

THERMAL ARC

INVERTER

ARC

WELDER

MODEL 600 GMS
CC/CY

PRELIMINARY

* STICK
* TIG-Lift Start
* MIG-Short Circuit
- Globular
- Spray

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NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.



WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

IMPORTANT SAFETY PRECAUTIONS



WARNING

Operation and maintenance of arc welding equipment involves potential hazards. Operators and all others in the operating area should be alerted to possible hazards, and precautions should be taken to prevent possible injury.

Gases and Fumes



Read these safety precautions and the entire instruction manual before operating.

Do not use this power supply to thaw frozen water pipes.

This equipment must be installed, operated, and serviced by qualified personnel only.

GASES AND FUMES produced during arc welding can be dangerous and hazardous to your health.

Keep all fumes and gases from the breathing area.

Different arc welding processes, electrodes, and fluxes can produce different fumes, gases and radiation levels. Consult Material Safety Data Sheets (MSDS's) and manufacturer's instructions for specific technical data and precautionary measures for all fluxes, electrodes, and materials used.

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Ventilation must be adequate to remove gases and fumes during operation as described in ANSI Standard Z49.1.

Use a downdraft table or water table to capture fumes and gases.

Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.

When working in confined spaces provide adequate ventilation or wear an air-supplied respirator if necessary.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

When leaving confined space, shut off gas supply at source to prevent possible accumulation of gases if downstream valves are accidentally opened. Check that area is safe before re-entering.

Materials containing lead, cadmium, zinc, mercury, beryllium, and similar materials may produce harmful concentrations of toxic fumes when welded or cut. Adequate local exhaust ventilation must be used, or operators and others in the operating area must wear an air-supplied respirator. For beryllium, both must be used.

IMPORTANT SAFETY PRECAUTIONS (continued)

Gases and Fumes (continued)



Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from work surface and work area is well ventilated. Wear an air-supplied respirator if necessary.

Vapors from chlorinated solvents can be decomposed by the heat of the arc or flame to form phosgene, a highly toxic gas, and other lung and eye irritating products. The ultraviolet radiant energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. Do not weld or cut where solvent vapors may be drawn into the welding or cutting atmosphere or where radiant energy may penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene. Solvents, degreasers, and potential sources of these vapors must be removed from the operating area.

Oil or grease in the presence of oxygen may ignite and burn violently. Keep cylinders, valves, couplings, regulators, hoses, and other apparatus clean and free from oil and grease. Oxygen cylinders and apparatus should not be handled with oily hands or gloves. Do not allow an oxygen stream to contact oily or greasy surfaces.

Do not use oxygen as a substitute for compressed air.

NEVER ventilate with oxygen.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

Arc Rays



ARC RAYS can injure eyes and burn skin.

Never look at an electric arc without protection. Protect eyes from exposure to arc. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause permanent damage to vision.

Use a welding helmet or shield with proper filter (see chart on page *v*). Place over face before striking arc.

Protect filter plate with a clear cover plate.

Do not use cracked or broken helmet or shield; radiation can pass through to cause burns.

Replace any cracked, broken or loose filter plates immediately. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields must be worn under helmet to protect eyes in case helmet is not in position before arc is struck.

Wear proper protective clothing. Arc rays can penetrate light-weight clothing.

Welding arc rays can reflect from light-colored surfaces.

IMPORTANT SAFETY PRECAUTIONS (continued)

Arc Rays (continued)



Make sure others in the operating area are protected from arc rays.

For production welding, use separate room or enclosed bay. In open areas, surround operation with low reflective non-combustible screens or panels. Make sure that screen flaps or bay doors are closed before welding. Allow for free air circulation, particularly at floor level.

Provide face shields for all others viewing the weld.

Make sure others in the operating area are wearing flash goggles.

Welding or Cutting Operation	Electrode Size Metal Thickness or Welding Current	Filter Shade Number
Torch soldering	-	2
Torch brazing	-	3 or 4
Oxygen Cutting		
Light	Under 1 in (25 mm)	3 or 4
Medium	1-6 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	1/8-1/2 in (3-12 mm)	5 or 6
Heavy	Over 1/2 in (12 mm)	6 or 8
Shielded metal arc welding (stick) electrodes		
Light	Under 5/32 in (4 mm)	10
Medium	5/32-1/4 in (4-6.4 mm)	12
Heavy	Over 1/4 in (6.4 mm)	14
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 amps	9
Medium	300-400 amps	12
Heavy	Over 400 amps	14

Recommended Eye Protection for Welding and Cutting (Based on AWS A6.2-73)

IMPORTANT SAFETY PRECAUTIONS (continued)

Electric Shock



ELECTRIC SHOCK can kill.

Do not contact electrically live parts.

Install equipment according to safety precautions, instruction manual, and all applicable codes.

Keep all panels, covers, and guards in place.

Disconnect all primary power before installing or servicing this equipment.

Insulate operator and others from work and ground.

Replace any cracked or damaged insulating parts.

Shut down welding power source before touching electrode, wire drive assembly, welding wire, wire reel, or any metal parts in contact with the welding wire.

Exposed hot conductors or other bare metal in the welding circuit or in ungrounded, electrically hot equipment can cause potentially fatal electric shock. Do not contact a wet surface when welding without suitable protection.

Wear dry insulating gloves and body protection. Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat cannot be avoided. Sweat, sea water, or moisture between body and an electrically hot part or grounded metal reduces electrical resistance and could cause potentially fatal electric shock.

A voltage will exist between the electrode and any conducting object in the work circuit. Examples of conducting objects include, but are not limited to, buildings, electrical tools, work benches, welding power source cases, workpieces, etc. Never touch electrode to any metal object unless the welding power source is off.

Arc welding equipment must be grounded according to the National Electrical Code, and the work must be grounded according to ANSI Z49.1 "Safety in Welding and Cutting."

When installing, connect the frames of each unit such as welding power source, control, work table and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made electrically hot by stray current may cause potentially fatal electric shock. Do not ground to electrical conduit or to pipe carrying any gas or flammable liquid such as oil or fuel.

Check phase requirements before installing. If only three-phase power is available, connect single-phase equipment to only two wires of the three-phase line. Do not connect the equipment ground lead to the third (live) wire, or the equipment will become

IMPORTANT SAFETY PRECAUTIONS (continued)

Electric Shock (continued)



electrically hot - a dangerous condition that may cause potentially fatal electric shock.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground plug.

Fully insulated electrode holders should be used. Do not use holders with protruding screws.

Fully insulated lock-type connectors should be used to join welding cable lengths.

Frequently inspect cables for wear, cracks and damage. Replace those with excessively worn or damaged insulation to avoid potentially fatal electric shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cables dry, free of oil and grease, and protected from hot metal and sparks.

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

Electrode

For equipment with output ON/OFF control (contactor): Welding power sources for use with gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and similar processes normally are equipped with devices that permit ON-OFF control of the welding power output. When so equipped the electrode wire becomes electrically hot when the power source switch is ON and welding gun switch is closed. Never touch electrode wire or any conducting object in contact with electrode circuit unless the welding power source is OFF.

For equipment without output ON/OFF control (no contactor): Welding power sources used with shielded metal arc welding (SMAW) and similar processes may not be equipped with welding power output ON-OFF control devices. With such equipment the electrode is electrically hot when the power switch is turned ON. Never touch the electrode unless the welding power source is off.

Safety devices such as interlocks and circuit breakers should never be disconnected or shunted out.

IMPORTANT SAFETY PRECAUTIONS (continued)

Electric Shock (continued)



Before installing, inspecting, or servicing equipment, disconnect primary power and remove line fuses (or lock or red-tag switches) to prevent accidental electric shock. Disconnect all cables from welding power source and pull all 115V line-cord plugs.

Do not open power circuit or change polarity while welding. If it must be disconnected in an emergency, guard against shock burns and flash from switch arcing.

Always shut off and disconnect all primary power when leaving equipment unattended.

Primary power disconnect switch must be available near the welding power source.

Fire and Explosion



FIRE AND EXPLOSION can be caused by hot slag, spatter, sparks, extreme heat, misuse of compressed gases and cylinders, and electrical short circuits.

Remove all combustibles from working area or provide a fire watch. Avoid paint spray rooms, dip tanks, storage areas, ventilators. Move work to an area free of combustibles if possible. If work cannot be moved, move combustibles at least 35 ft (10.7 m) away from sparks and heat or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls having combustibles on opposite sides should not be welded on or cut. Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

A fire watch with suitable fire extinguishing equipment must be provided during and after welding or cutting if combustibles (including building construction) are within 35 ft (10.7 m), if combustibles are further than 35 ft but may be ignited by flying sparks, or if openings (concealed or visible) in floors or walls within 35 ft may expose combustibles to sparks.

Combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

A hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

Do not weld or cut an empty container that has held combustibles, or that can produce flammable or toxic vapors when heated, unless container has first been cleaned as described in AWS Standard A6.0. This includes a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

IMPORTANT SAFETY PRECAUTIONS (continued)

Fire and Explosion (continued)



A container with unknown contents should be cleaned (see preceding paragraph). Do not depend on smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting to prevent explosion.

Never weld or cut in potentially explosive atmospheres containing flammable dust, gas, or liquid vapor (such as gasoline).

Do not mount this equipment over combustible surfaces.

Flying sparks or falling slag can fly up to 35 ft (10.7 m) and pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the operator.

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

Overloading arc welding equipment beyond rated capacity may overheat cables and cause fire.

Loose cable connections may overheat or flash and cause fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to rupture under rough handling.

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

Burn Prevention - Wear protective clothing including gauntlet welding gloves, hat, and high safety toe shoes. Button shirt collar to protect chest and neck, button pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag. Wear dark colored, substantial long-sleeve clothing (particularly for gas-shielded arc). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

Wear helmet with safety goggles and glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass) for welding or cutting (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered.

Avoid oily or greasy clothing which may be ignited by sparks.

Do not handle hot metal such as electrode stubs and workpieces without gloves.

Medical first aid and eye treatment facilities and personnel should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

IMPORTANT SAFETY PRECAUTIONS (continued)

Fire and Explosion
(continued)

Noise



High Pressure
Gas Cylinders

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

Allow work and equipment to cool before handling.

NOISE can cause permanent hearing loss.

Wear proper protective ear muffs or plugs.

Make sure others in the operating area are protected from noise.

Comply with the precautions in this manual and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS.

Pressure Regulators:

Regulator relief valve is designed to protect only the regulator from overpressure and not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve) if gas leaks externally, if delivery pressure continues to rise with downstream valve closed, or if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Do not attempt to repair faulty regulators. Send to manufacturer's authorized repair center where special techniques and tools are used by trained personnel.

Cylinders must be handled carefully to prevent leaks and damage to walls, valves, or safety devices.

Contact with electrical circuits including third rails, electrical wires, or welding circuits can product short circuit arcs that may lead to a serious accident.

ICC or DOT markings must be on each cylinder as an assurance of safety when the cylinder is properly handled.

Use only cylinders with name of gas clearly marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. Never deface or alter name, number or other markings on a cylinder.

Keep valves closed on empty cylinders, replace caps securely, mark MT, keep separate from full cylinders and return promptly.

Never use a cylinder or contents for other than intended use.
Never use as a support or roller.

IMPORTANT SAFETY PRECAUTIONS (continued)

High Pressure Gas Cylinders (continued)

Locate or secure cylinders so they cannot be knocked over.

Keep cylinders clear of passageways and work areas where they may be struck.

To transport cylinders with a crane, use a secure support such as a platform or cradle. Do not lift cylinders by valves or caps, or by chains, slings, or magnets.

Do not expose cylinders to excessive heat, sparks, slag, or flame which may cause rupture. Do not allow contents to exceed 1300°F. Cool with water spray where such exposure exists.

Protect cylinders and valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Do not use hammer or wrench to open a cylinder lock valve which cannot be opened by hand. Notify supplier.

Never mix gases in a cylinder.

Never refill any cylinder.

Do not modify or exchange cylinder fittings.

Hose

Never use hose unless appropriate for specified gas. General hose identification is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

Do not use copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Coil excess hose to prevent kinks and tangles. Suspend hose off ground to protect from damage. Protect hose from damage by sharp edges, sparks, slag, excessive heat, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in soapy water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing. Do not tape.

Proper Connections

Keep cylinder valve outlet free of impurities which may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily and point outlet away from people and sources of ignition. Wipe clean with a lintless cloth.

Match regulator to cylinder. Before connecting, check that regulator label and cylinder marking area match and that regulator inlet and cylinder outlet match. Never connect a regulator designed for one type of gas to a cylinder containing another gas.

IMPORTANT SAFETY PRECAUTIONS (continued)

Proper Connections (continued)

When assembling threaded connections, clean and smooth seats where necessary before tightening. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Use a CGA adapter (available from supplier) between cylinder and regulator, if required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

Pressurizing Steps

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw clockwise. Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Do not stand in front of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) open cylinder valve fully to seal stem against possible leak when using oxygen and inert gases. For fuel gas, open less than one turn to permit quick emergency shutoff.

Use pressure charts (available from supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly thereafter. Brush with soapy solution (one capful of liquid detergent per gallon of water); bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

Remove leaky or defective equipment immediately for repair.

Close gas supply at source and drain gas when leaving equipment unattended.

Do not use rope staging support for welding or cutting operation; rope may burn.

Electronic Life Support Devices (Pacemakers)

Magnetic fields from high currents can affect pacemaker operation. Persons wearing electronic life support equipment (pacemakers) should consult with doctor before going near arc welding, gouging, or spot welding operations.

IMPORTANT SAFETY PRECAUTIONS (continued)

Publications

Refer to the following standards or their latest revisions for more information:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

IMPORTANT SAFETY PRECAUTIONS (continued)

Publications (continued)

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

STATEMENT OF WARRANTY

LIMITED WARRANTY: Thermal Dynamics Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows: A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the following further limitations on such two (2) year period:

<u>PAK UNITS, POWER SUPPLIES</u>	<u>PARTS</u>	<u>LABOR</u>
MAIN POWER MAGNETICS	2 YEARS	1 YEAR
ORIGINAL MAIN POWER RECTIFIER	2 YEARS	1 YEAR
CONTROL PC BOARD	2 YEARS	1 YEAR
ALL OTHER CIRCUITS AND COMPONENTS	1 YEAR	1 YEAR
INCLUDING, BUT NOT LIMITED TO, STARTING CIRCUIT, CONTACTORS, RELAYS, SOLENOIDS, PUMPS, POWER SWITCHING SEMI-CONDUCTORS		
<u>CONSOLES, CONTROL EQUIPMENT, HEAT EXCHANGES, AND ACCESSORY EQUIPMENT</u>	1 YEAR	1 YEAR
<u>TORCH AND LEADS</u>	180 DAYS	180 DAYS
<u>REPAIR/REPLACEMENT PARTS</u>	90 DAYS	90 DAYS

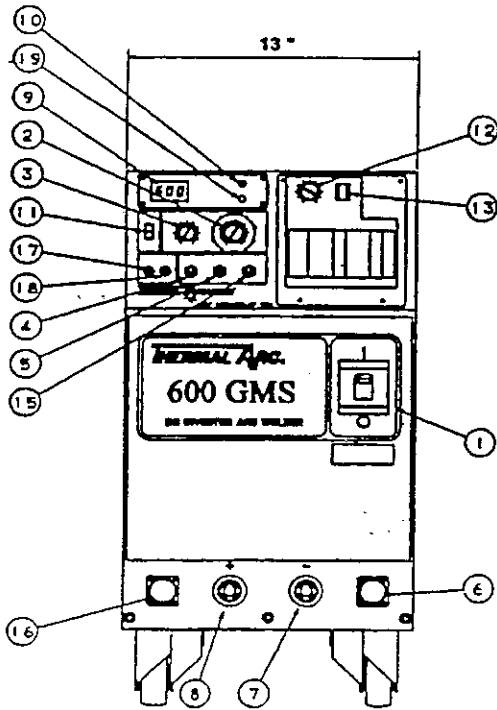
Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Arc® repair facility within thirty (30) days of the repair. Authorized Thermal Arc® repair facilities are authorized distributors and authorized Thermal Arc® Service Centers. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Thermal Arc® is a Registered Trademark of Thermal Dynamics.

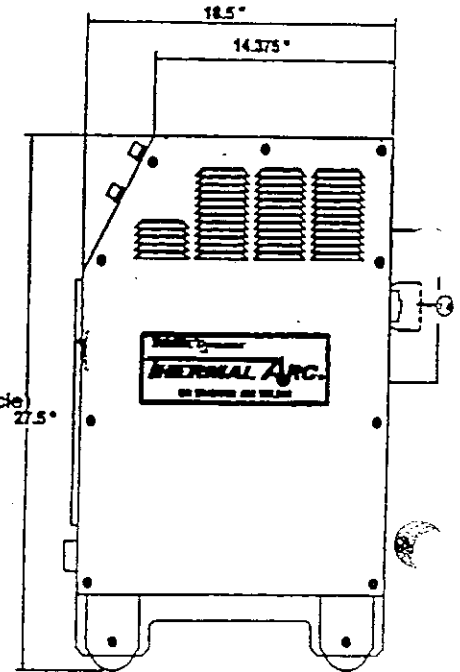
Effective January 18, 1991



OUTLINE DRAWING



- 1 — Primary Circuit Breaker
- 2 — Amp/Volt Control
- 3 — Arc Control
- 4 — Process Selector Switch
- 5 — Output Contactor Switch
- 6 — 14 Pin Control Receptacle
- 7 — Output Terminal (-)
- 8 — Output Terminal (+)
- 9 — Amp/Volt Meter
- 10 — Amp/Volt Meter Switch
- 11 — Warning Light (Low Voltage/Duty Cycle)
- 12 — Arc Length (Optional Pulsar)
- 13 — Program Selector (Optional Pulsar)
- 14 — Primary Input Terminals
- 15 — Volt/Amperage Switch
- 16 — 17 pin Receptacle
- 17 — Circuit Breaker
- 18 — Circuit Breaker
- 19 — Meter Preview Button



DESCRIPTION

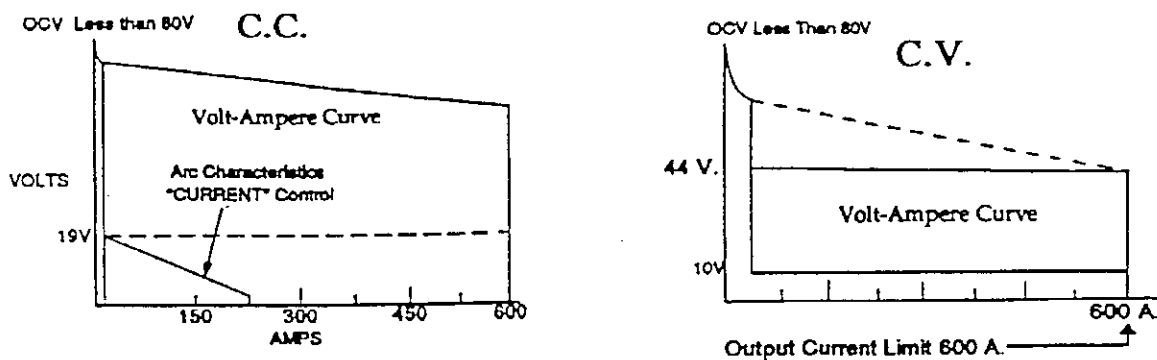
The 600GMS unit is a three-phase DC, arc welding power source with selectable constant current (CC) and constant voltage (CV) output characteristics. This unit is designed for use with Shielded Metal Arc (SMAW), Gas Metal Arc (GMAW) in the spray and short circuit mode, and Lift start Gas Tungsten Arc (GTAW) Welding processes. A digital Amp and Volt meter is optional. The models available are listed below.

10-1016 380/415 VAC MODEL (3 Phase Only)

10-1020 230/460 VAC MODEL (3 Phase Only)

SECTION 1 - SPECIFICATIONS

VOLT-AMPERE CURVES (Chart)



NOTE Volt-ampere curves show the voltage and amperage output capabilities of the power supply. Curves of other settings will fall between the curves shown.

(Figure 1)

The volt-ampere curves show the voltage and amperage output capabilities of the welding power source. Curves of other settings will fall between the curves shown.

SPECIFICATIONS (CONTINUED)

INPUT DATA 50/60 Hz	AT RATED LOAD		NO LOAD
	600A/44V	500A/40V	
208 VAC 3 PHASE	97 amps.	76 amps.	1.5 amps.
230 VAC 3 PHASE	87 amps.	69 amps.	1.0 amps.
380 VAC 3 PHASE	53 amps.	42 amps.	1.0 amps.
400 VAC 3 PHASE	50 amps.	40 amps.	1.0 amps.
415 VAC 3 PHASE	48 amps.	38 amps.	0.5 amps.
460 VAC 3 PHASE	43 amps.	34 amps.	0.5 amps.
KW	31 KW	23 KW	0.3 KW
KVA	35 KVA	27 KVA	0.5 KVA

RATED OUTPUT	THREE PHASE
AMPERES VOLTS	600 amps. 44 vdc
DUTY CYCLE %	60
RANGE (Min-Max) AMPERES VOLTS	5-600 amp. 10-44 vdc
MAXIMUM OCV	70 vdc
WIDTH HEIGHT LENGTH	13in(330mm) 21.75in(552.5mm) 27.5in(698.5mm)
WEIGHT	148LB(325.6kg)

DUTY CYCLE

The duty cycle of a welding power source is the percentage of a ten minute period that a welding power source can be operated at a given output without causing overheating and damaging of the unit. THIS UNIT IS RATED AT 60 PERCENT DUTY CYCLE WHEN OPERATED AT 600 AMPERES FROM THREE PHASE POWER. If the unit is operated from three-phase input power, the unit can be operated at 600 amperes for six consecutive minutes, but it must operate at no load for the remaining four minutes to allow proper cooling. If the welding amperes decrease, the duty cycle increases. If the welding amperes are increased beyond rated output, the duty cycle will decrease.

CAUTION: EXCEEDING DUTY CYCLE RATINGS will cause thermal overload protection circuit to become energized and shut down output until unit has cooled to operating temperature.

CAUTION: CONTINUAL EXCEEDING OF THE DUTY CYCLE RATINGS CAN CAUSE DAMAGE THE WELDING POWER SOURCE

Do not exceed indicated duty cycles!

SECTION 2 - INSTALLATION

SITE SELECTION

Select an installation site which provides the following:

1. Correct input power supply (see unit nameplate)
2. Shielding gas supply (if applicable)
3. Water supply (if applicable)
4. Adequate ventilation and fresh air supply
5. No flammables
6. A clean and dry area
7. Proper temperature that avoids extremes of heat or cold
8. Proper airflow around unit

WARNING: FIRE OR EXPLOSION can result from placing unit on or over combustible surfaces; RESTRICTED AIRFLOW can cause overheating and possible damage to internal parts.

- . Do not locate unit over combustible surfaces.
 - . Maintain at least 3 inches (76 mm) of space from sides of unit, 6 inches (152 mm) from rear, and open, unrestricted access to ambient air at front of unit.
 - . Do not place any filtering device over the intake air passages that provide airflow for cooling this part.
- Warranty is subject to being voided if any type of filtering device is used at intake air passages.

TRANSPORTING METHODS

This unit is equipped with two eyelets for carrying purposes.

WARNING: ELECTRIC SHOCK can kill.

- . Do not touch live electrical parts.
- . Disconnect input power conductors from deenergized supply line BEFORE moving welding power source.

FALLING EQUIPMENT can cause serious personal injury and equipment damage.

- . Lift unit at eyelets on top ends of case.
- . Have two persons of adequate physical strength lift unit.
- . Move unit with hand cart of similar device of adequate capacity.
- . If using a fork lift vehicle, place and secure unit on a proper skid before transporting.

This unit has eyelets on top ends of case for lifting. Be sure unit is lifted and transported safely and securely.

WELD OUTPUT CONNECTIONS

To obtain full rated output from this unit, it is necessary to select, prepare, and install proper weld cables. Failure to comply in any of these areas may result in unsatisfactory welding performance.

Table 1 Weld Cable Size

Welding Amperes	Total Cable (Copper) Length In Weld Circuit Not Exceeding*							
	100 ft. Or Less (30 m)		150 ft. (45 m)	200 ft. (60 m)	250 ft. (70 m)	300 ft. (90 m)	350 ft. (105 m)	400 ft. (120 m)
	10 To 60% Duty Cycle	60 Thru 100% Duty Cycle	10 Thru 100% Duty Cycle					
100	4	4	4	3	2	1	1/0	1/0
150	3	3	2	1	1/0	2/0	3/0	3/0
200	3	2	1	1/0	2/0	3/0	4/0	4/0
250	2	1	1/0	2/0	3/0	4/0	2-2/0	2-2/0
300	1	1/0	2/0	3/0	4/0	2-2/0	2-3/0	2-3/0
350	1/0	2/0	3/0	4/0	2-2/0	2-3/0	2-4/0	2-4/0
400	1/0	2/0	3/0	4/0	2-2/0	2-3/0	2-4/0	3-3/0
500	2/0	3/0	4/0	2-2/0	2-3/0	2-4/0	3-3/0	3-4/0
600	3/0	4/0	2-2/0	2-3/0	2-4/0	3-3/0	3-4/0	3-4/0
700	4/0	2-2/0	2-3/0	2-4/0	3-3/0	3-4/0	3-4/0	4-4/0
800	4/0	2-2/0	2-3/0	2-4/0	3-4/0	3-4/0	4-4/0	4-4/0
900	2-2/0	2-3/0	2-4/0	3-3/0	3-4/0	4-4/0	4-4/0	

*Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of more than 300 circular mils per ampere.

Weld Cable Selection

Use the following guidelines to select weld cables:

1. Use the shortest possible cables, and place cables close together. Excessive cable lengths may reduce or cause unit overload due to added resistance.
2. Use weld cable with an insulation voltage rating equal to or greater than the maximum open-circuit voltage (OCV) of the welding power source.
3. Select welding cable size according to maximum weld output and total length of connecting cables in weld circuit. For example, if a 25 foot (7.5 m) electrode holder or torch cable is used with a 25 foot (7.5 m) work cable, select the cable size recommended in Table 1 for 50 feet (15 m).
4. Do not use damaged or frayed cables.

B. Weld Cable Preparation

1. Install terminal lugs of adequate amperage capacity and correct size onto ends of cables that connect to the work clamp and electrode holder or torch.
2. If installing electrode holder, follow manufacturer's installation instructions. Always use an insulated electrode holder to ensure operator safety.
3. Install work clamp onto cable.
4. Install supplied male connectors onto remaining ends of both cables according to Subsection.

C. Connector Installation (Figure 2)

Install the supplied male connectors onto proper cables as follows:

1. Obtain cable of desired length and proper size for installation.
2. If the installation requires cable larger than 3/0 AWG, prepare one of 3/0 AWG pigtail no longer than 2 feet (610 mm) for connector installation. The remaining end of the pigtail is connected to the main run of 3/0 AWG or larger weld cable.
3. Push weld cable through insulator as shown in Figure.
4. Remove 1 in. (25 mm) of insulation from end of cable.
5. Install supplied sleeve on stripped end of cable.
6. Insert cable with sleeve into connector body so that cable is snug and against bottom of connector body.
7. Install and tighten setscrew with supplied hex wrench to secure connector body onto cable.
8. Push insulator onto connector body to cover setscrew.

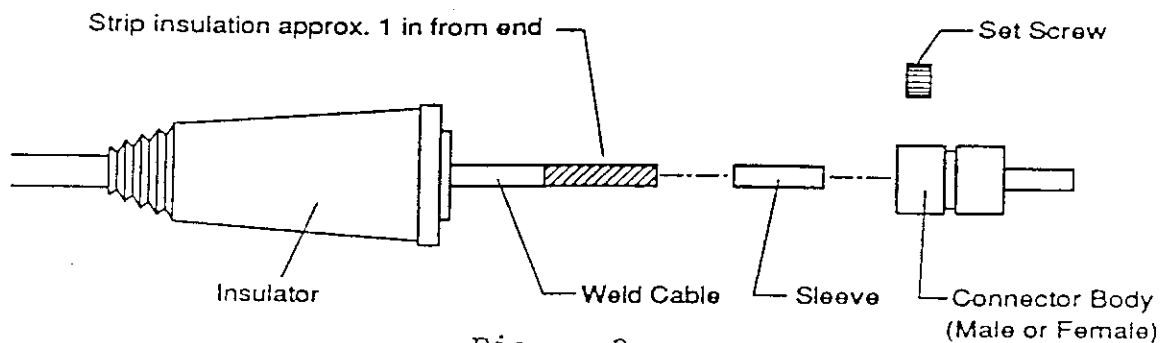
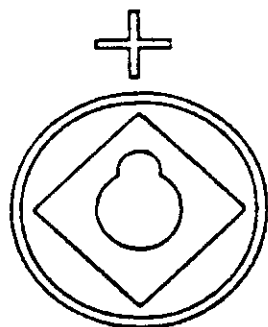


Figure 2

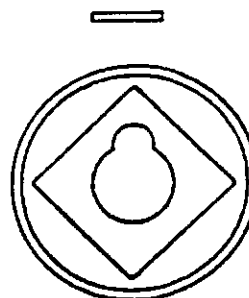
D. Weld Cable Connections (Figure 3)

(+) POSITIVE

(-) NEGATIVE



Positive



Negative

WARNING: ELECTRIC SHOCK can kill; ARCING can burn skin or damage electrical connections.

- Do not touch live electrical parts.
- Shut down unit before making any weld output connections.
- Do not change position of the welding cable connectors while welding.
- Be sure the connectors are secure in receptacles before welding.

1. FOR SHIELDED METAL ARC WELDING (SMAW) (Electrode Positive/Reverse Polarity)

- a. Connect end of electrode holder cable to POSITIVE (+) weld output receptacle as follows: align keyway, insert plug, and rotate plug clockwise until it is securely seated in receptacle.
- b. Connect work cable connector to NEGATIVE (-) weld output receptacle as follows: align keyway, insert plug, and rotate plug clockwise until it is securely seated in receptacle.

IMPORTANT: For Electrode Negative/Straight Polarity connections, reverse cable connections to weld output receptacles; electrode becomes negative.

2. FOR GAS METAL ARC (GMAW) and FLUX CORED ARC (FCAW) WELDING
(Electrode Positive/Reverse Polarity)

- a. Connect end of electrode holder cable to POSITIVE (+) weld output receptacle as follows: align keyway, insert plug, and rotate plug clockwise until it is securely seated in receptacle. Remaining end to terminal connection located on drive housing of wire feeder (see wire feeder Owner's Manual for location).
- b. Connect work cable connector to NEGATIVE (-) weld output receptacle as follows: align keyway, insert plug, and rotate plug clockwise until it is securely seated in receptacle.

IMPORTANT: For Electrode Negative/Straight Polarity connections, reverse cable connections to weld output receptacles; electrode becomes negative.

FOR GAS TUNGSTEN ARC WELDING (GTAW) (Electrode Negative/Straight Polarity)

- a. Connect torch cable connector to NEGATIVE (-) weld output receptacle as follows: align keyway, insert plug, and rotate plug clockwise until it is securely seated in receptacle.
- b. Connect work cable connector to POSITIVE (+) weld output receptacle as follows: align keyway, insert plug, and rotate plug clockwise until it is securely seated in receptacle.

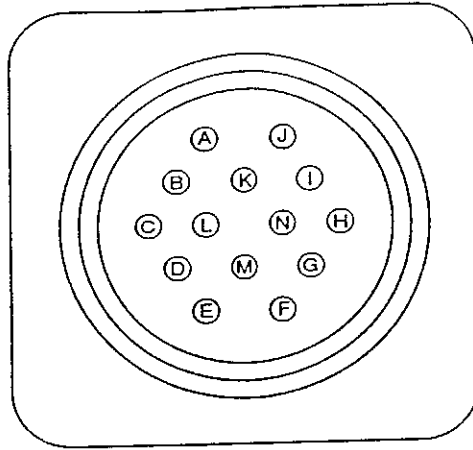
IMPORTANT: For Electrode Positive/Reverse Polarity connections, reverse cable connections to weld output receptacles; electrode (torch) becomes positive.

REMOTE 14 RECEPTACLE INFORMATION AND CONNECTIONS

REMOTE 14 receptacle is used to connect any of the following equipment to the welding power source circuitry:

- a. *REMOTE CONTACTOR CONTROL*
- b. *REMOTE AMPERAGE CONTROL*
- c. *WIRE FEEDER WHICH PROVIDES CONTACTOR CONTROL TO WELDING POWER SOURCE.*
- d. *COMBINATION OF THE ABOVE*

**Figure 4 FRONT VIEW OF 14-SOCKET RECEPTACLE
WITH SOCKET LOCATIONS**



To make connections. align keyway, insert plug, and rotate threaded collar fully clockwise.

The following socket information is included in case the supplied cord is not suitable, and it is necessary to wire a plug or cord to interface with REMOTE 14 receptacle.

- Socket A: Up to 10 amps of 24VAC, 60Hz, with respect to Socket G (circuit common); protected by circuit breaker MCB3.
 - Socket B: Input to energize the solid-state contactor; 24VAC (contact closure is provided between Sockets A and B to energize the solid-state contactor).
 - Socket C: Amperage remote control (**MAXIMUM**) input command signal; +1- volts for maximum.
 - Socket D: Amperage remote control (**MINIMUM**); Printed circuit board common; use as return for remote control inputs/outputs
 - Socket E: Remote amperage reference signal (**WIPER**); 0 to +10 volts (peak current set by main rheostat) in CC or CV mode.
 - Socket G: 24VAC circuit common; also connected to welding power source chassis.
 - Socket H: 100VAC with respect to Socket L
 - Socket I: Up to 1.5 Amps. of 115 vac 60 Hz. with respect to socket G.
 - Socket J: 115 vac input control to energize the solid state contactor.
 - Socket K: Chassis common
 - Socket L: 100VAC with respect to Socket H
 - Socket M: Current sensing contactor with respect to Socket N (N/O).
 - Socket N: Current sensing contactor with respect to Socket M (N/O).
- IMPORTANT:** The remaining sockets in the receptacle are not used.

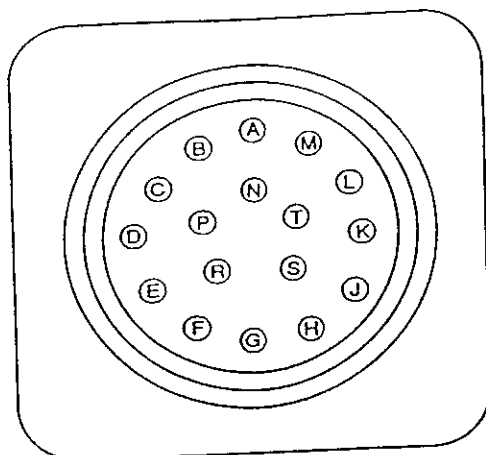


Figure 5

The 17-socket REMOTE receptacle provides a junction point for connecting various remote controls to the welding power source. The functions available from this receptacle are:

- remote amperage control
- remote voltage control
- remote pulsing control
- remote contactor control
- robot control
- signals indicating weld current and voltage for remote metering

To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

The following socket information is included in case the supplied cord is not suitable, and it is necessary to wire a plug or cord to interface with REMOTE 17 receptacle.

**Figure 5 FRONT VIEW OF 17-SOCKET RECEPTACLE
WITH SOCKET LOCATIONS**

- Socket A:** Amperage/ voltage reference output signal; +10 volts; for use pulse controls.
- Socket B:** Amperage/voltage remote control input command signal; +10 volts for machine maximum.
- Socket D:** Solid-state contactor remote control command signal; +24 volts (operates above 13 volts) turns contactor On; 0 volts (open or ground) turns contactor Off.
- Socket E:** Actual weld current signal; +1 volt per 100 amperes of output current.
- Socket F:** Printed circuit board common; use as return for remote control inputs/outputs only from Terminals A,B,C,D,E,J, and K.
- Socket H:** +24 volts unregulated; fused for 1/2 ampere.
- Socket K:** Remote amperage/voltage reference signal; 0 to +10 volts (set by main rheostat) in CC and CV mode.
- Socket L:** -24 volts unregulated; fused for 1/2 ampere.
- Socket M:** Load voltage output signal; +1 volt per 10 volts of load voltage.
- Socket P:** Circuit common (printed circuit board common and internal chassis ground) use as return (+/-)18 volts logic supply only (pins H and L).
- Socket S:** Chassis ground **IMPORTANT:** The remaining sockets in the receptacle are not used.

ELECTRICAL INPUT CONNECTIONS

WARNING: ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE exists after remove of input power.

- . Do not touch live electrical parts.
- . Shut down welding power source, disconnect input power employing lockout/tagging procedures, wait 60 seconds, and measure voltage on input capacitors according to Section before touching any parts.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

A. Electrical Input Requirements

Operate the welding power source from a three-phase 50/60 Hertz, AC power supply. The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate. Contact the local electric utility for information about the type of electrical service available, how proper connections should be made, and inspection required.

The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power supply whenever it is necessary to inspect or service the unit.

IMPORTANT: This unit is equipped with a electrical box mounted to the back panel of the power supply for the connection of primary power. A terminal block inside the electrical box is used to connect the three phase power and ground connections. The terminals are marked L-1, L-2, L-3 for input power and G for ground.

- . Do not connect an input (white, red, or black) conductor to the ground terminal.
- . Do not connect the ground (green) conductor to an input line terminal.

1. Connect end of Green ground conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
2. For Three-phase electrical input power: connect ends of Red (line 1), White (line 2), and Black (line 3) input conductors to a *deenergized* line disconnect switch.
3. Use Table 2 as a guide to select line fuses for the disconnect switch.

FUSE SIZE*

INPUT POWER	INPUT VOLTAGE	FUSE SIZE
THREE PHASE	208	130
	230	115
	380	70
	415	70
	460	60

Table 2

Fuse size is based on not more than 200 percent of the rated input amperage of the welding power source (Article 630 of the National Electrical Code).

VOLTAGE SELECTION.

IMPORTANT: The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate.

This power source incorporates the SMART LINK™ circuit which automatically links the power source to primary input-voltage and adjusts it to allow for operation of unit within input rating on data tag. It is not necessary to manually switch (terminals or links) if unit is moved to a new location and a different input power is selected.

- . About two seconds after power on, the SMART LINK™ circuit detects input voltage and automatically selects the correct circuits for operation.
- . The surge current prevention circuit becomes activated.
- . The welding machine is ready for operation in five seconds after turn-on.

SECTION 3 OPERATOR CONTROLS

POWER Switch and AC POWER Lamp

Placing the POWER switch on the rear panel in the ON position energizes the welding power source. The AC power lamp located on the front panel, comes on when the POWER switch is in the ON position, indicating that the unit is energized. Placing the Power switch in the OFF position shuts down the welding power source and turns off the AC power lamp.

IMPORTANT: When the Power switch is placed in the ON position, there is a precharge time delay of approximately 4-5 seconds before the unit is ready to weld. The AC power lamp will be on during the precharge time delay.

WARNING Lamp

The **WARNING** lamp located on the front panel will become activated if the unit witnesses the following:

- . Primary overcurrent . Input voltage too low . Thermal overload

AMPERAGE/VOLTAGE Control

The **AMPERAGE/VOLTAGE** control provides a means of selecting the desired amperage within the entire range of the welding power source. Rotating this control in a clockwise direction increases the amperage output. The scale surrounding the **AMPERAGE/VOLTAGE** control is calibrated in actual amperage and voltage values and is read according to the selected mode: Constant Voltage (CV) or Constant Current (CC). The amperage scale (CC) is for SMAW and GTAW. The voltage scale is for GMAW and FCAW.

IMPORTANT: The **AMPERAGE** control may be adjusted while welding.

ARC CONTROL/INDUCTANCE Control

IMPORTANT: The ARC CONTROL/INDUCTANCE control may be adjusted while welding. For Gas Tungsten Arc Welding (GTAW), set the ARC CONTROL/INDUCTANCE control at 0 (zero).

Operations of this control depends on the welding mode selected.

Arc Control For STICK (CC) Mode.

The ARC CONTROL provides a variable selection of short-circuit amperage to suit individual welding situations when operating in the Shielded Metal Arc Welding (SMAW) mode. Rotating this control clockwise causes the amperage to increase as a short-circuit condition is approached.

When the control is set at 100, short circuit amperage is considerably higher than normal welding amperage. This provides extra amperage for arc starting in out-of-position welds as well as momentary over amperage necessary for certain types of electrodes.

When the control is set at 0 (zero), short-circuit amperage above normal welding amperage is minimal.

When the control is set at 50, short-circuit amperage is approximately half that of the 100 position, but still higher than normal welding amperage. The 50 position provides a moderate amperage increase for arc starting necessary for certain type of electrodes and applications.

Select a setting best suited for the application and type of electrode.

B. Inductance For The MIG (CV) Mode

In the MIG (CV) Mode, the ARC CONTROL/INDUCTANCE control functions as an inductance control, allowing for the adjustment of the dynamic properties of the arc enhancing the weld puddle control when operated in the Gas Metal Arc (GMAW) and Flux Cored Arc (FCAW) welding processes.

The 0 (zero) setting provides a minimum inductance, i.e., a stiff, fast-responding arc, and a small fast-freezing weld puddle.

The 100 setting provides maximum inductance characteristics, i.e., a soft, slower-responding, low spatter arc, and high weld puddle fluidity.

Select a setting best suited for the application and type of electrode.

PROCESS SELECTOR Switch

The Process Selector switch allows the operator to choose between the STICK WELDING (SMAW) process, the MIG WELDING (GMAW) process, and LIFT START TIG WELDING (GTAW) process.

WELD MODES:

STICK WELDING (SMAW)

The unit will provide weld output characteristics specifically designed for the Shielded Metal Arc Welding (SMAW) process. When the Process Selector switch is in this position, the Arc control function of the ARC CONTROL/INDUCTANCE control is active, and the Amperage scale of the Amperage/Voltage control is functional.

MIG (GMAW and FCAW)

The unit will provide weld output characteristics specifically designed for the Gas Metal Arc (GMAW) and Flux Cored Arc (FCAW) welding processes. When the Process Selector switch is in this position, the Inductance function of the ARC CONTROL/INDUCTANCE control is active, the Voltage scale of the Amperage/Voltage control is applicable.

LIFT TIG (GTAW without High Frequency)

The unit will provide weld output characteristics specifically designed for LIFT start Gas Tungsten Arc Welding (GTAW) process. High frequency will not be present. When the Process Selector switch is in this position, the ARC CONTROL/INDUCTANCE Control will not function. The unit will provide a low open circuit voltage and approximately 15 amps to the tungsten electrode when touched to the work and lifted away from surface. After the welding arc becomes established, the output current will be regulated at determined current levels.

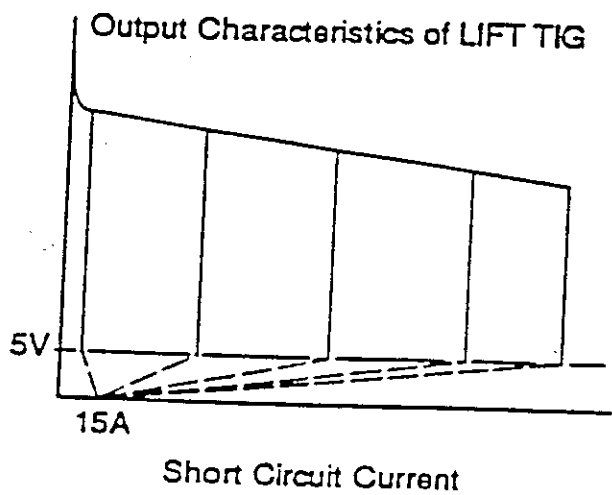


FIGURE 6

AMPERAGE/VOLTAGE Control Switch

This switch determines whether the Amperage/Voltage is adjusted by the front panel AMPERAGE/VOLTAGE control or by a remote control device. If remote control function is not desired, place this switch in the PANEL position.

If remote Amperage/Voltage control is desired, place the AMPERAGE/VOLTAGE control switch in the REMOTE 14 position if remote control connections are made to the REMOTE 14 receptacle, or to the REMOTE 17 position if remote control connections are made to the REMOTE 17 receptacle.

When the REMOTE 14 receptacle is used, Remote control is a percentage of the value set by the front panel AMPERAGE/VOLTAGE control. For example, if the AMPERAGE/VOLTAGE control is set at half maximum output, the maximum output available from the remote control will be half the welding power source maximum output.

When the REMOTE 17 receptacle is used, two possibilities exist. If Socket K is used to determine remote output, the REMOTE 17 receptacle functions the same as the REMOTE 14 (Remote control is a percentage of the value set by the front panel AMPERAGE/VOLTAGE control). If Socket B is used to determine remote output, the REMOTE 17 receptacle will command the full range of the welding power source output, independent of what the front panel AMPERAGE/VOLTAGE control is set at. Determining which socket is used will depend on the remote control device is being used for the application.

OUTPUT CONTACTOR Switch

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Do not touch the weld output receptacles when the contactor is energized.
- Do not touch electrode and work clamp at the same time.

If the OUTPUT CONTACTOR switch is in the ON position, open-circuit voltage will be present at the output receptacles whenever the POWER switch is in the ON position.

IMPORTANT: Although the term CONTACTOR is used on the nameplate and throughout this manual, the output is not switched on or off by a physical contactor; rather, the unit uses solid-state output control.

If remote contactor control is desired, place the **OUTPUT CONTACTOR** switch in the **REMOTE 14** position if remote contactor connections are made to the **REMOTE 14** receptacle, or to the **REMOTE 17** position if remote contactor connections are made to the **REMOTE 17** receptacle. Open-circuit voltage will be present at the weld output receptacles whenever the torch switch or remote device is closed.

If remote contactor control is not desired, place the **OUTPUT CONTACTOR** switch in the **ON** position. Open-circuit voltage will be available whenever the **POWER** switch is in the **ON** position.

DIGITAL METER AND SWITCH (Optional)

The LED meter displays either an amperage or voltage value. The selected (preview) amperage value is displayed when welding is not taking place. Refer to Table for the values displayed for each meter switch setting and parameters selected.

The meter is not intended for exact amperage or voltage measurement. The amperage display indicates amperage output of the welding power source and is driven by circuitry on control board PC1. The voltage sensing circuitry is internally connected to the welding power source output terminals. The voltage display indicates the voltage at the weld output terminals, but does not necessarily indicate the actual voltage at the welding arc (due to cable resistance, poor connections, etc.).

SECTION 4 - SEQUENCE OF OPERATION

GAS TUNGSTEN ARC WELDING (GTAW) LIFT START ONLY

WARNING: Read and follow safety information before proceeding.

1. INSTALL AND CONNECT UNIT ACCORDING TO SECTION 2.
2. SELECT AND OBTAIN PROPER TUNGSTEN ELECTRODE.
3. PREPARE TUNGSTEN ELECTRODE AND INSERT INTO TORCH.
4. WEAR DRY INSULATING GLOVES AND CLOTHING.
5. CONNECT WORK CLAMP TO CLEAN, BARE METAL AT WORKPIECE.
6. PLACE PROCESS SELECTOR SWITCH IN LIFT TIG WELDING POSITION.
7. PLACE OUTPUT CONTACTOR SWITCH IN DESIRED POSITION.
8. PLACE AMPERAGE CONTROL SWITCH IN DESIRED POSITION.
9. ROTATE AMPERAGE CONTROL TO DESIRED POSITION.
10. TURN ON SHIELDING GAS AND WATER SUPPLIES AS APPLICABLE.
11. WEAR WELDING HELMET WITH PROPER FILTER LENS ACCORDING TO ANSI Z49.1.
12. PLACE POWER SWITCH IN ON POSITION.
13. ACTIVATE REMOTE CONTROL DEVICE (FOOT CONTROL OR REMOTE PENDANT)
14. BEGIN WELDING.

WARNING: HIGH CONCENTRATION OF SHIELDING GAS can harm health or kill.
. Shut off gas supply when not in use.

SHIELDED METAL ARC WELDING (SMAW)

WARNING: Read and follow safety information before proceeding.

1. Install and connect unit according to Section 2.
2. Wear dry insulating gloves and clothing.
3. Connect work clamp to clean, bare metal at workpiece.
4. Select proper electrode.
5. Place PROCESS SELECTOR switch in Shielded Metal Arc Welding position (Stick).
6. Place OUTPUT CONTACTOR switch in ON position.
7. If remote amperage control is not used, place the AMPERAGE Control switch in the PANEL position. If remote amperage control is to be used, place the AMPERAGE Control switch in the REMOTE 14 position.
8. Rotate AMPERAGE control, or remoted amperage control, if applicable, to desired position.
9. Rotate ARC CONTROL to desired position.
10. Insert electrode into electrode holder.
11. Wear welding helmet with proper filter lens according to ANSI Z49.1.
12. Place POWER switch in ON position.
13. Begin welding.

GAS METAL ARC WELDING (SMAW)

WARNING: Read and follow safety information before proceeding.

1. Install and connect unit according to Section 2.
2. Install and connect wire feeding system according to its Owners Manual.
3. Wear dry insulating gloves and clothing.
4. Connect work clamp to clean, bare metal at workpiece.
5. Place PROCESS SELECTOR switch in MIG Welding position.
6. Place OUTPUT CONTACTOR switch in REMOTE position.
7. Place the AMPERAGE/VOLTAGE Control switch in the desired position.
Rotate AMPERAGE/VOLTAGE control to desired position.
9. Rotate ARC CONTROL/INDUCTANCE control to desired position.
10. Turn on shielding gas supply, set desired flowrate.
11. Wear welding helmet with proper filter lens according to ANSI Z49.1.
12. Place POWER switch in ON position.
13. Begin welding.

FLUX CORED ARC WELDING (FCAW)

WARNING: Read and follow safety information before proceeding.

1. Install and connect unit according to Section 2.
2. Install and connect wire feeding system according to its Owners Manual.
3. Wear dry insulating gloves and clothing.
4. Connect work clamp to clean, bare metal at workpiece.
5. Place PROCESS SELECTOR switch in MIG Welding position.
6. Place OUTPUT CONTACTOR switch in REMOTE position.
7. Place the AMPERAGE/VOLTAGE Control switch in the desired position.
Rotate AMPERAGE/VOLTAGE control to desired position.
9. Rotate ARC CONTROL/INDUCTANCE control to desired position.
10. Wear welding helmet with proper filter lens according to ANSI Z49.1.
11. Place POWER switch in ON position.
12. Begin welding.

SHUTTING DOWN

1. Stop welding.
2. Place the POWER switch in the OFF position.
- 3 Turn off the shielding gas and water supplies, if applicable.

SECTION 5 TROUBLESHOOTING

TROUBLE: NO WELD OUTPUT; UNIT COMPLETELY INOPERATIVE.

- CAUSE: Line disconnect switch in the OFF position.
REMEDY: Place line disconnect switch in the ON position.
- CAUSE: Line fuse(s) open.
REMEDY: Check and replace line fuse(s).
- CAUSE: Improper electrical input connections.
REMEDY: See Section 2 for proper input connections.
- CAUSE: Power switch MCB
REMEDY: Check and replace MCB if necessary.

TROUBLE: NO WELD OUTPUT; FAN MOTOR RUNNING AND AC POWER LAMP ON.

- CAUSE: OUTPUT CONTACTOR switch S2 in REMOTE 14 position with no remote contactor control connected to REMOTE 14 receptac
REMEDY: Place S2 in ON position or connect remote contactor cont to REMOTE 14 receptacle.
- CAUSE: Defective remote control device.
REMEDY: Check and replace remote control device if necessary.
- CAUSE: Warning lamp on. Thermostat THS 1, THS 2 open (thermal shutdown)
REMEDY: Allow a cooling period of approximately five minutes.

TROUBLE: ERRATIC OR IMPROPER WELD OUTPUT.

CAUSE: Loose welding cable connections.

REMEDY: Tighten all welding cable connections

CAUSE: Incorrect welding cable size.

REMEDY: Use proper size and type of cable.

CAUSE: Poor and/or improper input and/or output connections.

REMEDY: Use proper size and cable size.

CAUSE: Poor and/or improper input and/or output connections.

REMEDY: Check input and output for proper connections.

CAUSE: Electrode condition

REMEDY: Replace electrode.

CAUSE: Remote Amperage control (when applicable)

REMEDY: Check remote Amperage control potentiometer and connection

Repair or replace if necessary.

TROUBLE: REMOTE DEVICE COMPLETELY INOPERATIVE.

CAUSE: Remote control not connected or connected improperly to
REMOTE 14 receptacle.

REMEDY: Connect remote control to REMOTE 14 receptacle.

TROUBLE: WANDERING ARC - POOR CONTROL OF ARC DIRECTION.

CAUSE: Use of tungsten considerably larger than recommended.

REMEDY: Use proper size tungsten.

CAUSE: Improperly prepared tungsten.

REMEDY: Prepare tungsten properly.

CAUSE: Gas flow rate too high.

REMEDY: Reduce flow rate.

CAUSE: Drafts blowing shielding gas away from tungsten electrode.

REMEDY: Shield weld zone from drafts.

CAUSE: Loose gas fittings on regulator or gas line. This will draw air into the weld zone.

REMEDY: Check and tighten all gas fittings.

CAUSE: Water in torch.

REMEDY: Refer to torch parts list for part(s) requiring replacement and repair torch as necessary.

SECTION 6 PARTS LIST

600GMS

CAT.NO.	DESCRIPTION	230/460	380/415
10-2236	PL1 & 2 Pilot Lamp	X	X
10-2274	F1 Fuse 3amp 600v	X	X
10-2206	F3 Fuse 2amp 250v	X	X
10-2160	CT1 Current Transformer	X	X
10-2161	CT2 Current Transformer	X	X
10-2195	S1 & 2 & 3 Switch 1P3T	X	X
10-2432	MC1 Mag. Contactor	X	X
10-2433	MC2 Mag Contactor	X	O
10-2273	THS1 & 2 Thermal Switch	X	X
10-2434	MCB1 Molded Case C.B.	O	X
10-2435	MCB1 Molded Case C.B.	X	O
10-2234	MCB2 Molded Case C.B.	X	X
10-2235	MCB3 Molded Case C.B.	X	X
10-2124	VR1 & 2 10k Potentiometer	X	X
10-2296	R1 100w 100 ohms	X	X
10-2209	R2 & 3 30w 10k ohms	X	X
10-2211	R4 & 5, 19 20w 10 ohms	X	X
10-2212	R6 - 9 3w 100k ohm	X	X
10-2231	R18 3w 6.8k ohm	X	X
10-2211	R19 20w 10ohm	X	O
10-2270	C1 & 2 1250vdc .1uf	X	X
10-2278	C4 & 5 400vdc 3300uf	X	X
10-2119	C6 - 9 350vdc 20uf	X	X

SECTION 6 PARTS LIST (Continued)

60 M

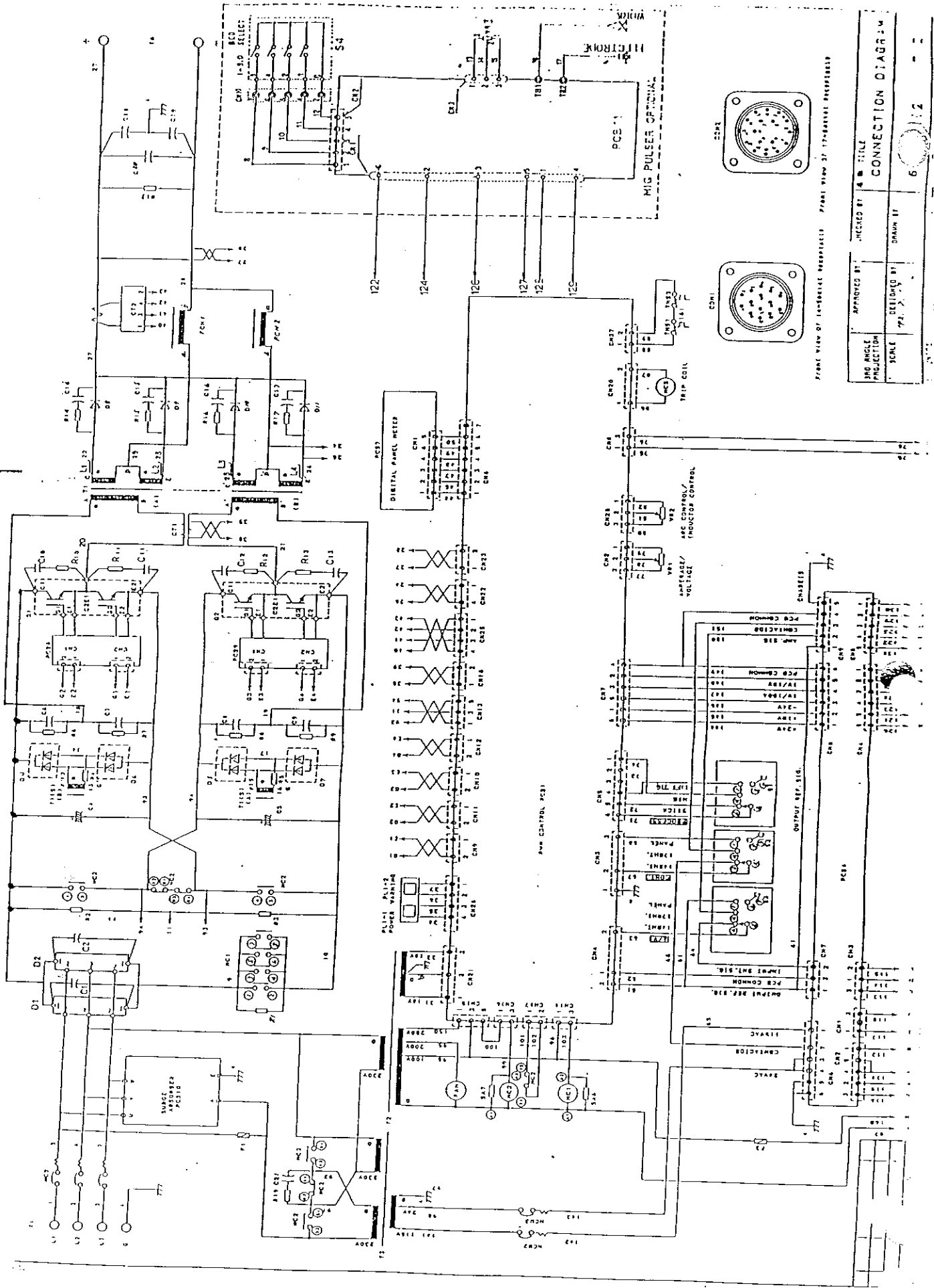
CAT.NO.	DESCRIPTION	230/460	380/415
10-2297	C10 - 13 1200v .01uf	X	X
10-2217	C14 - 17 1200v .022uf	X	X
10-2298	C18 & 19 .01uf	X	X
10-2241	C20 1000v .1uf	X	X
10-2299	C21 250vac 10uf	X	O
10-2436	Q1 & 2 600v 300 amp	X	X
10-2156	D1 & 2 Diode	O	X
10-2158	D1 & 2 Diode	X	O
10-2111	D4 & 5 10amp 600v	X	X
10-2112	D6 & 7 10amp 600v	X	X
10-2437	D8 - 11 Diode	X	X
10-2221	SA6 & 7 Surge Sup. (SA7 not used in 380/415 model)	X	X
10-2288	FAN Fan Cooling	X	X
10-2438	T1 Transformer	O	X
10-2289	T1 Transformer	X	O
10-2148	T2 Transformer	O	X
10-2150	T2 Transformer	X	O
10-2151	T3 Transformer	O	X
10-2153	T3 Transformer	X	O
10-2290	L1 - 4 Reactor	X	X
10-2291	FCH1 & 2 DC Reator	X	X
10-2135	CON1 14 Pin Receptacle	X	X

SECTION 6 PARTS LIST (Continued)

600GMS

CAT.NO.	DESCRIPTION	230/460	380/415
10-2133	CON1 17 Pin Receptacle	X	X
10-2439	PCB1 Printed Circuit Bd.	O	X
10-2292	PCB1 Printed Circuit Bd.	X	O
10-2197	PCB4 Filter Bd.(14 pin)	X	X
10-2293	PCB7 Meter PC Bd.	X	X
10-2285	PCB8 & 9 IGBT Gate Bd.	O	X
10-2145	PCB10 Printed Circuit Bd.	O	X
10-2164	PCB10 Printed Circuit Bd.	X	O
10-2440	T1 Input Terminal	O	X
10-2294	T1 Input Terminal	X	O
10-2295	TO Output Terminal	X	X
	R10 - 13 10ohm	X	X
	R14 - 17 5 ohm	X	X

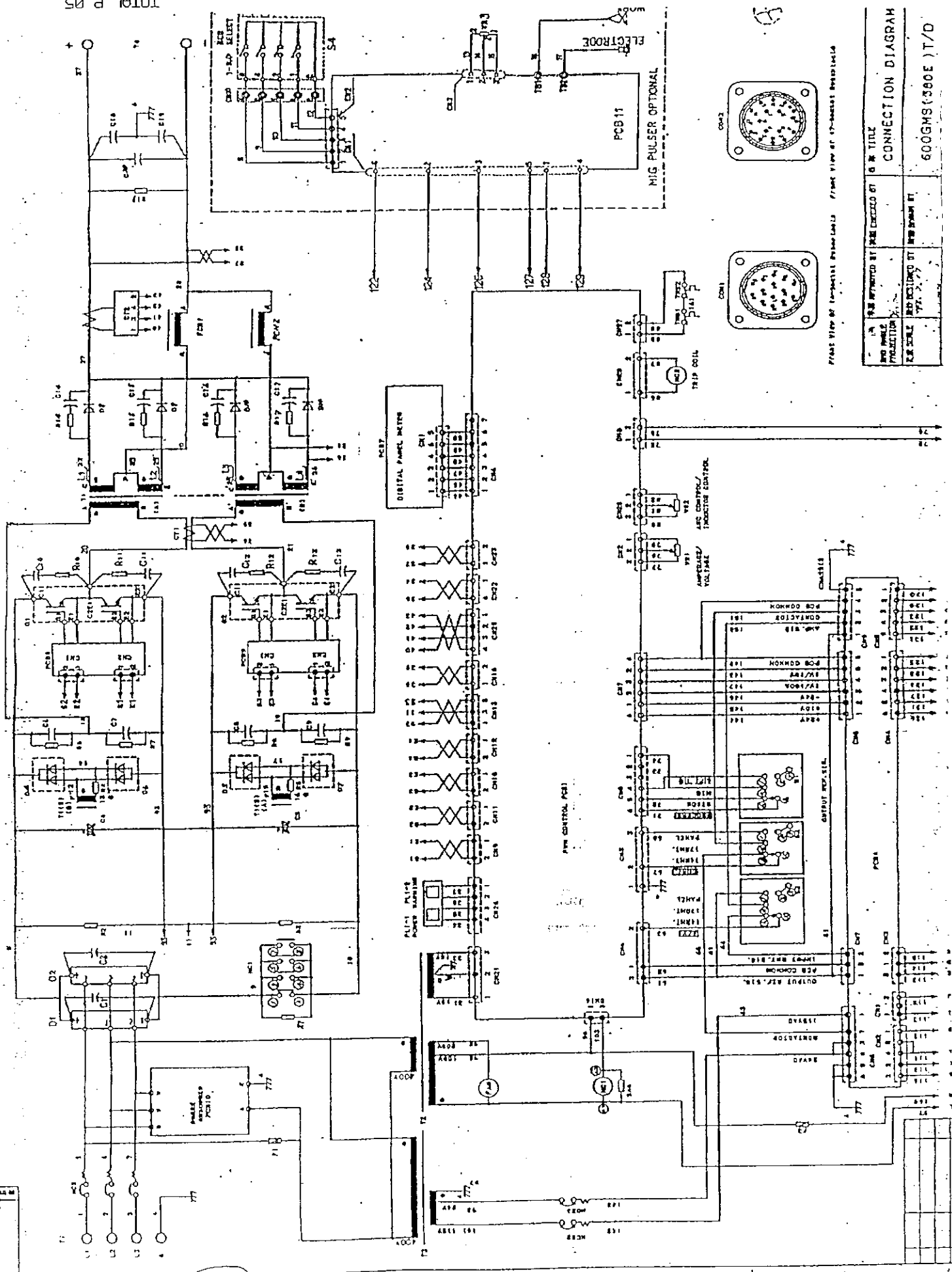
KLA 4/93



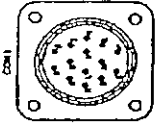
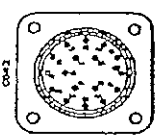
FRONT VIEW OF ISOMETRIC REPRESENTATION PART VIEW 37 ISOMETRIC REPRESENTATION

3RD ANGLE PROJECTION	APPROVED BY	INCHES BY	TITLE
SCALE	DESIGNED BY	DRAWN BY	CONNECTION DIAGRAM
			6

TOTAL P.05



FRONT VIEW OF INTERNAL PULSER LEADS FRONT VIEW OF 17-LEAD BATTERY LEADS



1. HAS APPROVED BY NAME CHECKED BY	2. TITLE
3. HAS APPROVED BY NAME CHECKED BY	CONNECTION DIAGRAM
4. FOR SCALE	600GMS(390E) T/D

