HOBART

OWNER'S MANUAL

IMPORTANT: Read these instructions before installing, operating, or servicing this product.

Specifications covered by this manual:

TECHNICAL MANUAL NO. TM-641

for

Cyber-Tig Programmers
Models 100 Series and 110 Series

This manual covers units for the following assembly number.

Model 100	362830-3
	362830-4
Model 110	363606

DO NOT DESTROY

HOBART BROTHERS COMPANY, TROY, OHIO 45373, U.S.A.

Manufacturers of Arc Welding Systems/Aircraft Ground Power Equipment/Industrial Battery Chargers

HOBART

HOW TO USE THIS MANUAL

This manual, identified by a "TM-" prefixed number, usually covers just the underlined assembly number in the listing below; in which case, the diagrams at the rear of this manual cover only that particular assembly no. If none of the assembly nos. are underlined, they're all covered.

EQUIPMENT IDENTIFICATION

Some equipments which perform auxiliary operation, including some types of Programmer Drawers, are identified only by assembly numbers, printed on the outside of the shipping container. Record this number for reference.

TECHNICAL MANUAL NO. TM-641

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Cyber-Tig Programmers
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Model 100	362830-3
	362830-4
Model 110	363606

Revised: Nov 17/80
Issued: Oct 24/78

Important!

This listing is of special importance to the performance of this Cyber Tig Programmer. Refer to the appropriate section of this manual for details.

- Operating instructions for each type of welding must be followed closely, to prevent equipment damage or poor result.
- Clean the unit on a regular basis as instructed.

Table of Contents

ARC WELDING SAFETY INSTRUCTIONS AND WARNINGS

⚠ WARNING

ARC WELDING can be hazardous.

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld. Certain of the practices apply to equipment connected to power lines; other practices apply to engine driven equipment.

Safe practices are outlined in the American National Standard Z49.1 entitled: SAFETY IN WELDING AND CUTTING. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions.

HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.

ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
14. Wear a safety harness to prevent falling if working above floor level.
15. Keep all panels and covers securely in place.

ARC RAYS can burn eyes and skin; NOISE can damage hearing.

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved ear plugs or ear muffs if noise level is high.

Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A6.2-73.

Welding or Cutting Operation	Electrode Size Metal Thickness or Welding Current	Filter Shade No.
Torch soldering	—	2
Torch brazing	—	3 or 4
Oxygen cutting		
Light	Under 1 in., 25 mm	3 or 4
Medium	1 to 6 in., 25-150 mm	4 or 5
Heavy	Over 6 in., 150 mm	5 or 6
Gas welding		
Light	Under 1/8 in., 3 mm	4 or 5
Medium	1/8 to 1/2 in., 3-12 mm	5 or 6
Heavy	Over 1/2 in., 12 mm	6 or 8
Shielded metal-arc welding (stick) electrodes	Under 5/32 in., 4 mm	10
	5/32 to 1/4 in., 4 to 6.4 mm	12
	Over 1/4 in., 6.4 mm	14

Welding or Cutting Operation	Electrode Size Metal Thickness or Welding Current	Filter Shade No.
Gas metal-arc welding (MIG)		
Non-ferrous base metal	All	11
Ferrous base metal	All	12
Gas tungsten arc welding (TIG)	All	12
Atomic hydrogen welding	All	12
Carbon arc welding	All	12
Plasma arc welding	All	12
Carbon arc air gouging		
Light		12
Heavy		14
Plasma arc cutting		
Light	Under 300 Amp	9
Medium	300 to 400 Amp	12
Heavy	Over 400 Amp	14

FUMES AND GASES can be hazardous to your health.

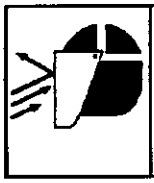
Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

1. Keep your head out of the fumes. Do not breath the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

WELDING can cause fire or explosion.

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

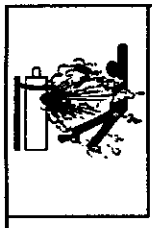
1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.
6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks or drums.
8. Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use welder to thaw frozen pipes.
10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
11. Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.



FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding cause flying metal. As welds cool, they can throw off slag.

1. Wear approved face shield or safety goggles. Side shields recommended.
2. Wear proper body protection to protect skin.



CYLINDERS can explode if damaged.

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

⚠ WARNING

ENGINES can be hazardous.

ENGINE EXHAUST GASES can kill.

Engines produce harmful exhaust gases.

1. Use equipment outside in open, well-ventilated areas.
2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.

ENGINE FUEL can cause fire or explosion.

Engine fuel is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.

MOVING PARTS can cause injury.

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (–) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.

SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.

Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and –) on batteries.

STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.

NOTE: Considerations About Welding And The Effects Of Low Frequency Electric And Magnetic Fields

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields – Background Paper, OTA-BP-E-63 (Washington, DC: U.S. Government Printing Office, May 1989): "... there is now a very large volume of scientific findings based on experiments at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields can interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risks."

To reduce magnetic fields in the workplace, use the following procedures:

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around the body.
4. Keep welding power source and cables as far away from body as practical.
5. Connect work clamp to workpiece as close to the weld as possible.

About Pacemakers:

The above procedures are among those also normally recommended for pacemaker wearers. Consult your doctor for complete information.

PRINCIPAL SAFETY STANDARDS

Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

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Instructions

RECEIPT OF EQUIPMENT

Check the equipment received against the Hobart Brothers Company invoice to make certain that the shipment is complete and undamaged. If the equipment has been damaged in transit, notify the carrier (railroad, trucking company, etc.) at once and file a claim for damages. If you require assistance with a damage claim, furnish Hobart Brothers Company full information about the claim. If the shipment is in error, contact: Order Department, Hobart Brothers Company, Troy, Ohio 45373.

Give the MODEL, ASSEMBLY, and SERIAL numbers of the equipment, and a full description of the parts in error. Refer to the PARTS LIST section of this manual for an explanation of the assembly numbers.

Generally, it is good practice to move the equipment to the site of installation before uncrating. Use care in uncrating in order to avoid damage to the equipment when bars, hammers, etc., are used.

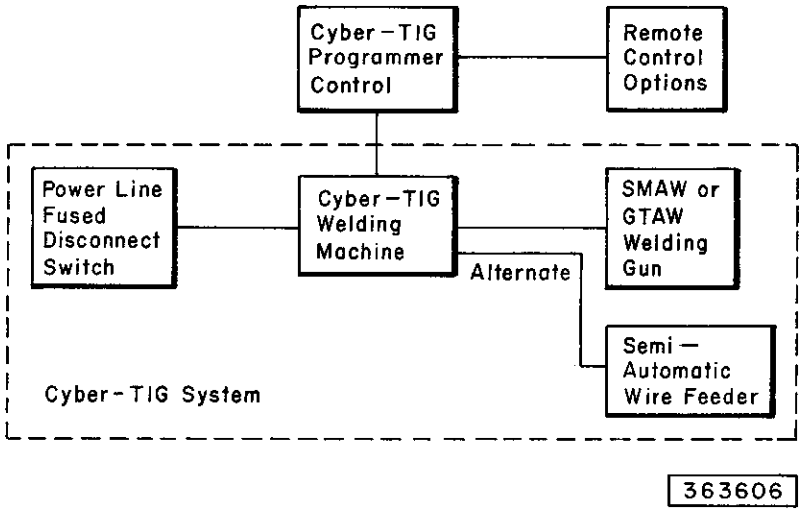
Best results with this equipment will be obtained ONLY if the responsible operating and maintenance personnel have access to and are familiar with these instructions. Additional copies may be obtained at small cost per copy by writing to: Hobart Brothers Company, Troy, Ohio 45373. Supply the technical manual no. (TM-641) plus the assembly, model, and serial numbers of your equipment.

DESCRIPTION OF EQUIPMENT

The Cyber-Tig Programmer Models 100 Series and 110 Series provide semiautomatic control over certain functions in specified types of Cyber-Tig Welding Machines, see Table 1.

The 100 Series Programmer is used for manual GTAW and stick welding. It may also be used for automatic welding where no slope control is required. A prepurge timer control is available as an option.

The 110 Series Programmer performs the same functions as the 100 and in addition has prepurge and spot welding timer control. This Programmer is used for manual GTAW and spot welding. It may also be used for semiautomatic welding where no slope control is required. The monitor circuits function to maintain the welding voltage to within 2% of any preset voltage.

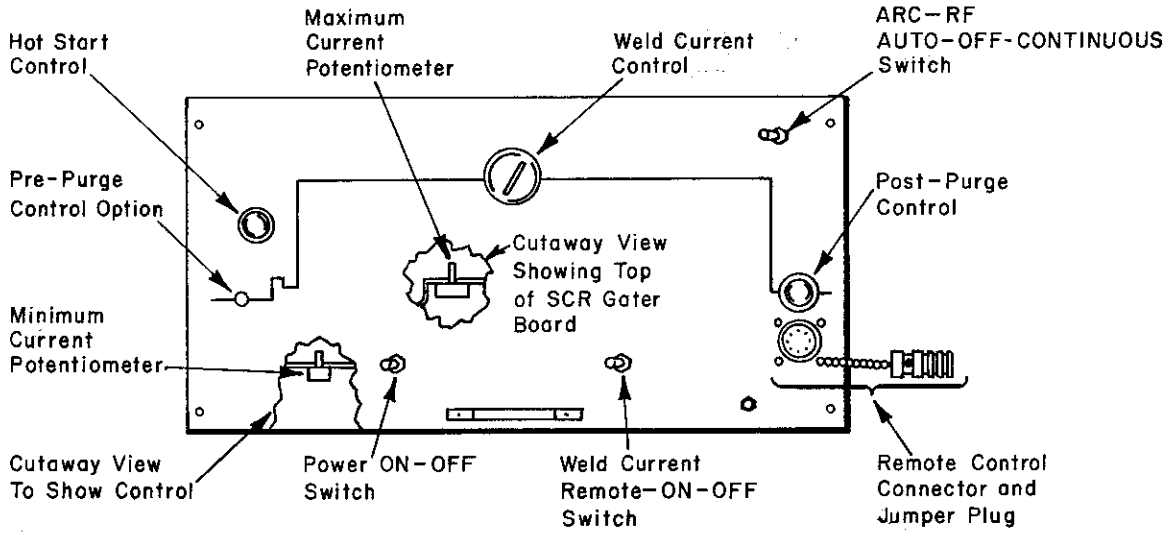


Cyber-Tig Programmer Control
Figure 1

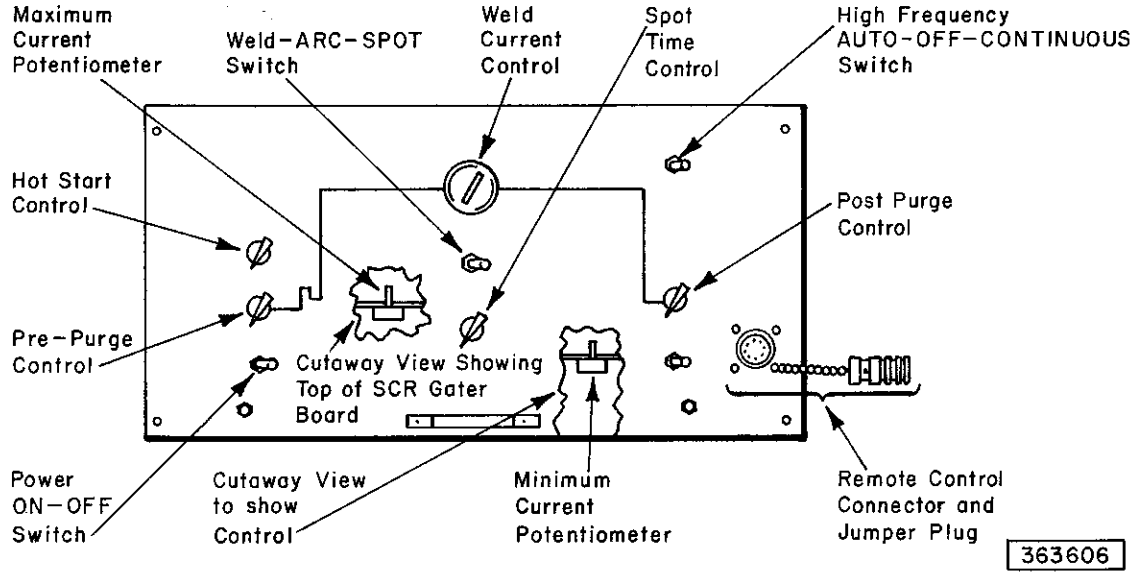
PART NUMBER LISTING

Programmer Model	Part No.	Used On Welding Machine Specs
100 Series	362830-3	5302B-4, 5301C-4, 5290B-4, 5289C-4, 5283C-4, 5282B-4, 5266B-4, 5195C-4, 5159B-4, 5159A-4
	362830-4	5301C-5, 5290B-5, 5289C-5, 5283C-5, 5282B-5, 5266B-5, 5159C-5
110 Series	363606	5301C-18, 5290B-18, 5289C-18, 5159C-18

Programmers and Associated Welding Machines
Table 1



100 Series Programmer Front Panel



110 Series Programmer Front Panel
Figure 2

CONTROLS

POWER ON-OFF SWITCH – This two position toggle switch turns power ON or OFF to the Programmer electrical circuits, including the Remote Control Connector.

PREPURGE POTENTIOMETER – This control is standard on the 110 Series and optional on the 100 Series. It is a single turn potentiometer that controls the duration of prepurge for inert gas and water. Clockwise rotation increases time, counterclockwise decreases time. Time duration of prepurge for 100 Series is 0 – 10 seconds and for 110 Series is 0 – 50 seconds.

HOT START POTENTIOMETER – This control is a single turn potentiometer that controls amplitude of starting current pulse. Clockwise rotation increases amplitude and counterclockwise decreases amplitude.

WELD CURRENT CONTROL – This control is a ten turn potentiometer that adjusts welding current. Clockwise rotation increases current, counterclockwise decreases current.

POSTPURGE CONTROL – This control is a single turn potentiometer that controls time duration of postpurge (0 – 50 seconds) for inert gas and water. Clockwise rotation increases time, counterclockwise decreases time.

WELD CURRENT CONTROL ON-OFF SWITCH – This two position toggle switch selects remote or local Programmer control of welding current. In the ON position, the foot or hand rheostat will control welding current as a percentage of the Programmer current setting. In the OFF position welding current is controlled by the Programmer current setting and the foot rheostat functions as an ON-OFF switch. When the Jumper Plug is plugged into the Remote Control Connector, remote operation is electrically bypassed and inoperative.

REMOTE CONTROL CONNECTOR AND JUMPER PLUG – The Remote Control Connector provides control and power connections between the Programmer and remote controls. The Jumper Plug must be plugged into the connector when remote control is not used so that the Programmer will function.

ARC-RF AUTO-OFF-CONTIN SWITCH (100 Series)
HIGH FREQUENCY AUTO-OFF-CONTIN SWITCH (110 Series) – This switch selects the mode of high frequency (rf) operation. In the AUTO position, high frequency (rf) stops when welding arc is established (DC GTAW). In the OFF position, high frequency (rf) is inoperative (DC SMAW). In the CONTIN position the high frequency (rf) is ON continuously (AC GTAW).

WELD ARC-SPOT SWITCH (100 Series) – This two position toggle switch selects the mode of welding. When set to the WELD position, welding current continues until arc is broken. When set to the ARC-SPOT position, welding time is limited to the time controlled by the Spot Time Control.

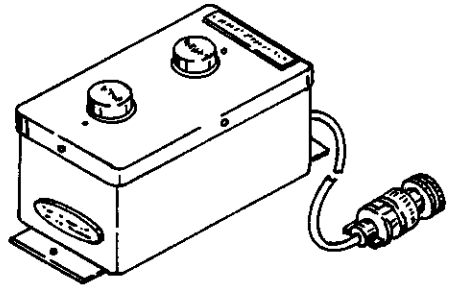
SPOT TIME CONTROL – This single turn potentiometer controls the duration of the welding current (0 – 10 seconds). Clockwise rotation increases time, counterclockwise decreases time. This control is operative only when the Weld Arc-Spot Switch is set in the ARC-SPOT position.

MINIMUM CURRENT POTENTIOMETER – This control is adjusted to calibrate the Programmer to produce a minimum welding current from the welding machine.

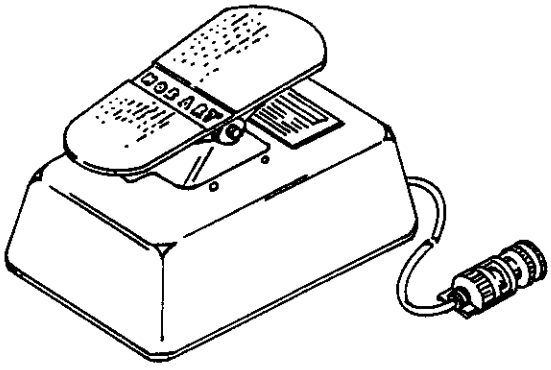
MAXIMUM CURRENT POTENTIOMETER – This control is adjusted to calibrate the Programmer to produce a maximum welding current from the welding machine.

OPTIONAL REMOTE CONTROLS

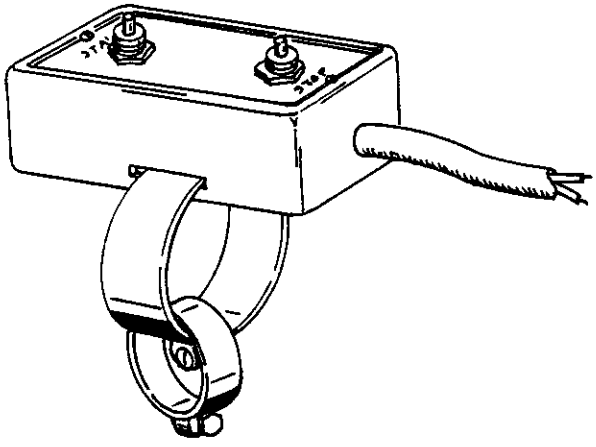
Five optional remote controls are available for use with the Programmers. Each of the five remote controls is equipped with a control lead assembly and a connecting plug that mates with the Remote Control Connector on the Programmer panel. The five remote controls are shown in Figure 3.



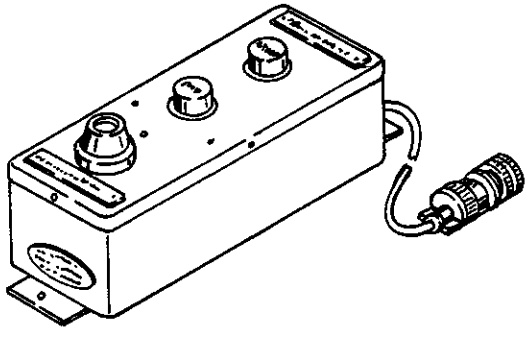
Hand Operated ON/OFF Switch



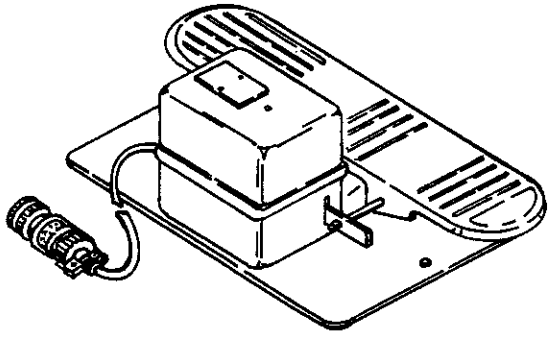
Foot Operated ON/OFF Rheostat



Gun Mounted, Hand Operated ON/OFF Switch



Hand Operated ON/OFF Switch and Ten Turn Potentiometer to Control Welding Current



Foot Operated ON/OFF Switch

363606

Optional Remote Controls
Figure 3

INSTALLATION

LOCATION

The Programmer is designed to be mounted on slide tracks built into the welding machine with which it is to operate (see Table 1 for specified welding machines). The Programmer should not be operated with welding machines other than those specified, because of compatibility problems.

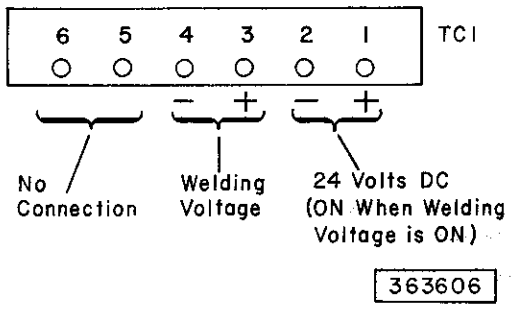
GROUNDING

The frame of the welding machine must be grounded for personnel safety. Where grounding is mandatory under state or local codes, it is the responsibility of the user to comply with all applicable rules and regulations. Where no state or local codes exist, it is recommended that the National Electrical Code be followed. Refer to the welding machine manual for detailed grounding instructions. The Programmer is correctly grounded when all connecting plugs to the welding machine are mated and the chassis panel is seated and secured by the four panel screws to the welding machine frame.

ELECTRICAL CONNECTIONS

The Programmer is completely wired at the factory and requires no additional wiring. On both Programmers, a terminal block at the rear of the chassis is provided to supply connections to external optional equipment (see Figure 4).

All other electrical connections to the Programmer are made through chassis plugs 1PA and 2PA to the welding machine.



Terminal Board TC1
Figure 4

The SCR Gater Board on the Programmer connects to the Programmer electrical system through plug 5PG.

PROGRAMMER CALIBRATION

Following the installation of the welding machine, refer to welding machine manual, loosen the four screws holding the panel of the Programmer in the welding machine. Carefully slide the Programmer forward until it is extended about half the width of the chassis. Inspect for any broken wires, damage, etc. Be sure all plugs are firmly seated. Tape used to secure relays and timers should be removed and timers and relays firmly seated. Before making any adjustments or changes, be sure that the fused disconnect switch to the welding machine is OFF. Be sure that the Power ON-OFF Switch is OFF, then perform the following steps:

1. Connect the Work Lead to short the welding terminals on the welding machine, that is, connect "Work" terminal to "Electrode" terminal.

2. Set the welding machine to DC.

3. Set Weld Current Remote ON-OFF Switch to OFF.

4. Remove small button cover on SCR Gater cover to expose Maximum Current Potentiometer.

5. Set Arc-Rf Switch (on 100 Series) to OFF. On the 110 Series, set High Frequency Switch to OFF.

6. Set Prepurge Control to minimum setting.

7. Set the Hot Start Control to minimum setting.

8. Close fused disconnect switch and turn Power Switch ON and insert Jumper Plug in Remote Control Connector.

9. Set Weld Current Control to maximum (clockwise) setting.

10. Insert insulated screwdriver into slotted shaft of Maximum Current Potentiometer. Slowly adjust to produce maximum rated current output on ammeter for three phase welding machines. For single phase AC-DC welding machines, adjust current to 5% greater than rated current; for example, if maximum rated current is 300 amperes, adjust potentiometer so that ammeter reads 315 amperes.

PROGRAMMER CALIBRATION (Continued)

11. Replace button cover on SCR Gater cover.

12. Set Weld Current Control on front panel to minimum setting (counterclockwise).

13. Loosen the locknut on the Minimum Current Potentiometer located on the chassis of the Programmer, see Figure 1. Slotted shaft requires insulated screwdriver to adjust.

14. Set Minimum Current Potentiometer to minimum setting (counterclockwise).

15. Read the welding machine current and record.

16. Set Minimum Current Potentiometer to maximum setting (clockwise).

17. Slowly turn Minimum Current Potentiometer counterclockwise until welding current is the same as it was in Step 15. Lock the shaft by tightening locknut.

18. Remove Jumper Plug and turn Power Switch OFF.

19. Push Programmer back into welding machine cabinet and secure Programmer with the four panel screws previously removed.

20. Open fused disconnect switch.

21. Remove the Work Lead from the "Electrode" terminal. Calibration is completed and the unit is ready for operation.

OPERATION

PREWELD OPERATION

1. Set fused disconnect switch in OFF position.

2. Set Power Switch in OFF position.

3. On single phase welding machines, set selector for AC, straight (DCEN) DC, or reverse (DCEP) DC, as required for the type of welding to be done.

4. Set Range Switch on welding machine for desired current range, 3 — 50 amperes, 3 — 100 amperes, or 3 — 300 amperes.

5. On three phase welding machines, set DC Polarity Switch to straight (DCEN) DC, or reverse (DCEP) DC, as required for type of welding to be done.

6. Connect Work and Electrode welding leads to welding terminals on welding machine.

7. If GTAW (gas tungsten arc welding) is used, connect water and gas supplies.

8. Set Weld Arc-Spot Switch to WELD (110 Series).

CAUTION: Never initiate the arc by using the Power Switch, or fused disconnect switch. Power must be on to all circuits and then the arc is struck by touching to work, or by high frequency-rf start, or by inserting Jumper Plug into Remote Control Connector.

CAUTION: Never stop or turn off arc by using the Power Switch, or the fused disconnect switch. Arc should be stopped by setting remote control to OFF. Power Switch and power must remain ON until postpurge is completed.

SMAW (Shielded Metal Arc Welding)

1. Set Arc-Rf Auto-Off-Contin Switch (100 Series) to OFF. In the 110 Series, set the High Frequency Auto-Off-Continuous Switch to OFF.

2. Be certain that any water or gas supplies are turned OFF.

3. Be certain that power is OFF, then check or connect work and electrode leads.

4. If remote control is used, set Weld Current Remote Control Switch to REMOTE. Connect Remote Control plug to Remote Control Connector. If remote control is not used, insert Jumper Plug into Remote Control Connector, and set Weld Current Remote Control to OFF.

5. Set Hot Start to the desired level. Set Weld-Arc-Spot Switch to WELD position.

6. Close fused disconnect switch, turn Power Switch ON. Be certain that electrode holder is not touching work, or ground.

7. If remote control is used, push START button or depress foot control.

8. Touch electrode to work. Adjust Weld Current to desired level. Hold electrode approximately 1/4" from work and proceed with welding.

9. To stop welding, lift electrode away from work until arc breaks. Restart as in step 8. Upon completion of welding, break arc and remove jumper plug, or if remote control, release foot control or press STOP button on hand control.

10. Turn Power Switch to OFF position, and open fused disconnect switch.

GTAW (Gas Tungsten Arc Welding)

1. Be certain fused disconnect switch and Power Switch are both OFF.

2. Check or make all electrical connections, gas and/or water supply couplings to welding gun.

3. For DC welding, place Arc-Rf (100 Series) or High Frequency (110 Series) Switch in AUTO position. For AC welding this switch should be placed in CONTIN position.

4. Set the High Frequency Control on the welding machine to the lowest position that will initiate an arc consistently.

5. Set the Hot Start Control on the Programmer to the starting current pulse that will start arc but will not produce burn through.

6. Turn on gas and/or water supplies.

7. Set Prepurge and Postpurge timing to required values.

8. Set Weld Current Control to required value.

9. Set Weld Current Remote Control Switch to REMOTE.

10. Plug in Remote Control foot or hand operated device into Remote Control Connector. Because of the timing and high frequency start requirements for GTAW, such welding requires a remote control device. Do not use jumper plug with this type of welding.

11. Turn fused disconnect switch ON and turn Power Switch ON.

12. Place welding gun in vicinity of work and press Remote Control Switch ON, or depress foot operated switch. High Frequency will initiate arc. Be sure that gas and/or water flow is functioning, otherwise welding gun may be damaged.

13. To stop welding lift welding gun from vicinity of work until arc breaks. Restart by bringing gun in vicinity of work.

> NOTE: On DC welding, the high frequency will stop once arc is initiated, on AC welding high frequency remain ON continuously to stabilize arc.

14. Upon completion of welding, break arc and press OFF button on Remote Control Switch, or release foot operated switch. Hold gun over work during Postpurge. After Postpurge times out, turn Power Switch OFF and open fused disconnect switch.

GTAW ARC-SPOT PROCEDURES (110 Series)

1. Be certain fused disconnect switch and Power Switch are both OFF.

2. Check or make all electrical connections, gas and/or water supply couplings to welding gun.

3. Set the High Frequency Control on the welding machine to the lowest position that will initiate an arc consistently.

4. For DC welding, place High Frequency Switch in AUTO position. For AC welding this switch is placed in the CONTIN position.

5. Set the Hot Start Control on the Programmer to the start current pulse level that will start and maintain the arc, but will not burn through.

6. Connect the spot weld gun trigger to the Remote Control Connector.

7. Set Weld Arc-Spot Switch to ARC-SPOT.

8. Turn on gas and/or water supplies.

9. Set Prepurge and Postpurge timing to required value.

10. Set Weld Current Control to required value.

11. Set Weld Current Remote Control Switch to REMOTE.

12. Set Spot Time Control to required time out.

13. Align welding gun with work to be spot welded.

14. Turn fused disconnect switch ON and turn Power Switch ON.

15. Squeeze trigger on welding gun.

16. After Postpurge times out, move gun into alignment with next spot to be welded.

17. Following Postpurge time out after last spot weld, turn Power Switch OFF, and turn fused disconnect switch OFF.

MAINTENANCE

EXCHANGE SERVICE POLICY

Because of the definite superiority of certain solid state control components over conventional electromechanical relays and regulators, Hobart Brothers Company product lines now incorporate solid state controls for applications in which they may be used to advantage.

To facilitate testing and servicing, these control components and circuits have been assembled as modules on printed circuit boards, mounted in such a manner as to be quickly and easily removed. Electrical connections to other components of the unit are by means of plug-in connectors.

In recognition of the fact that most users of this equipment lack the facilities and specially trained personnel necessary to service and repair solid state electronic equipment, Hobart Brothers Company has established a control module exchange service plan.

Under the Control Module Exchange Plan, the owner of the equipment may exchange the entire module in which a fault has developed for a new or factory rebuilt replacement. A standard exchange price has been established for each module design, which applies without regard to the amount of repair required to the original turned in which is applied against the cost of the replacement. Exchange prices for specific modules may be determined by contacting an authorized Hobart distributor or by writing to the factory, giving ASSEMBLY, MODEL, and SERIAL numbers of the unit in which the module is installed.

This Exchange Plan applies only to specified solid state control components and circuitry which have failed due to electrical fault or normal deterioration resulting from use and age. The plan does not cover parts which have been physically damaged through accident or abuse, or to which unauthorized repairs have been made or attempted. See Warranty Sheet in back of this manual for details.

EXCHANGE SERVICE POLICY (Continued)

> WARNING: Before performing any maintenance operations, disconnect all power input cables to the equipment.

INSPECTION

A periodic inspection of the equipment should be established and maintained. The following inspections and time periods are recommended.

EVERY DAY – Check all power cables and hoses for cuts and other damage. Repair any damage immediately to prevent shorts, damage spreading, etc.

ONCE A WEEK – Check tightness of all electrical connections. If arcing has occurred at any connection, recondition it, and, if it's a power cable connection, cover mating surfaces with a light, uniform coat of electrical joint compound before reassembling. Electrical joint compound is available from Hobart Brothers Company in 5 oz. (141.8 g) tubes (Hobart part no. 903170).

CLEANING

The unit should be cleaned periodically, as required. Do not allow a dust buildup to occur on the unit. Do not operate the unit if moisture accumulation or condensation has occurred. Use clean, dry compressed air, with a pressure not to exceed 25 pounds per square inch (172 kPa) to clean dust and dry moisture from surfaces and terminal blocks.

> WARNING: Do not use flammable cleaning materials, gasoline, naptha, etc., to clean unit. Do not use chemically treated cleaning rags to clean terminal blocks, or electrical components.

HIGH FREQUENCY-RF MALFUNCTIONS

Should the high frequency-rf energizer fail to function, or fail to develop sufficient output, use the following procedure to determine the problem.

1. Be certain that Power Switch is ON and that the circuit breaker has not tripped. Check fuses in the fused disconnect switch.

2. If circuit breaker has tripped, remove remote control Jumper Plug (if used), or press Remote Control Switch to OFF and wait approximately 5 minutes for circuit breaker to reset.

3. If circuit breaker trips a second time, open fused disconnect switch and turn Power Switch OFF. See welding machine manual for troubleshooting procedures. Check for shorted wiring between welding machine, Programmer and high frequency-rf energizer.

4. Inspect and check for broken leads, defective parts, incorrect connections at terminal blocks. If terminal block at end of welding gun hose is connected to water valve, high frequency-rf will short to ground. Install short length of hose to connect to valve.

5. Check all connections to welding gun and work to be certain that they are secure. Check length of welding leads. Maximum recommended length is 25 feet (7620 mm).

6. Check spark gap, set to .008 inch (20 mm).

7. Make certain that welding leads are lying in a straight line from welding machine to work. Do not cross welding leads over each other and avoid bringing the leads in contact with metallic surfaces, or conducting liquids. Do not use welding leads with broken or cracked insulation.

8. Check welding gun terminal for burns. Replace terminal if any burned spots are noticed.

9. Check inert gas flow. Insufficient gas flow will hamper high frequency-rf operation.

10. Check size of electrode. Electrode diameter is specified for the welding current used. Oversize electrodes make starting arc difficult. Thoriated tungsten electrodes usually start better than pure tungsten.

11. Close fused disconnect switch and turn Power Switch ON. Insert Jumper Plug in Remote Control Connector.

HIGH FREQUENCY-RF MALFUNCTIONS (Continued)

> WARNING: Voltage hazardous to life is present on some terminals and components. Do not touch any components or terminals.

12. Using insulated probes, check the voltage at the primary terminals of the high voltage transformer 3T. If no voltage is present, the trouble is in the power supply or power supply leads to the high frequency-rf unit. If 50 to 115 volts AC is present and the unit does not operate, the trouble is in the high frequency-rf unit.

13. Turn Power Switch OFF and open fused disconnect switch. Check capacitors C7 and C14. Also, check rheostat 8P. If these components test good, the trouble is in the secondary of the high voltage transformer 3T.

14. If high frequency-rf operates in CONTIN but not in AUTO, check operation and contacts of voltage control relay VCR on Programmer. If relay is defective, replace.

15. If no voltage is present (18-24 volts) on the coil of the relay, check zener diode Z1, capacitor C15, rectifier DB1 and resistor R2.

TROUBLESHOOTING

The following chart contains information which can be used to diagnose and correct unsatisfactory operation or failure of the various components of the welding machine. Each symptom of trouble is followed by a list of probable causes and procedure to correct them.

TROUBLE	CAUSE	REMEDY
Gas and water do not turn off	Defective postpurge timer	Replace timer.
	Postpurge timer set too high	Decrease setting.
	Postpurge timer contacts burned shut	Replace timer or clean contacts.
Intermittent timer and relay operation	5 amp fuse blown	Replace fuse.
No Hot Start regardless of setting	2CR relay contacts not functioning	Repair or replace relay.
	Weld being initiated with master power switch	Initiate weld with remote control or local plug.
Hot Start control controls welding current	Relay circuitry defective	Repair VCR, 2CR, or 3CR circuit.
High frequency-rf does not come on in AUTO position	VCR relay circuit defective	Replace defective part.
	Pins loose on connector at rear of drawer	Tighten pins.
	Wires loose on connector at top of high frequency panel	Tighten loose wires.
Output of machine is at minimum (3 amps) regardless of current setting	Pins loose on connectors at rear of drawer or at SCR Gater	Tighten pins.
	Feedback resistor open	Replace resistor.
	2CR relay contacts not operating properly	Replace relay.
	Amp-traps blown	Replace amp-traps after checking for shorted SCRs, shorted diode or shorted reactor control coil.
	SCR Gater defective	Replace SCR Gater.
No open circuit voltage	Range and selector switch not in detent position.	Set switch on detent.

TROUBLE	CAUSE	REMEDY
No open circuit voltage (continued)	Prepurge timer not working	Replace timer.
	Line contactor not energizing	Replace line contactor or circuit.
	1CR relay not energizing	Plug in remote control or local operation plug.
Output of machine will not reach maximum rated load	Line voltage incorrect	Check nameplate of welding machine for line voltage to use, check line voltage.
	Links on overload panel incorrectly connected	Check wiring diagram for link positions, connect links correctly.
	Maximum current calibration control misaligned	Realign maximum current.
	Amp-trap failed	Replace amp-trap.
	SCR failed	Replace SCR.
	SCR Gater failed	Replace SCR Gater.
	Control coil on reactor has shorted turns	Repair or replace reactor.
	Wrong size electrode and ground cable used	Use correct size cables.
Output of machine won't reach minimum rated output	Line voltage incorrect	Check nameplate of welding machine for line voltage to use, check line voltage.
	Links on overload panel incorrectly connected	Check wiring diagram for link positions, connect links correctly.
	Minimum current calibration control misaligned	Realign minimum current.
	Load turns on reactor shorted	Repair or replace reactor.
Output current goes to maximum regardless of current setting	Open circuit in pickup coils	Replace defective coil.
	Wires loose on pickup coils	Tighten wires.
	Pins loose on connectors to drawer or SCR Gater	Tighten pins.
	SCR Gater defective	Replace SCR Gater.

TROUBLE	CAUSE	REMEDY
Weld timer will not start	Prepurge time set too long	Set to 1-3 seconds.
	Weld-Arc Spot switch set to weld	Set to Arc Spot.
	Open lead at Weld-Arc Spot switch or weld timer	Reconnect.
	Failed weld timer or prepurge timer	Replace.
	Control relay 1CR contacts stuck	Free and clean.
Weld timer does not stop welding current	Line contactor LC contacts burned closed	Clean and burnish contacts, or replace contacts.
	Welding machine timer failed	Replace.
	Control relay 1CR contacts burned closed	Clean and burnish contacts or replace relay.
	Weld-Arc Spot switch set to weld	Set to Arc Spot.
High frequency rf will not cut off after arc is struck, and high frequency rf switch is in AUTO position	Voltage control relay VCR contacts burned closed	Clean and burnish or replace.
Rheostat does not control the welding current	No plug in remote control receptacle	Insert local operation plug when not using remote control.
	Panel rheostat set to "0" or very low, when using remote rheostat control	Set panel rheostat to obtain desired welding current. See operating instructions.
	Contacts on voltage control relay VCR sticking	Free contacts and clean them.
	Rheostat burned out	Replace rheostat.
	5 amp fuse on front panel blown	Replace. Check for cause of fuse blowing.
	SCR Gater not operating	Check SCR Gater.
	Loose connections in control circuit	Check connections at SCR Gater, control coils, remote receptacle and terminal strips.

TROUBLE	CAUSE	REMEDY
Rheostat does not control the welding current (continued)	Control coil failure	Repair reactor.
Fan will not start	Power switch OFF	Place power switch in ON position.
	Power lines dead	Check voltage.
	Broken power lead	Repair.
	Wrong line voltage	Check power supply.
	Incorrect input power connections at welding machine, linkages or jumpers on overload panel	Check connections against wiring diagrams.
	Blown line fuses	Replace, check for cause.
	Blown fuse on front panel	Replace, check for cause.
	Fan motor failed	Replace.
	Control transformer failed	Replace.
	Loose connections at contactor, terminal strip, control transformer, or switch SW-1	Reconnect.
Contactor will not close	Remote Control Receptacle open — no local or remote plug	Plug in remote control or local operation plug.
	Broken lead at contactor	Repair.
	Mechanical obstruction on contactor	Remove obstruction.
	Failed prepurge timer (units with prepurge timer only)	Replace.
	Loose connections at control transformer, terminal strip, remote control receptacle, weld timer, preflow timer, or contactor coil	Reconnect.

Parts List

EQUIPMENT IDENTIFICATION – An identification plate on the unit shows its model number, serial number, and assembly number. Whenever ordering parts or making inquiries, furnish all these numbers.

NOTE: An "assembly number", in some cases, must have a "dash number" suffix (-1, -2, -3, etc.) in order to be a complete number.

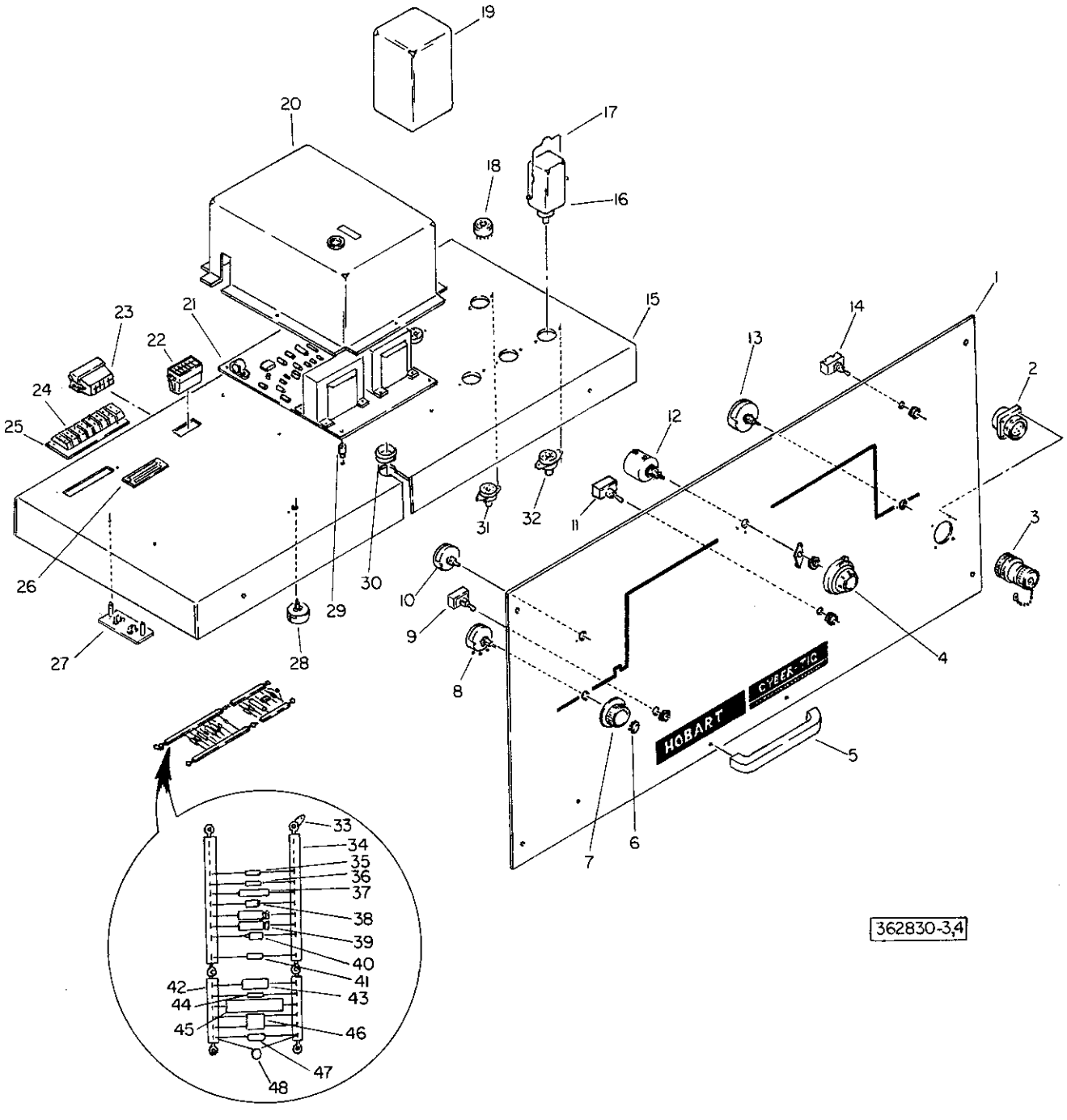
HOW TO USE THIS PARTS LIST – The part name listings may be indented to show part relationships as indicated in the following example.

Fig. No.	Item No.	Part No.	Nomenclature 1 2 3 4 5 6 7	Units per Assembly	Application Code
1–		123456	Assembly (Not Shown)	1	
	1	234567	. A detail of assembly	1	
	2	345678	. A sub-assembly	1	
	3	456789	. . A detail of sub-assembly (Item 2)	1	
	4	567891	. . A sub-assembly of Item 2	1	
	5	678910	. . . A detail of sub-assembly (Item 4)	1	

Locate the assembly number below that appears on your unit, and note the "APPLICATION CODE" letter adjacent to it.

Assembly Number	Application Code
362830-3	A
362830-4	B
363606	C

After locating the desired part in the following figures and parts lists, if the "Application Code" column says "All", proceed to order the part. If there are several part numbers after the same "Item No.", order only the part number corresponding to the "Application Code" letter that you selected above.



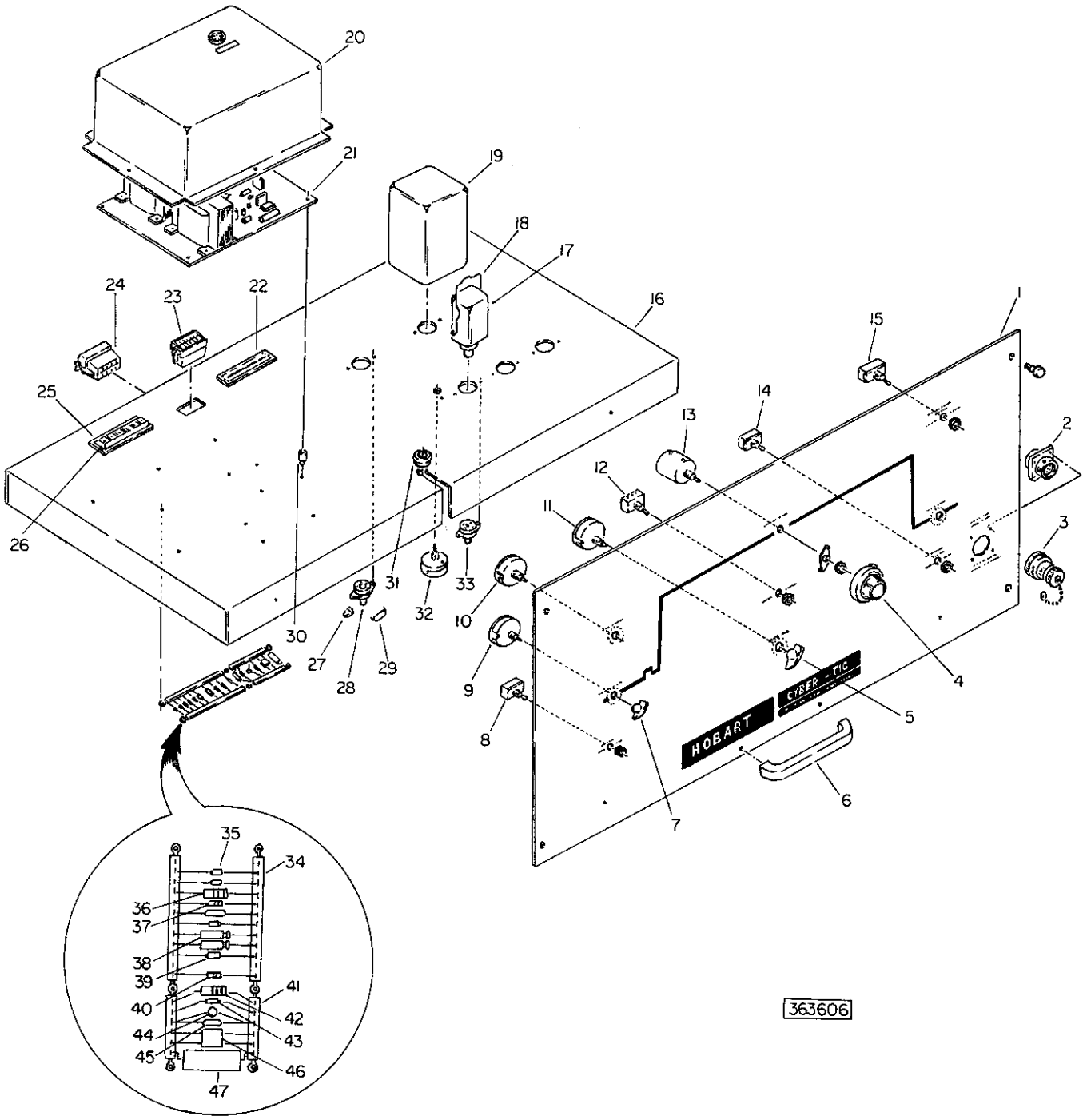
Series 100 Programmer
Figure 1

Fig. No.	Item No.	Part No.	Nomenclature 1 2 3 4 5 6 7	Units per Assembly	Application Code
1—		362830-3	Drawer - Programmer, Series 100	1	A
		362830-4	Drawer - Programmer, Series 100	1	B
	1	362774-2	. Panel - Front	1	AB
	2	401533	. Receptacle	1	AB
	3	362841	. Plug - W/Chain Assembly	1	AB
	4	402876	. Dial - Counting	1	AB
	5	363282-1	. Handle - Drawer	1	AB
	6	403091-2	. Button - Hole, Plug	1	A
	7	400248	. Knob - Single Turn	2	A
		400248	. Knob - Single Turn	3	B
	8	401428-7	. Potentiometer	1	B
	9	403099-2	. Switch - Toggle	1	AB
	10	401428-8	. Potentiometer	1	AB
	11	402856	. Switch - Toggle	1	AB
	12	404104-1	. Potentiometer	1	AB
	13	401428-9	. Potentiometer	1	AB
	14	402855	. Switch - Toggle	1	AB
	15	362773	. Frame - Drawer	1	AB
	16	16DA-4004A-7	. Relay	3	AB
	17	16DA-4253-1	. Retainer - Relay	3	AB
	18	362891	. Plug - Jumper Assembly	1	A
	19	362533	. Timer - Delay Assembly	1	A
		362533	. Timer - Delay Assembly	2	B
	20	362864	. Cover - SCR Gater Assembly	1	AB
	21	362733	. Gater - SCR	1	AB
	22	401563-4	. Housing - Pin Conn.	2	AB
	23	401563-3	. Housing - Pin Conn.	1	AB
	24	402776-6	. Block - Terminal	1	AB
	25	402765	. Strip - Marker Term.	1	AB
	26	356795-23	. Nameplate - Ident.	1	A
		356795-28	. Nameplate - Ident.	1	B
—		363770-1	. Tubing - Shrinkable	40	AB
—		400456-5	. Terminal - Ring	4	AB
	27	8TW-156	. Rectifier - Control	1	AB
	28	400698-8	. Potentiometer	1	AB
	29	B-93	. Bushing - Fiber	4	AB
	30	402037-12	. Grommet	1	AB
	31	16DA-4052-0	. Socket - 11 Pin	2	AB
	32	16DA-4052-1	. Socket - 8 Pin	3	AB
	33	400706	. Lug - Terminal	2	AB
	34	8TRY-63-11	. Strip - Terminal 12 Conn.	2	AB
	35	W-9714-27	. Resistor	1	AB
	36	W-10827-26	. Resistor	1	AB
	37	400382	. Capacitor	1	AB
	38	1CZ-93B	. Diode	1	AB
	39	401426-6	. Capacitor	2	AB
	40	401429-5	. Diode	1	AB
	41	W-10827-31	. Resistor	1	AB

— Not Illustrated

Fig. No.	Item No.	Part No.	Nomenclature 1 2 3 4 5 6 7	Units per Assembly	Application Code
1—	42	8TRY-63-5	. Strip - Term. 6 Conn.	2	AB
	43	W-9714-29	. Resistor	1	AB
	44	402857-1	. Diode	1	AB
	45	402461-3	. Capacitor	1	AB
	46	403718	. Rectifier - Controlled Avalanche	1	AB
	47	401943-1	. Capacitor	1	AB
	48	403955-2	. Suppressor - Semiconductor	1	AB
—		405781	. Retainer - Spring, Relay	1	A
—		405781	. Retainer - Spring, Relay	2	B

— Not Illustrated



Series 110 Programmer
Figure 2

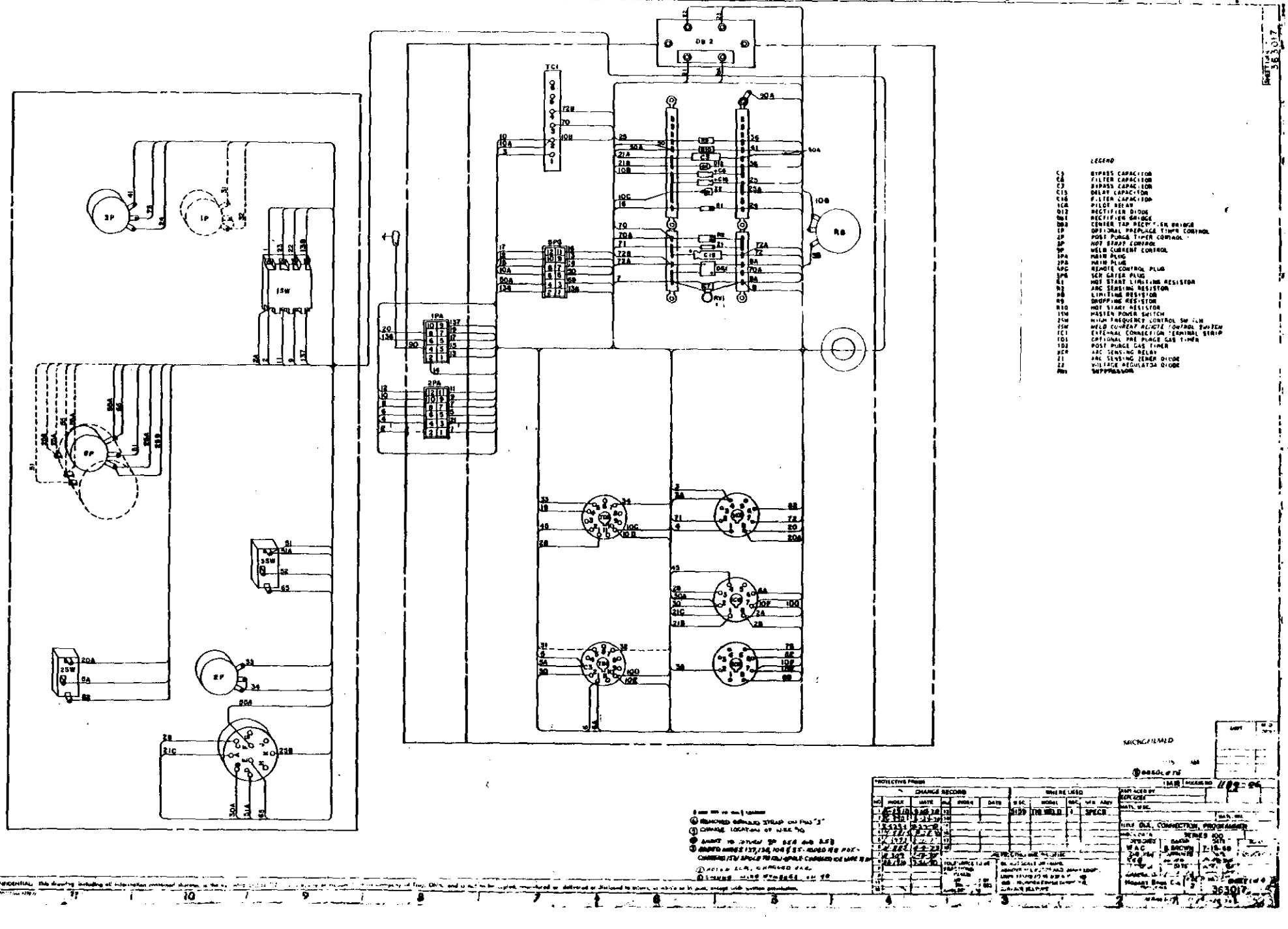
Fig. No.	Item No.	Part No.	Nomenclature 1 2 3 4 5 6 7	Units per Assembly	Application Code
2–		363606	Drawer - Programmer	1	C
	1	363597	. Panel - Front	1	C
	2	401533	. Receptacle	1	C
	3	362841	. Plug - W/Cap and Chain Assembly	1	C
	4	402876	. Dial - Counting	1	C
	5	Y-723	. Knob - Timer	1	C
	6	363282-1	. Handle - Drawer	1	C
	7	W-11597	. Knob - Pointer	3	C
	8	403099-2	. Switch - Toggle	1	C
	9	401428-9	. Potentiometer	2	C
	10	401428-8	. Potentiometer	1	C
	11	401428-7	. Potentiometer	1	C
	12	402758	. Switch - Toggle	1	C
	13	404104-1	. Potentiometer	1	C
	14	402856	. Switch - Toggle	1	C
	15	402855	. Switch - Toggle	1	C
	16	363596	. Frame - Drawer	1	C
	17	16DA-4004A-7	. Relay	3	C
	18	16DA-4253-1	. Retainer - Spring, Relay	3	C
	19	362533	. Delay - Time Assembly	3	C
	20	362864	. Cover - SCR	1	C
	21	362733	. Gater - SCR	1	C
	22	356795-14	. Nameplate - Ident.	1	C
	23	401563-4	. Housing - 12 Pin	2	C
	24	401563-3	. Housing - 10 Pin	1	C
	25	402765	. Strip - Marker, Terminal	1	C
	26	402776-6	. Block - Term., 6 Conn.	1	C
	27	400706	. Lug - Terminal	2	C
	28	16DA-4052-0	. Socket - 11 Conn.	3	C
	29	401427-4	. Capacitor	4	C
	30	B-93	. Bushing - Fiber	4	C
	31	402037-12	. Grommet - Rubber	1	C
	32	400698-8	. Potentiometer	1	C
	33	16DA-4052-1	. Socket - 8 Conn.	3	C
	34	8TRY-63-11	. Strip - Terminal	2	C
	35	1CZ-93B	. Diode	3	C
	36	W-9714-27	. Resistor	1	C
	37	W-10827-26	. Resistor	1	C
	38	401426-6	. Capacitor	2	C
	39	401429-5	. Diode	1	C
	40	W-10827-31	. Resistor	1	C
	41	8TRY-63-5	. Terminal - 6 Conn.	2	C
	42	W-9714-29	. Resistor	1	C
	43	402857-1	. Diode	1	C
	44	403955-2	. Suppressor - Semiconductor	1	C
	45	401943-1	. Capacitor	1	C
	46	403718	. Rectifier - Controlled Avalanche	1	C
	47	402461-3	. Capacitor	1	C
–		364864	. Plug - Spot, Gun to Tig Assembly	1	C
–		405781	. Retainer - Spring, Relay	3	C

– Not Illustrated

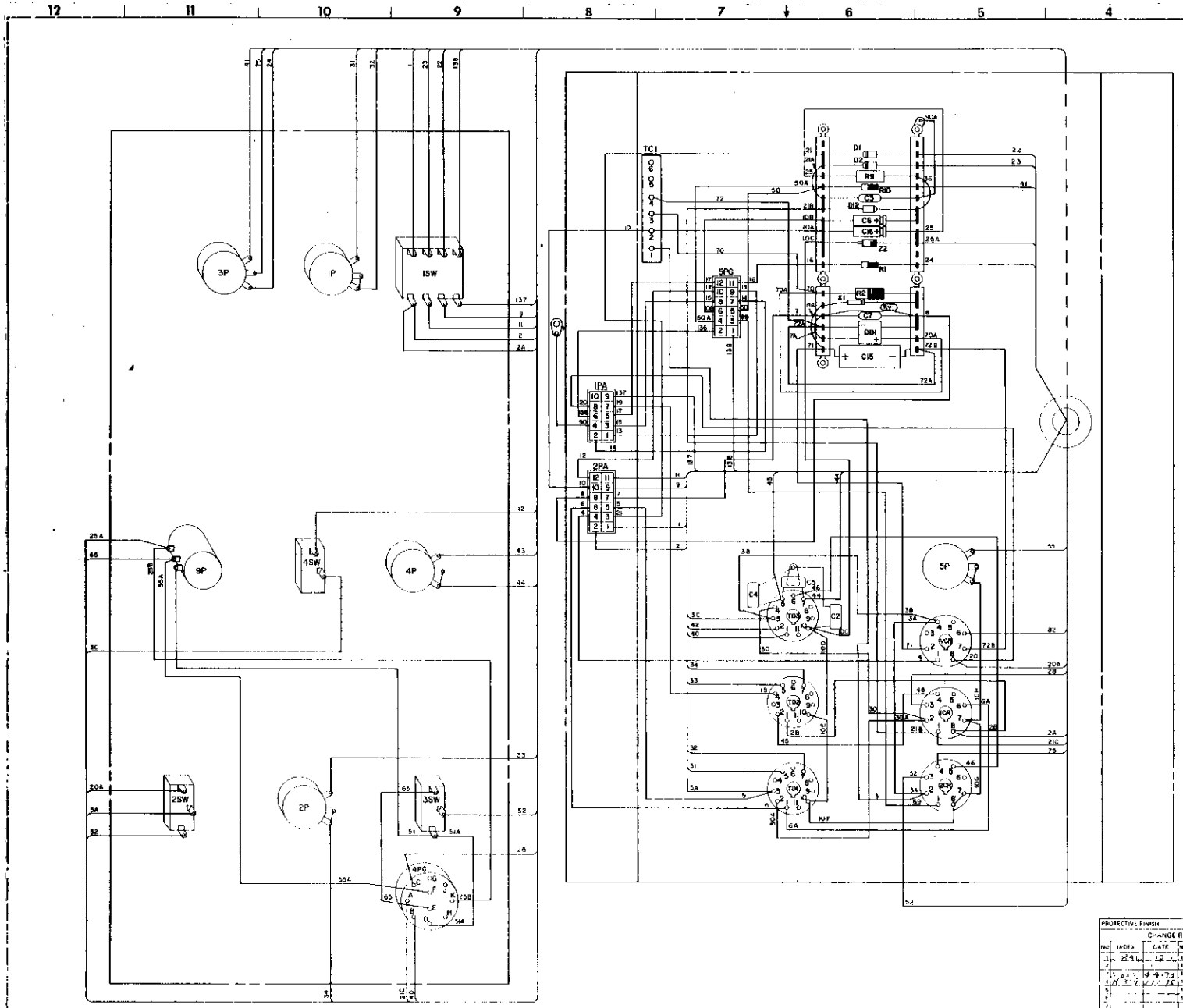
Diagrams

Select the desired diagram applicable to your unit's assembly number on the chart of diagrams supplied.

Model	Programmer Connection Diagram		Schematic Diagram		Primary Changeover Diagram		Circuit Diagram	
	1 Ph.	3 Ph.	1 Ph.	3 Ph.	1 Ph.	3 Ph.	SCR Gater	Time Delay Relay
100 Series	363017	363017	364107	364322	363015	363016	362733	362533
110 Series	363634	363634	364108	364330	363015	363016	362733	362533


LEGEND
C3 BYPASS CAPACITOR
C6 FILTER CAPACITOR
C7 BYPASS CAPACITOR
C15 DELAY CAPACITOR
C16 FILTER CAPACITOR
CR PILOT RELAY
D12 RECTIFIER DIODE
DB1 RECTIFIER BRIDGE
DB2 CENTER TAP RECTIFIER BRIDGE
FP OPTIONAL PREPURGE TIMER CONTROL
GP POST PURGE TIMER CONTROL
HP HOT START CONTROL
WP WELD CURRENT CONTROL
1PA MAIN PLUG
2PA MAIN PLUG
6PC REMOTE CONTROL PLUG
SPR SCR GATER PLUG
R1 HOT START LIMITING RESISTOR
R2 ARC SENSING RESISTOR
R8 LIMITING RESISTOR
R9 SHUNTING RESISTOR
R10 HOT START RESISTOR
15W MASTER POWER SWITCH
2SW HIGH FREQUENCY CONTROL SWITCH
15W WELD CURRENT SELECTOR CONTROL SWITCH
TC1 EXTERNAL CONNECTION TERMINAL STRIP
TD1 OPTIONAL PRE PURGE GAS TIMER
TD2 POST PURGE GAS TIMER
VCR ARC SENSING RELAY
Z1 ARC SENSING ZENER DIODE
Z2 VOLTAGE REGULATOR DIODE
RVI SUPPRESSOR
TC1
DB 2
1PA
2PA
6PC
SPR
15W
2SW
TD1
TD2
VCR
CR
HP
WP
RVI
R8
3P
1P
6P
2P
5P
4P
CHANGE RECORD
WHERE USED
MICROFILMED
363017

363634



LEGEND

C2	BYPASS CAPACITOR
C3	BYPASS CAPACITOR
C4	BYPASS CAPACITOR
C5	BYPASS CAPACITOR
C6	FILTER CAPACITOR
C7	BYPASS CAPACITOR
C15	DELAY CAPACITOR
C16	FILTER CAPACITOR
1CR	CONTROL RELAY
2CR	CONTROL RELAY
D1	RECTIFIER DIODE
D2	RECTIFIER DIODE
D12	BLOCKING DIODE
DB1	RECTIFIER DIODE BRIDGE
1P	PREPURGE TIMER CONTROL
2P	POST PURGE TIMER CONTROL
3P	HOT START CONTROL
4P	ARC SPOT TIME CONTROL
5P	MINIMUM CURRENT ADJUST CONTROL
9P	WELD CURRENT CONTROL
1PA	MAIN PLUG
2PA	MAIN PLUG
4PG	REMOTE CONTROL PLUG
5PG	SCR GATER PLUG
R1	HOT START LIMITING RESISTOR
R2	ARC SENSING RESISTOR
R9	DROPPING RESISTOR
R10	HOT START RESISTOR
1SW	MASTER POWER SWITCH
2SW	HIGH FREQUENCY CONTROL SWITCH
3SW	WELD CURRENT REMOTE CONTROL SWITCH
4SW	WELD-ARC SPOT SWITCH
TD1	PREPURGE TIMER
TD2	POST PURGE TIMER
TD3	ARC SPOT TIMER
1CR	ARC SENSING RELAY
Z1	ARC SENSING ZENER DIODE
Z2	VOLTAGE REGULATOR DIODE
RN1	SUPPRESSOR

4 ADD IN1 TO DWG 1 LEGEND
3 REMOVED GR. STRAP - PIN 3 ITEM 4145
2 ADD TO # CHANGE ALIGNED

CHANGE RECORD									
NO.	INDEX	DATE	NO.	INDEX	DATE	SPEC	MODEL	REQ.	NEXT ASSY
1	2.96	12-4-73				5159	TIG WELD	1	SPECS
2		4-9-74							
3		4-17-75							

PROTECTIVE FINISH

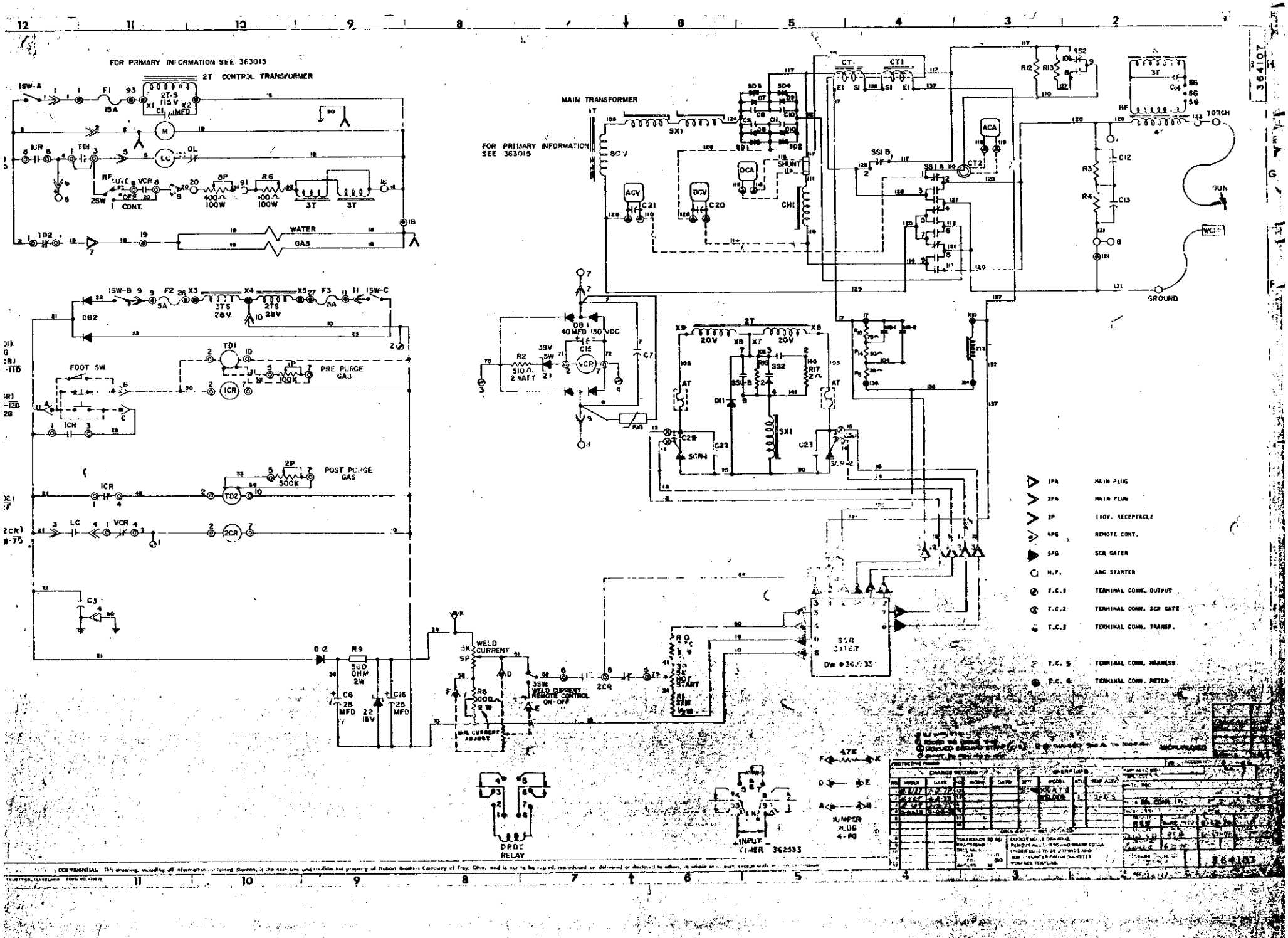
TOLERANCE FOR FRACTIONS ± .010
DECIMALS .XX ± .01 .XXX ± .005
ANGLES ± 30'

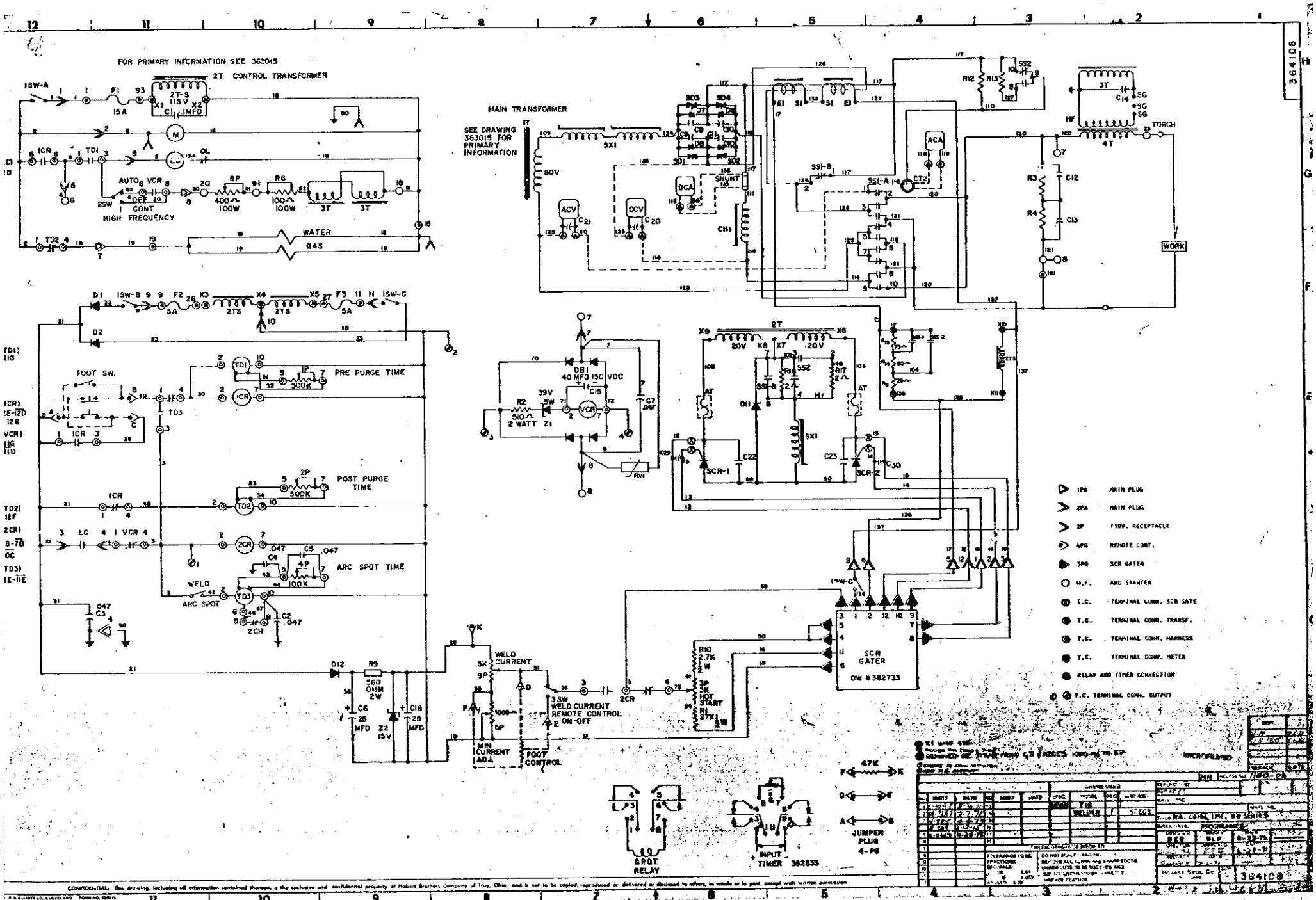
UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND SHARP EDGES
UNDERCUT SIDES OF ALL SHARP CORNERS

REPLACED BY
REPLACES
TAIL SEC
MATL
TITLE DIA. CONNECTION, PROGRAMMER
SERIES 110
DRAWN WAC 10-2-70
CHECKED B.L. KNIFE
APPROVED
DATE
SCALE
SHEET 1 OF 4
363634

DATE	ECO NO.
6-10-74	1180-06
6-18-74	1237

AM SERVICE

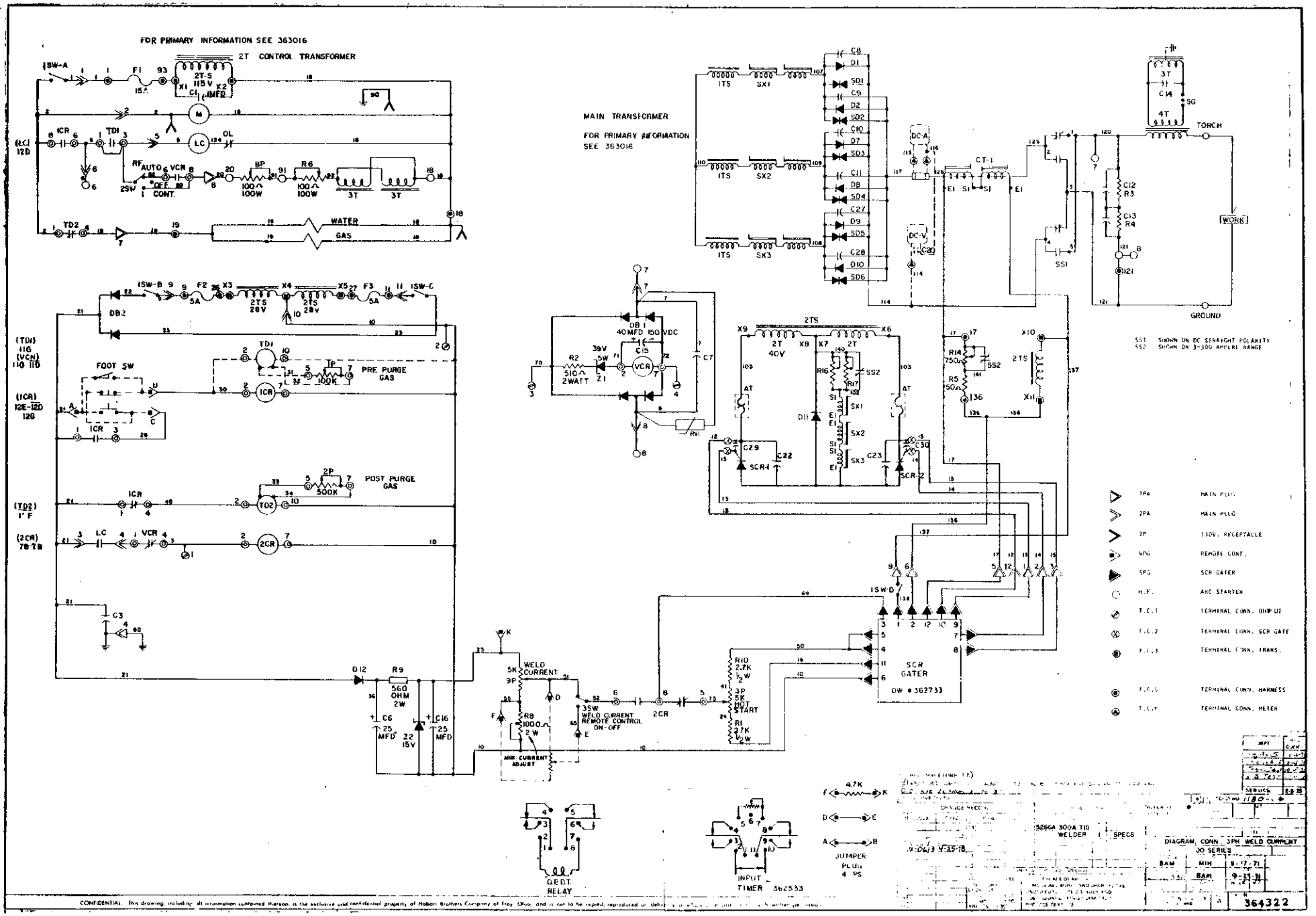

FOR PRIMARY INFORMATION SEE 363015
2T CONTROL TRANSFORMER
ISW-A
F1
15A
2T-S
115 V
X1
X2
C1 MFD
M
KCR
TDI
OL
LC
RF
VCR
OFF
CONT.
25W
8P
400Ω 100W
R6
100Ω 100W
3T
3T
WATER
GAS
102
MAIN TRANSFORMER
FOR PRIMARY INFORMATION SEE 363015
460 V
SX1
CT-
CT1
R12
R13
9S2
3T
HF
TORCH
4T
ACA
CT2
SSI B
SSI A
SHUNT
DCA
ACV
DCV
C21
C20
CH1
R3
R4
C12
C13
GUN
GROUND
WC1
ISW-B
F2
5A
X3
2TS
28 V.
X4
X5
F3
5A
ISW-C
DB2
FOOT SW
TDI
PRE PURGE GAS
100K
ICR
POST PURGE GAS
500K
TD2
LC
VCR
2CR
C3
DB1
40 MFD 150 VDC
C15
VCR
R2
510Ω 2 WATT
Z1
39V
5W
C7
RV1
2T
X9
20V
X8
X7
20V
X6
SS2
R7
2Ω
SS1-B
DI1
AT
SX1
C29
C22
C23
SCR-4
SCR-1
SCR-2
1PA MAIN PLUG
2PA MAIN PLUG
2P 110V. RECEPTACLE
6PG REMOTE CONT.
5PG SCR GATER
H.F. ARC STARTER
T.C.1 TERMINAL CONN. OUTPUT
T.C.2 TERMINAL CONN. SCR GATE
T.C.3 TERMINAL CONN. TRANSF.
T.C. 5 TERMINAL CONN. HARNESS
T.C. 6 TERMINAL CONN. METER
SCR CHART
DW # 364132
D12
R9
350 OHM 2W
C6
25 MFD 22 15V
C16
25 MFD
5K
WELD CURRENT
5P
R8
3000 2 W
WELD CURRENT ADJUST
35W
WELD CURRENT REMOTE CONTROL ON-OFF
2CR
R10
R11
HOT START
DPDT RELAY
INPUT FILTER 362533
4.7E
JUMPER PLUG 4-P8
364107

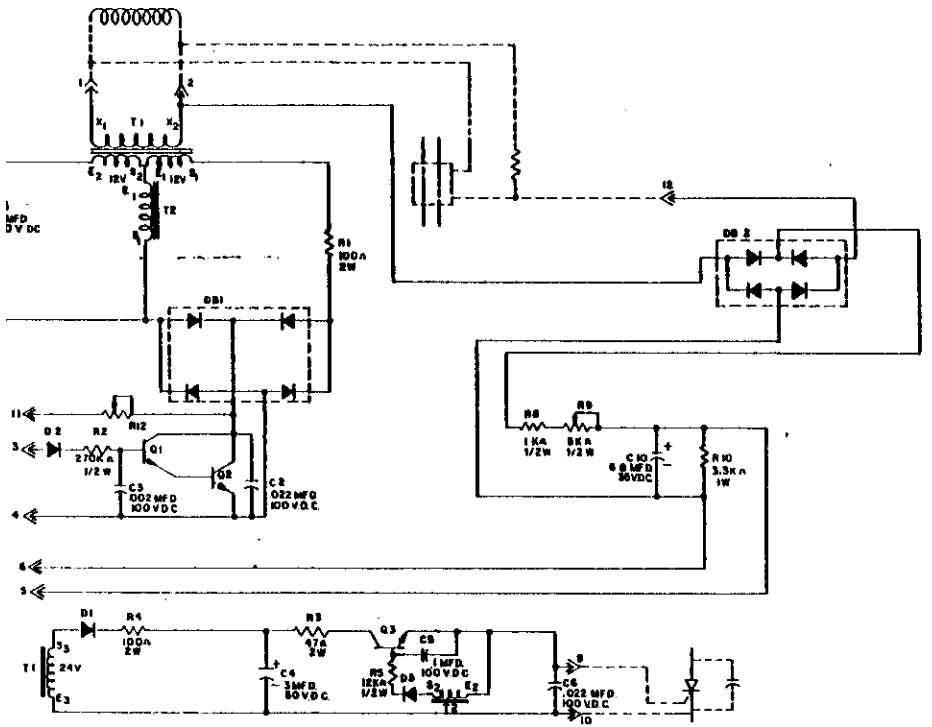


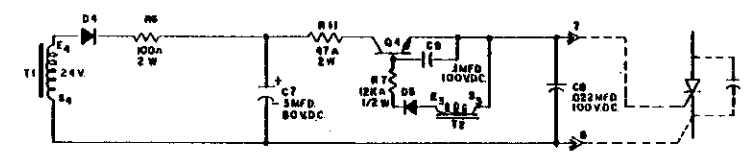
364108

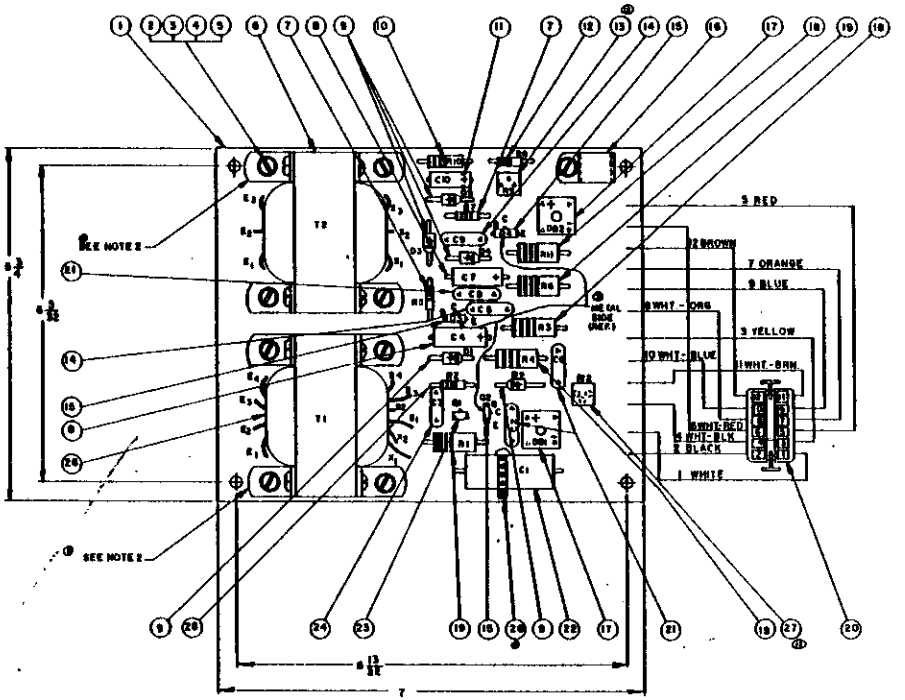
364109

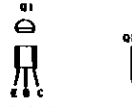
36 y322











C1	5 MFD, 150 W V DC	Q1	2N - 3904 TRANSISTOR
C2	.022 MFD, 100 W V DC	Q2	2N - 4921 TRANSISTOR
C3	.002 MFD, 100 W V DC	Q3	2N - 4921 TRANSISTOR
C4	3 MFD, 50 W V DC	Q4	2N-4921 TRANSISTOR
C5	.1 MFD, 100 W V DC	R1	100 OHM, 2 W RESISTOR
C6	.022 MFD, 100 W V DC	R2	270K OHM, 1/2 W RESISTOR
C7	3 MFD, 50 W V DC	R3	47 OHM, 2 W RESISTOR
C8	.022 MFD, 100 W V DC	R4	100 OHM, 2 W RESISTOR
C9	.1 MFD, 100 W V DC	R5	12K OHM, 1/2W RESISTOR
C10	6.8 MFD, 35 W V DC	R6	100 OHM, 2 W RESISTOR
D1	1 AMP, 400V DIODE	R7	12K OHM, 1/2W RESISTOR
D2	1 AMP, 400V DIODE	R8	1K OHM, 1/2W RESISTOR
D3	1 AMP, 400V DIODE	R9	5K OHM, 1/2W ADJ. RESISTOR
D4	1 AMP, 400V DIODE	R10	3.3K OHM, 1 W RESISTOR
D5	1 AMP, 400V DIODE	T1	CONTROL TRANSFORMER
DB1	500 MA, DIODE BRIDGE	T2	PHASE SHIFT TRANSFORMER
DB2	500 MA, DIODE BRIDGE	R11	47 OHM, 2W RESISTOR
		R12	100K OHM, 1/2W ADJ. RESISTOR

●4LEAD FORMING (INCHES)

NOTES:

1. FORM TRANSISTOR LEADS WITH AUTOMATIC FORMING MACHINE USING DIE TJ-24A.
2. BEFORE ASSEMBLING TRANSFORMERS (ITEMS 6 & 26) TO BOARD, PLACE TRANSFORMERS ON FLAT SURFACE AND CHECK TO SEE IF MOUNTING FEET ARE FLAT. IF NOT, BEND FEET SO THAT TRANSFORMER MOUNTS FLAT ON PC BOARD.

ITEM	DESCRIPTION	MFG. NO.	R	[illegible]
1	BOARD, PRINTED CKT, SOLID STATE	362733A	1	
2	SCREW, #6-32 X 1/2, RD,HD,MH,ST.	W-11110-4	8	
3	WASHER, #6, FL,BRS.	W-11245-2	8	
4	WASHER, #6,LK,ST.	W-11354-1	8	
5	NUT, #6-32, SCR,MH,HEX,ST.	W-11287-3	8	
6	TRANSFORMER, PHASE SHIFT AY.	362524	1	
7	RESISTOR, 1/2 WATT, 12K OHMS	W-10837-25	2	---
8	CAPACITOR, ALUMINUM ELECTROLYTIC	406135-15	2	1.000
9	DIODE, SILICON, 400 PRV, 1.5 AMP, NOMINAL	SCR-93B	5	---
10	RESISTORS, 1 WATT, 3300 OHMS	400032-12	1	---
11	CAPACITOR, 6.8 MFD	400030-1	1	.700
12	RESISTOR, 1/2 WATT, 1000 OHMS	W-10837-4	1	---
13	POTENTIOMETER, TRIMMER 5K OHMS	402796-2	1	--
14	CAPACITOR, RADIAL, LEAD, DIPPED, 100V, .1 MFD	401527-1	2	.375
15	TRANSISTOR, SILICON, POWER	402455-1	3	--
16	CLAMP, WIRE	W-10051-5	1	
17	RECTIFIER, CONTROLLED, AVALANCHE	402125	2	--
18	RESISTOR, 2 WATT, 47 OHMS	W-9114-10	2	--
19	RESISTOR, 2 WATT, 100 OHMS	W-9714-8	3	--
20	HOUSING, SOCKET, CONNECTOR (12 PIN)	401564-4	1	
21	CAPACITOR, RADIAL, LEAD, 100V, .022 MFD.	401527-2	3	.375
22	CAPACITOR, TUBULAR, 5 MFD, 150V DC	W-10658-1	1	2.200
23	TRANSISTOR, HIGH FREQ. MOLDED CASE (NOTE 1)	400760-2	1	.1000
24	CAPACITOR, RADIAL, LEAD, DIPPED, 100V, .0022 MFD	401527-5	1	.375
25	RESISTOR, 1/2 WATT, 270K OHMS	W-10837-39	1	---
26	TRANSFORMER, POWER AY.	362525	1	
27	POTENTIOMETER, TRIMMER, 100K OHMS	402796-6	1	--
28	TIE, PLASTIC	400820-2	1	
29	CHART, WIRE	367007	1	

REVISION CHART	
DRAWING REV.	LAST REV.
11	11

PROTECTIVE FINISH CODE A2 PER 910176

CHANGE RECORD					
No.	INDEX	DATE	No.	INDEX	DATE
1	L-1382	5-3-71	13	Y0314	4-22-82
2	S-3691	7-26-71	14	2222P	6-6-85
3	M-1741	5-31-72	15	20477	7-15-88
4	M-1441	3-2-72	16		
5	P-0160	1-24-74	17		
6	S-1180	6-17-76	18		
7	S-1351	9-15-76	19		
8	T-1990	1-25-78	20		
9	U-1010	7-13-78	21		
10	U-1020	8-19-78	22		
11	W-1020	6-21-80	23		
12	W-1241	11-11-80	24		

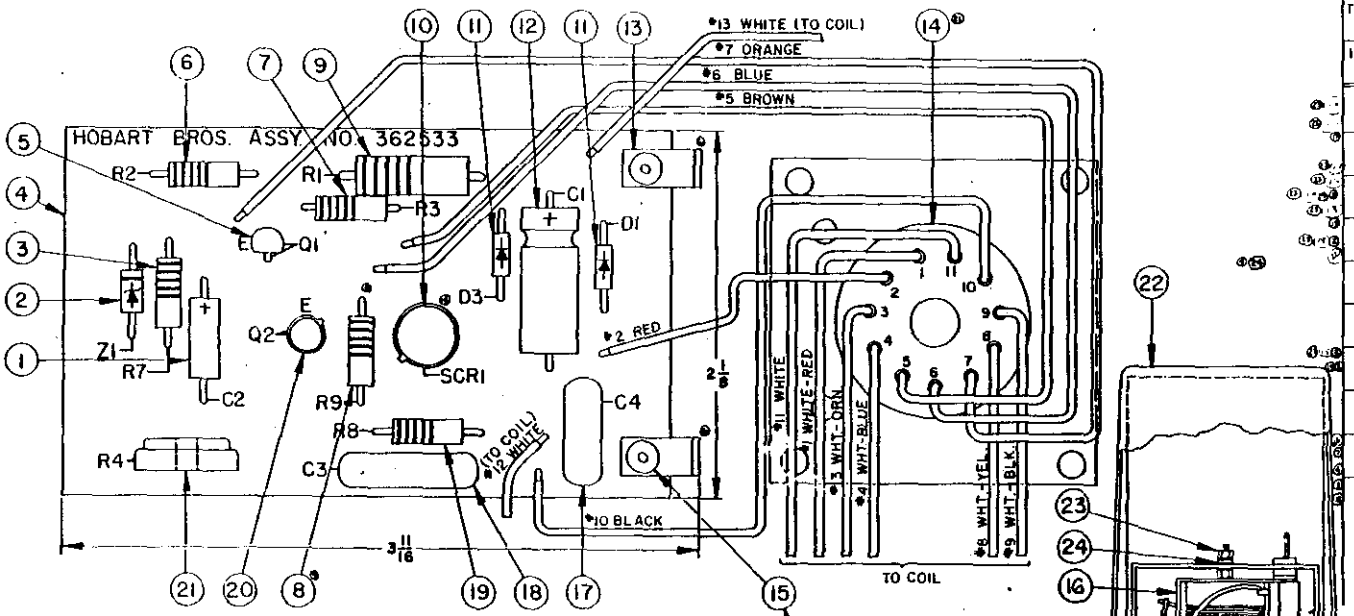
WHERE USED		
NEXT ASSY.	NO. REQ.	USED ON
362830	1	5159

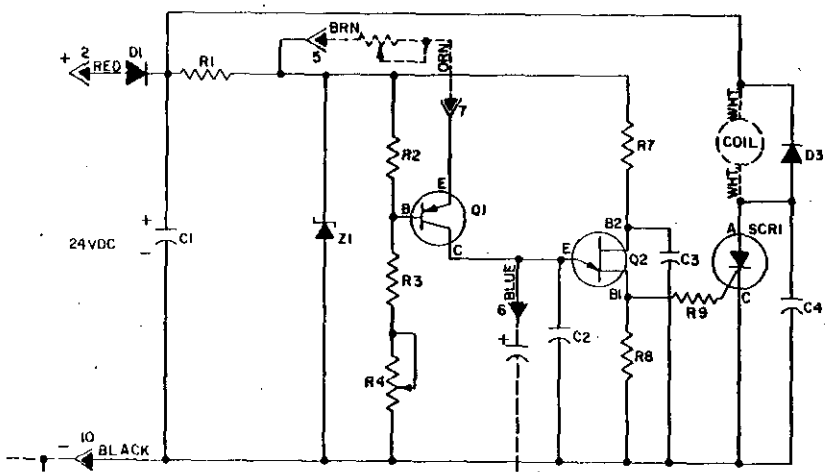
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES. DO NOT SCALE DRAWING. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS
FRACTIONS ±1/32

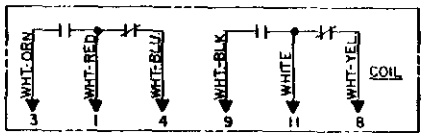
ACTIVITY
XR
REPLACED BY
ACCESS NO.
MATERIAL NO.
MATERIAL SPEC. AY.
TITLE BOARD, GATER, SCR, AY.
DESIGNED B.E.B.
DRAWN R.P.H.
DATE 3-29-81
CHECKED A.J.J.
DATE 4-8-81
APPROVED SAM
RECORDS LEWIS M
DATE 11-10-69
HOBART BROS. CO.
TROY, OHIO 45373
U.S.A.
SIZE D
DWG NO. 362733

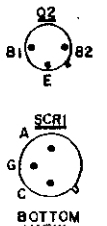
QI-B
Q.R. TEST
P.C. ENGR.
SERVICE
OUTSIDE DISTR.
DISTRIBUTION

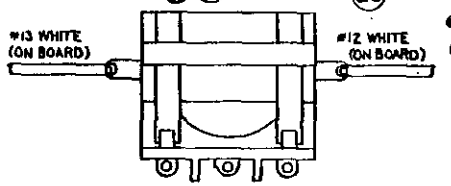
CONFIDENTIAL: This drawing, including all information contained thereon, is the exclusive and confidential property of Hobart Brothers Company of Troy, Ohio, and is not to be copied, reproduced or delivered or disclosed to others, in whole or in part, except with written permission.

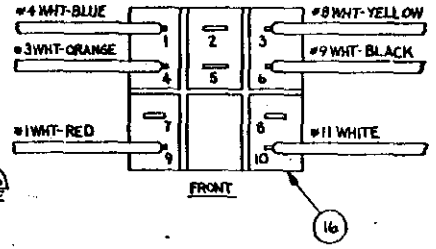












ITEM	DESCRIPTION	DWG. NO.	R	LEAD FORMING INCHES
1	CAPACITOR, ELECTROLYTIC, 10MFD. 20VDC	402798-3	1	.700
2	DIODE, ZENER, 1 WATT, 22V.	401429-1	1	
3	RESISTOR, 1/2 WATT, 470 OHM	W-10821-8	1	
4	BOARD, PRINTED CIRCUIT	362531A	1	
5	TRANSISTOR, HIGH FREQ., 2N3906(NOTE 3)	400760-4	1	.200 D
6	RESISTOR, 1/2 WATT, 1K OHM	W-10827-4	1	.400
7	RESISTOR, 1/2 WATT, 6800 OHM	W-10827-38	1	
8	RESISTOR, 1/2 WATT, 22 OHM	W-10827-11	1	
9	RESISTOR, 1 WATT, 680 OHM	400072-17	1	
10	RECTIFIER, SILICON CONTROLLED	401431-1	1	
11	DIODE, SILICON, ICZ-93B	ICZ-93B	2	
12	CAPACITOR, ELECTROLYTIC, 25MFD. 50VDC	400135-6	1	1.000
13	BRACKET, MOUNTING, P.C. BOARD	402709	2	
14	BRACKET, MOUNTING WITH PLUG	362573	1	
15	RIVET, BLIND, STEEL, DOMED HEAD(NOTE 2)	400795-8	2	
16	RELAY, CONTACT, 24 VDC	402711	1	
17	CAPACITOR, RADIAL LEAD, .001MF, 100VDC	401427-3	1	.375
18	CAPACITOR, RADIAL LEAD, .022MF, 100VDC	401427-2	1	.375
19	RESISTOR, 1/2 WATT, 100 OHM	W-10827-2	1	
20	TRANSISTOR, UNIJUNCTION, 2N2647(NOTE 3)	400411-3	1	.200 D
21	CONTROL, SUB-MINIATURE, 5K	401424-1	1	
22	BOX	362555	1	
23	NUT, #6-32, SCR, MH, HEX, ST.	W-11287-2	1	
24	WASHER, #6, LK, ST.	W-11254-1	1	
25	SCREW, #4-40 X 3/16, RD.HD.SF-TAP, ST.	W-11234-2	2	
26	SCREW, 8ND. HD. SF-TAP, #6 X 3/8 (B)	W-11221-1	4	
27	LABEL	903981	--	
28	INSTRUCTIONS, TEST	365733	REF	
29	CHART, WIRE	367005.	1	

NOTES:

1. WIRE #12 FROM BOARD TO CONNECT TO COIL TERMINAL CLOSEST TO CIRCUIT BOARD WHEN ASSEMBLED.
2. INSERT POP RIVET THROUGH FOOT AND CLINCH IN CIRCUIT BOARD.
3. FORM TRANSISTOR LEADS WITH AUTOMATIC FORMING MACHINE USING DIE TJ-24A.
4. PRINT LABEL PER MANUFACTURING INSTRUCTION 910351.

LEGEND

C1	CAPACITOR, 25/50
C2	CAPACITOR, 10/20
C3	CAPACITOR, .022/100
C4	CAPACITOR, .001/100
D1	DIODE
D3	DIODE
Q1	TRANSISTOR, HIGH FREQUENCY 2N-3906
Q2	TRANSISTOR, UNIJUNCTION, 2N-2647
R1	RESISTOR, 680 OHM, 1W
R2	RESISTOR, 1K, 1/2W
R3	RESISTOR, 6800, 1/2W
R4	RESISTOR, 5K
R7	RESISTOR, 470 OHM, 1/2W
R8	RESISTOR, 100 OHM, 1/2W
R9	RESISTOR, 22 OHM, 1/2W
SCR1	SILICON CONTROLLED RECTIFIER
Z1	ZENER DIODE 22V, 1W

REVISION CHART	
LTR	LABEL REV.
24	24
25	25

61-8	3-69
61-8 TRS.	3-69
SERIES	11-75
02707	MEG
OUTSIDE DISTR.	2

DISTRIBUTION TABLE

MICROFILMED

PROTECTIVE FINISH CODE A1 PER 910176 REV

CHANGE RECORD

No.	INDEX	DATE	No.	INDEX	DATE
1	L-1852	3-5-71	13	L-1960	8-20-76
2	L-1939	3-30-71	14	S-2119	11-8-76
3	L-4815	11-1-71	15	S-2319	12-30-76
4	L-1980	11-23-71	16	T-2669	5-6-77
5	M-1441	8-2-72	17	T-1808	12-1-77
6	M-2951	8-15-73	18	L-1020	8-14-79
7	M-3959	4-22-74	19	V-1040	7-5-79
8	P-0309	2-18-76	20	W1241	11-11-80
9	S-1179	6-18-76	21	X0449	5-13-81
10	S-1491	6-23-76	22	Y0266	5-17-82
11	S-1691	7-23-76	23	Z2229	6-6-85
12	S-1751	9-14-76	24	Z1153	12-25-87

WHERE USED

NEXT ASSY.	NO. REQ.	USED ON
362005	1	3, 5159

25	2 5H17	1-12-84	29		
26			30		
27			31		
28			32		

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES. DO NOT SCALE DRAWING. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS.

SURFACE TEXTURE

FRACTIONS	DECIMALS	ANGLES
± 1/16	.00 ± .01 .000 ± .003	± 30'

ACTIVITY	XR	ACCESS NO.	
MATERIAL NO.	MATERIAL SPEC.	REPLACED BY	REPLACES 34 x 939 DTD 2-22-71
	ASSEMBLY		QUANTITY/U.M.
TITLE	BOARD, TIME DELAY, AY.		
INDEX DATA			
DESIGNED EGW	DRAWN DDP	DATE 11-14-77	SCALE DOUBLE
CHECKED PWC	DATE 11-21-77	APPROVED	REPRO FROM
RECORDS	DATE	INDEXED	M.P.

HOBART BROS. CO. TROY, OHIO 45373 U.S.A.

SIZE C

OWG. NO. 362533

ATTENTION!!!

PLEASE FILL OUT AND RETURN THE WELDER REGISTRATION CARD BELOW.

Cut Along Dotted Line

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 12 TROY, OHIO

POSTAGE WILL BE PAID BY ADDRESSEE

Hobart Brothers Company
600 West Main Street
Troy, Ohio 45373-9933

HOBART BROTHERS CO. — WELDER REGISTRATION CARD

Serial No. _____

Owner's Name _____

Address _____

City _____ State _____

Date Received _____ In Satisfactory Order? _____

Obtained From: Factory ☐ Dealer or Distributor ☐

IMPORTANT! Fill out at once in ink and return to Hobart Brothers. Immediate return of this card registers warranty date.

425141

THE HOBART "531" CANADA WARRANTY CERTIFICATE

1. **General:** Hobart's products are warranted for one (1) year following date of shipment to the original user, with exception of items listed in paragraphs 2 through 9 below.

2. **Main Power Rectifiers:** Silicon diodes and power SCRs used in the welding output circuits of equipment are **warranted for five (5) years** following date of shipment to the original user. Hobart will cover parts and labor in year one and parts replacement only in years two through five.

3. **Major Power Components:** Main power transformers, control, stability and filter reactors, armatures, stators, and printed circuit boards with a price in excess of $200.00, are **warranted for three (3) years** following date of shipment to the original user. Hobart will cover parts and labor in year one and parts replacement only in years two and three.

4. **Expendable Items:** Primary and secondary switch contacts, cable connectors, carbon brushes, fuses, bulbs, filters, nozzles, contact tips, liners, cutting tips and wire feed rolls are worn or consumed in the normal process of welding or cutting and are therefore warranted only if found to be defective prior to use.

5. **Replacement Parts:** Replacement and exchange parts are warranted for the remainder of the original equipment warranty or for a period of ninety (90) days, whichever is greater.

6. **Semiautomatic Items:** Mig welding guns and cables and plasma cutting torches and cables are warranted for ninety (90) days.

7. **Engines, Tires, and Batteries:** Hobart does not warrant items furnished by Hobart but manufactured by others, including without limitation, gasoline or diesel engines, engine electrical equipment, batteries, and tires. Such items are warranted directly by the manufacturer, and Hobart may periodically inform customers of such warranty coverage; however, Hobart does not guarantee the accuracy or completeness of its information regarding such warranties.

8. **Exclusive Remedies:** In case of Hobart's breach of warranty or any other duty with respect to the quality of any product or service, the sole and exclusive remedies therefore shall be:

   As to **PRODUCTS**, (1) repair, (2) replacement, or (3) where authorized by Hobart, payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the product, and as to **SERVICES** (including repair under warranty), the sole and exclusive remedies therefore shall be payment or credit for Hobart's actual charge therefore or, in the absence of any actual charge, the customary or reasonable charge for such services, and if such breach also involves impairment of Hobart products, the remedies available for breach of warranty with respect to the product.

9. **Modification and Misuse:** This warranty does not apply to products which have been modified in any way by any party other than Hobart; nor to products which have not been installed and operated in accordance with applicable industry standards; nor to products which have been used other than under the usual conditions for which designed; nor to products that have not received proper care, lubrication, protection, and maintenance under supervision of competent personnel. **Use of a product after discovery of a defect voids all warranties.**

DISCLAIMER OF WARRANTIES AND CONDITIONS

ALL OTHER GUARANTEES, WARRANTIES, CONDITIONS, REPRESENTATIONS, EITHER EXPRESSED OR IMPLIED, WHETHER ARISING UNDER ANY STATUTE, COMMON LAW, COMMERCIAL USAGE OR OTHERWISE, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXCLUDED.

WARNING

At all times, safety is an important consideration in the installation, servicing, and operation of the product, and skilled, qualified technical assistance should be utilized at all times. Specific recommendations are included in CAN/CSA-W117.2-M87 Safety in Welding, Cutting, and Allied Processes.

Hobart Brothers of Canada Limited
Woodstock, Ontario, Canada, N4S 7W8

October 1989
910516

THE HOBART "531" WARRANTY

1. **General:** Hobart's products are warranted for one (1) year following date of shipment to the original user, with exception of items listed in paragraphs 2 through 9 below.

2. **Main Power Rectifiers:** Silicon diodes and power SCRs used in the welding output circuits of equipment are **warranted for five (5) years** following date of shipment to the original user. Hobart will cover parts and labor in year one and parts replacement only in years two through five.

3. **Major Power Components:** Main power transformers, control, stability and filter reactors, armatures, stators, and printed circuit boards with a price in excess of $150.00, are **warranted for three (3) years** following date of shipment to the original user. Hobart will cover parts and labor in year one and parts replacement only in years two and three.

4. **Expendable Items:** Primary and secondary switch contacts, cable connectors, carbon brushes, fuses, bulbs, filters, nozzles, contact tips, liners, cutting tips and wire feed rolls are worn or consumed in the normal process of welding or cutting and are therefore warranted only if found to be defective prior to use.

5. **Replacement Parts:** Replacement and exchange parts are warranted for the remainder of the original equipment warranty or for a period of ninety (90) days, whichever is greater.

6. **Semiautomatic Items:** Mig welding guns and cables and plasma cutting torches and cables are warranted for ninety (90) days.

7. **Engines, Tires, and Batteries:** Hobart does not warrant items furnished by Hobart but manufactured by others, including without limitation, gasoline or diesel engines, engine electrical equipment, batteries, and tires. Such items are warranted directly by the manufacturer, and Hobart may periodically inform customers of such warranty coverage; however, Hobart does not guarantee the accuracy or completeness of its information regarding such warranties.

8. **Exclusive Remedies:** In case of Hobart's breach of warranty or any other duty with respect to the quality of any product or service, the sole and exclusive remedies therefore shall be:

   As to **PRODUCTS**, (1) repair, (2) replacement, or (3) where authorized by Hobart, payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the product, and as to **SERVICES** (including repair under warranty), the sole and exclusive remedies therefore shall be payment or credit for Hobart's actual charge therefore or, in the absence of any actual charge, the customary or reasonable charge for such services, and if such breach also involves impairment of Hobart products, the remedies available for breach of warranty with respect to the product.

9. **Modification and Misuse:** This warranty does not apply to products which have been modified in any way by any party other than Hobart; nor to products which have not been installed and operated in accordance with applicable industry standards; nor to products which have been used other than under the usual conditions for which designed; nor to products that have not received proper care, lubrication, protection, and maintenance under supervision of competent personnel. **Use of a product after discovery of a defect voids all warranties.**

DISCLAIMER OF WARRANTIES

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, EXCEPT AS SPECIFICALLY PROVIDED IN THE EXPRESSED WARRANTIES SET FORTH ABOVE, ALL PRODUCTS ARE SOLD "AS IS". HOBART MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

WARNING

At all times, safety is an important consideration in the installation, servicing, and operation of the product, and skilled, qualified technical assistance should be utilized at all times. Specific recommendations are included in "Safety in Welding and Cutting", American National Standard No. Z-49-1.

Hobart Brothers Company
Troy, Ohio 45373 U.S.A.

October 1989
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