



INDUSTRIAL EQUIPMENTS PVT. LTD.

FINELINE 160DN

CNC-Dedicated IGBT Inverter Air Plasma Cutting Machine

160 A | 45 mm clean cut / 55 mm severance | 100 % duty cycle | Manual and CNC operation



INSTRUCTION MANUAL

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

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This cutting equipment for industrial and professional use conforms to the IEC 60974 international safety standard for arc welding and cutting equipment.

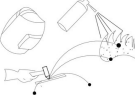
Cruxweld provides a warranty for this equipment from the date of purchase, as stated in Chapter 12.

Please read and understand this instruction manual carefully before installing and operating the equipment.

The contents of this manual may be revised without prior notice and without obligation.

1 Safety

If the equipment is not operated correctly, cutting can be dangerous to the operator, to people in or near the work area and to the surroundings. Cutting work must therefore be carried out with strict and full compliance with all relevant safety regulations. Please read and understand this manual carefully before installation and operation.

	Notice • Do not switch the operating mode while cutting – this may damage the equipment. • Before connecting or changing the torch, disconnect the power supply. • Install a residual-current (earth-leakage) circuit breaker in the supply. • Use cutting torches and accessories of good quality. • The operator must be qualified.
	Electric shock can kill • Earth the machine according to the regulations. • Never touch live parts of the cutting circuit, the torch or the workpiece with bare hands. Always wear dry, insulating gloves. • Keep yourself insulated from the workpiece. The open-circuit voltage of a plasma cutter is high (above 300 V).
	Fumes and gases are harmful to health • Do not breathe the fumes and gases produced by cutting. • Keep the work area well ventilated; use fume extraction or a water / downdraft table.
	Arc radiation harms eyes and skin • Wear a helmet or goggles with the correct filter shade (shade 9 – 12 for plasma cutting at this current), protective clothing and gloves. • Protect people in or near the work area with screens.
	Fire hazard • Cutting sparks and molten metal can cause fire. Remove flammable material from the work area. • Keep a fire extinguisher nearby and a person trained to use it.
	Noise can damage hearing • Plasma cutting is noisy. Wear approved hearing protection when the noise level is high.
	Machine fault • Refer to this manual (Chapter 10). • Contact Cruxweld service for further advice.

2 General description

The FINELINE 160DN delivers the highest cutting ability in its class: it cleanly cuts up to 45 mm and severs up to 55 mm, with a 100 % duty cycle at 160 A for uninterrupted production. It offers dedicated manual and CNC operating modes, air or water cooling of the torch, and digital setting of pre-flow, slopes, micro-arc current and post-flow.

The Cruxweld FINELINE 160DN is an air plasma cutting machine built with high-power IGBT (insulated gate bipolar transistor) inverter technology and pulse-width modulation (PWM). It cuts all conductive metals and is particularly suitable for high-alloy steel and non-ferrous metals that cannot be cut with an oxy-fuel flame. The machine has ideal static output characteristics, good dynamic response and high-frequency arc ignition. Its characteristics are:

1. Highly concentrated arc energy, good stability and strong cutting force.
2. Fast cutting – 3 to 5 times faster than gas cutting.
3. Low cutting cost: only electricity and compressed air.
4. Narrow, smooth, clean kerf, close to vertical.
5. Small deformation of the workpiece.
6. Continuously adjustable cutting current.
7. Easy, reliable non-contact arc striking.
8. Very convenient operation.
9. Compact size and easy to move.
10. High efficiency and power factor – energy-saving equipment.
11. Low noise and strong adaptability to site conditions.
12. 2T (non-latching) and 4T (latching) torch modes for short and long cuts, reducing operator fatigue.
13. Easy integration into automatic and CNC cutting systems.

3 Main components and principle of the main circuit

1 IGBT modules: semiconductor switches forming the full-bridge inverter that converts DC into medium-frequency AC (about 20 kHz).

2 Input rectifier bridge: rectifies the three-phase AC supply to DC.

3 Fan: removes the heat produced during operation (forced-air ventilation).

4 Control transformer: supplies the control circuits.

5 Control PCB: controls the output characteristics and all functions of the machine.

6 Housing, partition and base: the main transformer is fixed to the base; the housing encloses the machine and forms the cooling air duct.

The three-phase input is rectified and fed to the IGBT inverter, which produces medium-frequency AC. After isolation by the medium-frequency transformer and rectification and filtering, a DC output suitable for cutting is obtained. This greatly improves the dynamic response and reduces the size and weight of the transformer and reactor. The closed-loop control gives a steeply drooping (constant-current) output characteristic that resists mains fluctuations. The control sequence provides gas pre-flow, high-frequency arc ignition, cutting and delayed gas shut-off; protection circuits guard against over-current, under-voltage and over-temperature.

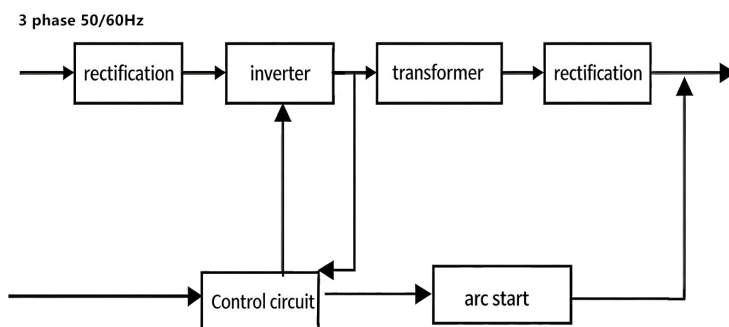


Fig. 3.1 Block diagram of the main circuit

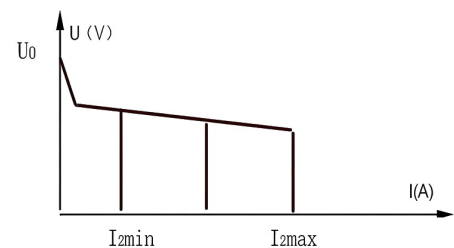


Fig. 3.2 Output characteristic

4 Technical specifications

Model	FINELINE 160DN
Supply voltage	3 phase, AC 380 V / 415 V ± 15 %
Frequency	50/60 Hz
Max. input	32 kVA
Rated input current	45 A
Open-circuit voltage	320 V
Rated open-circuit voltage	315 V
Rated output current	160 A
Rated output voltage	144 V
Cutting current range	20 – 160 A
Rated duty cycle	100 %
Arc ignition	High frequency (HF), non-contact pilot arc
Power factor (cos ϕ)	0.93
Degree of protection	IP21S
Insulation class	H
Recommended compressor capacity	6 – 8 CFM
Cutting capacity (clean cut)	45 mm
Cutting capacity (severance)	55 mm
Power source cooling	Forced air
Torch cooling	Air or water (selectable)
Dimensions (L x W x H)	734 x 375 x 598 mm
Weight (approx.)	58 kg

The rating plate on the machine is binding. Specifications may change without notice as a result of continuous improvement.

Mechanised and CNC cutting

The FINELINE 160DN can be upgraded to mechanised or fully automated cutting. With the straight-neck machine torch and a torch holder it can be mounted on the Cruxweld UNITRACK-45K cutting carriage or on a CNC gantry. Connect the CNC start/stop signal to the control interface and, where a torch height controller is used, the arc-voltage signal interface on the rear panel.



Mechanised cutting with a carriage



CNC cutting

5 Installation

▲ **Switch off the mains supply before carrying out any of the following work.**

5.1 Installation environment

- Place the machine on a surface inclined by no more than 15°, firmly and securely.
- Install it in a dry, ventilated place, protected from direct sunlight, rain and dust.
- Keep at least 50 cm free space at the front and rear and at least 20 cm at both sides; keep adjacent machines at least 20 cm apart.
- Do not let metal objects fall into the machine.
- Operating ambient temperature –10 °C to +40 °C.
- Have the machine installed by a qualified electrician. Do not touch hot power parts.

▲ **Warning**

Keep the machine away from flammable and explosive materials. Do not place the machine on other machines, and do not stack one machine on top of another.

5.2 Input wiring

- Make sure the voltage, phase, frequency and capacity of the supply match the rating plate.
- The input cable and the air inlet are on the rear panel (see Chapter 7). Connect the three phases of the input cable to the supply in any order through a suitably rated fused switch or circuit breaker.
- The housing **must be earthed**: connect the earth bolt (marked with the earth symbol) at the lower rear of the machine, or the earth conductor of the input cable, reliably to earth.

5.3 Output connection

- The rated output current is available within the rated duty cycle.
- The work (earth) cable socket, the torch connections and the torch-switch plug are on the lower part of the front panel (see Chapter 7).

5.4 External connection

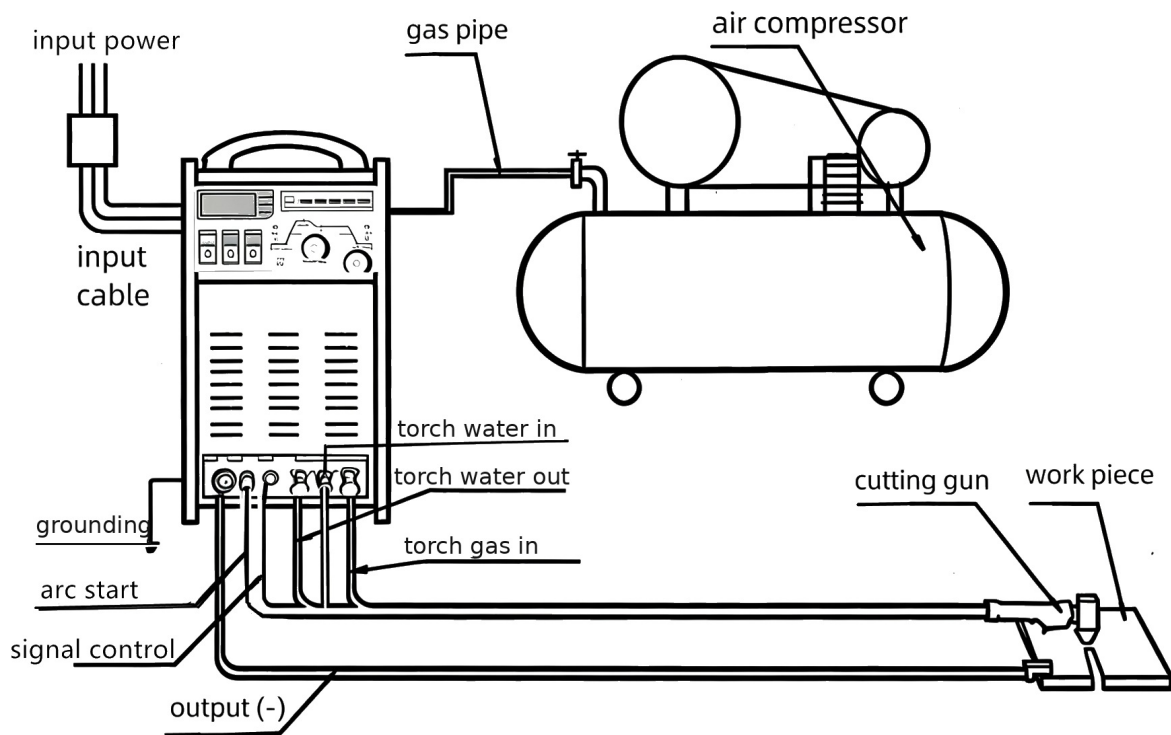


Fig. 5.1 External connection of the FINELINE 160DN

1. Connect the work cable to the output socket and clamp the work clamp firmly to clean metal of the workpiece.
2. Connect the torch: gas / current connector, pilot-arc (arc start) lead, torch-switch (signal control) plug and, for a water-cooled torch, the torch water-in and water-out hoses.
3. Connect the compressed-air supply to the inlet of the air filter-regulator on the rear panel.
4. Connect the earth bolt to earth and the input cable to the mains supply.

Compressed air: use an air compressor with a maximum working pressure of 0.8 MPa and a delivery of at least 250 L/min (6 – 8 CFM (170 – 230 L/min), 0.6 – 0.8 MPa). The air must be clean, dry and oil-free. Switch on the compressor and bring the air to the required pressure before cutting.

6 Operation

6.1 Duty cycle

Check the model and duty cycle of the machine and do not overload it. The duty cycle is the percentage of a 10-minute period during which the machine can cut at the stated current without overheating.

6.2 Conditions of use

Ambient temperature	–10 °C to +40 °C during cutting; –25 °C to +55 °C in transport and storage
Relative humidity	≤ 50 % at 40 °C; ≤ 90 % at 20 °C
Air quality	Dust, acid and corrosive gases not above normal levels
Wind speed at the arc	≤ 1 m/s
Floor inclination	≤ 10°
Clearance	> 20 cm to walls; > 10 cm between machines
Water-cooled torch	Use anti-freeze coolant in freezing conditions
Supply	Standard sine wave, 50/60 Hz, 3 phase

6.3 Using the machine

1. After checking that the installation is correct, switch on the power. The power indicator lights and the fan runs.
2. Set the gas-check button on the front panel to **gas check**. The air valve opens: pre-purge for about 1 minute to remove condensed water from the torch, and adjust the air filter-regulator until the pressure gauge reads about **0.45 MPa**. Then set the button back to **cut**.
3. Set the cutting current with the current knob to suit the material thickness (see Chapter 8).
4. The machine uses a **non-contact** torch: hold the nozzle 3 – 5 mm above the workpiece to strike the arc, and do not let the nozzle touch the work while cutting.
5. Start the cut preferably at the edge of the workpiece. To pierce inside the plate, tilt the torch slightly to one side at first so that the molten metal is blown away and an initial hole is formed, then bring the torch upright.
6. Move the torch at a constant speed during cutting.
7. At the end of the cut, keep the torch over the workpiece until the plasma arc has gone out, then lift it away; otherwise the workpiece may be damaged. The gas continues to flow for the post-flow time to cool the torch.

6.4 Important notes

1. If the kerf becomes abnormal, the arc breaks or the arc is difficult to strike, check the consumables (nozzle and electrode) and replace worn parts in time.
2. When assembling the electrode, swirl ring, nozzle and shield cap, make sure they are coaxial and that the shield cap presses the nozzle firmly.
3. Do not move the torch too fast, or the cut will not go through and the arc may blow back and burn the nozzle. Do not move too slowly either, as this spoils the cut quality.
4. Keep the compressor pressure within 0.6 – 0.8 MPa during cutting and drain the water from the air filter regularly.
5. The machine has **under-voltage protection**: when the mains voltage is too low, it does not cut.
6. The machine has **over-temperature protection**: when the internal temperature is too high, it stops cutting and the over-temperature indicator on the front panel lights. Leave it switched on so the fan cools it down.

6.5 Torch modes (2T / 4T)

Mode	Operation	Use
2T	Press and hold the torch switch to cut; release it to stop.	Short cuts
4T	Press the switch to strike the arc, then release it and cutting continues. Press the switch again to stop.	Long cuts, reduced operator fatigue

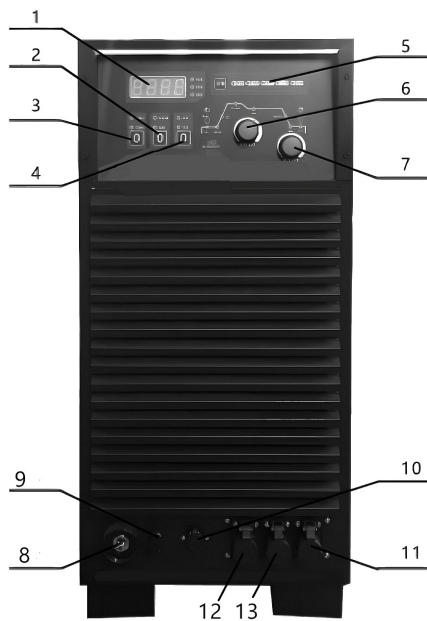
6.6 Parameter settings

With the parameter knob and the Set key the following functions can be adjusted and are shown on the digital display (current, time or frequency):

Gas pre-flow	Gas flows before the arc starts, clearing the torch and protecting the consumables.
Up-slope	Smooth rise of the current for clean piercing.
Micro-arc (pilot) current	Pilot-arc current; reduce it for thin sheet to avoid melting and distortion.
Cutting current	Main cutting current (current knob).
Down-slope	Smooth fall of the current at the end of the cut.
Gas post-flow	Gas continues after the arc stops to cool the torch and consumables.
Air / water cooling	Select the cooling mode of the torch fitted.
Manual / CNC mode	Select hand-held cutting or control by a CNC machine through the control interface.

7 Machine structure

7.1 Front panel



1	Display meter – shows current, time or frequency.
2	2T / 4T switch – torch trigger mode (see 6.5).
3	Gas check – valve A / valve B.
4	Water / air cooling switch.
5	Indicator lights: power; work; air pressure (air is flowing); over-temperature (machine stops when lit); water pressure.
6	Parameter adjustment knob.
7	Current adjustment knob – sets the cutting current.
8	Output (work) cable socket – connect the work cable to the workpiece.
9	Arc start – pilot-arc lead of the torch.
10	Signal control – torch-switch plug.
11	Gas in – gas / current connection of the torch.
12	Water out – water-out line of the torch.
13	Water in – water-in line of the torch.

Fig. 7.1 Front view

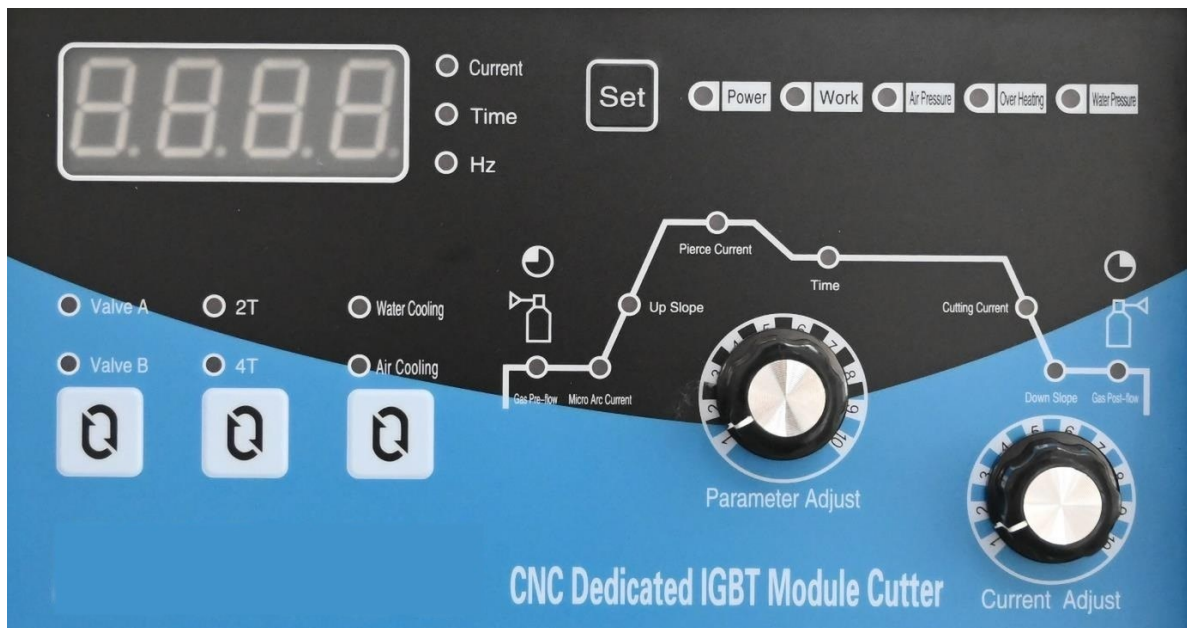


Fig. 7.2 Control panel of the FINELINE 160DN

7.2 Rear panel

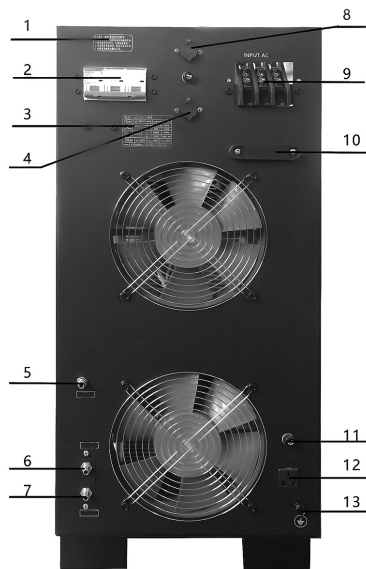


Fig. 7.3 Back view

1	Electric-shock warning label.
2	Automatic circuit breaker – cuts off the power automatically in case of overload or fault. Normally keep it in the ON position; use the switch on the distribution board to start and stop the machine, not this breaker.
3	Rating plate – basic parameters of the machine.
4	Control interface – CNC start/stop and signals.
5	Gas inlet – connect the air hose through the pressure-reducing valve / filter, which reduces the pressure and removes moisture.
6	Water inlet.
7	Water outlet.
8	Arc-voltage signal interface – for a torch height controller.
9	Power input terminal box – the three terminals are connected to the three phases in any order.
10	Input cable clamp.
11	Water tank fuse.
12	Water tank power supply.
13	Earth bolt – for personal safety and correct operation, connect this bolt reliably to earth with a wire, or earth the earth conductor of the input cable reliably.



Fig. 7.4 Rear of the FINELINE 160DN

8 Cutting guide and consumables

8.1 Reference cutting parameters (mild steel, air plasma)

Plate thickness (mm)	Cutting current (A)	Cutting speed (mm/min)
3	40 - 60	2500 - 3500
6	60 - 80	1500 - 2200
10	100 - 120	900 - 1300
16	130 - 160	600 - 900
20	160	450 - 650
25	160	300 - 450
32	160	200 - 300
45	160	100 - 150
55 (severance)	160	50 - 80

Starting values for hand-held or machine cutting of mild steel with a stand-off of 3 - 5 mm. For stainless steel reduce the speed by about 20 %, for aluminium increase the current. Adjust according to the actual cut: a trailing arc and dross on the bottom edge mean the speed is too high; a wide kerf and heavy dross mean the speed is too low.

8.2 Torch consumables

The electrode, swirl ring, nozzle and shield cap are wear parts. Replace them when:

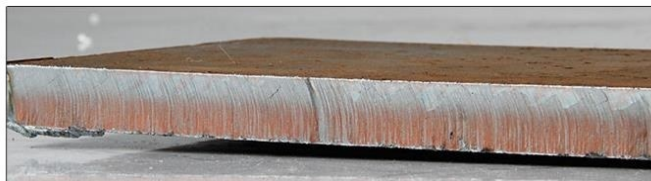
- the hafnium insert of the electrode is worn more than about 1.5 mm deep;
- the nozzle orifice is enlarged, oval or damaged;
- the cutting speed drops, the kerf becomes wide or bevelled, or the arc is difficult to start.

Always replace the electrode and nozzle together, assemble them coaxially and tighten the shield cap so it presses the nozzle firmly. Use genuine Cruxweld consumables.



Plasma cutting torch

8.3 Typical cut parts



9 Maintenance

Regular maintenance ensures safe and efficient operation of the machine. Before inspecting the internal circuit or external connectors, switch off the supply at the distribution board. When the internal circuit needs to be inspected, wait five minutes after switching off so that the voltage inside the machine falls to a safe level.

9.1 Daily inspection

1. Check that the switches and knobs move freely and work correctly.
2. Check that the cooling fan runs normally.
3. Check for abnormal vibration, humming, unusual smell or air leaks.
4. Check that the electrical connectors are tight and not overheating.
5. Check the cable sheaths and insulation for damage.

9.2 Monthly inspection (every 1 - 2 months)

1. Clean the machine: blow out dust and dirt with dry compressed air, especially from the transformer, the power modules and the heat sinks.
2. Check the input and output terminals for looseness and corrosion; remove rust, tighten loose screws and keep good metal contact.
3. Check that the earth connection is good.

9.3 Annual inspection

1. Measure the insulation resistance between the circuits and the housing. If it is less than 1 MΩ, the insulation is damaged and must be repaired or replaced.
2. Replace any damaged parts.

▲ Notes

1. The internal circuit carries high voltage: always switch off at the distribution board before servicing.
2. The machine is accurately adjusted in the factory; do not modify it.
3. Handle connections gently and do not change the position of internal connections.
4. Switch off the power before connecting cables or changing torch parts.

10 Troubleshooting

Faults of the cutting machine directly affect the cutting quality. Because many factors affect the cut, judge and test according to the actual situation. The table below is for reference. Repairs inside the machine must be carried out by qualified service personnel; if you do not have them, contact Cruxweld service.

No.	Fault	Possible cause	Remedy
1	Power indicator off with the power switch on	1. No supply 2. One phase of the supply missing 3. Power indicator faulty 4. Power switch / breaker faulty 5. Fault on the control board	1-2. Check and repair the supply and switch 3. Replace 4. Replace 5. Check, repair or replace
2	Over-temperature indicator on	1. Temperature inside the machine too high 2. Thermal switch faulty 3. Wiring fault of the thermal switch	1. Leave switched on until fully cooled 2. Replace the faulty part 3. Repair the wiring
3	Power indicator on, but no gas flows	1. Fault in the air supply 2. Pressure regulator faulty 3. Solenoid valve faulty 4. Fault on the control board	1. Turn the regulator clockwise to 0.4 MPa; check the supply 2. Repair or replace 3. Replace or repair 4. Check and repair
4	No transferred arc when cutting	1. Electrode and nozzle touching 2. Fault on the control board 3. HF spark gap too small or too large 4. Fault on the arc-starting board 5. Fast-recovery diode faulty 6. Fault on the drive board 7. IGBT module faulty	1. Adjust or replace electrode and nozzle 2. Repair or replace 3. Adjust the gap 4-6. Repair or replace 7. Replace
5	Torch switch does not work	1. Torch faulty 2. Torch-switch wire broken	1. Replace 2. Replace the wire
6	Kerf widened or deflected	1. Electrode or nozzle worn 2. Wrong cutting speed 3. Torch head deformed, parts not aligned	1. Replace 2. Too fast deflects the kerf, too slow widens it - adjust 3. Replace the torch
7	Cuts only for a few seconds, then stops	1. Air flow too small, pressure drops 2. Poor contact of the work cable	1. Provide the required air flow 2. Reconnect the work clamp to clean metal
8	Torch parts burn out quickly	1. Too much moisture in the compressed air, reducing insulation 2. Shield cup not tightened when fitting the electrode	1. Drain / dry the air; fit a filter-dryer 2. Tighten the shield cup when assembling

11 Wiring diagram

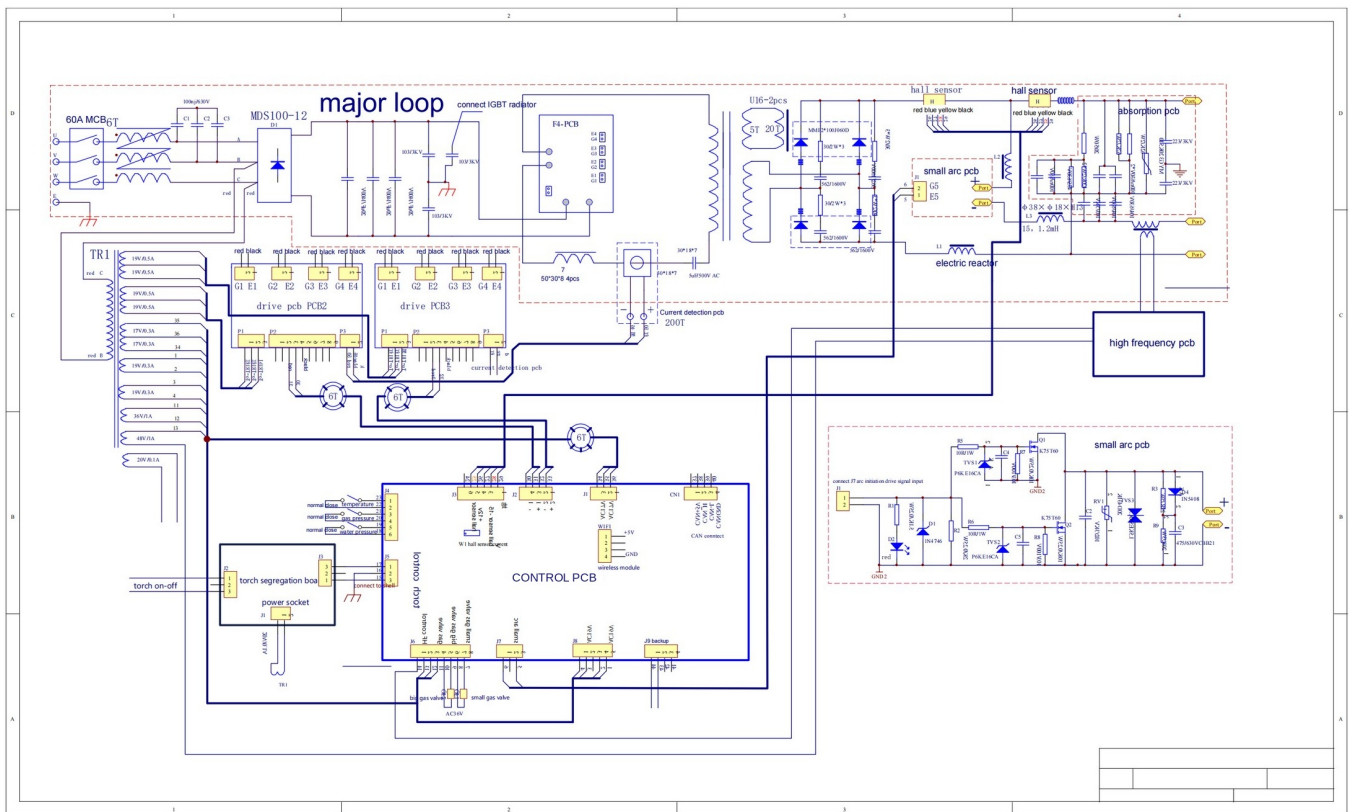


Fig. 11.1 Wiring diagram (for service personnel)

▲ DANGER

The machine contains high voltage. Only qualified service personnel may open the housing, after switching off the supply and waiting at least 5 minutes.

12 Warranty

Cruxweld warrants the FINELINE 160DN against defects in material and workmanship for the period stated in the sales contract, from the date of invoice. The warranty does not cover consumables (electrodes, nozzles, swirl rings, shield caps, torch and cables) or damage caused by incorrect supply voltage, missing earth, wet or oily compressed air, overload, lack of maintenance, misuse or repair by unauthorised persons.

Model	FINELINE 160DN
Serial number	
Invoice no. / date	
Customer	
Dealer stamp	

For service, spare parts and consumables please contact:

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