OPERATOR'S MANUAL

MIG 300-1 INVERTER

Part No. **9136H**

IMPORTANT

Read this Operator's Manual completely before attempting to use this equipment.

Save this manual and keep it handy for quick reference.

Pay particular attention to the safety instructions we have provided for your protection.

Contact your distributor if you do not fully understand this manual.

CONTENT

§1 Safety

Notice: **The instructions are for reference only. The manufacturer reserves the right to explain the differences between the description and the product due to product changes and upgrades!**

The device is manufactured using state-of-the-art technology and according to recognised safety standards. If used incorrectly or misused, however, it can cause:

- Injury or death to the operator.
- Damage to the device and other material assets belonging to the operating company.
- Inefficient operation of the device.

General

All persons involved in commissioning, operating, maintaining and servicing the device must:

- Be suitably qualified.
- Have sufficient knowledge of welding.
- Read and follow these operating instructions carefully.

The operating instructions must always be at hand wherever the device is being used. In addition to the operating instructions, attention must also be paid to any generally applicable and local regulations regarding accident prevention and environmental protection.

Before switching on the device, rectify any faults that could compromise safety.

This is for your personal safety!

Environment

Products are limited to use under suitable conditions. In extreme cases, the use of products, such as high temperature, low temperature, thunderstorm weather, will shorten the life of the machine and even cause damage, please avoid the above situation.

Excessive ambient temperature will cause the machine heat dissipation is not smooth, so that the internal components of the machine heat seriously. Usually the maximum operating temperature is 104°F (40°C).

Low temperature may lead to performance degradation or damage of components inside the product, resulting in ice inside the water tank. Usually the lowest operating temperature is 14°F (-10°C). Please keep warm and add antifreeze in the water tank if necessary.

Too humid environment may lead to rust of shell and circuit components. In rainy weather, using products may lead to short circuit and other abnormalities. Please try to avoid using in the above environment. If the machine is wet, please dry in time.

Areas

Running parts and specific parts of risk will take damage for your body or others. The corresponding notices are as follows. It is quite a safe operation after taking several necessary protection measures.

Items being welded generate and hold high heat and can cause severe burns. Don’t touch hot parts with bare hands. Allow a cooling period before working on the welding gun. Use insulated welding gloves and clothing to handle hot parts and prevent burns.

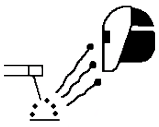
A high risk of injury exists when the welding wire emerges from the welding torch. Always keep the torch well away from the body.

Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-gears, fans and all other moving parts when starting, operating or repairing equipment, for example:

- Fans
- Cogs
- Rollers
- Shafts
- Wire spools and welding wire

By product

Many harmful phenomena, such as noise, bright light and harmful gas, will inevitably occur in the welding process. In order to avoid harmful phenomena causing harm to the human body, it is necessary to make corresponding preparations in advance.



Arc rays from the welding process produce intense visible and invisible ultraviolet and infrared rays that can burn eyes and skin.

- Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding.
- Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

Noise from some processes or equipment can damage hearing. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.

The build up of gas can causes a toxic environment, deplete the oxygen content in the air resulting in death or injury. Many gases use in welding are invisible and odorless.

- Shut off shielding gas supply when not in use.
- Always ventilate confine spaces or use approved air-supplied respirator.

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.

- Do not breathe the smoke and gas generated whilst welding or cutting, keep your head out of the fumes. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. Additional precautions are also required when welding on galvanized steel.

- Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet and follow your employer's safety practices.

Explosion

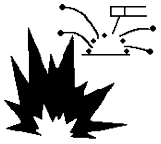
In the process of using, careless operation will lead to fire, explosion and gas leakage or other dangers. Before using the product, we need to know the correct preventive measures in order to avoid accidents.

Don't add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting.

Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

Flying sparks from the welding arc, hot work piece, and hot equipment can cause fires and burns. Accidental contact of electrode to metal objects can cause sparks, explosion, overheating or fire.

- Welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Avoid welding near hydraulic lines.
- Have a fire extinguisher readily available. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situation.



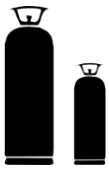
- Vent hollow castings or containers before heating, cutting or welding. They may explode.
- Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuff less trousers, high shoes and a cap over your hair.
- Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- Protect gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames sparks, and arcs.

- Insure cylinders are held secure and upright to prevent tipping or falling over.
- Never allow the welding electrode or earth clamp to touch the gas cylinder, do not drape welding cables over the cylinder.
- Open the cylinder valve slowly and turn your face away from the

cylinder outlet valve and gas regulator.



Cylinder

Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

- Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- Cylinders should be located:
  - Away from areas where they may be struck or subjected to physical damage.
  - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

Electricity

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and internal machine circuits are also live when power is on.

Different products have different requirements for input voltage, such as single-phase and three-phase. If the machine with three-phase electricity as input appears phase absence or voltage fluctuation, it may cause serious damage to the product interior.

All products must be well grounded before they are connected to the power supply. In case of abnormal case such as shell leakage, please disconnect the power supply immediately and notify the professionals for

maintenance.

Don’t sling cables or leads around either the body or parts of the body. The electrode (rod electrode, tungsten electrode, welding wire, etc) must

- Never be immersed.
- Never be touched when current is flowing.

When the machine is connected to the power supply, there is electricity inside the machine. Please do not touch the wires, circuit boards and related electrical parts in order to avoid life hazards and property losses.

During MIG/MAG or TIG welding, the welding wire, the wire spool, the drive rollers and all metal parts that are in contact with the welding wire are live. Always set the wire-feed unit up on a sufficiently insulated surface or use a suitable, insulated wire-feed unit mount.

According to the domestic and international standards, the ambient devices’ electromagnetism situation and anti-interference ability must be checked:

- Safety device.
- Power line, Signal transmission line and Date transmission line.
- Date processing equipment and telecommunication equipment.
- Inspection and calibration device.

EMC

Supporting measures for avoidance of EMC problems:

1. Mains supply

If electromagnetic interference arises despite correct mains connection, additional measures are necessary.

2. Welding power leads must be kept as short as possible, must run close together and be kept well apart from other leads
3. Equipotential bonding
4. Earthing of the workpiece

If necessary, establish an earth connection using suitable capacitors.

5. Shielding, if necessary

- Shield off other nearby devices.

- Shield off entire welding installation.

EMC Class

Radiation Class A Device.

- Only can be used in the industrial area.
- If it is used in other area, it may cause connection and radiation problems of circuit.

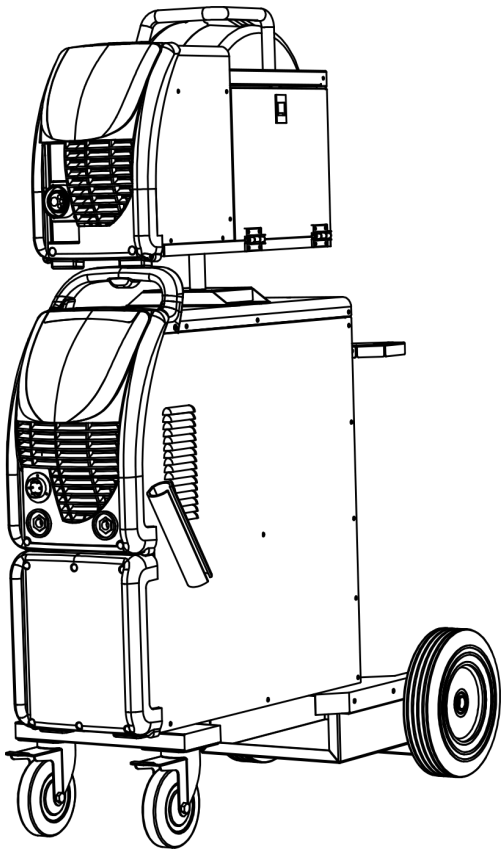
Radiation Class B device.

- Satisfy the emissions criteria for residential and industrial areas. This is also true for residential areas in which the energy is supplied from the public low-voltage mains.

EMC device classification as per the rating plate or technical data.

§2 Overview

§2.1 Features



- New PWM technology and IGBT inverter technology.
- MIG/MAG with Manual.
- MIG waveform (inductance) control for great arc control and smoother welding results.
- 2T /4T trigger operation with crater control setting.
- Adjustable pre flow, post flow, burn back and soft start setting
- Dual digital display meters for accurate pre-setting and feedback of welding parameters & output
- Internal wire feeder, gear driven for up to 300mm Ø spool.
- Euro style MIG torch connection.
- IP21S rating for environmental/safety protection.
- Tolerant to variable power supply.
- Trolley integrated design，bring your own roller, save effort and light.

§2.2 Technical Data

Models / Parameters	MIG 300-1
Input Voltage (V)	1~230±10%
Frequency (HZ)	50/60
Input Current (A)	66.6
Input Power (kVA)	15.3
Welding Current (A)	30-300
Welding Voltage (V)	15.5-29.0
No-load Voltage (V)	82.5
Duty cycle (40℃)	40% 300A 60% 245A 100% 190A

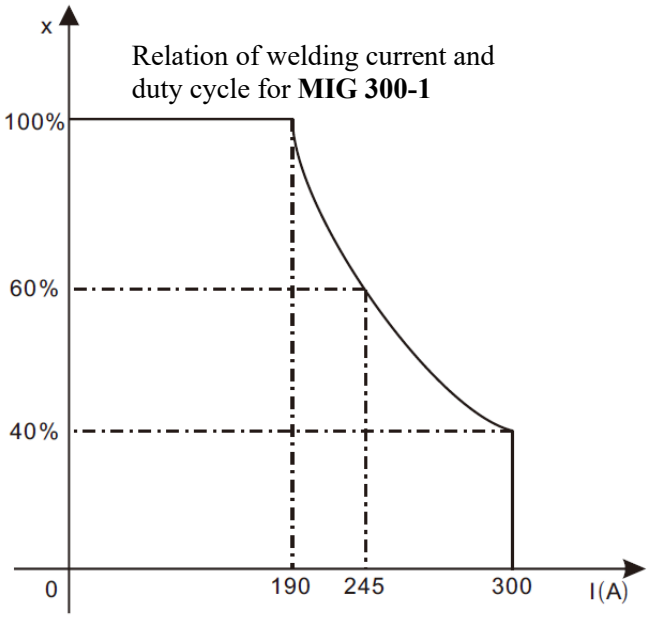
Diameter (mm)	Fe: 0.6/0.9/1.0/1.2 SS: 0.8/0.9/1.0/1.2 Flux-Cored: 0.6/0.8/0.9/1.0/1.2
Circuit Breaker Standard	LW31-63B-4AB-02/1
Protection class	IP21S
Dimensions (mm)	960*460*890
Weight (Kg)	43.5
Power Factor	0.66
Efficient (%)	86.5

Note: The above parameters are subject to change with future machine improvement!

§2.3 Duty cycle and Over-heat

The letter “X” stands for Duty Cycle, which is defined as the portion of the time a welding machine can weld continuously with its rated output current within a certain time cycle (10 minutes).

The relation between the duty cycle “X” and the output welding current “I” is shown as the right figure.

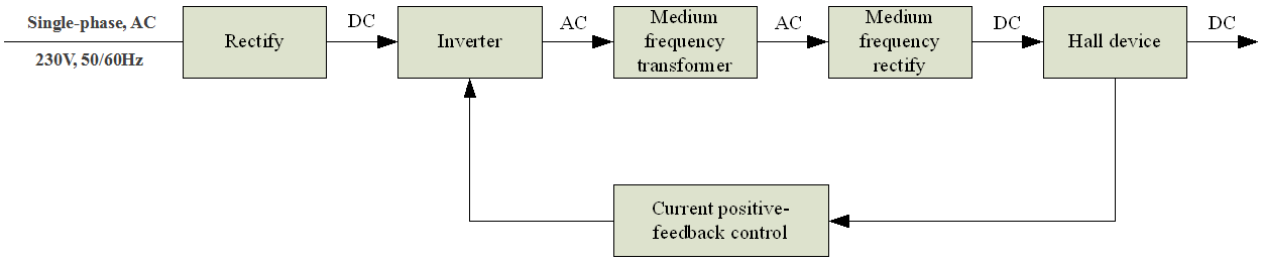


If the welding machine is overheating, the IGBT over-heat protection sensing will send a signal to the welding machine control unit to cut the output welding current OFF and light the over-heat pilot lamp on the front panel. In that case, the machine should not be welding for 10-15 minutes to cool down with the fanrunning. When operating the machine again, the welding output current or the duty cycle should be reduced.

§2.4 Working Principle

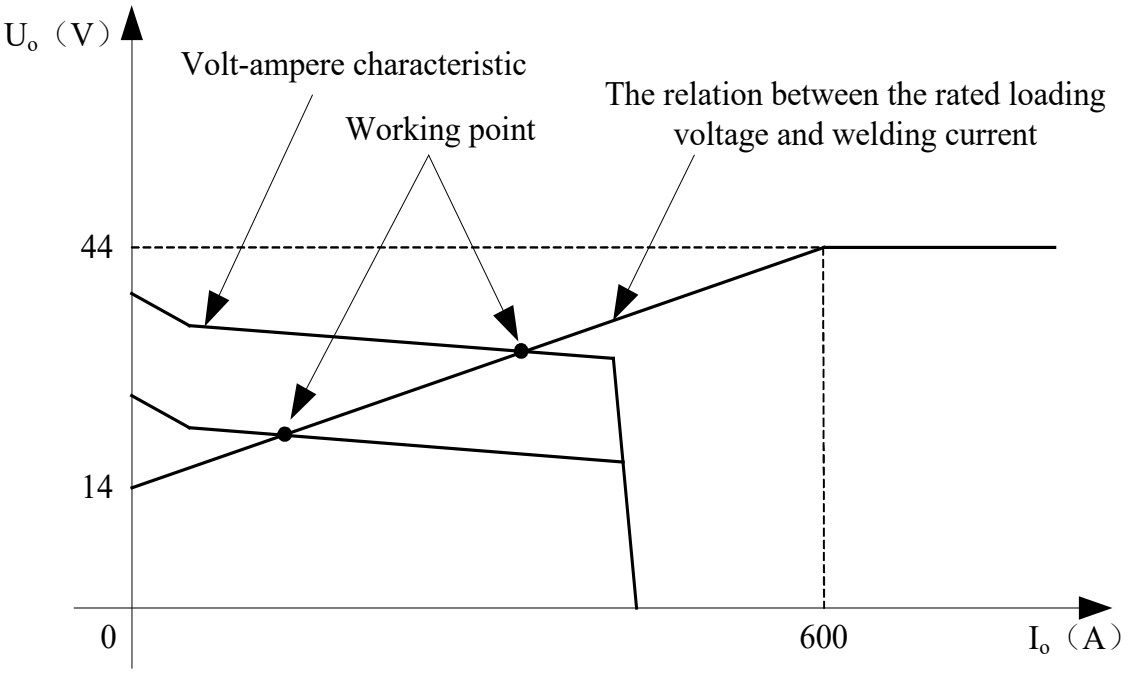
The working principle of MIG series welding machine is shown as the following figure. Single-phase 230V work frequency AC is rectified into DC, then is converted to medium frequency AC by inverter device (IGBT), after reducing voltage by medium transformer (the main transformer) and rectifying by medium frequency rectifier (fast recovery diodes), and is outputted by inductance filtering. The circuit adopts voltage feedback

control technology to insure voltage output stably when MIG. Meanwhile, the welding current parameter can be adjusted continuously and infinitely to meet with the requirements of welding craft.



§2.5 Volt-Ampere Characteristic

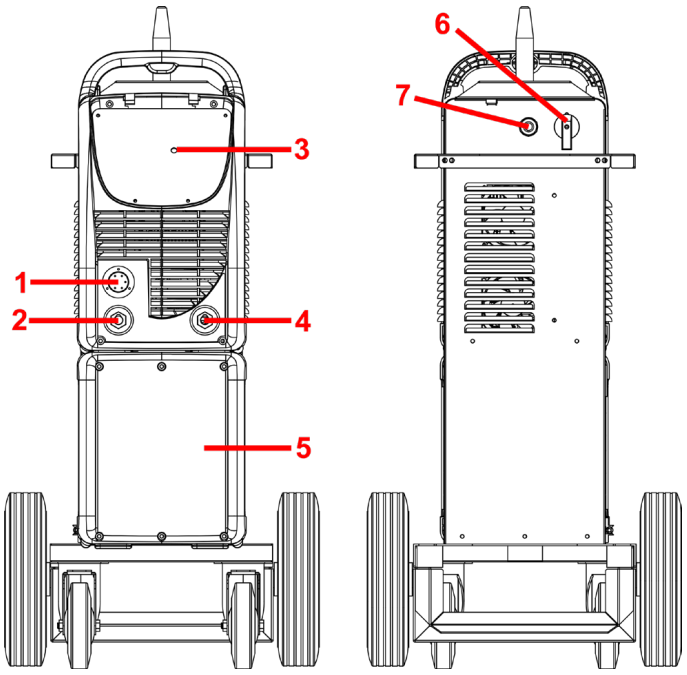
MIG series of welding machines has an excellent volt-ampere characteristic, whose graph is shown as the following figure. The relation between the rated loading voltage U_2 and welding current I_2 is as follows: $U_2=14+0.05I_2$ (V).



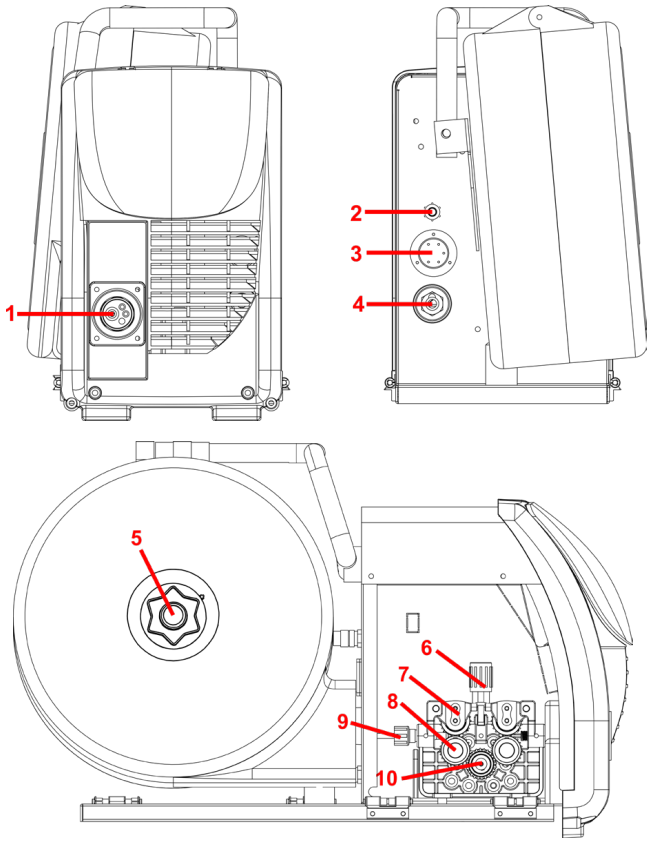
§3 Panel Functions & Descriptions

§3.1 Machine Layout Description

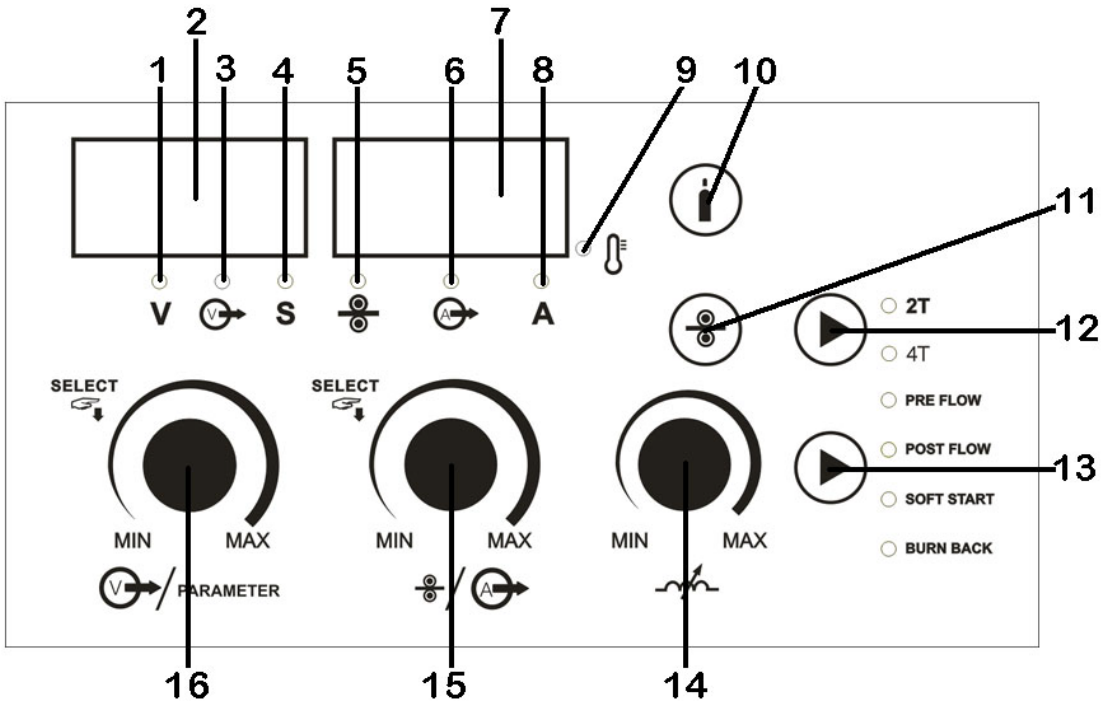
1. **Aviation plug:** Used to connect to the control cable of wire feeder.
2. **Negative (-) welding power output connection socket.**
3. **Power indicator:** When machine is powered on, it light on.
4. **Positive (+) welding power output connection socket.**
5. **Toolkit**
6. **Power switch.**
7. **Input power cable.**



1. **MIG torch euro connector.**
2. **Gas inlet connector.**
3. **Wire feeder control cable connector.**
4. **Positive (+) welding power intput connection socket.**
5. **Spool holder.**
6. **Wire feed tension adjustment.**
7. **Wire feed tension arm (2x).**
8. **Wire feeder roller (2x).**
9. **Wire feeder inlet guide.**
10. **Wire drive roller**



§3.2 Front Panel Functions and Descriptions



1. **Welding Voltage Indicator.**
2. **Lh Digital Display**.∗
3. **Crater Voltage Indicator:** Crater voltage is used to control the melting speed of the welding wire before the end of welding (only MIG 4T). ∗
4. **Time Indicator:** When adjust Pre Flow/Post Flow, it light on.
5. **Wire Feed Indicator.**
6. **Crater Current Indicator:** Crater current is used to adjust the speed of wire feeding before the end of welding (only MIG 4T). ∗
7. **Rh Digital Display**.∗
8. **Welding Current Indicator.**
9. **Alarm Indicator**. ∗
10. **Air Check Button.**∗
11. **Manual Wire Button.**∗
12. **2T/4T Selector Button** *
13. **Mig Parameter Selection Button***
14. **Inductance adjusting knob***
15. **Rh Parameter Adjustment/ Selector Knob***
16. **Lh Parameter Adjustment/ Selector Knob***

***Denotes more detailed explanation of function to follow.**

Further Controls Explained

Lh Digital Display (2)

Before welding, displays welding voltage (V), crater voltage or time (S), depending on the parameter being adjusted. During welding, displays welding voltage. The parameter displayed is indicated by the LED below the display. If left inactive for several seconds, display will revert back to main welding voltage setting.

Crater Fill Function (3) (6)

This is enabled in MIG 4T trigger mode and allows output voltage and wire speed values independent of the main welding values to be set that are enabled when the torch trigger is held before releasing to stop the arc in 4T trigger mode. As the name implies, this is used to create a smooth finish to a weld, especially when welding thicker material at high amperage where the instant stop of the welding current would normally create a 'crater' in the weld bead. These set-tings would normally be set lower than the main wire feed and voltage settings.

Rh Digital Display (7)

Before welding, displays wire feeding speed, crater wire feed or current, depending on the parameter being adjusted. During welding, displays welding current. The parameter displayed is indicated by the LED below the display. If left inactive for several seconds, display will revert back to main welding voltage setting.

Alarm Indicator (9)

Lights when over voltage, over current, input phase loss or electrical overheating (due to exceeding duty cycle) is detected and protection is activated. When protection is activated, welding output will be disabled until the safety system senses the overload has reduced sufficiently and indicator lamp goes out. May also trigger if machine experiences an internal power circuit failure.

Air Check Button (10)

The button is used to check whether the gas supply is normal. After pressing the key, if the gas supply is normal, there will be a jet at the welding gun. If the gas supply is abnormal, there will be no gas flow at the muzzle of the welding gun.

Manual Wire Button (11)

The button is used for manual wire feeding. In general, when replacing the new welding wire, it will be used when it is installed and will be more convenient. In addition, during wire feeding, the welding wire has not been output, which increases the safety.

2T /4T selector button (12)

2T mode the trigger is pulled and held on to activate the welding circuit, when the trigger is released, the welding circuit stops. 4T is known as 'latching' mode. The trigger is pulled once and released to activate the welding circuit, pulled and released again to stops the welding circuit. This function is useful to longer welds as the trigger is not required to be held on continuously.

Mig Parameter Selection Button (13)

This button selects the following welding parameters, which are displayed on the LH display (2) and adjusted using the LH control knob (16).

Pre flow

Controls the period shielding gas will flow for when the torch is triggered before the arc starts. This purges the work area of atmospheric gas which could contaminate the weld before the weld starts. Unit (S).Range: 0-5.

Post flow

Controls the period of time the shielding gas continues to flow for after the arc is stopped. This protects the weld area from contamination while it is still hot enough to react with atmospheric gases, after the weld is finished. Unit (S).Range: 0-10.

Soft start

Sometimes known as 'hot start'. When a weld is started, the workpiece and the wire will be 'cold' compared to welding temperature, this can cause an uneven and poor start to the weld using the voltage and wire feed speed selected as optimal once the arc is established. This setting slows the wire speed down at the start of the weld which improves the weld starting performance. Range: 0-10.

Burn back

Burn back adjustment controls the short period of time that the wire feed will continue to run for after the main welding current stops. If the wire feed and current is stopped at exactly the same time, the wire will still be hot and 'burn' back and stick to the welding tip. If this problem is happening, increasing the burn back adjustment will cause the wire feeder to run for longer after the arc has stopped. If the burn back is adjustment is excessive, after a weld is stopped, the operator will be left with excess 'stickout' wire length from the torch tip that will require correcting before starting the next weld. Range: 0-10.

MIG Wave Control/ Inductance Knob (14)

This setting changes the MIG waveform to simulate changing the inductance of the

welding circuit. Inductance controls the rate of the current rise and fall as the welding wire contacts the workpiece (known as a short circuit). More inductance increases the short circuit time and decreases the short circuit frequency rate. This causes a wider and more penetrating arc, useful for thicker weld joints. Less inductance will create a narrow more focused arc. This effect can also be used to fine tune the arc to produce less splat-ter. Wire speed, wire size and type, shielding gas will all change the effect that the inductance setting has on the welding arc. Inductance change will have no practical effect on MIG spray transfer process (as op-posed to short circuit process).

Rh Parameter Adjustment/ Selector Knob (15)

Control parameters displayed on the RH display screen (7). Pressing the knob will switch between parameters displayed.

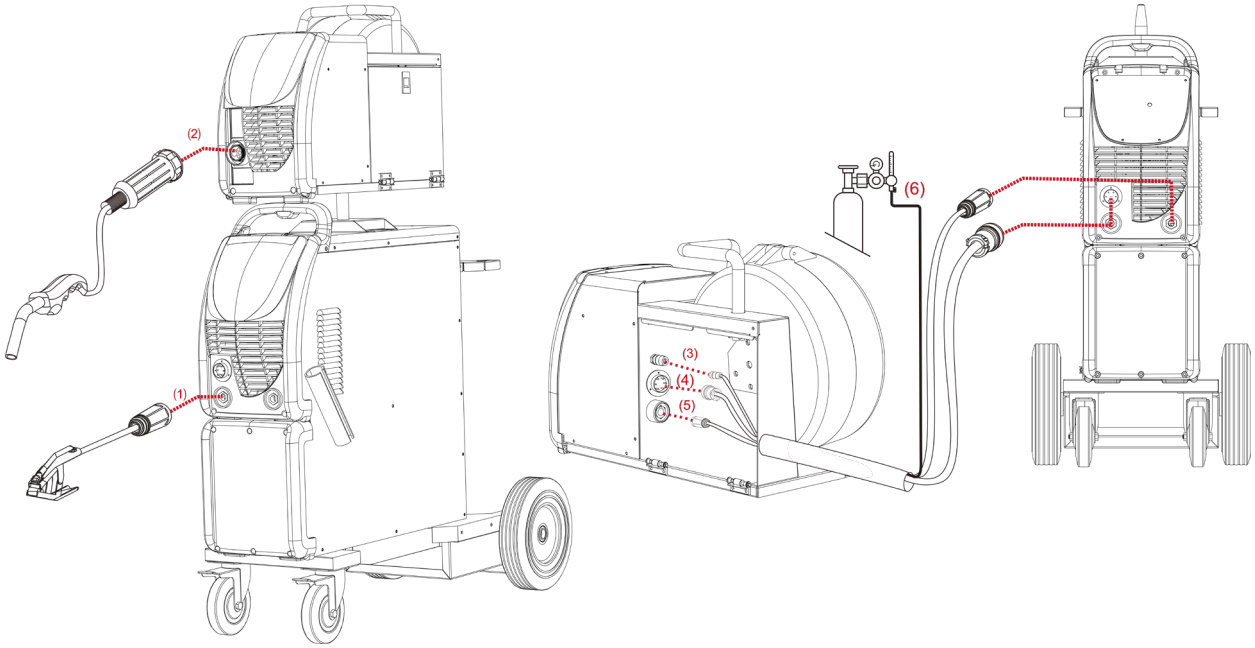
Lh Parameter Adjustment/ Selector Knob (16)

Control parameters displayed on the LH display screen (2). Pressing the knob will switch between parameters displayed.

§4 Installation & Operation

§4.1 Installation & Operation for MIG Welding

§4.1.1 Set up installation for MIG Welding



(1) Insert the earth cable plug into the negative socket on the front of the machine and tighten it.

(2) Plug the welding torch into the MIG torch connection socket on the front panel of the wire feeder, and tighten it.

IMPORTANT: When connecting the torch be sure to tighten the connection. A loose connection can result in the connector arcing and damaging the machine and gun connector.

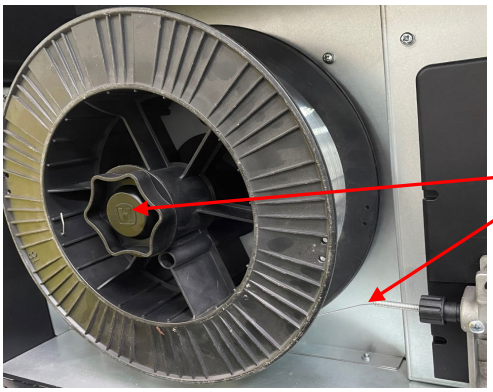
(3) Connect the gas line to gas connector on the rear panel of wire feeder. **Check for Leaks!**

(4) Connect the control cable of wire feeder with the aero socket on the front panel of welding machine.

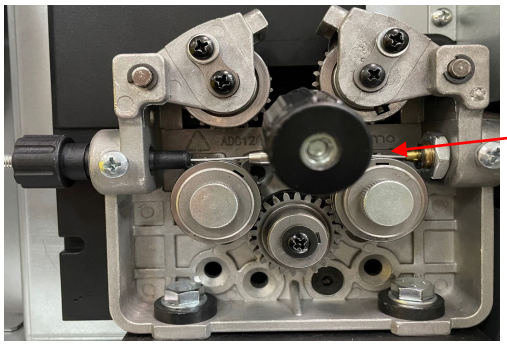
(5) Connect the cable of wire feeder with the positive output of welding machine.

(6) Connect the gas regulator to the Gas Cylinder and connect the gas line to the Gas Regulator. **Check for Leaks!**

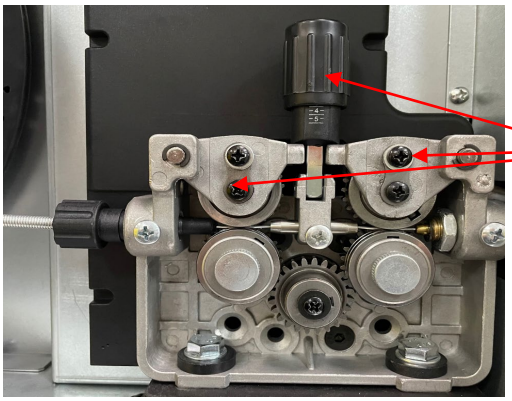
(7) Connect the power cable of welding machine with the output switch in electric box on site.



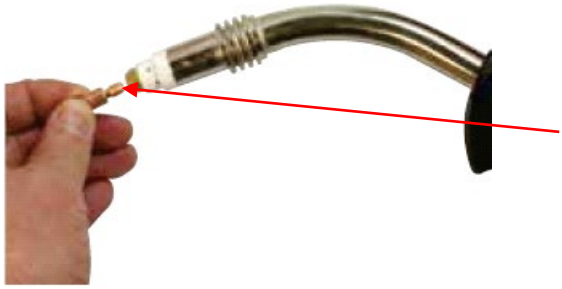
(8) Place wire onto spool holder - (spool retaining nut is left hand thread) Feed wire through the inlet guide tube on to the drive roller.



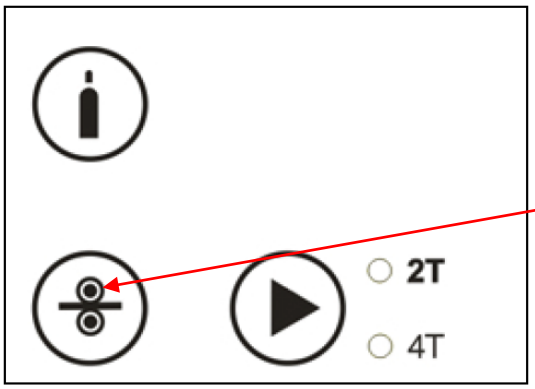
(9) Feed wire over the drive roller into the outlet guide tube, Push the wire through approx 150mm.



(10) Close down the top roller bracket and clip the pressure arm into place with a medium amount of pressure applied.



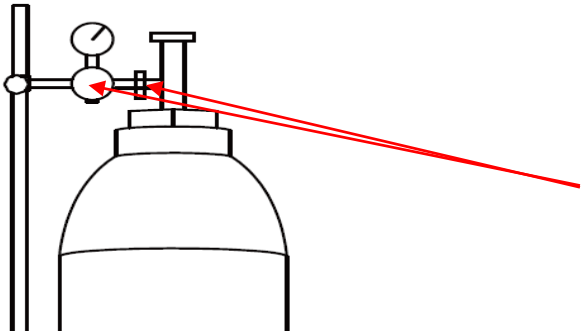
(11) Remove the gas nozzle and contact tip from the front end of the MIG torch.



(12) Press and hold the manual wire key to feed the wire down the torch cable through to the torch head.

(13) Fit the correct size contact tip over the wire and fasten tightly into the tip holder.

(14) Fit the gas nozzle to the torch head.



(15) Carefully open the gas cylinder valve and set the required gas flow rate.

(16) Select torch trigger mode: 2t or 4T.

(17) Select the required welding parameters using the knobs and buttons.

§4.1.2 Wire Feed Roller Selection

The importance of smooth consistent wire feeding during MIG welding cannot be emphasized enough. Simply put the smoother the wire feed then the better the welding will be.

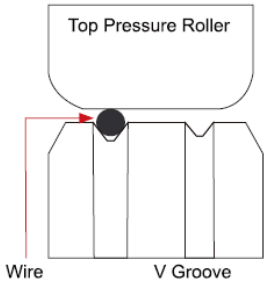
Feed rollers or drive rollers are used to feed the wire mechanically along the length of the welding gun. Feed rollers are designed to be used for certain types of welding wire and they have different types of grooves machined in them to accommodate the different

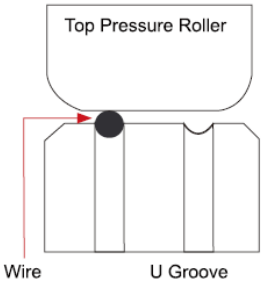
types of wire. The wire is held in the groove by the top roller of the wire drive unit and is referred to as the pressure roller, pressure is applied by a tension arm that can be adjusted to increase or decrease the pressure as required. The type of wire will determine how much pressure can be applied and what type of drive roller is best suited to obtain optimum wire feed.

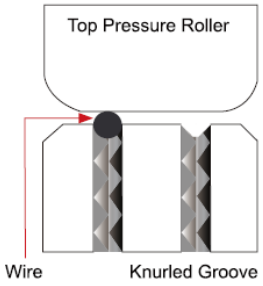
Solid Hard Wire - like Steel, Stainless Steel requires a drive roller with a V shape groove for optimum grip and drive capability. Solid wires can have more tension applied to the wire from the top pressure roller that holds the wire in the groove and the V shape groove is more suited for this. Solid wires are more forgiving to feed due to their higher cross sectional column strength, they are stiffer and don't bend so easy.

Soft Wire - like aluminum requires a U shape groove. Aluminum wire has a lot less column strength, can bend easily and is therefore more difficult to feed. Soft wires can easily buckle at the wire feeder where the wire is fed into inlet guide tube of the torch. The U-shaped roller offers more surface area grip and traction to help feed the softer wire. Softer wires also require less tension from the top pressure roller to avoid deforming the shape of the wire, too much tension will push the wire out of shape and cause it to catch in the contact tip.

Flux Core/ Gasless Wire - these wires are made up of a thin metal sheath that has fluxing and metal compounds layered onto it and then rolled into a cylinder to form the finished wire. The wire cannot take too much pressure from the top roller as it can be crushed and deformed if too much pressure is applied. A knurled drive roller has been developed and it has small serrations in the groove, the serrations grip the wire and assist to drive it without too much pressure from the top roller. The down side to the knurled wire feed roller on flux cored wire is it will slowly over time eat away at the surface of the welding wire, and these small pieces will eventually go down into the liner. This will cause clogging in the liner and added friction that will lead to welding wire feed problems. A U groove wire can also be used for flux core wire without the wire particles coming of the wire surface. However it is considered that the knurled roller will give a more positive feed of flux core wire without any deformation of the wire shape.



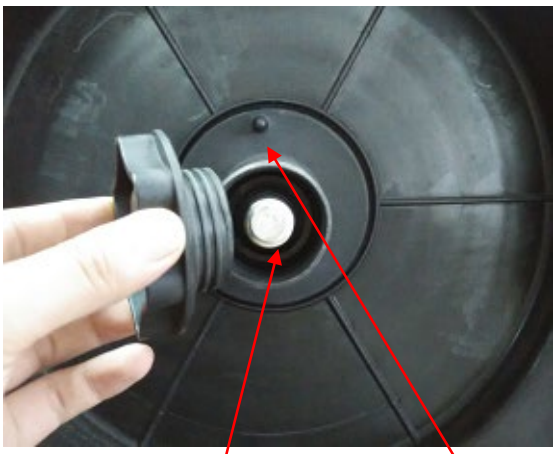




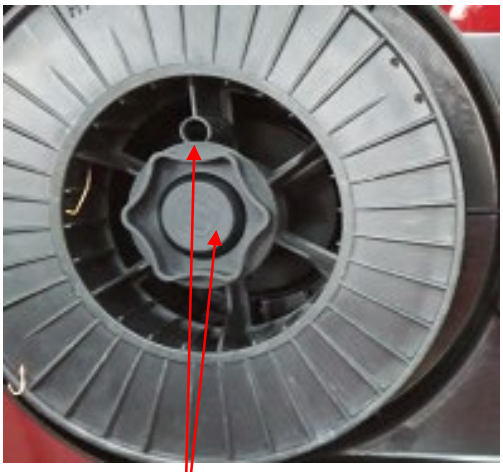
§4.1.3 Wire Installation and Set Up Guide

Again the importance of smooth consistent wire feeding during MIG welding cannot be emphasized enough. The correct installation of the wire spool and the wire into the wire feed unit is critical to achieving an even and consistent wire feed. A high percentage of faults with MIG welders emanate from poor set up of the wire into the wire feeder. The guide below will assist in the correct setup of your wire feeder.

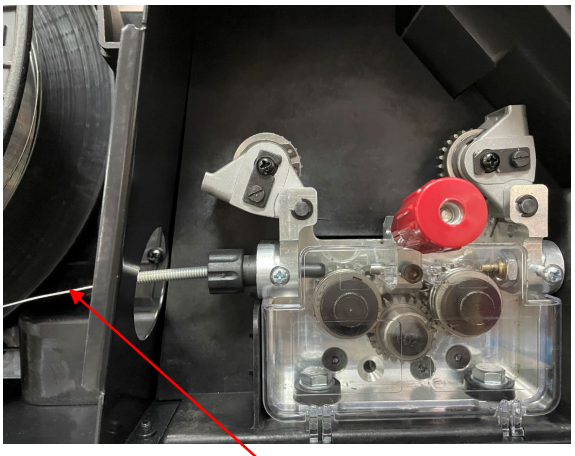
(1) Remove the spool retaining nut.



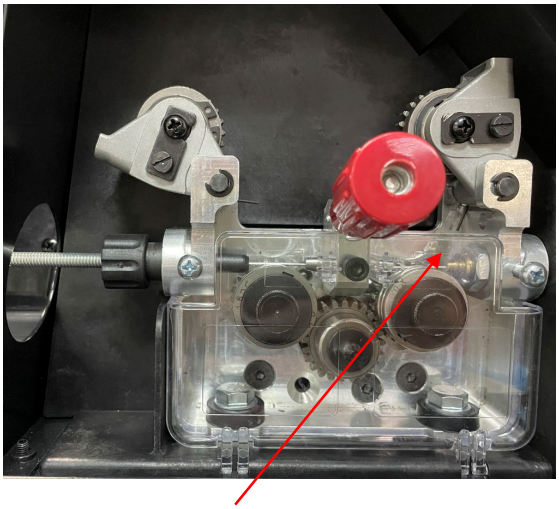
(2) Note the tension spring adjuster and spool locating pin.



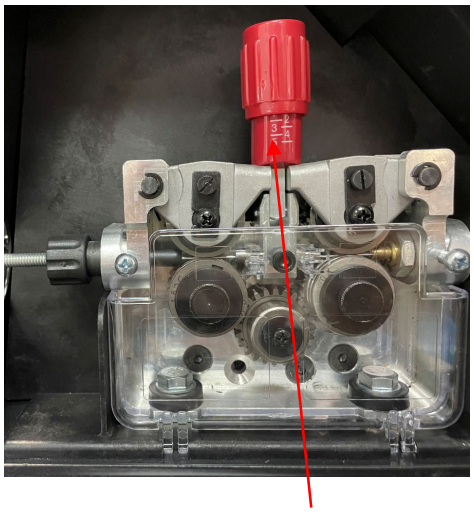
(3) Fit the wire spool onto the spool holder fitting the locating pin into the location holeon the spool. Replace the spool retaining nut tightly.



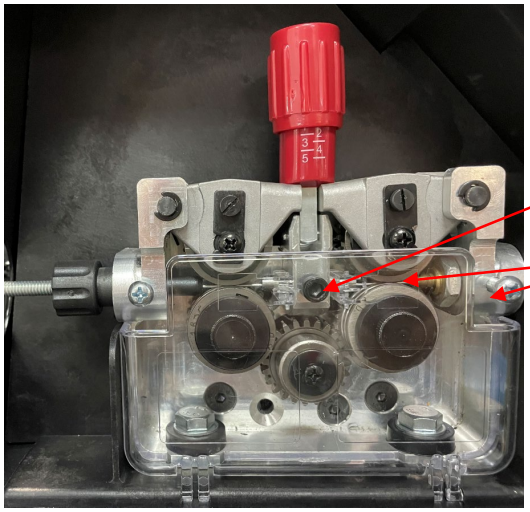
(4) Snip the wire carefully, be sure to hold the wire to prevent the spool uncoiling. Carefully feed the wire into the inlet guide tube of the wire feed unit.



(5) Feed the wire through the drive roller and into the outlet guide tube of the wire feeder.

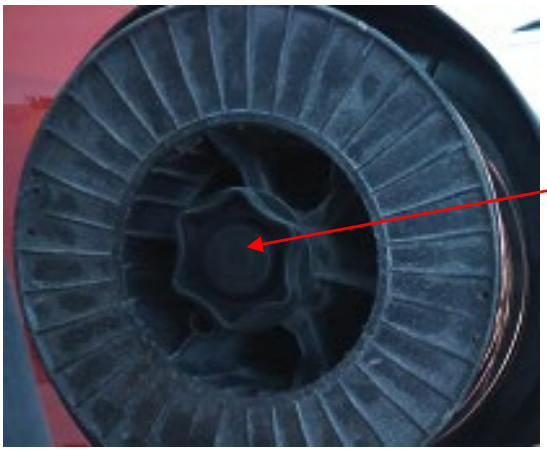


(6) Lock down the top pressure roller and apply a medium amount of pressure Using the tension adjustment knob.



(7) Check that the wire passes through the centre of the outlet guide tube without touching the sides. Loosen the locking screw and then loosen the outlet guide tube retaining nut too make adjustment if required. Carefully retighten the locking nut and screw to hold the new position.

(8) A simple check for the correct drive tension is to bend the end of the wire over hold it about 100mm from your hand and let it run into your hand, it should coil round in your hand without stopping and slipping at the drive rollers, increase the tension if it slips.



(9) The weight and speed of the wire spool turning creates an inertia that can cause the spool to run on and the wire loop over the side of the spool and tangle.
if this happens increase the pressure on the tension spring inside the spool holder assembly using the tension adjustment screw.

§4.1.4 MIG Torch Liner Types and Information

MIG Torch Liners

The liner is both one of the simplest and most important components of a MIG gun. Its sole purpose is to guide the welding wire from the wire feeder, through the gun cable and up to the contact tip.

Steel Liners

Most MIG gun liners are made from coiled steel wire also known as piano wire, which provides the liner with good rigidity and flexibility and allows it to guide the welding wire smoothly through the welding cable as it bends and flex during operational use. Steel liners are primarily used for feeding of solid steel wires, other wires such as Aluminum, Silicon Bronze etc, will perform better using a Teflon or Polyamide line. The internal diameter of the liner is important and relative to the wire diameter being used and will assist in smooth feeding and prevention of the wire kinking and birdnesting at the drive rollers. Also bending the cable too tightly during welding increases the friction between the liner and the welding wire making it more difficult to push the wire through the liner resulting in poor wire feeding, premature liner wear and birdnesting. Dust, grime and metal particles can accumulate inside the liner over time and cause friction and blockages, it is recommended to periodically blow out the liner with compressed air. Small diameter welding wires, 0.6mm through 1.0mm have relatively low columnar strength, and if matched with an oversized liner, can cause the wire to wander or drift within the liner. This in turn leads to poor wire feeding and premature liner failure due to excessive wear. By contrast, larger diameter welding wires, 1.2mm through 2.4mm have much higher columnar strength but it is important to make sure the liner has enough

internal diameter clearance. Most manufacturers will produce liners sized to match wire diameters and length of welding torch cable and most are color coded to suit.

Steel Liners

Blue-0.6mm-0.8mm

Red - 0.9mm - 1.2mm

Yellow - 1.6mm

Green - 2.0mm - 2.4mm

Teflon and Polyamide (PA) Liners

Teflon liners are well suited for feeding soft wires with poor column strength like Aluminum wires. The interiors of these liners are smooth and provide stable feed ability, especially on small diameter welding wire Teflon can be good for higher heat applications that utilize water-cooled torches and brass neck liners. Teflon has good abrasion resistance characteristics and can be used with a variety of wire types such as silicon bronze, stainless steel as well as Aluminum. A note of caution to careful inspect the end of the welding wire prior to feeding it down the liner. Sharp edges and burrs can score the inside of the liner and lead to blockages and accelerated wear. Polyamide Liners (PA) are made of carbon infused nylon and ideal for softer aluminum, copper alloy welding wires and push pull torch applications. These liners are generally fitted with a floating collet to allow the liner to be inserted all the way to the feed rollers.

Teflon Liners

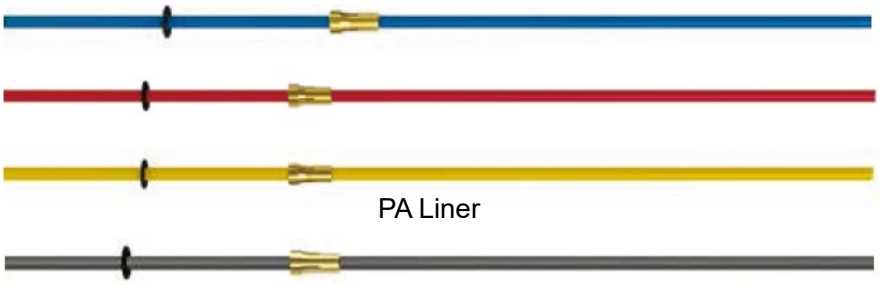
Blue-0.6mm-0.8mm

Red - 0.9mm - 1.2mm

Yellow - 1.6mm

PA Liner

Black-1.0mm-1.6mm



Copper - Brass Neck Liners

For high heat applications fitting brass or copper wound jumper or neck liner on the end of the liner at the neck end will increase the working temperature of the liner as well as improve the electrical conductivity of the welding power transfer to the wire.

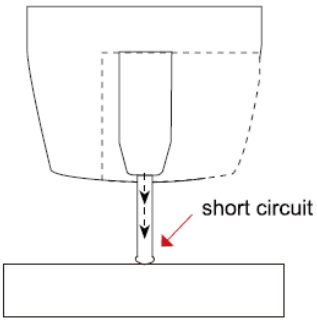
Neck Liner

§4.1.5 MIG Welding

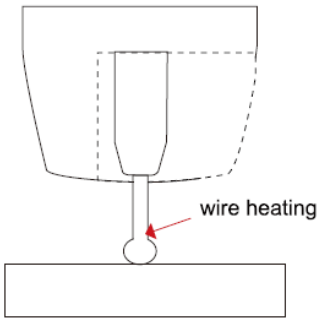
Definition of MIG Welding

MIG (metal inert gas) welding also known as GMAW (gas metal arc welding) or MAG (metal active gas welding), is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with MIG welding. There are four primary methods of metal transfer in MIG welding, called short circuit (also known as dip transfer) globular transfer, spray transfer and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations. To perform MIG welding, the basic necessary equipment is a welding gun, a wire feed unit, a welding power supply, an electrode wire, and a shielding gas supply.

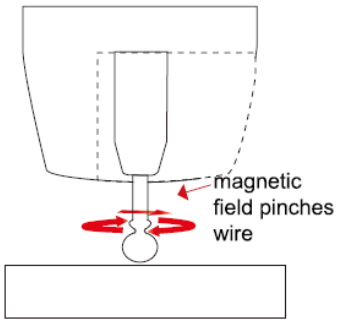
Short Circuit Transfer - Short circuit transfer is the most common used method whereby the wire electrode is fed continuously down the welding torch through to and exiting the contact tip. The wire touches the work piece and causes a short circuit the wire heats up and begins to form a molten bead, the bead separates from the end of the wire and forms a droplet that is transferred into the weld pool. This process is repeated about 100 times per second, making the arc appear constant to the human eye.



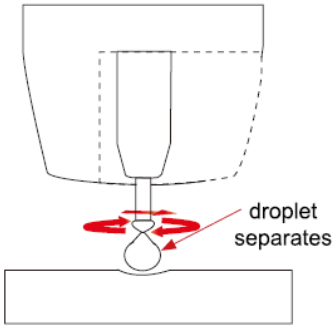
The wire approaches the work piece and touches the work creating a short circuit between the wire and the base metal, because there is no space between the wire and the base metal there is no arc and current flows through the wire.



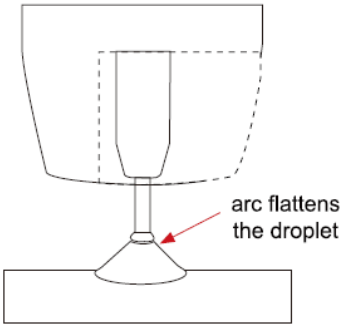
The wire cannot support all the current flow, resistance builds up and the wire becomes hot and weak and begins to melt.



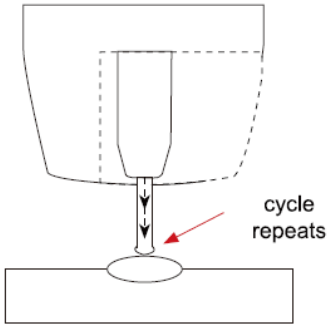
The current flow creates a magnetic field that begins to pinch the melting wire forming it into droplet.



The pinch causes the forming droplet to separate and fall towards the now creating weld pool.



An arc is created at the separation of the droplet and the heat and force of the arc flattens out the droplet into the weld pool. The heat of the arc melts the end of the wire slightly as it feeds towards the base metal.



The wire feed speed overcomes the heat of the arc and the wire again approaches the work to short circuit and repeat the cycle.

Basic MIG Welding

Good weld quality and weld profile depends on gun angle, direction of travel, electrode extension (stick out), travel speed, thickness of base metal, wire feed speed and arc voltage. To follow are some basic guides to assist with your setup.

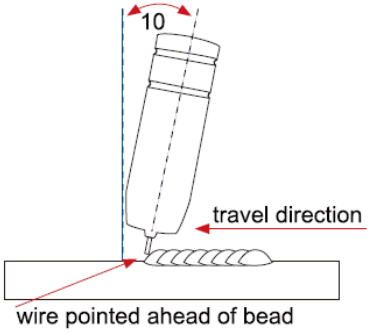
Gun Position - Travel Direction, Work Angle: Gun position or technique usually refers to how the wire is directed at the base metal, the angle and travel direction chosen. Travel speed and work angle will determine the characteristic of the weld bead profile and degree of weld penetration.

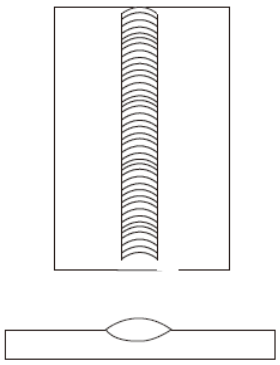
Push Technique - The wire is located at the leading edge of the weld pool and pushed towards the un-melted work surface. This technique offers a better view of the weld joint and direction of the wire into the weld joint. Push technique directs the heat away from the weld puddle allowing faster travel speeds providing a flatter weld profile with light penetration - useful for welding thin materials. The welds are wider and flatter allowing for minimal clean up/grinding time.

Perpendicular Technique - The wire is fed directly into the weld, this technique is used primarly for automated situations or when conditions make it necessary. The weld profile is generally higher and a deeper penetration is achieved.

Drag Technique - The gun and wire is dragged away from the weld bead. The arc and heat is concentrated on the weld pool, the base metal receives more heat, deeper melting, more penetration and the weld profile is higher with more build up.

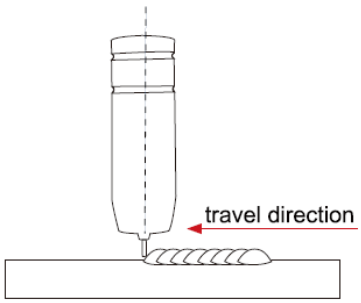
(A) Push Technique

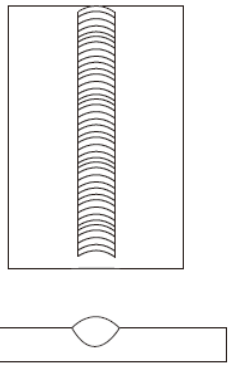




Flat even weld profile light penetration

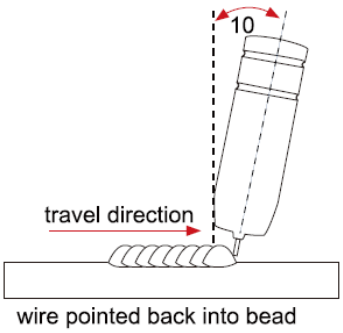
(B) Gun Perpendicular

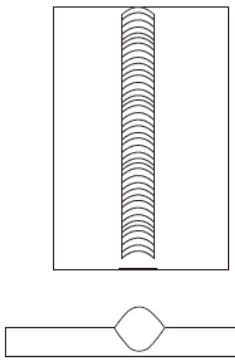




Narrower weld profile even penetration

(C) Drag Technique

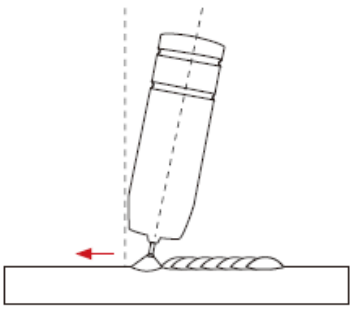




Narrow higher weld profile more penetration

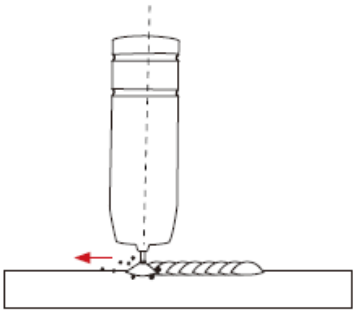
Travel Angle - Travel angle is the right to left angle relative to the direction of welding. A travel angle of 5°- 15° is ideal and produces a good level of control over the weld pool. A travel angle greater than 20° will give an unstable arc condition with poor weld metal transfer, less penetration, high levels of spatter, poor gas shield and poor quality finished weld.

Angle 5°- 15°



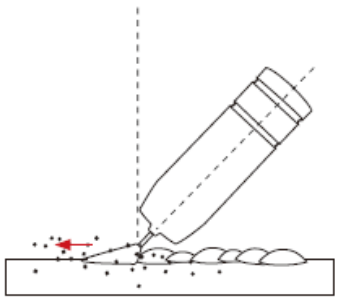
Good level of control over the weld pool, even flat weld.

Not enough angle



Less control over the weld pool more spatter.

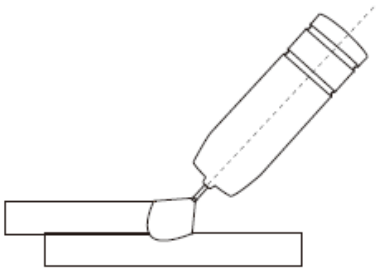
Angle more than 20°



Poor control, unstable arc, less penetration, lots of spatter.

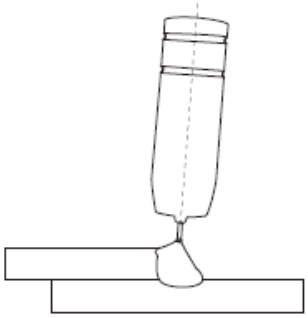
Angle to Work - The work angle is the forward back angle of the gun relative to the work piece. The correct work angle provides good bead shape, prevents undercut, uneven penetration, poor gas shield and poor quality finished weld.

Correct angle



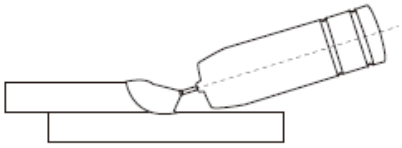
Good level of control over the weld pool, even flat weld.

Not enough angle



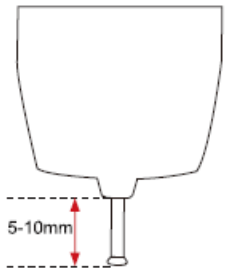
Less control over the weld pool more spatter.

Too much angle

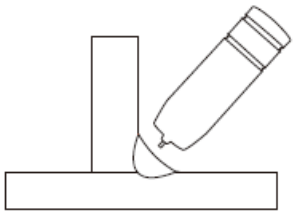


Poor control, unstable arc, less penetration, lots of spatter.

Stick Out- Stick out is the length of the unmelted wire protruding from the end of the contact tip. A constant even stick out of 5-10mm will produce a stable arc, and an even current flow providing good penetration and even fusion. Too short stick out will cause an unstable weld pool, produce spatter and over heat the contact tip. Too long stick out will cause an unstable arc, lack of penetration, lack of fusion and increase spatter.

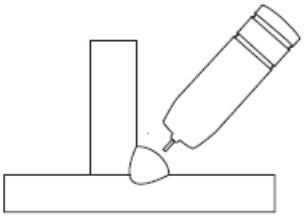


Normal stick out



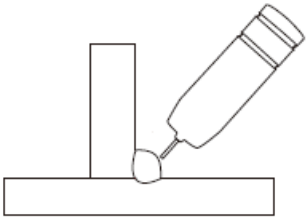
Even arc, good penetration even fusion, good finis.

Too short



Unstable arc, spatter, over heat contact tip.

Too long



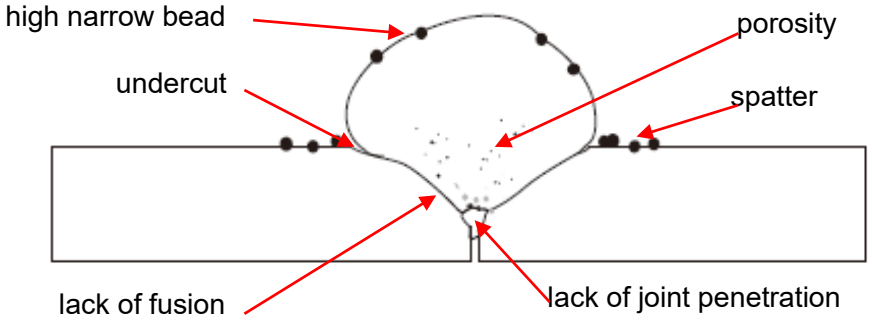
Unstable arc, spatter, poor penetration and fusion.

Travel Speed - Travel speed is the rate that the gun is moved along the weld joint and is usually measured in mm per minute. Travel speeds can vary depending on conditions and the welder's skill and is limited to the welder's ability to control the weld pool. Push technique allows faster travel speeds than Drag technique. Gas flow must also correspond with the travel speed, increasing with faster travel speed and decreasing with

slower speed. Travel speed needs to match the amperage and will decrease as the material thickness and amperage increase.

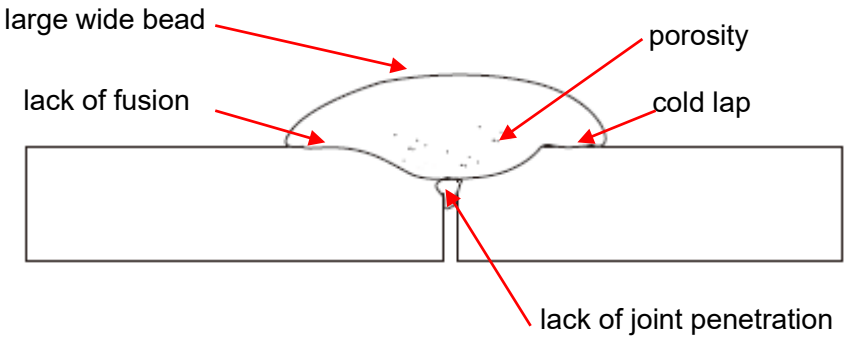
Too Fast Travel Speed - A too fast travel speed produces too little heat per mm of travel resulting in less penetration and reduced weld fusion, the weld bead solidifies very quickly trapping gases inside the weld metal causing porosity. Undercutting of the base metal can also occur and an unfilled groove in the base metal is created when the travel speed is too fast to allow molten metal to flow into the weld crater created by the arc heat.

Too Fast Travel Speed



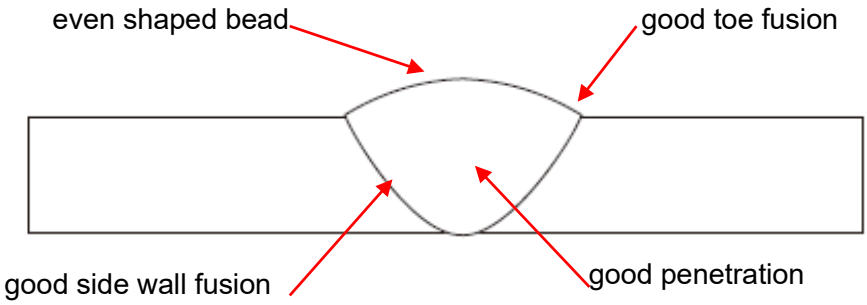
Too Slow Travel Speed - A too slow travel speed produces a large weld with lack of penetration and fusion. The energy from the arc dwells on top of the weld pool rather than penetrating the base metal. This produces a wider weld bead with more deposited weld metal per mm than is required resulting in a weld deposit of poor quality.

Too Slow Travel Speed



Correct Travel Speed - The correct travel speed keeps the arc at the leading edge of the weld pool allowing the base metal to melt sufficiently to create good penetration, fusion and wetting out of the weld pool producing a weld deposit of good quality.

Correct Travel Speed



Wire types and sizes - Use the correct wire type for the base metal being welded. Use stainless steel wire for stainless steel, Aluminum wires for Aluminum and steel wires for steel.

Use a smaller diameter wire for thin base metals. For thicker materials use a larger wire diameter and larger machine, check the recommended welding capability of your machine. As a guide refer to the “Welding Wire Thickness Chart” below.

WELDING WIRE DIAMETER CHART					
MATERIALTHICKNESS	**RECOMMENDED WIRE DIAMETERS**				
	0.8	0.9	1.0	1.2	1.6
0.8mm					
0.9mm					
1.0mm					
1.2mm					
1.6mm					
2.0mm					
2.5mm					
3.0mm					
4.0mm					
5.0mm					
6.0mm					
8.0mm					
10mm					
14mm					
18mm					
22mm					

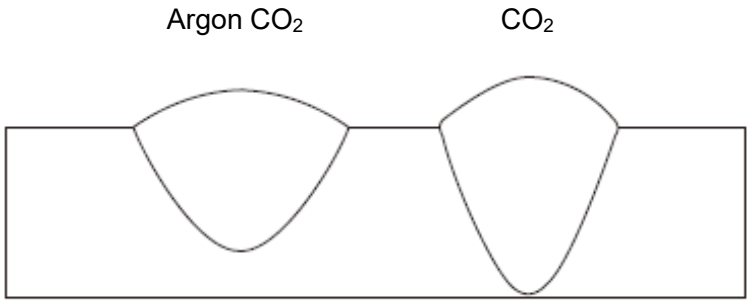
For material thickness of 5.0mm and greater, multi-pass runs or a beveled joint design may be required depending on the amperage capability of your machine.

Gas selection - The purpose of the gas in the MIG process is to protect / shield the wire, the arc and the molten weld metal from the atmosphere. Most metals when heated to a molten state will react with the air in the atmosphere, without the protection of the shielding gas the weld produced would contain defects like porosity, lack of fusion and slag inclusions. Additionally some of the gas becomes ionized (electrically charged) and

helps the current flow smoothly.

The correct gas flow is also very important in protecting the welding zone from the atmosphere. Too low flow will give inadequate coverage and result in weld defects and unstable arc conditions. Too high flow can cause air to be drawn into the gas column and contaminate the weld zone.

Use the correct shielding gas. CO_2 is good for steel and offers good penetration characteristics, the weld profile is narrower and slightly more raised than the weld profile obtained from Argon CO_2 mixed gas. Argon CO_2 mix gas offers better weld ability for thin metals and has a wider range of setting tolerance on the machine. Argon 80% CO_2 20% is a good all round mix suitable for most applications.



Penetration Pattern for Steel

§4.2 Operation environment

- Height above sea level ≤1000 M.
- Operation temperature range -10～+40°C.
- Air relative humidity is below 90% (20°C).
- Preferable site the machine some angles above the floor level, the maximum angle does not exceed 15℃.
- Protect the machine against heavy rain and against direct sunshine.
- The content of dust, acid, corrosive gas in the surrounding air or substance cannot exceed normal standard.
- Take care that there is sufficient ventilation during welding. There must be at least 30cm free distance between the machine and wall.

§4.3 Operation Notices

- Read Section §1 carefully before starting to use this equipment.
- Connect the ground wire with the machine directly.
- Ensure that the input is single-phase: 50/60Hz, 230V ±10%.
- Before operation, none concerned people should not be around the working area and especially children. Do not watch the arc in unprotected eyes.
- Ensure good ventilation of the machine to improve Duty Cycle.
- Turn off the engine when the operation finished for energy consumption efficiency.
- When power switch shuts off protectively because of failure. Don’t restart it until problem is resolved. Otherwise, the range of problem will be extended.
- In case of problems, contact your local dealer if no authorized maintenance staff is available!

§5 Welding trouble shooting

§5.1 MIG welding trouble shooting

The following chart addresses some of the common problems of MIG welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	**Excessive Spatter**	Wire feed speed set too high	Select lower wire feed speed
		Voltage too high	Select a lower voltage setting
		Wrong polarity set	select the correct polarity for the wire being used - see machine setup guide
		Stick out too long	Bring the torch closer to the work
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal
		Contaminated MIG wire	Use clean dry rust free wire. Do not lubricate the wire with oil, grease etc
		Inadequate gas flow or too much gas flow	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set the gas flow between 6-12 l/min flow rate. Check hoses and fittings for holes, leaks. Protect the welding zone from wind and drafts
2	**Porosity - small cavities or holes resulting from gas pockets in weld metal.**	Wrong gas	Check that the correct gas is being used
		Inadequate gas flow or too much gas flow	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min flow rate. Check hoses and fittings for holes, leaks etc. Protect the welding zone from wind and drafts
		Moisture on the base metal	Remove all moisture from base metal before welding
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal
		Contaminated MIG wire	Use clean dry rust free wire. Do not lubricate the wire with oil, grease etc
		Gas nozzle clogged with spatter, worn or out of shape	Clean or replace the gas nozzle
		Missing or damaged gas diffuser	Replace the gas diffuser
		MIG torch euro connect O-ring missing or damaged	Check and replace the O-ring
3	**Wire stubbing during welding**	Holding the torch too far away	Bring the torch closer to the work and maintain stick out of 5-10mm
		Welding voltage set too low	Increase the voltage
		Wire Speed set too high	Decrease the wire feed speed

4	**Lack of Fusion − failure of weld metal to fuse completely with base metal or a proceeding weld bead.**	Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal
		Not enough heat input	Select a higher voltage range and/or adjust the wire speed to suit
		Improper welding technique	Keep the arc at the leading edge of the weld pool. Gun angle to work should be between 5 & 15° Direct the arc at the weld joint Adjust work angle or widen groove to access bottom during welding Momentarily hold arc on side walls if using weaving technique
5	**Excessive Penetration − weld metal melting through base metal**	Too much heat	Select a lower voltage range and /or adjust the wire speed to suit Increase travel speed
6	**Lack of Penetration − shallow fusion between weld metal and base metal**	Poor in incorrect joint preparation	Material too thick. Joint preparation and design needs to allow access to bottom of groove while maintaining proper welding wire extension and arc characteristics Keep the arc at the leading edge of the weld pool and maintain the gun angle at 5 & 15° keeping the stick out between 5-10mm
		Not enough heat input	Select a higher voltage range and /or adjust the wire speed to suit Reduce travel speed
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal

§5.2 MIG wire feed trouble shooting

The following chart addresses some of the common WIRE FEED problems during MIG welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	**No wire feed**	Wrong mode selected	Check that the TIG/MMA/MIG selector switch set to MIG position
		Wrong torch selector switch	Check that the Wire Feeder /Spool Gun selector switch is set to Wire Feeder position for MIG welding and Spool Gun when using the Spool gun

2	**Inconsistent / interrupted wire feed**	Adjusting wrong dial	Be sure to adjust the wire feed and voltage dials for MIG welding. The amperage dial is for MMA and TIG welding mode
		Wrong polarity selected	Select the correct polarity for the wire being used - see machine setup guide
		Incorrect wire speed setting	Adjust the wire feed speed
		Voltage setting incorrect	Adjust the voltage setting
		MIG torch lead too long	Small diameter wires and soft wires like Aluminum don't feed well through long torch leads - replace the torch with a lesser length torch
		MIG torch lead kinked or too sharp angle being held	Remove the kink, reduce the angle or bend
		Contact tip worn, wrong size, wrong type	Replace the tip with correct size and type
		Liner worn or clogged (the most common causes of bad feeding)	Try to clear the liner by blowing out with compressed air as a temporary cure, it is recommended to replace the liner
		Wrong size liner	Install the correct size liner
		Blocked or worn inlet guide tube	Clear or replace the inlet guide tube
		Wire misaligned in drive roller groove	Locate the wire into the groove of the drive roller
		Incorrect drive roller size	Fit the correct size drive roller eg; 0.8mm wire requires 0.8mm drive roller
		Wrong type of drive roller selected	Fit the correct type roller (e.g. knurled rollers needed for flux cored wires
		Worn drive rollers	Replace the drive rollers
		Drive roller pressure too high	Can flatten the wire electrode causing it to lodge in the contact tip - reduce the drive roller pressure
		Too much tension on wire spool hub	Reduce the spool hub brake tension
		Wire crossed over on the spool or tangled	Remove the spool untangle the wire or replace the wire
		Contaminated MIG wire	Use clean dry rust free wire. Do not lubricate the wire with oil, grease etc

§6 Maintenance & Troubleshooting

§6.1 Maintenance

In order to guarantee safe and proper operation of welding machines, they must be maintained regularly. Let customers understand the maintenance procedure of welding machines. Enable customers to carry on simple examination and inspections. Do your best to reduce the fault rate and repair times of welding machines to lengthen service life of arc welding machine. Maintenance items in detail are in the following table.

● **Warning: For safety while maintaining the machine, please shut off the main input power and wait for 5 minutes, until capacitors voltage already drop to safe voltage 36V!**

Date	Maintenance items
Daily examination	Observe that the knobs and switches in the front and at the back of arc welding machine are flexible and put correctly in place. If any knob has not been put correctly in place, please correct. If you can't correct or fix the knob, please replace immediately; If any switch is not flexible or it can't be put correctly in place, please replace immediately! Please get in touch with maintenance service department if there are no accessories. After turn-on power, watch/listen if the arc-welding machine has shaking, whistle calling or peculiar smell. If there is one of the above problems, find out the reason and clear it. If you can't find out the reason, please contact your local service repair station or distributor/Agent. Observe that the display value of LED is intact. If the display number is not intact, please replace the damaged LED. If it still doesn't work, please maintain or replace the display PCB. Observe that the min./max.Values on LED agree with the set value. If there is any difference and it has affected the normal welding results, please adjust it. Check whether the fan is damaged and whether it is normal to rotate or control. If the fan is damaged, please change immediately. If the fan does not rotate after the machine is overheated, observe if there is something blocking the blade. If it is blocked, please clear the problem. If the fan does not rotate after getting rid of the above problems, you can poke the blade by the rotation direction of fan. If the fan rotates normally, the start capacity should be replaced. If not, change the fan. Observe whether the fast connector is loose or overheated. If the arc-welding machine has the above problems, it should be fastened or changed. Observe whether the current output cable is damaged. If it is damaged, it should be insulated or changed.
Monthly examination	Using the dry compressed air to clear the inside of arc welding machine. Especially for clearing up the dusts on radiator, main voltage transformer, inductors, IGBT modules, fast recover diodes, PCB's, etc. Check the screws and bolts in the machine. If any is loose, please screw it tight. If it is shaved, please replace. If it is rusty, please erase rust on all bolts to ensure it works well.
Quarter-yearly examination	Check whether the actual current accords with the displaying value. If they did not accord, they should be regulated. The actual welding current value can be measured by and adjusted by plier-type ampere meter.
Yearly examination	Measure the insulating impedance among the main circuit, PCB and case, if it below 1MΩ, insulation is thought to be damaged and need to change, and need to change or strengthen insulation.

§6.2 Troubleshooting

- **Before the welding machines are dispatched from the factory, they have already been tested and calibrated accurately. It is forbidden for anyone who is not authorized by our company to do any change to the equipment!**
- Maintenance course must be operated carefully. If any wire becomes flexible or is misplaced, it maybe potential danger to user!
- Only professional maintenance staff that is authorized by our company could overhaul the machine!
- **Be sure to shut off the Main Input Power before doing any repair work on the welding machine!**
- If there is any problem and there is no authorized professional maintenance personal on site, please contact local agent or the distributor!

If there are some simple troubles with the welding machine, you can consult the following Chart:

NO.	Troubles		Reasons	Solution
1	Close the breaker, but the power light isn't on		Breaker damaged	Change it
			Fuse damaged	Change it
			Input power damaged	Change it
2	After welding machine is over-heat, the fan doesn't work		Fan damaged	Change it
			The cable is loose	Screw the cable tight
3	Press the gun switch, no output shielded gas	No output gas when test gas	No gas in the gas cylinder	Change it
			Gas hose leaks gas	Change it
			Electromagnetic valve damaged	Change it
		Output gas when test gas	Control switch damaged	Repair the switch
			Control circuit damaged	Check the PCB
4	Wire-feeder doesn't work	Wire reel doesn't work	Motor damaged	Check and change it
			Control circuit damaged	Check the PCB
		Wire reel works	The press wheel is loosen or weld wire skids	Press it tightly again
			The wheel doesn't fit with the diameter of weld wire	Change the wheel
			Wire reel damaged	Change it
			Wire feed pipe is jammed	Repair or change it
			Tip is jammed because of splash	Repair or change it

5	No striking arc and no output voltage	Output cable is connected incorrectly or loosen	Screw it down or change it
		Control circuit damaged	Check the circuit
6	Welding stops, and alarm light is on	Machine has self-protection	Check over-voltage, over-current, over-temperature, lower-voltage and over-temperature, and solve it
7	Welding current is run away and can be not controlled	The potentiometer damaged	Check or change it
		The control circuit damaged	Check the circuit
8	The crater current can be not adjusted	The PCB damaged	Check it
9	No post-gas	The PCB damaged	Check it

§6.3 List of error code

Error Type	Error code	Description	Lamp status
Thermal relay	E01	Over-heating (1st thermal relay)	Yellow lamp (thermal protection) always on
	E02	Over-heating (2nd thermal relay)	Yellow lamp (thermal protection) always on
	E03	Over-heating (3rd thermal relay)	Yellow lamp (thermal protection) always on
	E04	Over-heating (4th thermal relay)	Yellow lamp (thermal protection) always on
	E09	Over-heating (Program in default)	Yellow lamp (thermal protection) always on
Welding machine	E10	Phase loss	Yellow lamp (thermal protection) always on
	E11	No water	Yellow lamp (lack water) always on
	E12	No gas	Red lamp always on
	E13	Under voltage	Yellow lamp (thermal protection) always on
	E14	Over voltage	Yellow lamp (thermal protection) always on
	E15	Over current	Yellow lamp (thermal protection) always on
	E16	Wire feeder over load	
Switch	E20	Button fault on operating panel when switch on the machine	Yellow lamp (thermal protection) always on
	E21	Other faults on operating panel when switch on the machine	Yellow lamp (thermal protection) always on
	E22	Torch fault when switch on the machine	Yellow lamp (thermal protection) always on
	E23	Torch fault during normal working process	Yellow lamp (thermal protection) always on
Accessory	E30	Cutting torch disconnection	Red lamp blink
	E31	Water cooler disconnection	Yellow lamp (lack water) always on
Communication	E40	Connection problem between wire feeder and power source	
	E41	Communication error	

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