deutsche Fassung der Anleitung ist der Urtext, welchen inliegende Übersetzungen wiedergeben.
The German version of the manual enclosed herein is the original copy, reflected in both translations herein.
La version allemande ci-après représente le texte original du manuel, rendu par les deux traductions ci-joint.*



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HÜRNER
SCHWEISSTECHNIK

Version September 2017

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The success of the jointing operation depends on the proper pressures, times, and temperatures of the welding as given in the welding value tables in the appendix. The correct pressure value depends on the section of the cylinder of the welding machine. Prior to using the tables in the appendix, verify carefully that the section quoted in the technical specifications of this manual is the same as the section given on the name plate affixed to your machine.

1 Introduction

Dear Customer:

Thank you very much for purchasing our product. We are confident that it will bring you success and meet your expectations.

The development, manufacture, and check of the heating element butt-welding machine **HÜRNER Manual 160** has been performed with a view to superior operation safety and user-friendliness. The machine was manufactured and checked according to state-of-the-art technology and widely recognized safety regulations.

To ensure maximum operation safety, please conform to the appropriate messages in this booklet and the regulations for the prevention of accidents.

Thank you.

2 Safety Messages

This User's Manual contains important instructions for the intended and safe operation of the product. Every person who operates the product has to conform to the instructions of this manual.

2.1 The User's Manual

The User's Manual is presented according to sections which explain the different functions of the product. All rights, in particular the right to copy or reproduce (in print or electronic form) and distribute as well as to translate, are reserved and subject to prior written consent.

2.2 Explaining Icons

The following expressions and icons are used in this User's Manual to refer to safety-related issues:



This icon indicates that non-compliance may result in a hazardous situation that possibly causes bodily injury or material damage.



This icon indicates important messages related to the correct use of the product. Non-compliance may cause problems of operation and damage to the product.



This icon indicates tips and useful information for using the product more efficiently and more economically.

2.3 Operating the Product Safely

For your own safety, comply with the following instructions

- Protect the power supply cord and the hydraulic pressure lines from cutting edges. Have an authorized service shop replace damaged cables or lines immediately.
- The product may be operated and serviced exclusively by authorized staff who were briefed on it.
- The product may be operated only when observed.
- Before operating the product, always check for damaged parts and have them repaired or replaced by an authorized service shop as needed.

- The cover caps of the hydraulic lines have to be closed during transport in order to prevent contaminants and humidity from entering the hydraulic and control unit.
- EVU wiring regulations, VDE provisions, DIN/CE regulations, and applicable national legislation have to be respected.
- Without prior authorization by the manufacturer, modifications to the product are unacceptable.



Caution

Parts Under Power

After opening the machine or removing the cover, parts of it are accessible that may be under power. The machine may be opened exclusively by an authorized service shop.



Caution

Pipe Facing Tool

Start the pipe facing tool only after it was inserted into the machine and carry it only by the handle, never by the disk enclosure.

It is unacceptable to remove shavings from the machine while the facing process is in progress. Make sure nobody is present in this danger zone.



Caution

Heating Element

When working with the machine, be extremely cautious while the heating element is used. Since the heating element presents a temperature of more than 200°C during the welding process, it is absolutely indispensable that operators wear suitable protective gloves. Bear in mind that the heating element will remain hot for a while after it was turned off.



Caution

Danger of Bruises and Injury

Do not remain in the danger zone while the machine carriage moves apart or closes in, and be sure not to have your arms or legs between the moving and the fixed carriage of the machine.



Caution

Acceptable Work Conditions

The work zone has to be clean and has to have proper lighting. It is dangerous to operate while it is raining, in a humid environment, or close to flammable liquids. In regard of this, acceptable work conditions have to be ensured (tent, heating, etc.).



Info

User's Manual

The User's Manual has to be available at any time on the site where the machine is used. If the User's Manual becomes incomplete or unreadable, replace it without delay. Feel free to contact us for assistance.

2.4 Owner and Operator Obligations

- The machine may be operated exclusively by persons who are familiar with the applicable regulations, the guidelines for the prevention of accidents, and the User's Manual. The owner/manager shall provide the worker operating the machine with the User's Manual and shall make sure that the operator reads and understands it.
- The machine may be operated only when observed. Welders must have been briefed properly on the operation of the machine or must have participated in a dedicated training. The operating/

owning organization engages to check at reasonable intervals if the machine is operated by the welders as intended and under proper guidelines of occupational safety.

- The machine must be operated only when in proper state of repair and for one of the intended uses. Before welding, the welder is required to make sure that the state of the machine is in order.



Important

During transport, the facing tool and the heating element have to be placed into the provided carrying rack at all times.

2.5 Intended Use

The Butt-Welding Machine is intended exclusively for joining plastic pipes and fittings according to the butt-welding process with heating element. See Section 3 for a detailed overview of the welding process enabled by this machine.

The notion of intended use also includes:

- Compliance with the instructions in the User's Manual
- Observation of all service and maintenance intervals



Important

All uses other than those mentioned above are not allowed and will cancel any and all liability or warranty by the manufacturer. Unintended use may cause considerable hazards and material damage.

2.6 Warranty

Warranty claims may be raised only if the conditions for warranty given in the General Terms and Conditions of Sale and Delivery obtain.

2.7 Transport and Storage

The box in which the product arrives should also be used for storage as a protection against humidity. During transport or storage in the box, the hydraulic tubing should **not be detached or squeezed**. The pipe facing tool and heating element have to be transported in the provided carrying rack.

2.8 Identifying the Product

Every product is identified by a name plate. It shows the model ("Typ"), the serial number ("Maschinennr."), and the manufacturer. The first two digits of the serial number represent the year of manufacture.

Butt Fusion Welding Device
Type: Manual Mini Hydraulic
Ser. No.: 16856614
Input: 230V 50/60 Hz IP54 5,4kW
Hyd.-Oil Type: HF-E 15 Shell naturelle
Manufacturer: HÜRNER Schweisstechnik GmbH
Nieder-Ohmener Str. 26
35325 Mücke (Germany)
Ph.: +49 6401 9127-0 Fx: -39

3 Understanding the Machine

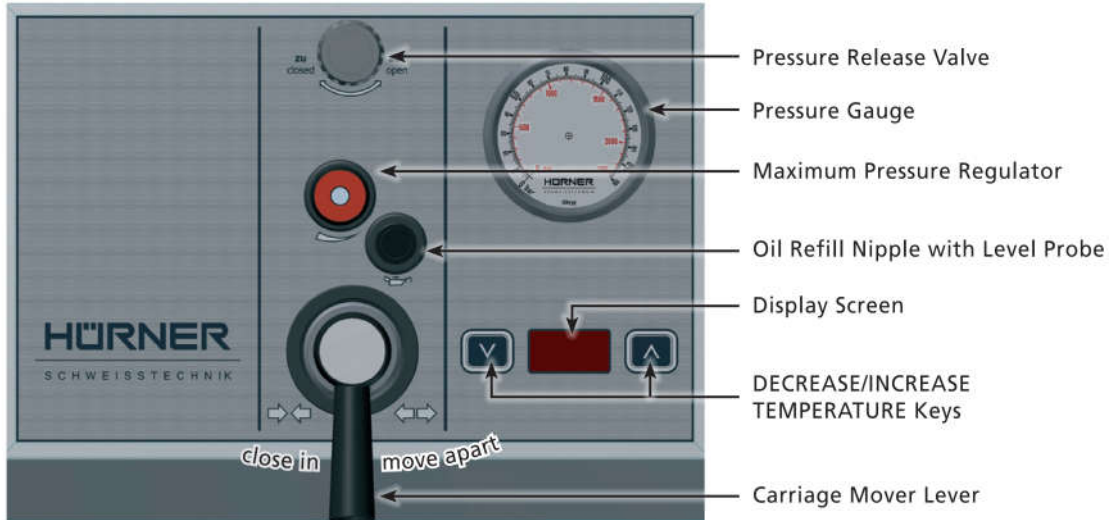
This butt-welding machine for plastics can be used both as an on-site and as a workshop installation, for jointing operations pipe-to-pipe, but also for processing tees and elbows (see also the first paragraphs of Sect. 4.3 for more detailed information on this).

3.1 Included Components

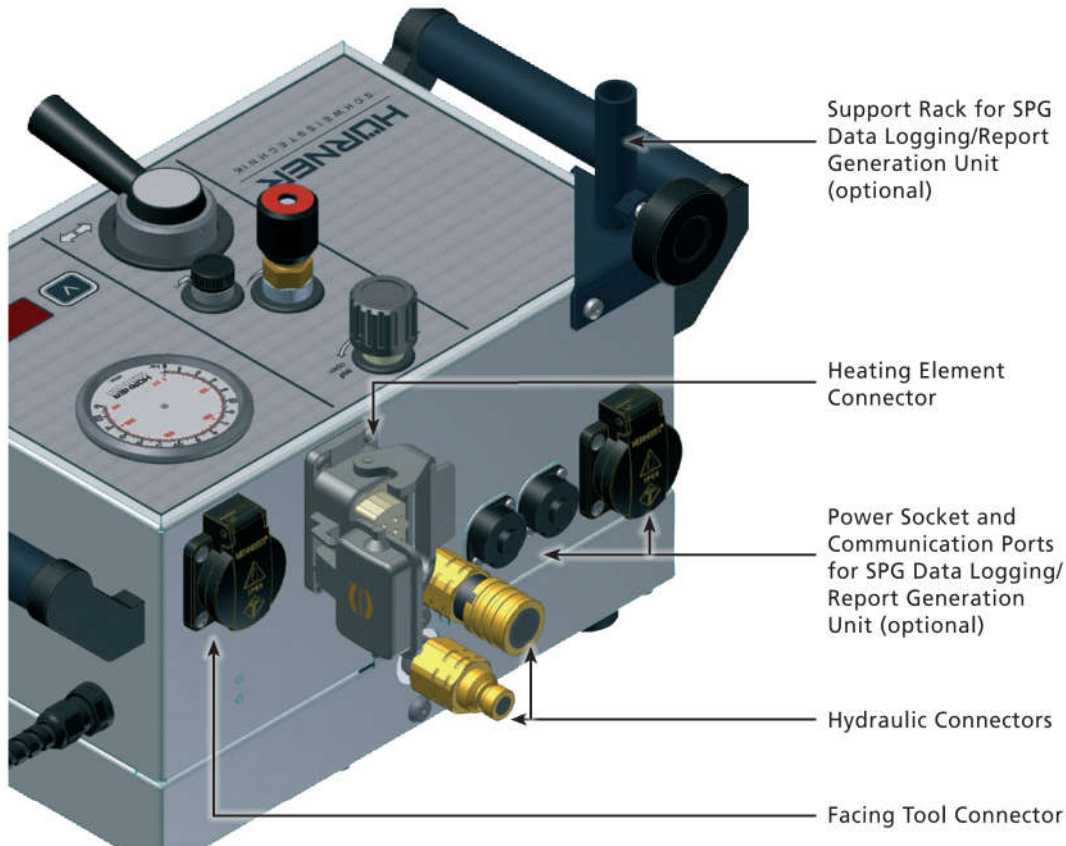
The product ships in its transport box with the following components:

- Machine chassis ("basic machine") to secure the parts to be welded
- Electrical heating element with anti-stick coating
- Electrical facing tool
- Carrying and storage rack for heating element and facing tool
- Hydraulic and control unit with control panel
- Reducer inserts for clamps of machine chassis for the following nominal pipe sizes: O.D. 40, 50, 63, 75, 90, 110, 125, 140 mm

3.2 Control Panel



3.3 Connectors



3.4 Technical Specifications

HÜRNER Manual 160	
Power Specifications	
Voltage	230 V
Frequency	50/60 Hz
Total Rated Power	2.45 kW
Heating Element	0.80 kW
Facing Tool	1.05 kW
Hydraulic & Control Unit	0.60 kW
Hydraulic Specifications	
Operating Pressure max.	160 bar
Cylinder	1.95 cm ²
Ambient Temperature Range	-5°C to +50°C
Hydraulic Oil	HF-E 15
Operating Range	40 through 160 mm
Dimensions	
Basic Machine Chassis	600 x 400 x 410 mm
Facing Tool	430 x 330 x 80 mm
Heating Element	450 x 350 x 50 mm
Hydraulic & Control Unit	480 x 310 x 300 mm
Carrying and Storage Rack	300 x 370 x 400 mm
Weights	
Basic Machine Chassis	27 kg
Facing Tool	8 kg
Heating Element	4 kg
Hydraulic & Control Unit	23 kg
Carrying and Storage Rack	4 kg
Transport Box	27 kg
All Reducer Inserts	21 kg

3.5 Overview of the Welding Process

The welder performs the welding process in the following manner:

- Applicable welding times and pressures are looked up in the overview tables in the appendix.
- Pipes are clamped into the frame.
 If pipes with an outside diameter smaller than the maximum dimension of the machine are welded, select the reducer set needed. The 8 individual inserts of the set that matches the outside diameter of the pipe to be welded have to be attached to the clamps of the machine chassis using the provided bolts.
- Pipe butts are worked using the pipe facing tool.
- Pipe alignment is checked.
- The drag pressure, i.e. the minimum pressure to set the carriage in motion and "drag" it along, is recorded at the machine.
- The pressures relevant to the welding operation are set.
- The heating element is inserted after cleaning it and checking its temperature.
- The welding process proper is performed (see section 4), and the operator waits for the jointed pipes to cool down.
- After the cooling time is over, pressure can be shut off from the pipes and the joint can be taken out of the chassis.

4 Operation

4.1 Start of Operation, Switching the Machine on



Important

Before the control unit is turned on, check the oil level of the hydraulic and control unit and top up with HF-E 15 hydraulic oil as needed.



Important

The surfaces of the heating element have to be free of grease and clean, or they have to be cleaned.



Important

Make sure all connectors are tight in their sockets and note that operation on a worksite is only acceptable if the power supply has earth-leakage circuit breakers.

After the power supply cord was connected to the mains power supply or a generator, the machine is ready for operation.



Caution

It has to be ensured that the voltage of the power source the machine is connected to corresponds to the rated voltage of the machine. Also the following has to be respected when using extension cables:

For 230 V power: wire section 2.5 mm² = max. 75 m long
wire section 4.0 mm² = max. 100 m long

Using the Integrated Heating Element Temperature Control

When the machine was connected to the power supply, the control electronics runs an auto-test of the three-digit 7-segment display screen. This is indicated by three short flashes of all segments. After the test, the software switches to control mode, which is recognizable from the display now showing a number. This number corresponds to the currently set nominal temperature of the heating element.

As long as the actual temperature of the heating element is not equal to the required nominal temperature (lower or higher), the display screen flashes. This indicates in most cases that the heating element is heating up. When the nominal temperature is reached, providing it is reached within the specified tolerances and time delays, the display screen stops flashing and the heating element can be used.

The value of the nominal temperature can be changed using the DECREASE/INCREASE TEMPERATURE keys, either by pressing them repeatedly or by holding them down. The settable temperatures range from 190°C through 250°C. When this setting was changed, the screen starts flashing again, until the heating element has reached the new nominal temperature. The new value is saved to memory and can be used again after the machine is switched on again. To see the current actual temperature of the heating element, hold down both temperature keys. A dot in the lower right-hand corner of the display indicates that the actual temperature is showing.

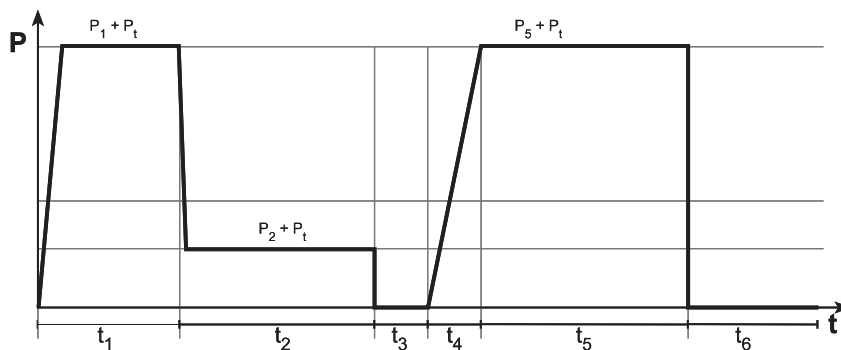
4.2 Welding Process Overview

The welding process proper, after pipe butt facing and pipe alignment check, has the following four stages, or phases, which are also illustrated by the time-and-pressure diagram below.

- **Bead Build-up Stage** – In this stage, t_1 in the diagram, the pipes are pressed against the heating element and heated to the temperature of it; to ensure consistent bead formation, do this at drag pressure (P_d) plus P_1 from the welding value tables in the Appendix.

- **Heating Stage** – In this stage, t_2 in the diagram, the pipes remain in contact with the heating element, soaking heat from it; the pressure is reduced to drag pressure (P_t) plus P_2 from the welding value tables in the Appendix.
- **Change-over Stage** – In this stage, t_3 in the diagram, pressure is shut off from the pipes, the carriage moves apart to the far end to allow taking the heating element out from in-between the pipes.
- **Joining and Cooling Stage** – This stage is characterized by a succession of events. First, after change-over, the pipe butts are put together and pressure increases as a linear ramp to drag pressure (P_t) plus P_5 from the welding value table in the Appendix (t_4 in the diagram). Then, the joint cools down at $P_t + P_5$, either until pressure is completely removed from the pipes (t_5 in the diagram) or until pressure is reduced to one-third of P_5 (10 seconds into t_5 in the diagram); in the second case, cooling is completed at the reduced pressure.

Pipe and fitting manufacturers may include data on how long the new joint should not be exposed to external strain. Also, the applicable welding standard may require a minimum cool-on time after pressure shut-off (t_6 in the diagram). In most cases, however, t_6 is not relevant to the welder.



4.3 Performing the Welding Process

To start welding, clamp the pipes into the machine chassis. Use the appropriate reducer inserts if the component size is smaller than the basic machine chassis. When the fourth clamp of the machine is removed, tees and elbows can be processed.

4.3.1 Facing the Pipe Butts

To ensure that the pipe butts are level, insert the pipe facing tool between the machine carriages and turn it on. Using the carriage mover lever on the hydraulic unit, have the movable carriage close in toward the center in order to bring the pipes into contact with the facing tool. Use the pressure regulator to adjust the pressure manually while the facing tool is trimming the pipes.



The farther the carriage mover lever is pushed to the left, the faster the carriage closes in and the faster pressure increases. The farther it is pushed to the right, the faster the carriage of the machine moves apart, and the faster pressure decreases.

Pipe facing should continue until shaving forms a continuous blade that rolls twice or three times around the pipe ends, so the butts are level. Facing is stopped by moving the carriage apart with the carriage mover lever.

If you discover after the facing process that the butts are still not level,

start over, insert the facing tool and repeat the process. When facing is properly done, pipe alignment has to be checked.

4.3.2 Checking Pipe Alignment and Determining Drag Pressure

When the pipes are properly faced, close in the movable carriage completely to check whether a potential vertical and horizontal pipe misalignment is within the tolerance allowed by the applicable welding standard. If pipe alignment is in order, the welding proper can start. If the misalignment is outside tolerance, the pipes must be readjusted in the clamps and, if needed, facing has to be repeated.

When pipe alignment is appropriate, move the carriage apart using the carriage mover lever; make sure the movable carriage is as far apart as possible before continuing. Turn the maximum pressure regulator counter-clockwise as far as it will go to have zero pressure in the hydraulic circuit. Then set the carriage mover lever to its close-in position while simultaneously turning the maximum pressure regulator gradually clockwise. Watch the pressure gauge closely to observe at which pressure level the carriage is "dragged" to start moving. Take note of this value, preferably on paper, as the drag pressure P_t for this welding operation.



Important

The exact drag pressure depends on various conditions (pipe size and material, position/altitude of the machine, etc.) and has to be determined for every welding individually. The value P_t is needed to compute the bead build-up, the heating, and the joining pressures needed for jointing (stages t_1 , t_2 , and t_5 in the welding diagram respectively).

4.3.3 Bead Build-up Stage

Use the welding value tables in the Appendix to look up the joining pressure (maximum pressure to be applied during bead build-up and joining) appropriate for your situation. Then set the maximum pressure regulator to joining pressure plus drag pressure (see Sect. 4.3.2) while observing the actual pressure shown on the gauge, and move apart the carriage of the machine. Using the welding value tables, check that the heating element (heating plate) has the correct temperature and insert it between the butts, move the carriage in on the heating plate and press the pipe butts to it at a pressure of $P_1 + P_t$ for the bead build-up duration given in the welding value tables in the Appendix (t_1 in the diagram above) until the weld bead has properly formed.

4.3.4 Heating Stage

After the bead build-up stage (t_1 in the diagram) was completed, the pressure must be decreased to below or equal to the level of $P_2 + P_t$. The decreased pressure will then be applied for the entire duration of the heating stage (t_2 in the diagram), in which the pipe butts continue to soak heat from the plate. Use the welding value tables in the Appendix to determine the heat-soaking time (t_2) and the heat-soaking pressure ($P_2 + P_t$) applicable to your welding situation. To reduce the pressure applied to the pipe, use the pressure release valve and observe the pressure level on the gauge.



Important

Full contact has to be continuously established between the heating plate and the bead, even with lower pressure. While heating, if contact between them is lost somewhere along the circumference, welding has to be aborted and repeated.

4.3.5 Change-over Stage

After the end of the heating, or heat-soaking, stage, set the carriage mover lever on the hydraulic unit to its move-apart position in order to move the carriage to the far end. Then remove the heating element from in-between the pipes.

The change-over has to be followed immediately by the joining stage. The change-over time given for your welding situation in the tables in the Appendix (t_3) must not be exceeded. If it is, welding has to be aborted and repeated.

4.3.6 Joining and Cooling Phase

Set the carriage mover lever to its close-in position again in order to move the pipe butts in on each other and to build the joining pressure ($P_5 + P_t$) according to a consistent increase. Watch the reading of the gauge. Building the joining pressure must correspond to a linearly increasing ramp and its duration must neither be longer nor shorter than indicated for your welding situation in the welding value tables in the Appendix at t_4 .

Once the joining pressure is reached and has stabilized at $P_5 + P_t$, depending on the applicable welding standard, the pressure will either be kept at this level until the end of the joining stage is reached (t_5), or pressure will be reduced after 10 seconds to one-third of P_5 and the reduced pressure will be kept until the end of the stage t_5 is reached. Towards the end of the joining stage, the new joint also starts cooling down. If the pressure has to be reduced in the course of the joining stage (under the WIS standard or the UNI standard for PE100 with walls thicker than 20 mm), reducing the pressure is done with the pressure release valve on the hydraulic unit.

Pipe and fitting manufacturers may include data on how long the new joint should not be exposed to external strain. Also, the applicable welding standard may require a minimum cool-on time (t_6 in the diagram). In most cases, however, t_6 is not relevant to the welder.

4.3.7 End of Welding

The welding is finished at the end of a successful joining and cooling stage. The welder has to shut the pressure off from the pipes using the pressure release valve.

4.4 Data Logging/Welding Report Generation (optional)

As an option, the butt-welding machines of the Manual series offer the possibility to log welding and traceability data of every joint and to save them to a welding report.

All it takes is the connection of a HÜRNER Data Logging/Report Generation Unit of the SPG series to the machine. A model version with a support bracket and connection ports for the data logger is available upon request.

5 Indication of Errors Related to the Heating Element

Error indications that may appear on the 7-segment display are composed of the letter "E" and a code number. When an error is cleared while the machine is still running and provided the cleared error was the only one that occurred, the machine changes back to control mode. No machine re-start is needed. As soon as an error condition is

detected, the heating element is switched off. The control unit supports the following error messages:

- Error 'E01' Temperature sensor not connected or ohm value too high
- Error 'E02' Heating element temperature exceeds maximum (> 280°C)
- Error 'E03' Short-circuit at the temperature sensor input

6 Service and Repair

As the product is used in applications sensitive to safety considerations, it may be serviced and repaired only on our premises or by partners who were specifically trained and authorized by us. Thus, constantly high standards of operation quality and safety are maintained.



Non-compliance with this provision will dispense the manufacturer from any warranty and liability claims for the product and any consequential damage.

Important

7 Service and Repair Contact

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We reserve the right to change technical specifications of the product without prior notice.

8 Accessories/Parts for the Product

Facing Tool Blade for HÜRNER Manual 160



Only genuine spare parts are acceptable. The use of non-genuine parts voids any and all liability and warranty on the part of the manufacturer.

For consultation and ordering spare parts, refer to the seller or manufacturer of the product.

Schweißtabellen
Welding Value Tables
Paramètres de soudage

HÜRNER Manual 160



Technische Änderungen an der Maschine bleiben vorbehalten.

We reserve the right to change technical specs of the machine without prior notice.

Nous nous réservons le droit d'apporter des modifications techniques sans préavis.

PE 80 / PE 100 DVS 2207-1 (09/2005)		HÜRNER Manual 160 Zylinder/Cylinder/Vérin 1,95 cm ²				Angleichen <i>Bead Build-up</i>		Anwärmen <i>Heating</i>		Um- stellen <i>Change- over</i>	Fügerampe (t ₃), Fügen u. Abkühlen <i>Pressure Ramp (t₃), Joining and Cooling</i>		
Durchmesser <i>Diameter</i>	Wandstärke <i>Wall Thickn.</i>	Ø / Wand <i>Ø / Wall</i>	Versatz <i>Align Offset</i>	Temperatur <i>Temperature</i>	Temperatur <i>Temperature</i>	P ₁ bar	Wulst <i>Bead</i>	P ₂ max. bar	t ₂ sec	t ₃ max. sec	t ₄ sec	P ₅ bar	t ₆ min
mm	mm	SDR	mm	°C (PE 80)	°C (PE 100)	bar	mm	bar	sec	sec	sec	bar	min
40	1,6	26	0,2	220	220	1,0	0,5	0,0	45	5	5	1,0	6
40	1,9	21	0,2	220	220	1,5	0,5	0,0	45	5	5	1,5	6
40	2,3	17,6	0,3	220	220	2,0	0,5	0,0	45	5	5	2,0	6
40	2,4	17	0,3	220	220	2,0	0,5	0,0	45	5	5	2,0	6
40	2,9	13,6	0,3	220	220	2,5	0,5	0,0	45	5	5	2,5	6
40	3,6	11	0,4	219	220	3,0	0,5	0,0	45	5	5	3,0	6
40	4,4	9	0,5	219	220	3,5	0,5	0,5	45	5	5	3,5	6
40	5,4	7,4	0,6	218	220	4,5	1,0	0,5	54	5	5	4,5	8
50	1,9	26	0,2	220	220	2,0	0,5	0,0	45	5	5	2,0	6
50	2,4	21	0,3	220	220	2,5	0,5	0,0	45	5	5	2,5	6
50	2,8	17,6	0,3	220	220	3,0	0,5	0,0	45	5	5	3,0	6
50	2,9	17	0,3	220	220	3,0	0,5	0,0	45	5	5	3,0	6
50	3,7	13,6	0,4	219	220	4,0	0,5	0,5	45	5	5	4,0	6
50	4,5	11	0,5	218	220	4,5	0,5	0,5	45	5	5	4,5	6
50	5,6	9	0,6	217	220	6,0	1,0	0,5	55	5	5	6,0	8
50	6,8	7,4	0,7	216	220	7,0	1,0	0,5	68	5	5	7,0	10
63	2,4	26	0,3	220	220	3,5	0,5	0,0	45	5	5	3,5	6
63	3,0	21	0,3	220	220	4,0	0,5	0,5	45	5	5	4,0	6
63	3,6	17,6	0,4	220	220	5,0	0,5	0,5	45	5	5	5,0	6
63	3,7	17	0,4	219	220	5,0	0,5	0,5	45	5	5	5,0	6
63	4,6	13,6	0,5	218	220	6,0	1,0	0,5	46	5	5	6,0	7
63	5,7	11	0,6	217	220	7,5	1,0	1,0	57	5	6	7,5	8
63	7,0	9	0,7	216	220	9,0	1,0	1,0	70	6	6	9,0	10
63	8,5	7,4	0,9	215	220	11,0	1,5	1,0	85	7	7	11,0	12
75	2,9	26	0,3	220	220	5,0	0,5	0,5	45	5	5	5,0	6
75	3,6	21	0,4	220	220	6,0	0,5	0,5	45	5	5	6,0	6
75	4,3	17,6	0,5	219	220	7,0	0,5	0,5	45	5	5	7,0	6
75	4,4	17	0,5	219	220	7,5	0,5	1,0	45	5	5	7,5	6
75	5,5	13,6	0,6	217	220	9,0	1,0	1,0	55	5	5	9,0	8
75	6,8	11	0,7	216	220	11,0	1,0	1,0	68	6	6	11,0	10
75	8,3	9	0,9	215	220	13,0	1,5	1,5	83	7	7	13,0	12
75	10,1	7,4	1,0	213	220	15,5	1,5	2,0	101	7	7	15,5	14



Angleichdruck *Bead Build-up Pressure* = P₁ + P_t (Bewegungsdruck *Drag Pressure*)
 Anwärmdruck *Heat Soaking Pressure* = P₂ + P_t (Bewegungsdruck *Drag Pressure*)
 Fügedruck *Joining Pressure* = P₅ + P_t (Bewegungsdruck *Drag Pressure*)

PE 80 / PE 100 DVS 2207-1 (09/2005)		HÜRNER Manual 160 Zylinder/Cylinder/Vérin 1,95 cm ²				Angleichen <i>Bead Build-up</i>		Anwärmen <i>Heating</i>		Um- stellen <i>Change-over</i>	Fügerampe (t ₂), Fügen u. Abkühlen <i>Pressure Ramp (t₂), Joining and Cooling</i>		
Durchmesser <i>Diameter</i>	Wandstärke <i>Wall Thicken.</i>	Ø / Wand Ø / Wall	Versatz <i>Align Offset</i>	Temperatur <i>Temperature</i>	Temperatur <i>Temperature</i>	P ₁	Wulst Bead	P ₂ m _{ax.}	t ₂	t ₃ m _{ax.}	t ₄	P ₅	t ₆
mm	mm	SDR	mm	°C (PE 80)	°C (PE 100)	bar	mm	bar	sec	sec	sec	bar	min
90	3,5	26	0,4	220	220	7,0	0,5	0,5	45	5	5	7,0	6
90	4,3	21	0,5	219	220	8,5	0,5	1,0	45	5	5	8,5	6
90	5,1	17,6	0,5	218	220	10,0	1,0	1,0	51	5	5	10,0	7
90	5,3	17	0,6	218	220	10,5	1,0	1,0	53	5	5	10,5	7
90	6,6	13,6	0,7	216	220	13,0	1,0	1,5	66	6	6	13,0	9
90	8,2	11	0,9	215	220	16,0	1,5	2,0	82	7	7	16,0	11
90	10,0	9	1,0	213	220	19,0	1,5	2,5	100	7	7	19,0	13
90	12,2	7,4	1,3	211	220	22,5	2,0	3,0	122	8	8	22,5	15
110	4,2	26	0,5	219	220	10,5	0,5	1,0	45	5	5	10,5	6
110	5,2	21	0,6	218	220	13,0	1,0	1,5	52	5	5	13,0	7
110	6,2	17,6	0,7	217	220	15,5	1,0	2,0	62	6	6	15,5	9
110	6,5	17	0,7	217	220	16,0	1,0	2,0	65	6	6	16,0	9
110	8,1	13,6	0,9	215	220	19,5	1,5	2,5	81	6	6	19,5	11
110	10,0	11	1,0	213	220	24,0	1,5	3,0	100	7	7	24,0	14
110	12,2	9	1,3	211	220	28,5	2,0	3,5	122	8	8	28,5	16
110	14,9	7,4	1,5	209	220	34,0	2,0	4,5	149	8	9	34,0	19
125	4,8	26	0,5	218	220	13,5	1,0	1,5	48	5	5	13,5	6
125	6,0	21	0,6	217	220	17,0	1,0	2,0	60	6	6	17,0	8
125	7,1	17,6	0,7	216	220	20,0	1,5	2,5	71	6	6	20,0	10
125	7,4	17	0,8	216	220	21,0	1,5	2,5	74	6	6	21,0	10
125	9,2	13,6	1,0	214	220	25,5	1,5	3,0	92	7	7	25,5	13
125	11,4	11	1,2	212	220	31,0	1,5	4,0	114	8	8	31,0	15
125	13,9	9	1,4	210	220	37,0	2,0	4,5	139	9	9	37,0	18
125	16,9	7,4	1,7	208	220	44,0	2,0	5,5	169	9	10	44,0	22
140	5,4	26	0,6	218	220	17,5	1,0	2,0	54	5	5	17,5	7
140	6,7	21	0,7	216	220	21,5	1,0	2,5	67	6	6	21,5	9
140	8,0	17,6	0,8	215	220	25,5	1,5	3,0	80	6	6	25,5	10
140	8,2	17	0,9	215	220	26,0	1,5	3,0	82	7	7	26,0	12
140	10,3	13,6	1,1	213	220	32,0	1,5	4,0	103	7	7	32,0	14
140	12,7	11	1,3	211	220	39,0	2,0	5,0	127	8	8	39,0	17
140	15,6	9	1,6	209	220	46,5	2,0	6,0	156	9	10	46,5	20
140	18,9	7,4	1,9	207	220	55,0	2,0	7,0	190	10	11	55,0	24
160	6,2	26	0,7	217	220	23,0	1,0	3,0	62	6	6	23,0	9
160	7,6	21	0,8	215	220	27,5	1,5	3,5	76	6	6	27,5	10
160	9,1	17,6	1,0	214	220	33,0	1,5	4,0	91	7	7	33,0	12
160	9,4	17	1,0	214	220	34,0	1,5	4,5	95	7	7	34,0	13
160	11,8	13,6	1,2	212	220	42,0	1,5	5,0	119	8	8	42,0	16
160	14,5	11	1,5	210	220	50,5	2,0	6,5	146	9	9	50,5	19
160	17,8	9	1,8	207	220	61,0	2,0	8,0	179	10	11	61,0	23
160	21,6	7,4	2,2	205	220	72,0	2,5	9,5	219	10	12	72,0	27



Angleichdruck *Bead Build-up Pressure* = P₁ + P_t (Bewegungsdruck *Drag Pressure*)
 Anwärmdruck *Heat Soaking Pressure* = P₂ + P_t (Bewegungsdruck *Drag Pressure*)
 Fügedruck *Joining Pressure* = P₅ + P_t (Bewegungsdruck *Drag Pressure*)

PP DVS 2207-11 (02/2017)		HÜRNER Manual 160 Zylinder/Cylinder/Vérin 1,95 cm ²			Angleichen <i>Bead Build-up</i>		Anwärmen <i>Heating</i>		Um- stellen Change- over	Fügerampe (t ₄), Fügen u. Abkühlen Pressure Ramp (t ₄), Joining and Cooling		
Durchmesser <i>Diameter</i>	Wandstärke <i>Wall Thickn.</i>	Ø / Wand Ø / Wall	Versatz <i>Alignment Offset</i>	Temperatur <i>Temperature</i>	P ₁	Wulst <i>Bead</i>	P ₂ m _{ax.}	t ₂	t ₃ m _{ax.}	t ₄	P ₅	t ₆
mm	mm	SDR	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
40	1,0	41	0,1	210	0,5	0,5	0,0	53	5	6	0,5	6,5
40	1,2	33	0,1	210	0,5	0,5	0,0	53	5	6	0,5	6,5
40	1,5	26	0,2	210	0,5	0,5	0,0	53	5	6	0,5	6,5
40	2,3	17,6	0,3	210	1,0	0,5	0,0	53	5	6	1,0	6,5
40	3,6	11	0,4	210	2,0	0,5	0,0	53	5	6	2,0	6,5
40	4,4	9	0,5	210	2,5	0,5	0,0	53	5	6	2,5	6,5
40	5,4	7,4	0,6	210	3,0	0,5	0,0	63	5	6	3,0	7,5
40	6,7	6	0,7	210	3,5	0,5	0,0	78	5	6	3,5	9,0
50	1,2	41	0,1	210	0,5	0,5	0,0	53	5	6	0,5	6,5
50	1,5	33	0,2	210	1,0	0,5	0,0	53	5	6	1,0	6,5
50	1,9	26	0,2	210	1,0	0,5	0,0	53	5	6	1,0	6,5
50	2,8	17,6	0,3	210	2,0	0,5	0,0	53	5	6	2,0	6,5
50	4,5	11	0,5	210	3,0	0,5	0,0	53	5	6	3,0	6,5
50	5,6	9	0,6	210	4,0	0,5	0,0	65	5	6	4,0	8,0
50	6,8	7,4	0,7	210	4,5	0,5	0,0	79	5	6	4,5	9,5
50	8,3	6	0,9	210	5,5	1,0	0,5	95	6	8	5,5	11,0
63	1,5	41	0,2	210	1,0	0,5	0,0	53	5	6	1,0	6
63	1,9	33	0,2	210	1,5	0,5	0,0	53	5	6	1,5	6
63	2,4	26	0,3	210	2,0	0,5	0,0	53	5	6	2,0	6
63	3,6	17,6	0,4	210	3,0	0,5	0,0	53	5	6	3,0	6
63	5,7	11	0,6	210	5,0	0,5	0,5	66	5	6	5,0	9
63	7,0	9	0,7	210	6,0	0,5	0,5	81	6	7	6,0	12
63	8,5	7,4	0,9	210	7,0	1,0	0,5	97	6	8	7,0	15
63	10,5	6	1,1	210	8,5	1,0	0,5	119	7	9	8,5	18
75	1,8	41	0,2	210	2,0	0,5	0,0	53	5	6	2,0	6,5
75	2,3	33	0,3	210	2,5	0,5	0,0	53	5	6	2,5	6,5
75	2,9	26	0,3	210	3,0	0,5	0,0	53	5	6	3,0	6,5
75	4,3	17,6	0,5	210	4,5	0,5	0,0	53	5	6	4,5	6,5
75	6,8	11	0,7	210	7,0	0,5	0,5	79	6	7	7,0	9,5
75	8,3	9	0,9	210	8,5	1,0	0,5	95	6	8	8,5	11,0
75	10,1	7,4	1,0	210	10,5	1,0	1,0	114	7	10	10,5	13,0
75	12,5	6	1,3	210	12,5	1,0	1,0	140	7	11	12,5	16,0
90	2,2	41	0,3	210	3,0	0,5	0,0	53	5	6	3,0	6,5
90	2,7	33	0,3	210	3,5	0,5	0,0	53	5	6	3,5	6,5
90	3,5	26	0,4	210	4,5	0,5	0,0	53	5	6	4,5	6,5
90	5,1	17,6	0,5	210	6,5	0,5	0,5	60	5	6	6,5	7,0
90	8,2	11	0,9	210	10,5	1,0	1,0	94	6	8	10,5	11,0
90	10,0	9	1,0	210	12,5	1,0	1,0	113	7	9	12,5	13,0
90	12,2	7,4	1,3	210	15,0	1,0	1,5	137	7	11	15,0	15,5
90	15,0	6	1,5	210	18,0	1,0	1,5	165	8	14	18,0	19,0



Angleichdruck *Bead Build-up Pressure* = P₁ + P_t (Bewegungsdruck *Drag Pressure*)
 Anwärmdruck *Heat Soaking Pressure* = P₂ + P_t (Bewegungsdruck *Drag Pressure*)
 Fügedruck *Joining Pressure* = P₅ + P_t (Bewegungsdruck *Drag Pressure*)

PP DVS 2207-11 (02/2017)		HÜRNER Manual 160 Zylinder/Cylinder/Vérin 1,95 cm ²			Angleichen <i>Bead Build-up</i>		Anwärmen <i>Heating</i>		Umstellen <i>Change-over</i>	Fügerampe (t ₄), Fügen u. Abkühlen <i>Pressure Ramp (t₄), Joining and Cooling</i>		
Durchmesser <i>Diameter</i>	Wandstärke <i>Wall Thickn.</i>	Ø / Wand <i>Ø / Wall</i>	Versatz <i>Alignment Offset</i>	Temperatur <i>Temperature</i>	P ₁	Wulst <i>Bead</i>	P ₂ m _{ax.}	t ₂	t ₃ m _{ax.}	t ₄	P ₅	t ₆
mm	mm	SDR	mm	°C	bar	mm	bar	sec	sec	sec	bar	min
110	2,7	41	0,3	210	4,5	0,0	0,0	53	5	6	4,5	6,5
110	3,3	33	0,4	210	5,5	0,0	0,5	53	5	6	5,5	6,5
110	4,2	26	0,5	210	7,0	0,5	0,5	53	5	6	7,0	6,5
110	6,2	17,6	0,7	210	10,0	0,5	1,0	72	6	7	10,0	8,5
110	10,0	11	1,0	210	16,0	1,0	1,5	113	7	9	16,0	13,0
110	12,2	9	1,3	210	17,0	1,5	1,5	137	7	11	17,0	15,5
110	14,9	7,4	1,5	210	22,5	1,5	2,0	164	8	13	22,5	19,0
110	18,3	6	1,9	210	27,0	2,0	2,5	199	9	16	27,0	23,0
125	3,0	41	0,3	210	5,5	0,5	0,5	53	5	6	5,5	6,5
125	3,8	33	0,4	210	7,0	0,5	0,5	53	5	6	7,0	6,5
125	4,8	26	0,5	210	9,0	0,5	0,5	56	5	6	9,0	7,0
125	7,1	17,6	0,8	210	13,0	1,0	1,0	82	6	7	13,0	9,5
125	11,4	11	1,2	210	20,5	1,0	2,0	129	7	10	20,5	15,0
125	13,9	9	1,4	210	24,5	1,0	2,0	154	8	13	24,5	18,0
125	16,9	7,4	1,7	210	29,0	1,0	2,5	185	8	15	29,0	21,5
125	20,1	6	2,0	210	33,5	1,5	3,0	216	10	18	33,5	25,5
140	3,4	41	0,4	210	7,0	0,5	0,5	53	5	6	7,0	6,5
140	4,2	33	0,5	210	9,0	0,5	0,5	53	5	6	9,0	6,5
140	5,4	26	0,6	210	11,5	0,5	1,0	63	5	6	11,5	7,5
140	8,0	17,6	0,8	210	17,0	1,0	1,5	92	6	8	17,0	10,5
140	12,7	11	1,3	210	26,0	1,0	2,5	142	7	12	26,0	16,5
140	15,6	9	1,6	210	31,0	1,0	3,0	172	8	14	31,0	20,0
140	18,9	7,4	1,9	210	36,5	1,0	3,5	205	9	17	36,5	24,0
140	23,3	6	2,4	210	43,5	1,5	4,0	246	10	20	43,5	29,0
160	3,9	41	0,4	210	9,5	0,5	0,5	53	5	6	9,5	6,5
160	4,8	33	0,5	210	12,0	0,5	1,0	56	5	6	12,0	7,0
160	6,2	26	0,7	210	15,0	0,5	1,5	72	6	7	15,0	8,5
160	9,1	17,6	0,9	210	22,0	1,0	2,0	104	6	9	22,0	12,0
160	14,5	11	1,5	210	33,5	1,0	3,0	160	8	13	33,5	18,5
160	17,8	9	1,8	210	40,5	1,0	4,0	194	9	16	40,5	22,5
160	21,6	7,4	2,2	210	48,0	1,5	4,5	230	10	19	48,0	27,0
160	26,7	6	2,7	210	57,0	2,0	5,5	277	11	26	57,0	33,0



Angleichdruck *Bead Build-up Pressure* = P₁ + P_t (Bewegungsdruck *Drag Pressure*)
 Anwärmdruck *Heat Soaking Pressure* = P₂ + P_t (Bewegungsdruck *Drag Pressure*)
 Fügedruck *Joining Pressure* = P₅ + P_t (Bewegungsdruck *Drag Pressure*)