



*Butt fusion machine*

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# FM -355 Butt Fusion Machine Operation Manual

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**JILIN SONG JIANG SMART JOINT CO., LTD**

Address: Tiangang Economic Developing Region Jiaohe City Jilin Province China

Post Code: 132021

Tele : 0086-432-66976665 Fax :0086- 432- 66976664

<http://www.jlsjpipe.com>

Email: [info@jlsjpipe.com](mailto:info@jlsjpipe.com)

# Safety Rules According to Directives CE

(To be read carefully and apply while utilizing the FM 355)

Due to the specific use, this machine cannot be supplied with all kind of fix and removable protection suitable to avoid any risk of accident.

The machine, therefore, must be utilized, adjusted and keep in perfect functioning conditions by skill operators.

## Warning – Rules - Obligations

The use of machine composed by electrical components and movable parts, it's always a potential danger. In order to avoid any kind of accident caused by electrical or mechanical sources it's strongly suggested to read and follow carefully the following safety rules before operating the machine.

### Transport

- ✓ **Basic Machine**, keep the maximum care while moving and it's suggested to utilize mechanical aids.
- ✓ **Facing Tool**, keep the maximum care while moving it and it's compulsory to utilize the handle also take care about the blades mounted in, it's compulsory use gloves.
- ✓ **Heating plate**, supplied with transport handle.  
keep the maximum care while moving it also keep the maximum care while utilizing it due to the high temperature involved always more than 200°C, it's strongly suggested to use suitable gloves.  
In order to move from one working place to the other, the facing tool and the heating plate must located into the special support. This support is heavy therefore it's necessary to utilize the maximum care to move it.
- ✓ **Hydraulic unit**, supplied with transport's frame.  
Keep the maximum care while moving and in case utilize two person.  
Avoid transport the components by holding from the cable and remember to use suitable gloves.

### Electrical Connections

- ✓ The machine is operated by 220 Volts therefore be sure that the power supply plug is supplied with the safety devices according to the standard requirements, also check that the power supply will be on the rang of maximum 10% of the machine's nominal tension.
- ✓ While the facing tool is connected to the power supply do not leave it into the basic machine but place it into the special support. In this position, even if the start bottom is pushed the engine does not start.
- ✓ Check regularly the cable and the plug and in case substitute by qualify personnel.
- ✓ Before carry out a reparation or maintenance all the plugs must with plug out from the power supply.

### Environmental Conditions

The working area must be clean and duly lighted. It's very dangerous to utilize the machine in case of rain or in wheat conditions or close to flammable agents.

### Clothes

Keep the maximum care while utilizing the machine due to the high temperature involved on the heating plate always more than 200 °C, it's strongly suggested to use suitable gloves. Avoid long clothes and

avoid bracelets, necklaces that might be hooked into the machine.

**Correct machine's operation**

Remember to check and read carefully the manual before utilizing the machine and the accessories.

**Keep always the maximum attention**

After the heating plate has been disconnected temperature will be hot for some minutes.

Keep the maximum care while utilizing facing tool. Be carefully to the blades, it's strongly suggested to use suitable gloves. During the facing operation (facing tool in movement) it's forbidden to take out the shavings,

Avoid utilizing the machine after drinking or drugs use.

Take care that all the people around the machine are at safety distance.

While starting operating take care to avoid leave arms between the movable and fix trolleys. It's compulsory to

**Squashing danger**

While starting operating take care to avoid leave legs or arms between the movable and fix trolleys. It's compulsory to be far the basic machine.

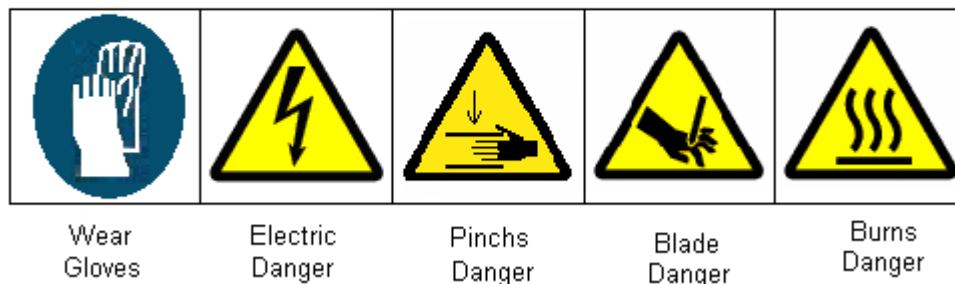
**Acoustic pollution**

The acoustic pollution of the drill engine is less than 85dB (value measured at 1 meter distance from the operator). Due to some particular cases such as too much pressure during the facing the noise should be increased, therefore it's suggested to protections.

**Important !!!**

Keep the maximum care reading and following the above Warning – Rules – Obligations the JILIN SONGJIANG THE EQUIPMENT OF PLASTIC CHENNELS. CO. LTD decline all responsibilities if are not followed totally.

Label on machine's components showing potential dangers



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## 1: Main Technical Parameter

1.1 Largest Work Pressure: 7Mpa;

1.2 Cylinder section: 1622 mm<sup>2</sup> (double);

1.3 Scope of the heating plate Temperature: 40~250°C.

1.4 Applied Welding Materials: PE, PP.

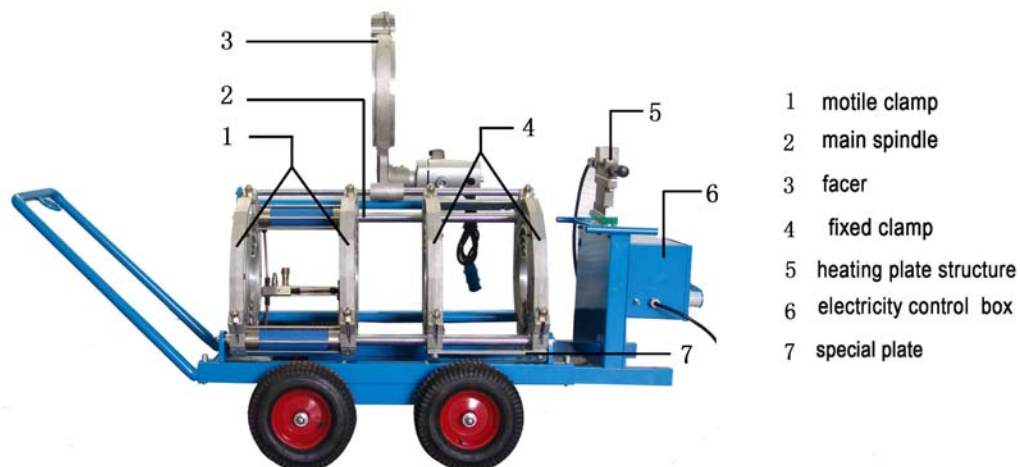
1.5 Liquid Pressure Oil: YB-46N or YB-32N the anti-whets liquid pressure oil.

### 1.6 Electric data

Power Supply	AC: 220 V
Facer	1,100 w
Heater	3,000 w
Hydraulic station	750 w
Total Power Consumption	4,850 w

## 2. Main components description

### 2.1 Base machine

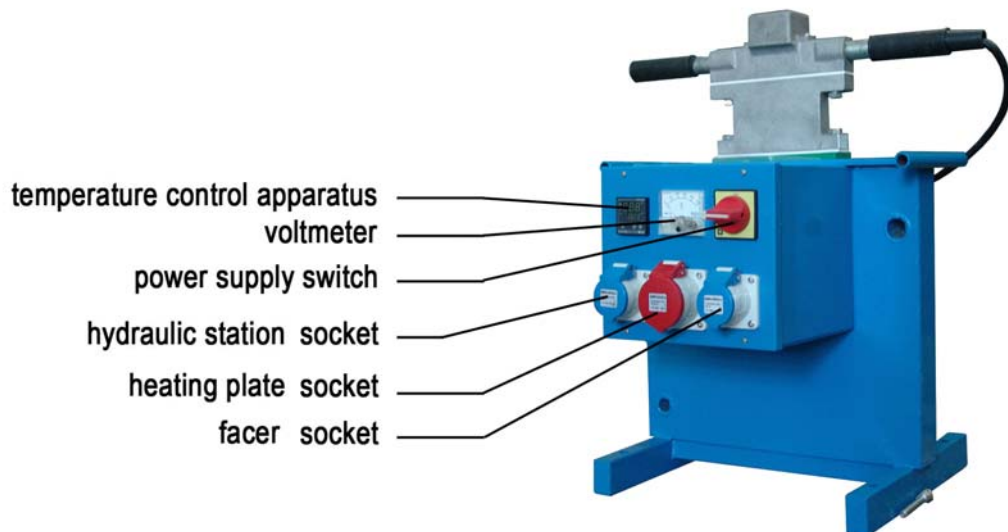




Standard	Supply on request
Dn315	Dn280
Dn250	Dn225
Dn200	Dn180
Dn160	Dn140
Dn110	Dn125

- A. The base framework adopts the structure of two kinds of clamps(motile and fixed).  
 B.Adjusting eight locknuts on the clamps, the operator can calibrate the jointing ends of the pipe.  
 C.Adjust connecting plate, you can configure the machine according to different welding as per followed 2 ways----  
 Two fixed clamps and two movable clamps  
 One fixed clamp and three movable clamps  
 D: Oil quick connector need be connected with oil hoses when you start the welding.

## 2.2 Electric control box & storage shelf



A. The basic components of the electric control box are followed:

- Voltmeter displays the voltage.
- Power supply switch, turn it on “ on” &”off” postion to start and close the power supply.
- Sockets---One red socket for heating plate; two blue sockets for hydraulic station and facer which are changeable.
- Temperature control apparatus

When power supply turned on and heating plate socket inserted into red plug on the electric box, there will be two lines of digits displayed on the temperature control apparatus.

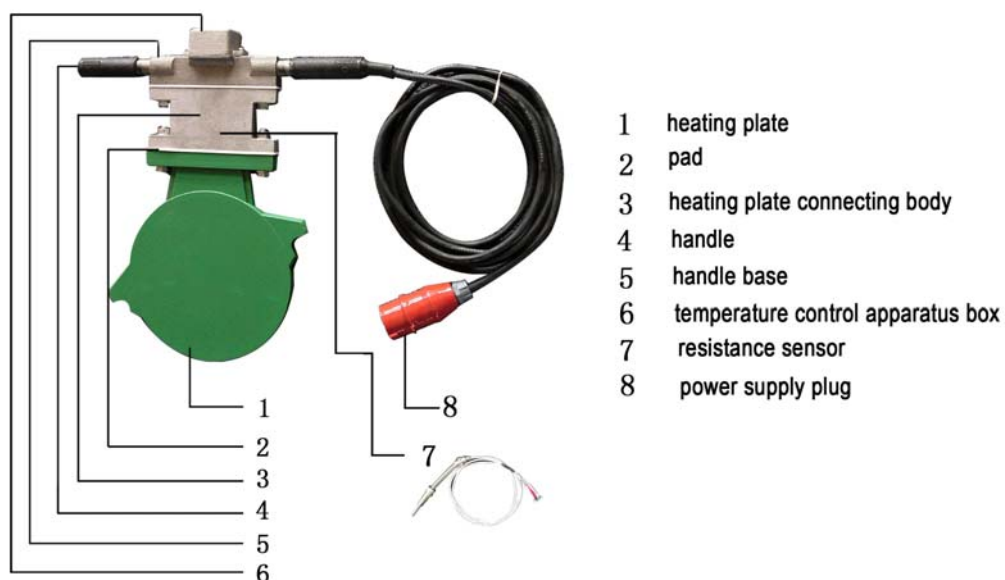
- A. Red digits represent the real temperature of the heating plate.
- B. Green digits represent the temperature operator set.

How to set the temperature?

Press “set” button, the green digits start to sparkle, then by acting arrow keys UP to increase the temperature and DOWN to decrease the temperature.

Press” set” again to finish the temperature setting.

### 2.3 Heating plate

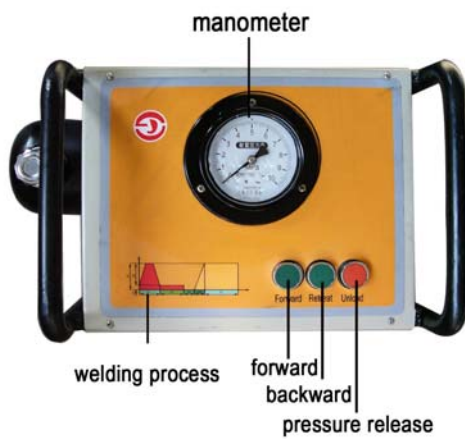
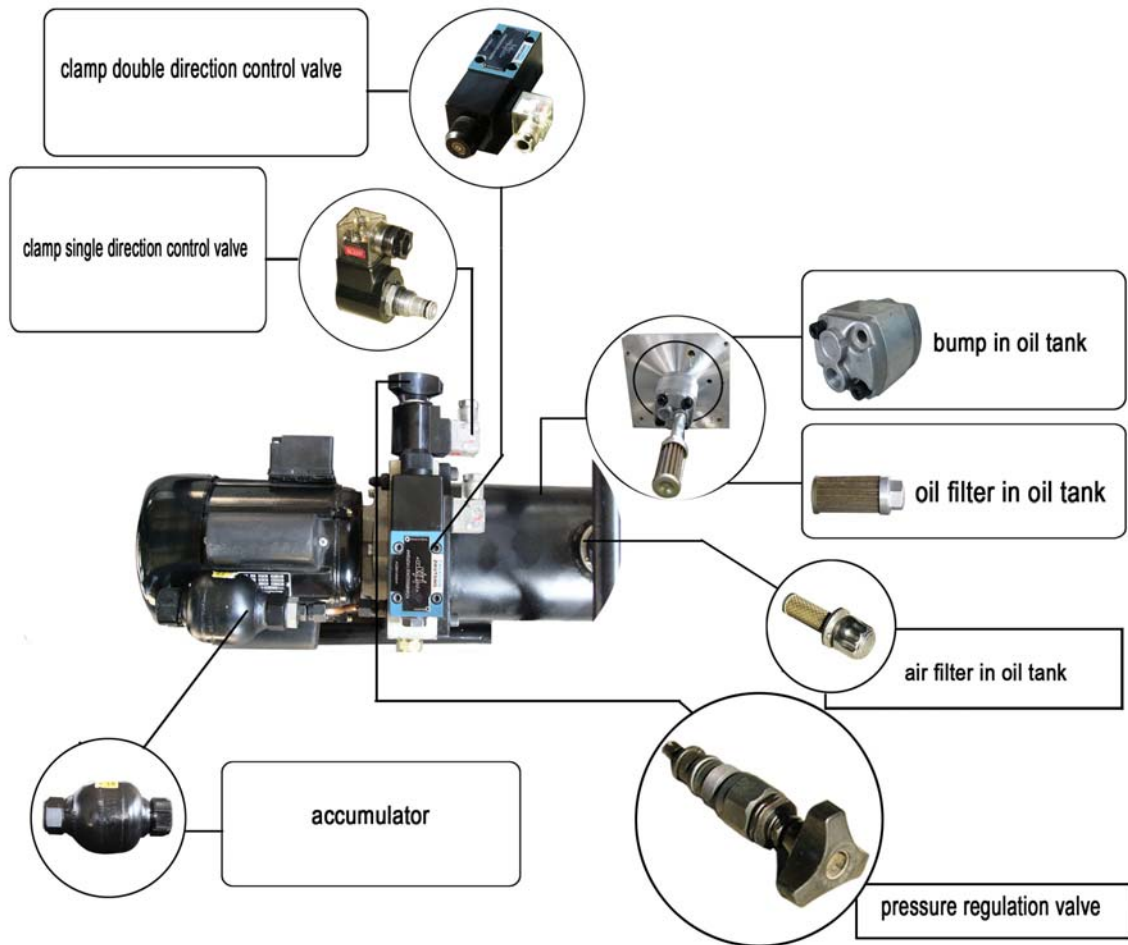


The heating plate is coated with green color PTFE.

The temperature of the heating plate can reach 260°C so, and the following protection measures should be aware of:

- Using protective gloves to avoid the direct touch of naked hands to the heating plate.
- When heating finished, put the heating plate back inside the storage shelf.

## 2.4 Hydraulic station



A. The basic components of the hydraulic station are followed:

- Electric motor
- Oil tank
- Hydraulic pump
- Accumulator



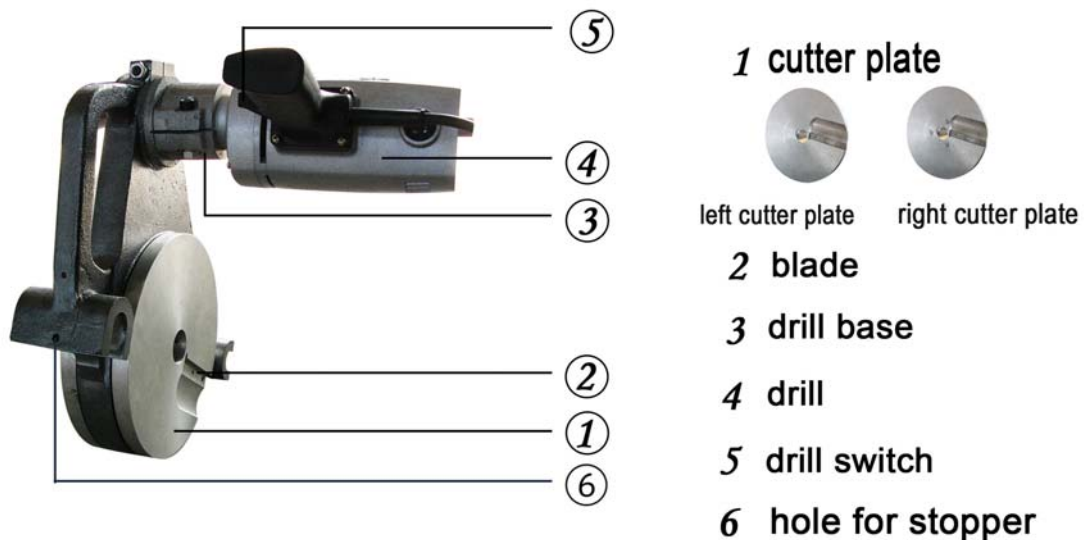
- Controls valves
- Metal frame
- Control pannel

B. How to operate the hydraulic station?

Pressure regulation valve: Turn in clockwise direction, the pressure increase, in anti-clockwise direction, the pressure decrease.

Control pannel: Press forward button, the motile clamp move forward; press backward button, the motile clamp move backward; press release button, release the pressure.

### 2.5 Facer



The facer's chain transmission system driven by electric motor.

A safety stopper connected can keep the facer hooked to the machine.

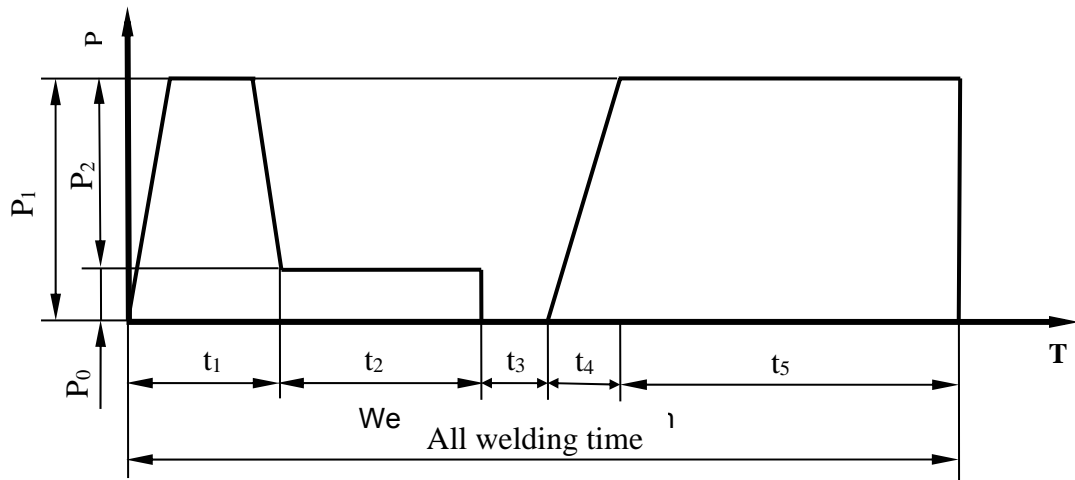
### 3 Welding parameter calaculation formula

#### 3.1 Formula

System Welding Pressure ( $P_1$ ) = System Driving Pressure ( $P_0$ ) + Standard Welding Pressure( $P_2$ )

### 3.2 Welding process chart

Followed diagram displays the pressure in the different period in a whole welding process.



Welding process is divided into five phases:

- |                                 |       |  |
|---------------------------------|-------|--|
| a) Heating phase:               | $t_1$ | correspondent pressure $P_1 = P_0 + P_2$ |
| b) Heat absorption phase        | $t_2$ | correspondent pressure $P_0$             |
| c) Heating plate take-out phase | $t_3$ |  |
| d) Pressure increase phase:     | $t_4$ | correspondent pressure $P_1$             |
| e) Cooling phase:               | $t_5$ | correspondent pressure $P_1$             |

### 3.3 System driving pressure $P_0$

How to test system driving pressure?

Load and fix the pipe well, press release button until the the pressure showed on the manumeter is 0.

Press forward button and regulate the pressure regulation valve slightly until the motile clamp can move slowly, record current pressure which is defined as  $P_0$ .

### 3.4 Standard Pressure $P_2$

$$P_2 = \frac{A_1 \cdot 0.15}{S} \quad (\text{Mpa})$$

sectional area of pipe =  $A_1 = \pi \cdot e \cdot (DN - e)$

$$P_2 = \frac{0.15\pi e (DN-e)}{S} \quad (\text{Mpa})$$

A1: pipe section area

e: wall thickness(mm)

$\pi$ : 3.1416

DN: diameter(mm)

S: Surface of hydraulic cylinder ( $\text{mm}^2$ )

0.15: the pressure coefficient of 0.15 Mpa

For Example:

To weld PE80 pipe of SDR 11 in dn 200mm, and chooses FM-355 Butt Fusion Welder.

Have already known: DN=200 mm e=18.1 mm S=1622 $\text{mm}^2$

$$P_2 = \frac{0.15\pi e (Dn-e)}{S} = \frac{0.15 \times 3.14 \times 18.1 \times (200-18.1)}{1622} = 0.96 \text{Mpa}$$

### 3.5 Total pressure $P_1$

$$P_1 = P_0 + P_2$$

## 4 Operation method

### 4.1 Operation condition requirement

#### 4.11 The power cable requirement

The power cable must be the rubber power cable ( $3 \times 1.5 \text{ mm}^2$ ) that can bear the physical

impact and the chemistry corrosion. When the length of electric cable is longer than 100 meters, its section area should be larger than  $(3 \times 2.5 \text{ mm}^2)$  square millimeter.

The whole workplace must have an earthing.

#### **4.12 The operator requirement**

The operator must be trained so that he can professional operate the machine. At least there should be 2 persons in charge of the whole welding process. One operates butt fusion machine, the other takes the responsibility for assistance and supervision.

#### **4.13 The climate condition requirement**

Climate condition under gale and storm are not suitable for welding.

When environmental temperature is lower than  $0^\circ\text{C}$ , welding operation need be carried out in cold shed, and two end of pipe should be closed to prevent the cold wind from influencing the welding quality.

When environmental temperature is higher than  $25^\circ\text{C}$ , measures should be taken to prevent the sunlight from influencing the welding quality.

#### **4.14 The wall thickness requirement**

The wall thickness of pipe and fitting for welding should be the same.

### **4.2 Operation Process**

#### **4.21 Connect the power source and set the heating plate temperature**

a. Insert the heating plate, the planning tool plug into the relevant socket on the electricity-controlling box.

b. Connect the electric box with the power supply, turn on the main power supply charge switch, then the heating plate will start to work immediately and planning tool is able to start now.

c. Set the temperature of heating plate according to 2.3.

#### **4.22 Pipe loading**

Press the " backward" button to move the motile clamps to the rearmost position, followed by loosening the eight locking nuts on the motile and fixed clamps, and then unload four upper clamps, put the pipes on the motile clamps and the fixed clamps respectively, and

finally, load four upper clamps and tighten the eight locking nut.

#### **4.23 Check the system driving pressure $P_0$**

Followed 3.3 then record the system driving pressure  $P_0$ . Through calculation to get standard welding pressure  $P_2$ . Then get  $P_1$ .

#### **4.24 Facing the ends of pipe**

a. Put the facer between the pipes, insert the safety stopper on the facer, press the "forward" button to move the frame forward until the ends of pipe contact the facer plate then push down the facer switch to make facer revolve.

b. When the scraps appear, stop pressing "forward" button, as the accumulator will sustain the pressure for the facing.

c. When scraps appear continuously, when the press "release" button to release the pressure.

d. Press "backward" button to move the motile clamp backward then take out the facer and check the ends.

#### **4.25 Welding**

a. Heating process

Adjust pressure regulation valve and set the pressure to  $P_1$ .

When the temperature of the heating plate reaches standard requirement, put it between two ends of pipe.

Press "forward" button to move the motile clamp forward until the two ends of pipe contact the surface of the heating plate, then loose the "forward" button.

Start observing the melting bead and wait the bead reach the height required by standard.

b. Heat absorption process.

When the bead height reaches the standard requirement, press "release" button to release the pressure close to  $P_0$ . Then enter into heat absorption process.

Start timing.

c. Heating plate take-out process

Press "backward" button to move the motile clamp backward very soon.

Take out the heating plate.

d. Fusion process

Press "forward" button to move the motile clamp forward very soon.

e. Cooling process

Start timing.

## 5. Familiar Causes of Malfunction and the Solutions

Familiar Causes of Malfunction and the Solutions

Malfunctions	Causes	Solutions
The liquid pressure control system leak oil from connection, urn, etc.	The ageing or wearing out of sealed parts	Tighten or replace sealed parts
The electrical instrument does not work	1) The loosening screw of the charge switch or the bad connection 2) The bad connection of electric power plug, the breaks of the power supply cable, etc.	1) Tighten the touch screws or replace the charge switch 2) Replace the power cable. Check the plug
The electrical instrument turns slowly; Abnormal noise; High temperature of the electrical instrument.	The power supply voltage is lower than the working voltage.	Check out whether the power supply is in the allowable scope.
The liquid pressure system has no pressure or the pressure is low	1) The oil road blocks up 2) Invalid spring of pressure regulation valve 3) Damaged pump of the liquid pressure	1) Open the oil pipe to clean. 2) Replace the spring or the pressure regulation valve. 3) Replace the pump
The heating plate is not hot.	1) A broken heat tube. 2) The loop of connecting machine burns out. 3) Breaks inside the thermometer. 4) No display appears on the thermometer, power supply part inside the thermometer damage. 5) Breaks of the power source of the thermometer. Bad connection of the plug of the	1) Replace the heating plate. 2) Replace the connecting machine 3) Check the power cable of the thermometer. 4) Replace the thermometer. 5) Check the plug contact is good or not, replace the power cable if not.

	<p>connecting machine. Breaks on the power supply cable.</p> <p>6) Breaks of signal line of the sensor component Pt100 (Platinum electric resistance) or the connection is bad. "HHH" always appears on the thermometer.</p> <p>7) Short circuit of the sensor component Pt100 (Platinum electric resistance). "-LL" always appears on the thermometer.</p>	<p>6) Checkout the plug. Replace the cable. Tighten the screws or find out the break line.</p> <p>7) Replace sensor component Pt100 (Platinum electric resistance)</p>
The automatically temperature controlling apparatus cannot be controlled, and the heating plate is working all the time.	<p>1) The conglutination of the touch points inside the apparatus.</p> <p>2) Short Circuit of the connecting machine. The heat board loses the function of temperature self-controlling.</p>	<p>1) Replace the temperature controlling apparatus.</p> <p>2) Replace the connecting machine</p>
The liquid pressure urn do not work when the enter or back button is pressed	<p>1) The valve is blocked.</p> <p>2) The valve and pipeline is blocked up.</p> <p>3) Bad connection of the button.</p>	<p>1) Clean the valve or open the oil pipeline to clean it.</p> <p>2) Clean the valve or open the oil pipeline to clean it.</p> <p>3) Replace or dispose the button.</p>
Scraps does not appear in the process of milling	<p>1) The razor blade is placed too lowly.</p> <p>2) The cutter blade has been worn out.</p>	<p>1) Adjust the razor blade.</p> <p>2) Replace the razor blade or change the direction of the razor blade.</p>
The planning tool motor does not work. The motor does work but the cutter blade doesn't work.	<p>1) The oil pipeline is blocked up. Broken motor.</p> <p>2) The gearing chain breaks or chain wheel is damaged.</p>	<p>1) Replace the motor.</p> <p>2) Replace the chain or the chain wheel.</p>

## 6. Attached form

The welding parameters of pipe SDR11							
( Set temperature of <u>heating plate</u> : PE80 = 210°C; PE100 = 225°C )							
diameter	thickness	P2	pressure=P1	Pressure=P0			Pressure=P1
Dn	e		Bead height	absorb heat time	Heating plate	pressure increase	cool off time

					take-out time	time	
(mm)	(mm)	(Mpa)	h	t <sub>2</sub>	t <sub>3</sub>	t <sub>4</sub>	t <sub>5</sub>
			(mm)	(sec)	(sec)	(sec)	(min)
110	10	0.28	1.5	100	≤ 6	< 7	≥ 14
125	11.4	0.37	1.5	114	≤ 6	< 8	≥ 15
140	12.7	0.46	2	127	≤ 8	< 8	≥ 17
160	14.5	0.60	2	145	≤ 8	< 9	≥ 19
180	16.4	0.76	2	164	≤ 8	< 10	≥ 21
200	18.2	0.94	2	182	≤ 8	< 11	≥ 23
225	20.5	1.19	2.5	205	≤ 10	< 12	≥ 26
250	22.7	1.46	2.5	227	≤ 10	< 13	≥ 28
280	25.5	1.84	2.5	255	≤ 10	< 14	≥ 31
315	28.6	2.32	3	286	≤ 12	< 15	≥ 35
355	32.3	2.95	3	323	≤ 12	< 17	≥ 39

The welding parameters of pipe SDR17.6							
(Set temperature of <u>heating plate</u> : PE80 = 210°C; PE100 = 225°C )							
diameter	thickness	P2	pressure=P1	Pressure=P0			Pressure=P1
Dn	e		Bead height	absorb heat time	Heating plate take-out time	pressure increase time	cool off time
(mm)	(mm)	(Mpa)	h	t <sub>2</sub>	t <sub>3</sub>	t <sub>4</sub>	t <sub>5</sub>
			(mm)	(sec)	(sec)	(sec)	(min)
110	6.3	0.19	1	63	< 4	< 6	≥ 9
125	7.1	0.24	1.5	71	< 4	< 6	≥ 10
140	8	0.31	1.5	80	< 4	< 6	≥ 11
160	9.1	0.40	1.5	91	< 5	< 7	≥ 13
180	10.2	0.50	1.5	102	< 5	< 7	≥ 14
200	11.4	0.62	1.5	114	< 5	< 8	≥ 15
225	12.8	0.79	2	128	< 5	< 8	≥ 17
250	14.2	0.97	2	142	< 6	< 9	≥ 19
280	15.9	1.22	2	159	< 6	< 10	≥ 20
315	17.9	1.54	2	179	< 6	< 11	≥ 23
355	20.2	1.96	2.5	202	≤ 10	< 12	≥ 25