



INDUSTRIAL EQUIPMENTS PVT. LTD.

CWR-400D

Welding Rectifier – Diode Based, 400 A

Heavy duty DC arc welding rectifier | 3 phase, 415 V | 50 – 400 A stepless



INSTRUCTION MANUAL

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

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Contents

1	Safety precautions	2
2	General description	4
3	Technical specifications	5
4	Machine overview and controls	6
5	Installation	8
6	Operation	10
7	Welding guide	12
8	Maintenance	13
9	Troubleshooting	14
10	Warranty	15

This manual contains the description, installation, operation, safety and maintenance instructions for the Cruxweld CWR-400D diode based welding rectifier.

Please read and understand this manual before installing and operating the machine, and keep it near the machine for future reference.

Cruxweld provides a warranty for this machine from the date of purchase, as stated in Chapter 10.

Cruxweld improves its products continuously. The contents of this manual may be revised without prior notice.

Signs used in this manual

▲ DANGER	Immediate danger which will cause death or serious injury if it is not avoided.
▲ WARNING	A potential hazard which may cause death or serious injury if it is not avoided.
▲ CAUTION	A hazard which may cause injury or damage to the machine if it is not avoided.
Note	Useful information for correct operation.

1 Safety precautions

Arc welding can be dangerous to the operator and to people in or near the work area. Read this chapter carefully and follow all safety rules. Installation, operation, inspection and maintenance must be carried out only by trained and qualified persons.

1.1 Protection of the operator and others

- Always use a welding helmet or face shield with the correct filter glass to protect the eyes, face, neck and ears from sparks and arc rays. Bystanders must not look at the arc.
- Wear flame-resistant protective clothing, leather gloves, an apron and safety shoes. Keep all buttons and pockets closed so that sparks and spatter cannot enter.
- Use non-flammable screens and curtains to protect other workers from arc rays and sparks.
- Wear safety glasses when chipping slag and cleaning spatter. Wear ear protection where the noise level is high.

1.2 Electric shock can kill

- Never use the welding machine in wet areas. Keep the machine, cables, electrode holder, clothing and work area dry.
- Make sure the machine is correctly connected to the mains earth, and that the work cable is firmly connected to the workpiece.
- Keep your body insulated from the workpiece and from the ground. In confined or damp places, stand on a dry wooden board or an insulating mat and wear rubber-soled shoes.
- Wear dry, undamaged insulating gloves before switching on. Switch off the power before taking the gloves off.
- Replace damaged or worn cables immediately. Never touch the electrode or live parts with bare skin.

1.3 Fire and burns

- The heat of the arc, sparks and spatter can cause fire. Remove flammable materials (wood, cloth, fuel, gas) from the work area.
- Never weld on sealed or closed containers – they may burst. Clean drums and tanks that have held flammable material before welding.
- Keep fire-fighting equipment near the work area, and check the area for smouldering fires after welding.
- Do not overload the machine. Allow the work and electrode stubs to cool before handling.

1.4 Fumes and gases

- Do not breathe welding fumes and gases. Provide natural or mechanical ventilation, especially in confined spaces.
- Use fume extraction or breathing protection when welding galvanised, coated or painted steel, stainless steel, copper, zinc, lead, beryllium or cadmium.
- Do not weld near degreasing or spray-painting operations – the arc can form toxic gases.
- If your eyes, nose or throat become irritated, stop welding and improve the ventilation.

1.5 Electromagnetic fields

- Persons with a cardiac pacemaker must consult their doctor before welding or going near welding operations.
- To reduce exposure: keep the electrode and work cables together (tape them if possible); never coil the cables around your body; keep both cables on the same side of your body; connect the work clamp as close to the weld as possible; and keep away from the machine and the cables as far as practical.

1.6 Equipment maintenance

- Only qualified persons may install, repair or maintain the machine.
- Switch off and isolate the mains supply before any work inside the machine.
- Keep cables, earth wires, connectors and the supply in good condition. Keep all covers and doors closed and in good condition.
- Do not modify the machine.

1.7 Operating environment

Ambient temperature during welding	–10 °C to +40 °C
Temperature during transport and storage	–25 °C to +55 °C
Relative humidity	below 50 % at 40 °C; below 90 % at 20 °C
Altitude	up to 1000 m above sea level
Inclination of the machine	not more than 15°
Air quality	no dust, acid or corrosive gases beyond normal levels (except those produced by welding)
Noise	not more than 75 dB(A) during operation

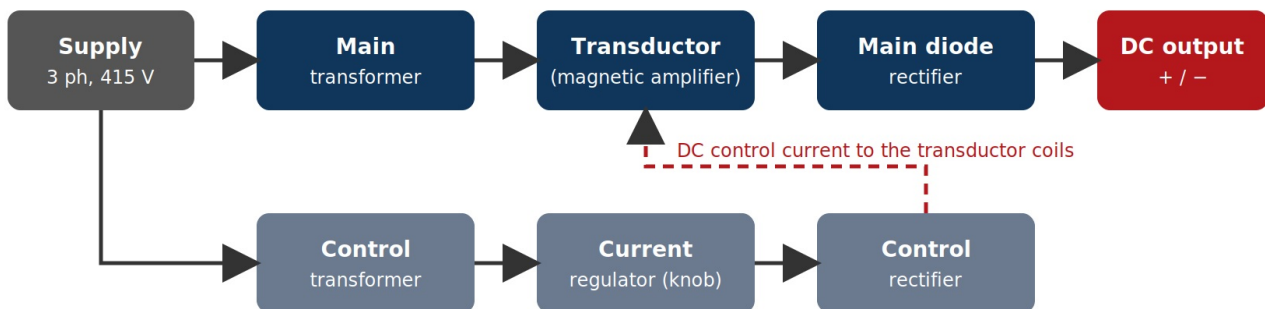
2 General description

The Cruxweld CWR-400D is a heavy duty, diode based DC welding rectifier for manual metal arc (MMA / stick) welding with all types of covered electrodes, including cellulosic (E6010) and low-hydrogen (E7018) electrodes. It is suitable for welding low carbon steel, medium carbon steel, alloy steel and other ferrous metals in heavy fabrication, structural work, pipelines and project sites.

The machine uses simple, reliable and maintenance-free diode technology without complex electronic circuitry, in a robust construction that withstands rough handling at project sites. It is mounted on four wheels for easy movement.

2.1 Working principle

The machine consists of a 3-phase step-down main transformer, a 3-phase magnetic amplifier (transducer) and a 3-phase silicon diode rectifier. The welding current is controlled by varying the DC current in the control coils of the transducer. This control current is supplied by a control transformer, the current regulator on the front panel and a single-phase control rectifier. Turning the current regulator changes the control current and therefore the welding current, smoothly and steplessly.



Power circuit (top) and control circuit (bottom). Turning the current regulator changes the DC control current in the transducer, which changes the welding current smoothly and steplessly.

Fig. 2.1 Block diagram of the CWR-400D

2.2 Salient features

- Simple, reliable and maintenance-free diode based technology.
- Robust and rugged construction for rough handling at project sites.
- Stepless, smooth current control through an electromagnetic transducer.
- Superior performance with all electrodes, including E6010 and E7018.
- High open-circuit voltage for easy arc striking.
- Dynamic output characteristics for a smooth, uninterrupted arc and better metal transfer with minimum spatter.
- Resistant to supply voltage fluctuation; stable welding current.
- Fine current control minimises heat input and the heat-affected zone (HAZ).
- Heavy duty transformer design for trouble-free operation over many years.



Heavy duty transformer

3 Technical specifications

Specification	Unit	CWR-400D
Input supply	V	415 ±15 %
Phase	No.	3
Frequency	Hz	50 / 60
Input at 100 % duty cycle	kVA	26
Input current	A	45
Welding current range	A	50 – 400
Open-circuit voltage	V	80
Welding current at 60 % duty cycle	A	400
Welding current at 100 % duty cycle	A	310
Output	–	DC, constant current (CC)
Current regulation	–	Stepless (transducer)
Insulation class	–	H
Protection class	–	IP23
Cooling	–	Fan cooled
Dimensions (L x W x H)	mm	840 x 705 x 905
Weight (approx.)	kg	240

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

3.1 Duty cycle

The duty cycle is the percentage of a 10-minute period during which the machine can weld at a given current without overheating.

Welding current	Duty cycle	Welding time in 10 minutes
400 A	60 %	6 min
310 A	100 %	Continuous

Do not exceed the duty cycle. Overheating damages the transformer, the transducer and the diodes.

3.2 Rating plate symbols

U₀	Open-circuit (no-load) voltage, V	U₁	Rated supply voltage, V
X	Rated duty cycle, %	I_{1max}	Maximum input current, A
I₂	Welding current, A	I_{1eff}	Effective input current, A
U₂	Conventional welding voltage, V	IP23	Degree of protection of the enclosure
3~ 50/60 Hz	3-phase supply, line frequency	S	Suitable for use in environments with increased risk of electric shock

4 Machine overview and controls

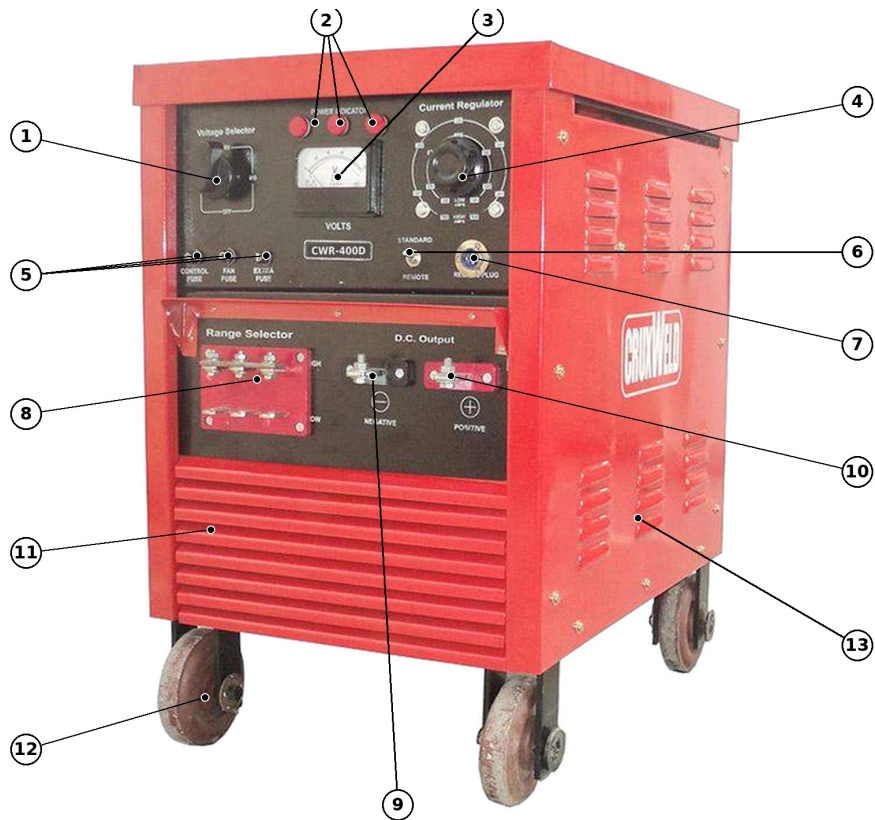


Fig. 4.1 Main parts of the CWR-400D

1	Main switch (voltage selector) with OFF position	8	Range selector (HIGH / LOW links)
2	Power indicator lamps (one per phase)	9	DC output terminal - NEGATIVE (-)
3	Voltmeter	10	DC output terminal - POSITIVE (+)
4	Current regulator with LOW / HIGH ampere scales	11	Front air intake louvers
5	Control fuse, fan fuse, extra fuse	12	Wheels
6	STANDARD / REMOTE switch	13	Side ventilation louvers
7	Remote control socket (remote plug)		

4.1 Controls

Control	Function
Main switch (voltage selector)	Switches the machine on and off. In the ON position the cooling fan starts, the main transformer is energised and the power indicator lamps light.
Power indicator lamps	Three lamps, one for each phase. All three must light. If one lamp is off, a supply phase is missing – do not weld.
Voltmeter	Shows the output voltage: the open-circuit voltage (about 80 V) when not welding, and the arc voltage while welding.
Current regulator	Turn clockwise to increase and anti-clockwise to decrease the welding current. Read the set current on the inner scale (LOW range) or the outer scale (HIGH range), according to the range selector setting. The current can be adjusted while welding.
Range selector	Copper links on the lower panel select the LOW or HIGH current range. Change the links only with the machine switched off.
STANDARD / REMOTE switch	STANDARD: current is set with the current regulator on the front panel. REMOTE: current is set with an optional remote control unit connected to the remote socket.
Fuses	Control fuse (control circuit), fan fuse (cooling fan) and extra fuse. Replace a blown fuse only with one of the same rating.
DC output terminals	NEGATIVE (–) and POSITIVE (+) terminals for the electrode and work cables. See 5.3 for the polarity.

▲ CAUTION

Never change the range selector links or the STANDARD / REMOTE switch while welding. Switch the machine off first.

5 Installation

5.1 Location

- Place the machine in a relatively clean, dry place on a firm, level floor (inclination not more than 15°). Lock or chock the wheels.
- Leave at least **0.5 m** of free space around the machine for cooling. The fan draws fresh air in at the front and blows it out at the back; never block the louvres.
- Protect the machine from rain, dripping water, dust and corrosive gases.
- The machine weighs about 240 kg. Move it on its wheels or lift it with suitable equipment only.

5.2 Electrical input connection

▲ DANGER

The input connection must be made by a qualified electrician with the supply switched off and isolated.

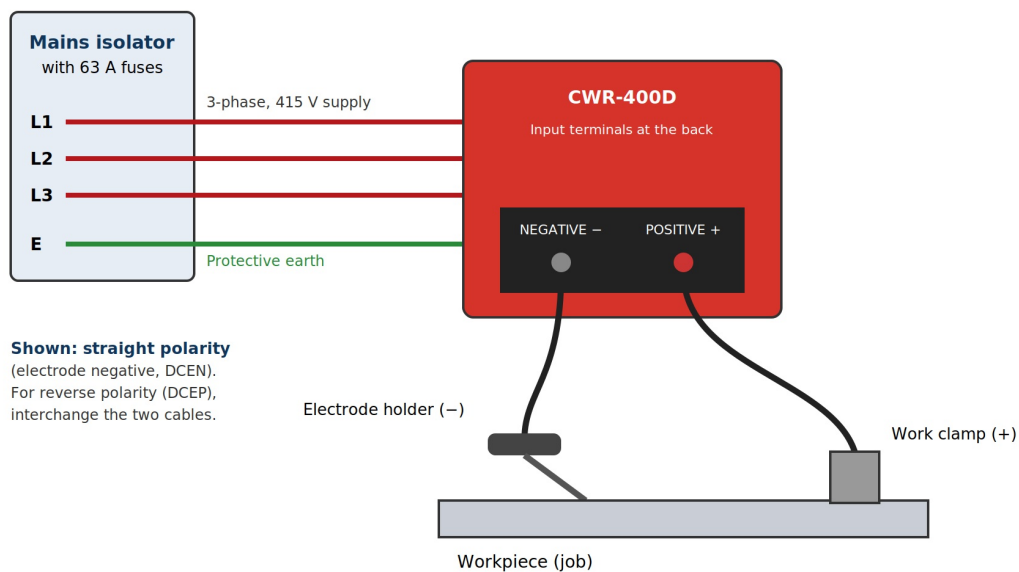


Fig. 5.1 Input and output connections

1. Check that the supply matches the rating plate: **3-phase, 415 V ± 15 %, 50 / 60 Hz**.
2. Provide a separate, good-quality mains isolator with fuses (recommended **63 A**) near the machine, easily reachable by the operator.
3. Connect the three phases L1, L2, L3 to the input terminals at the back of the machine with a 4-core copper cable of at least **10 mm²** (3 phases + earth).
4. Connect the earth conductor to the earth terminal of the machine. **The machine must always be properly earthed.**
5. Make sure all connections are firm and tight, and refit the terminal cover.

5.3 Welding cable connection and polarity

1. Connect the electrode holder cable and the work cable to the DC output terminals and tighten the terminal nuts firmly.
2. **Straight polarity (DCEN):** electrode holder to NEGATIVE (–), work cable to POSITIVE (+). Used for most rutile electrodes and for thin sheet.
3. **Reverse polarity (DCEP):** electrode holder to POSITIVE (+), work cable to NEGATIVE (–). Used for low-hydrogen (E7018) and cellulosic (E6010) electrodes and for deeper penetration.
4. Always follow the polarity recommended by the electrode manufacturer on the packet.

Welding current	Cable length up to 15 m	Cable length 15 - 30 m
up to 250 A	35 mm ²	50 mm ²
250 – 350 A	50 mm ²	70 mm ²
350 – 400 A	70 mm ²	95 mm ²

Table 5.1 Recommended copper welding cable size (total length of electrode and work cables)

▲ CAUTION

Loose output terminals and undersized or very long cables overheat and reduce the welding current. Keep the cables as short as possible.

6 Operation

6.1 Starting to weld

1. Install and connect the machine as described in Chapter 5, with the required polarity.
2. Set the **range selector** to LOW or HIGH according to the required current (machine switched off).
3. Set the STANDARD / REMOTE switch to **STANDARD** (unless a remote control is used).
4. Wear dry insulating gloves, protective clothing and a welding helmet with the correct filter glass.
5. Connect the work clamp firmly to clean, bare metal on the job, as close to the weld as possible.
6. Switch on the mains isolator, then turn the **main switch** to ON. The fan starts and all three power indicator lamps light.
7. Set the welding current with the **current regulator** (see Table 6.1).
8. Insert the electrode in the holder, strike the arc and begin welding. Readjust the current if necessary – it may be adjusted while welding.

6.2 Current setting

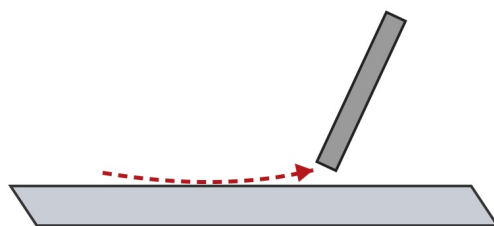
Electrode diameter (mm)	Welding current (A)	Typical plate thickness (mm)
2.5	60 – 90	2 – 4
3.15	90 – 140	3 – 8
4.0	130 – 190	5 – 12
5.0	180 – 260	10 and above
6.3	250 – 350	heavy sections

Table 6.1 Guide values for mild steel electrodes (flat position)

- Always follow the current range printed on the electrode packet.
- Reduce the current by about 10 – 15 % for vertical and overhead welding.

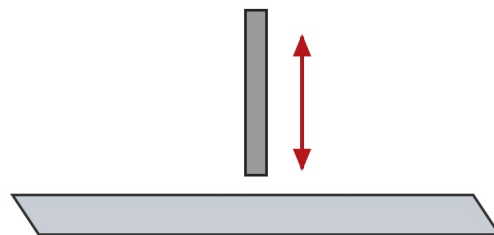
6.3 Striking the arc

A Scratch method



Strike the electrode lightly across the plate like a match, then lift it to the arc length.

B Tapping method



Bring the electrode straight down onto the plate and lift it at once to the arc length.

Fig. 6.1 Arc striking methods

The high open-circuit voltage of the CWR-400D makes arc striking easy. If the electrode sticks to the work, free it with a quick twist of the wrist.

6.4 Arc length and electrode angle

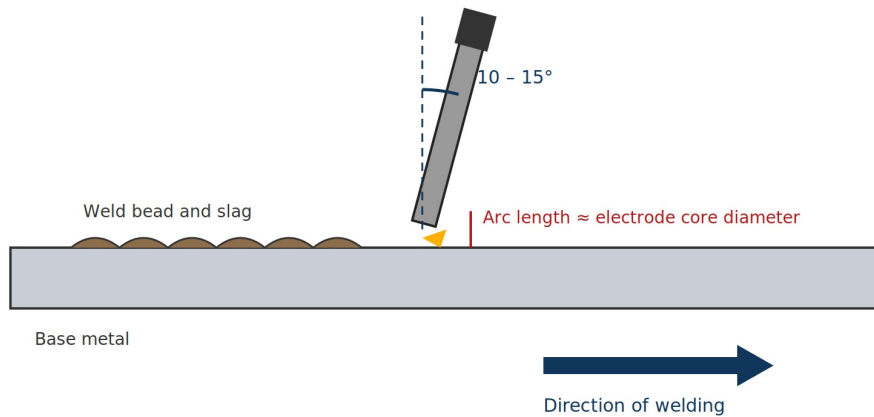


Fig. 6.2 Electrode position

- Hold a short arc: the arc length should be about equal to the core diameter of the electrode.
- Hold the electrode tilted 10 - 15° in the direction of travel. Travel at a uniform speed and feed the electrode down steadily.
- For wider beads, weave the electrode from side to side, not more than 2½ times the electrode diameter.
- Remove the slag with a chipping hammer and wire brush before depositing the next bead.

6.5 Finishing and shutting down

1. When welding is complete, lift the electrode away from the work and any earthed objects, and raise the face shield.
2. Remove the electrode stub and place the holder on an insulated surface.
3. Let the machine run without load for about **3 minutes** so that the fan cools the transformer and the rectifier.
4. Turn the main switch to OFF, then switch off the mains isolator.

▲ CAUTION

Welding at high current for a long time beyond the rated duty cycle overheats the machine. Allow it to cool, and reduce the welding time or the current.

7 Welding guide

7.1 Weld quality

Observation	Cause	Correction
Good bead	Correct current, arc length and travel speed.	Uniform ripples, good penetration, little spatter, no undercut.
Excessive spatter	Current too high; arc too long; wrong polarity.	Reduce the current; hold a shorter arc; check the polarity.
Poor penetration, high narrow bead	Current too low; travel too fast.	Increase the current; travel slower.
Wide, flat bead; burn-through	Current too high; travel too slow.	Reduce the current; travel faster.
Undercut at the edges	Current too high; wrong electrode angle; arc too long.	Reduce the current; correct the angle; hold a shorter arc.
Porosity (holes)	Damp electrodes; dirty, rusty or oily plate; arc too long.	Use dry electrodes; clean the joint; shorter arc.
Slag inclusions	Slag not removed between passes; current too low.	Clean each pass thoroughly; increase the current.
Electrode sticks	Current too low; arc too short.	Increase the current; lift the electrode slightly.
Arc wanders (arc blow)	Magnetic effect of DC current; poor work connection.	Move the work clamp; weld towards the clamp; shorten the arc; tilt the electrode.

7.2 Joint preparation

- Clean the joint of rust, scale, paint, oil and moisture before welding.
- For butt joints in plates thicker than about 6 mm, bevel the edges (single or double V) for full penetration.
- Tack-weld the parts at intervals before welding to hold them in position and reduce distortion.

7.3 Electrode storage

Keep electrodes in their packets in a dry place. Damp electrodes cause porosity, spatter and cracking. Re-dry low-hydrogen (E7018) electrodes in an oven as recommended by the electrode manufacturer before use.

8 Maintenance

▲ WARNING

Before any maintenance, switch off the main switch and the mains isolator. If the machine does not work normally, stop using it at once and find the cause. Only trained, qualified persons may check or repair the machine, using recommended spare parts.

8.1 Cleaning

- Remove the side panels and blow the dust and dirt out of the air passages and internal parts with **clean, dry, low-pressure compressed air**. Clean more often in dusty conditions.
- Keep the air passages clean so that enough cooling air circulates.
- Clean dirt and spatter from the electrode holder jaws.
- After cleaning, check that all hardware and all electrical connections are tight.

8.2 Maintenance schedule

Interval	Work
Daily	Check the welding cables, electrode holder and work clamp for damage and loose connections. Keep the louvres free. Check that all three power lamps light.
Every 3 months	Inspect the cable insulation; replace frayed cables. Clean and tighten the DC output terminals and the range selector links.
Every 6 months	Blow out the inside of the machine (8.1). Check the fan and its mounting. Check the tightness of the diode and transformer connections.
Yearly	Have a qualified electrician check the input terminals, the earth connection, the insulation of the transformer and the condition of the diodes.

8.3 Transformer and cables

- The transformer needs no maintenance other than regular cleaning with dry, low-pressure air.
- Keep the machine dry, free from grease, and protected from hot metal and sparks.
- Store the welding cables in a clean, dry place.

▲ WARNING

If a cable is replaced incorrectly, a bare conductor may touch earthed objects and cause arcing, eye injury or fire. Touching a bare live conductor can cause burns or death. Cable replacement must be done by a qualified person.

9 Troubleshooting

▲ WARNING

Switch off the main switch or breaker before repairing. Electrical repairs must be made only by a qualified electrician.

Trouble	Probable cause	Remedy
Machine does not come on; indicator lamps off	No supply at the input terminals. Mains isolator faulty or fuses blown. Control fuse blown.	Check the 3-phase supply. Check the isolator contacts; replace the fuses. Replace the control fuse.
One indicator lamp off	One supply phase missing.	Stop welding; check the supply and the mains fuses.
Machine on but no welding output	Welding or work cable loose or broken. Machine overheated. STANDARD / REMOTE switch on REMOTE without remote unit.	Check and tighten the cables. Let the machine cool, then continue. Set the switch to STANDARD.
Fan does not run	Fan fuse blown; fan motor faulty.	Replace the fan fuse; check and replace the fan.
Welding current varies	Loose mains or welding connection. Current regulator worn or poor contact.	Tighten the connections. Check and repair or replace the regulator.
Only minimum current; current does not increase	Current regulator faulty. Control transformer or control rectifier failed. Control fuse blown.	Check and replace. Check and replace. Replace the fuse.
Control fuse blows repeatedly	Control transformer, fan, current regulator or control rectifier damaged.	Check each part and replace the faulty one.
Weak, sluggish arc	Current too low; range selector on LOW. Loose connection. Low supply voltage.	Increase the current or set HIGH range. Make firm connections. Check the supply voltage.
Arc unstable, heavy spatter	Current too high. Wrong polarity for the electrode. One or more diodes failed.	Reduce the current. Interchange the cables and check. Replace the diode(s).
Mains fuse blows	Short circuit in the primary of the main transformer. Short-circuited main diodes.	Remove the short circuit. Replace the diodes.

If a fault cannot be corrected, contact Cruxweld service.

10 Warranty

Cruxweld warrants the CWR-400D against defects in material and workmanship for the period stated in the sales contract, from the date of invoice. The warranty does not cover welding cables, electrode holder, work clamp, fuses and other accessories, or damage caused by incorrect supply voltage, a missing phase, missing earth, overload, blocked ventilation, moisture, lack of maintenance, misuse or repair by unauthorised persons.

Model	CWR-400D
Serial number	
Invoice no. / date	
Customer	
Dealer stamp	

For service and spare parts please contact:

Cruxweld Industrial Equipments Pvt. Ltd.

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When ordering spare parts, always state the model and serial number from the rating plate.



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