



INDUSTRIAL EQUIPMENTS PVT. LTD.

MIG300iW

Inverter MIG / MAG Welding Machine

CO₂ gas-shielded • 300 A • with MMA function



INSTRUCTION MANUAL

Please read this manual carefully before using the machine

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Before You Begin

About this manual

This manual covers the Cruxweld **MIG300iW** inverter MIG / MAG welding machine for CO₂ and mixed-gas shielded welding, which also carries an MMA (stick) function. It explains how to install the machine safely, how to set it for the work in hand, how to look after it, and what to do when something goes wrong.

Read and understand this manual, together with the safety rules that apply at your site, before the machine is installed or switched on. Keep the manual with the machine so that every operator can reach it.

Declaration

- This welding equipment is intended for industrial and professional use and conforms to the international safety standard IEC 60974-1.
- Cruxweld provides a guarantee of one year on this welding equipment from the date of purchase, on the terms set out at the end of this manual.
- The contents of this manual may be revised without prior notice and without obligation.
- This machine is not designed to be serviced in the field. Return it to the Cruxweld service centre for any repair work.

How this manual is arranged

Section	What it covers
1 Safety	The hazards of welding and the precautions that must be taken.
2 General description	What the machine is and what it does well.
3 Technical data	Rating, duty cycle, dimensions and consumables.
4 Main components	The principal assemblies inside the machine.
5 Main circuit	How the inverter works and what its output characteristic means.
6 Installation	Siting, connecting and commissioning the machine.
7 Operation	Duty cycle, conditions of use and the working procedure.
8 Welding parameters	Current, voltage and wire size for the job.
9 Controls	Every control and connector on the front and rear panels.
10 Maintenance	Daily, weekly and periodic work.
11 Fault finding	Symptoms, causes and remedies.

Conventions used in this manual

- Panel controls are printed in small capitals, for example **ARC VOLTAGE**, **INDUCTANCE**.
- A boxed **WARNING** marks a hazard that can cause death or serious injury.
- A boxed **CAUTION** marks a hazard that can damage the machine or spoil the work.
- A shaded note gives practical advice that is not a safety matter.

READ THIS FIRST

Only a qualified electrician may connect this machine to the supply, and only a trained operator may weld with it. If you are not sure that you are qualified for the work in front of you, stop and ask.

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1 Safety

Welding and cutting are dangerous to the operator, to the people in or near the work area and to the surroundings if the equipment is not used correctly. Welding work must therefore be carried out carefully and in full compliance with the safety regulations that apply at your site. Read and understand this manual before the machine is installed and used.

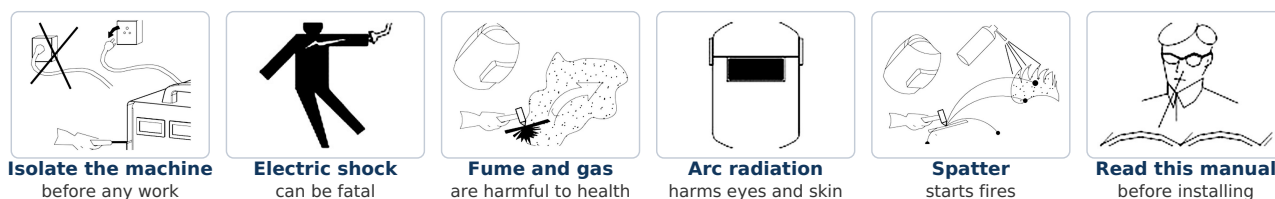


Figure 1.1 Safety symbols used in this manual

1.1 General precautions

- Do not change the function mode while welding is in progress; it can damage the machine.
- Disconnect the torch cable from the machine before you carry out any work on the torch.
- Fit a residual-current device or a comparable safety switch upstream of the machine to protect against earth-leakage current.
- Use good-quality welding tools, cables and consumables.
- Only a trained and qualified person may operate the machine.

WARNING - ELECTRIC SHOCK CAN KILL

- Connect the earth conductor in accordance with the applicable standard before the machine is switched on.
- Never touch live parts of the welding circuit, the electrode or the wire with bare hands. Always wear dry welding gloves.
- Keep yourself insulated from the workpiece and from earth. Stand on a dry insulating mat and wear dry, undamaged clothing.
- Switch off and isolate the machine before opening any cover, changing a torch part or working on the wiring.
- The voltage inside the machine reaches 600 V. Never open the enclosure while the machine is connected to the supply.

WARNING - FUME AND GAS ARE HARMFUL TO HEALTH

- Do not breathe the fume and the gas produced by welding or cutting.
- Keep the work area well ventilated and use local fume extraction wherever the work allows it.
- Shielding gas displaces air. Never weld in a confined space without forced ventilation and a second person watching from outside.

WARNING - ARC RADIATION HARMS EYES AND SKIN

- Wear a welding helmet with the correct filter shade, safety glasses under it, and clothing that covers the arms and neck.
- Screen the work area so that people nearby are not exposed to the arc.

WARNING - FIRE AND EXPLOSION

- Welding spatter starts fires. Remove every flammable material from the work area before welding, or screen it properly.
- Keep a suitable fire extinguisher within reach and make sure that someone present knows how to use it.
- Never weld on a container that has held fuel, solvent or any other flammable substance until it has been cleaned and certified safe.
- Watch the work area for at least half an hour after welding has finished; smouldering fires take time to show themselves.

WARNING - GAS CYLINDERS

- Chain or clamp every cylinder upright to a wall, a post or the cylinder trolley.
- Keep cylinders away from the arc, from sparks and from any source of heat.
- Never strike an arc on a cylinder and never earth the return cable to one.
- Close the cylinder valve and release the pressure in the regulator when the work is finished.

1.2 Noise

Welding and cutting produce noise, and on some work the level is high enough to damage hearing. Measure the level at the working position and provide hearing protection where it is needed.

1.3 Hot surfaces and moving parts

- The torch, the workpiece and the cut-off ends stay hot long after the arc is out. Use pliers and leave the work to cool before it is handled.
- Keep hands clear of the wire feed rolls. The wire emerges from the torch with enough force to pierce skin; never point the torch at yourself or at anybody else.
- The cooling fan runs whenever the machine is on. Keep fingers and loose clothing away from the rear grille.

1.4 Electromagnetic compatibility

The welding current produces a strong magnetic field around the cables. People who wear a pacemaker or any other electronic medical implant must consult their doctor before going near a welding machine in use. Route the welding cable and the return cable together and keep them away from control and signal wiring.

1.5 If the machine malfunctions

- Stop welding, switch the machine off and isolate it from the supply.
- Refer to section 11 of this manual.
- If the fault is not covered there, contact Cruxweld or your local dealer. Do not attempt a repair for which you are not qualified.

1.6 Personal protective equipment

Item	Requirement
Welding helmet	Correct filter shade for the current in use; shade 11 to 13 covers most MIG work at 150 A to 300 A.
Safety glasses	Worn under the helmet at all times, including while chipping and grinding.
Gloves	Dry leather welding gauntlets, free of holes.
Clothing	Flame-resistant jacket and trousers with no turn-ups, buttoned at the neck and cuffs.
Footwear	Safety boots with insulating soles.
Hearing protection	Where the measured noise level requires it.
Respiratory protection	Where extraction alone cannot keep the fume below the exposure limit.

2 General Description

The Cruxweld MIG300iW is a high-performance, general-purpose semi-automatic welding machine for CO₂ and mixed-gas shielded welding. It takes solid and flux-cored wire from Ø 0.8 mm to Ø 1.6 mm and welds mild steel and low-alloy steel components. The wire feed unit and the wire spool are carried in the upper compartment of the machine, so no separate feeder is needed for normal work.

An MMA (stick) function is built in, so the same machine also welds with covered electrodes when the job calls for it.

The inverter has a well-shaped static characteristic and a fast dynamic response. Its main qualities are these.

1. Inverter regulation holds the welding voltage steady while the mains voltage fluctuates and while the arc length changes. Arc self-regulation is strong and the process runs smoothly.
2. Spatter is low and the deposition rate is high.
3. The bead is well formed and distortion of the workpiece is small.
4. A strong pulse is used to strike the arc, so starts are reliable.
5. A burn-back control removes the ball from the wire end when the arc is closed, so the next start is clean.
6. The 4T (self-locking) mode reduces operator fatigue on long seams, because the trigger does not have to be held.
7. The wire feed circuit runs from a stabilised supply, so the feed speed does not drift with the load.
8. Light weight and small size make the machine easy to move around a fabrication shop.
9. Efficiency is high, running cost is low, and the demand on the supply is modest for the output delivered.

2.1 What the machine is used for

Application	Notes
General fabrication in mild steel	Sheet, plate, sections and pipe from about 1 mm upwards.
Structural and heavy fabrication	Fillet and butt welds in low-alloy structural steel.
Flux-cored welding	Gas-shielded flux-cored wire for higher deposition on thick sections.
Repair and maintenance	Plant and vehicle repair, hard facing with suitable wire.
MMA welding	Covered electrodes where access or site conditions rule out MIG.

The machine is not intended for aluminium or stainless steel with the standard equipment. Those materials need a different wire, a different shielding gas and, for aluminium, a U-groove feed roll and a suitable liner. Ask Cruxweld before you set the machine up for them.

2.2 Shielding gas

Gas	Typical flow	Effect on the weld
100 % CO ₂	12 - 18 l/min	Deep penetration and low cost; more spatter and a coarser bead. The usual choice for general fabrication in mild steel.
80 % Ar + 20 % CO ₂	12 - 18 l/min	Smoother arc, much less spatter and a flatter bead; a little less penetration. Preferred for thin sheet and for visible welds.

Raise the flow when working in a draught and reduce it in still air. Too high a flow draws air into the gas stream and causes porosity just as surely as too low a flow.

2.3 Items supplied

No.	Item	Quantity
1	MIG300iW welding machine with built-in wire feed unit	1
2	MIG welding torch with Euro connector, 3 m	1
3	Earth return cable with clamp	1
4	CO ₂ flow regulator with 36 V heater	1
5	Gas hose with clips	1
6	Spare contact tips	as ordered
7	Instruction manual	1

Check the delivery against this list as soon as the machine is unpacked, and report any shortage or transport damage to Cruxweld at once. Keep the packing until the machine has been commissioned.

3 Technical Data

3.1 Rating

Item	MIG300iW
Process	MIG / MAG (CO ₂ and Ar-CO ₂), MMA
Supply voltage	3-phase 415 V ± 10 %
Supply frequency	50 / 60 Hz
Rated input capacity	13.5 kVA
Rated input current	19 A
No-load voltage	62 V
Output current range, MIG	60 – 300 A
Output voltage range, MIG	17 – 32 V
Output current range, MMA	30 – 250 A
Rated duty cycle	60 % at 300 A (10-minute cycle, 40 °C)
Duty cycle, continuous	100 % at 232 A
Inverter frequency	20 kHz
Efficiency	85 %
Power factor	0.93
Wire diameter, solid	Ø 0.8 / 1.0 / 1.2 mm
Wire diameter, flux-cored	Ø 1.2 / 1.6 mm
Wire spool	up to 15 kg, 300 mm diameter
Wire feed speed	2 – 18 m/min
Gas heater output	AC 36 V, 3.5 A
Insulation class	F
Enclosure protection	IP21S
Cooling	Forced air
Machine dimensions (L × W × H)	680 × 330 × 600 mm
Machine weight	48 kg

The figures above are the rating of the standard machine. The rating plate fixed to the machine is the authority for the unit in front of you; where the plate and this manual differ, the plate applies.

3.2 Working conditions

Condition	Limit
Ambient temperature, welding	–10 °C to +40 °C
Ambient temperature, transport and storage	–25 °C to +55 °C
Relative humidity	not more than 50 % at 40 °C; not more than 90 % at 20 °C
Air quality	Dust, acid and corrosive gas not above the normal content of clean workshop air
Wind speed at the arc	not more than 1 m/s
Slope of the floor	not more than 10°
Tilt of the machine	not more than 15°
Supply waveform	Sine wave, 415 V ± 10 %, 50 / 60 Hz ± 1 %

A draught of more than 1 m/s blows the shielding gas away from the weld pool and causes porosity. Screen the work when welding outdoors or near an open door.

3.3 Supply and protection

Item	Recommendation
Supply cable, up to 20 m	4-core, 4 mm ² copper (3 phases + earth)
Supply cable, 20 m to 40 m	4-core, 6 mm ² copper
Upstream protection	32 A three-pole circuit breaker, type C or D
Earth-leakage protection	300 mA residual-current device, type B or type A according to local rules
Welding cable	50 mm ² up to 10 m; 70 mm ² above 10 m
Earth (protective) conductor	Same size as the phase conductors, bonded to the earth bolt on the rear panel

3.4 Consumables

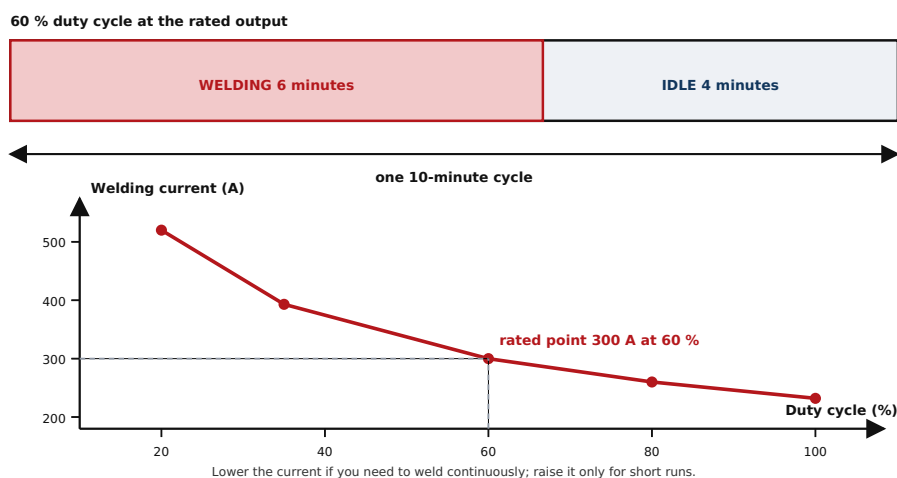
Wire diameter	Contact tip	Feed roll groove	Liner
Ø 0.8 mm	0.8 mm bore	V-groove 0.8 / 1.0	steel, 0.8 - 1.0
Ø 1.0 mm	1.0 mm bore	V-groove 0.8 / 1.0	steel, 0.8 - 1.0
Ø 1.2 mm	1.2 mm bore	V-groove 1.2 / 1.6	steel, 1.2 - 1.6
Ø 1.6 mm	1.6 mm bore	V-groove 1.2 / 1.6	steel, 1.2 - 1.6

Flux-cored wire is soft and crushes easily. Use a knurled feed roll for it and set the pressure only as high as it needs to be to feed without slipping.

3.5 Duty cycle explained

The duty cycle is the proportion of a ten-minute period for which the machine can weld at a stated current without overheating. A rating of 60 % at 300 A means six minutes of welding at 300 A followed by four minutes with the machine switched on but not welding, so that the fan can carry the heat away.

Figure 3.1 Duty cycle



If the duty cycle is exceeded, the thermal cut-out operates: the **ALARM** indicator lights and the output is switched off. Leave the machine running so that the fan keeps working; the output returns by itself once the machine has cooled, usually within a few minutes.

Do not switch the machine off when the thermal cut-out has operated. Switching off stops the fan, and the machine then takes much longer to cool.

4 Main Components

The sections below describe the principal assemblies inside the machine. They are given so that a qualified service engineer can understand what has failed; nothing in this section is an instruction to open the enclosure.

No.	Assembly	Function
1	IGBT module	Semiconductor switching devices arranged as a full-bridge inverter, which converts the rectified DC back to AC. The inverter runs at 20 kHz.
2	Rectifier bridge	Rectifies the incoming three-phase supply to DC for the inverter.
3	Cooling fan	The machine generates heat while it works. The fan draws air through the enclosure and carries the heat away; the machine is of the ventilated type.
4	Control transformer	Supplies the control circuit at 19 V / 0.21 A and 18 V / 0.8 A.
5	Control circuit board	The main control assembly, mounted on the separator. It sets the output characteristic and carries out every function of the machine.
6	Main transformer	The high-frequency transformer that steps the inverter output down to welding voltage. It is bolted to the base plate.
7	Secondary rectifier and reactor	Rectifies and smooths the transformer output to give the DC that the arc needs.
8	Wire feed unit	Drive motor, feed rolls and pressure arm in the upper compartment, with the spool hub behind them.
9	Gas solenoid valve	Opens the shielding gas when the torch trigger is pressed and closes it after the burn-back time.
10	Hall current sensor	Measures the welding current and feeds it back to the control board for regulation and for the ammeter display.
11	Enclosure, separator and base plate	The main transformer is fixed to the base plate and the other assemblies to the middle or base plate through brackets and fasteners. The enclosure encloses the whole machine and forms the air duct.

WARNING

The voltage inside the machine reaches 600 V, and the capacitors hold a dangerous charge for several minutes after the supply is removed. Only a qualified service engineer may open the enclosure, and only after the machine has been isolated and left to discharge.

4.1 Air flow through the machine

The fan draws air in through the rear grille, passes it over the heat sinks, the transformer and the rectifier, and discharges it through the louvres at the front and the sides. The path only works if the clearances given in section 6.1 are respected and the louvres are kept clear.

In a dusty shop the air path fills with conductive dust, which is the commonest single cause of breakdown in an inverter welding machine. Follow the cleaning interval in section 10.

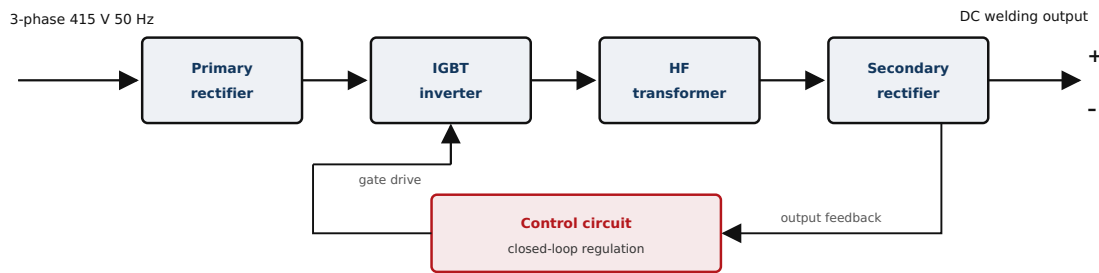
4.2 Protective functions

Protection	What it does
Thermal cut-out	Switches the output off and lights the ALARM indicator when the heat sink temperature rises too far. It resets by itself when the machine has cooled.
Over-current protection	Limits the output if the torch is short-circuited to the work for longer than the control allows.
Under- and over-voltage protection	Shuts the output down when the supply falls outside the working range, which protects the inverter from the surge when the supply returns.
Main circuit breaker	Isolates the machine from the supply if the input current becomes excessive. It is on the rear panel.

5 Principle of the Main Circuit

5.1 Block diagram

Figure 5.1 Block diagram of the main circuit



Mains power is rectified, inverted at 20 kHz by the IGBT bridge, stepped down by the high-frequency transformer and rectified again for welding.

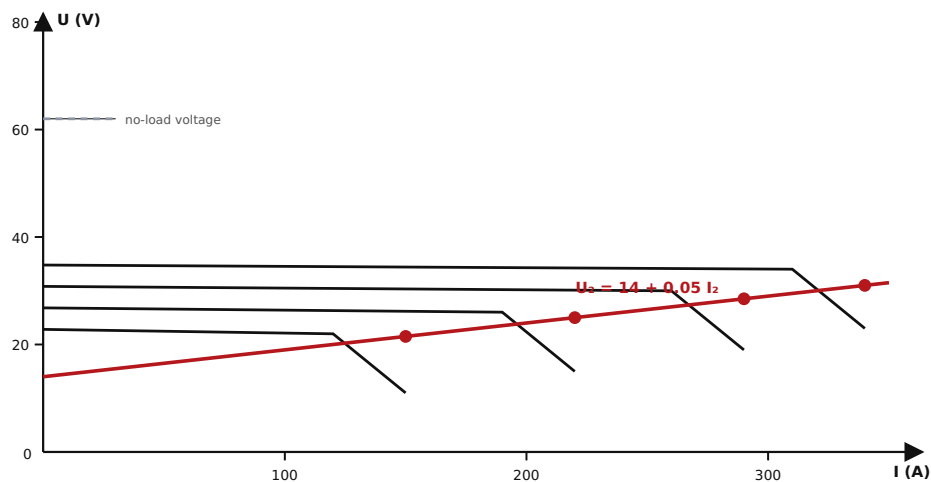
The machine uses IGBT soft-switching inverter technology. The incoming mains supply is rectified and then converted to high-frequency AC by the IGBT inverter. The high-frequency transformer steps that AC down, the secondary rectifier turns it back into DC, and a reactor smooths it to give the output that the arc needs.

Because the transformer works at 20 kHz instead of at mains frequency, it can be far smaller and lighter than the transformer of a conventional machine of the same rating, and the dynamic response of the whole power source is much faster.

The control circuit closes the loop around the whole machine. It compares the measured output with the setting, corrects the inverter drive many thousand times a second, and so gives the power source a strong resistance to mains fluctuation together with excellent welding behaviour.

5.2 Static output characteristic

Figure 5.2 Static output characteristic



The flat characteristic keeps the arc voltage almost constant while the current adjusts itself to the wire feed speed.

The machine has a **flat, or constant-voltage, characteristic**, which is what MIG welding needs. The operator sets the voltage; the current then settles at whatever value the wire feed speed demands.

The arc itself follows the straight line

$$U_2 = 14 + 0.05 \times I_2$$

where U_2 is the arc voltage in volts and I_2 the welding current in amperes. The working point of the machine is where this line crosses the flat characteristic that has been set. The relationship is useful when a welding procedure gives a current but not a voltage: at 200 A, for example, the arc voltage works out at about 24 V.

5.3 Arc self-regulation

Arc self-regulation is what keeps a MIG arc stable, and it is worth understanding.

- If the torch is lifted, the arc lengthens, the arc voltage tries to rise, and the machine responds by reducing the current. The wire then burns off more slowly than it is fed, so the arc shortens again.
- If the torch is lowered, the arc shortens, the voltage falls and the current rises. The wire burns off faster than it is fed, so the arc lengthens again.

The correction happens in a few milliseconds, which is why a MIG arc tolerates a hand that is not perfectly steady. The flatter the characteristic and the faster the power source, the stronger this effect – which is why an inverter gives a steadier arc than an older transformer machine.

5.4 Inductance and what it does

The **INDUCTANCE** control on the front panel changes how fast the current is allowed to rise when the wire short-circuits to the weld pool, which happens many times a second in dip-transfer welding.

Setting	Effect
Low inductance	The current rises quickly, the short clears sharply. The arc is crisp and penetration is deeper, but there is more spatter and the bead is narrower. Suits thin sheet and positional work.
High inductance	The current rises slowly, the short clears gently. The arc is soft, spatter is low and the bead is wider and flatter, with less penetration. Suits thicker sections and welds that must look good.

Set it by ear: turn it until the arc gives a steady, even crackle rather than an irregular spitting.

6 Installation

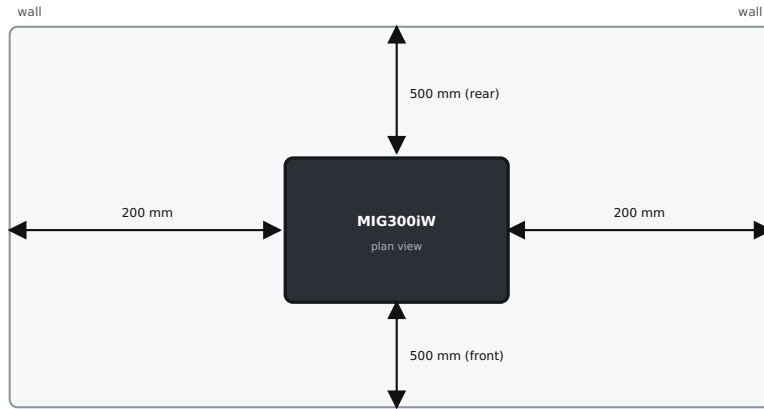
WARNING

Switch the supply off and lock it off before carrying out any of the work in this section. Only a qualified electrician may connect the machine to the supply.

6.1 Siting the machine

- Stand the machine on a firm, level floor. The tilt must not exceed 15°.
- Choose a dry, well-ventilated place, out of direct sunlight, rain and dust.
- Leave at least 500 mm clear in front of and behind the machine and at least 200 mm at each side. Keep two machines at least 200 mm apart.
- Never stack one welding machine on another, and never stack anything on top of a welding machine.
- Keep the machine away from flammable and explosive materials.
- Do not let any loose metal object fall inside the machine through the louvres.
- The ambient temperature during operation must be between –10 °C and +40 °C.

Figure 6.1 Minimum clearances around the machine



Keep two machines at least 200 mm apart, and never stack one machine on another.

6.2 Electrical supply

1. Check that the supply voltage matches the rating plate: three-phase 415 V $\pm$ 10 %, 50 / 60 Hz.
2. Fit a circuit breaker of the size given in section 3.3 ahead of the machine. If no suitable fuse or breaker is fitted, do not connect the machine.
3. Take the input cable through the gland on the rear panel and connect the three phases to the input terminals.
4. **Connect the protective earth first and disconnect it last.** Bond it to the earth bolt on the rear panel, or earth the protective conductor in the input cable reliably.
5. Close the gland so that the cable cannot be pulled out or chafed.

CAUTION

A machine that is not earthed, or that is earthed through the workpiece alone, is dangerous and will also weld badly. Check the earth with an instrument, not by eye.

6.3 Connecting the machine

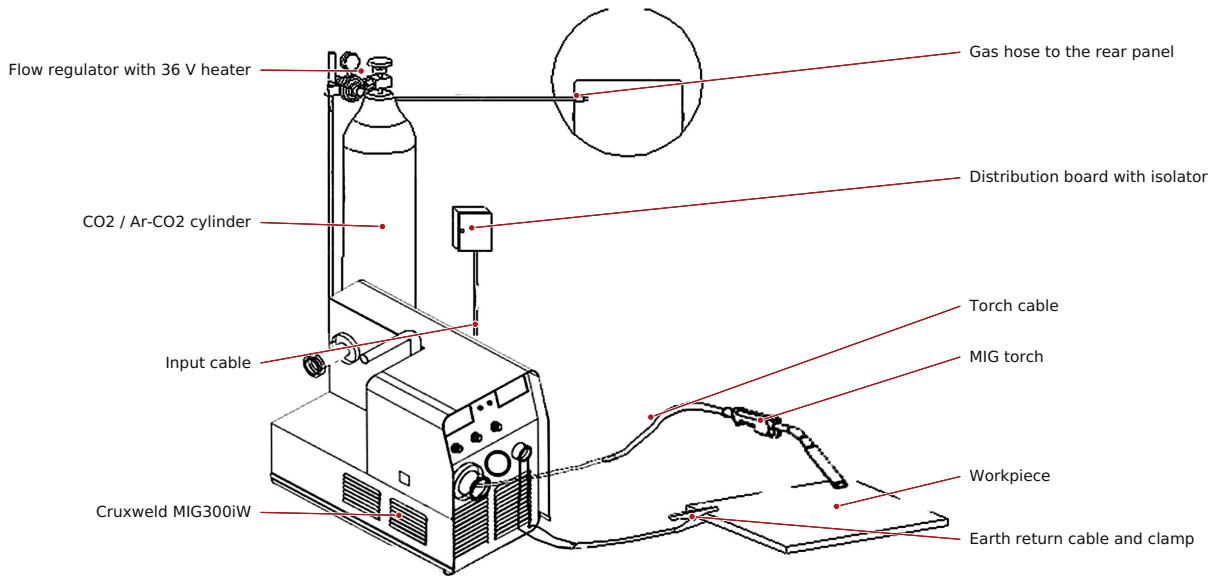


Figure 6.2 Connecting the Cruxweld MIG300iW

1. Connect the earth return cable to the output terminal **(-)** and clamp its other end to the workpiece, as close to the weld as the job allows.
2. Plug the MIG torch into the Euro connector on the front panel and tighten the collar by hand. For MMA welding, connect the electrode holder to the **MMA OUTPUT (+)** terminal instead.
3. Connect the gas hose from the CO₂ regulator to the gas inlet on the rear panel and secure both ends with hose clips.
4. Plug the heater cable of the gas regulator into the **36 V heater output** socket on the rear panel.
5. Connect the input cable to the distribution board and earth the protective conductor reliably.
6. Switch the main circuit breaker on the rear panel to **ON**.

Make sure the gas connection at the rear of the machine is tight before the cylinder valve is opened. A leaking joint wastes gas and lets air into the shielding stream, which causes porosity.

6.4 Loading the wire

1. Switch the machine off at the rear breaker.
2. Open the side door of the wire compartment and fit the spool on the hub so that the wire comes off the **bottom** of the spool towards the feed rolls. Tighten the spool brake only enough to stop the spool over-running; too much drag makes the feed erratic.
3. Check that the groove in the feed roll matches the wire diameter (section 3.4) and that the liner and the contact tip are the right size as well.
4. Release the pressure arm, cut the wire end square with side cutters, and feed about 150 mm through the inlet guide, over the roll groove and into the torch adaptor.
5. Close the pressure arm and set the pressure so that the wire feeds without slipping. Test it by letting the wire run against a piece of wood: the rolls should just begin to slip when the wire is stopped.
6. Remove the gas nozzle and the contact tip from the torch, switch the machine on, and hold the **WIRE** switch until the wire emerges from the torch neck. Fit the correct contact tip and the nozzle, and cut the wire back to about 10 mm.

CAUTION

Keep the torch pointing away from your body and from other people while the wire is being fed. Never let go of the wire end while it is coming off the spool; a released spool unwinds in an instant and the wire whips.

6.5 Commissioning check

1. Confirm that the earth is connected and that the supply voltage is correct.
2. Switch on. The **POWER** indicator must light and the fan must turn in the direction marked on it.
3. Open the cylinder valve, set the regulator to about 15 l/min and operate the **GAS** switch: gas must flow from the nozzle and stop cleanly when the switch is released.
4. Operate the **WIRE** switch: the wire must feed smoothly and at a steady speed.
5. Set the machine to **MIG** and **2T**, set a mid-range voltage and wire speed, and make a short test weld on scrap of the same thickness as the job.
6. Adjust the voltage and the wire speed until the arc sounds like a steady crackle, then trim the inductance.

7 Operation

7.1 Before every shift

- Check that the machine is earthed and that the supply cable and the welding cables are undamaged.
- Check that the torch, the earth return clamp and the gas hose are tight.
- Check the contact tip and the nozzle; replace them if the tip bore is worn oval or the nozzle is clogged with spatter.
- Check that the cylinder is secured upright and that enough gas remains for the work.
- Check that the louvres and the rear grille are clear.
- Confirm that the duty cycle of the machine suits the work planned, and do not overload it.

7.2 Starting the machine

1. Close the circuit breaker on the distribution board. The **POWER** indicator lights and the fan turns in the direction marked on it.
2. Open the cylinder valve slowly and set the flow on the regulator. Operate the **GAS** switch and check the flow at the nozzle.
3. Operate the **WIRE** switch to feed the wire out to the nozzle; cut it back to about 10 mm of stick-out.
4. Select **MIG** or **MMA**, and **2T** or **4T**.
5. Set the welding voltage and the wire feed speed from the tables in section 8, and set the inductance to mid position for the first weld.
6. Pull the torch trigger. The wire feeds, gas flows from the nozzle and the arc strikes.

After welding, close the cylinder valve, release the pressure from the regulator and switch the supply off.

7.3 2T and 4T trigger modes

Mode	How the trigger works	Use it for
2T	Press and hold the trigger to weld; release it to stop. The arc is live only while the trigger is held.	Tacks, short runs and any work where close control of the arc time matters.
4T (self-locking)	Press and release to start; the arc stays on with the trigger free. Press and release again to stop, when the crater fill takes over.	Long seams, where holding the trigger for minutes at a time tires the hand.

7.4 Crater fill

A weld that simply stops leaves a crater at the end of the bead, and a crater is where cracks start. In **4T** mode the machine steps down to a lower current and voltage for a moment at the end of the weld so that the crater is filled before the arc goes out. The two controls that set this are **CRATER V** (the arc voltage during crater fill) and **CRATER A** (the current during crater fill).

As a starting point, set both about 70 % of the main welding setting and adjust from the look of the finished crater: too high and the crater is proud, too low and it is still hollow.

7.5 Burn-back

When the arc closes, the machine keeps the output on for a few milliseconds after the wire feed has stopped. This burns the wire back clear of the weld pool and removes the ball from the wire end, so that the next start is clean and the wire does not freeze into the pool.

If the wire sticks in the weld pool at the end of every weld, the burn-back is too short. If the wire burns back into the contact tip, it is too long. Both are set on the control board and should be adjusted by a service engineer.

7.6 Welding technique

Point	Practice
Stick-out	Keep 10 mm to 15 mm of wire between the contact tip and the work. Longer stick-out lowers the current and the penetration; shorter stick-out burns the tip.
Torch angle	Hold the torch 10° to 15° from vertical. Pushing (torch leading) gives a flatter, wider bead with less penetration; dragging (torch trailing) gives deeper penetration and a narrower bead.
Travel speed	Keep the arc on the leading edge of the weld pool. If the pool runs ahead of the arc the weld will lack fusion.
Cleanliness	Remove mill scale, rust, paint, oil and moisture from the joint. CO ₂ welding tolerates less contamination than stick welding, not more.
Gas flow	12 l/min to 18 l/min for most work. Raise it in a draught, but screen the work rather than simply turning the gas up.
Starting	Start about 10 mm ahead of where the weld is to begin and run back over the start, so that the start point is remelted.

7.7 Reading the arc

What you hear or see	What it means	What to change
Steady, even crackle	Voltage and wire speed are matched.	Nothing.
Popping, wire stubbing into the plate	Wire speed too high, or voltage too low.	Reduce the wire speed or raise the voltage.
Long, hissing arc with large droplets	Voltage too high, or wire speed too low.	Lower the voltage or raise the wire speed.
Heavy spatter, irregular arc	Inductance too low, contact tip worn, or gas flow wrong.	Raise the inductance, change the tip, check the gas.
Porosity in the bead	Loss of shielding – draught, leaking hose, blocked nozzle, or dirty plate.	Screen the work, check the gas line, clean the nozzle and the joint.
Bead sits proud with poor fusion at the toes	Travel speed too slow, or voltage too low.	Travel faster, or raise the voltage.

7.8 MMA welding

1. Switch the machine off.
2. Connect the electrode holder to **MMA OUTPUT (+)** and the earth return to the **(-)** terminal. For electrodes that call for direct current electrode negative, reverse the two connections.
3. Set the selector switch to **MMA**.
4. Set the current from the electrode maker's recommendation; as a guide, about 40 A per millimetre of electrode diameter.
5. Strike the arc by scratching the electrode along the joint, then lift it to about one electrode diameter above the work.

Disconnect the MIG torch before MMA welding, and disconnect the electrode holder before MIG welding. Leaving both connected exposes a live terminal.

7.9 Shutting down

1. Stop welding and let the fan run for a few minutes if the machine has been working hard.
2. Close the cylinder valve and drain the gas from the regulator and the hose.
3. Switch the machine off at the rear breaker and at the distribution board.
4. Coil the cables loosely; sharp bends break the conductors inside the insulation.
5. Hang the torch up so that the neck and the liner are not kinked.

8 Welding Parameters

The tables in this section are a starting point, not a welding procedure. Always make a test weld on scrap of the same material and thickness, and adjust from what you see and hear.

8.1 Current, voltage and wire diameter

Welding current (A)	Welding voltage (V)	Wire diameter (mm)
60 – 80	17 – 18	Ø 0.8
80 – 130	18 – 21	Ø 0.8 / Ø 1.0
130 – 200	20 – 24	Ø 0.8 / Ø 1.0
200 – 250	24 – 27	Ø 1.0 / Ø 1.2
250 – 300	26 – 30	Ø 1.2 / Ø 1.6

300 A is the rated output of the MIG300iW. The machine will deliver more for very short periods, but the duty cycle falls away quickly above the rating; see section 3.5.

8.2 Starting settings by plate thickness

Thickness	Wire	Current	Voltage	Notes
1.0 – 1.5 mm	Ø 0.8	60 – 90 A	17 – 19 V	Stitch or short runs to limit distortion; low inductance.
2 – 3 mm	Ø 0.8 / 1.0	90 – 140 A	18 – 21 V	Single pass, both sides on butt joints.
4 – 6 mm	Ø 1.0	140 – 210 A	21 – 25 V	Single-pass fillet; prepare butt joints above 5 mm.
8 – 12 mm	Ø 1.2	210 – 280 A	25 – 29 V	Multi-pass; V-preparation on butt joints.
above 12 mm	Ø 1.2 / 1.6	260 – 300 A	28 – 32 V	Multi-pass with a root run; preheat where the steel and the thickness require it.

8.3 Fillet weld size

Leg length	Wire	Current	Passes
3 mm	Ø 0.8 / 1.0	120 – 160 A	1
5 mm	Ø 1.0 / 1.2	180 – 230 A	1
6 mm	Ø 1.2	230 – 280 A	1
8 mm	Ø 1.2	250 – 300 A	2 – 3
10 mm and above	Ø 1.2 / 1.6	280 – 300 A	3 or more

A single MIG pass much above 8 mm leg is hard to control and tends to undercut the vertical member. Split it into runs.

8.4 Wire feed speed

On this machine the wire feed speed sets the current: the more wire that is fed, the more current the machine draws to melt it. The table below is a guide to the relationship.

Wire diameter	Wire feed speed	Approximate current
Ø 0.8 mm	3 – 9 m/min	60 – 150 A
Ø 1.0 mm	3 – 11 m/min	90 – 230 A
Ø 1.2 mm	3 – 12 m/min	130 – 300 A
Ø 1.6 mm	2 – 8 m/min	200 – 300 A

8.5 Setting the machine, step by step

1. Choose the wire diameter from the plate thickness (section 8.2) and fit the matching contact tip, feed roll and liner.
2. Set the gas flow to about 15 l/min.
3. Set the voltage from the table for the current you intend to use.
4. Set the wire feed speed to the middle of its range for that wire.
5. Make a test run about 100 mm long on scrap.
6. Listen. Popping and stubbing mean too much wire or too little voltage; a long hissing arc means the opposite. Correct one control at a time.
7. When the sound is a steady crackle, check the bead: it should be slightly convex, with the toes fused smoothly into the plate and no undercut.
8. Trim the inductance last, to take the edge off the spatter without making the arc sluggish.
9. Note the settings on the job card before you start on the work itself.

8.6 Common weld defects

Defect	Cause	Remedy
Porosity	Loss of gas shielding: draught, leaking hose, blocked nozzle, low flow; or oil, paint, rust or moisture on the joint.	Screen the work, check the gas line for leaks, clean the nozzle, clean the joint, raise the flow to 15 – 18 l/min.
Undercut	Current or voltage too high, travel speed too fast, torch angle wrong.	Reduce the current, slow down, hold the torch closer to vertical and pause briefly at the toes.
Lack of fusion	Current too low, travel too fast, arc riding on the weld pool instead of the leading edge.	Raise the current, keep the arc on the leading edge of the pool, widen the preparation.
Lack of penetration	Root gap too small, current too low, wire too large, stick-out too long.	Open the root gap, raise the current, use a smaller wire, shorten the stick-out.
Excessive spatter	Voltage too low for the wire speed, inductance too low, worn contact tip, wrong gas.	Raise the voltage, raise the inductance, change the tip, check the gas mixture.
Burn-through	Current too high for the thickness, travel too slow, root gap too wide.	Reduce the current, travel faster, use stitch welding, fit a backing bar.
Crater cracking	The arc was broken without filling the crater.	Use 4T mode with crater fill, or back up over the crater before releasing the trigger.
Distortion	Too much heat in one place.	Use a smaller weld, stitch weld, balance the welds about the neutral axis, clamp the work.
Irregular bead width	Erratic wire feed – worn liner, wrong roll pressure, tangled spool.	Clean or replace the liner, reset the roll pressure, check the spool and the brake.

8.7 Recording what works

When a setting produces a sound weld on a job you repeat, write it down. A simple record like the one below saves a great deal of setting-up time and makes the work consistent between operators.

Job	Thickness	Wire	Gas	Current	Voltage	Inductance	Gas flow

9 Controls and Connections

Every control the operator needs is on the front panel. The displays are on the left, the mode switches and the indicators across the top, the three setting knobs in the middle and the output connections along the bottom. The table on the following page explains each item in turn; the numbers in that table are the numbers in the figure below.

9.1 Front panel

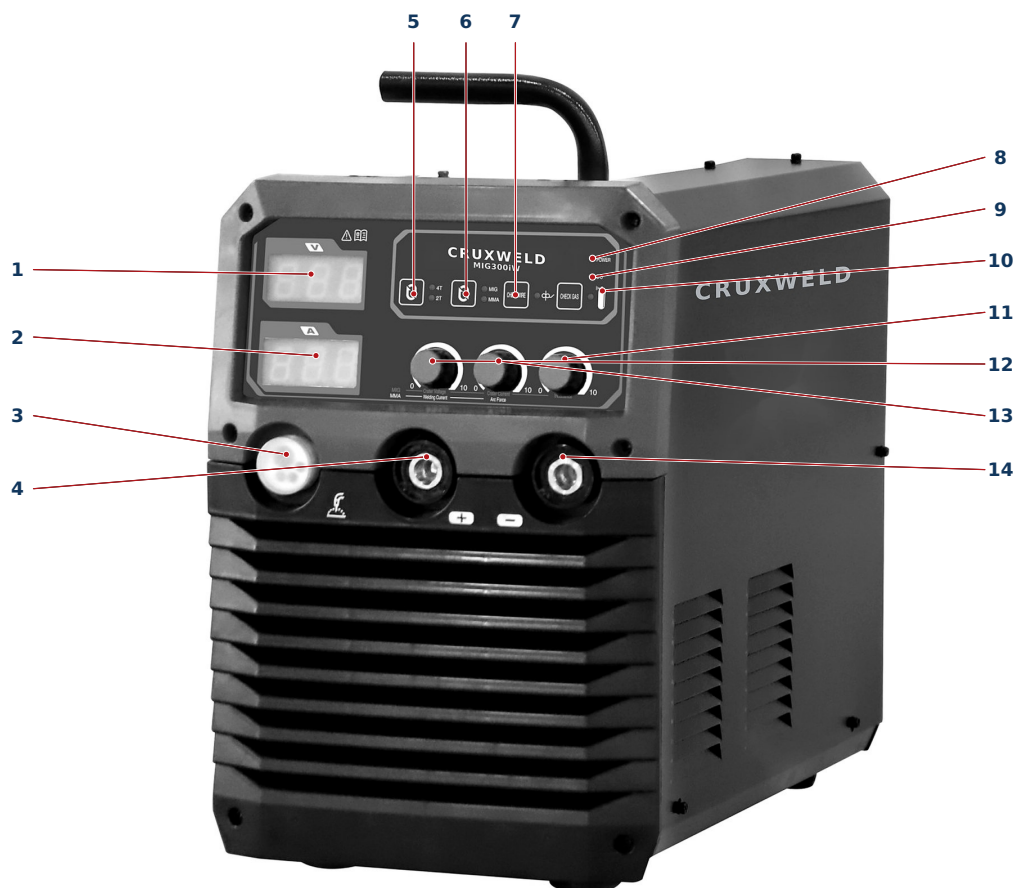


Figure 9.1 Front view of the Cruxweld MIG300iW

The layout shown is that of the standard machine. If your machine carries an extra option, its control is added to the panel and is described on the sheet supplied with the option.

No.	Control	Function
1	Output voltage display (V)	Shows the set voltage when the machine is off load, and the actual welding voltage while welding.
2	Output current display (A)	Shows the relative wire feed speed when the machine is off load, and the actual welding current while welding.
3	Torch connector (+)	Euro connector for the MIG torch. It carries the welding current, the shielding gas, the wire and the trigger circuit in one plug.
4	MMA output (+)	Connect the electrode holder here for MMA welding.
5	2T / 4T selector	Chooses the trigger mode. 2T: the arc is live only while the trigger is held. 4T: press and release to start, press and release again to stop. See section 7.3.
6	MIG / MMA selector	Chooses between gas-shielded wire welding and covered-electrode welding.
7	Wire check switch	Feeds the wire without striking an arc and without gas. It has the same effect as the torch trigger, and is used for loading the wire and for checking that the feed works.
8	Power indicator	Lights when the supply is connected and the machine is switched on.
9	Alarm indicator	Lights when the temperature inside the machine is too high. The output is switched off automatically until the machine has cooled.
10	Gas check switch	Opens the solenoid valve so that the gas flow can be set and checked without striking an arc.
11	Inductance control	Varies arc stability, penetration and the amount of spatter. See section 5.4.
12	Crater voltage control	In 4T mode, sets the arc voltage used while the crater is filled at the end of the weld.
13	Crater current control	In 4T mode, sets the current used while the crater is filled at the end of the weld.
14	Output (-)	Connect the earth return cable here and clamp it to the workpiece.

The voltage and current displays read the actual values only while the arc is burning. Off load, the current display shows a relative wire-speed figure and not an ampere value.

CAUTION

Do not move the MIG / MMA selector or the 2T / 4T selector while the arc is burning. Changing mode under load can damage the machine.

9.3 Wire compartment

The upper compartment holds the wire spool, the drive motor and the feed rolls. It is reached through the side door.

Item	Function
Spool hub with brake	Takes a spool up to 15 kg and 300 mm diameter. The brake stops the spool over-running when the feed stops.
Drive roll	Grooved roll driven by the feed motor. The groove must match the wire diameter.
Pressure roll and arm	Presses the wire into the groove. Set only as much pressure as is needed to feed without slipping.
Inlet and outlet guides	Keep the wire aligned with the groove and with the torch adaptor.
Torch adaptor	The Euro connector block that carries the current, the gas and the wire into the torch.

Close the side door before welding. An open door exposes the drive rolls and lets spatter and dust into the compartment.

9.2 Rear panel



Figure 9.2 Rear view of the Cruxweld MIG300iW

No.	Item	Function
1	Main circuit breaker (ON / OFF)	Cuts the supply automatically if the machine is overloaded or faulty, which protects the machine. It is normally left in the ON position. Use the switch on the distribution board to start and stop the machine in daily work, not this breaker.
2	Heater output socket, AC 36 V 3.5 A	Supplies the heating coil of the CO ₂ flow regulator, which prevents the regulator from freezing as the gas expands.
3	Cooling fan	Cools the components inside the machine. It draws air into the machine; the direction is marked on the fan.
4	Earth bolt	Bond this bolt reliably to earth with a conductor, or earth the protective conductor in the input cable reliably. This is required both for personal safety and for the machine to work correctly.
5	Input cable gland	Entry for the three-phase supply cable and the protective conductor.
6	Gas inlet	Connection for the hose from the CO ₂ or Ar-CO ₂ flow regulator.

WARNING

The main circuit breaker is a protective device, not an isolator. Before any work on the machine or the cables, switch off and lock off at the distribution board.

10 Maintenance

WARNING

Switch off and lock off at the distribution board before any maintenance work. Capacitors inside the machine hold a dangerous charge for several minutes after the supply is removed.

10.1 Precautions for use

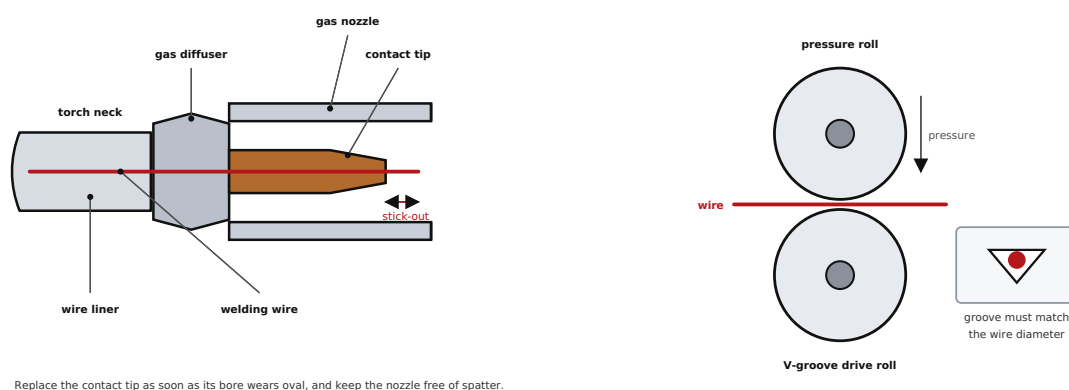
1. The rating plate must stay riveted in its place on the cover. Drilling or riveting anywhere else on the cover can damage the components underneath.
2. The welding cable must be tight on the machine terminal stud. A loose joint overheats, burns the terminal and makes the arc unstable.
3. Keep the exposed copper of the welding cable and the terminal stud away from earthed metal, so that the output cannot be short-circuited.
4. Protect the welding cables and the control cables from damage and from being pulled apart at the joints.
5. Do not pile heavy objects on the machine; the cover will deform and the air path will be blocked.
6. Keep the ventilation clear at all times.

10.2 Maintenance schedule

Interval	Work
Every shift	Check the contact tip and the nozzle, and clean the spatter off the nozzle. Check the gas flow. Check that the cables and the torch are undamaged.
Weekly	Blow the liner through with dry compressed air from the torch end. Check the feed roll for wear and the pressure setting. Check that the louvres and the rear grille are clear.
Monthly	Check every cable joint for tightness. Check the earth connection with an instrument. Inspect the gas hose for cuts and the clips for tightness.
Every 3 to 6 months	A trained service person blows the dust out of the machine with dry compressed air at low pressure, and checks for loose fasteners inside. In a dusty shop do this every three months.
Yearly	Full electrical safety test, including insulation resistance and the continuity of the protective conductor.

10.3 Consumables and wear parts

Figure 10.1 Torch front end and wire feed roll



Part	Replace when	Notes
Contact tip	The bore is worn oval, or the arc starts to wander.	The commonest cause of an unstable arc. Keep a box of the right size at the machine.
Gas nozzle	Spatter has bridged the gap to the tip, or the bore is distorted.	Clean the spatter out with a reamer and use anti-spatter spray, sparingly.
Gas diffuser	The gas holes are blocked, or the thread is damaged.	Blocked holes cause porosity that looks like a gas-supply fault.
Wire liner	Feeding becomes erratic and the liner cannot be cleaned.	Blow it through weekly. Replace it when the wire size changes, and always if the torch has been kinked.
Feed roll	The groove is worn shiny and the wire slips.	Fit the groove size for the wire. Use a knurled roll for flux-cored wire.
Torch cable	The outer cover is cut, or the neck is loose.	A damaged torch cable is an electrical hazard, not just a nuisance.

10.4 Cleaning the liner

1. Switch off and isolate the machine.
2. Remove the nozzle, the contact tip and the diffuser.
3. Release the pressure arm and withdraw the wire from the torch.
4. Blow dry compressed air through the liner from the torch end towards the machine, so that the dust and swarf come out at the feed end rather than being driven further in.
5. Refit the wire, the diffuser, the tip and the nozzle.

Use dry, oil-free air. Compressed air with oil or water in it contaminates the liner and causes porosity for weeks afterwards.

10.5 Storage

- Store the machine between -25°C and $+55^{\circ}\text{C}$ in a dry place.
- Remove the wire spool if the machine will stand idle for more than a few weeks, and keep the spool in a sealed bag; wire rusts, and rusty wire welds badly.
- Cover the machine to keep dust out, but not with a sheet that traps condensation against the cover.
- Before putting a stored machine back into service, blow the dust out, check the earth and make a test weld on scrap.

10.6 Checks before calling for service

Work through this list before the machine is opened up. It settles most calls.

1. Are the switches on the front panel in the right positions for the work?
2. Is the supply voltage within range at the machine terminals, on all three phases?
3. Is the input cable connected correctly and tight?
4. Is the earth of the machine correct and tight?
5. Is the welding cable connected correctly, and is the earth return clamp making good contact with clean metal?
6. Is the gas circuit in order, and is the CO_2 regulator working and heated?
7. Are the contact tip, the liner and the feed roll the right size for the wire, and are they serviceable?

WARNING

The voltage inside the machine reaches 600 V. Opening the case is strictly forbidden except to a qualified service engineer, and then only after the machine has been isolated and left to discharge. Switch the power off before welding cables are installed and before torch parts are changed.

11 Fault Finding

WARNING

Only a qualified technician may repair this welding machine. For your own safety and to avoid electric shock, observe every safety note and precaution in this manual before any repair work is started.

11.1 Electrical faults

No.	Symptom	Cause	Remedy
1	After switching on, the indicator does not light	A phase is missing from the supply; the main circuit breaker on the rear panel has failed	Check the supply on all three phases; replace the circuit breaker
2	The breaker on the rear panel trips immediately when the machine is switched on	The breaker has failed; the IGBT module is damaged; the rectifier bridge is damaged; the varistor is damaged; the control board is damaged	Replace the breaker; replace the IGBT module and the drive board together; replace the rectifier bridge; replace the varistor; replace the control board
3	The breaker trips while welding	The machine has been run above its duty cycle for a long period; the breaker has failed	Work within the duty cycle of the machine; replace the breaker
4	The welding current cannot be adjusted	The control board has failed; the leads to the Hall current sensor are broken	Replace the control board; repair the broken lead
5	The ALARM indicator lights and the output stops	The thermal cut-out has operated because the duty cycle was exceeded, the air path is blocked, or the ambient temperature is too high	Leave the machine switched on so that the fan keeps running; clear the louvres and the rear grille; reduce the current or the duty cycle
6	No output at all, indicators normal	The MIG / MMA selector is in the wrong position; the earth return clamp is not making contact; an output cable is broken	Check the selector; clean the clamping point on the workpiece; check the cables end to end

11.2 Gas and wire feed faults

No.	Symptom	Cause	Remedy
7	The CO ₂ regulator does not heat and freezes up	The regulator has failed; the heater cable is broken or shorted; the thermistor has failed	Replace the regulator; repair the heater cable; replace the thermistor
8	The trigger is held, the wire feeds normally, but no gas flows	The control board has failed; the gas solenoid valve has failed; the hose is blocked or kinked	Replace the control board; replace the solenoid valve; clear or replace the hose
9	The trigger is held, the wire does not feed and there is no open-circuit voltage	The torch trigger switch has failed; the torch control cable is broken; the control board has failed	Replace the torch; repair the control cable; replace the control board
10	The wire feeds unevenly	Feed roll pressure too low or too high; the groove does not match the wire; the liner is dirty or the wrong size; the spool brake is too tight; the spool is tangled	Reset the pressure; fit the correct roll; clean or replace the liner; slacken the brake; re-lay the wire on the spool
11	The wire burns back into the contact tip	Burn-back time too long; wire feed speed too low for the voltage; contact tip worn	Have the burn-back set by a service engineer; raise the wire speed; replace the tip

11.3 Arc and weld quality faults

No.	Symptom	Cause	Remedy
12	The arc is unstable and spatter is heavy	The welding specification is wrong; the contact tip is badly worn; the inductance is set too low; the gas mixture or flow is wrong	Trim the voltage and the wire speed; replace the contact tip; raise the inductance; check the gas
13	The arc will not strike	Poor earth return; oxide or paint under the clamp; wire not protruding from the tip; torch not seated in the Euro connector	Clean the clamping point; cut the wire back to 10 mm; seat and tighten the torch
14	The arc wanders along the joint	Contact tip worn; magnetic arc blow, most often near the end of a run or close to the earth clamp	Replace the tip; move the earth clamp, weld towards the clamp, or split the return into two clamps
15	Porosity in the bead	Loss of shielding; dirty or damp joint; blocked nozzle; leaking gas hose; draught over the work	See section 8.6 – check the gas line, clean the joint and the nozzle, screen the work
16	The weld cracks in the crater	The arc was broken without filling the crater	Use 4T mode with crater fill, or run back over the crater before releasing the trigger
17	The current shown is much lower than expected	Stick-out too long; poor earth return; supply voltage low	Shorten the stick-out; improve the return; check the supply on all three phases

11.4 A logical order of checks

1. **Start with the return path.** A poor earth return imitates almost every other fault. Clean the clamping point to bright metal and clamp it close to the weld.
2. **Then the consumables.** Contact tip, liner, feed roll and nozzle account for most of the arc complaints a service engineer is called out for.
3. **Then the gas.** Check the cylinder contents, the flow at the nozzle and the hose for leaks.
4. **Then the supply.** Measure all three phases at the machine terminals, under load if possible.
5. **Then the settings.** Voltage, wire speed and inductance, one control at a time.
6. **Only then the machine itself.** By this point the fault really is internal, and the machine should go to a qualified service engineer.

11.5 Information to have ready

Having the following to hand settles most support calls in a few minutes.

- The model and the serial number from the rating plate.
- The supply voltage measured at the machine, on all three phases.
- The wire type and diameter, the shielding gas and the plate thickness.
- The settings in use: voltage, wire speed, inductance, gas flow.
- Exactly what happens and when – at switch-on, at the trigger, after some minutes of welding.
- What has been tried already, and what changed just before the fault appeared.

If the machine has to be returned, pack it in its original packing or in equivalent protective packing and enclose a note describing the fault and the conditions under which it occurs.

Warranty and Service

Warranty

Cruxweld Industrial Equipments Pvt. Ltd. provides a guarantee of **one year** on this welding equipment from the date of purchase, against defects in material and workmanship under normal use and service. The detailed terms are those stated on the invoice or in the supply contract.

The warranty does not cover:

- damage caused by installation or wiring that does not follow this manual, in particular a machine that is run without a proper earth;
- damage caused by a supply outside the stated limits, or by running the machine above its duty cycle;
- damage caused by water, cutting fume, corrosive substances, conductive dust or mechanical impact;
- equipment that has been opened or modified without authorisation;
- consumable and wear parts: contact tips, nozzles, diffusers, liners, feed rolls and torch cables.

Service

This product is not designed to be serviced in the field. Return it to the Cruxweld service centre for any repair work. Work through section 10.6 and section 11.4 before calling; most faults are settled there without a visit.

Spare parts and accessories

Item	Remark
Contact tips	0.8 / 1.0 / 1.2 / 1.6 mm bore
Gas nozzles and diffusers	To suit the torch supplied
Wire liners	Steel liner, 0.8 – 1.0 mm and 1.2 – 1.6 mm
Feed rolls	V-groove for solid wire, knurled for flux-cored wire
MIG torch	Euro connector, 3 m or 4 m
Earth return cable and clamp	50 mm ² or 70 mm ²
CO ₂ flow regulator with 36 V heater	For the AC 36 V socket on the rear panel
Electrode holder and cable	For the MMA function

When ordering spares, always quote the model and the serial number of the machine.

Machine record

Fill this in when the machine is commissioned and keep the manual with the machine.

Model	MIG300iW
Serial number	
Date of purchase	
Supplier	
Installed by	
Commissioning date	
Supply voltage measured	
Last service	



INDUSTRIAL EQUIPMENTS PVT. LTD.

MIG300iW

Inverter MIG / MAG welding machine with MMA function

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Cruxweld improves its products continuously. The technical and hardware data in this manual may change without notice.

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