



Hydraulic Butt Fusion Machines

TURBO LP SERIES

(Low Pressure)

Operator's Manual



Features

The Hayes Hydraulic TURBOLP series butt fusion machines will give many years of service if operation procedures and maintenance are followed carefully and correctly.

- ✓ The TURBOLP series is suitable for butt fusion pipes and fittings made of HDPE and any other kind of thermoplastic pipes.
- ✓ Machine consists of pipe alignment carriage, hydraulic power unit, insert sets, Teflon-coated heating plate, electric trimmer and electric stand.
- ✓ Designed and manufactured according to the American international standard (Inches) ASTM F2620.
- ✓ This machine is rugged, reliable and manually-operated. Capable of fusing pipe consistently with high-quality results.
- ✓ This machine requires only one operator and minimal maintenance.
- ✓ Additional DIPS and Metric pipe inserts are available and sold separately

Do not operate this machine until you have carefully read, and understand all the sections of this manual.

About this manual

This manual is only a manufacturer's guide. It does not take the place of proper training by qualified instructors. The information in this manual is operational and cannot cover all the situations that may appear in the field. This guide does not exceed the experience of a professional.

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IMPORTANT Safety Information

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”. The Safety Alerts are shown below.



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

Signal words “NOTICE” and “IMPORTANT” are used to bring attention to important information. The meaning of these signal words are as follows:

“NOTICE” - Can keep you from doing something that might damage the machine or someone’s property. It may also be used to alert against unsafe practices.

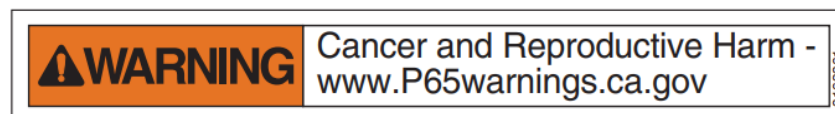
“IMPORTANT” - Can help you do a better job or make your job easier in some way.

California Proposition 65 Label

The California Office of Environmental Health Hazard Assessment (OEHHA) amended regulations related to “clear and reasonable” Proposition 65 warnings (“Warning”) went into effect August 30, 2018. For HAYES machines which are sold into and/or operated within California, the included label must stay attached to the machine. The purpose of Proposition 65 is to ensure the public is informed about potential exposures to chemicals which the state of California has determined can cause cancer, birth defects, or other reproductive harm.

The list now includes more than 900 chemicals. HAYES machines are safe, stable and non-toxic under normal condition and when handling correctly, but may contain a trace amount of listed compounds as a result of our manufacturing processes. The requirements for Prop 65 warnings have evolved, however, and these warnings are now required for California equipment.

For more information about Proposition 65, go to www.P65warnings.ca.gov.



NOTICE: All data in this Operator’s manual is offered in good faith as typical values. The information was compiled from data supplied by the vendors of the components of this machine and is believed to be accurate. It is the user’s responsibility to determine the safety, potential hazard, toxicity, and suitability for their own use of the machine described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by HAYES INDUSTRIAL SOLUTIONS INC as to the effects of such use, the results to be obtained, or the safety, potential hazard and toxicity of the product, nor does HAYES INDUSTRIAL SOLUTIONS INC assume any liability arising out of use, by others, of the product referred to herein. The information is intended only to assist in the safe handling of this machine.

Industrial Safety

RISK MATRIX



Avoid serious Injury: This unit must be operated by trained personnel only.

Skill and knowledge are required to properly use this equipment.

Improper operation, maintenance or repair of this product can be dangerous and could result in injury or death.

Be alert and report anything that you see, feel, smell or hear differently than expected, or that you think is unsafe.

HAZARD	RISK	SOURCE	RISK CONTROL
MECHANICAL 	Cutting Risk	Trimmer	<ul style="list-style-type: none"> Maintain a safe distance during trimming. Keep hands and fingers away from the trimmer blades when is running. Trimmer blades are extremely sharp. Wait for the trimmer to come to a complete stop before removing it from the alignment carriage.
ELECTRICAL 	Electrocution Risk	Heater Trimmer	<ul style="list-style-type: none"> Ensure you are using the correct power source. Confirm electrical cords are in good condition. If you are working in a wet environment, proper ground connections help to minimize the chances of an electric shock. Use GFCI electrical connection if possible. Do not allow the cables to come into contact with chemical agents, water or mechanical stress.
THERMAL 	Risk of Fire	Heater Trimmer	<ul style="list-style-type: none"> Do not use the machine in environments with explosion risk (due to the presence of gases, flammable vapors, etc.). Ensure to keep out any material that could deteriorate or ignite with the heater or with the combustion of the heater such as: oil, solvents, paints or varnishes, etc.
	Burn Risk	Heater Hydraulic Unit	<ul style="list-style-type: none"> Wear protective gloves and eyewear. When the heater is on it will burn clothing and skin. Never touch the surface of the heating element when is on. Wait until it completely cooled down. Carefully clean the heating plate with a dry lint free non-synthetic cloth. Move the heating plate cautiously. Do not touch the welding seam or surrounding areas before they have completely cooled down. Stay away from pinholes that eject fluid under pressure. A sudden hydraulic high-temperature and pressure oil leak can cause fatal injury.
ERGONOMIC 	Injury Risk	Weight	<ul style="list-style-type: none"> Move the large parts of the equipment correctly. Use the appropriate industrial safety positions for cargo handling.



Both the heater element and the trimmer with electric motor are **NOT EXPLOSION PROOF**. If operating in an explosive atmosphere, heater should be brought up to temperature in a safe environment, then unplugged before entering the explosive

atmosphere for fusion. Operation of heater in an explosive atmosphere without necessary safety precautions will result in serious injury or death.

Hydraulic Butt Fusion Machines

Introduction

Application

The HAYES Hydraulic Butt fusion machine is used for welding thermoplastic pipes and fittings made of HDPE (Polyethylene), PPR (Polypropylene), PB (Polybutene) and PVDF by heat fusion and pressure hydraulically controlled (not manually operated). This method plays a crucial role in joining pipes and fittings, ensuring leak-proof connections and long-lasting joints when maintaining the integrity of fluid transportation networks.

What is Butt Fusion?

Butt fusion is a thermal welding process used for joining thermoplastic pipes and fittings, as result of heat fusion and pressure, the molecules of the two pipes melt and mix together and when the joint cools, the molecules of plastics return to their original form, and the two parts finally become one monolithic pipe, creating a seamless, end-to-end connection.

When to Use Butt Fusion

Butt fusion is commonly used in various industries and applications, including:

- ✓ **Water and Gas Distribution:** It provides leak-free connections that are critical for the safe and efficient transport of these essential utilities.
- ✓ **Wastewater Management:** In sewage and wastewater systems, where pipes are subjected to a variety of harsh chemicals and environmental conditions, butt fusion is the go-to method for reliable, long-lasting connections.
- ✓ **Industrial Pipelines:** Industries such as chemical processing, mining, and agriculture often rely on butt fusion to join pipes that transport a wide range of materials, from corrosive chemicals to irrigation water.
- ✓ **Geothermal and HVAC Systems:** Butt fusion is used to connect pipes in geothermal heating and cooling systems, ensuring efficient heat transfer and long-term durability.

Benefits of Butt Fusion

Butt fusion offers several advantages that make it a preferred choice for many applications:

- ✓ **Leak-Proof Joints:** The resulting joints are seamless and completely leak-proof, ensuring the integrity of the fluid or gas being transported.
- ✓ **Longevity:** Butt fusion joints are highly durable and can withstand the test of time, making them ideal for applications where longevity is crucial.
- ✓ **No Need for Solvents or Adhesives:** Unlike other joining methods, butt fusion does not require the use of solvents or adhesives, reducing the risk of chemical contamination.
- ✓ **Low Maintenance:** Once a butt fusion joint is made, it requires minimal maintenance, reducing operational costs.
- ✓ **Consistency:** Butt fusion offers a high degree of repeatability and consistency in joint quality.

Butt fusion Procedure

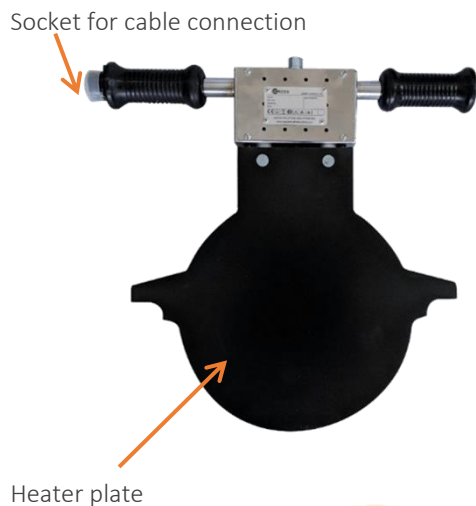
The butt-fusion procedure consists of heating the ends of two pipes, a pipe and a fitting, or two fittings, by holding them against a heated plate, removing the heater plate when the proper melt is obtained, promptly bringing the ends together, and allowing the joint to cool while maintaining the appropriate applied force/pressure.

An appropriately sized butt fusion machine is used to clamp, align and face the pipe or fitting ends and to apply the specified fusion force/pressure.

Parts of the Hydraulic Butt Fusion Machine

Teflon-coated heating plate

The heater is coated to reduce polymer adhesion. The heater temperature is controlled by a microprocessor installed in the electric power unit support.



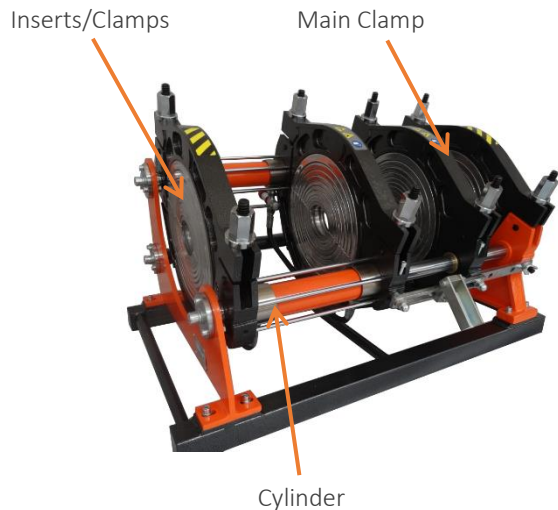
Electric Trimmer/Facer

A trimmer or facer is a rotating cutting device used to square-off the pipe or fitting ends to obtain properly mating fusion surfaces. This a heavy-duty trimmer/Facer with a robust electric motor will simultaneously prepare the ends of the pipes to be joined.



Pipe alignment carriage

This pipe alignment carriage has a stationary and a movable clamping fixture for aligning and holding each of the two parts to be fused to assist with pipe welding process. It also includes all the appropriate inserts for clamping different pipe sizes or fitting shapes.



Electric control unit / support

For more accurate and stable connection, the electric system and temperature display are controlled by the power unit support. It is also a stand for the heater and trimmer.

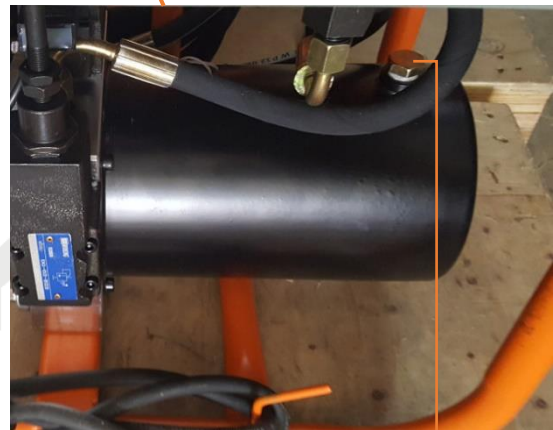
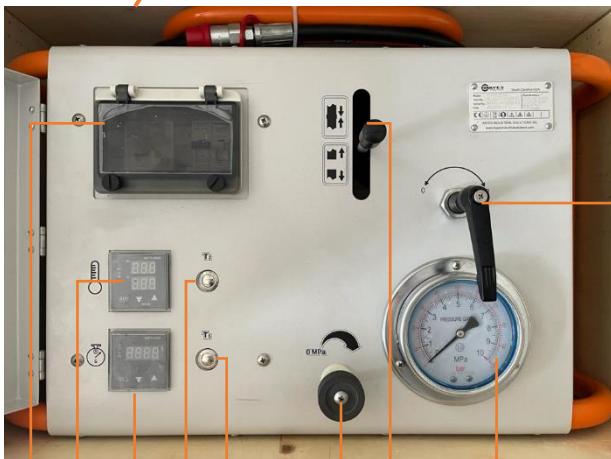


Hydraulic Unit



Control panel

Oil tank



Metal screw for shipping purpose only

Replace metal screw on oil tank with the red dipstick cap. The metal screw is not meant to be used when operating the hydraulic unit.

- Timer
- Temperature controller
- T2
- T5
- Pressure gauge
- Direction valve
- Pressure regulating valve
- Pressure relief valve



Voltmeter

Ground fault interrupter

Red dipstick cap



DATASHEET SPECIFICATIONS

MODEL	TURBOLP26-200	TURBOLP28-250	TURBOLP310-315	TURBOLP312-355	TURBOLP814-450
	6"	8"	10"	12"	14"
Welding Range (Inches IPS)	2" 3" 4" 6"	2" 3" 4" 6" 8"	3" 4" 6" 8" 10"	3" 4" 6" 8" 10" 12"	8" 10" 12" 14"
Welding Range (Metric)	63 - 200 mm	63 - 250 mm	90 - 315 mm	90 - 355 mm	200 - 450 mm
Cylinder Area	0.97 In ² 6.26 cm ²	1.7 In ² 10.98 cm ²	3.1 In ² 20 cm ²	3.1 In ² 20 cm ²	3.46 In ² 22.36 cm ²
What is included?	*Inch inserts 2" - 6" IPS	*Inch inserts 2" - 8" IPS	*Inch inserts 3" - 10" IPS	*Inch inserts 3" - 12" IPS	*Inch inserts 8" - 14" IPS
	*Pipe alignment *Hydraulic power unit *Heater *Trimmer	*Pipe alignment *Hydraulic power unit *Heater *Trimmer	*Pipe alignment *Hydraulic power unit *Heater *Trimmer	*Pipe alignment *Hydraulic power unit *Heater *Trimmer	*Pipe alignment *Hydraulic power unit *Heater *Trimmer
Pressure Adjustable Ranges	913.7 PSI 63 Bar	913.7 PSI 63 Bar	913.7 PSI 63 Bar	913.7 PSI 63 Bar	1.160 PSI 83 Bar
Oil tank capacity	3L	3L	3L	3L	3L
Oil requirement	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s
Plug	Nema L14-30	Nema L14-30	Nema L14-30	Nema L14-30	Nema L14-30
Heating Plate Max. Temp.	270 °C 518 °F	270 °C 518 °F	270 °C 518 °F	270 °C 518 °F	270 °C 518 °F
Temp. Deviation in Surface	≤ ± 7°F ≤ ± 5°C	≤ ± 7°F ≤ ± 5°C	≤ ± 7°F ≤ ± 5°C	≤ ± 5°F ≤ ± 5°C	≤ ± 5°F ≤ ± 5°C
Environment Temperature	50 °F – 113 °F (10 °C – 45 °C)	50 °F – 113 °F (10 °C – 45 °C)	50 °F – 113 °F (10 °C – 45 °C)	50 °F – 113 °F (10 °C – 45 °C)	50 °F – 113 °F (10 °C – 45 °C)
Working Voltage	220V ± 10% 2 phases	220V ± 10% 2 phases	220V ± 10% 2 phases	220V ± 10% 2 phases	220V ± 10% 3 phases
Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Total Power	2.95 kW / 15.7A	3.85 kW / 20.9A	4.85 kW / 25.4A	5.85 kW / 30A	8.4 kW / 23.38A
Heating Plate Power	1.5 kW / 6.8A	2.0 kW / 9.1A	3.0 kW / 13.6A	4.0 kW / 18.2A	5.4 kW / 14.1A
Trimmer Tool Power	0.7 kW / 4.9A	1.10 kW / 7.8A	1.10 kW / 7.8A	1.10 kW / 7.8A	1.50 kW / 4.6A
Hydraulic Unit Power	0.75 kW / 4.0A	0.75 kW / 4.0A	0.75 kW / 4.0A	0.75 kW / 4.0A	1.5 kW / 4.6A
Weight	336 LBS 18 CFT	443 LBS 23.9 CFT	548 LBS 34 CFT	605 LBS 36 CFT	1074 LBS 98.8 CFT
Packing	3 boxes 35x17x21 In./139 lbs 18x16x24 In./71 lbs 26x17x25 In./126 lbs	3 boxes 35x21x22 /176 lbs 22x21x28 /145 lbs 26x17x22 /122 lbs	3 boxes 38x27x27 /271 lbs 30x24x29 /149 lbs 27x18x21 /128 lbs	3 boxes 38x27x27 /317 lbs 30x24x29 /163 lbs 27x18x21 /125 lbs	3 boxes 53x41x42 /485 lbs 38x33x53 /429 lbs 30x18x22 /160 lbs

MODEL	TURBOLP818-500	TURBOLP1224-630	TURBOLP1832-800	TURBOLP2436-1000	TURBOLP2442-1200
	18"	24"	32"	36"	42"
Welding Range (Inches IPS)	8" 10" 12" 14" 16" 18"	12" 14" 16" 18" 20" 24"	18" 20" 24" 32"	24" 32" 36"	24" 32" 36" 42"
Welding Range (Metric)	200 – 500 mm	315 – 630 mm	450 – 800 mm	630 – 1000 mm	630 – 1200 mm
What is included?	*Inch inserts 8" - 18" IPS	*Inch inserts 12" - 24" IPS	*Inch inserts 18" - 32" IPS	*Inch inserts 24" - 36" IPS	*Inch inserts 24" - 42" IPS
	*Pipe alignment *Hydraulic power unit *Heater *Trimmer *Crane with hoist (Not included)	*Pipe alignment *Hydraulic power unit *Heater *Trimmer *Crane with hoist (Not included)	*Pipe alignment *Hydraulic power unit *Heater *Trimmer *Crane with hoist (Not included)	*Pipe alignment *Hydraulic power unit *Heater *Trimmer *Crane with hoist (Not included)	*Pipe alignment *Hydraulic power unit *Heater *Trimmer *Crane with hoist (Not included)
Cylinder Area	5.84 In ² 37.7 cm ²	5.84 In ² 37.7 cm ²	6.82 In ² 44 cm ²	6.02 In ² 38.9 cm ²	7.858 In ² 50.7 cm ²
Pressure Adjustable Ranges	1.160 PSI 83 Bar	1.160 PSI 83 Bar	2.320 PSI 160 Bar	2.320 PSI 160 Bar	2.320 PSI 160 Bar
Oil tank capacity	3L	3L	6L	6L	6L
Oil requirement	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s	46# Hydraulic oil (kinematic viscosity) mm ² /s
Plug	Nema L14-30	Nema L14-30	Nema L14-30	Nema L14-30	Nema L14-30
Heating Plate Max. Temp.	518 °F 270 °C	518 °F 270 °C	518 °F 270 °C	518 °F 270 °C	518 °F 270 °C
Temp. Deviation in Surface	≤ ± 7°F ≤ ± 5°C	≤ ± 7°F ≤ ± 5°C	≤ ± 7°F ≤ ± 5°C	≤ ± 7°F ≤ ± 5°C	≤ ± 7°F ≤ ± 5°C
Environment Temperature	14 °F – 104 °F (5 °C – 45 °C)	14 °F – 104 °F (5 °C – 45 °C)	14 °F – 104 °F (5 °C – 45 °C)	14 °F – 104 °F (5 °C – 45 °C)	14 °F – 104 °F (5 °C – 45 °C)
Difference Temp.	± 44 °F 6.67°C	± 44 °F 6.67°C	± 44 °F 6.67°C	± 44 °F 6.67°C	± 44 °F 6.67°C
Working Voltage	220V ± 10% 3 phases	220V ± 10% 3 phases	220V ± 10% 3 phases	220V ± 10% 3 phases	220V ± 10% 3 phases
Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Total Power / Current	9.5 kW / 26.32A	12.4 kW / 33.8A	17.7 kW / 48.86A	23.5 kW / 64.45A	28.5 Kw / 78.03A
Heating Plate Power	6.5 kW / 17.1A	9.4 kW / 24.5A	12.5 kW / 32.8A	17.5 kW 45.9A	21.5 kW / 56.4A
Trimmer Tool Power	1.50 kW / 4.6A	1.50 kW / 4.6A	2.2 kW / 6.8A	3 kW 9.3A	4 kW / 12.3A
Hydraulic Unit Power	1.5 kW / 4.6A	1.5 kW / 4.6A	3 kW / 9.3A	3 kW 9.3A	3 kW / 9.3A
Crane Power		0.9 kW / 2.8A	0.9 kW / 2.8A	0.9 kW / 2.8A	1.5 kW / 4.6A
Dielectric resistance	>2MΩ	>2MΩ	>2MΩ	>2MΩ	>2MΩ
Undesired sound	<70 dB	<70 dB	<70 dB	<70 dB	<70 dB
Weight	1294 LBS 118 CFT	1892 LBS 156 CFT	3216 LBS 316 CFT	5102 LBS 568 CFT	5665 LBS 791 CFT
Packing	3 boxes 65x41x42 / 683 lbs 39x34x53 / 451 lbs 30x18x22 / 160 lbs	3 boxes 65x48x48 / 1137 lbs 45x34x65 / 595 lbs 30x18x22 / 160 lbs	3 boxes 85x62x62 / 2059 lbs 54x43x68 / 970 lbs 30x18x22 / 187 lbs	3 boxes 100x75x82 / 3108 lbs 65x45x86 / 1807 lbs 30x18x22 / 187 lbs.	3 boxes 100x75x82 / 3549 lbs 65x45x86 / 1874 lbs 30x18x22 / 242 lbs

Other available parts

- ✓ DIPS Inserts
 - ✓ Metric Inserts
- ✓ Aluminum Stub Device
 - ✓ Datalogger
- ✓ Trolley
 - ✓ Crane with Hoist

Machine Operation

Before operation make sure of the following:



- ✓ Skill and knowledge are required to obtain a good quality joint.
- ✓ The machine should be placed on a stable and dry surface to operate.
- ✓ Check field generator for adequate power supply and fuel sufficient to complete the fusion joint.
- ✓ Pouring water or applying wet cloths to the joint to reduce cooling time is not acceptable.
- ✓ Make sure the blades of the trimmer are sharp and the Teflon in the heating plate is in good condition.
- ✓ Place the appropriate inserts for the pipe OD or the fitting being fused.

- ✓ **Non-stick coating (Teflon):** Coated surfaces have been treated to reduce polymer adhesion. If the polymer adheres to the heating plate, lightly wipe with a clean cotton cloth to remove. Do not use a wire brush or an abrasive.
- ✓ **Welding parameters:** Pipe manufacturers have established qualified fusion procedures which should be followed precisely. You should obtain a copy of the pipe manufacturer's procedures or appropriate joining standard for the pipe being fused.
- ✓ **Heater temperature:** Ensure you select the proper temperature according to the pipe manufacturer's recommendation. The surface temperature of the heating tool plate should be measured periodically with a surface pyrometer prior to initial use and at reasonable time intervals thereafter.



Setting up the Unit

- ✓ Connect the hydraulic unit to the basic frame with the quick couplers.



- ✓ Connect the trimmer and the heater to the hydraulic unit with the special connectors as shown in the image.



- ✓ Place the appropriate inserts for the pipe OD or the fitting being fused.



- ✓ Make sure the blades of the trimmer are sharp.



- ✓ Ensure the Teflon in the heater plate is in good condition.







Temperature and timer controller setting

Every time you change the pipe standard (diameter, pipe type, or SDR), you need to readjust the temperature, pressure, heating time, and cooling time.

Set temperature



Press "SET"  for more than 3 seconds, until you see "SDR", then press the arrows   to adjust the desired temperature. Press "SET"  again to confirm. Permit enough time to reach the desired temperature.

Set Pressure



Adjust the Drag Pressure

1. Fully open the pressure regulating valve.
2. Relieve pressure with relief valve.
3. Move the directional valve forward until the cylinder begins to move. At that point, the drag pressure recorded on the pressure gauge has been found.

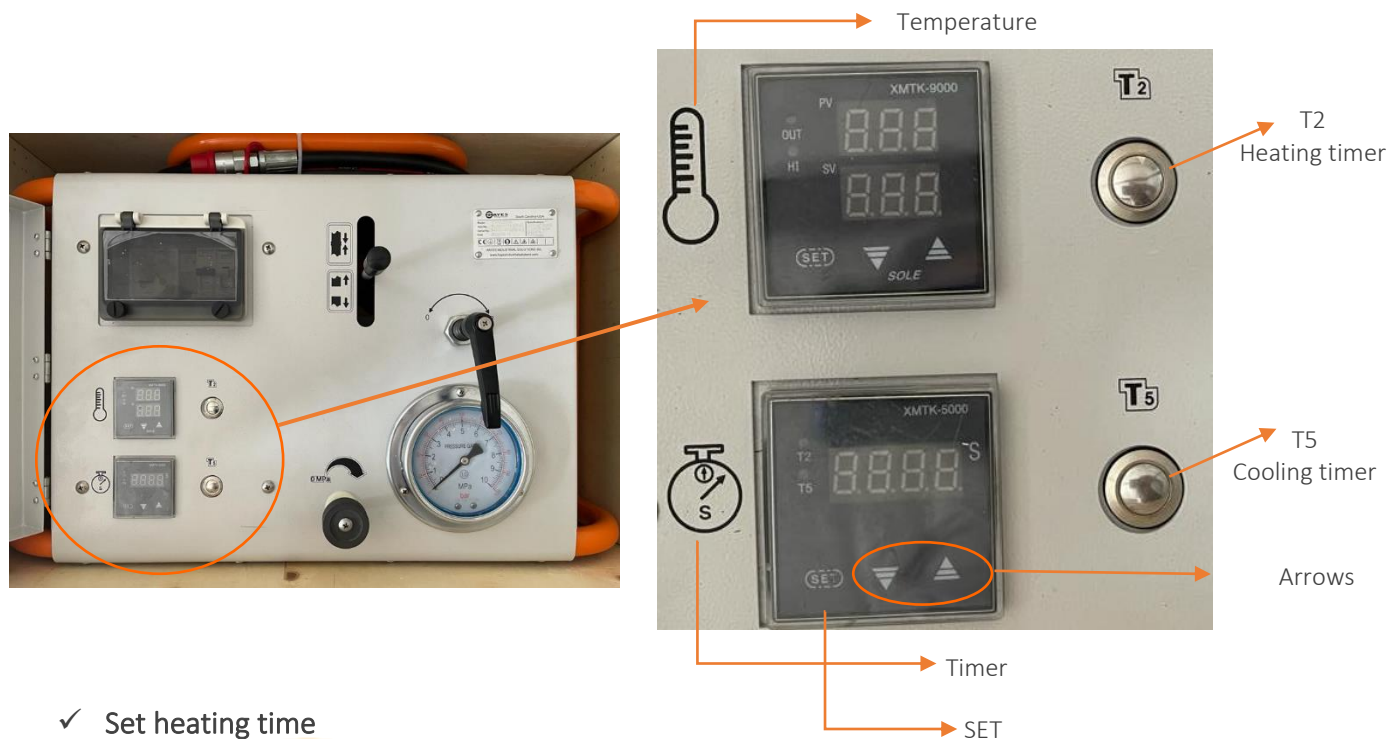
Fusion pressure



Voltmeter


Ground fault interrupter

Set heating and cooling time




✓ Set heating time


Press "SET"  until T2 shows a green light  and T5 is unactive.

Use the arrows  to increase or decrease the heating time in seconds.


✓ Set cooling time


Press "SET"  until T5 shows a green light  and T2 is unactive.

Use the arrows  to increase or decrease the cooling time in seconds.

Press "SET"  to confirm and end the setting.

✓ Set timer

Press T2  to start the heating timer. You Will hear a sound at the end and it Will go away after 8 seconds.

Press T5  to start the cooling timer. You Will hear a sound at the end and it Will go away after 8 seconds.

To stop the timer, Press both arrows  at the same time.

Welding procedure

Description of Method

The principle of Butt fusion is to heat to a designated temperature the ends of two thermos plastic pipes until a bead is formed, then fuse them together by application of a sufficient force or pressure. This force or pressure causes the melted materials to flow and mix, thereby resulting in fusion that is stronger than the pipe itself.

The butt fusion procedure has 4 stages:

The Welding Parameters contains the amount of Pressure and Time to apply in each stage. Obtain a copy of the pipe manufacturer's **Welding Parameters** for the appropriate joining standard for the pipe being fused. Follow the procedure carefully and adhere to all specified parameters. Failure to follow the pipe manufacturer's fusion procedures or appropriate joining standard could result in a bad fusion joint



PREPARE THE PIPE		Stage #1	
<u>Process involved</u>	<u>Parameter Required</u>		
✓ Cut and clean the pipe	None		
✓ Trim the edges and clean the pipe	None		
✓ Align the pipe	None		

HEATING UP THE PIPE		Stage #2	
<u>Process involved</u>	<u>Parameter Required</u>		
✓ Bead Up with pressure until a slight melt is observed	Pressure (P ₁) and Time (T ₁)		
✓ Heat soak until min. bead size is formed	DRAG Pressure (P ₂) and Time (T ₂)		

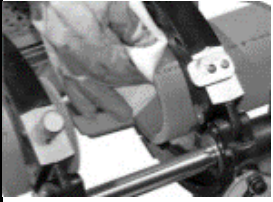


JOINING THE PIPE		Stage #3	
<u>Process involved</u>	<u>Parameter Required</u>		
✓ Changeover-Remove pipe and fuse	Time (T ₃)		
✓ Fuse the pipe ends together	Pressure (P ₃) and Time (T ₃ -T ₄)		
✓ Cooling time with pressure	Keep Pressure (P ₃) and Time (T ₅)		

REMOVING THE PIPE		Stage #4	
<u>Process involved</u>	<u>Parameter Required</u>		
✓ Cooling time without pressure	Only 10 min. ≤ 1IPS		
✓ Removing the pipe from alignment	None		
✓ Inspecting the welding	None		

Step by step welding procedure

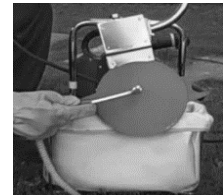
Stage #1: PREPARE THE PIPE

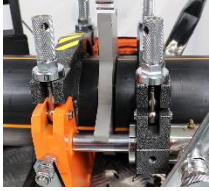

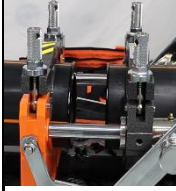
Place pipe support stands at both ends of the butt fusion machine and adjust the support stands to align the pipe with the fusion machine centerline. Install the pipes or fittings being joined in the stationary and movable clamps of the butt fusion machine. Leave enough pipe protruding through the clamps to allow for facing and clamp the pipe or fitting in the machine.

Cut and Clean	Trimming pipes	Alignment
 <p>Cut the pipe and clean the inside and outside of both ends of the pipes with a clean lint-free dry cloth. Remove all dirt from the clamps surfaces where the pipes will be clamped in the butt fusion machine.</p>	 <p>Face the pipe ends until the trimmer bottoms out on the stops and is locked between the clamps to establish clean, parallel mating surfaces between the pipe ends. Open the clamps, remove the trimmer and clean the inside and outside of both ends of the pipes with a clean lint-free dry cloth.</p>	 <p>Check the pipe ends for high low alignment and out-of-roundness. If adjustment is needed, adjust the high side down by tightening the high side clamp. Do not loosen the low side clamp or slippage may occur during fusion. Re-face the pipe ends if excessive adjustment is required and remove any dirt with a clean, lint-free cotton cloth. The maximum OD high-low misalignment allowed in the butt fusion procedure must be less than 10% of the pipe minimum wall thickness.</p>


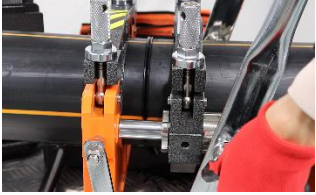

Stage #2: HEATING UP THE PIPE

Preheat: Verify that the heater surface temperatures are in the specified temperature range according to the standard. ASTM F 2620-13 (204-232°C / 400-450°F). Please follow pipe manufacturer's procedure. A pyrometer or other surface temperature measuring device should be used before the first joint of the day and periodically throughout the day to insure proper temperature of the heater plate. The thermometer on the electric box indicates internal temperature of the heater which varies from the actual surface temperature. **NOTICE:** Incorrect heating temperature can result in questionable fusion joints.



Bead Up with pressure	Heat Soak	Change over
 <p>Use an initial pressure (P1) to push the end of the 2 pipes against the heating plate, holding it for time (T1) until a slight melt is observed.</p>	 <p>Decrease the pressure at the DRAG pressure to start the Heat Soak. Maintain the contact with DRAG pressure (P2) for the Time (T2) until the Bead size (B) is within the recommended range.</p>	 <p>When the proper bead size is observed, quickly remove the heating tool and quickly inspect the pipe ends. The maximum time spent must be less than or equal to (T3). Bring the pipe together and begin the next step. Joining the Pipe.</p>

Stage #3: JOINING THE PIPE

Fuse pipe together	Cooling with pressure	Cooling Without pressure
 <p>Close the clamps by bringing the pipe ends together. Raise the pressure gradually and steadily using the set time until a welding pressure (P3) is reached during the time (T4). Do not use excessive or insufficient force.</p>	 <p>Keep the pipes joined on the carriage aligner under the same pressure (P3) during the cooling time (T5) until sufficiently cooled. Cooling under pressure before removal from the butt fusion machine is important in achieving joint integrity.</p>	 <p>Once the cooling time with pressure has ended, decrease the pressure at contact pressure to 0. For ambient temperatures 100°F and higher, additional cooling time may be needed.</p> <p><i>Pouring water or applying wet cloths to the joint to reduce cooling time is not acceptable.</i></p>

Stage #4: REMOVING THE PIPE

**Cooling time without pressure**

(only 10 minutes additional cooling time is required for IPS 1 in. and smaller pipe sizes). Do not apply internal pressure until the joint and surrounding material have reached ambient air temperature.

Removing Pipe

After pipe has cooled sufficiently, apply closing force on the lever handle and push the locking cams down into the unlocked position. Unscrew the clamp knobs enough that they can be swiveled outward.

Inspecting

Visually check the entire joint. The joint should be smooth symmetry, and the bottom of groove between the beads should not be lower than the pipe surface. The misalignment of two beads should not exceed 10% of the wall thickness.

NOTE: Avoid high stress such as pulling, installation or rough handling for an additional 30 min or more after removal from the fusion machine (only 10 minutes additional cooling time is required for IPS 1 in. and smaller pipe sizes). Do not apply internal pressure until the joint and surrounding material have reached ambient air temperature.



Cold weather procedures

- ✓ When the ambient temperature becomes colder, it will require a longer heating time to develop an indication of melt and the final bead size. The pipe wall thickness and pipe diameter are primary factors to consider when determining the necessary heating cycle time.
- ✓ The **heating plate temperature range shall not be exceeded** to accommodate cold weather conditions. That could drastically damage the heating iron, ruin the pipe and it also can cause an undesired accident.
- ✓ **Do not apply additional pressure** during the heat soak to accommodate cold weather conditions
- ✓ Cold Ambient Temperatures below -4°F (-20°C) is generally not recommended without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating.
- ✓ **Wind**— Exposure of the fusion heater plate and pipe to wind can result in unacceptable temperature variations during butt fusions and possible joint contamination. When extreme wind conditions exist, the provision of a suitable shelter is required to protect the pipe and fusion heater plate to ensure a more consistent environment is provided.
- ✓ The fusion operator shall be aware of ambient weather conditions to make adjustments to the fusion procedure, these modifications require validation through the production of test fusions and their assessment by comparison to visual guidelines and bend testing.

Quality welding assurance recommendations

Butt Fusion of different wall thicknesses:

The butt fusion procedure is based on joining piping components (pipes and fittings) having the same outside diameter and the same wall thickness (the same SDR) per ASTM or other industry product specifications. Try to butt fusion pipes and fittings that have the same outside diameter but different wall thickness is not recommended.

The quality of butt fusion joints made between pipes of unlike wall thickness is highly dependent on the performance properties of the thermoplastic material used for the pipes or fittings being joined. Consult the pipe or fitting manufacturer for applicable butt fusion procedures for components with dissimilar wall thicknesses.

The correct fusion pressure:

Follow the fusion pressure parameters. If the ends of the pipes (fittings) are brought together with excessive force, molten material may be pushed out of the joint and cold material brought into contact forming a “cold” joint. If too little force is used, voids and weak bonded areas can develop in the joint as molten material cools and contracts.

Datalogger:

If possible, use a datalogging device with hydraulic joining equipment to record the critical fusion parameters of pressure, temperature and time for each joint

Butt fusion visual appearance guideline

Reference: ASTM F 2620

ACCEPTABLE VISUAL APPEARANCE



Proper double roll-back bead.
Proper alignment.

UNACCEPTABLE VISUAL APPEARANCE



Incomplete face-off.



Improper alignment in fusion machine—mitered joint.



“high-low” pipe alignment.
Visually mitered joint.

Improper

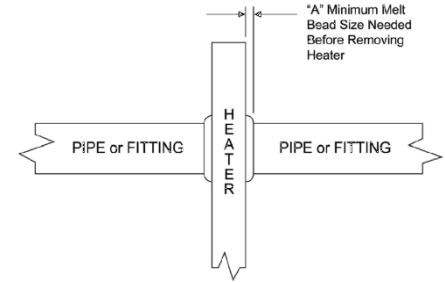
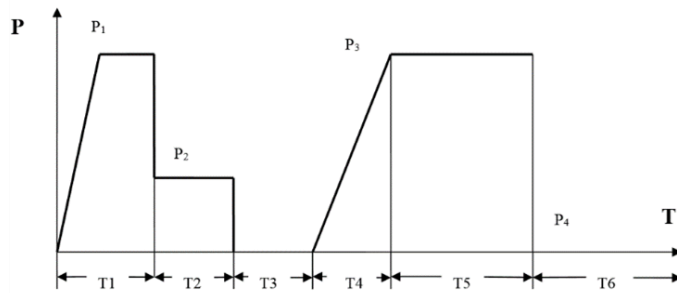


Contamination in joint.

Reference Welding Standard

Pressure and Time Calculations

American Standard the ASTM F 2620



Temperature: **400 – 450 °F (204 – 232 °C)**

IFP: 75 PSI = 0.517 Mpa = 0.517 N/mm² = 51.71 N/cm² (Average 60 - 90 PSI)

IFP MIN 60 PSI = 0.41 Mpa = 0.41 N/mm² = 41 N/cm²

IFP MAX 90 PSI = 0.62 Mpa = 0.62 N/mm² = 62 N/cm²

DRAG: 30 PSI

BEAD UP	HEAT SOAK		BEAD UP (MINIMUM BEAD SIZE)		HEATER REMOVAL		FUSE	COOL
BEAD UP Pressure	HEAT SOAK	Time T2 (s)	If Outside Diameter in. (mm)	Min. Bead Size in. (mm)	Wall Thickness in. / (mm)	Time T3 (s)	FUSE Pressure	Cooling Time T5 (m) with force
IFP*Ap + DRAG Time T1: 10 s on 14 in. pipe and smaller	Drag 30 PSI	4.5 min (270 s) x 1" (25.4 mm) Wall Thickness (T)	< 2.37 (60) ≥ 2.37 (60) < 3.5 (89) > 3.5 (89) < 8.62 (219) > 8.62 (219) < 12.75 (324) > 12.75 (324) < 24 (610) > 24 (610) < 36 (900) > 36 (900) ≤ 65 (1625)	1/32 (1) 1/16 (1.5) 3/16 (5) 1/4 (6) 3/8 (10) 7/16 (11) 9/16 (14)	0 – 5 0.20-0.36 (5-9) >0.36-0.55 (9-14) >0.55-1.18 (14-30) >1.18-2.5 (30-64) >2.5-4.5 (64-114)	4 8 10 15 20 25	IFP*Ap + DRAG Time T4: T3 & T4 is the max time allow Open/Close	11 min (660 s) x 1" (25.4 mm) Wall Thickness (T)

European Standard DVS 2207-1

Temperature: **(200 – 220 °C) (392 – 428 °F)**

IFP: 0.15 MPa = 21.76 PSI = 0.15 N/mm² = 15 N/cm²

DRAG: 0.02 Mpa

BEAD UP	HEAT SOAK		BEAD UP (MINIMUM BEAD SIZE)		CHANGEOVER (Heater Removal)	JOINING / WELDING / FUSING		
BEAD UP Pressure	HEAT SOAK	Time T2 (s)	Wall Thickness (mm)	Min. Bead Size (mm)	Time T3 (s) Per Wall thickness	Joining pressure build-up Time T4 (s)	FUSE Pressure	Cooling Time Under pressure Time T5 (m)

IFP*Ap + DRAG	Drag	10 times	...4.5	0.5	5	5	IFP*Ap + DRAG	6
	0.02	the Wall	4.5 – 7	1.0	5 – 6	5 – 6		6 – 10
	Mpa	Thickness	7 – 12	1.5	6 – 8	6 – 8		10 – 16
		pipe in	12 – 19	2.0	8 – 10	8 – 11		16 – 24
		seconds	19 – 26	2.5	10 – 12	11 – 14		24 – 32
			26 – 37	3.0	12 – 16	14 – 19		32 – 45
			37 – 50	3.5	16 – 20	19 – 25		45 – 60
			50 – 70)	4.0	20 – 25	25 – 35		60 – 80

Glossary of terms

How to Calculate the PRESSURE GAUGE (Hydraulic Machines)

(PG) = Pressure Gauge

$$PG = \frac{IFP * Ap}{TEPA} + DRAG$$

IFP = Interfacial Pressure

ASTM F2620 › IFP = 0.41 – 0.62 MPa / 60 – 90 PSI

DVS 2207 -1 › IFP = 0.15 MPa / 21.75 PSI

Ap = (Pipe Area)

$$AP = (OD - T) * T * \pi$$

$$T = \frac{OD}{SDR} \quad SDR = \frac{OD}{T}$$

$\pi = 3,14$

TEPA = Total Effective Piston Area

DRAG = Drag pressure

Welding terminology

T = Time

P = Pressure

B = Bead size

Pipe terminology

ND = Nominal Diameter

DIN = Internal Diameter

OD = Outside Diameter

T = Thickness

PN = Nominal Pressure

SDR = Standard Dimensional Ratio

Relation between the Outside diameter and Thickness of the wall

Temperature terminology

Celsius to Fahrenheit

$$1^{\circ}C = 33.8^{\circ}F$$

$$1^{\circ}F = (X^{\circ}C * 9/5 + 32) = ^{\circ}F$$

$$1^{\circ}F = -17.22^{\circ}C$$

$$1^{\circ}C = (X^{\circ}F - 32 * 5/9) = ^{\circ}C$$

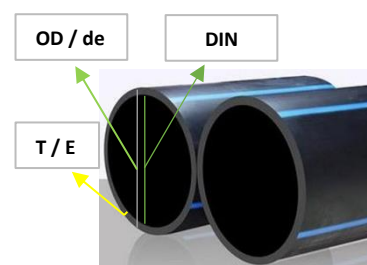
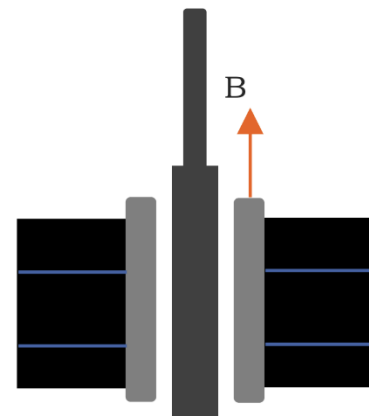
Pressure terminology

How to Calculate the FORCE (Manual Machines)

For reference only

(F) = FORCE

$$F = IFP * Ap + DRAG$$



PSI=	Pound square inches
MPa=	Mega Pascal
1 MPa=	10 Bar = 145 PSI = 1 N/mm ² = 100 N/cm ²
1 In ² =	6.4516 cm ²
1 cm ² =	100 mm ² = 0.155 In ²
1 mm ² =	0.01 cm ² = 0.00155 In ² = 0.00001076 Ft ²

How to calculate fusion pressure EXAMPLE (Hydraulic Machine)

AMERICAN STANDARD ASTM F2620					
MACHINE: TURBO500LP818 - LOW PRESSURE					
Welding ranges:	8" 10" 12" 14" 16" 18" IPS				1 Mpa= 145 PSI = 10 Bar = 1 N/mm ²
Pressure ranges:	1160.0	PSI	8	Mpa	1mm=0.1cm=0.03937In=0.001217In ²
Cylinder Area:	5.84	In ²	37.7	cm ²	TEPA 1mm ² = 0.01 cm ² = 0.00155 In ²
IFP:	75	PSI	0.517	Mpa	
Material:	PE				
Formula					
(PG) = Pressure Gauge					
$PG = \frac{IFP * A_p}{TEPA} + DRAG$					
IFP Interfacial Pressure			ND = Nominal Diameter		
A _p Pipe Area = (OD – T) * T * π			OD = Outside Diameter		
T Thickness = OD/SDR			DIN = Internal Diameter		
TEPA Total Effective Piston (Cylinder) Area			SDR = Standard Dimensional Ratio		
DRAG Drag pressure - 30 PSI = 0.20 Mpa			PN = Nominal Pressure		
CALCULATING...					
$PG = \frac{IFP * A_p}{TEPA} + DRAG$					
Pipe size	18				
SDR	11				
OD of	18	18.00	"	457.2	mm
T= OD/SDR =		1.636			
A _p =	A _p Pipe Area = (OD – T) * T * π				
A _p =	84.1	In ²			
PG=	75	PSI	*	84.1	In ²
		5.84	In ²		
					DRAG (30 PSI)
PG=	1079.79	PSI	+	DRAG (30 PSI)	1110 PSI

References

Machine datasheet: TURBO500LP818
 Formula: How to calculate pressure Gauge Page #22
 OD: Pipe sizes Chart Conversion Page #24

Download the Fusion Parameters guide for your machine on our website:

www.hayesfusion.com/university

HDPE Thermoplastic pipe sizes IPS DIPS mm Chart Conversion

Nominal Pipe Size IPS (Known as Inches)	Real Size Outside Diameter (OD) (Inches)	Real Outside Diameter (OD) (mm) 1 Inch = 25,4 mm	Closer Metric Pipe size or (mm) (Not the same)	Real Size Outside Diameter (OD) (mm)
1/2" IPS	0,84"	21,34 mm	20 mm	20.3
3/4" IPS	1,05"	26,67 mm	25 mm	25.3
1" IPS	1,32"	33,40 mm	32 mm	32.3
1-1/4" IPS	1,66"	42,16 mm	40 mm	40.4
1-1/2" IPS	1,90"	48,26 mm	50 mm	50.5
2" IPS	2,38"	60,33 mm	63 mm	63.4
3" IPS	3,50"	88,90 mm	90 mm	90.6
4" IPS	4,50"	114,30 mm	110 mm	110.7
6" IPS	6,63"	168,28 mm	160 mm	161
8" IPS	8,63"	219,08 mm	200 mm	201.2
10" IPS	10,75"	273,05 mm	250 mm	249.7
12" IPS	12,75"	323,85 mm	315 mm	314.6
14" IPS	14,00"	355,60 mm	355 mm	354.2
16" IPS	16,00"	406,40 mm	400 mm	399.3
18" IPS	18,00"	457,20 mm	450 mm	449.9
20" IPS	20,00"	508,00 mm	500 mm	499.4
22" IPS	22,00"	558,80 mm	550 mm	563.4
24" IPS	24,00"	609,60 mm	600 mm	629.2
25" IPS	25,00"	635,00 mm	630 mm	633.8
28" IPS	28,00"	711,20 mm	700 mm	
32" IPS	32,00"	812,80 mm	800 mm	807.2
36" IPS	36,00"	914,40 mm	900 mm	908.1
42" IPS	42,00"	1066,80 mm	1000 mm	1009
48" IPS	48,00"	1219,20 mm	1200 mm	

Recommendations Preventative Maintenance

The Hayes manual COMBAT PROX series butt fusion machines will give many years of service if operation procedures and maintenance are followed carefully and correctly.

PROPERLY HANDLE ELECTRICAL CORDS

- ✓ Yanking or pulling on the cord instead of gently unplugging it can strain the cord's connections, leading to frayed wires, loose connections, or even short circuits. This can result in costly repairs or the need to replace damaged equipment.
- ✓ Following safe handling techniques ensures personal safety and device longevity.
- ✓ Regularly inspect and maintain electrical cords to prevent accidents. Avoid overloading outlets, protect cords from damage, and keep them away from moisture, children, and pets.
- ✓ Hold the plug firmly, making sure to grip it by the insulated portion. Avoid pulling on the cord itself, as this can strain the connections and potentially damage the cord and the plug.

STORE

- ✓ Keep the machine and all its components clean and well maintained to ensure the best performance.
- ✓ Store machine inside, in a dry cover area, out of the element of the weather.

CLEAN AND DRY

- ✓ Clean the pipe alignment with a soap and water, wash as needed and keep it dry. Never pressure wash.
- ✓ Protect the heater, trimmer and the electric power unit from water and other chemicals agents.
- ✓ Keep the heater clean to avoid build-up plastic pipe residue, when cleaning the tool don't use an abrasive pad or steel wool. Use a non-synthetic cloth that won't damage or scratch surfaces.
- ✓ Keep the trimmer and its blades clean and lubricated for optimum performance.
- ✓ Make sure all the cables and connections are clean.
- ✓ Never allow dirt, water, or other foreign matter to enter the electric power unit.

REMOVE DIRT AND LUBRICATE

- ✓ **Alignment:** Remove oily dirt buildup from guide rods and use WD-40 to lubricate it and wipe it. Do not leave the cleaning agent on the guide rods. Lubricate guide rod bushings with SAE 10W-40 motor oil through the oil holes on the movable jaw.
- ✓ Occasionally add a drop of oil to pivot pins and shafts.
- ✓ Wash and clean bearings and threads in kerosene or solvent and keep them lubricated.

KEEP EVERYTHING NICE AND TIGHT

- ✓ Ensure all screws, nuts, bolts, and snap rings are secure and tight.

ADJUSTING TEMPERATURE

Allow heater to stabilize at the new temperature (5 to 10 minutes) after adjusting.

Machine Maintenance and Inspection

Part	Serial #	Details	Satisfactory or needs repair
Electric trimmer / Facer		Inspect the trimmer blades for damage and sharpness	
		Check cord, plug and sockets	
		Trimmer does not wobble when trapped between jaws	
		Check for loose pieces, screws and mechanical connections	
Teflon-coated heating plate		Check cord, plug and sockets	
		Heater surface is clean and the PTFE coat is in good condition	
		Surface temperature checked with pyrometer	
		Check for loose pieces, screws and mechanical connections	
Electric control unit / support		Check cord, plug and sockets	
		Check display indicator and connections	
		Check Contactors	
		Check Breakers	
		Check for loose pieces, screws and mechanical connections	
Pipe alignment carriage		Ensure clamp knob bearings are lubricated and move freely	
		Ensure the mobile handles aren't bend	
		Ensure all nuts and bolts are tight	
		Check guide rods condition	
Hydraulic Unit		Check pressure gauge	
		Replace seals if hydraulic unit is leaking	
		Change filters if necessary	
		Check Oil Levels or oil changes	
		Replace the hose couplings if need it	
		Check the Control panel and display controllers	
		Check the voltmeter, valves and valves	

Warranty

LIMITED WARRANTY

Hayes Fusion warrants all products distributed. All products have 12 months warranty against manufacturer's defects from the date of purchase directly from Hayes Fusion or Hayes Fusion authorized dealers. Furthermore, this warranty only covers factory defects.

RETURN OF GOODS

Buyer must receive written authorization directly from Hayes Fusion or Hayes Fusion authorized dealer before any returns. The goods must be in the same condition as received. The buyer has 15 days to request a return of goods after the date of the purchase. Buyer is responsible for return freight for any reason other than manufacturer's defects.

IMPROVEMENT

Hayes Fusion reserves the right to make any changes in or improvements on its products without incurring any liability or obligation to update or change previously sold machines and/or the accessories.

PROPRIETARY RIGHTS

All proprietary rights pertaining to the design, colors, and branding, are exclusively the property of Hayes Fusion.

DISCLAIMER OF LIABILITY

Hayes Fusion accepts no responsibility of liability for fusion joints. Operation and maintenance of the product is the responsibility of operators. We recommend qualified joining procedures to be follow when using Hayes fusion equipment. Hayes Fusion makes no further warranty of any kind whatever, express or implied; and all implied warranties of merchantability and fitness for a particular purpose which exceed the obligation are hereby disclaimed by Hayes Fusion.

Remember your product information to activate your warranty.

Model No: _____

Serial No.: _____

Inspector: _____

Date of the purchase: _____

Distributor: _____



HAYES FUSION Quality Certificate

Dear Customer,

Your machine has been fully tested and inspected for quality assurance by our technical department.

□ TURBO SERIAL# _____

This welding machine meets the HAYES FUSION quality standards and is released for field use.

Date:

Signature: