

# OPERATION & MAINTANANCE MANUAL

## MODEL – AIRCUT- 65 I

### **Inverter Based Air Plasma Cutting machine**



**WARPP ENGINEERS PVT.LTD.**

S.NO. 36/15,Unique Industrial Complex Dhumal Nagar,Vasai (E)

Distt. Palghar 401208 Maharashtra (India) Contact No. 8551817744 / 9944

Website : [www.warpp.co.in](http://www.warpp.co.in)

## PREFACE

Thanks for purchasing our product & looking forward to your precious advice for improvement of our product. We will dedicate to produce the best products and offer the best services.

The machine has been carefully inspected both mechanically and electrically before it left the factory. The machine should be initially inspected upon receipt, if any damage which may have occurred in transit inform “WARPP ENGINEERS PVT.LTD. OR It’s Dealer immediately. Check for the accessories supplied against those listed in packing slip.

**Caution:** Before attempting to connect the equipment to any Power source, read instructions carefully. In case any defect or deficiency, contact “WARPP ENGINEERS PVT.LTD.” or it’s authorized Agent. Make sure to quote model number and serial number of the equipment in all correspondence.

THE DESIGN OF THIS EQUIPMENT IS SUBJECT TO CONTINUOS DEVELOPMENT AND IMPROVEMENTS, CONSEQUENTLY “WARPP ENGINEERS PVT.LTD.” RESERVES THE RIGHT TO INCORPORATE MINOR CHANGES FROM THE INFORMATION CONTAINED IN THIS MANUAL.

\*\*\*\*\*

## **INDEX**

1. Safety Precautions
2. Product Description & Features
3. Working Condition & Environment Required
4. Technical Specification
5. Working Principle
6. Installation
7. Controls
8. Parameters & its operational meaning
9. How to operate the machine
10. Do's & Don'ts
11. Trouble Shooting
12. Wiring Diagram
13. Maintenance
14. Spare Part List

\*\*\*\*\*

## 1. Safety Precaution



### General safety precaution :

- Please strictly comply with rules defined in this manual to avoid unexpected accidents
- How to connect to power supply, select working area and use pressure gas, please comply with proper rules
- Not allow non-operator to enter working area
- Machine's installation, inspection, maintenance, and manipulation must be completed by authorized person.
- Don't use welding machine for unrelated purposes (Such as recharging, heating or plate cutting, etc.)
- Must take safe precaution in case machine falling when it is put on the uneven ground



### Avoid being electric shocked and burnt :

- Never touch on the hot electrical units.
- Please instruct the authorized electrician to ground the machine frame by using Proper-sized copper wire.
- Please instruct the authorized electrician to connect the welder to power supply by using proper- sized, well-insulated copper wire.
- When operating in the damp, space limited area, must ensure well-insulated between body and work piece
- When operating in the high-rising location, must ensure safety by using safe net.
- Please power off the input voltage while no longer using.



### Avoid breathing in hazardous welding fume or gas :

- Please use specified ventilation to prevent being gas poisoned and asphyxiated
- Especially in the container where oxygen is depleted easily



### Avoid being harmed by arc flash, hot spatter and slag :

- Arc rays can injure your eyes and make your eyes feel uncomfortable.
- Hot spatter and slag can burn your skin. Please wear proper welding helmet, leather gloves, long- sleeved suit, cap, apron and boot before welding.



**Preventing from fire, explosion, container break accidents :**

- Don't put flammable material in the working area. Hot spatter and hot weld can easily start a fire.
- Cable must be connected the work piece firmly to ensure good conductivity in case causing fire by resistance heat.
- Don't weld in the flammable gas or weld container which contains flammable material, otherwise it can cause explode.
- Don't weld encapsulated container, otherwise it can cause break.
- Ensuring a fire extinguisher at hand in case fire break out.



**Avoid being hurt by moving parts :**

- Never let the finger, hair, and cloth near the rotary cooling fan and wire feeder rollers.
- When feeding wire, don't let the bottom of torch near your eyes, face and body, to prevent being harmed by wire.



**Avoid gas bottle falling or gas regulator breaking :**

- Gas bottle must be firmly fixed on the ground, else if injure will exerts on.
- Never place bottle under high temperature or straight sun light.
- Never let your face near gas outlet while turning on the gas valve to prevent from being hurt by pressure gas.
- Customer should use the gas regulator provided by our company, and comply with the proper instruction.



**Avoid being hurt by welding machine while in transport :**

- When moving the welding machine by fork-lift truck or crane, nobody can be allowed for standing downright the route of the moving welder, in case being hurt by the falling welding machine.
- The ropes or wires which used for hanging up the welding machine must be strong enough to withstand corresponding tension strength. The rope or wire inclination hanging on the tackle must be no more than 30°

\*\*\*\*\*

## 2. Product Description & Features

AIRCUT series air plasma cutter is newly designed equipment for metal processing. It is designed and produced with IGBT WITH PWM full-bridge soft-switch technology which is advanced at the end of 20<sup>th</sup> century. The series of cutters are able to cut all the metal materials and are especially suitable for high alloy steels and non-ferrous metals, which cannot be cut with flame cutting. The series of cutters have the perfect external static characteristics and well dynamic characteristics, and performs a function of high-frequency arc starting. The features are as follows:

- 👉 Highly centralized arc energy, good stability, strong cutting force.
- 👉 High speed in cutting on lower thickness
- 👉 Low cutting cost for lower thickness
- 👉 Less distortion of piece.
- 👉 Continuously adjustable cutting current.
- 👉 Effortless arc starting.
- 👉 Easy operation.

Light in weight, small volume, easy to be moved.

Besides, the economic efficiency has also been considered sufficiently when it is first designed. The electricity utility rate reaches 90% and the power factor is 0.89. Finally, the series of advanced designs have passed the strictest testing and met the following standards:

### 3. Working Condition and Environment Required

- 1) Please note that this equipment to be installed in a clean place free from dust & dirt, moisture
- 2) Avoid direct exposure to sunlight
- 3) Care should be taken to see that it is not exposed to rain
- 4) Whenever the machine to be used at a site make sure proper shade is provided for the machine
- 5) Do not keep the machine near oven, furnace where temperature may be higher and it can affect the performance of the machine
- 6) Always keep the machines at lease with a gap of 300 mm around the machine as it is required for free circulation of air
- 7) Keep the machine in a flat position and if it is placed in an inclined position then the degree of inclination shall not be more than 15 degree
- 8) This machine can operate in the temperature range of 0 ~ 50 degree centigrade. When used over 40 degree centigrade the duty cycle of the machine may be lower than what is mentioned in the catalogue
- 9) Always connect the machine to the electric supply through a preferably D type MCB of suitable capacity
- 10) Use cables with proper cross section based on the input power requirement of the machine (Please refer to technical specification page for input power of the machine)
- 11) When long cables are used you need to select higher cross sectional area of conductors to avoid voltage drop during the usage.

#### **Selection guide for type of MCB**

MCB Type	Tripping Current	Application
B Type	3 to 5 times the rated current	Purely resistive load like lighting and general purpose outlets
C Type	5 to 10 times the rated current	Moderate inductive load like air conditioners, residential / commercial pumps
D Type	10 to 20 times the rated current	Heavy inductive loads like heavy induction motor and welding machines

## Selection of cable size for input supply

Please note that the cable size required for input supply depends on following

- 1) Whether the machine is single phase or three phase
- 2) Input KVA of the machine
- 3) Distance from electrical supply point

First calculate the current the machine will draw based on the input KVA given (refer to technical specification page for this)

If the machine is a single phase machine then each KVA would require around 4.6 Amps of current. That if input KVA of the machine is 5 KVA, then it would draw 23 Amps at full load

If the machine is a three phase machine then each KVA would require around 1.4 Amps of current. That if the input KVA of the machine is 5 KVA, then it would draw around 7 amps of current at full load

Cable capacity for copper cable can be taken as 5 Amps / Sq mm when cable length is less than 10 meters. That means 1 sq mm cable can carry a current of 6 Amps of current

Now you have input current of the machine based on its input KVA.

You can calculate the conductor size by this formula

Input current / capacity of conductor

Example

From the above for a single phase machine of 5 KVA you would need  $23/6=3.8$  Sq mm cable. ( You can choose 4 sq mm cable)

From the above for a three phase machine of 5 KVA you would need  $7/6=1.16$  Sq mm cable. ( You can choose 1.5 sq mm core cable for each phase)

Note :

When the length of the cable is short the required cross section for input cable will come down

Below table will help you in selecting the right size of welding cable based on the length and current to be used

Welding Cable selection chart					
Welding Current in Amps	Recommended Cable size ( Sq mm) based on length ( inMtrs)				
	1 ~ 15 Mtrs	15 ~ 30 Mtrs	30 ~ 45 Mtrs	45 ~ 60 Mtrs	60 ~ 75 Mtrs
100	16	25	25	35	50
150	16	25	35	50	50
200	35	35	50	50	70
300	50	50	70	70	95
400	70	70	70	95	120
600	95	95	95		

Table given is just for reference and the actual result may vary depending on the quality of conductor  
Multiple cables can be used where ever single cable of that capacity is not available

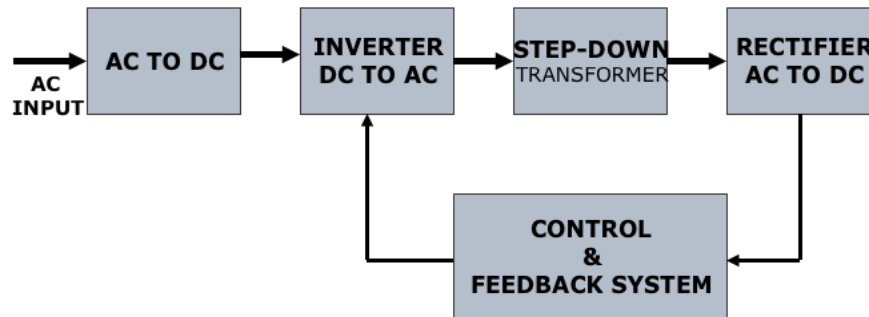


#### 4. Technical Specification

<b>MODEL</b>	<b>AIRCUT 65 I</b>
Input Supply	415 V $\pm$ 10% ,3Phase 50HZ
Input Power at Full Duty Cycle	9.5 KVA
Input Current at Full Duty Cycle	13A
Open Circuit Voltage (OCV)	300 - 350VDC
Cutting Current at full Duty Cycle	65A
Pilot Arc Current	< 10A
Cutting Current Range	25 – 65A
Efficiency	89%
Cooling Of Machine	Forced Air
Insulation	Class 'H'
Protection	IP 23
Weight	26 KG (Approx)
Dimension LXWXH (mm)	<b>550 X 290 X 550</b>
Plasma Generating Media	Compressed air
Compressed Air Pressure	5 bar
Max. Cutting Thickness	12 mm
Optimum Cutting Thickness	18 mm
Torch Cooling	Compressed Air

## 5. WORKING PRINCIPLE

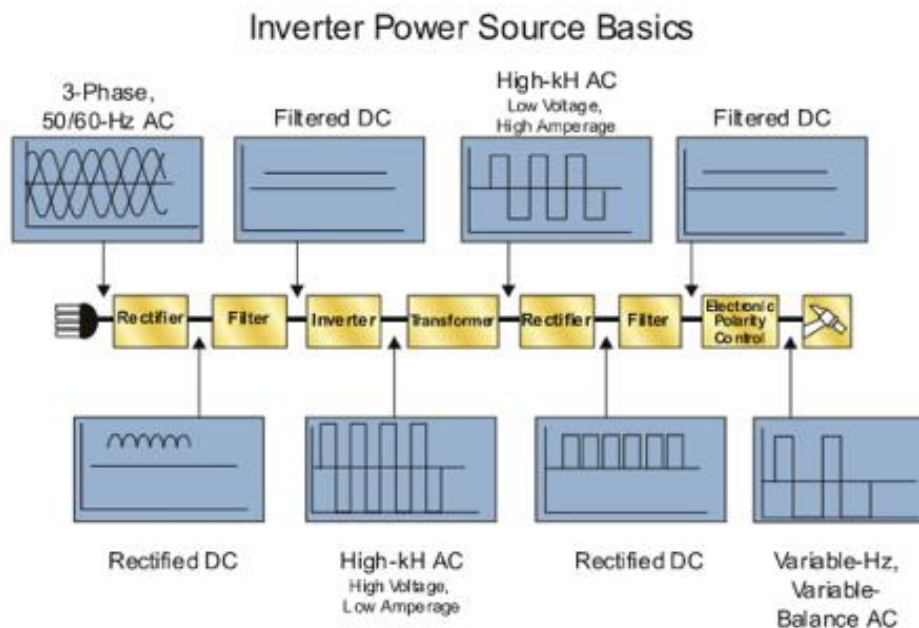
### Block Diagram



These power sources are used for various types of welding and they are based on IGBT inverter Technology. In these types of machines input supply is first converted into DC by a rectifier circuit. The rectified voltage is then filtered and fed to an inverter section. This section will convert the DC to high frequency AC. In this case it is 20 K Hz AC. This AC voltage is fed to a specially designed high frequency transformer which steps down the voltage to acceptable welding voltage and increases the current to required level. The output of the transformer is fed to a high frequency rectifier circuit which converts this AC to DC for various welding applications.

In the case of machines having capability to deliver both AC & DC outputs for welding, this DC is fed to one more inverter circuit OR electronic polarity control circuit which converts this into low frequency AC output for Aluminum TIG application. In this case controls are provided for adjusting the AC frequency, AC balance along with other regular controls.

Block diagram with waveforms at different stages is given below for reference :



Different types of power sources are available for welding and most commonly used are as under

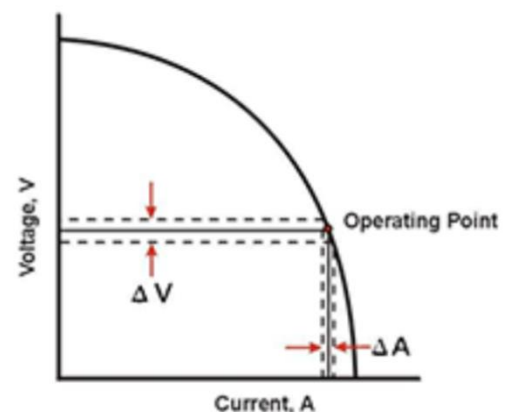
- Constant current (CC) power source
- Constant Voltage (CV) power source
- CC/CV power source

Please refer to the below chart for process-wise recommended power source types

Process	Power source type
SMAW	CC
GTAW	CC
GMAW /FCAW	CV
SAW	CV is commonly used and sometimes CC is used
Plasma Cutting	CC

## Constant Current (CC) type power source

Constant current characteristics are also called as drooping characteristics. Typical V/I curve of such Power source is shown below. Here the current remains stable even if the arc length varies. When There is change in arc length, change in the voltage is more when compared to change in current and hence they are called constant current type power source



Relationship between the voltage and current for different process in CC type power source is as under

SMAW:

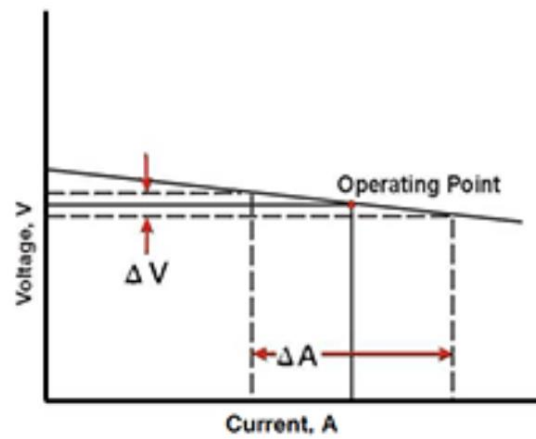
$$V = I * 0.4 + 20$$

GTAW:

$$V = I * 0.4 + 10$$

## Constant Voltage (CV) type power source

Constant voltage characteristics are also called as Flat characteristics. Typical V/I curve of such power source is shown below. Here the voltage remains stable even if the arc length varies. When there is change in arc length, change in the current is more when compared to change in voltage and hence they are called constant voltage type power source



Constant Voltage (CV) Power Source

Relationship between the voltage and current for different process in CV type power source is as under

GMAW:  $V = I * 0.5 + 14$   
 FCAW:  $V = I * 0.5 + 17$

**Note:** Some power sources have both CC and CV characteristics. The explanation given above is general and the capability of the machines depends on the model number of the machine purchased by you.

## 6. Installation

### **Installation :**

1. Place the Cutting machine in the room/shop where there is no straight sunlight, no rain, less dust, low humidity, and temperature range of 0° - 50°C.
2. The gradient of ground must not be more than 15°
3. Ensure no wind in the cutting area
4. The distance between cutter and wall must be more than 300 mm.
5. Connect the 3 phase Input supply to the machine. Supply voltage must be in the range of 400 V  $\pm$  10% as mentioned in the Technical specification of this manual.

### **6. Power supply :**

- The size of fuse and breaker in the table are for reference :

Product type		AIRCUT 65 I	
Power supply		3 phase 400 VAC	
Min. power capacity		9.5KVA	
Input protection	Fuse	25A	
	breaker	32 A	
Min. Cable size	Input side	2.5mm <sup>2</sup>	
	Output side	25mm <sup>2</sup>	
	Earth lead	2.5mm <sup>2</sup>	

### **7. TORCH CONNECTION :**

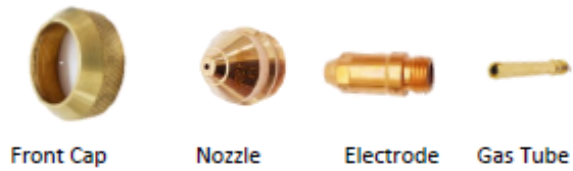
- Connect the air hose connector to the -Ve terminal of the machine
- Connect the yellow wire of the torch to the nozzle point of the machine
- Connect 2 pin connector of the torch to the respective connector marked torch switch
- Connect earthing cable to the +Ve

### **8. AIR CONNECTION :**

- Compressed air supply is to be connected at the air filter provided at the rear panel of the machine.

9. **CONSUMABLE INSTALLATION :**

- While installing electrode, nozzle and the front cap, pay attention to coaxial installation and the front cap must be pressed tightly against the nozzle.



**Consumables installation**



**Torch**

## 7. Controls

### Front panel of AIRCUT- 65 I

- 1) **A (Display)** : This is Ammeter which reads output current during cutting
  - 2) **POWER ON** : It will glow when MCB of the machine turned on. It shows the availability of the input supply.
  - 3) **OVER LOAD** : It will glow when machine is getting heated up for long run of the machine. When light is on, it stops working automatically. It will go off after some time after sufficient cooling of the machine.
  - 4) **AIR PRESSURE**: Air pressure indicator – It will glow When the air pressure of the compressed air is sufficient at input side of the air filter provided on the back panel of the machine. Spark will not come when it will not glow.
  - 5) **CURRENT CONTROL** : Knob regulating current - Used to adjust the cutting current.
- + **Ve TERMINAL** : This is positive supply of the machine. Lugged end of the Earthing cable is to be connected at this terminal & the clamp to the job to be cut.
  - **Nozzle** : This is pilot arc point of the machine. Yellow wire of the machine is to be connected here.
  - **2PIN CONNECTOR** : This is provided for the cutting switch.
  - -**Ve TERMINAL** : This negative supply of the machine. Torch air connector is to be connected here.

### Back panel of Aircut-65 I

- **MCB** - This is miniature circuit breaker to switch on & switch off the machine. This is also used to cut off the electricity automatically to protect the machine when it is overloaded or goes anything wrong.
- **Power input cable** – This is provided to supply the electricity to the machine. There are 4 colored core wire. R,Y,B colored cable is for 3 phase supply & 4<sup>th</sup> wire yellow & green is for earthing of the machine.
- **Air filter** - It is connected with the air compressor via air pipe. It is used to regulate air pressure and filter the moisture available in compressed air. Water in the water-logging cup should be drained every day.
- **Machine earth** - In order to make sure of the personal safety and the normal operation of the machine please connect this stud to the industrial earth with lead properly, or connect the earth line in the input cable to the earth properly.



## 8. Parameters & It's Operational Meaning

By air plasma cutting machines all types of metals can be cut i.e. ferrous & non ferrous. Fast cutting process can be achieved as compared to oxy fuel process.

- a) **CUTTING CURRENT**: Cutting current can be adjusted with cutting current pot as per below chart

Table 1 Cutting parameters

Nozzle Size (mm )	1.5			
Cutting current (A)	40~65			

Note: Current range mentioned here is general range and it may vary for different types of plates

## 9. How To Operate The Machine

1. Switch on the main switch for input supply provided for the machine
2. Switch on the MCB of the machine provided on the rear side of the machine
3. Start the compressor & wait for the store of the air in the tank. Release the air to the machine
3. Set the output current as per requirement.
4. Press the torch switch & check the pilot arc in the torch
5. Adjust the plate & start cutting. While cutting, keep the nozzle of the cutting torch 3 to 5 mm Above the job. The nozzle cannot touch the work piece while cutting.
6. When cutting is over, wait for the air goes off automatically after 2.45 minutes.
7. Switch off the MCB of the machine & close the compressor valve for the machine.

### Note:

- Do not move the cutting torch too fast while cutting, in case that the work piece that is not cut thoroughly may cause the backflow of arc flames and damage nozzle. Avoid cutting too slow, which may affect the quality of the cut. Optimum speed has to be achieved.
- While cutting, the pressure of the air compressor shall be over 5Kg/Cm<sup>2</sup>. The water in the air receiving tank of compressor must be drained on daily basis.
- There is pressure protection in this machine. When the pressure of the air compressor is lower than 4Kg/Cm<sup>2</sup>, the machine stops working and the air pressure indicator light in the front panel turns on.
  - There is overheating protection in this machine. When the machine is overheated, the machine stops working and the protection indicator light (Overload indicator) in the front panel turns on

After using the machine for a longer amount of time, do not turn off the machine immediately. Keep the machine in ON state for some time so that the fan will cool the machine. You must keep the machine ON for at least 15 minutes after the cutting is finished so as to allow the machine to cool down.

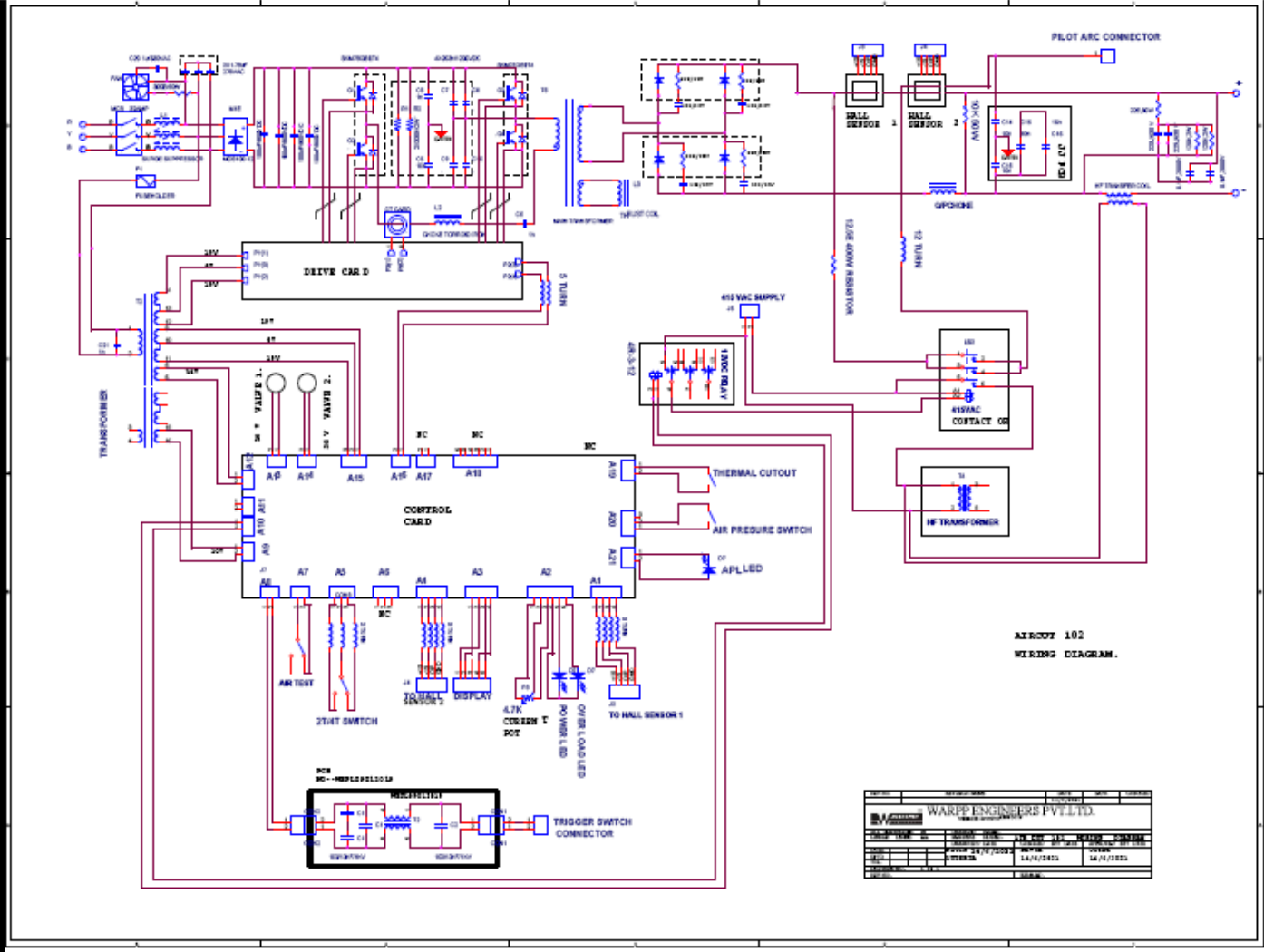
## 10. Do's & Don'ts

<b>Do's</b>	<b>Don'ts</b>
Clean the machine with compressed air @ < 3 Kg/Cm <sup>2</sup> on weekly basis	Don't keep any foreign material or plate on the top cover of the machine
Use proper polarity & current	Never use the higher current than recommended
Use proper welding cable size for earthing	Never use long cable if not required
Use proper welding angle	Never use long arc
Make firm connection of welding cable	Never use the joint of cable unless proper technique is used to join the cable
Keep the machine in proper shade to protect it from rain & direct sun light	Don't keep the machine in open ground or site

## 11. Trouble Shooting

S.No.	Phenomenon	Cause	Measures
1	The working indicator light does not light and the machine does not work after starting the machine	<ol style="list-style-type: none"> <li>1. Default phase of the machine</li> <li>2. Wire break</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the power supply</li> <li>2. Check whether the blower, power transformer, and main control panel are in good condition</li> <li>3. Check the wire</li> </ol>
2	The protection indicator light turns ON	<ol style="list-style-type: none"> <li>1. The inside of the machine is overheated</li> <li>2. The temperature relay breaks down</li> </ol>	<ol style="list-style-type: none"> <li>1. Use it after the machine has been cooled</li> <li>2. Change it</li> </ol>
3	The air pressure indicator light turns ON	<ol style="list-style-type: none"> <li>1. Low pressure</li> <li>2. The air passage is blocked</li> <li>3. The pressure switch break down</li> </ol>	<ol style="list-style-type: none"> <li>1. Regulate the air pressure</li> <li>2. Check the air passage</li> <li>3. Change it</li> </ol>
4	The controlling switch of the cutting torch fails	<ol style="list-style-type: none"> <li>1. The switch break down</li> <li>2. Wire break</li> <li>3. The control board breaks down</li> </ol>	<ol style="list-style-type: none"> <li>1. Change it</li> <li>2. Connect the line</li> <li>3. Change it</li> </ol>
5	The cut is too wide	<ol style="list-style-type: none"> <li>1. Too slow in cutting</li> <li>2. The nozzle is burnt</li> </ol>	<ol style="list-style-type: none"> <li>1. Raise the speed</li> <li>2. Change it</li> </ol>
6	The cut is slant	<ol style="list-style-type: none"> <li>1. The nozzle is burnt</li> <li>2. The nozzle and the electrode do not correctly matched</li> <li>3. The cutting torch is not vertical</li> </ol>	<ol style="list-style-type: none"> <li>1. Change it</li> <li>2. Adjust</li> <li>3. Adjust it to be vertical</li> </ol>

# 12. Wiring Diagram



### 13. Maintenance

- Regular maintenance is required of the machine
- The professional maintenance persons will remove the dust with the blower once every month.
- At the same time, check electrical connection for loose connection. If any correct it.
- Regularly check whether the plasma cable is damaged. Exposed electrical conductors will create safety hazard.
- Whether the power input cable is connected correctly.
- Whether the earth line is proper.
- It is recommended to provide dry air supply for plasma cutting as moisture content in compressed air can damage consumables and torch.
- Ensure that the air pressure is adequate before starting cutting. It should be 4 to 4.5 kg. it can be checked by using AIR CHECK switch on panel. Adjust pressure through FRL at the back panel.
- Check the condition of consumables timely. Replace worn out consumables. Do not use the consumables till damage stage.
- In case machine is overload due to heat, do not switch off the machine, let the FAN cool the machine, it will restart in some time.
- Keep the machine away from the cutting area and above ground level as the fine cutting metal dust can enter the machine and can cause internal component damage.
- Please avoid unnecessary striking pilot arc constantly as it can reduce the consumable life.

## 14. SPARE PARTS LIST

DESCRIPTION	PART CODE
AC Capacitor 4Mfd-500VDC	SSP00173
Control Transformer	SSP00899
Control Card	SSA00023
DC Capacitor-100Uf/800VDC	SSP01068
Digital Panel Meter	SSP01103
Drive Card	SSP01229
Cooling Fan	SSP01321
Out Put Diode Module Positive	SSP08727
Out Put Diode Module Negative	SSP08728
Air Filter	SSP08216
Fuse Holder-	SSP01497
Hall Sensor	SSP04553
HF PCB - 01	SSP02738
HF Transfer Coil	SSA00206
Hf Transformer	SSP01692
Igbt-	SSP01871
Input Bridge Module	SSP01901
Input Surge Suppressor	SSP01916
JJ PCB	SSA00213
Lm Choke	SSA00034
Main Transformer	SSP08242
MCB- 25Amp,3Phase	SSP02488
Out Put Terminal For Torch	SSP02674
Output +Ve Terminal	SSP02683
Potentiometer For Current	SSP02827
Air Pressure Gauge	SSP08217
Air Pressure Switch	SSP02899
Solenoid valve	SSP08362
Thrust Coil	SSA00043

\*\*\*\*\*