

PAC / PAG

PLASMA ARC CUTTING AND
PLASMA ARC GOUGING INSTALLATION AND
OPERATIONAL PROCEDURES MANUAL

SAFE HANDLING OF GAS CYLINDERS & REGULATORS

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

The following should be observed when setting up and using cylinders of Gas:

1. Properly secure the cylinder.
2. Before connecting a regulator purge the valve of dust and debris.
3. When a regulator is attached to a 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.

FUMES AND GASES

The PAC process produces fumes and gases which can harm your health. The composition and rate of generation of fumes and gases depends on many factors including arc current, cutting speed, material being cut, and gases used. The fume and gas by products will usually consist of the oxides of the metal being cut, ozone, oxides of nitrogen and phosgene gas.

These fumes must be removed from the work area or eliminated at the source by an appropriate exhaust system.

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.

NOISE

The amount of noise generated by a PAC torch operated in the open depends primarily on the cutting current. A torch operating at 400A typically generates approximately 100dBA measured at about 6 feet. At 750A the noise is in the frequency range of 5000-20000 HZ. Such noise levels damage your hearing.

Hearing protection should be worn when the noise level exceeds specified limits.

RADIATION

The plasma arc emits intense visible and invisible radiation (ultraviolet and infrared)

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 rapid 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 Plasma

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

ELECTRIC SHOCK

The electrical voltages used in plasma cutting equipment range from 100 to 400 volts.

Under no circumstances should the torch be used partially assembled or with any visible signs of cracks or cuts in torch bodies or cables.

GENERAL

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

INSTALLATION

Prior to installation it is important to check that all consumable parts are correctly fitted to the torch head in accordance with the amperage and cutting requirements.

Note: It is only necessary to fit the constricting nozzle and insulating cap finger tight. The electrode should always be fitted with the appropriate electrode tool.

Once the torch is connected to the power source use the purge button or the torch switch to check the input of airflow and pressure gauges. It is imperative that the recommended

flow rates specified in the Plasma torch brochure are strictly adhered to.

If the Plasma arc torch is run without an adequate supply of dry compressed air / gas the torch head will be damaged by internal arcing.

It is therefore recommended that an adequate gas pressure switch is present in the gas supply system. This pressure switch will also render the torch inoperative if there is a gas supply failure.

High current torches are normally water-cooled and it is recommended that an adequate water flow protection device is present to shut the power supply off if a failure in coolant flow or a restriction in current flow occurs.

Parweld recommend the use of its XTS water recirculation system designed specifically for use with the majority of plasma cutting torches.

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

Note: Water flows into a torch and is delivered directly to the prime source of heat, the torch body and consumables. The recirculated water is then passed through the power cable to cool the power cable and is then returned to the cooling system.

Ensure you have all air removed from the water-cooling circuit before cutting.

OPERATION

Once the desired cutting amperage and correct bore tip have been fitted, all gas and water pressures checked, you are ready to cut.

If a torch guide or buggy is to be used ensure the correct torch to work piece stand off distance is set.

Positioning the Hand Torch for a Cut

Place the torch at the edge of the metal to be cut. Once the trigger is depressed a short arc known as the pilot arc will ignite. This arc is issued to ionise the plasma gas prior to the initiation of the main arc current. As the torch is moved over the base metal the main arc current will initiate and begin the cutting process. In order to maintain the quality of the cut it is important to maintain the correct cutting speed for the application.

If it necessary to begin a cut away from an edge it is important to angle the torch head approximately 30° to pierce the base metal prior to returning it to a cutting position and continuing the cut.

Piercing causes severe tip and electrode wear (similar to metal gouging) and should be restricted to short runs. (3 to 5 seconds) and smaller plate thickness than the plate capacity of the torch.

Alternatively use a drilled hole through the work piece for a cut edge start.

PLASMA ARC GOUGING

Plasma arc gouging is an adaptation of the plasma cutting process. For gouging arc constriction is reduced resulting in a lower arc stream velocity. The temperature of the arc and the velocity of the gas stream are used to expel metal in a similar manner to other gouging processes. A major difference compared to other gouging processes is that the gouge is bright and clean particularly on non-ferrous metals.

The torch is held at an angle to the base metal which spreads the arc. Moving the torch in the direction of the arc removes the metal.

An increase in head angle will increase the depth of the gouge. The balance of travel speed and head angle will require practice.

If any operational problems occur consult the troubleshooting section at the back of this guide

It should be noted that the electrode and cutting nozzle wear much quicker when gouging.

Care should be taken to periodically inspect the wear parts of the torch. The higher the amperage the greater the wear rate. Generally replace the nozzle tip when the edges of the cut are no longer symmetrical or cutting speed has been reduced.

Replace the electrode once a wear rate of 1.5mm is evident on the insert.

Wear rates and consumable life expectancy vary from torch to torch.

Further advice and recommendations for the plasma cutting and gouging process are available in the Plasma Arc Cutting Process Synopsis available on www.parweld.com.

MAINTENANCE, SERVICE TIPS AND ADVICE

Plasma Arc Cutting

Single Gas (Compressed Air) Style Torches

1. The **quantity** and **quality** of the gas flow rate through the torch body is paramount for the successful application of the torch.
2. The technical data supplied with each torch will state the gas supply required as **pressure** (bar) and **flow rate** (litre. min) values.
3. Within the torch body design the gas flow is separated to provide the cooling gas and plasma cutting gas. (Approximate ratio 9:1)
4. When installing a conversion kit torch it is strongly **recommended** that the flow rate through the cutting tip is measured using a simple flow meter to ensure the correct flow rate delivery (usually 25 litre / min) and no restrictions are present.
5. When the compressed air supply is from a shared supply source it is important that the flow rate and pressure remains constant, a fluctuating supply might cause arc-out during cutting and mislead the operator into suspecting a product fault.

Note. To covert litre / min to cubic feet / min (CFM) multiply by 0.0353

For example; 200 lit / min = 7 cuft / min

Pressure 1 bar = 14.7lbs / sq in

For example 5 bar = 73.5lbs / sq in

- Never replace consumables or carry out maintenance on the torch unless the power source is fully isolated.
- Purge the torch system for a minimum of 3 minutes before use
- Check all gas and water inlet flow pressures prior to use
- Never over tighten consumables on the torch head. Use the appropriate electrode tools.
- Allow sufficient post flow to cool the torch head and consumables after cutting
- Never attempt to remove consumables whilst the torch head is hot
- Investigate any resistance noted when installing new parts and clean threads if necessary

- Use only clean, dry air to the specified quality. The Plasma power source should be supplied by a compressor with a 25% greater capacity than the required flow. Ensure the air filter and regulator are regularly maintained.
- Always replace spare parts immediately when they are worn
- Using the electrode beyond its recommended wear distance may result in irreparable damage to the torch head
- If at any time a green cutting flame is witnessed cease cutting immediately.

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

TROUBLESHOOTING GUIDE FOR PLASMA CUTTING TORCHES

1. **Failure to Establish a Pilot Arc**
Check input plasma gas pressure
Purge the torch cables to ensure there is no water in the plasma gas stream
Check condition and tightness of consumables.
Check all torch connections.
2. **Failure to Transfer the Main Arc**
Check all earth return leads
Check all torch connections
Check work to nozzle distance
3. **Insufficient Penetration**
Current insufficient for material thickness
Cutting speed is too fast
Poor earth connection
Cutting tip worn
4. **Main Arc Extinguishes**
Cutting speed too low
Electrode badly worn
Stand off set too high
5. **Cut is at an angle**
Cutting tip worn
Air pressure incorrect or flow restricted
Travel speed too high
6. **Poor consumable life**
Current too high for consumables
Poor air quality
Poor air pressure
7. **Heavy Dross**
Poor air pressure or flow restriction
Cutting speed too low
Amperage setting too low for material thickness.