

# Manual



**migmate**

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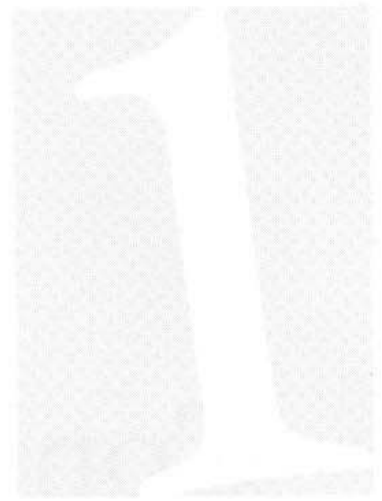
# Contents.

1	INTRODUCTION	22	MASK ASSEMBLY
3	THE EQUIPMENT	23	ACCESSORIES
4	SPECIFICATIONS	24	MAIN CIRCUIT DIAGRAMS
5	SETTING UP	26	115V MK2 & MIG 3F PCB's
10	INDICATOR CHARTS	27	220/240V MK2 PCB
11	100/120 (SETTINGS)	28	220/240V AUSTRALIAN PCB
13	GASLESS (SETTINGS)	29	220/240V MIG 3F PCB
14	STARTING TO WELD	30	PARTS LISTS
17	WELDING PROBLEMS	32	APPENDIX 1
19	TORCH POSITION	33	SAFETY
20	TORCH TYPE T		
21	TORCH TYPE B		

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# Introduction.



With this welding unit you can now experience the many advantages of the Mig/Mag welding process. This unit will enable you, with the help of this booklet and a little practice, to obtain a professional finish in welding car bodywork, and many other uses for which you will find it ideal.

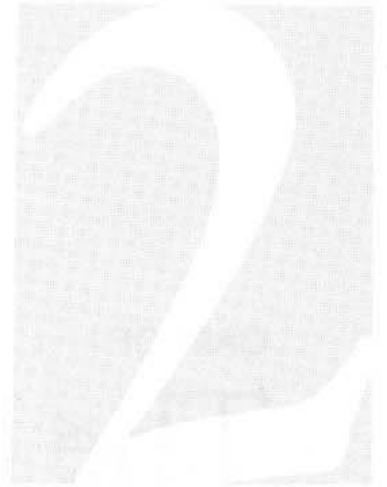
## **THE MIG/MAG WELDING PROCESS:**

This welder produces a direct current output (DC), enabling an arc to be struck between a continuously fed consumable electrode (wire) and the work piece. The current passes to the wire through the small copper contact tip. The wire is fed through the tip by the wire feed rollers mounted on a DC drive motor within the machine. This wire melts in the arc and is transferred to the weld pool in the form of droplets.

The gas which is passed down through the torch and exits around the shroud, shields the arc and molten metal protecting it from the effects of oxygen and nitrogen in the atmosphere. In the gasless machine this gas is produced when the core of the self shielding wire is heated.

The welding current is determined by the wire feed speed and the welding voltage. The current will increase with greater wire speed.

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If the wire speed is too high for the welding voltage, the wire dips into the molten pool and does not melt. If the voltage is too high for the speed, there will be excessive spatter. Therefore, there are practical limits to the wire speed settings for a given size of wire at a particular voltage setting.

The Mig/Mag process results in a low heat input to the work piece, giving low heat spread and distortion which combine with ease of use, and clean neat welds to make it the ideal process for a multitude of jobs particularly on thin material.

**GUARANTEE:**

This welder is fully guaranteed, for 12 months from the date of purchase. The unit will be repaired free of charge with the exception of damage caused due to lack of proper maintenance, mis-use or tampering with the unit, and replacement of parts requiring normal replacement after a period of work, eg. tips, shrouds, liners, etc.

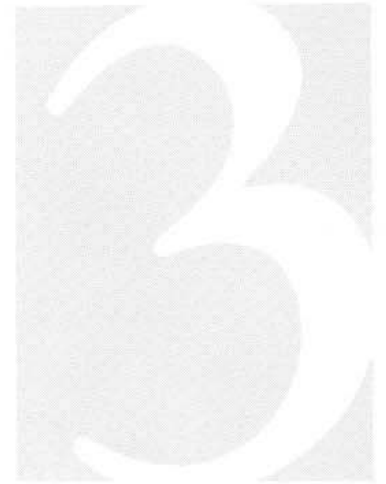
If your welder proves faulty during the guarantee period, it should be returned to the place of purchase together with the original receipt.

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CARE OF

# The Equipment.



## **TIPS:**

The tip should be replaced if it becomes burnt or worn as otherwise a poor contact and hence poor welding will result.

## **SHROUDS:**

The shroud must always be kept clear of spatter, particularly when welding with CO<sub>2</sub> and replaced if it becomes damaged.

## **LINER:**

The torch liner will require replacement after prolonged periods of use.

## **WIRE:**

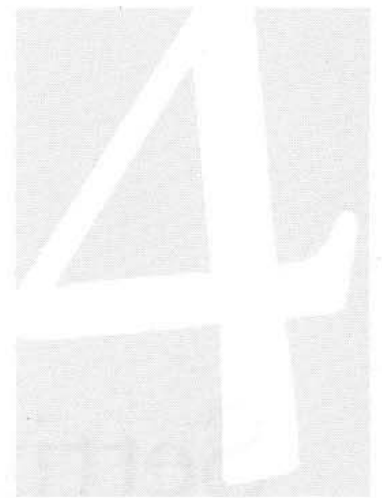
Welding wire should always be stored in dry conditions, and be protected from dirt and contamination. This is to avoid oxidation of the surface of the wire, which leads to jamming and a poor electrical contact. Also, reels which are stored in such a way that the reel becomes loose or tangled can present difficulties.

## **GAS:**

When using small disposable bottles always unscrew the regulator from the gas bottle when you have finished welding, this will avoid wasting any of the gas. When using refillable bottles with a valve, always switch off valve after use.

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# Specifications.



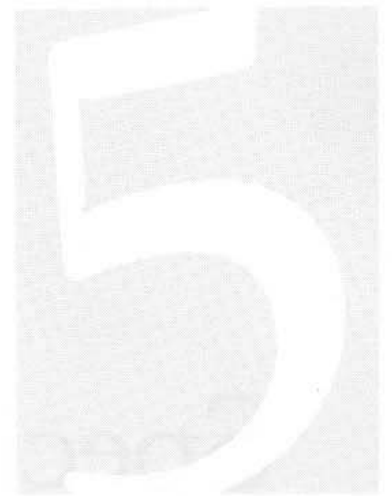
MODEL	100 AMP WELDER	120 AMP WELDER	GASLESS WELDER
WELDING CURRENT	35-100 AMPS	35-120 AMPS	35-100 AMPS
OPEN CIRCUIT VOLTAGE	20-27 VOLTS	20-30 VOLTS	20-27 VOLTS
INPUT VOLTAGE	240V 220V 115V	240V 220V 115V	240V 220V 115V
FUSE RATING	13A(10A AUS.) 15A 20AD	13A(10A AUS.) 15A 20AD	13A(10A AUS.) 15A 20AD
WELDABLE WIRE	0.6mm (.024")/0.8mm (.030") STEEL/STAINLESS STEEL 0.8mm (.030") ALUMIN.	0.6mm (.024")/0.8mm (.030") STEEL/STAINLESS STEEL 0.8mm (.030") ALUMIN.	0.8mm (.030")/0.9mm (.035") SELF SHIELDING WIRE
PACKED DIMEN. HxWxL	390x330x520mm 16x13x20ins	390x330x520mm 16x13x20ins	390x330x520mm 16x13x20ins
WEIGHT	24kg/48.5lbs	26kg/57lbs	24kg/48.5lbs

## GASES AVAILABLE:

- a. CARBON DIOXIDE (CO<sub>2</sub>) for Steel
- b. ARGON + CARBON DIOXIDE for Steel or Stainless Steel
- c. ARGON for Aluminium
- d. ARGON + OXYGEN for Stainless Steel (critical applications)

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# Setting Up.



## OBSERVE ALL SAFETY INSTRUCTIONS (PAGE 33)

### 1. ELECTRICAL:

1. This welder can be connected to a domestic supply socket. Connection to a suitable voltage through the recommended fuse supply must be made by a good quality (rubber preferred) plug or a suitable fused isolator switch, with the wire connected as follows:

Wire Colour		Pin Connection
Brown (or red)	Black	Live
Blue	or White	Neutral
Green/Yellow	Green	Earth/Ground

THIS APPLIANCE MUST BE EARTHED/GROUNDED.

(For certain markets a moulded on standard grounded plug is provided.)

### 2. FEEDING THE WIRE:

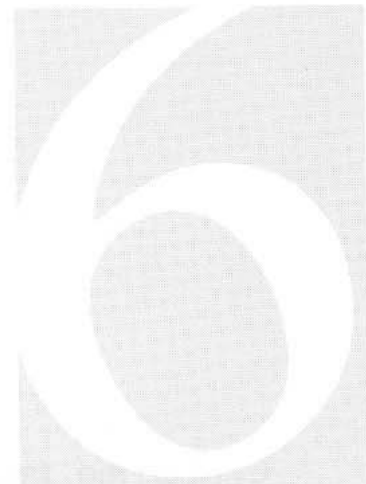
2. If the wire is not already fed through the Torch, or when fitting a new reel you will have to follow the procedure, as below:

a. Remove the Shroud from the Torch and unscrew the contact tip.

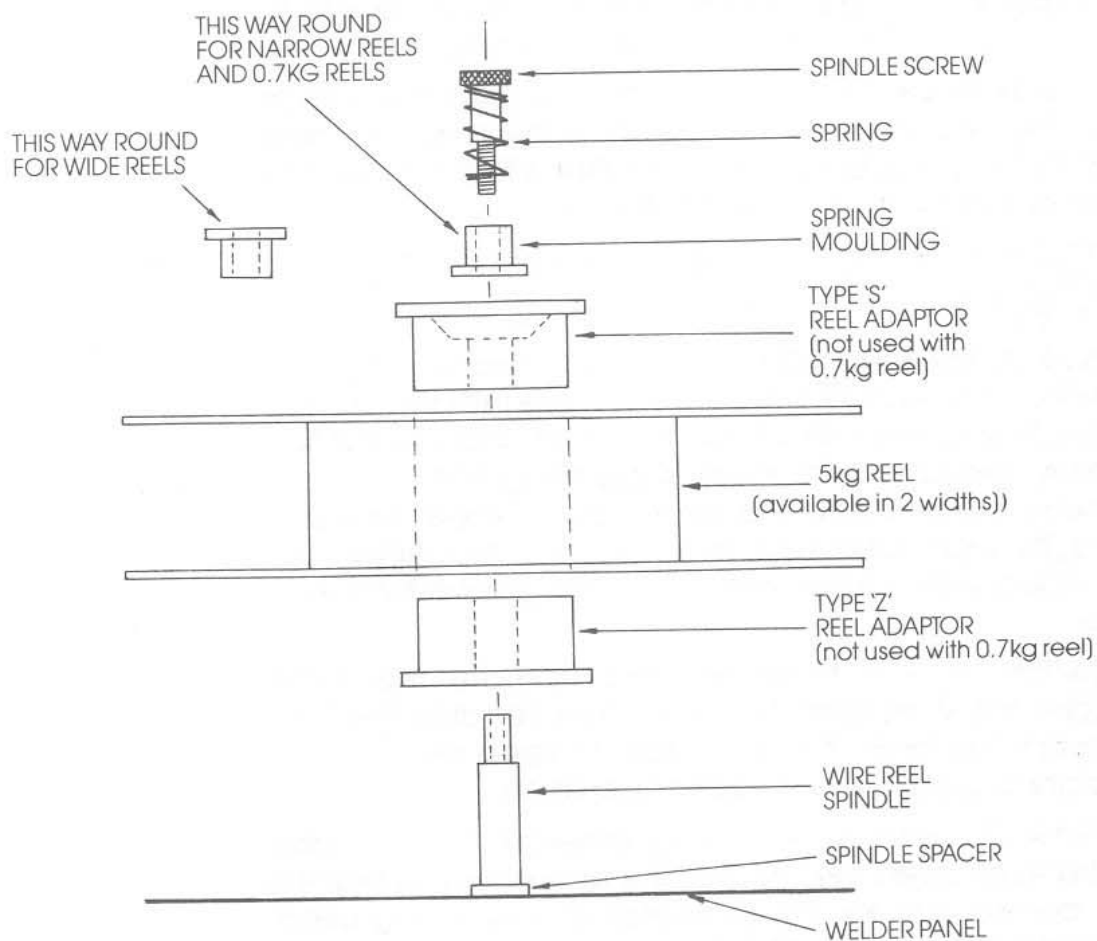
b. Fit Wire Reel onto Spindle. There are a set of Spacers which allow the use of various sizes of reels. Two sizes of wire reels can be fitted to the welder

i) 0.7kg reels fit straight onto the wire reel Spindle.

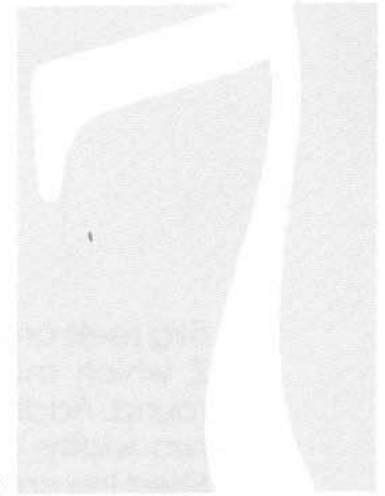
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- ii) 5kg reels are fitted using two spacers marked S & Z which must be assembled the correct way round. Additionally, the 5kg reels are available in two widths and the Spring moulding should be fitted the correct way round.







c. Find the free end of the wire which will be terminated in a hole on the reel rim. Remove the end from the hole and cut off any distorted wire with a pair of sharp wire cutters. Be careful not to allow the wire to unwind, which it will tend to do, as it is very springy.

d. Hinge back the Pressure Arm and feed the end of the wire into the hole in the end of the liner, ensuring that the wire has been fitted so that it is fed into the wire feed mechanism in a straight line.

e. Fasten down the Pressure Arm ensuring that the wire is in the groove in the Feed Roller.

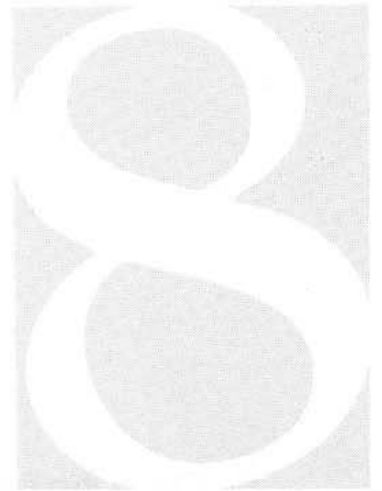
**N.B.** The feed roller for solid wire has two grooves, one for 0.6 wire and one for 0.8 . Ensure that the correct one is being used. To reverse the roller unscrew the two screws securing the roller supporting bracket and remove the bracket. The roller can now be removed from its shaft and reversed. Gasless machines are provided with a roller with a knurled groove for cored wire.

f. Switch on the machine and operate the Torch Trigger, the Wire Feed Roller will turn, feeding the wire through the Torch. It is advisable to keep the Torch as straight as possible during this operation.

g. When the end of the wire has emerged from the end of the Torch, feed the Tip onto the wire, ensuring that it is the correct size for the diameter of wire being used, tighten it and replace the Shroud.

The following setting up procedures do not apply to the gasless machine.

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### 3. FITTING GAS CYLINDER MOUNTING BRACKETS (where provided).

Fit the two brackets to the rear of the machine using the four self tapping screws provided. The rear of the machine has four punched holes for this purpose. N.B. The bracket with the larger hole should be uppermost.

### 4. CONNECTING THE GAS PIPE:

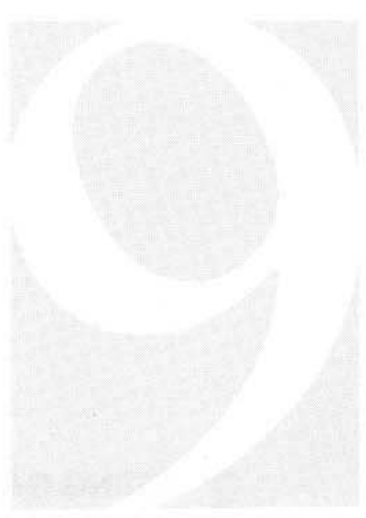
a. 4mm diameter nylon type. Connect the Gas Pipe to Cylinder by pushing the free end into the connector on the Regulator. (If required, the pipe can be detached again by pushing the pipe and the small ring around it into the fitting, and then pulling the pipe whilst maintaining the pressure on the ring.)

b.  $\frac{3}{16}$ " bore hose nylon type. On the back of the machine (lower left hand corner) is a hose fitting. Push one end of the hose firmly onto this fitting, and the other end onto the regulator. Secure each end with a hose clip.

### 5. FITTING GAS REGULATOR AND DISPOSABLE CYLINDER.

a. Remove the seal from the cylinder thread and depress slightly the valve pin to allow a small amount of gas to escape. The valve will close automatically when the pin is released.

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- b. Open the flowmeter tap completely by rotating the knob anti-clockwise (plastic type only).
  - c. Connect cylinder flowmeter by slowly screwing it in. Hand tighten only by gripping it on the lower moulding not on the clear moulding or flow control knob.
  - d. **Important:** Always detach flowmeter from cylinder when you have finished welding. This is to avoid small leakages that may occur in fittings and torches emptying the cylinder in the long run.

**N.B.** a. Due to local regulations, some machines are supplied with different types of regulators, either with or without a gas cylinder. For details see appendices at the back of the manual.

## 5. SETTING THE GAS FLOW:

- a. Release the Wire Pressure Arm.
  - b. Turn on the machine and operate the Torch Trigger.
  - c. **PLASTIC FLOWMETER/REGULATOR:** Adjust the flow to read approximately 3 on the gauge by turning the Control Knob on the Regulator anti-clockwise from its fully closed position.
  - d. **BRASS REGULATOR:** Turn the control knob fully clockwise and then turn back anticlockwise  $\frac{1}{2}$  - 1 turn depending on welding conditions.
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# Indicator Charts.

The following is intended as an approximate guide only to setting up the welder. The condition of the material, the position of the weld, and variations in technique will require modifications to the settings indicated. In particular, the wire-feed setting should be adjusted to suit the application. A practical rule of thumb is to adjust the arc according to its sound. A smooth crackling sound usually indicates a correct setting.

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FIG. A: VOLTAGE SETTING

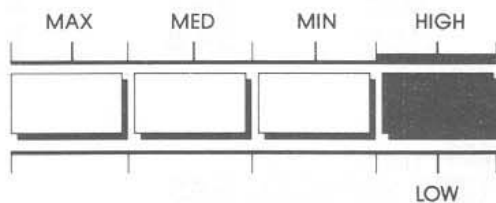
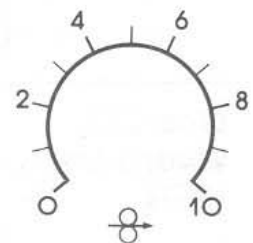


FIG. B: WIRE SPEED SETTING



**N.B.** Wire Feed speed is automatically adjusted when the voltage is selected. The wire speed setting control provides fine tuning.

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100/120 TYPICAL

# Settings.



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Set wire speed initially to the middle of the range suggested below for the selected voltage setting. Fine adjustment of the wire speed control can then be made to give a smooth crackling sound to the arc.

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## Mild Steel

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**Gas:** Argon/CO<sub>2</sub> Mixture

**Wire:** 0.6mm/.024" – 0.8mm/.030"

<b>Voltage Setting:</b>		<b>Material Thickness:</b>		<b>0.6φ</b>	<b>0.8φ</b>
				<b>Wire Speed Setting:</b>	
HIGH	MIN.	1.0/0.7mm	.039/.027"	2-4	2-3
	MED.	1.2/1.0mm	.047/.039"	3-5	2-4
	MAX.	1.5/1.2mm	.058/.047"	3.5-5.5	3-5
LOW	MIN.	1.5mm	.058"	4.5-6.5	4-6
	MED.	2.0mm	.078"	5-7	4.5-6.5
	MAX.	4.0mm	.156"	6-8	5.5-7.5

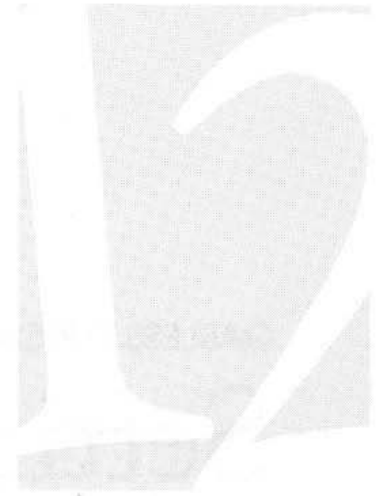
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**Gas:** CO<sub>2</sub>

**Wire:** 0.6mm/.024" – 0.8mm/.030" Mild Steel

HIGH	MIN.	NOT NORMALLY USED WITH CO <sub>2</sub> GAS			
	MED.	0.7mm	.027"	2.5-4.5	2-3
	MAX.	1.0/0.7mm	.039/.027"	3-5	2-4
LOW	MIN.	1.5/1.2mm	.058/.047"	3.5-5.5	4-6
	MED.	2.0mm	.078"	4-6	4.5-6.5
	MAX.	3.0mm	.125"	4.5-6.5	3.5-5.5

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## Stainless Steel

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**Gas:** Argon/Oxygen or Argon CO<sub>2</sub>

**Wire:** 0.8mm/.030" Stainless Steel

<b>Voltage Setting:</b>		<b>Material Thickness:</b>		<b>Wire Speed Setting:</b>
HIGH	MIN.	1.0/0.7mm	.039/.027"	2-3
	MED.	1.2/1.0mm	.047/.039"	2-4
	MAX.	1.5/1.2mm	.058/.047"	3-5
LOW	MIN.	2.0/1.5mm	.078/.058"	4-6
	MED.	3.0/2.0mm	.125/.078"	4.5-6.5
	MAX.	5.0/4.0mm	.200/.156"	5.5-7.5

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## Aluminium

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**Gas:** Pure Argon

**Wire:** 0.8mm/.030" Aluminium 5% Silicon Alloy

<b>Voltage Setting:</b>		<b>Material Thickness:</b>		<b>Wire Speed Setting:</b>
HIGH	MED.	1.5mm	.058"	9-10
	MAX.	2.0mm	.078"	9-10
LOW	MIN.	4.0mm	.156"	9-10
	MED.	5.0mm	.200"	9-10
	MAX.	6.0mm	.236"	9-10

**N.B.** Always start with maximum wire speed when using Aluminium.

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GASLESS TYPICAL

# Settings.



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## Mild Steel

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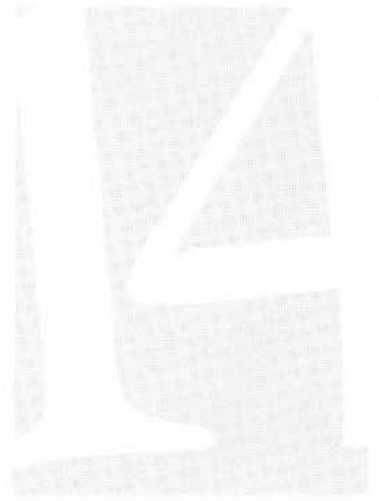
Wire: 0.8mm/.030" Self Shielding Wire

Voltage Setting:		Material Thickness:		Wire Speed Setting:
HIGH	MIN.	1.0/0.7mm	.039/.027"	1-1.5
	MED.	1.2/1.0mm	.047/.039"	1-2
	MAX.	1.5/1.2mm	.058/.047"	1-2
LOW	MIN.	1.5mm	.058"	1-2
	MED.	2.0mm	.078"	1-2
	MAX.	4.0mm	.156"	1-2

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# Starting to Weld.



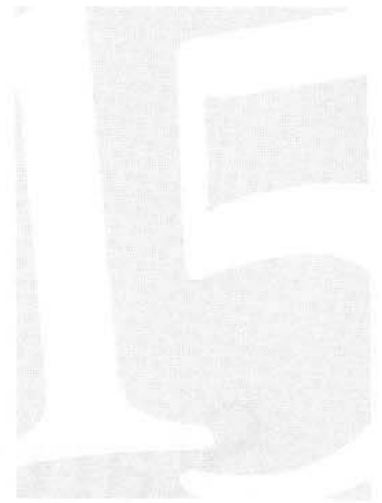
## BEFORE WELDING ENSURE THE FOLLOWING:

- a. Read safety section of these instructions.
- b. All oil, petrol and inflammable containers have been removed from the area.
- c. There is good all round ventilation, particularly at the rear and the side of the unit.
- d. You have an adequate fire fighting appliance on hand.
  1. Connect the earth clamp onto the metal to be welded (scrap material for first attempt).
  2. Set voltage and wire feed setting by turning or pressing the appropriate controls, see figs (A & B) according to the indicator charts, taking into account the material, material thickness and the gas.

**N.B.** a. Unless one of the push buttons marked MAX, MED or MIN is fully depressed the machine will not operate.

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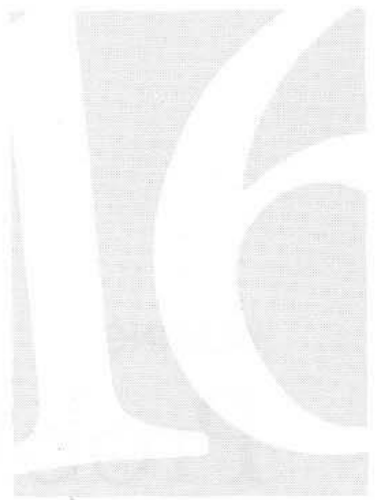


3. Plug in and switch on the machine.
4. Clip off any protruding wire to 3mm ( $\frac{1}{8}$ " ) from tip.
5. Position tip 6mm ( $\frac{1}{4}$ " ) from point where welding is to commence at angles, (see figs C & D p.18) depending on the welding direction to be used.
6. Hold the mask in front of your eyes.
7. Press the trigger and move the torch slowly in the chosen direction.
8. If the arc gives a humming sound and a blob tends to form on the end of the wire, you have insufficient wire feed speed and it should be increased.

OR If it gives an erratic sound with possibly a feel that the wire is stubbing against the work and excessive spatter, you have too much wire speed and it should be reduced.

When the speed is correct you will get a steady smooth crackling sound.

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9. If you have a porous weld you have insufficient gas flow and it should be increased or replace the cylinder if empty.

**N.B.** b. Normal Mig welders do not perform correctly in areas that are subject to wind or severe draughts as the gas is blown from the weld area.

10. If the weld has a stringy appearance you are moving the torch too quickly.

11. If the arc melts holes in the workpiece you are moving too slowly.

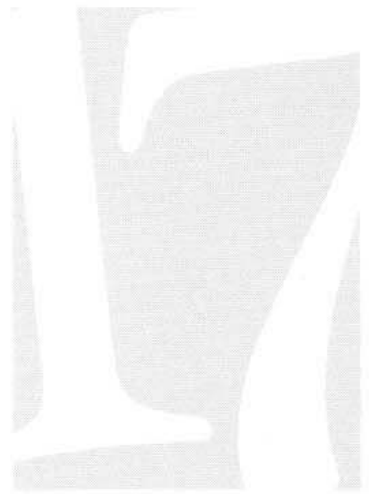
12. The unit is fitted with a Thermal Overload Cut-out which will prevent it from operating if the winding temperatures become too high due to over use. If the overload operates, switch off the machine and allow it to cool down. The Thermal Overload will re-set automatically after a short period when the windings have cooled, and you will be able to restart working.

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## WELDING

# Problems.



### WELD DEPOSIT 'STRINGY' AND INCOMPLETE:

- a. Torch moved over workpiece too quickly.
- b. Gas flow incorrect.

### WELD DEPOSIT TOO THICK:

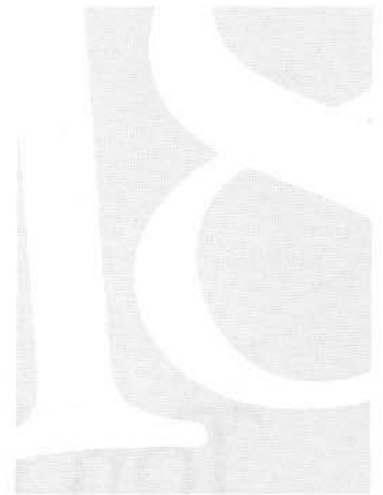
- a. Torch moved over workpiece too slowly.
- b. Welding voltage too low.

### ARC UNSTABLE, EXCESSIVE SPATTER & WELD POROSITY:

- a. Torch held too far from the workpiece.
- b. Rust, grease or paint on workpiece.
- c. Insufficient shielding gas, check the gas flow and operation of the gas valve.

### WIRE REPEATEDLY BURNS BACK:

- a. Torch held too close to the workpiece.
  - b. Intermittent break in the welding circuit caused by:
    1. Contact tip loose – tighten.
    2. Contact tip damaged – replace.
    3. Welding wire corroded – replace wire.
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C. Wire feed slipping caused by:

1. Restrictions or kinks in liner; faulty contact tip – check and replace if necessary.
2. Worn feed rolls – replace.
3. Pressure roll adjustment incorrect – re-adjust.

**WIRE BURNS BACK:**

- a. Poor gas coverage.

**BURNING HOLES IN THE WORKPIECE:**

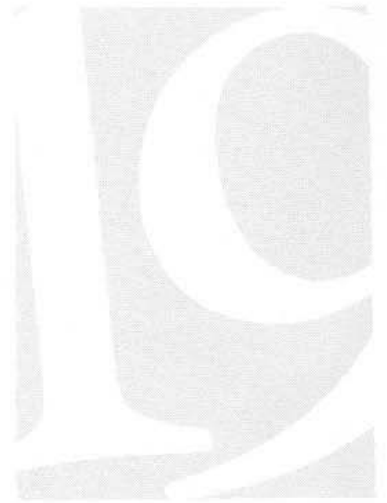
- a. Torch moved too slowly or erratically.
- b. Welding voltage too high.
- c. Wire feed speed too high.

**LACK OF PENETRATION:**

- a. Torch moved too fast.
  - b. Welding voltage too low.
  - c. Wire feed speed too low.
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# Torch Position.



When welding with a Mig-Mag machine it is possible to move the torch in either direction, see fig. C and fig. D. The quality of weld is not affected by the direction of travel, but fig. C may be found to be the easiest.

FIG. C:

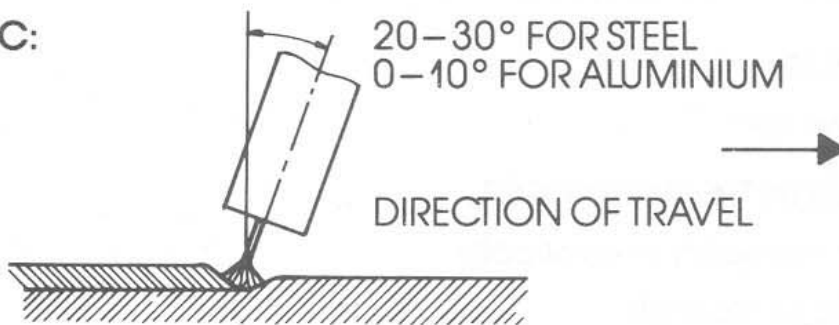
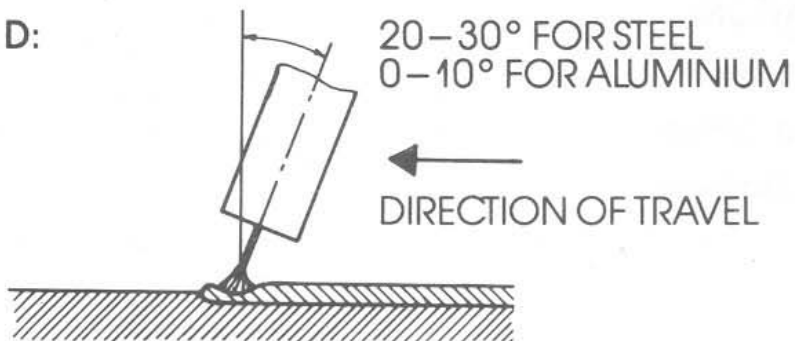
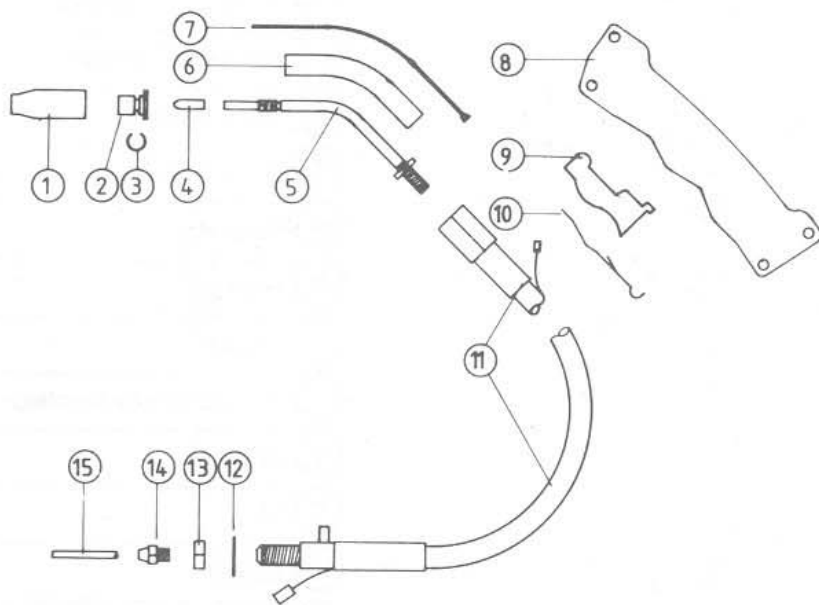


FIG. D:



ASSEMBLY

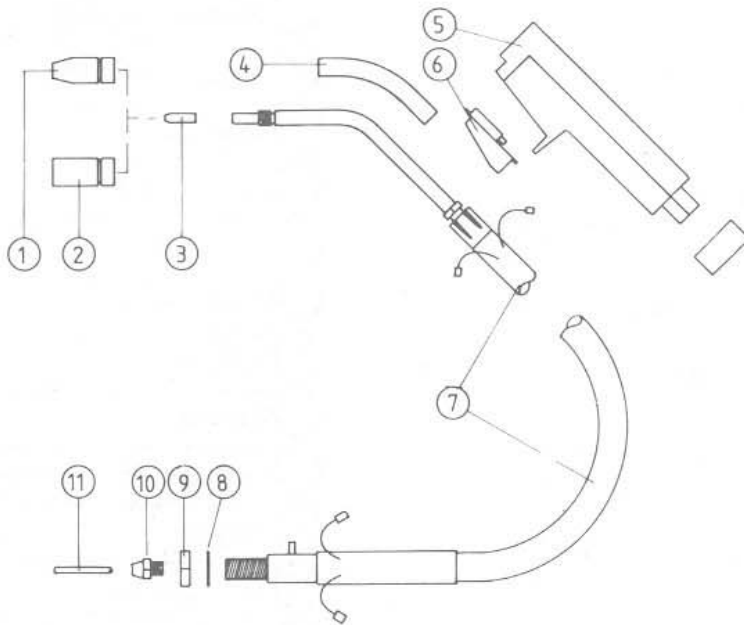
# Torch Type T.



	DESCRIPTION	PART No
○	TORCH – COMPLETE	02787
①	Shroud – Conical	02784
②	Shroud – Insulator	02784
③	Spring Clip	02784
④	Tip – 0.6mm	02651
④	Tip – 0.8mm	02652
⑤	Swan Neck	10061
⑥	Insulator	10062
⑦	Spring	10063
⑧	Handle – Complete	10064
⑨	Trigger	10065
⑩	Spring Plate	10066
⑪	Cable – Complete	10067
⑫	Washer	10068
⑬	Nut	10069
⑭	Collett	10070
⑮	Torch Liner	02783

ASSEMBLY

# Torch Type B.



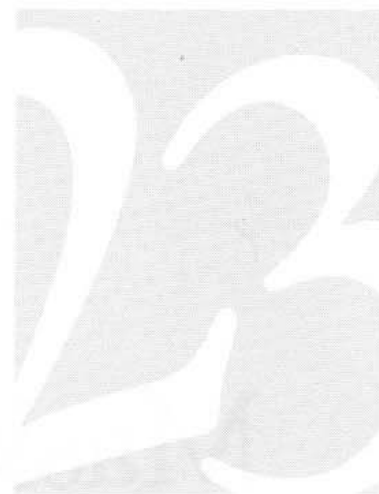
	DESCRIPTION	PART No
○	TORCH – COMPLETE	10071
1	Shroud – Conical	09033
2	Shroud – Straight	02784
3	Tip – 0.6mm	02651
3	Tip – 0.8mm	02652
4	Insulator	10072
5	Handle	10073
6	Trigger	10074
7	Hose Assembly c/w Swan Neck	10075
8	Washer	10076
9	Nut	10077
10	Collett	10078
11	Torch Liner	02783
○		
○		
○		
○		





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# Accessories.



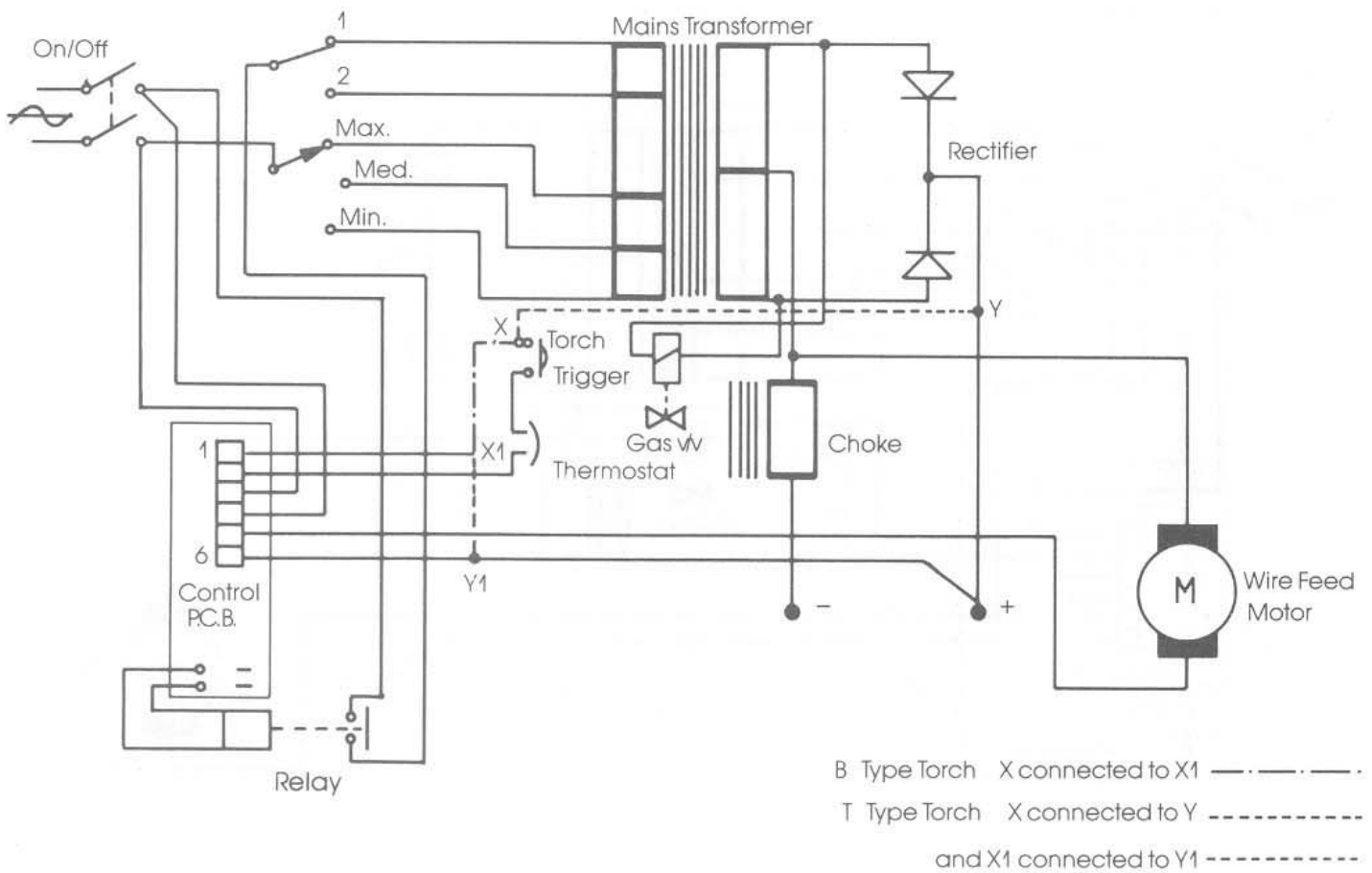
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DESCRIPTION	PART No
Bottle Mounting Brackets	10079
Mask – Complete	02825
Mask Glass	10210
Earth Clamp	10080
Gas Cylinder CO <sub>2</sub> (Disposable)	02658
Gas Cylinder Argon/CO <sub>2</sub> (Disposable)	02657
Gas Cylinder Argon/Oxygen (Disposable)	02659
Gas Cylinder Argon (Disposable)	02656
Brass Regulator	10211
Plastic Flowmeter	09017
0.7kg x 0.8mm Mild Steel Wire	02662
5.0kg x 0.8mm Mild Steel Wire	02669
5.0kg x 0.6mm Mild Steel Wire	02666
0.7kg x 0.8mm Stainless Steel Wire	02664
0.5kg x 0.8mm Aluminium/Silicon (5%) Wire	02663

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115V

# Main Circuit.

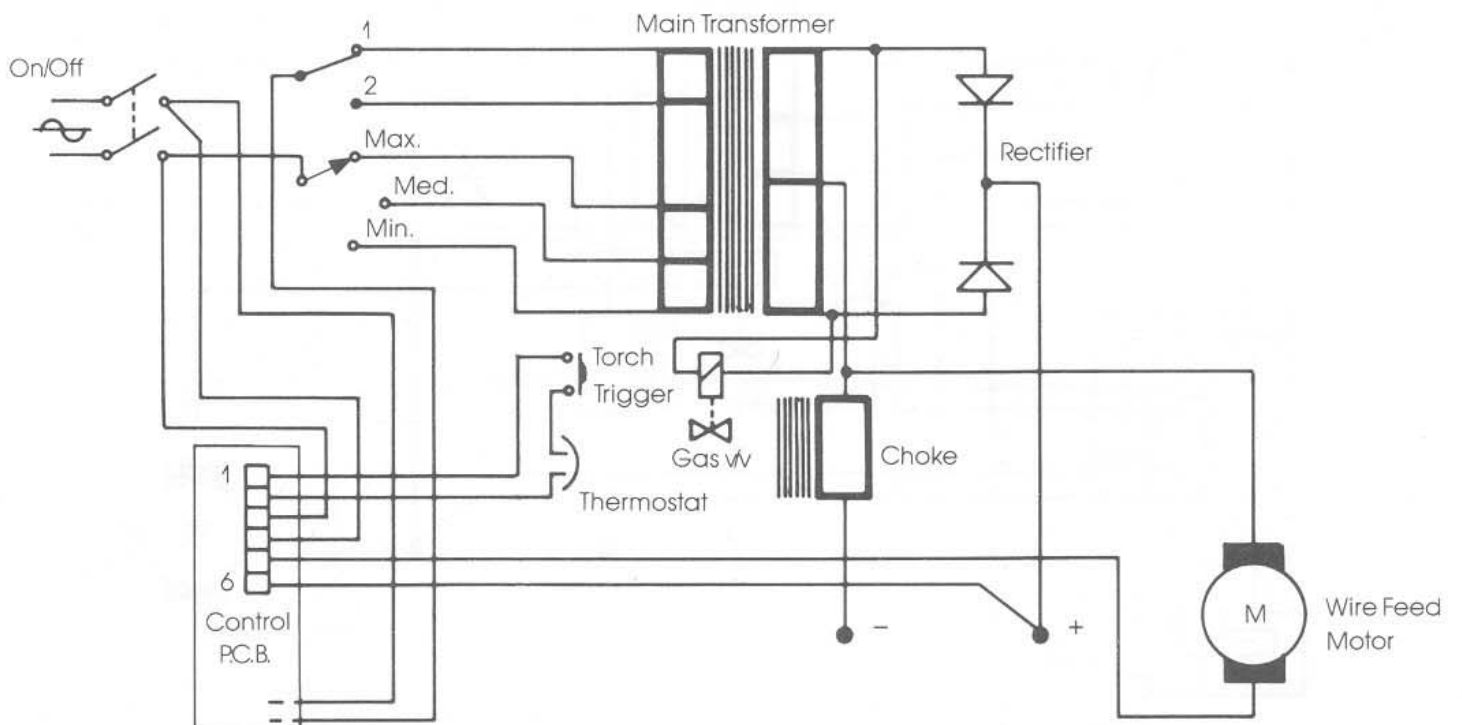


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220/240V

# Main Circuit.

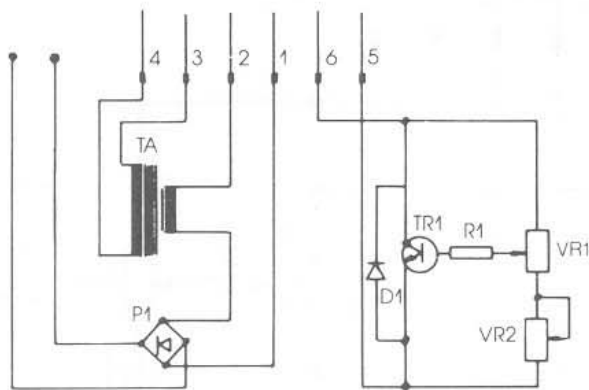
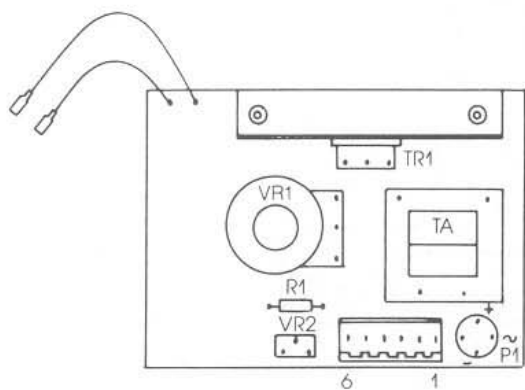
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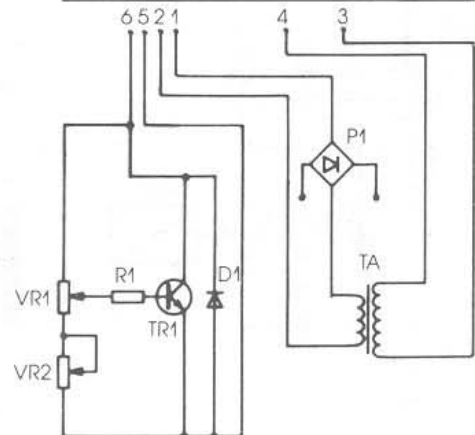
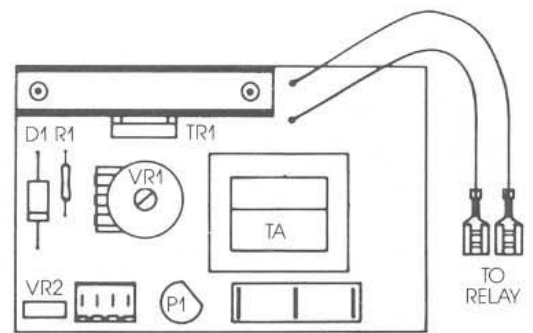
115V

115V MIG

# MK2 & 3F PCB.



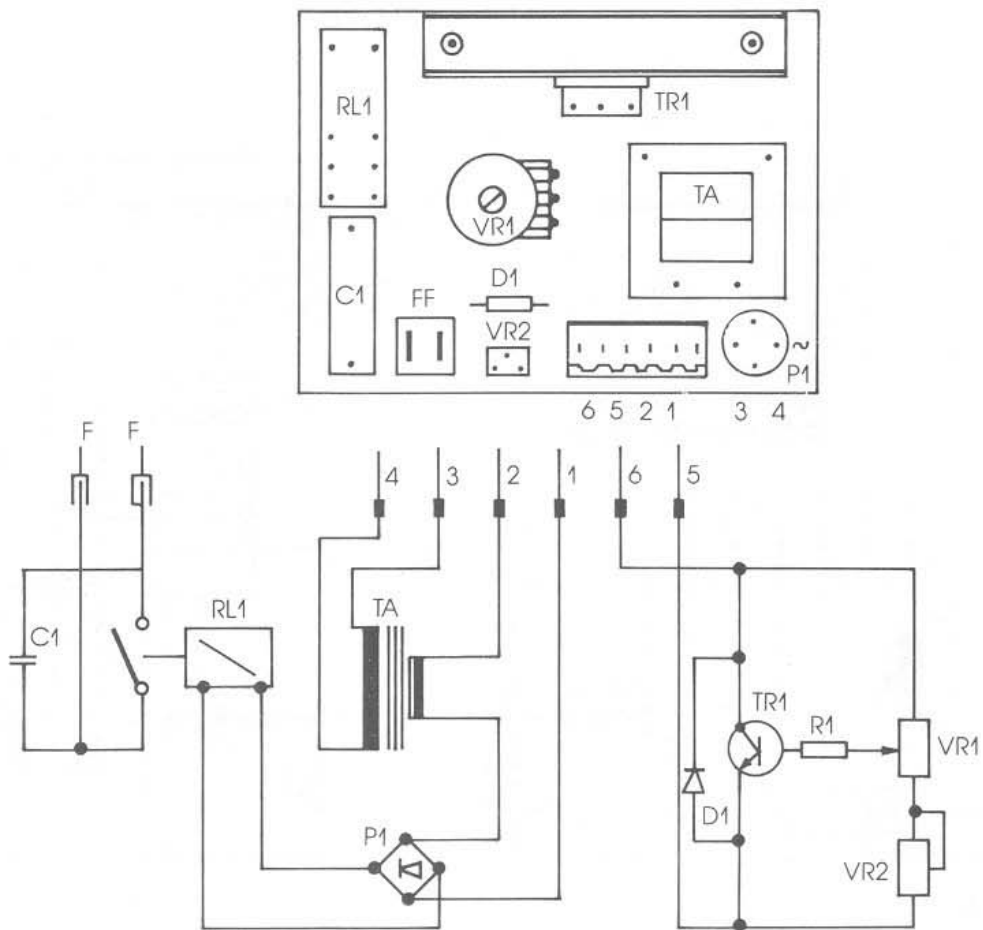
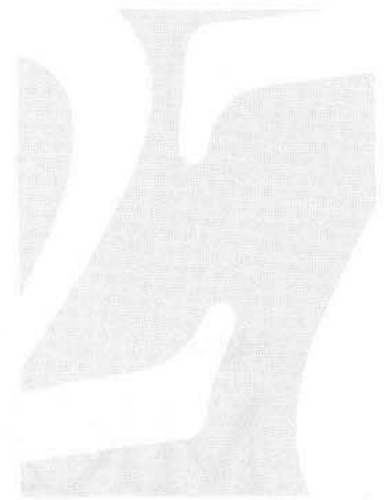
MK2 PCB



MIG 3F PCB

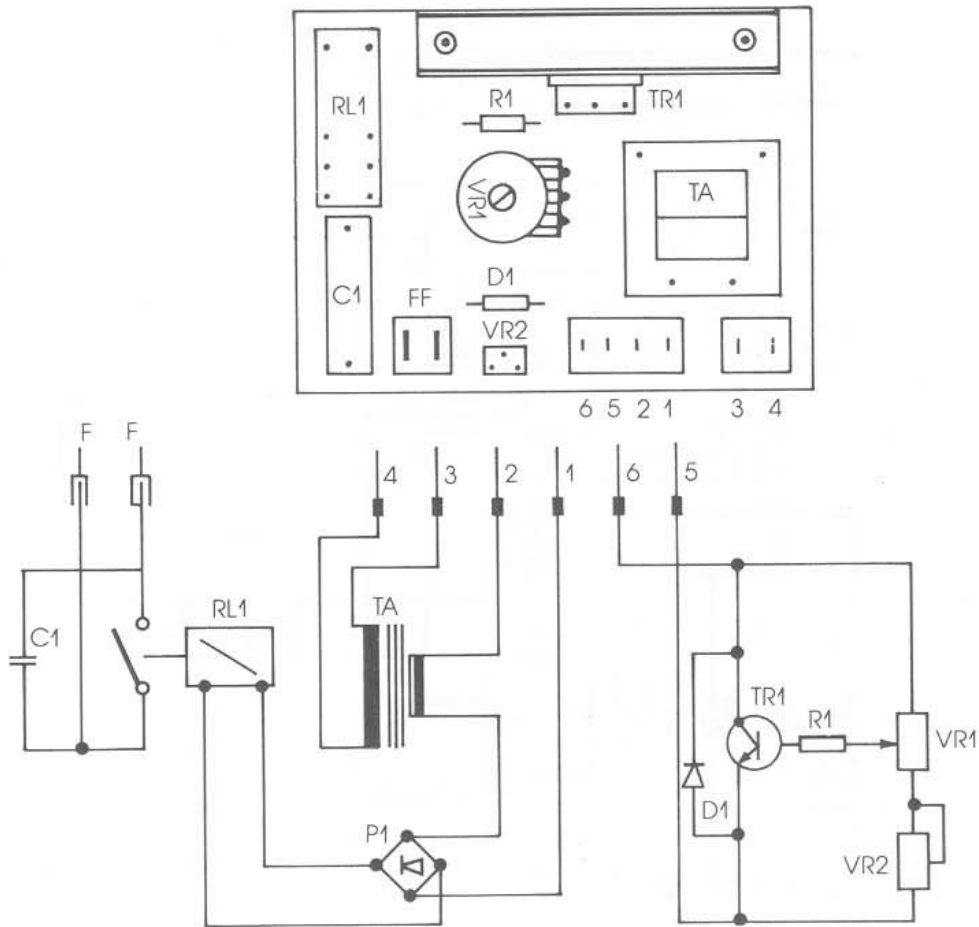
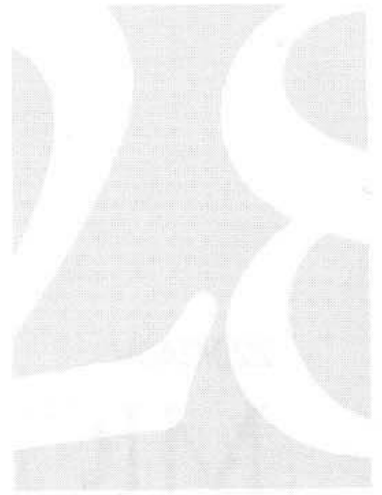
220/240V

# MK2 PCB.



240V

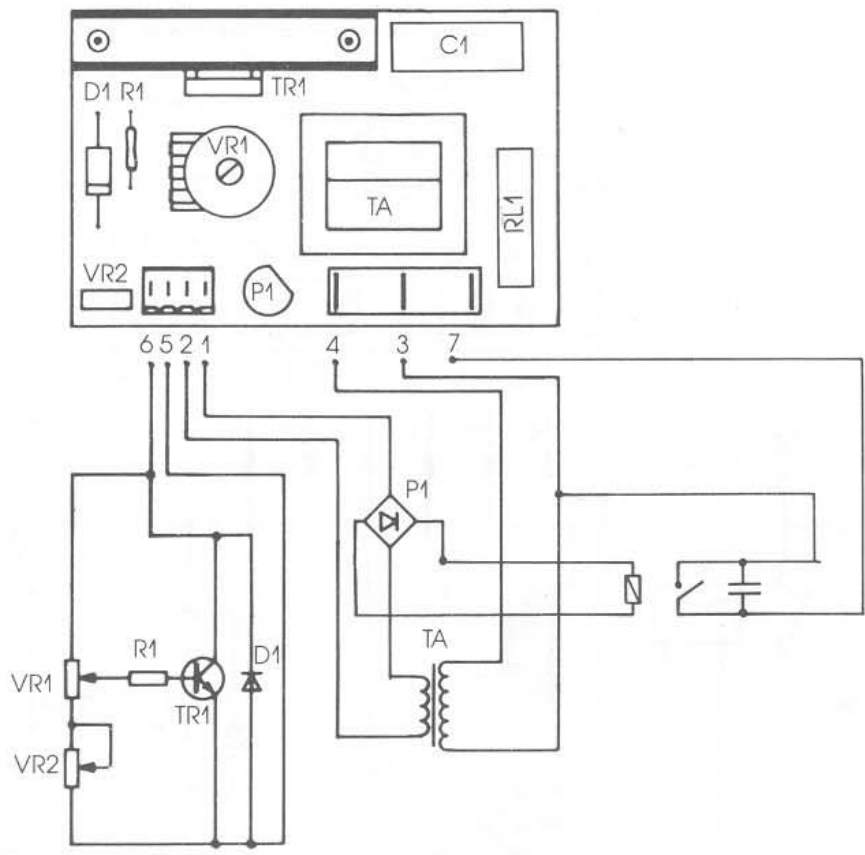
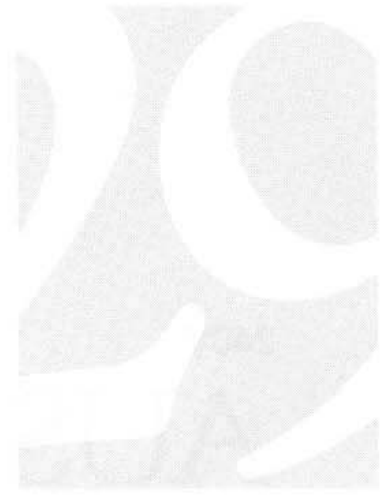
# AUS. PCB.



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220/240V

# MIG 3F PCB.









Ref	Description	Qty	PARTS LIST					
			115V 100 AMP	115V 120 AMP	240V 100 AMP	240V 120 AMP	220V 100 AMP	220V 120 AMP
3	L.H. SIDE PANEL (not illustrated)	1	10002	10002	10002	10002	10002	10002
4	CENTRE PANEL	1	10003	10003	10003	10003	10003	10003
5	LID	1	10004	10004	10004	10004	10004	10004
6	RELAY	1	10005	10005	N/A	N/A	N/A	N/A
7	RECTIFIER BRACKET	1	10006	10006	10006	10006	10006	10006
8	RECTIFIER	1	10007	10007	10007	10007	10007	10007
9	P.C.B.	1	02788	02788	10008	10008	10008	10008
10	FOOT INCLUDING SCREW	4	10010	10010	10010	10010	10010	10010
11	CONTROL KNOB	1	10011	10011	10011	10011	10011	10011
12	SPACER	2	10012	10012	10012	10012	10012	10012
13	4-WAY SELECTOR SWITCH	1	10013	10013	10013	10013	10013	10013
14	ON/OFF SWITCH	1	10014	10014	10014	10014	10014	10014
15	CHOKE	1	10015	10015	10015	10015	10015	10015
16	GROMMET	1	10016	10016	10016	10016	10016	10016
17	STRAIN RELIEF BUSH	2	10017	10017	10017	10017	10017	10017
18	WIRE FEED TENSION UNIT AND MOTOR	1	10089	10089	10089	10089	10089	10089
19	TRANSFORMER	1	10027	10028	10023	10024	10025	10026
20	SPINDLE SPACER	1	10029	10029	10029	10029	10029	10029
21	WIRE REEL SPINDLE	1	10030	10030	10030	10030	10030	10030
22	WIRE REEL 0.7kgx0.6mm MILD STEEL	1	02661	02661	02661	02661	02661	02661
23	SPRING MOULDING	1	10031	10031	10031	10031	10031	10031
24	SPRING	1	10032	10032	10032	10032	10032	10032
25	WIRE REEL SPINDLE SCREW	1	10033	10033	10033	10033	10033	10033
26	5kg REEL ADAPTORS	2	10034	10034	10034	10034	10034	10034
27	TAIL ADAPTOR	1	10036	10036	10036	10036	10036	10036
28	PUSH-IN ADAPTOR	1	10035	10035	10035	10035	10035	10035
29	GAS VALVE	1	10038	10038	10037	10037	10037	10037
30	HANDLE	1	10039	10039	10039	10039	10039	10039
31	LID RETAINING SCREW & CIRCLIP	1	10040	10040	10040	10040	10040	10040
32	INSULATION PAPER	1	10041	10041	10041	10041	10041	10041
33	INSULATING BOARD	1	10042	10042	10042	10042	10042	10042
34	INSULATING WASHER	1	10043	10043	10043	10043	10043	10043
35	CASTOR (not illustrated)	1	N/A	10044	N/A	10044	N/A	10044
36	TRANSFORMER THERMAL CUT-OUT	1	10109	10109	10109	10109	10109	10109

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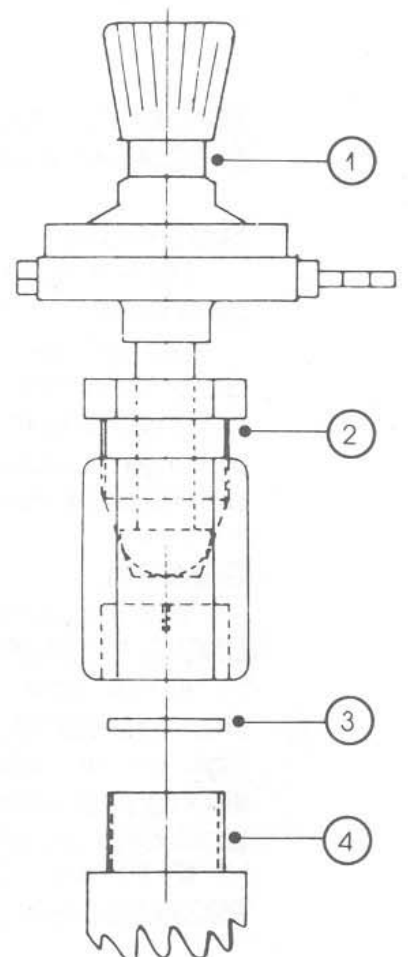
# Appendix 1.

## INDUSTRIAL TYPE REGULATOR AND REFILLABLE BOTTLE.

This regulator when provided with your welder will fit directly to an industrial Argon or Argon/CO<sub>2</sub> bottle. Where a refillable bottle is also supplied, an adaptor is provided to enable you to use it with this small gas bottle. In order to fit the adaptor follow the instructions below:

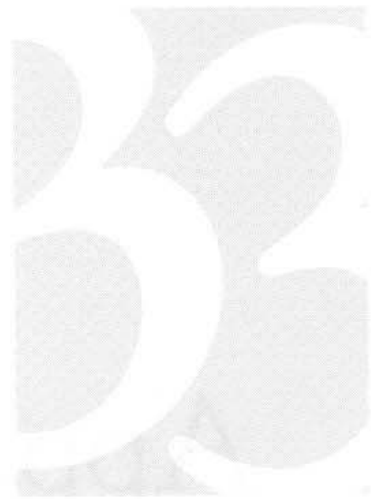
- a. Push the rubber washer (3) into the end of the adaptor (2) with the pin in the centre.
- b. Holding the adaptor firmly screw the regulator (1) in the opposite end of the adaptor from the pin and tighten with a spanner.
- c. Fit gas pipe to regulator and welder.
- d. Screw the adaptor/regulator assembly on to the gas bottle (4), tightening firmly by hand.
- e. Check there are no leaks either where the regulator joins the adaptor or the adaptor the bottle. Re-tighten if necessary.
- f. Adjust regulator to Min. position.

N.B. Remove adaptor/regulator assembly from bottle each time after use.



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# Safety.



**BEFORE OPERATING THE WELDING UNIT, YOU MUST PAY SPECIAL ATTENTION TO THE SAFETY NOTES GIVEN BELOW.**

**ELECTRICAL:**

Do not operate the machine with any of the panels removed.

Do not attempt any electrical repairs unless you are a competent electrician.

Ensure that the machine is connected to the correct voltage supply through the recommended fuse. This unit must be earthed.

**GENERAL:**

This Mig welding unit is simple and SAFE TO OPERATE UNDER NORMAL CIRCUMSTANCES.

If the unit is to be used under unusual circumstances, eg. in wet or damp conditions, on boats or oil rigs, in an elevated position or platform, then we strongly recommend that extra thought be given to any possible hazard introduced by that situation.

IF IN ANY DOUBT WHATSOEVER PLEASE SEEK OUR PROFESSIONAL ADVICE.

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**FIRE:**

All flammable materials must be removed from the welding area.

**DO NOT STRIKE AN ARC ON OR NEAR THE GAS CYLINDER.**

The welding of fuel tanks is **not recommended**. If you need to do so, seek professional advice.

**FUMES:**

Toxic gases can be given off during the Mig welding process which may collect in the welding area if the ventilation is poor.

Be alert at all times to the possibility of fume build-up.

**IN SMALL OR CONFINED AREAS USE A FUME EXTRACTOR.**

**GLARE AND BURNS:**

The electric arc generated by the MIG process gives off direct heat and ultra-violet radiation which can damage the eyes.

It is essential that the eyes of the operator and bystanders are protected from glare during welding by a suitable filter.

**ALWAYS WEAR A FACESHIELD OR WELDING HELMET FITTED WITH THE CORRECT GLASS FILTER WHEN WELDING.**

A suitable mask is provided with your mig welder see page 22 for assembly details.

The ultra-violet radiation can also affect the skin causing burns similar to sun burn.

Gloves should be worn to protect the hands from ultra-violet radiation and the direct heat of the welding arc.

**NON-SYNTHETIC OVERALLS WHICH CAN BE BUTTONED AT THE NECK AND WRISTS OR SIMILAR CLOTHING SHOULD BE WORN.**

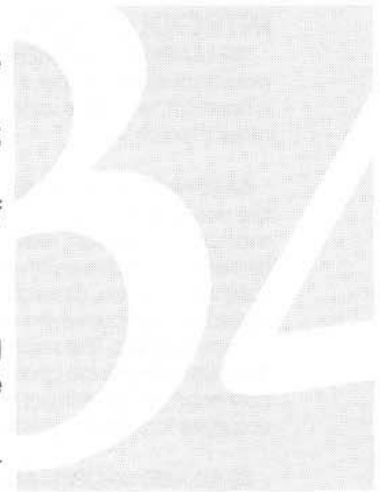
When welding in the overhead position, the head and neck should be protected by a skullcap and scarf.

Do not wear flimsy footwear whilst welding.

**GAS CYLINDERS:**

**Do not expose the gas cylinder to temperatures higher than normal room temperature.**

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## INTRODUCTION:

**WE LEARN BY EXPERIENCE** Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

**SAFE PRACTICES DEVELOPED FROM EXPERIENCE** in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for these safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

**READ AND UNDERSTAND THESE SAFE PRACTICES** before attempting to install, operate or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

**FAILURE TO OBSERVE THESE SAFE PRACTICES** may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

## SECTION 1

### GENERAL PRECAUTIONS:

#### A. BURN PREVENTION

1. **Wear Protective Clothing** – leather (or asbestos) gauntlet gloves, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

2. **Wear Helmet with Safety Goggles or Glasses** with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a **MUST** for welding or cutting (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered.

3. **Avoid Oily or Greasy Clothing.** A spark may ignite them.

4. **Hot Metal** such as electrode stubs and workpieces should never be handled without gloves.

5. **Medical First Aid and Eye Treatment.** First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

6. **Flammable Hair Preparations** should not be used by persons intending to weld or cut.

#### B. TOXIC PREVENTION

1. **Adequate Ventilation.** Severe discomfort, illness or death can result from fumes, vapours, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation. **NEVER** ventilate with oxygen.

2. **Lead-, Cadmium-, Zinc-, Mercury-, and Beryllium-bearing** and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

3. **Metals Coated** with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated, or the operator wears an air-supplied respirator.

4. **Work in a Confined Space** only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

5. **Gas Leaks in a Confined Space** should be avoided. Leaking gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

6. **Leaving Confined Space,** shut OFF gas supply at source to prevent possible accumulation of gases in the space if down stream valves are left open. Check to be sure that the space is safe before re-entering it.

7. **Vapours from Chlorinated Solvents** can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung- and eye-irritating products. The ultra-violet (radiant) energy of the arc can also decompose trichlorethylene and perchlorethylene vapours to form phosgene. **DO NOT WELD** or cut where solvent vapours can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to atmospheres containing even minute amounts of trichlorethylene or perchlorethylene.

#### C. FIRE AND EXPLOSION PREVENTION

1. **Causes of Fire** and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material, misuse of compressed gases and cylinders, and short circuits.

**BE AWARE THAT:** flying sparks or falling slag can pass through cracks, along pipes, through windows or



doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly up to 35 feet.

To prevent fires and explosion:

2. **Keep Equipment Clean and Operable**, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

3. **If Combustibles Are In Area**, do NOT weld or cut. Move the work if practical, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work can not be moved, move combustibles at least 35 feet away out of reach of sparks and heat, or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

4. **Walls Touching Combustibles** on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

5. **Fire Watcher** must be standing by with suitable fire-extinguishing equipment during and for some time after welding or cutting if:

- a. appreciable combustibles (including building construction) are within 35 feet.
- b. appreciable combustibles are further than 35 feet but can be ignited by sparks.
- c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks.
- d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

6. **After Work Is Done**, check that area is free of sparks, glowing embers, and flames.

7. **An Empty Container That Held Combustibles**, or that can produce flammable or toxic vapours when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 3 in Standards index. This includes a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

8. **A Container With Unknown Contents** should be cleaned (see paragraph above). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

9. **Hollow Castings or Containers** must be vented before welding or cutting. They can explode.

10. **Explosive Atmosphere**. Never weld or cut where the air may contain flammable dust, gas, or liquid vapours (such as gasoline).

## HOSE

1. **Prohibited Use**. Never use hose other than that designed for the specified gas. A general hose identification rule is red for fuel gas, green for oxygen, and black for inert gases.

2. **Use Ferrules or Clamps** designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

3. **No Copper Tubing Splices**. Use only standard brass fittings to splice hose.

4. **Avoid Long Runs** to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

5. **Coil Excess Hose** to prevent kinks and tangles.

6. **Protect Hose From Damage** by sharp edges, and by sparks, slag, and open flame.

7. **Examine Hose Regularly** for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

8. **Repair Leaking or Work Hose** by cutting area out and splicing. Do NOT use tape.

## CONNECTIONS

1. **Clean Cylinder Valve Outlet** of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

2. **Match Regulator to Cylinder**. Before connecting, check that the regulator label and cylinder marking agree, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

3. **Tighten Connections**. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

4. **Adaptors**. Use a CGA adaptor (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adaptor marked RIGHT and LEFT HAND threads.

6. **Regulator Outlet (or Hose) Connections** may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

#### PRESSURIZING STEPS

1. **Drain Regulator** of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjustment screw engaged slightly on single-stage regulators.
2. **Stand to Side of Regulator** while opening cylinder valve.
3. **Open Cylinder Valve Slowly** so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position. For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open less than one turn to permit quick emergency shut-off.
4. **Use Pressure Charts** (available from your supplier) for safe and efficient, recommended pressure settings on regulators.
5. **Check for Leaks** on first pressurization and regularly thereafter. Brush with soap solution (capful of Ivory Liquid\* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

#### D. COMPRESSED GAS EQUIPMENT

##### PRESSURE REGULATORS

1. **Never Connect** a regulator to a cylinder containing gas other than that for which the regulator was designed.
2. **Remove Faulty Regulator** from service immediately, (first close cylinder valve). The following symptoms indicate a faulty regulator.
  - Leaks – if gas leaks externally.
  - Excessive Creep – If delivery pressure continues to rise with downstream valve closed.
  - Faulty Gauge – If delivery pressure continues to rise with downstream valve closed.
  - Faulty Gauge – If gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.
3. **Repair.** Do NOT attempt to repair. Send faulty regulators for repair to manufacturer's designated repair centre, where special techniques and tools are used by trained personnel.

#### CYLINDERS

1. **CYLINDERS Must Be Handled Carefully** to prevent leaks and damage to their walls, valves, or safety devices.
2. **Avoid Electrical Circuit Contact** with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident.
3. **ICC or DOT Marking** must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.
4. **Identifying Gas Content.** Use only cylinders with name of gas marked on them, do not rely on colour of identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.
5. **Empties.** Keep valves closed, replace caps securely, mark MT; keep them separate from FULLS and return promptly.
6. **Prohibited Use.** Never use a cylinder or its contents for other than its intended use. NEVER as a supporter or roller.
7. **Locate or Secure** cylinders so that they cannot be knocked over.
8. **Passageways and Work Areas.** Keep cylinders clear of areas where they may be struck.
9. **Transporting Cylinders.** With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders on the ground by their valves or caps, or by chains, slings, or magnets.
10. **Do NOT Expose Cylinders** to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.
11. **Protect Cylinders, Particularly Valves** from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.
12. **Stuck Valve.** Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.
13. **Mixing Gases.** Never try to mix any gases in a cylinder.
14. **Never Refill Any Cylinder.**
15. **Cylinder Fittings** should never be modified or exchanged.

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## SECTION 2

### ARC WELDING:

Comply with precautions in Section 1 and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultra-violet and infra-red energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

#### A. BURN PROTECTION

The **Welding Arc** is intense and visibly bright. Its radiation can damage eyes, penetrate light-weight clothing, reflect from light-coloured surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. **DON'T GET BURNED: COMPLY WITH PRECAUTIONS.**

#### PROTECTIVE CLOTHING

1. **Wear Long-Sleeved Clothing** (particularly for gas-shielded arc) in addition to gloves, hat, and shoes. As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

2. **Bare Skin Protection.** Wear dark, substantial clothing. Button collar to protect chest and neck and button pocket to prevent entry of sparks.

#### EYE AND HEAD PROTECTION

1. **Protect Eyes From Exposure to Arc.** NEVER look at an electric arc without protection.

2. **Welding Helmet or Shield** containing a filter plate shade No. 10 or darker must be used when welding. Place over face before striking arc.

3. **Protect Filter Plate** with a clear cover plate.

4. **Cracked or Broken Helmet or shield** should NOT be worn; radiation can pass through to cause burns.

5. **Cracked, Broken, or Loose Filter Plates** must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

6. **Flash Goggles With Side Shields** MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity

gas shield arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

#### B. PROTECTION OF NEARBY PERSONNEL

1. **Warn Bystanders** not to watch the arc and not to expose themselves to the welding-arc rays or to hot metal.

2. **Keep Children Away** while welding. They are not aware that looking at an arc ray can cause serious eye damage.

3. **Protect Other Nearby Personnel** from arc rays and hot sparks with a suitable non-flammable partition.

4. **Bystanders** should also wear safety glasses or goggles.

#### C. ELECTRIC SHOCK

Either AC or DC voltages associated with the welding environment can cause severe burns to the body or fatal shock. Severity of electrical shock is determined by the path and amount of current through the body.

#### TO PROTECT AGAINST SHOCK

1. **Keep Body and Clothing Dry.** Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part – or grounded metal – reduces the body-surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

2. **Never Allow** live metal parts to touch bare skin or any wet clothing. Be sure gloves are dry.

3. **Install and Continue to Maintain Equipment** according to USA Standard C1, National Electric Code, or other applicable standards.

4. **Before Welding, Check for Continuity.** Be sure the ground cable is connected to the workpiece as close to the welding areas as possible. Grounds connected to building frame-work or other remote locations from the welding area reduce efficiency and increase the potential electric shock hazard. Avoid the possibility of the welding current passing through lifting chains, crane cables, or various electric paths.

5. **Frequently Inspect Cables** for wear, cracks, and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly-lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

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