



INDUSTRIAL EQUIPMENTS PVT. LTD.

CSP-15P

Pneumatic Operated Spot Welding Machine

15 kVA | Digital weld timer | Rocker arm with pneumatic cylinder | Water-cooled arms and electrodes



INSTRUCTION MANUAL

Please read this manual carefully before installing and using the machine.

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Thank you for choosing Cruxweld. We continue to build equipment that guarantees reliability and robustness, and we welcome any suggestion that helps us serve you better.

This manual must be read and understood carefully. Do not install, operate or maintain the machine before reading it. The machine must be installed, operated and maintained only by qualified persons. Never operate the machine with its covers removed, and always disconnect it from the mains before opening it.

Cruxweld provides a warranty for this machine from the date of purchase, as stated in Chapter 11. The contents of this manual may be revised without prior notice.

Signs used in this manual

 DANGER	A serious hazard which may cause a major accident, damage or death if it is not observed.
 WARNING	A hazard which may cause injury or damage to property if it is not observed.
 ATTENTION	A risk which may cause a fault in, or damage to, the machine if it is not observed.

1 Safety precautions

These safety instructions summarise, but do not replace, the current safety and accident-prevention regulations. Everyone who uses the machine must be trained in its use and in the basic rules of resistance welding.

1.1 Personal protection

- Spot welding produces sparks and expelled molten metal. Wear **safety glasses or a face shield**, leather gloves, a leather apron, long-sleeved flame-resistant clothing and safety shoes. Avoid clothes with open pockets or turn-ups where hot metal can collect.
- Do not wear rings, bracelets, watches or other metal objects – they can be heated by the welding current or attracted by the magnetic field.
- Protect people near the machine with non-flammable screens. Anyone moving in the work area must wear safety glasses.

1.2 Crushing hazard

▲ DANGER

The upper arm is moved by a pneumatic cylinder with high force. Never put your hands or any part of the body between the arms or electrodes. The machine starts when the foot switch is pressed – keep your foot off the switch while positioning the work.

1.3 Fire prevention

- Keep all combustible materials away from the work area (at least 10 m), or cover them with non-flammable covers.
- Sparks can enter cracks in walls and floors and cause hidden fires; protect such openings.
- Never weld containers or tanks that have held flammable or toxic substances.
- Keep a fire extinguisher nearby. After work, inspect the area for smouldering material.

1.4 Electric shock

- Connect the machine to a supply with a residual-current device and an efficient earth connection of the correct cross-section.
- Do not touch live parts. Do not work with wet clothing or in wet places; wear dry gloves.
- Do not use damaged cables. Disconnect the machine from the mains when it is not in use and before any maintenance.

1.5 Ventilation

- Welding coated, galvanised, oily or painted sheet produces fumes. Provide natural or forced ventilation or fume extraction.
- Do not weld near degreasing areas – chlorinated solvent vapours can form toxic gases.
- If your eyes, nose or throat become irritated, stop and improve the ventilation.

1.6 Magnetic fields

The welding current produces a strong magnetic field. Persons with a cardiac pacemaker or other implanted device must not operate the machine or come near it during welding. Watches and electronic devices can be damaged.

1.7 Compressed air

- Do not exceed the maximum air pressure of **8 kg/cm² (8 bar)**.
- Keep hoses, fittings and the filter-regulator in good condition and free of leaks. Release the air pressure before disconnecting any pneumatic part.
- Do not subject the regulator to sudden pressure changes.

1.8 Equipment maintenance

- Installation and maintenance must be carried out by qualified personnel. Do not carry out electrical repairs unless you are qualified.
- Disconnect the machine from the power supply and the compressed air before any maintenance.
- Keep the machine away from heat sources, damp places, oils and corrosive atmospheres. Keep all safety devices and covers in working order.
- Use the machine only for work that suits its characteristics. Do not modify it.

1.9 Operating environment

Working ambient temperature	5 °C to 40 °C
Relative humidity	below 90 %, without condensation
Storage temperature	0 °C to 40 °C, dry place (drain the cooling water if frost is possible)

2 General description

The Cruxweld CSP-15P is a 15 kVA pneumatic operated rocker arm spot welding machine for sheet metal fabrication. The upper arm is driven by a double-acting pneumatic cylinder through a rocker arm mechanism, and the weld is started with a foot switch, leaving both hands free for the work. A digital solid-state timer controls the squeeze time, weld time and heat, giving accurate and repeatable spots.

2.1 Salient features

Control system	Precision solid-state C-MOS integrated weld timer; welding current switched electronically.
Time control	Squeeze time and weld time adjustable in cycles, with heat (percentage current) control, for accurate and repeatable spots.
Pneumatic system	Double-acting pneumatic cylinder, 5/2-way solenoid valve, air filter, lubricator, regulator with gauge, and foot-operated initiating switch.
Electrode system	Electrode force applied through a rocker arm mechanism coupled to the pneumatic cylinder; force set by the air pressure.
Current control	Transformer tap switch, 6 steps between 50 % and 100 %, plus fine heat control on the timer.
Weld / No weld	Selector switch to run the cycle without current, for setting the arms and electrodes before welding.
Cooling	Electrodes, electrode holders and arms are water-cooled with hose connections; the transformer is air-cooled.

2.2 Arms and electrodes

The positions of the arms and electrodes can be changed to suit the shape of the workpiece (Fig. 2.1):

1. Loosen the arm fixing screw (1) and rotate the arm to the required angle.
2. Change the position of the electrode holder fixing set (2) and the electrode holder (3).
3. Adjust the arms and electrodes to their new positions. The electrode tips must meet squarely.
4. Change the electrode shapes if necessary, so that they make perfect contact with the workpiece. Tighten all screws.

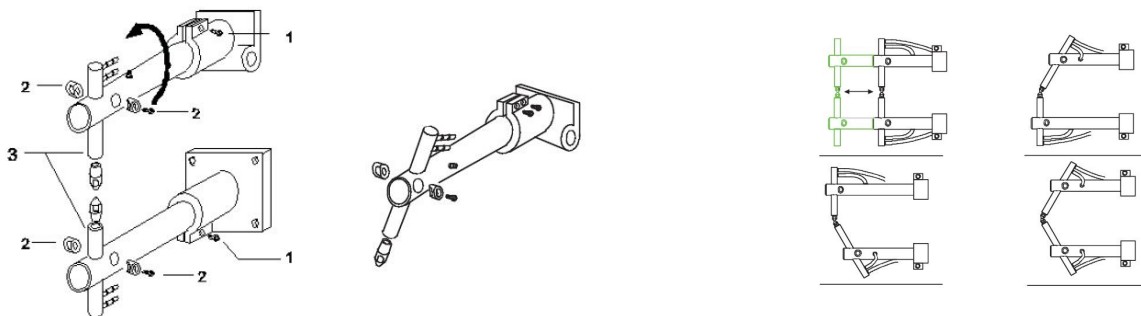


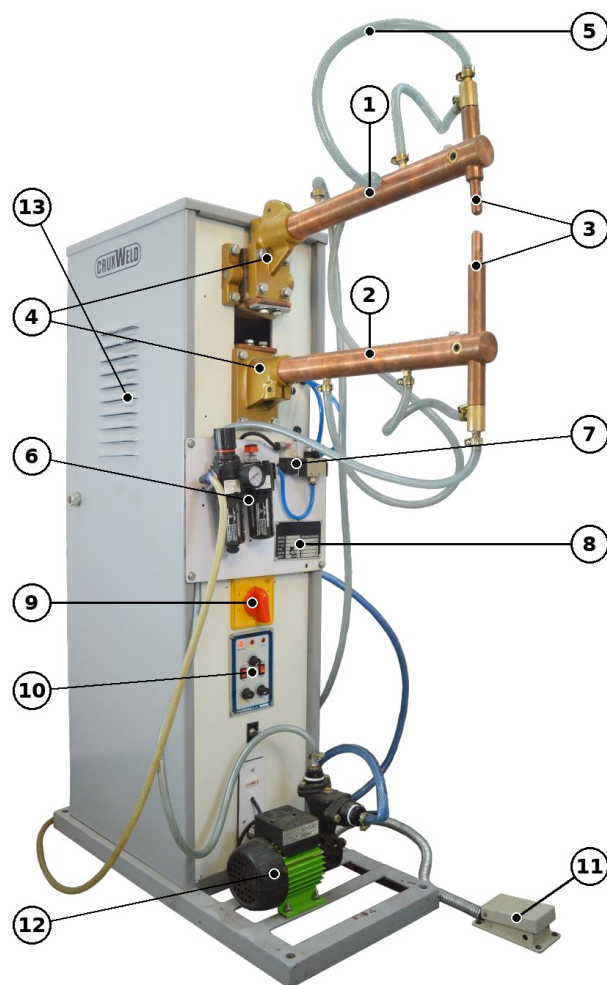
Fig. 2.1 Changing the arm position (left) and possible arm and electrode arrangements (right)

3 Technical specifications

Specification	Unit	CSP-15P
Input supply	V	415 ±15 %
Phase	No.	2 (two lines)
Frequency	Hz	50
Rating at 50 % duty cycle	kVA	15
Nominal throat clearance	mm	250
Throat depth	mm	450
Maximum electrode stroke	mm	40
Maximum available short-circuit current	kA	10.5
Welding range, mild steel (min. – max.)	2 x mm	0.3 – 3.6
Welding range, stainless steel (min. – max.)	2 x mm	0.3 – 3.0
Current control	-	Off-load tap switch, 6 steps (50 – 100 %)
Weld timer	-	Digital: squeeze, weld (cycles) and % heat
Insulation class	-	H
Transformer cooling	-	Air cooled
Cooling of arms and electrodes	-	Water
Cooling water (max. 30 °C)	L/min	3
Compressed air, max.	kg/cm ²	8
Main supply copper cable size	mm ²	16
Main disconnection switch	A	40
Dimensions (H x L x W)	mm	1450 x 840 x 410
Weight (approx.)	kg	215

Specifications may change without notice as a result of continuous improvement.

4 Machine overview and controls



1	Upper arm (moving)
2	Lower arm (fixed)
3	Electrode holders and electrodes
4	Arm holders (arm clamps)
5	Cooling water hoses
6	Air filter, regulator with gauge and lubricator
7	Solenoid valve (5/2-way)
8	Rating plate
9	Current tap switch
10	Digital weld timer
11	Foot switch (weld initiation)
12	Water pump (recirculating cooling)
13	Cabinet with transformer and pneumatic cylinder

Fig. 4.1 Main parts of the CSP-15P

4.1 Digital weld timer

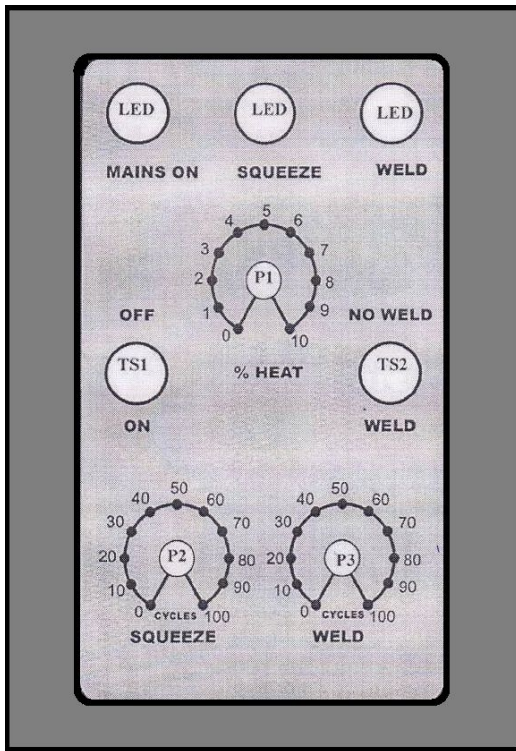


Fig. 4.2 Weld timer panel

Control	Function
MAINS ON LED	Lights when the timer is switched on.
SQUEEZE LED	Lights during the squeeze time.
WELD LED	Lights while welding current flows.
TS1 - OFF / ON	Switches the timer control on and off.
TS2 - NO WELD / WELD	NO WELD: the machine runs the full cycle without current – use it to set the arms and electrodes. WELD: normal welding.
P1 - % HEAT	Sets the percentage of the available current (dial 0 – 10).
P2 - SQUEEZE	Squeeze time in cycles (0 – 100): the delay between the electrodes closing and the start of the current, so that the full electrode force is reached.
P3 - WELD	Weld time in cycles (0 – 100). At 50 Hz, 1 cycle = 20 ms.

4.2 Current tap switch

The off-load tap switch selects the transformer tap (6 steps, 50 – 100 %) and thus the maximum available welding current. Fine adjustment is made with the % HEAT control of the timer.

▲ ATTENTION

The tap switch is an off-load switch. Change the tap position only when no welding is taking place, preferably with the machine switched off.

4.3 Pneumatic system

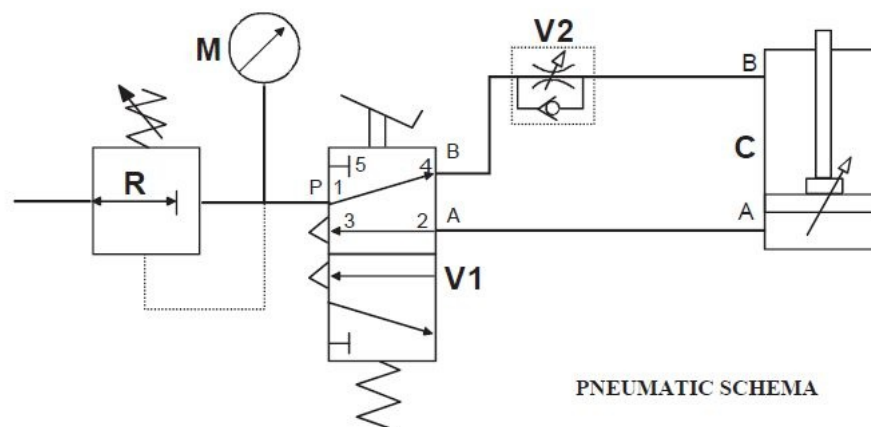


Fig. 4.3 Pneumatic diagram

R	Air pressure regulator (with filter and lubricator)	A	Cylinder up (return) movement
M	Air pressure gauge	B	Cylinder down (weld) movement
V1	Command valve (solenoid, operated by the foot switch)	C	Pneumatic cylinder (dia. 50 – 100 mm)
V2	Air flow regulator (electrode approach speed)		

5 Installation

5.1 Location

- Install the machine indoors on a firm, level floor where it stands stable. Bolt the base to the floor if required.
- Leave enough space around the machine for the operator, the workpieces and maintenance.
- Keep the air openings of the cabinet free.

5.2 Cooling water

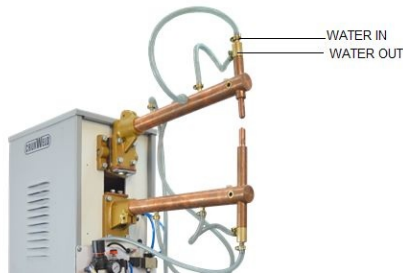


Fig. 5.1 Cooling water connections

■ Connect the cooling tubes of the arms, electrode holders and electrodes to the water supply or to a closed recirculating cooling system (with the water pump supplied, if fitted).

■ **WATER IN** – inlet of cold water; **WATER OUT** – outlet of hot water.

■ Water pressure must not exceed **2 kg/cm²**. Adjust the flow (about 3 L/min, max. 30 °C) so that the electrode temperature stays below **50 °C**.

■ Check that water flows freely from the outlet and that there are no leaks.

▲ ATTENTION

Never weld without cooling water – the arms and electrodes overheat and wear quickly.

5.3 Compressed air

- Connect clean, dry compressed air to the filter-regulator-lubricator unit. The air supply must be provided with a filter and lubricator.
- Air pressure must not exceed **8 kg/cm²**. Set the working pressure on the regulator according to the work (Chapter 7).
- Fill the lubricator with the recommended pneumatic oil.

5.4 Electrical connection

▲ DANGER

The electrical connection must be made by a qualified electrician with the supply switched off.

1. Check that the supply voltage matches the rating plate: **415 V, 2 lines** (230 V version optional).
2. Install a **40 A main disconnection switch** with delayed-action (slow) fuses near the machine.
3. Connect the two supply lines with a **16 mm²** copper cable. Connect the **earth** conductor (green / yellow) to the earth terminal – this is essential for the safety of the operator.

6 Operation

6.1 Checks before start-up

- Electrical connection and earthing made correctly; cooling water flowing; compressed air connected and set.
- Electrodes of the correct shape and diameter, clean, and aligned – the tips must meet squarely.
- Arms and electrode holders firmly clamped.
- Operator wearing safety glasses, gloves and apron.

6.2 Setting the machine

1. Switch on the main switch and set the timer switch TS1 to **ON**. The MAINS ON LED lights.
2. Set TS2 to **NO WELD**. Press the foot switch and check the stroke of the upper arm, the alignment of the electrodes and the electrode approach speed (air flow regulator V2). Adjust the arms and electrode holders if necessary.
3. Set the **air pressure** (electrode force), the **tap switch**, **% HEAT**, **SQUEEZE** and **WELD** time according to the sheet thickness (Chapter 7).
4. Set TS2 to **WELD**.

6.3 Welding

1. Place the sheets between the electrodes, resting on the lower electrode.
2. **Press the foot switch.** The solenoid valve operates the cylinder and the upper electrode clamps the sheets (SQUEEZE LED). After the squeeze time the welding current flows for the set weld time (WELD LED).
3. Keep the foot switch pressed briefly so that the nugget cools under pressure, then release it. The upper arm returns.
4. Move the work to the next spot and repeat.
5. Make trial welds on scrap pieces of the same material and check them (peel test). Adjust the settings until the weld is correct.

▲ DANGER

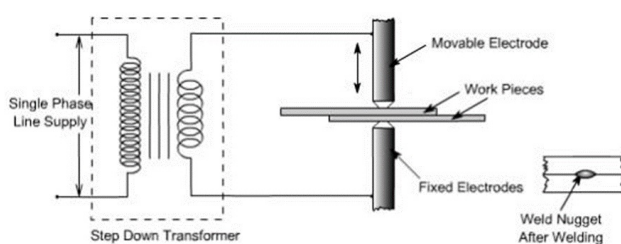
Keep hands away from the electrodes when pressing the foot switch – danger of crushing. Avoid welding without sheets between the electrodes.

6.4 Switching off

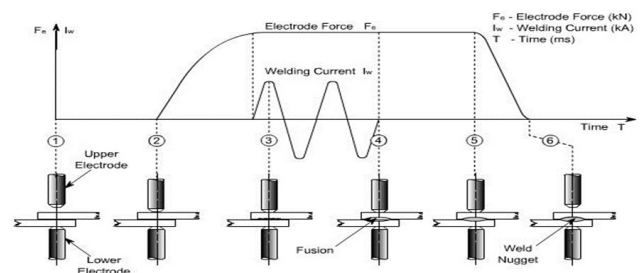
Set TS1 to OFF, switch off the main switch, close the cooling water and, at the end of the day, the compressed air.

6.5 Spot welding process

Spot welding joins overlapping sheets without filler metal, by pressure and heat. Copper-alloy electrodes clamp the sheets and pass a heavy current through them; the resistance of the metal heats the contact area, which melts and forms a weld nugget. The current is then switched off and the nugget solidifies under pressure. The heat produced is $E = I^2 \times R \times t$ (I = current, R = resistance, t = time).



Principle of spot welding



Spot welding cycle: squeeze, weld, hold, release

7 Welding parameters

7.1 Approximate settings for the CSP-15P

Sheet thickness	Squeeze (cycles)	Weld time (cycles)	% Heat	Air pressure (psi)	Tap no.
30 – 40 gauge	50	5	15 %	28	1
25 – 30 gauge	50	8	20 %	30	2
20 – 25 gauge	50	10	30 %	32	3
15 – 20 gauge	50	12	40 %	34	4
12 – 15 gauge	50	15	45 %	40	5
10 – 12 gauge	50	20	50 %	45	6

These settings are approximate and for guidance only; correct them by trial welds. 1 psi $\approx$ 0.07 kg/cm².

7.2 Reference values for mild steel (two equal sheets)

Sheet thickness (mm)	Electrode force (kN)	Weld current (A)	Weld time (cycles)	Hold time (cycles)	Electrode dia. (mm)
0.63 + 0.63	2.00	8 500	6	1	6
0.80 + 0.80	2.24	9 000	8	2	6
1.00 + 1.00	2.50	9 500	10	2	6
1.25 + 1.25	3.15	10 000	13	3	6 – 7
1.50 + 1.50	3.65	10 450	15	3	6 – 7
2.00 + 2.00	5.00	11 200	3 x 7 + 2*	4	7 – 8
2.50 + 2.50	5.60	11 800	3 x 9 + 3*	5	8
3.00 + 3.00	6.15	12 350	4 x 9 + 2*	6	8

* Pulse welding: number of pulses x cycles per pulse + cool cycles between pulses. Target values only – the CSP-15P delivers up to 10.5 kA short-circuit current.

7.3 Guidelines

Electrode force	Squeezes the sheets together. Too low gives spatter and weak welds; too high reduces the heat and needs more current. Target about 90 N per mm ² of electrode contact area.
Electrode diameter	The nugget diameter should be about 5√t (t = sheet thickness). The electrode contact diameter should be slightly larger: 6 mm is standard for 0.5 – 1.25 mm sheet.
Squeeze time	Time from the electrodes closing to the start of the current; lets the electrode force reach its full value.
Weld time	As short as possible. A good starting value is 10 x the sheet thickness in mm (e.g. 10 cycles for 1 + 1 mm). 1 cycle = 1/50 s.
Hold time	Time the electrodes stay closed after welding to let the nugget solidify. Not too long, or the electrodes heat up. Use a longer hold time for galvanised steel.
Weld current	Keep as low as possible. Select the tap so that the correct current is reached with % HEAT between 70 % and 90 %. Increase the current gradually until spatter just begins – then reduce slightly.
Materials	Low carbon steel welds best. High carbon and alloy steels can give hard, brittle welds. Galvanised steel and aluminium need higher current. Sheet thickness ratio should not exceed 3 : 1.

8 Maintenance

▲ DANGER

Before any maintenance, switch off and isolate the mains supply, close the cooling water and release the compressed air.

8.1 Electrodes

The electrodes conduct the current and withstand the high pressure. Their contact surface tends to deform ("mushroom") with each weld – mainly because of too high current, too high force, too small contact surface or soft electrode material. Coated sheets also contaminate the tips. Deformed electrodes need more current, give poor welds and waste energy.

- Dress the electrode tips regularly to their original shape and diameter with a tip dresser or fine file. For galvanised sheet, dress after about 25 spots.
- Replace electrodes that are too short or cannot be dressed any more.
- Check that the upper and lower electrodes are aligned.

8.2 Maintenance schedule

Interval	Work
Daily	Check cooling water flow and leaks. Drain water from the air filter bowl. Check the oil level in the lubricator. Clean and check the electrode tips.
Weekly	Check the tightness of the arm clamps and electrode holders. Clean the contact surfaces of the arm holders and the electrode tapers. Lubricate the rocker arm pivot. Check the air hoses and fittings for leaks.
Monthly	Blow out dust from inside the cabinet with dry, low-pressure air. Check all electrical and secondary connections for tightness and overheating. Check the foot switch and its cable.
Yearly	Have the insulation of the transformer and the tap switch contacts checked. Flush the water passages of the arms and holders to remove scale. Service the pneumatic cylinder and the solenoid valve.

Frost: if the machine may be exposed to temperatures below 0 °C, blow all cooling water out of the arms, holders and hoses.

9 Troubleshooting

Problem	Possible cause	Remedy
Machine does not switch on; MAINS ON LED off	No supply; main switch off; fuse blown; timer switch TS1 off.	Check the supply and fuses; switch on the main switch and TS1.
Arm does not move when the foot switch is pressed	No compressed air or pressure too low. Solenoid valve or foot switch faulty. Air flow regulator closed.	Check the air supply and regulator. Check the valve coil, foot switch and cable. Open the flow regulator.
Arm moves but no welding current	TS2 on NO WELD. % HEAT or weld time at zero. Dirty or oxidised arm / electrode contact surfaces. Timer or thyristor fault.	Set TS2 to WELD. Set the timer. Clean the contact surfaces. Contact Cruxweld service.
Weak welds	Current or weld time too low; worn or misaligned electrodes; low supply voltage.	Increase tap, % heat or weld time; dress and align the electrodes; check the supply.
Spatter, holes or burnt spots	Current too high; force too low; dirty sheets or electrodes; squeeze time too short.	Reduce current; increase air pressure; clean; increase squeeze time.
Deep indentation	Force or weld time too high; electrode tip too small.	Reduce pressure or time; use a larger tip.
Electrodes stick to the sheet	Dirty or mushroomed tips; insufficient cooling; hold time too short.	Dress the tips; check the water flow; increase hold time.
Arms or electrodes overheat	No or too little cooling water; blocked water passages; duty cycle exceeded.	Check water flow; flush passages; allow pauses.

If a fault cannot be corrected, contact Cruxweld service.

10 Electrical diagram

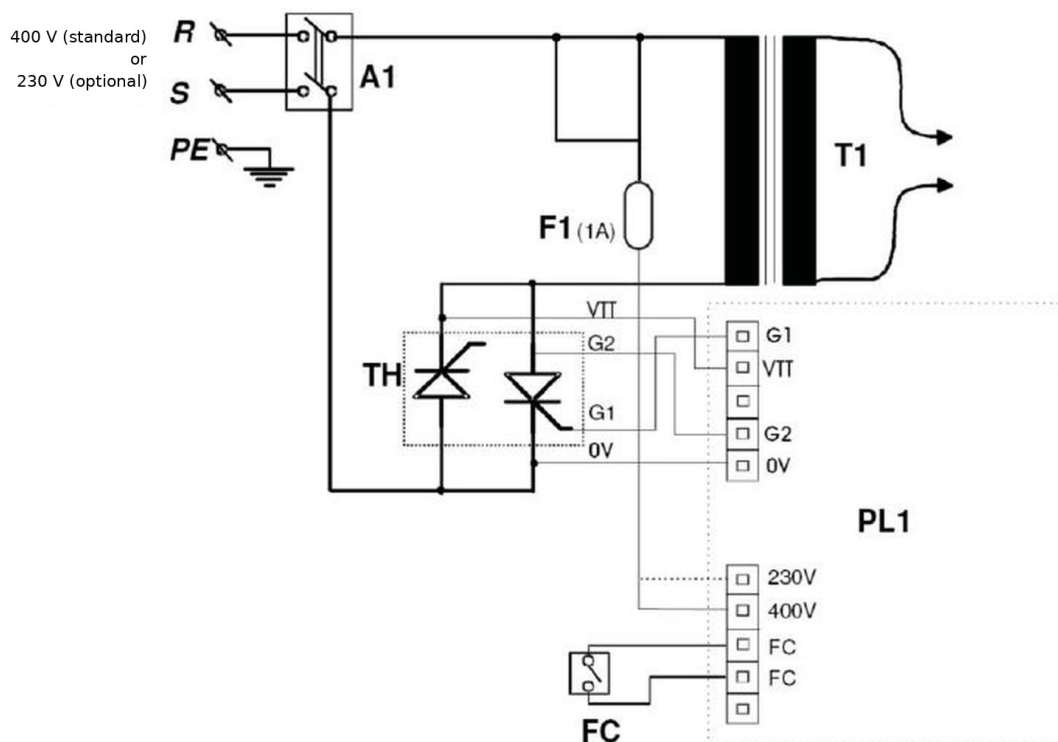


Fig. 10.1 Electrical diagram

Symbol	Description
R, S, PE	Supply lines and protective earth (415 V standard, 230 V optional)
A1	Main switch
F1	Fuse, 1 A (control circuit)
FC	Micro switch (foot switch contact)
PL1	Control printed circuit board (weld timer)
T1	Welding (power) transformer
TH	Thyristors (welding current switching)

▲ DANGER

Only qualified personnel may open the machine and work on the electrical circuit, after isolating the supply.

11 Warranty

Cruxweld warrants the CSP-15P against defects in material and workmanship for the period stated in the sales contract, from the date of invoice. The warranty does not cover electrodes, electrode tips, hoses and other wear parts, or damage caused by incorrect supply voltage, missing earth, lack of cooling water, dirty or wet compressed air, overload, lack of maintenance, misuse or repair by unauthorised persons.

Model	CSP-15P
Serial number	
Invoice no. / date	
Customer	
Dealer stamp	

For service, spare parts and electrodes please contact:

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