



AK 400
AK 600

**Fully Thyristorised MIG/MAG
Welding Power Source**

Instruction manual



AK400, AK 600

FULLY THYRISTORISED MIG/MAG WELDING POWER SOURCE



Instruction manual
For
Installation, Operation & General maintenance

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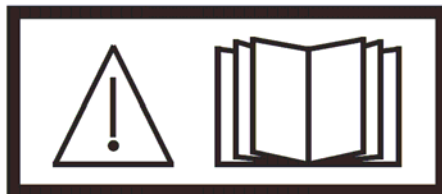
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SAFETY

Users of ESAB welding equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions. Safety precautions must meet the requirements that apply to this type of welding equipment. The following recommendations should be observed in addition to the standard regulations that apply to the workplace.

Trained personnel well acquainted with the operation of the welding equipment must carry out all the work. Incorrect operation of the equipment may lead to hazardous situations, which can result in injury to the operator and damage to the equipment.

1. Anyone who uses the welding equipment must be familiar with:
 - its operation
 - location of emergency stops
 - its function
 - relevant safety precautions
 - welding
2. The operator must ensure that:
 - no unauthorized person is stationed within the working area of the equipment when it is started up.
 - no one is unprotected when the arc is struck
3. The workplace must:
 - be suitable for the purpose
 - be free from drafts
4. Personal safety equipment
 - Always wear recommended personal safety equipment, such as safety glasses, flameproof clothing, and safety gloves.
 - Do not wear loose—fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns.
5. General precautions
 - Make sure the return cable is connected securely.
 - Only a qualified electrician may carry out work on high voltage equipment.
 - Appropriate fire extinguishing equipment must be clearly marked and close at hand.
 - Lubrication and maintenance must not be carried out on the equipment during operation.



Read and understand the instruction manual before installing or operating.
 ESAB can provide you with all necessary welding protection and accessories.



WARNING

Arc welding and cutting can be injurious to yourself and others. Take precautions when welding. Ask for your employer's safety practices which should be based on manufacturers' hazard data.

| | |
|--|---|
| | <p>ELECTRIC SHOCK – Can kill</p> <ul style="list-style-type: none"> • Install and earth the welding unit in accordance with applicable standards. • Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing. • Insulate yourself from earth and the workpiece. • Ensure your working stance is safe. |
| | <p>FUMES AND GASES – Can be dangerous to health</p> <ul style="list-style-type: none"> • Keep your head out of the fumes. • Use ventilation, extraction at the arc, or both, to take fumes and gases away from your breathing zone and the general area. |
| | <p>ARC RAYS – Can injure eyes and burn skin.</p> <ul style="list-style-type: none"> • Protect your eyes and body. Use the correct welding screen and filter lens and wear protective clothing. • Protect bystanders with suitable screens or curtains. |
| | <p>FIRE HAZARD</p> <ul style="list-style-type: none"> • Sparks (spatter) can cause fire. Make sure therefore that there are no inflammable materials nearby. |
| | <p>NOISE – Excessive noise can damage hearing</p> <ul style="list-style-type: none"> • Protect your ears. Use earmuffs or other hearing protection. • Warn bystanders of the risk. |
| <p>MALFUNCTION – Call for expert assistance in the event of malfunction. PROTECT YOURSELF AND OTHERS!</p> | |
| | <p>CAUTION! <i>This product is solely intended for arc welding</i></p> |

| | |
|--|---|
| | <p>Do not dispose of electrical equipment together with normal waste! In accordance with national law, electrical equipment that has reached the end of its life must be collected separately and returned to an environmentally compatible recycling facility. As the owner of the equipment, you should get information on approved collection systems from the local representative. By applying this Directive you will improve the environment and human health</p> |
|--|---|

A. ASSEMBLING

The complete Installation should consist of the following items:

| Description | Type | Quantity |
|--------------------------------------|--|----------|
| 1. Welding Power Source | AK 400 OR AK 600 | 1 |
| 2. Wire Feeder & Remote Control Unit | SERVO WIREFEEDER- I WITH ACCESSORIES & REMOTE CONTROL UNIT – RC AK 400 OR SERVO WIREFEEDER- II WITH ACCESSORIES & REMOTE CONTROL UNIT – RC AK 600 | 1 |

B. ACCESSORIES LIST FOR AK 400 / AK 600 THYRISTORISED MIG/MAG WELDING POWER SOURCES

| | |
|--------------------|---------|
| Fuse, element 5A | 1 piece |
| Fuse, element 8A | 1 piece |
| Instruction Manual | 1 piece |

C. RATING OF AK 400 / AK 600 THYRISTORISED MIG/MAG WELDING POWER SOURCES

| | | |
|---|--|-----------------|
| CHARACTERISTICS | CONSTANT POTENTIAL TYPE | |
| INPUT: | | |
| SUPPLY VOLTAGE, PHASE & FREQUENCY | 415 V \pm 10%, 3 PHASE, 50 HZ, AC | |
| MAXIMUM INPUT CURRENT | 31 Amps | 55 Amps |
| MAXIMUM RATING | 20.7 KVA | 40 KVA |
| OUTPUT: | | |
| OUTPUT CURRENT RANGE | DC 60A-400A | DC 60A-600A |
| Maximum output Current at 60% Duty Cycle | 400 Amps | 600 Amps |
| Maximum continuous current at 100% Duty cycle | 310 Amps | 470 Amps |
| Open circuit voltage (Max) | 53 Volts DC | 63 Volts DC |
| Type of Welding Voltage & Current control | Stepless through remote control Unit RC AUTO K 400 & RC AUTO K 600 | |
| Class of Insulation | CLASS H | |
| COOLING | FORCED AIR COOLED | |
| Approximate dimension (LENGTH X WIDTH X HEIGHT) in mm | 675X 350 X 690 | 617 X 455 X 850 |
| Weight (Approximate) | 110 Kgs. | 155 Kgs. |

D. CAUTIONS FOR INSTALLATION

a) Capacity of Equipment

| | | |
|-----------------------------|------------------------------|------------------------------|
| Input Voltage | AC 415 V \pm 10% | |
| Number of Phase & Frequency | 3 phases, 50 HZ | |
| | AK 400 | AK 600 |
| Maximum rating of Equipment | 20.7 KVA | 40 KVA |
| Capacity of Fuse (B Class) | 32 Amps | 63 Amps |
| Input Cable | More than 8 mm ² | More than 14 mm ² |
| Output Cable | More than 38 mm ² | More than 60 mm ² |

- Provide a Switch Box for every Welding Power Source, and use designated fuse
- Tolerance of Power Voltage Variation is \pm 10% of rated input voltage.
- 100 Amps MCB to be used as alternative to SFU.

b) Installation place

- Install in the place where less moisture and dust exist. Avoid direct sunlight and rain, and maintain ambient temperature within -10° to 45° C as much as possible.
- Keep the welding power source at least 20 cm. away from the wall (if any).
- In case of installation of more two units side by side, a distance of more than 20 cm. is recommended between the two power sources.
- Keep the Gas Cylinder on a separate stand.
- Use a shield to protect the welding arc in case of excessive air draft.

c) Ventilation

Adequate ventilation is recommended at the place of installation. For example the following guideline should be followed:

- a) In case of the area is more than 300 square meters (per unit), no ventilation is required, provided the room is not completely air tight.
- b) In case of the area is less than 300 square meters, the torch is used in fixed condition and the welding is continuously performed, adequate ventilation is recommended with the help of vent fan or exhaust duct.

E. INSTALLATION ITEMS OF AK 400 / AK 600

While performing the grounding work, it is recommended that a skilled electrician does the work.

| No. | Items | No. | Items |
|------------|--|------------|--|
| 1. | Remote Control Unit RC AUTO K 400 / RC AUTO K 600 | 12. | Terminal for Wire feeder (+) |
| 2. | Wire Feeder SERVO WIREFEEDER-I / SERVO WIREFEEDER-II | 13. | Gas Inlet |
| 3. | Welding Torch PSF 400 / PSF 500 | 14. | Connector for CO ₂ Heater |
| 4. | Base Metal | 15. | Control cable for RC AK 400 / RC AK 600 |
| 5. | Gas Regulator | 16. | Welding Cable |
| 6. | Gas Cylinder | 17. | Gas Hose |
| 7. | Switch Box | 18. | Welding Cable |
| 8. | Connector for Remote Control | 19. | Control cable for Wire feeder |
| 9. | Gas Outlet | 20. | Gas Hose |
| 10. | Connector for Wire Feed | 21. | Cable for CO ₂ Heater |
| 11. | Terminal for work | 22. | Input Cable |

F. WELDING OPERATIONS

The welding operation can be adjusted from the front operation panel of the power source and remote control unit.

Gas Supply:

To check the gas supply before welding, set the SHIELD GAS switch to CHECK position. The shielding gas will start flowing. After confirmation, release the switch and it will automatically return to WELD position.

Welding method:

Set the switch at CO₂ or Ar-CO₂ depending on the Shielding Gas used for GMA welding.

Self hold:

When the Self hold / Crater switch is ON, the arc is produced while the torch switch is ON and then the self hold is maintained even though the torch switch is turned OFF, and the crater control condition will start functioning if the torch switch is triggered 'ON' for the second time.

Crater control function

An Arc Crater normally formed at the end of the welding can be filled without any defect by adjusting the crater current and crater voltage knobs on the front panel of the Power Source.

Remote Control unit

Adjust welding voltage and current from the Remote Control Unit as per following guidelines:

a) Welding Current Adjustment:

Set the welding current by turning the current adjustment knob and adjust at the proper graduated value of the current. However, for fine-tuning, set the welding current from the ammeter in the front panel of the Power Source, by generating an experimental Arc.

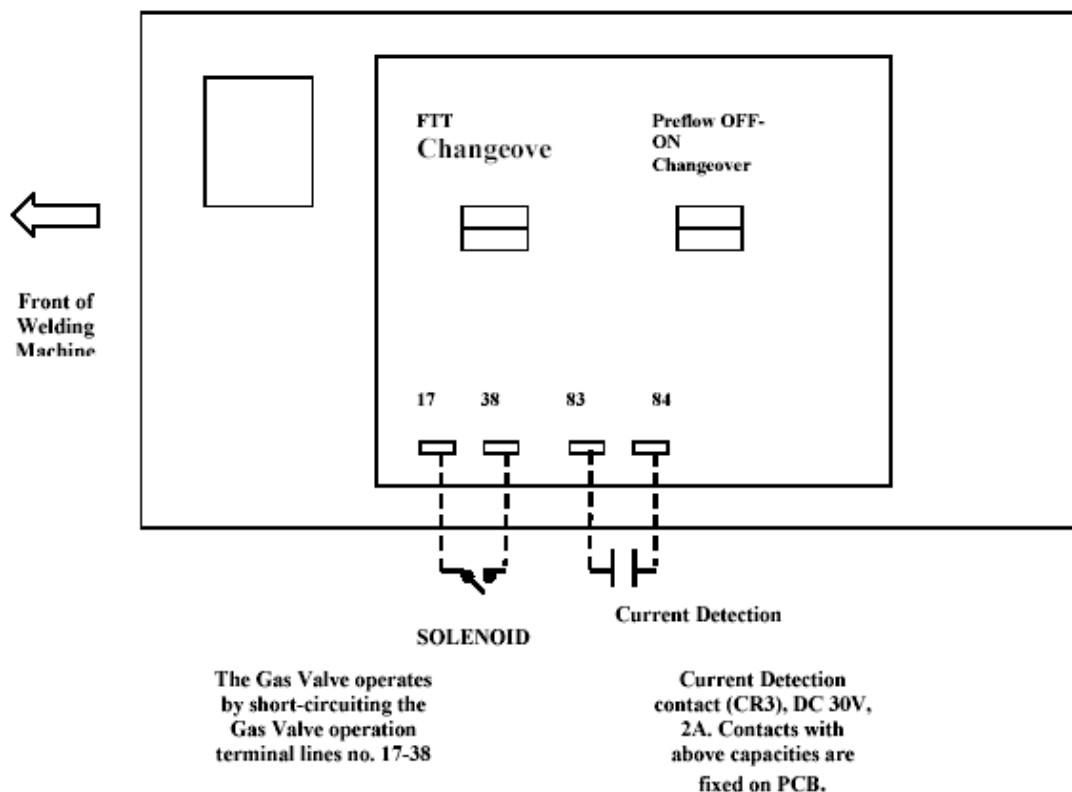
b) Welding Voltage Adjustment:

Adjust the welding voltage by turning the voltage adjustment knob of the Remote Control Unit. Set at a proper graduation of the voltage value. However, the voltage value indicated in the remote Control Unit is indicative only. Therefore, set a proper value from the voltmeter of the front panel by generating experimental arc.

G. JIG TERMINAL AND CHANGEOVER TERMINALS IN WELDING POWER SOURCE

Jig Terminals

- These are the signal terminals, which are convenient to use with welding jigs such as a welding, turn table, etc and terminals are also provided to operate a gas valve separately.
- The Jig terminals are fixed on Printed Circuit Board of welding power source. Printed Circuit Board will be visible when front panel cover is removed.



Preflow ON and OFF Changeover Terminals

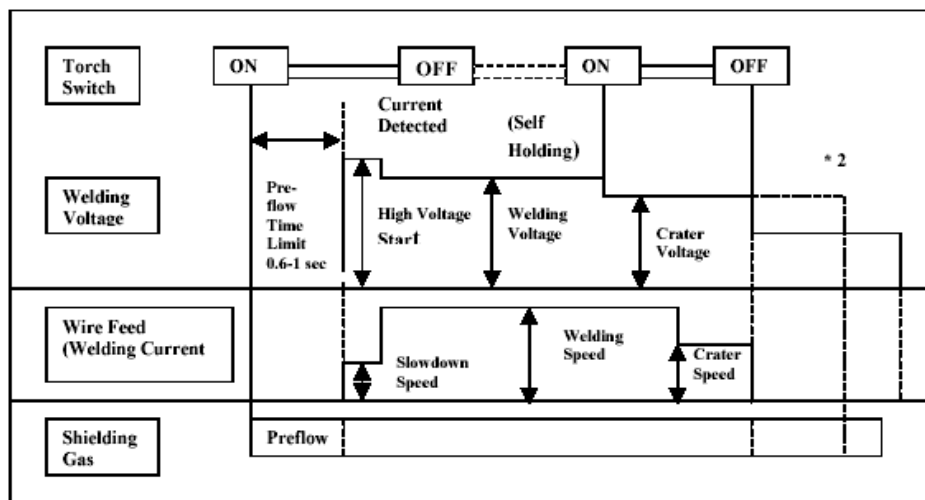
- A preflow timer (about 0.6 sec) is built in the control circuit. The Machine comes with the Preflow set at OFF position.
- The preflow of the shielding gas can be made either ON or OFF by changeover terminals on Printed Circuit Board.

FTT “ON” and “OFF” Changeover terminals

- FTT circuit is provided to stop the growth of globule at the end of the wire to enhance the arc striking while restarting the welding. The FTT circuit can be turned ON or OFF by the changeover terminal on Printed Circuit Board.
- FTT is set at ON as standard.
- Under special welding conditions where the welding is too frequently repeated, a spark can occur if the FTT is “ON”, due to the end of the wire touching the base metal immediately after welding (due to extended burn back time limit). In such case, FTT is to be set at OFF.

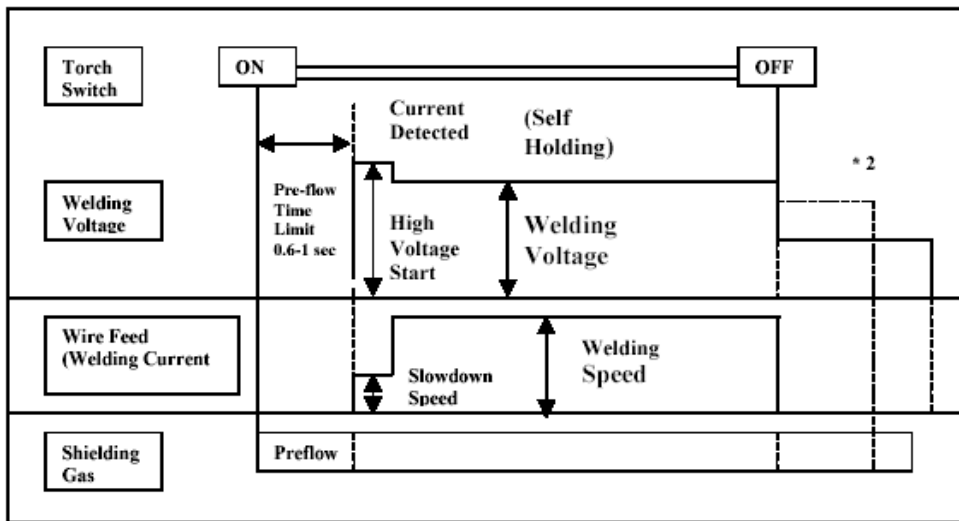
I. ACTION

- When crater unit / self hold function is turned on:



1. When the pre-flow is turned ON, the welding voltage and wire feed action is delayed by about 0.6 second. The preflow is turned OFF, while supplied from the factory.
2. The dotted line portion indicates an action when FTT is OFF.
3. About 25 seconds after releasing the torch switch, the power saving circuit is activated to turn off the electromagnetic contactor. Energy saving circuit is incorporated in the unit.

- When the self-hold function is turned off.



H. MAINTENANCE & INSPECTION

The maintenance and inspection should be carried out only after the switches in the switch box are turned OFF.

Try to maintain and inspect the set regularly as per the following guidelines:

a) Regular Inspection

(Every 3-6 months, depending on operation frequency):

| Inspection Portion | Inspection Point | Maintenance Method |
|----------------------------------|--|------------------------------------|
| Fuse Box | Fastening & looseness at the Connection. Confirmation of proper fuse. | Refer to the Equipment Capacity |
| Input and Output Terminals | Fastening & looseness at the Connection. Confirmation of Insulation. | Fasten first and Tape |
| Electro-magnetic Contactor | Confirmation of Abrasion at Contact Points. | Replace with new ones. |
| Interior of Welding Power Source | Sedimentation of Dust. Trace of Overheat | Blow off dust with Compressed Air. |

b) Cautions for Insulation Voltage-Proof Test & Insulation Resistance Measurement Test:

Careless execution of Dielectric Strength test and Insulation Resistance Measurement will cause damage to the power source, since the thyristors, transistors and other semiconductor parts are widely used in the unit. When these are to be performed in accordance with the bylaws of your company, the following points should be kept in mind: -

- Take off the cables from the switch box that are connected to the three input terminals and short circuit the three input terminals.
- Take off the cable that is connected to two output terminals and short circuit the two output terminals.
- Short circuit between anode and cathode of thyristors SCRI-6
- Remove the two grounding conductors. (Take off the side panel, and then remove one conductor nearby the electro-magnetic contactor and also the other conductor ground to leg of the DC reactor).

I. AFTER SALES SERVICE

In case of any abnormality observed during usage of equipment, which could not be rectified at site, please contact immediately Area Sales Manager of the nearest unit of **ESAB** with the following details:

- 1) Serial Number of the equipment and type
- 2) Nature of the complaint with the relevant details, if possible and the details of Input Supply
- 3) Date of purchase of the equipment and the date of commissioning.

The qualified and trained service team of **ESAB**, located at the ESAB Office, render the after sales service to the customers and also assist in proper selections of Welding Equipment & consumables for various applications.

J. FAULT FINDING

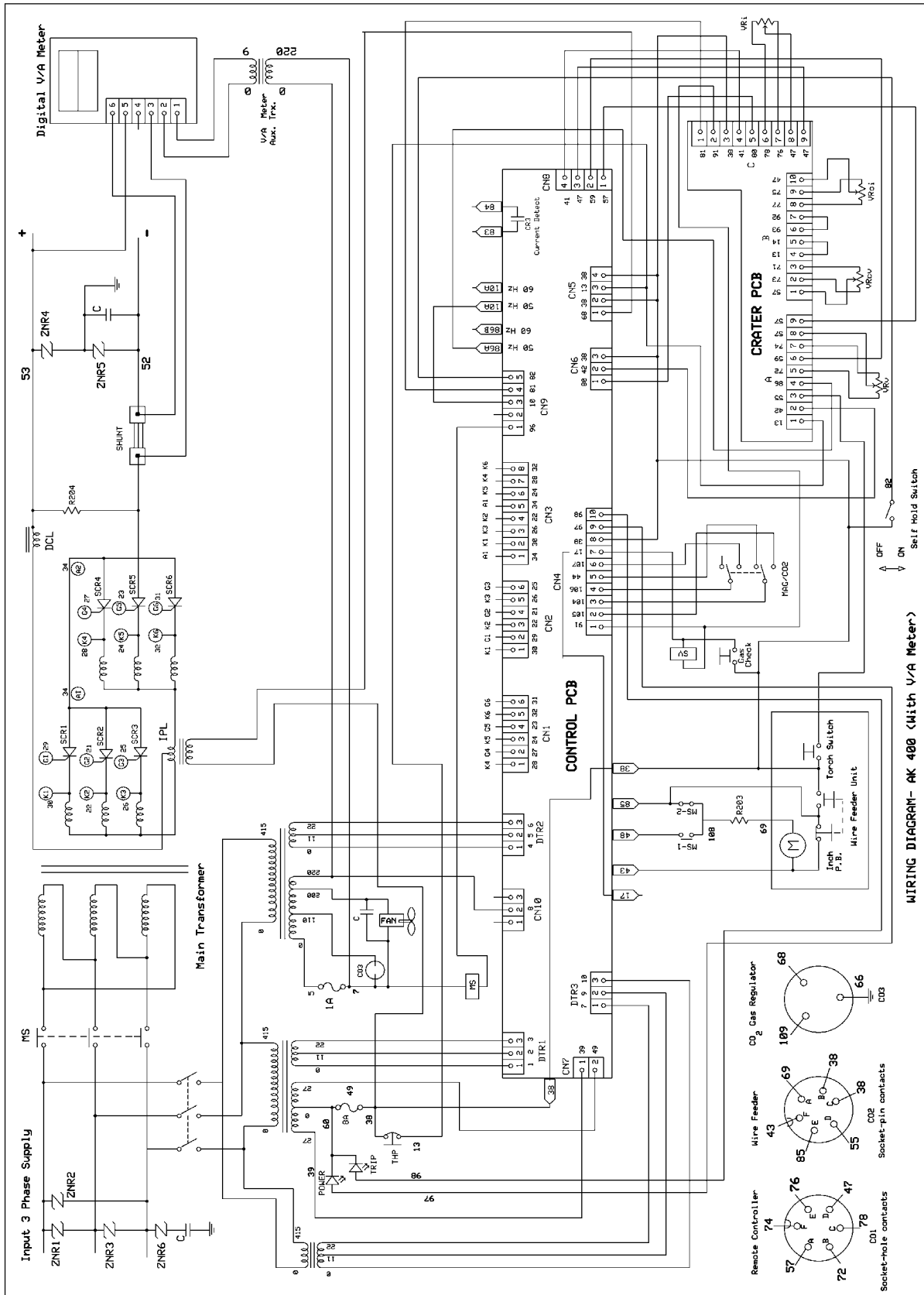
Check points in case of Abnormal Operation

| Fault | Possible Cause | Rectification |
|--|---|---|
| 1. Welding is automatically stopped, and the "INDICATOR WARN" lamp is ON | Control Fuse is blown | Replace with the rated fuse |
| | The Duty Cycle or welding current are higher than specified limits. | Wait and allow the Cooling Fan to rotate. Keep the Fan running more than 10 minutes after the abnormal Indication Lamp is turned OFF, and do not start the welding. While restarting welding, lower the welding current or duty cycle. Avoid the welding operation while indicator Lamp "WARN" is repeatedly ON. |
| 2. Wire does not feed even pressing the Torch Switch | Power Switch is in OFF position | Turn the power ON. |
| | Single phase Operation | Check Fuses, power switch in the switch box. |
| | The set value of the welding current at Remote Control unit is in the lowest. | Increase current value by turning clockwise the current adjustment knob. |
| | The Motor fuse is blown. | Replace fuses with the rated ones. |
| | Disconnection of the Wire Feeder's control cable or imperfect contact of the connector. | Check for continuity using a multimeter. Machine has to be kept switched OFF during continuity test |
| | Fault of the Control PCB / Crater PCB | Replace Control PCB / Crater PCB |

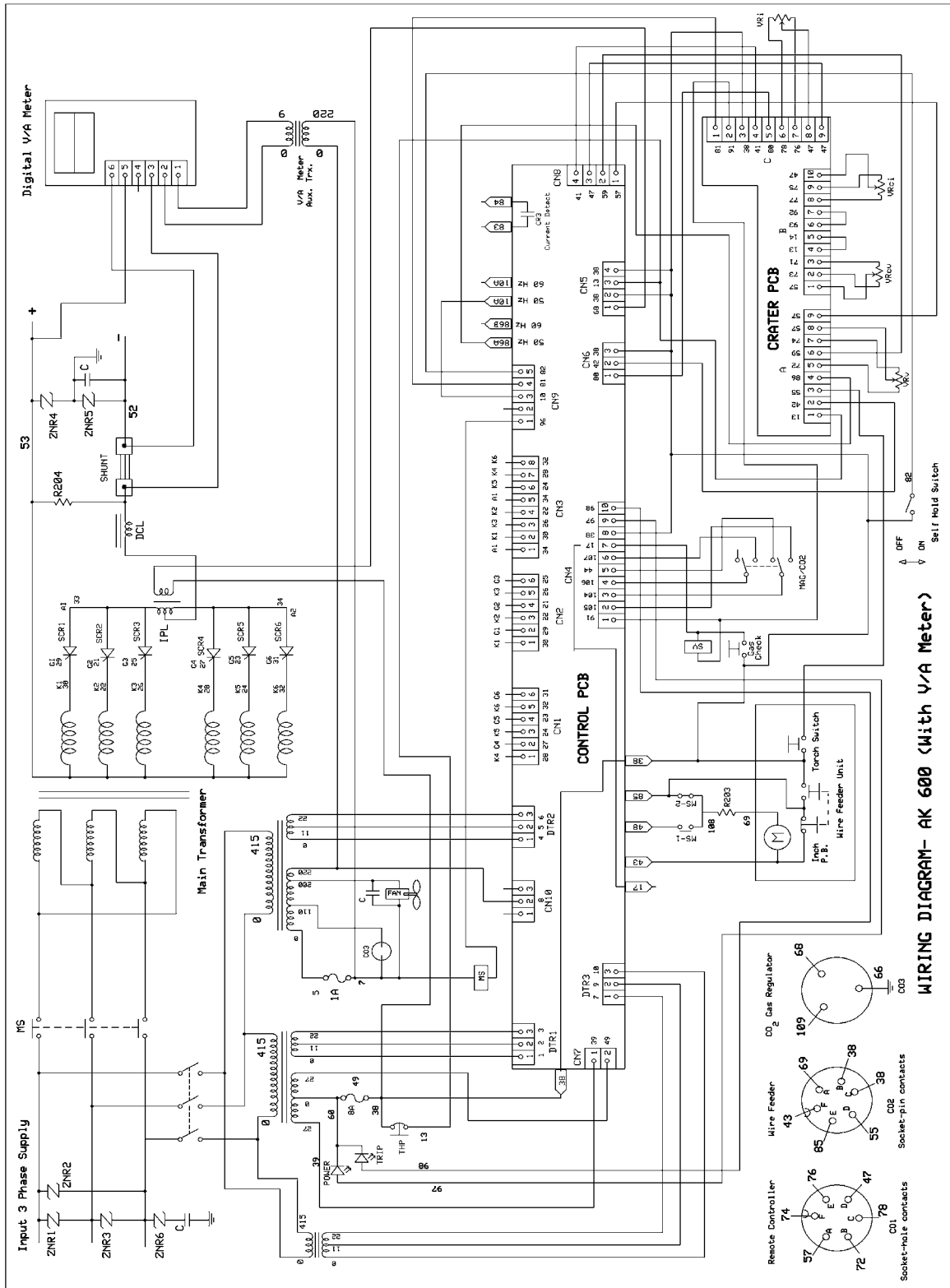
| Fault | Possible Cause | Rectification |
|--|---|---|
| 3. The wire feeds in inching but no feeding when the Torch Switch is pressed "ON" | Fault of the Torch Switch or disconnection of the control cables. | Check for continuity using a multimeter. Machine has to be kept switched OFF during continuity test |
| | Fault of main PCB / Crater PCB | Replace main PCB / Crater PCB |
| 4. When the Torch Switch is pressed, there is no wire feeding and output voltage is not available. | The Power Switch is in OFF position | Turn the Power Switch ON. |
| | The Power Fuses in the Supply lines are blown. | Check the Switch Box's fuse and Power Fuse. |
| | Failure of the Torch Switch or disconnection of the control cable. | Check for continuity using a multimeter. Machine has to be kept switched OFF during continuity test |
| 5. The current adjustment does not work. | Fault of the Current Control Potentiometer in Remote Control Unit. | Check and replace |
| | Fault of the Control PCB / Crater PCB | Replace Control PCB / Crater PCB |
| | Disconnection of the Control Cable in the Remote Control Unit or imperfect contact. | Fasten the plug socket firmly |
| | | Check for continuity using a multimeter. Machine has to be kept switched OFF during continuity test |
| 6. Voltage adjustment does not work. | Fault of the Voltage Control Potentiometer in Remote Control Unit. | Check and replace |
| | Fault of the Control PCB / Crater PCB | Replace Control PCB / Crater PCB |

| Fault | Possible Cause | Rectification |
|----------------|--|---|
| 7. No Gas flow | Disconnection of the Control Cable in the Remote Control Unit or improper contact of the connector | Fasten the Connector firmly. |
| | Damaged Gas Hose. | Replace the Gas Hose with new one. |
| | Mingled impurities in the gas passage. | Blow off the impurities etc, by raising gas pressure. |
| | Faulty Solenoid Valve | Check and replace |
| | Fault of the Control PCB / Crater PCB | Replace Control PCB / Crater PCB |

WIRING DIAGRAM - AK 400



WIRING DIAGRAM - AK 600



WIRING DIAGRAM- AK 600 (With V/A Meter)

RECOMMENDED LIST OF SPARES

| Item Code | Description | Holding for | |
|--------------|--|-------------|----------|
| | | 1-10 | Above 10 |
| 161-1642-301 | Digital V/A Meter | 1 | 2 |
| 165-1684-041 | Fan Cooling | 1 | 2 |
| 165-1684-056 | Line Contactor | 1 | 2 |
| 165-1684-064 | Printed CKT Board – Crater | 1 | 2 |
| 165-1684-170 | Printed CKT Board – Main | 1 | 2 |
| 165-1685-032 | Capacitor Fan (CF) | 1 | 2 |
| 165-1685-051 | Diode Light Emitting (Green) | 1 | 3 |
| 165-1685-052 | Diode Light Emitting (Red) | 1 | 3 |
| 165-1685-054 | Fuse Element (FU 1)-5A | 10 | 25 |
| 165-1685-055 | Fuse Element (FU 2)-8A | 10 | 25 |
| 165-1685-060 | Gas Valve (SOL) | 1 | 3 |
| 165-1685-096 | Braking Resistor 0.5 Ohm/ 30W | 2 | 4 |
| 165-1685-097 | Bleeder Resistor 75 Ohm/ 40W- AK 400 | 2 | 4 |
| 165-1684-070 | Bleeder Resistor 100 Ohm/40W- AK 600 | 2 | 4 |
| 165-1685-116 | Self-Hold (Crater selector) Switch | 1 | 3 |
| 165-1685-117 | Ar + CO ₂ / CO ₂ Selector switch | 1 | 3 |
| 165-1685-125 | Terminal Output- AK 400 | 1 | 2 |
| 165-1684-083 | Terminal Output- AK 600 | 1 | 2 |
| 165-1685-147 | Transformer Control, Motor Supply (TR 2) | 1 | 2 |
| 165-1685-148 | Transformer Control, Fan/ Contactor Supply (TR 3) | 1 | 2 |
| 165-1685-149 | Transformer Control, Synchronization | 1 | 2 |
| 165-1685-177 | Gas Check Switch | 1 | 3 |
| 165-1685-206 | Potentiometer 5 K | 2 | 4 |
| 165-1685-225 | Holder Fuse Motor (5A) | 3 | 8 |
| 165-1685-236 | Input Terminal Block | 1 | 2 |
| 165-1685-271 | Power ON/OFF Switch | 1 | 2 |
| 465-1685-316 | Thyristor Assy. with Heatsink- AK 400 | 2 | 6 |
| 465-1685-317 | Thyristor Assy. with Heatsink- AK 600 | 2 | 6 |
| 465-1685-002 | Main Transformer Assy.- AK 400 | 1 | 2 |
| 465-1684-005 | Main Transformer Assy. - AK 600 | 1 | 2 |
| 465-1685-003 | IPL/DCL Assy.- AK 400 | 1 | 2 |
| 465-1684-006 | IPL/DCL Assy.- AK 600 | 1 | 2 |
| 465-1685-040 | Input ZNR Assy. - AK 400 | 1 | 2 |
| 465-1684-122 | Input ZNR Assy. - AK 600 | 1 | 2 |
| 465-1685-033 | Output ZNR Assy. - AK 400 / AK 600 | 1 | 2 |

WELDING DEFECTS, POSSIBLE CAUSES AND CORRECTIVE ACTIONS GAS METAL ARC WELDING

This welding process produces high quality welds when proper welding procedures are used. The absence of flux coating on Welding Electrode (Wire) eliminates slag inclusions in the weld. Some dross formation may occur when highly deoxidized steel electrodes are used, and it should be removed before the next weld bead or pass is made.

Inert gas shielding provides excellent protection of the weld area from oxygen and nitrogen contamination. Hydrogen is virtually eliminated as a cause of cracking in the weld and heat-affected zones of low alloy steels. On the other hand, the process permits welding of carbon steels with the use of CO₂ gas shielding.

Weld defects may occur with GMA welding when the process variables, materials for welding or procedures are improper. Some of the defects specifically related to this process, their probable causes and recommended corrective actions are given below.

| Welding Defect | Possible Causes | Corrective actions |
|--------------------------|--|--|
| Weld metal cracks | Too high a weld depth to width ratio | Increase the arc voltage or decrease the welding current to widen the weld bead and decrease the penetration |
| | Too small a weld bead (Particularly fillet and root beads). | Decrease the travel speed to increase the cross section of the bead. |
| | Rapid cooling of the crater at the end of a weld | Use a higher crater current to reduce the cooling rate. |
| | | Fill craters adequately. |
| | Use a back step welding technique to end the weld on top of a finished bead. | |
| Inclusions | Use of multiple pass, short circuiting arc welding (slag type inclusions) | Remove any glossy dross islands from the weld bead before making subsequent passes. |
| | High travel speeds (film type inclusions) | Reduce the travel speed. Use a more highly deoxidized electrode. Increase the arc voltage. |

| Welding Defect | Possible Causes | Corrective actions |
|---------------------------------|-----------------------------------|---|
| Lack of penetration | Improper joint preparation | Joint design must be adequate to provide access to the bottom of the groove while maintaining proper nozzle-to-work distance and arc characteristics. Reduce root face height. Provide or Increase the root opening in butt joints. |
| | Improper angle of Torch | Position the Torch Nozzle and contact tip at the proper travel angle to achieve maximum penetration. Keep the arc on the leading edge of the weld pool. |
| | Inadequate heat input | Increase the wire feed speed to obtain higher welding current. Maintain proper nozzle-to-work distance. |
| Porosity | Inadequate shielding gas coverage | Increase the shielding gas flow to displace all air from the weld area. |
| | | Decrease the shielding gas flow to avoid turbulence and entrapment of air in the gas. |
| | | Remove spatter from the interior of the gas nozzle. |
| | | Eliminate drafts (from fans, open doors, etc.) |
| | | Allow the Gas to flow towards the welding arc. |
| | | Use a slower travel speed. |
| | | Reduce the nozzle-to-work distance. Hold the gun at the end of the weld until the molten crater solidifies. |
| | Electrode contamination | Use only clean and dry electrode wire. Eliminate pickup of lubricant on electrode in the wire feeder or conduit. |
| | Work piece contamination | Remove all grease, oil, rust paint and dirt from work surfaces before welding. Use a more highly deoxidizing electrode. |
| | Arc voltage too high | Reduce operating voltage. |
| Excess nozzle-to-work distance. | Reduce electrode extension. | |

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