

MIG / MAG TORCHES
INSTALLATION AND OPERATIONAL PROCEDURES
MANUAL

SAFE HANDLING OF GAS CYLINDERS AND REGULATORS

Compressed gas cylinders should be handled carefully and should be adequately secured when stored and in use. Knocks, falls or rough handling may damage cylinders and valves causing leakage and potential accidents.

The following should be observed when setting and using gas cylinders.

1. Properly secure the cylinder
2. Before connecting a regulator, purge the valve of dust and debris
3. When the regulator is attached to the cylinder it should be in a fully closed condition. Once the cylinder valve has been opened slowly, the adjusting screw on the regulator should be adjusted slowly until the correct pressure is obtained.
4. When not in use the cylinder valve should be shut off and the regulator closed down.

METAL FUMES

The welding fumes generated in the MIG / MAG process can be controlled by general ventilation, localised exhaust or respiratory protective equipment. The method of ventilation required to keep the level of toxic substances in the breathing zone below acceptable occupational exposure levels depends on a number of factors. Among them, the material being welded, the type of gas and filler metal used, the size of the work area and the degree of normal air movement.

Each operation has to be evaluated on an individual basis to determine what will be required.

GASES

The major toxic gases associated with MIG/MAG welding processes are ozone, nitrogen dioxide, carbon monoxide and phosgene gas.

Ozone

Ozone concentration generally increases with welding current, argon based gases and highly reflective metals. If ozone cannot be reduced to safe occupational exposure limits by fume extraction, a fresh air supply via respirators or other means should be available.

Nitrogen Dioxide

Test results show that high concentration of nitrogen dioxide are found only within 150mm of the welding arc. With natural ventilation these concentrations are quickly reduced to acceptable levels if the welders breathing zone is free of the fume plume.

Carbon Monoxide

Only a minimal amount of carbon monoxide is created by MIG / MAG welding process although high concentrations are found temporarily in the welding fume plume. However the carbon monoxide oxidises to carbon dioxide such that carbon monoxide concentrations are insignificant more than 100mm from the welding plume.

When welders must work over the weld plume or where welding is performed in a confined space, fume extraction adequate to deflect the plume or remove the fumes and gases should be provided.

Phosgene Gas

The dangers of phosgene gas are normally attributable to the presence of cleaning and degreasing agents in the welding zone. Phosgene gas can be present as a thermal or ultraviolet decomposition of chlorinated hydrocarbon cleaning agents such as trichlorethylene and perchlorethylene. Degreasing or other cleaning operations involving chlorinated hydrocarbons should be performed where vapours from these operations, are not exposed to radiation from the welding arc.

RADIANT ENERGY

The levels of ultra violet radiation produced by the MIG / MAG welding process generally increases with current. The highest intensities are produced with argon based gases and when welding aluminium and stainless steel.

Welders should be fully clothed with dark leather or woollen clothing. Dark clothing reduces reflection particularly underneath the welding helmet where reflected ultraviolet burns can occur to the face and neck.

Ultraviolet radiation can cause disintegration of cotton based clothing.

To provide adequate protection for the eyes filter lenses conforming to BS679 should be used.

Suggested Filter Glass Shades for MIG/MAG GMAW

Welding Current A	Lowest Shade No	Rec Shade No
Under 60	7	9
60-160	10	11
160-250	10	12
250-500	10	14

To select the best shade for an application select the darkest recommended shade, if it is difficult to see the operation properly select successively lighter shades until the operation is sufficiently visible for good control. However, do not go below the lowest recommended shade.

ELECTRIC SHOCK

Input voltages to power supplies can vary from 24 volts to 415 volts. Welders and service personnel should exercise caution during maintenance and service procedures.

Power source open circuit voltage can be 30 volts, ensure worn or damaged torch insulators are replaced immediately.

GENERAL

Keep the work area tidy and clean to prevent fire, slipping or tripping. When equipment is left unattached or is finished with, disconnect all mains and gas supplies. Never service or clean equipment with the power connected.

INSTALLATION

Your Parweld MIG/MAG Welding Torch has been supplied ready to weld. It has been supplied with the standard consumables denoted (*) in the product brochure.

To connect the torch to the power source:-

1. Remove the tip adaptor and contact tip
2. Inch the wire from the exit of the wire guide on the feed unit as **Figure 1**. Ensure that it does not short out on any machine panels.
3. Carefully slide the electrode wire into the torch liner and slowly locate the torch gun plug body into the feed unit central connector and tighten the gun plug nut as **Figure 2**.

Figure 1

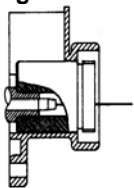
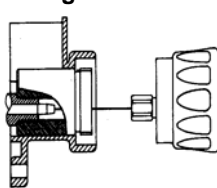


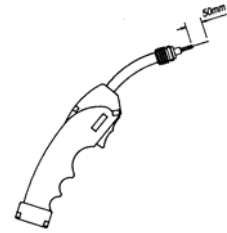
Figure 2



Note; To aid the initial location of a new torch and to prevent damage to the gas nipple O-ring a very light application of grease to the O Ring is beneficial.

4. Keeping the torch as straight as possible, use the power source inch facility or torch trigger to feed the electrode wire 50mm from the end of the liner conduit as **Figure 3**.

Figure 3



Once the electrode wire has stopped, refit the tip adaptor, diffuser, contact tip and gas nozzle.

Trim the electrode wire to within 5mm of the face of the nozzle, this will facilitate jolt free arc initiation.

Press the gas purge button and check the gas flow is adequate for your application.

An inexpensive flow meter is available from Parweld reference 806001.

5. If you are setting a water-cooled torch ensure you have the recommended water flow rate.

Note. It is essential to ensure adequate flow of clean, cool water to prevent irreparable torch failure, a minimum of 1.2 l/m is recommended.

Parweld recommend the use of its XTS water recirculation system designed specifically for use with all water cooled Mig, Tig and Plasma welding torches.

The Parweld XTS recirculation equipment can be fitted with a fail-safe flow protection device to prevent overheating or meltdown.

Note. Water flows into the torch through the blue hose. The blue hose delivers cold water directly to the prime source of heat, the swan neck and consumables. The recirculated water is then passed through the torch power cable to cool the power cable as it is returned to the cooler through the red water return lead.

Ensure all air is removed from the water cooling circuit before welding.

OPERATION

Once the installation guidelines have been followed you are ready to weld.

When using the torch do not exceed the published current carrying capacity and duty cycle ratings.

DUTY CYCLE

The duty cycle of a torch expresses the maximum time a torch can deliver its rated output during a test period without exceeding the temperature limits of its components.

European ratings are based on a 5 minute cycle. Therefore a 60% duty cycle implies a 3 minutes weld period followed by a 2 minute break.

American (NEMA) ratings are generally based on a 10 minutes cycle. Therefore a 60% duty cycle implies a 6 minutes maximum rated output followed by a 4 minute break.

A 100% duty cycle in both cases is a continuous rating.

AIR COOLED TORCHES

Air cooled torches rely on the dissipation of heat from their component parts into the atmosphere. Welding current, voltage, ambient air temperatures and shielding gases affect torch performance.

WATER COOLED TORCHES

Water cooled torches rely on the re-circulation of forced cooled water to remove the heat generated by the process. Water-cooled are far more efficient than air-cooled. Water cooled torches are considerably lighter and consumable life expectancy is far higher resulting in greater run lengths, deposition rates and increased productivity.

Parweld advocate the use of an efficient water recirculation system and water cooled torch in any problematic or arduous production application.

KEY PERFORMANCE RELATIONSHIPS

Once the duty cycle limitations are understood, there are 3 key areas to understand for continual problem free productivity.

1. LINER SPECIFICATION

Liner performance is subject to many process variables, torch length, wire size, rigidity of liner material, surface characteristics of filler metal, the severity of cable kinkages, the duty cycle and heat generation of the process.

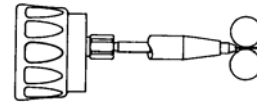
Ideally a liner should be as stiff as possible, maintain a tight tolerance over the electrode material without removing surface deposits or causing it to jar, and not suffer undue wear and tear as a reaction to the surface characteristics of the wire.

Note: Further guidance on liner choice can be found at this rear of this booklet.

2. DRIVE ROLL TO CONTACT TIP JUNCTIONS

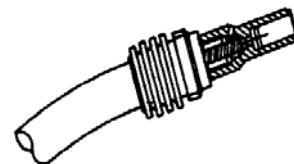
There are 3 junctions at which wire feed problems might occur in a torch circuit.

- a. At the point where the electrode wire is fed from the drive rolls through the wire guide



- b. The point at which the wire leaves the wire guide and enters the torch

- c. The point at which the wire leaves the torch liner and enters the tip adaptor.



It is imperative that there are no spaces at any of these junctions where the electrode wire can 'free wheel'.

Note. When soft liner material like Teflon or Carbon Teflon are the preferred choice a short section of the same material should replace the standard steel wire guide used to pick up the wire from the drive rolls.

3. CONTACT TIPS

It is important for trouble free arc conditions to maintain a smooth transition of the filler metal through the contact tip whilst maintaining maximum contact for current transfer.

As the working temperature of a contact tip increases, the component material expands in all directions, therefore shrinking the bore.

Contact tips are manufactured with strict bore tolerances to provide the best possible current transfer. Normal tolerances allow for bore shrinkage as the tip gets hot. However under certain process variations, particularly aluminium welding in argon gas, the tip bore constricts to the point at which wire feed problems occur. When this happens you should change to the next available bore size.

Arc initiation from cold can be problematic on shorter variations of contact tip when

bore size has been increased to alleviate wire feed problems when the tip is hot. Under these circumstances longer style contact tips should be used to increase electrode to contact tip surface contact when the tip is cold.

Contact tips made of harder copper alloys such as chrome zirconium or higher conductivity coppers are an option for problematic wires or increased performance under normal conditions.

MAINTENANCE, SERVICE TIPS AND ADVICE.

Full torch specifications and parts are available in the product brochures.

- Always keep the torch cables as straight as possible during use, If any burnback occurs release the torch trigger immediately. Remove the contact tip, free the wire and clean or renew the contact tip as necessary. If the wire between the drive rolls has been scored it must be cut off and new wire fed through the torch. If this is not done the damaged wire will jam in the contact tip and cause another burnback.
- When installing a new reel of wire always blow out the torch liner with dry compressed air or shielding gas to clear any build up of dust or wire residue.
- Always ensure adequate gas and water flow prior to welding.
- The inclusion of a torch coolant containing corrosive retardants is strongly recommended in the water supply.
- If the torch has not been used for more than 10 minutes purge the gas hose before starting the next weld.
- Periodically remove the nozzle, nozzle insulators, diffuser and contact tip and inspect for wear or damage. Any worn or damaged parts should be replaced immediately. This is particularly important with insulation items to prevent short circuit of the swan neck and consumables to the workpiece.
- The regular use of an anti-spatter compound will prevent spatter build up and reduce adhesion to consumable parts.
- The use of silicon coated wipers over the wire, before the drive rolls helps prevent coating residue entering the torch liner.

FUME EXTRACTION TORCHES

To maintain efficient air flow it is important to periodically remove the heavy fume deposits that gather on the internal torch and cable parts.

It is recommended that at regular intervals fume deposits that will have gathered and congealed in the fume torch are either 'blown out' or vacuumed.

The speediest way to achieve this is to remove the extraction nozzle chamber from the front of the torch and remove both worn clips from the front and rear of the outer fume hose.

Compressed air can then be blown into the torches at several points to help remove fume deposits. (Ensure that the appropriate respiratory equipment and eye protection is used.) For a more thorough clean, the handle and rear end of the torch can be stripped to allow complete access to all points.

Parweld recommends the use of its XTR fume extraction system designed with maximum features for delivering trouble free performance with 'on torch' extraction.

LINER INSTALLATION

For consistent wire feed it is imperative to always have the liner in a compressed state between the tip adaptor and liner-retaining nut.

To achieve this:

1. Lay the torch in a straight line.
2. Remove the nozzle and tip adaptor
3. Remove the liner retaining nut and old liner.
4. Insert the new liner and replace liner retaining nut.
5. Trim the liner within 50mm of the end of the torch.
6. Depending on the tip adaptor configuration, re-shorten the liner conduit protruding from the swan neck until the tip adaptor will just mate with the swan neck. This will then allow sufficient liner compression as the tip adaptor is tightened.
7. Ensure any interior or exterior burrs are removed and refit the consumables.

Full specification and parts identification numbers are available in the individual product brochures or direct on www.parweld.com

QUICK FAULT ANALYSIS OF INOPERATIVE TORCH.

In most cases, the process of elimination is best started by establishing if the problem is a mechanical fault or a torch fault. This is best done by removing the torch and checking the feed unit for consistent wire feed and gas delivery by either using the feed systems gas purge and wire inch facilities or manually short circuiting the female sockets on the central connector.

Warning. The switch wire circuiting carries a potentially harmful voltage, ensure fully insulated pliers are used.

Once the torch or feed unit problem is identified follow this quick procedure.

- Check male pins of torch, if broken replace.
- Using appropriate test equipment check torch switch circuitry.

If the torch switch circuitry is **operative**, the problem must be the mating between the male pins on the torch and the female pins on the central connector. Improper care when fitting the torch to the feed unit will result in the female central connector sockets pushing back into the central connector. Once this has happened they must be replaced.

Parweld fit spring loaded contact pins to prevent this.

If the torch circuitry is **inoperative**

- Check the torch switch
- Check for switch wire break in the coaxial cable

TROUBLE SHOOTING GUIDE FOR MIG/MAG/GMAW TORCHES

- 1. Wire feed unit operates but no gas flow**
Gas cylinder empty
Gas regulator closed
Faulty solenoid
Restriction in torch cables
- 2. Wire feed unit operates, but does not feed**
Insufficient drive roll pressure
Incorrect drive rolls
Excessive wire spool brake tension
Incorrect liner
Blocked liner
Bird nesting
Burnback
- 3. Bird nesting**
Excessive feed roll pressure
Incorrect or blocked liner
Incorrect contact tip size

Contact tip overheating
Restriction in torch cable
Misaligned drive rolls or wire guides
Excessive cable kinkage

4. Burnback

Improper voltage setting
Improper stick out
Erratic wire feed
Incorrect or blocked liner
Contact tip overheating
Excessive cable kinking

5. Erratic Wire Feeding or Arc

Improper drive roll tension
Improper drive roll size
Worn drive rolls
Incorrect or blocked liner
Incorrect wire guide size
Misaligned drive rolls or wire guide
Gaps at liner or wire guide junctions
Incorrect contact tip size
Contact Tip overheating
Spatter adhesion on exit geometry of tip bore
Excessive cable kinkage
Poor earth or cable connections
Weld joint area dirty

LINER SPECIFICATIONS

In general, steel liners are the most durable and the popular choice for more common steel fabrications. For softer wires a smooth bore material is more suitable, Teflon usually being the first choice.

As well as looking at the liners themselves, it is also necessary to look at the way in which the torches are cooled before making a choice of liner;

Water Cooled torches remove the heat from the swan neck area and allow more choice of liner selection in difficult wire feed circumstances.

Air Cooled torches run hotter at the swan neck area, being cooled only by design, surface area and ambient air temperatures.

This restricts the choice of liner selection.

In all cases, the final selection is one that produces the best trouble free results.

If you need any advice choosing the correct liner for your needs, Parweld personnel are always ready to help.

- **Standard Steel Liners**

These are used mainly for water-cooled torches because the shielding gas has a separate delivery tube.

- **Plastic Coated Steel Liners**
These are used for air-cooled torches. The liner lies within the core-tube of the coaxial power cable which delivers the shielding gas, hence it needs to be plastic coated in order to prevent the shielding gas from leaking into the space between the wire and liner I/D. This liner will also prevent the drawing of air into the stream which would cause weld porosity.
- **Plastic Coated High Tensile Steel Liners**
As the description suggest, these liners are similar to the Plastic Coated Steel Liners but are made from a harder wearing steel which is suitable for higher duty cycles, heavier weld deposition rates and stiffer wire materials.
- **Nylon Liners**
These are used only with low duty, low amp torches since the material will melt at temperatures in the region of 70-100°C.
- **Teflon Liners**
Teflon is well known for its 'non stick' qualities. These liners are recommended for difficult wire feed applications such as soft wires. Please bear in mind that Teflon will degrade at temperatures over 200°C and in most cases we would suggest that these liners are used only on water-cooled torches and low amp air cooled, or used in conjunction with a swan neck liner.
- **Outer Steel with Teflon Core Liners**
These liners are similar to the standard Teflon Liners but have the added strength of the outer steel to help protect the shape of the inner Teflon tube from distortion.
- **Carbon Teflon Liners**
The addition of carbon, which is a hard material, makes the liner more robust than Teflon liners. This sort of liner may well be the most suitable solution for very stiff or abrasive wires.
- **Polyamide Liners**
These liners are similar in application to the standard Teflon liners but the material is stiffer than Teflon and therefore more suitable for very soft wires. Polyamide materials degrade at around 150°C.