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OWNERS MANUAL

WELDMATIC 215S

MODEL NO. CP109-0, REV. B

11/2000

QUALITY WELDING PRODUCTS, SYSTEMS AND SERVICE

The information contained in this manual is set out to enable you to properly maintain your new equipment and ensure that you obtain maximum operating efficiency.

Please ensure that this information is kept in a safe place for ready reference when required at any future time.

When requesting spare parts, please quote the model and serial number of the machine and part number of the item required. All relevant numbers are shown in lists contained in this manual. Failure to supply this information may result in unnecessary delays in supplying the correct parts.

SAFETY

Before this equipment is put into operation, the Safe Practices section at the back of the manual must be read completely. This will help to avoid possible injury due to misuse or improper welding applications.

CONTENTS

FIGURES

1. INTRODUCTION

Gas Metal Arc Welding (G.M.A.W.) is a welding process where a consumable wire is fed by motor driven drive rollers to a welding gun, and where welding current is supplied from the welding power source. The welding arc is struck between the work piece and the end of the wire, which melts into the weld pool. The arc and the weld pool are shielded by gas flow from the gun, or in the case of "self shielded" wires, by gases generated by the wire core.

By selection of the correct wire composition, diameter and shielding gas, G.M.A.W. can be used for applications ranging from sheetmetal to heavy plate, and metals ranging from carbon steel to aluminium alloys.

The WELDMATIC 215S has been designed to be used with consumable wires in the range from 0.6mm to 1.2mm diameter. The smaller wire sizes are used when welding at lower currents, such as sheet-metal applications. Increasing the wire diameter permits higher welding currents to be selected.

A common application of G.M.A.W. is for welding Mild Steel. In this application, a Mild Steel solid consumable such as AUSTMIG ES6 is used with a shielding gas of Argon mixed with 5 - 25% Carbon Dioxide. Alternatively, Flux-cored consumables are available in both gas shielded, and 'gasless' self shielding types.

Stainless steel and Aluminium can be welded with G.M.A.W. using the correct consumable wire and shielding gas.

2. RECEIVING

Check the equipment received against the shipping invoice to make sure the shipment is complete and undamaged. If any damage has occurred in transit, please immediately notify your supplier.

The CP109-0 package contains;

- WELDMATIC 215S Power source.
- BEXT2-4E210AE BERNARD Gun cable, 3 metre, Euro connector.
- WGAC24 Regulator and Flow gauge. (Argon)
- (This) Owners Manual.

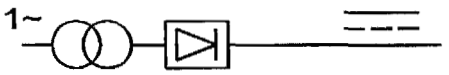
3. SPECIFICATIONS

Manufactured to Australian standard AS1966.1-1985
Rated to ISO/IEC 60974-1 (10 minute duty cycle)

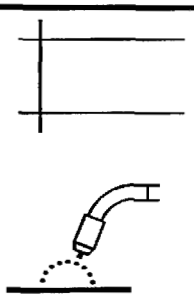
WELDING INDUSTRIES of AUSTRALIA

Weldmatic 215s

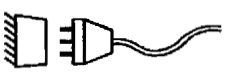
Made in Australia



RATED TO ISO/IEC 60974-1 N803



45A/16.3V - 215A/24.8V						
	U_1	240			230	220
⎓	X	15%	60%	100%	16%	18%
U_{20}(V)	I2(A)	215	120	90	200	190
20-45	U2(V)	24.8	20	18.5	24	23.5



	PF = 0.89 (215A) 0.93 (90A)						
	U_1(V)	I_{1max}(A)	42	17	11	40	36
	240V	I_{1eff}(A)	16	-	11	16	15
CLASS INS H	50Hz	S_1(kVA)	10.1	4.1	2.6	9.2	7.9
COOLING AF	IP21						

WIN306R

Under ISO/IEC 60974-1, duty cycle is defined as the ratio of arcing time to an operating time of 10 minutes, expressed as a percentage.

4. POWER SOURCE CONTROLS

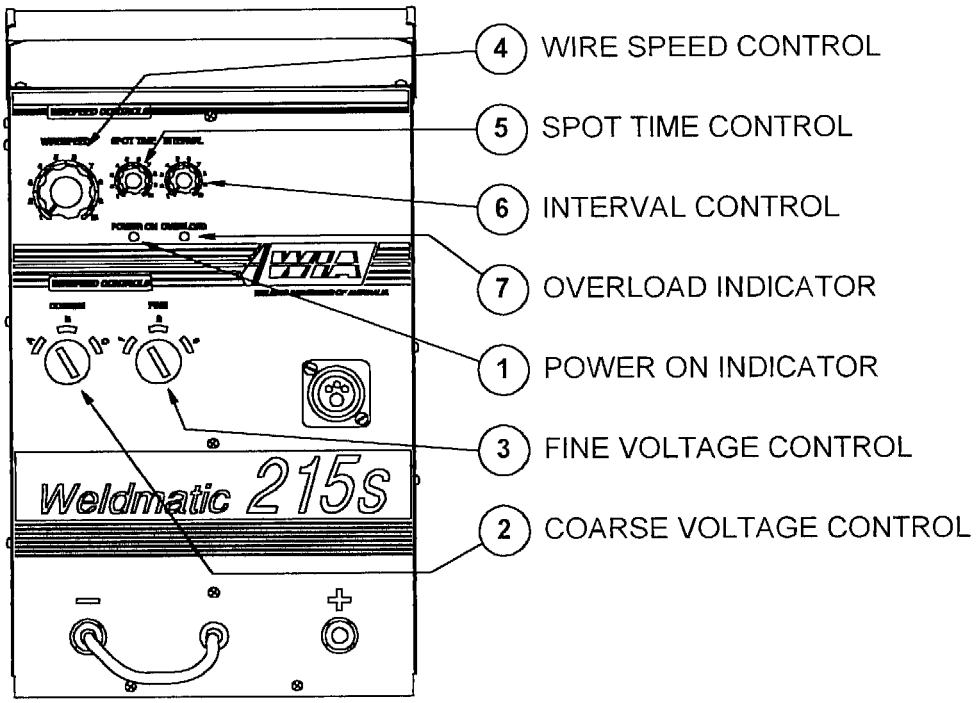


FIGURE 1. POWER SOURCE CONTROL

1. POWER ON INDICATOR

This is illuminated when electrical mains power is connected to the welding power source.

2. COARSE VOLTAGE CONTROL

This switch provides Coarse adjustment of the Output Welding Voltage over three ranges.

3. FINE VOLTAGE CONTROL

This switch provides Fine adjustment of the Output Welding Voltage over three ranges.

4. WIRE SPEED CONTROL

This control provides adjustment of the wirefeed speed. Rotating the dial in a clockwise direction will increase the wirefeed speed, thereby increasing the welding current.

5. SPOT TIME CONTROL

When operating the machine in Spot Weld mode, this control will vary the spot weld time. Rotating the dial in a clockwise direction will increase the spot weld time, in the range 0.4 – 3.0 seconds. If the Spot Weld mode is not required this feature may be turned off by rotating the control anti-clockwise until it 'clicks' into the minimum position.

6. INTERVAL CONTROL

When operating the machine in Cycle Arc mode this control sets the period between welds. The spot time control sets the welding period. Rotating the dial in a clockwise direction will increase the interval time, in the range 0.4 – 1.8 seconds. If the Cycle Arc mode is not required this feature may be turned off by rotating both controls fully anti-clockwise.

7. OVERLOAD INDICATOR

This is illuminated when the welding load exceeds the operating duty cycle. In this event the machine will not deliver welding current until the machine has cooled sufficiently. The over-temperature thermostats will reset automatically - do not switch the machine off as the cooling fan will assist the resetting of the thermostats.

5. INSTALLATION

5.1 CONNECTION TO ELECTRICAL MAINS POWER SUPPLY

NOTE. All electrical work shall only be undertaken by a qualified electrician.

The WELDMATIC 215S is factory fitted with a 3 metre, 3 core 50/0.25 Heavy Duty PVC mains power supply cable with moulded 3 pin, 15 Amp, Single Phase plug.

A 15 Amp plug and socket is recognisable by a wide Earth pin. Power Supply authorities require that equipment fitted with a 15 Amp plug shall ONLY be connected to a 240 Volt, 15 Amp power point. DO NOT modify the plug.

The minimum capacity of the mains wiring and power outlet supplying a welder is selected according to the *effective primary current* of the machine. The effective primary current for a Weldmatic 215S is 16 Amps.

The minimum recommended circuit breaker rating for a Weldmatic 215S is 20 Amps. Note : The tripping time of a typical 20A circuit breaker may limit the duty cycle available from the Weldmatic 215S. A higher rated circuit breaker can be selected, but the mains wiring capacity must be increased to suit.

The current rating of the mains cable depends on cable size and method of installation. Refer to AS/NZS 3008.1, Table 9. If it becomes necessary to replace the mains flexible supply cable, use only cable with correct current rating.

Access to the machine supply terminals is gained by removing the power source left hand side panel. (Power source viewed from front).

Pass the cable through the bush fitted to the machine back panel. The cables are terminated at the terminal block as shown in Figure 2.

Tighten the cable clamp leaving just sufficient slack in the cable so that the terminated wires are not in tension.

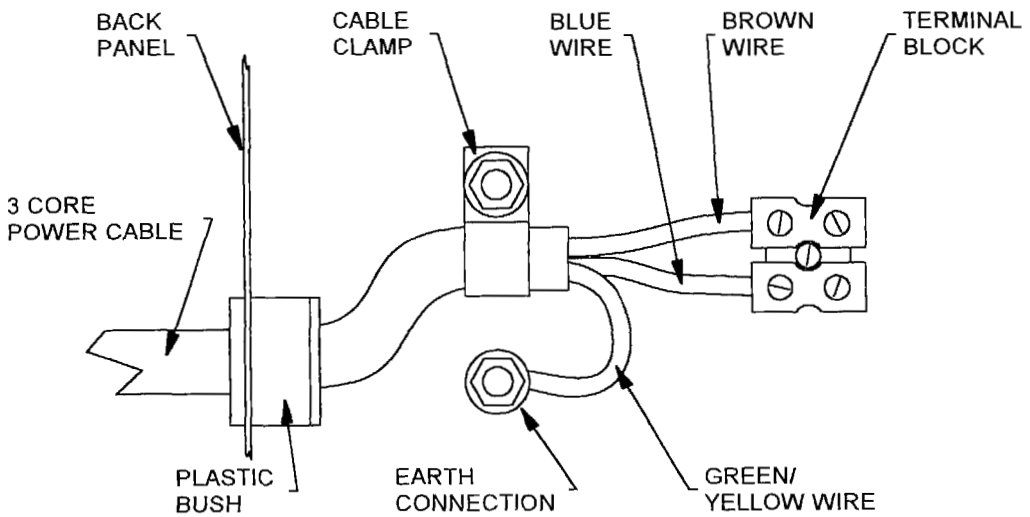


FIGURE 2. CONNECTION OF SUPPLY FLEXIBLE CABLE

5.2 FITTING THE GAS BOTTLE

Depending on configuration of the cylinder to be used, the gas flowmeter / regulator may be fitted directly to the cylinder, or in conjunction with an elbow fitting. DO NOT apply any grease to these joints, and tighten the nuts securely.

Fit the end of the gas inlet hose from the back of the machine to the connector supplied with the flow regulator, and secure with the clamp also supplied.

5.3 FITTING THE GUN CABLE

The BERNARD BEXT2-4E210AE gun cable is equipped with a 'Euro' wirefeeder connector which incorporates all required connection points to the gun cable for welding current, shielding gas and gun switch control.

To attach the gun cable to the wirefeeding mechanism, engage the mating parts of the male and female Euro connectors, then rotate the locking ring clockwise to firmly secure the connection.

5.4 FITTING THE CONSUMABLE WIRE

The quality of the consumable wire greatly affects how reliably a gas metal arc welder will operate. For best results when welding mild steel, we recommend quality WIA AUSTMIG ES6. Dirty, rusty or kinked wire will not feed smoothly through the gun cable and will cause erratic welding. Deposits from the wire will clog the gun cable liner requiring it to be replaced prematurely.

Place the spool of welding wire onto the spool holder. The location pin should mate with a hole provided on the wire spool body. Fit the spool retaining 'R' clip supplied. Check the adjustment of the spool brake, which should be set to prevent over-run of the wire spool at the end of a weld, without unduly loading the wirefeed motor. The braking can be adjusted by the Nyloc nut using a 15/16" AF or 24mm socket wrench.

5.5 FEEDING THE CONSUMABLE WIRE

With reference to Figure 11, release the pressure screw (6), and rotate the pressure arm (4) to the open position. The end of the welding wire can now be passed through the inlet guide (11), over the bottom driven roller (9), and into the output wire guide tube. Check that the drive roller groove is correct for the wire in use. The appropriate size is stamped on the visible side of the installed roller. Check also that the correct size contact tip is fitted at the gun end. Drive roller and tip details are available in Section 11 of this manual.

Return the pressure arm to the closed position and, adjust the pressure screw to provide sufficient clamping of the drive rolls drive to achieve constant wirefeed. Do not over tighten.

5.6 OUTPUT VOLTAGE POLARITY SELECTION.

The design of the WELDMATIC 215S allows external selection of the output voltage polarity – positive wire or negative wire.

5.6.1 POSITIVE WIRE

Most solid wire G.M.A.W. is carried out with the work piece Negative and the welding consumable wire Positive.

To set the machine for this condition, insert the 'WORK' lead plug into the (-) output socket on the front of the power source. Insert inter-connecting 'WELD' lead plug into the (+) output socket on the front of the power source. See Figure 3 below.

5.6.2 NEGATIVE WIRE

Some 'self-shielded' flux cored consumables are intended to be operated with the work piece Positive and the consumable wire Negative. Refer to the manufacturers data for the particular consumable to be used.

To set the machine for this condition, insert the 'WORK' lead plug into the (+) output socket on the front of the power source. Insert inter-connecting 'WELD' lead plug into the (-) output socket on the front of the power source. See Figure 4 below.

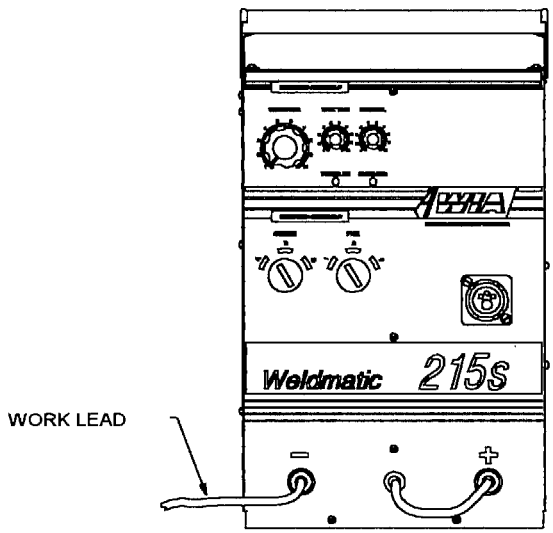


FIGURE 3. POSITIVE WIRE

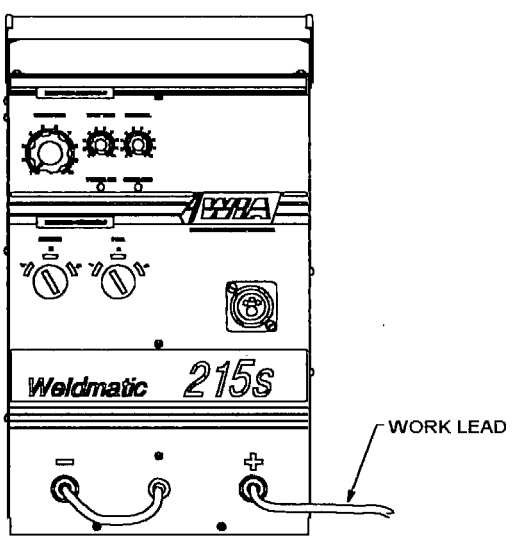


FIGURE 4. NEGATIVE WIRE

6. NORMAL WELDING SEQUENCE

6.1 WELD START

Closing the welding gun switch initiates this sequence of events:

- The gas valve is energised, gas flow commences;
- The power source triac function is initiated. Welding voltage is applied between the work piece and the consumable wire;
- The wire drive motor is energised. Wirefeed commences and the arc is established.

6.2 WELD END

Releasing the gun switch initiates this sequence of events:

- The wire drive motor is de-energised, and is dynamically braked to a stop;
- The power source triac function is de-energised;
- The gas valve is de-energised and the flow of shielding gas ceases.

7. BASIC WELDING INFORMATION

7.1 CHOICE OF SHIELDING GAS

The choice of shielding gas is largely determined by the consumable wire to be used. Many proprietary shielding gas mixtures are available.

The recommended shielding gases for use with the WELDMATIC 215S are :

- Mild Steel.....Argon + 5 to 25% Carbon Dioxide;
- Aluminium.....Argon;
- Stainless Steel.....Argon + 1 to 2% Oxygen.

Consult your gas supplier if more specific information is required.

7.2 SHIELDING GAS FLOW RATE

In G.M.A. welding, one of the functions of the shielding gas is to protect the molten weld pool from the effects of oxygen in the atmosphere. Without this protection the weld deposit becomes 'honeycombed' in appearance, an effect which is described as weld porosity.

In draft-free conditions the gas flow rate required to give adequate protection is typically 10 litres/min. In situations where drafts cannot be avoided, it may be necessary to increase this rate and/or to provide screening of the work area.

Weld porosity can also be caused by air entering the gas stream through a damaged hose, loose gas connection, or from restriction in the nozzle, such as from excess build-up of spatter.

7.3 ESTABLISHING A WELD SETTING

Once the consumable wire type, wire size and shielding gas have been chosen, the two variables which are adjusted in order to obtain a stable arc are;

- Wirefeed speed,
- Welding arc voltage.

The wirefeed rate determines the welding current; increasing the feed rate increases the current, and decreasing it decreases current. The selected wirefeed rate must be matched with sufficient arc voltage; an increase of wirefeed rate requires an increase of arc voltage.

If the voltage is too low the wire will stub and stutter, and there will not be a steady arc. If the voltage is too high the arc will be long with the metal transfer within the arc occurring as a series of large droplets.

IMPORTANT: Do not operate the Voltage Control switches during welding.

The welding current should be chosen to suit the thickness of the metal to be welded. It is important to check that the deposited weld provides sufficient strength to suit the application.

A "good" weld will have the characteristics illustrated in Figure 5. The weld has penetrated into the parent metal, fusing the root of the joint where the two plates meet, and the weld blends smoothly into the side walls.

A "bad" weld is shown in Figure 6. The weld has not penetrated the joint root, and there is poor side wall fusion. This lack of fusion would normally be corrected by increasing the arc voltage, or by increasing both wirefeed rate and arc voltage to achieve a higher current weld setting.

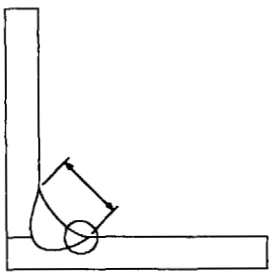


FIGURE 5. "GOOD" WELD

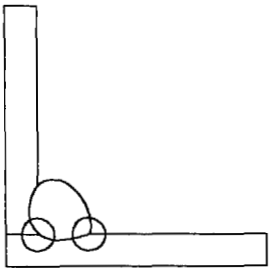


FIGURE 6. "BAD" WELD

7.4 GUN POSITION

For "down hand" fillet welding, the gun is normally positioned as shown in Figure 7 below with the nozzle end pointing in the direction of travel.

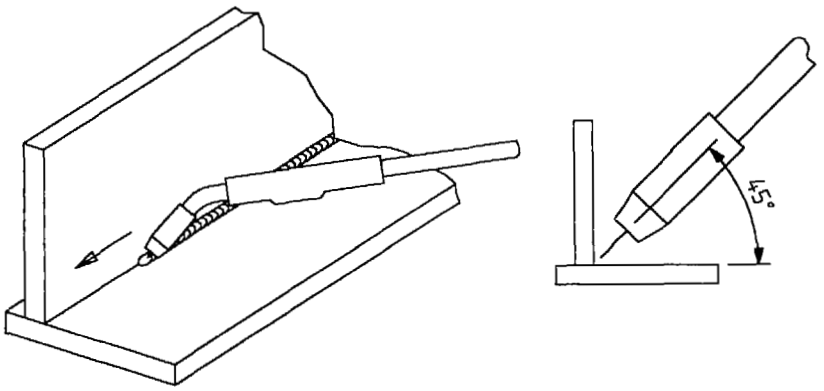


FIGURE 7. GUN POSITION

8. GENERAL MAINTENANCE

Before removing the machine cover, ENSURE that the unit is disconnected from the mains power supply. When the unit is energised LETHAL VOLTAGES are present on the electrical components enclosed.

DUST

Care should be taken to prevent excessive build-up of dust and dirt within the welding power source. It is recommended that at regular intervals, according to the prevailing conditions, the machine covers and enclosed wirefeeder covers be removed and any accumulated dust be removed by the use of dry, low pressure compressed air, or a vacuum cleaner.

WIREFEED

In order to obtain the most satisfactory welding results from the G.M.A.W. process, the wirefeed must be smooth and constant. It is therefore important to observe the following points;

- Keep the gun cable liner clear of dust and swarf build-up. When replacement becomes necessary, fit only the correct liner to suit the gun cable model. See page 19. The build-up of dust in a cable liner can be minimised by regular purging of the liner with dry compressed air. This may be conveniently done each time the wire spool is replaced.
- Replace the welding tip as it becomes worn.
- Keep the wire drive mechanism clean. Periodically check the drive rollers for wear and for free rotation.
- Check that the consumable wire spool holder rotates smoothly and that the braking action is not excessive. This also may be conveniently done each time the wire is replenished.

9. TROUBLE SHOOTING

FAULT	REMEDY
Power source has no power, ie. 1) power light is off 2) fans are not running	Turn on mains supply switch Check mains voltage, fuses or circuit breaker Check all primary connections in power source and in primary plug
Power source has no output but : 1) power light is off 2) fans are running	Check all connections to CP109-10 control board in power source Replace CP109-10 control board
Power source has no output and no wirefeed when gun switch is closed but: 1) power light is on 2) overload light is on 3) fans are running	Power source overheated. Allow thermostats to cool with fans on After cooling, if problem still persists, check rectifier thermostat and transformer thermostat for open circuit. Replace if faulty Check all connections to CP109-10 control board in power source
Power source has no output and no wirefeed when gun switch is closed but: 1) power light is on 2) overload light is off 3) fans are running	Gun switch circuit incomplete. Check gun switch for continuity with ohm meter when switch is pressed. Replace if faulty Gun switch circuit incomplete. Check the 2 pin receptacles in euro adaptor are making contact with the 2 pins from the gun cable. Check all connections to CP109-10 control board in power source Replace CP109-10 control board
Power source has live output all the time when mains power is applied and gun switch is off	Check triac in rectifier assembly of power source. Switch off mains power and disconnect yellow wire from gate terminal of triac. Switch on mains power and if output is still live, replace triac Replace CP109-10 control board
Power source has low weld output	Check welding circuit is making good electrical connection Check all cable connections in power source for hot spots.
Power source has no weld output variation when coarse and fine Switches are operated	Check all cable connections to coarse and fine switches Check coarse and fine switches Replace if faulty
Mains fuses blow or circuit breaker trips instantly when mains voltage is applied	Check welding transformer for a primary fault to earth. Replace if faulty Check fan in power source for short circuit or fault to earth Replace if faulty
Mains fuses blow or circuit breaker trips instantly when gun switch is closed	Check welding transformer for shorted turns. Replace if faulty Check rectifier for shorted diodes. Replace if faulty
Mains fuses blow or circuit breaker trips when welding	Check that the recommended fuse or circuit breaker rating has been used. Consider upgrading to larger fuse or circuit breaker & wiring.

TROUBLE SHOOTING cont.

UNSATISFACTORY WELDING PERFORMANCE AND RESULTS

FAULT	REMEDY
Erratic arc characteristics caused by poor wirefeed	Check gun liner for build up of dirt or blockage. Replace if dirty
	Check if wire is slipping on roller assembly. Replace feed roll if worn
	Check if there is too much drive roller pressure on wire
	Check spool holder is rotating smoothly
	Check that gun liner is not too short and is fitted correctly. Refer to page 19 for fitting instructions.
Constant poor arc characteristics	Check correct polarity has been selected for work and weld cables. Refer to page 8
	Check shielding gas is correct for the consumable in use
	Check welding circuit is making good electrical connection
	Check all connections in power source and wirefeeder for hot spots
Porosity in weld caused by lack of shielding gas	Check gas solenoid. Replace if faulty
	Check that the correct gas flow rate has been set
	Check for leaks in gas hose. Replace if leaking
	Check for leaks in gun cable, eg. o-rings. Replace if leaking
	Check nozzle is firmly attached to gun and that no air is being drawn in

10. SERVICE INFORMATION.

CP109-10 CONTROL BOARD

The CP109-10 Control board provides the following functions.

- Welding transformer ON/OFF control.
- Wirefeed motor ON / OFF control.
- Speed control of the wirefeed motor.
- Braking of the wirefeed motor at end of weld.
- Spot-weld timer.
- Interval timer.
- Gas solenoid ON / OFF control.
- Triac ON / OFF control, phase selected to minimise transformer inrush current.
- Triac protection by output short circuit detection.

Connections to the board are detailed in the drawing below.
The circuit is factory adjusted to provide a maximum drive roller speed of 160 rpm.

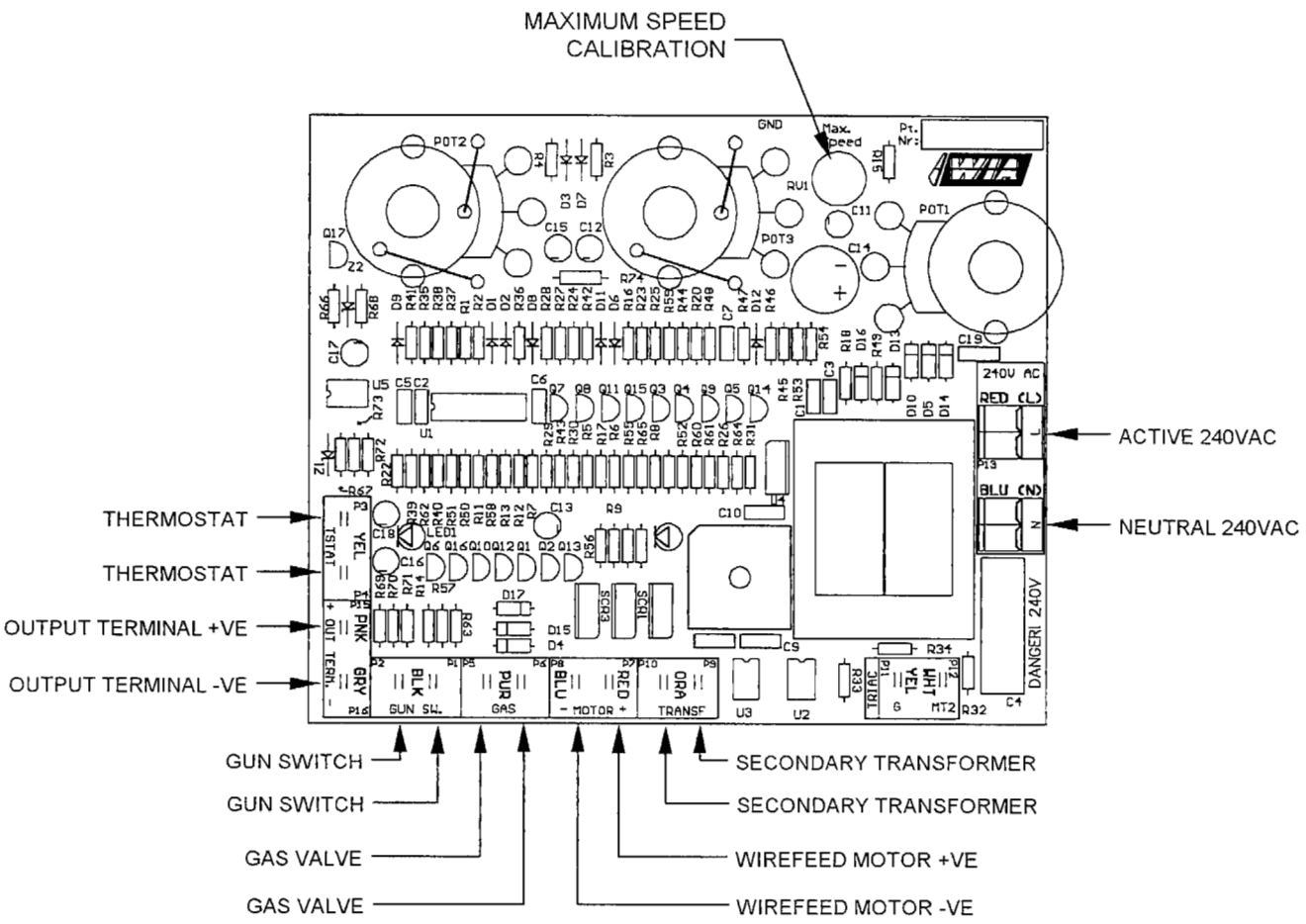


FIGURE 8. CP109-10 CONTROL BOARD

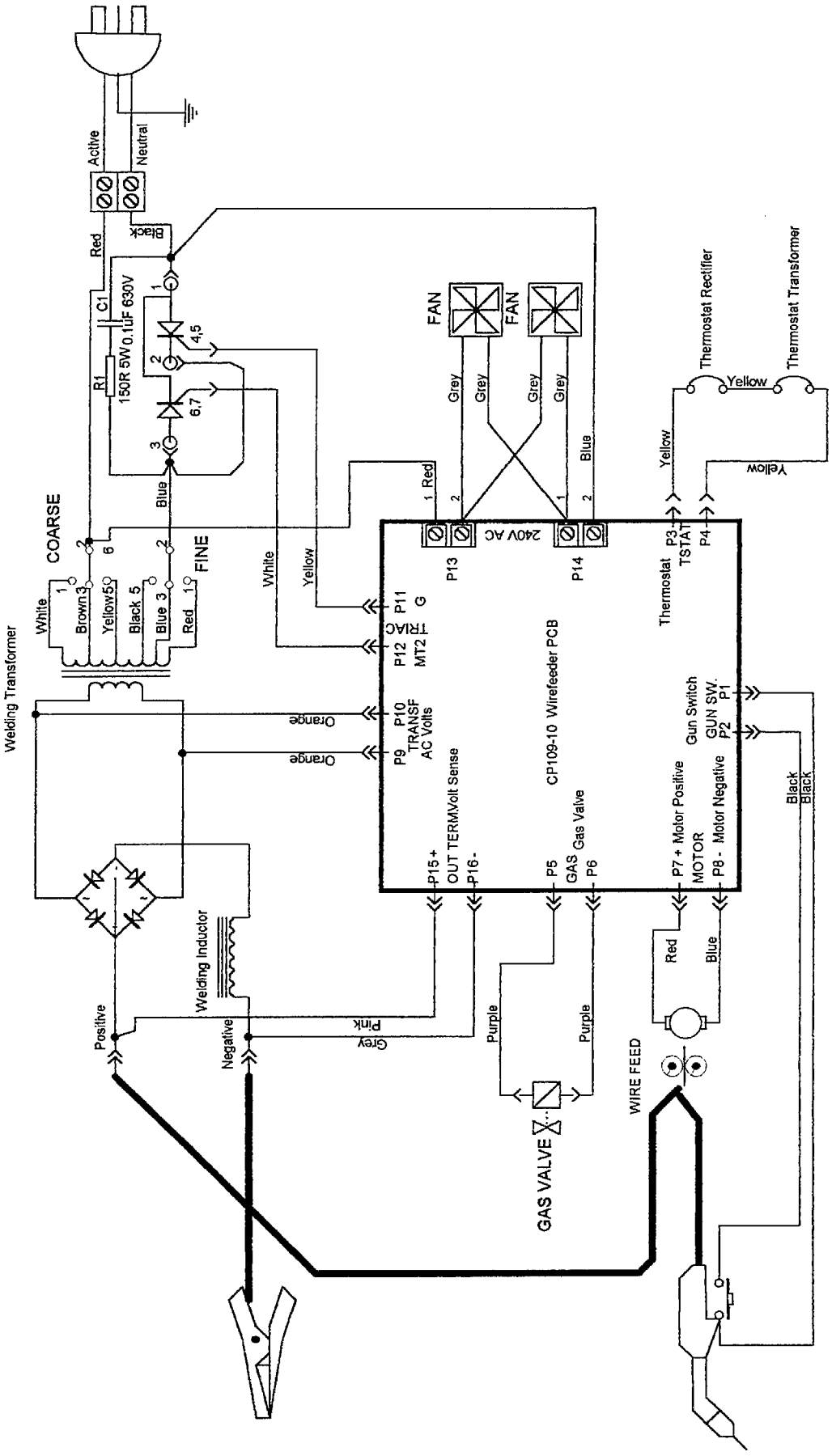


FIGURE 9. CP109-0 CIRCUIT DIAGRAM

11. PARTS LIST

WELDMATIC 215S POWER SOURCE

ITEM #	PART #	DESCRIPTION
1	CP109-10N	PCB Assy Wirefeed
2	CP109-5L	Weld Transformer Assy inc. Overload & Wire Loom
Includes		
2.1	CP104-16/2	Thermal Overload
3	CP109-6	Inductance Assembly
5	CP109-8	Rectifier Assembly
Includes		
5.1	CP106-0/1	Rectifier with Thermal overload
5.1.1	CP3-9/8	Thermal Overload (Not Shown)
5.2	CP102-51/2	SCR Module (Not Shown)
5.3	CP109-32	Heatsink (Not Shown)
6	CP43-23	Base Assembly
Includes		
6.1	CP42-24/6	Castor Wheel (2)
7	CP109-20Y	Front Panel
8	CP109-24Y	Back Panel
9	CP109-21Y	Centre Panel Assembly
10	CP109-23	Baffle Panel
11	CP42-27Y	Side Cover-Fixed Lower (Not Shown)
12	CP109-28Y	Door Hinged (Not Shown)
13	CP42-29Y	Top Cover
14	W29-1/20	Slam Action Latch On Door(Not Shown)
15	CP43-24Y	Side Cover (Not Shown)
16	CP42-0/3	Rubber Tyre Wheel (2)
17	MC11-53/6	Ratchet Cap (2)
18	CP109-50	Loom Assembly, Low Voltage (Not Shown)
19	CP109-54	External Polarity Change Lead
20	CP109-55	Loom Assembly, Transformer (Not Shown)
21	CP109-56	Loom Assembly, High Voltage (Not Shown)
22	SA140-0/2	Socket Dinsel 25mm (2)
23	MK6/2	Terminal Block, 2 position
24	CP27-0/15	Cooling Fan (2)
25	CP101-0/18	Gas Valve 24V DC
26	W11-11/1	Gas Valve Hose Tail (2)
27	OCL13	"O" Clip ½" (2)
28	CP106-0/3	20A Flex & 15A Plug
29	CP109-15	Rod Hinge (Not Shown)
30	W5-10/19	Potentiometer Knob, Small (2)
31	W11-0/16	Potentiometer Knob, Large
32	62513	Black Oxy Single Hose
36	SCG030M	Steel Chain 650mm
37	CP3-0/23	Rubber Grommet
50	CP42-39	Handle Assy
51	WF001-6	Plastic Cover
72	W39-0/1	Switch (2)
80	H907	Cable Clamp
84	BBA210-1	Busbar Inductance
85	BBA320-1	Busbar, Inductance to Output –ve
86	BBA315-2	Busbar, Rectifier -ve to Inductance
87	BBA500-1	Busbar, Rectifier +ve to Output +ve
	MC14-0/10	Male Insulating Bush For Flex Cord (Not Shown)
	MC14-0/11	Female Insulating Bush For Flex Cord (Not Shown)
	CP109-40	CP109-0 Owner s Manual (Not Shown)

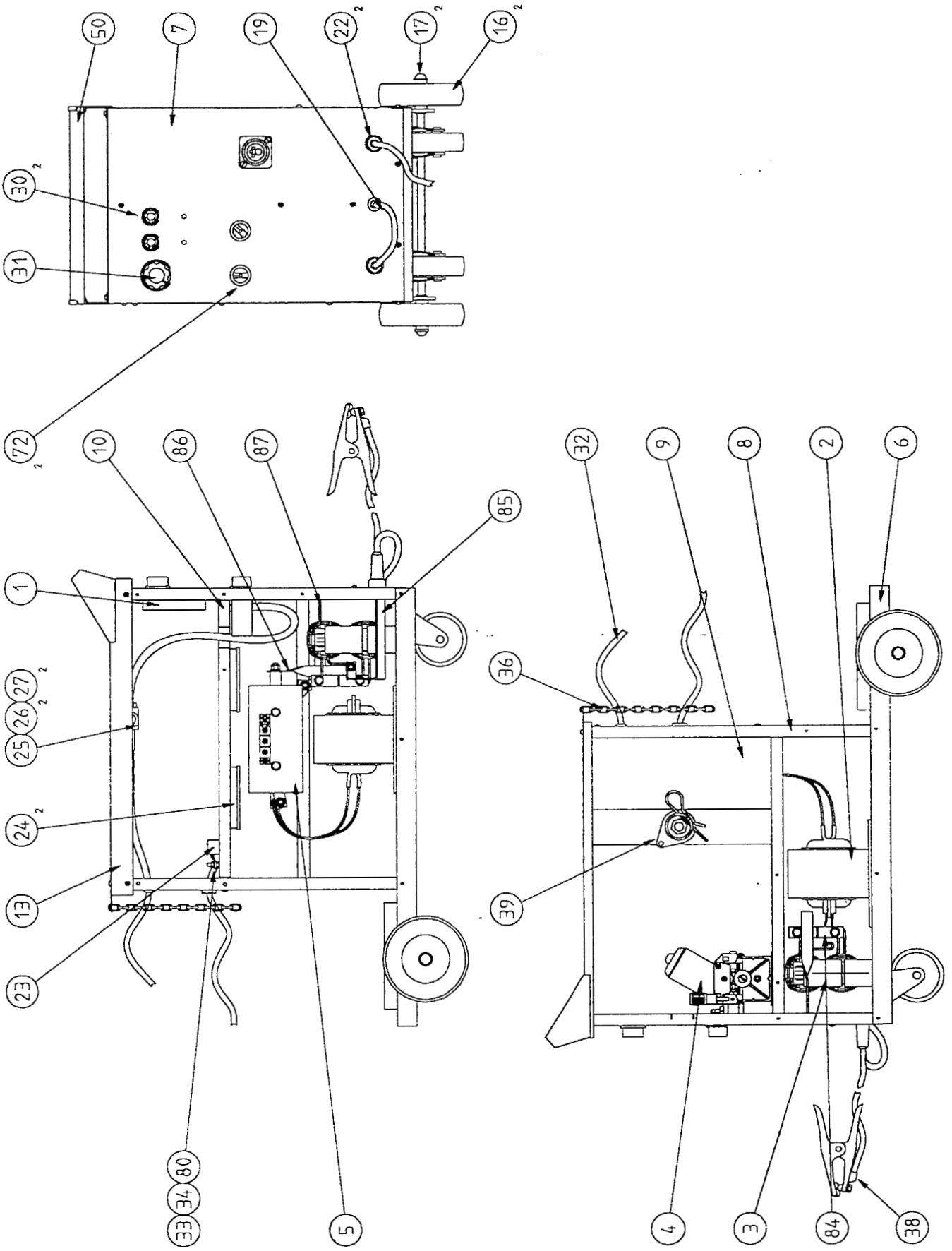


FIGURE 10. WELDMATIC 215S POWER SOURCE ASSEMBLY

12. PARTS LIST

CP109-7 MOTOR, TWO ROLL DRIVE & EURO ADAPTOR ASSEMBLY

ITEM #	PART #	DESCRIPTION
1	WF001-1	Motor & Gearbox
2	WF001-2	Euro Gun Adaptor inc. Guide & Gas Connector
3	WF001-3	2 Roll Feed Plate
4	WF001-4	Pressure Arm (Complete)
5	WF001-4/1	Pressure Roll 30mm Diameter
6	WF001-5	Pressure Screw Complete
7	WF001-6	Insulation Board
8	WF001-7	Insulation Washer
9	W26-1/8	Feed Roll 30mm - 0.8 + 1.0mm, Solid Wire
10	W27-0/9	Positioning Screw Main Gear
11	W26-0/13	Inlet Guide
12	WF001-21	Inlet Guide Tube
ALTERNATIVE PARTS		
(9)	W26-0/8	Feed Roll 0.6 + 0.8mm, Solid Wire
(9)	W26-5/8	Feed Roll 0.9 + 1.2mm, Solid Wire
(9)	W26-2/8	Feed Roll 1.0 + 1.2mm, Solid Wire
(9)	W26-4/8	Feed Roll 1.2 + 1.6mm, Solid Wire
(9)	W26-3/8	Feed Roll 1.0 + 1.2mm, Aluminium Wire
(9)	W26-7/8	Feed Roll 1.0 + 1.2mm, Flux Cored Wire
(9)	W26-6/8	Feed Roll 1.2 + 1.6mm, Flux Cored Wire

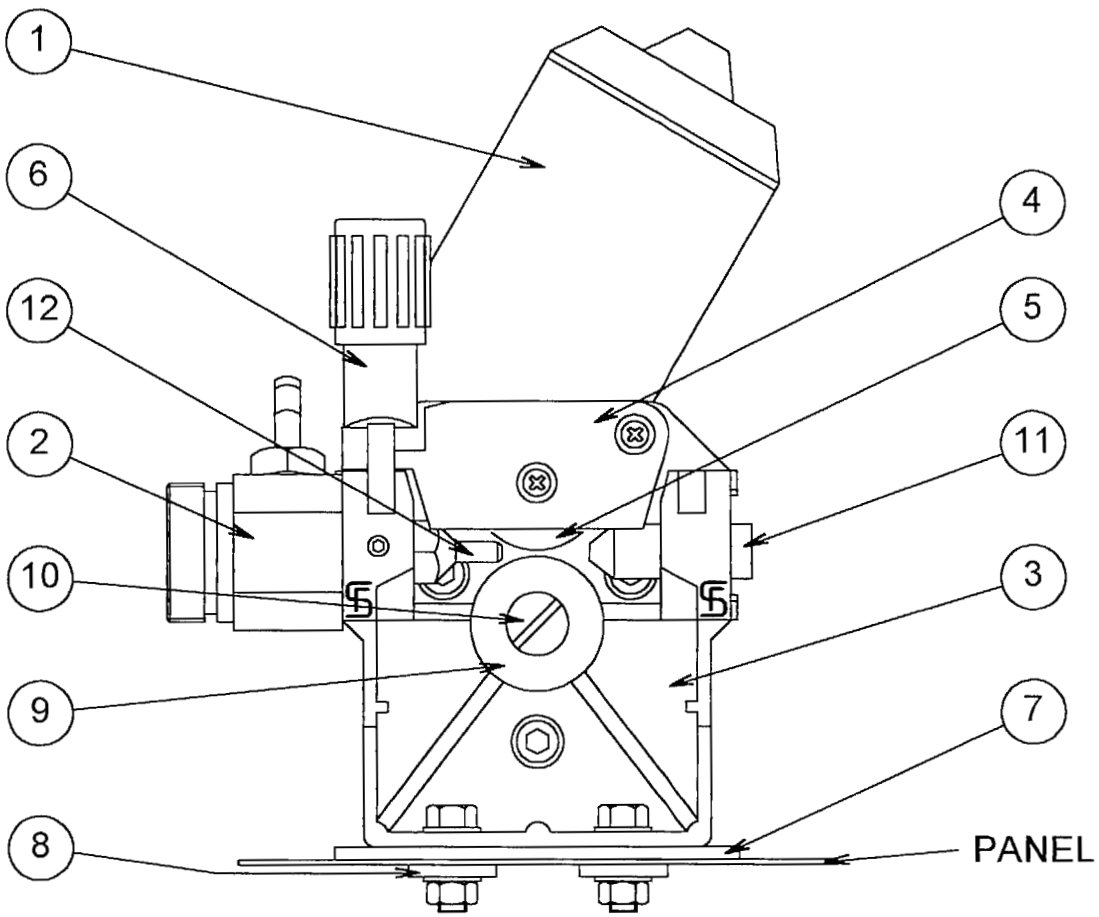


FIGURE 11. CP109-7 TWO ROLL DRIVE ASSEMBLY

13. PARTS LIST

BEXT2-4E210AE GUN ASSEMBLY

ITEM #	DESCRIPTION	PART #
1	Nozzle	BE4392
2	Contact tip 0.6mm	BE7497
	Contact tip 0.8mm	BE7488
	Contact tip 0.9mm	BE7489
	Contact tip 1.2mm	BE7490
3	Head	BE4335
4	Cap	BE4323R
5	Nut Insulator	BE4780
6	Insulator	BE1370117
7	Body Tube	BE1370116
8	Handle Kit	BE1780006
9	Trigger	BE5662
10	Screw Kit	BE1880004
14	Cable 3m	BE8681TE

ITEM #	DESCRIPTION	PART #
15	End Fitting	BE4E213B
16	Cone Nut	BE4305
17	Terminal	BE2660001
18	Clamp	BE1520008
19	Strain Relief	BE2520017
20	Bushing	BE1470007
21	Strain Relief, rigid	BE1880135
22	Screw	BE2280002
23	Insulated Link	H2072
24	Nut	BE4816
25	Euro Block	BE5060
26	'O' Ring	BE4421
27	Liner 0.9 - 1.2mm	BE43110

To replace liner: Disconnect gun cable assembly from the Euro adaptor on the machine case, remove nozzle (1) and head (3). Withdraw old liner from the wire feeder end. Insert new liner and refit gun cable assembly to Euro adaptor on the machine case. At the gun end, compress the liner within the gun cable, then **cut it one contact tip length past the end of the body tube** (7). Refit head, tip and nozzle.

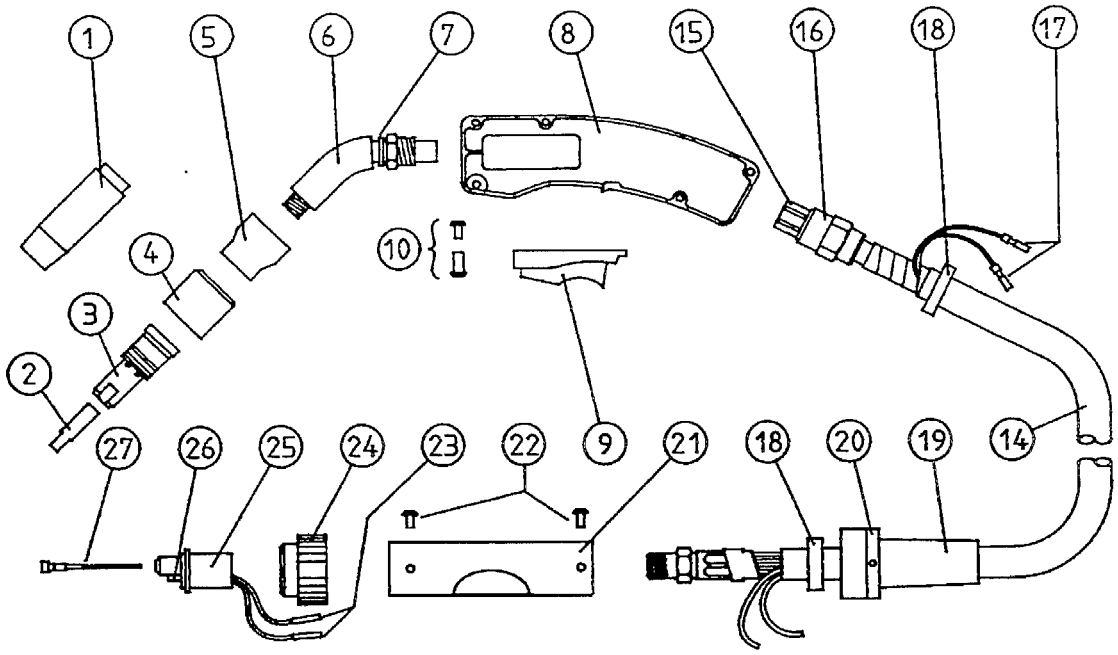


FIGURE 12. BEXT2-4E210AE (200 AMP) GUN CABLE ASSEMBLY

14. SAFE PRACTICES WHEN USING WELDING EQUIPMENT

These notes are provided in the interests of improving operator safety. They should be considered only as a basic guide to Safe Working Habits. A full list of Standards pertaining to industry is available from the Standards Association of Australia, also various State Electricity Authorities, Departments of Labour and Industry or Mines Department and other Local Health or Safety Inspection Authorities may have additional requirements. WTIA Technical Note TN7-98 also provides a comprehensive guide to safe practices in welding.

EYE PROTECTION

NEVER LOOK AT AN ARC WITHOUT PROTECTION. Wear a helmet with safety goggles or glasses with side shields underneath, with appropriate filter lenses protected by clear cover lens. This is a MUST for welding, cutting, and chipping to protect the eyes from radiant energy and flying metal. Replace the cover lens when broken, pitted, or spattered.

Recommended shade filter lens.

Amps	TIG	MMAW	MIG	Pulsed MIG
0-100	10	9	10	12-13
100-150	11	10	10	12-13
150-200	12	10-11	11-12	12-13
200-300	13	11	12-13	12-13
300-400	14	12	13	14
400-500	--	13	14	14
500 +	--	--	14	14

BURN PROTECTION.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-coloured surfaces, and burn the skin and eyes. Burns resulting from gas-shielded arcs resemble acute sunburn, but can be more severe and painful.

Wear protective clothing - leather or heat resistant gloves, hat, and safety-toe boots. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Avoid oily or greasy clothing. A spark may ignite them. Hot metal such as electrode stubs and work pieces should never be handled without gloves.

Ear plugs should be worn when welding in overhead positions or in a confined space. A hard hat should be worn when others are working overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

TOXIC FUMES.

Adequate ventilation with air is essential. Severe discomfort, illness or death can result from fumes, vapours, heat, or oxygen depletion that welding or cutting may produce. NEVER ventilate with oxygen.

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.

Metals coated with or containing materials that emit 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.

Work in a confined space only while it is being ventilated and, if necessary, while wearing air-supplied respirator.

Vapours from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and 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 percholorethylene.

FIRE AND EXPLOSION PREVENTION.

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 operator. Sparks and slag can travel up to 10 metres from the arc.

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are present in the work area, do NOT weld or cut. Move the work if practicable, 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 10 metres away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting fire-resistant covers or shields.

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.

A person acting as Fire Watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if;

- Combustibles (including building construction) are within 10 metres.
- Combustibles are further than 10 metres but can be ignited by sparks.
- Openings (concealed or visible) in floors or walls within 10 metres may expose combustibles to sparks.
- Combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

After work is done, check that area is free of sparks, glowing embers, and flames.

A tank or drum which has contained combustibles can produce flammable vapours when heated. Such a container must never be welded on or cut, unless it has first been cleaned as described in AS.1674-1974, the S.A.A. Cutting and Welding Safety Code. 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 AS.1674-1974. Water-filling just below working level may substitute for inerting.

Hollow castings or containers must be vented before welding or cutting. They can explode. Never weld or cut where the air may contain flammable dust, gas, or liquid vapours.

SHOCK PREVENTION.

Exposed conductors or other bare metal in the welding circuit, or ungrounded electrically alive equipment can fatally shock a person whose body becomes a conductor. Ensure that the machine is correctly connected and earthed. If unsure have machine installed by a qualified electrician. On mobile or portable equipment, regularly inspect condition of trailing power leads and connecting plugs. Repair or replace damaged leads.

Fully insulated electrode holders should be used. Do not use holders with protruding screws. Fully insulated lock-type connectors should be used to join welding cable lengths.

Terminals and other exposed parts of electrical units should have insulated knobs or covers secured before operation.