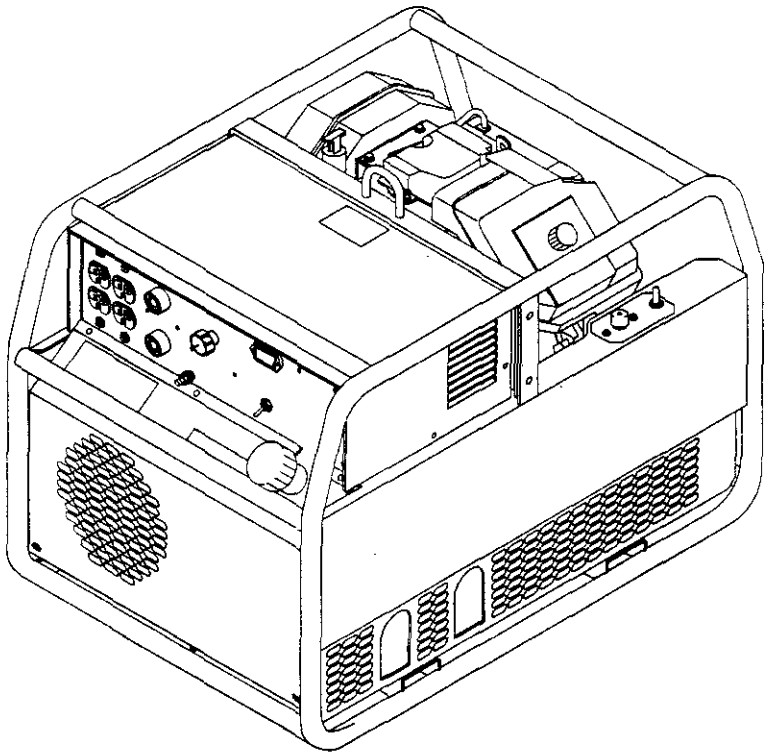
Miller®

March 1991 FORM: OM-436

Effective With Serial No. KB012373

MODEL: Blue Star™ 180K



OWNER'S MANUAL

IMPORTANT: Read and understand the entire contents of this manual, with special emphasis on the safety material throughout the manual, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

MILLER ELECTRIC Mfg. Co.
A Miller Group Ltd., Company

P.O. Box 1079
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Tel. 414-734-9821

SC-144 336

PRINTED IN U.S.A

LIMITED WARRANTY

EFFECTIVE: AUGUST 6, 1990

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

LIMITED WARRANTY – Subject to the terms and conditions hereof, MILLER Electric Mfg. Co., Appleton, Wisconsin warrants to its Distributor/Dealer that all new and unused Equipment furnished by MILLER is free from defect in workmanship and material as of the time and place of delivery by MILLER. No warranty is made by MILLER with respect to engines, trade accessories or other items manufactured by others. Such engines, trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any. All engines are warrantied by their manufacturer for two years from date of original purchase, except Deutz engines which have a one year, 2000 hour warranty.

Except as specified below, MILLER's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, MILLERMATIC parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

MILLER shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources, robots, and components ..... 1 year
2. Load banks ..... 1 year
3. Original main power rectifiers ..... 3 years (labor – 1 year only)
4. All welding guns, feeder/guns and torches ..... 90 days
5. All other MILLERMATIC Feeders ..... 1 year
6. Replacement or repair parts, exclusive of labor 60 days
7. Batteries ..... 6 months

provided that MILLER is notified in writing within thirty (30) days of the date of such failure.

As a matter of general policy only, MILLER may honor claims submitted by the original user within the foregoing periods.

In the case of MILLER's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at MILLER's option (1) repair or (2) replacement or, where authorized in writing by MILLER in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized MILLER service station or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Customer's risk and expense. MILLER's option of repair or replacement will be F.O.B., Factory at Appleton, Wisconsin, or F.O.B. at a MILLER authorized service facility, therefore, no compensation for transportation costs of any kind will be allowed. Upon receipt of notice of apparent defect or failure, MILLER shall instruct the claimant on the warranty claim procedures to be followed.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

EXCEPT AS EXPRESSLY PROVIDED BY MILLER IN WRITING, MILLER PRODUCTS ARE INTENDED FOR ULTIMATE PURCHASE BY COMMERCIAL/INDUSTRIAL USERS AND FOR OPERATION BY PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT AND *NOT* FOR CONSUMERS OR CONSUMER USE. MILLER'S WARRANTIES DO NOT EXTEND TO, AND NO RESELLER IS AUTHORIZED TO EXTEND MILLER'S WARRANTIES TO, ANY CONSUMER.

December 3, 1991 FORM: OM-436

ERRATA SHEET

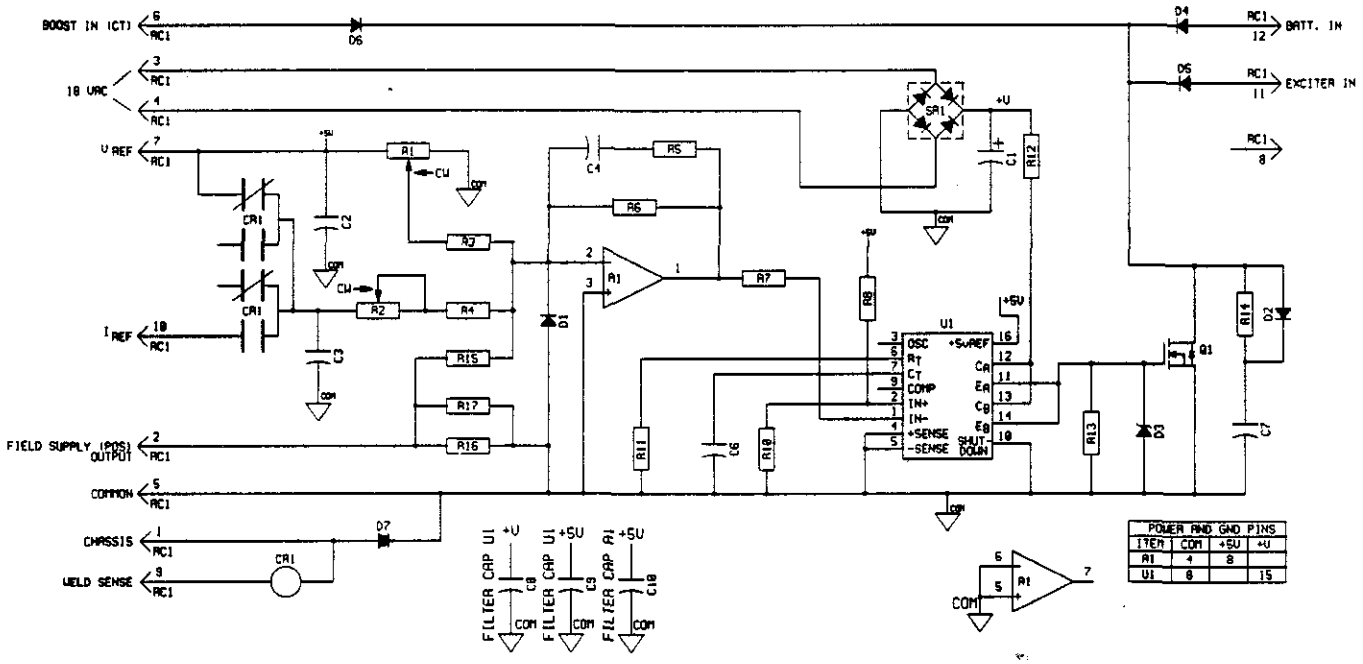
After this manual was printed, refinements in equipment design occurred. This sheet lists exceptions to data appearing later in this manual.

AMENDMENT TO SECTION 11 – ELECTRICAL DIAGRAMS

Amend Diagram 11-1. Circuit Diagram Effective With Serial No. KB110692 (see Page 2 on this Errata)

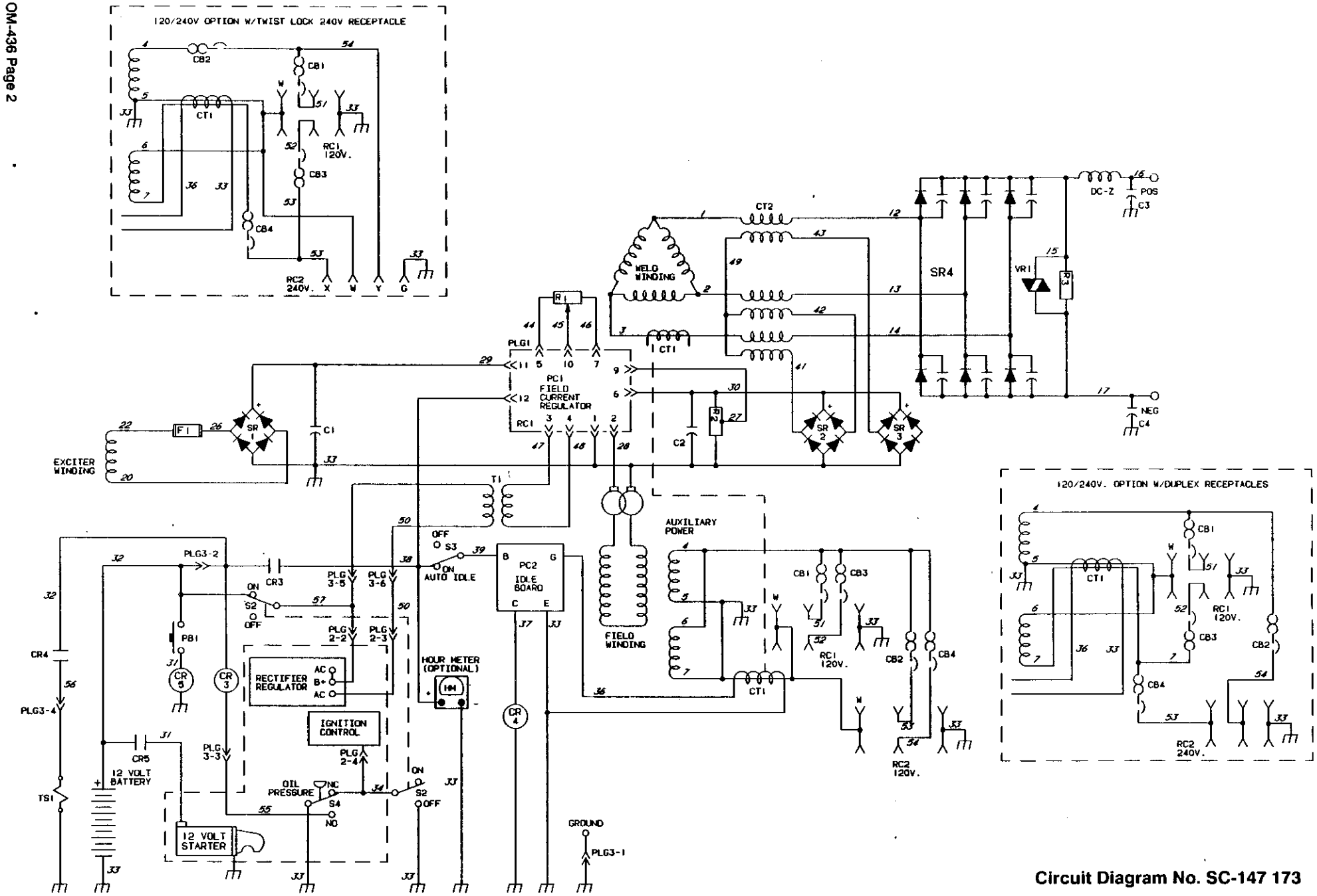
Amend Diagram 11-2. Wiring Diagram Effective With Serial No. KB110692 (see Page 3 on this Errata)

Amend Diagram 11-3. Circuit Diagram For Field Current Regulator Board PC1



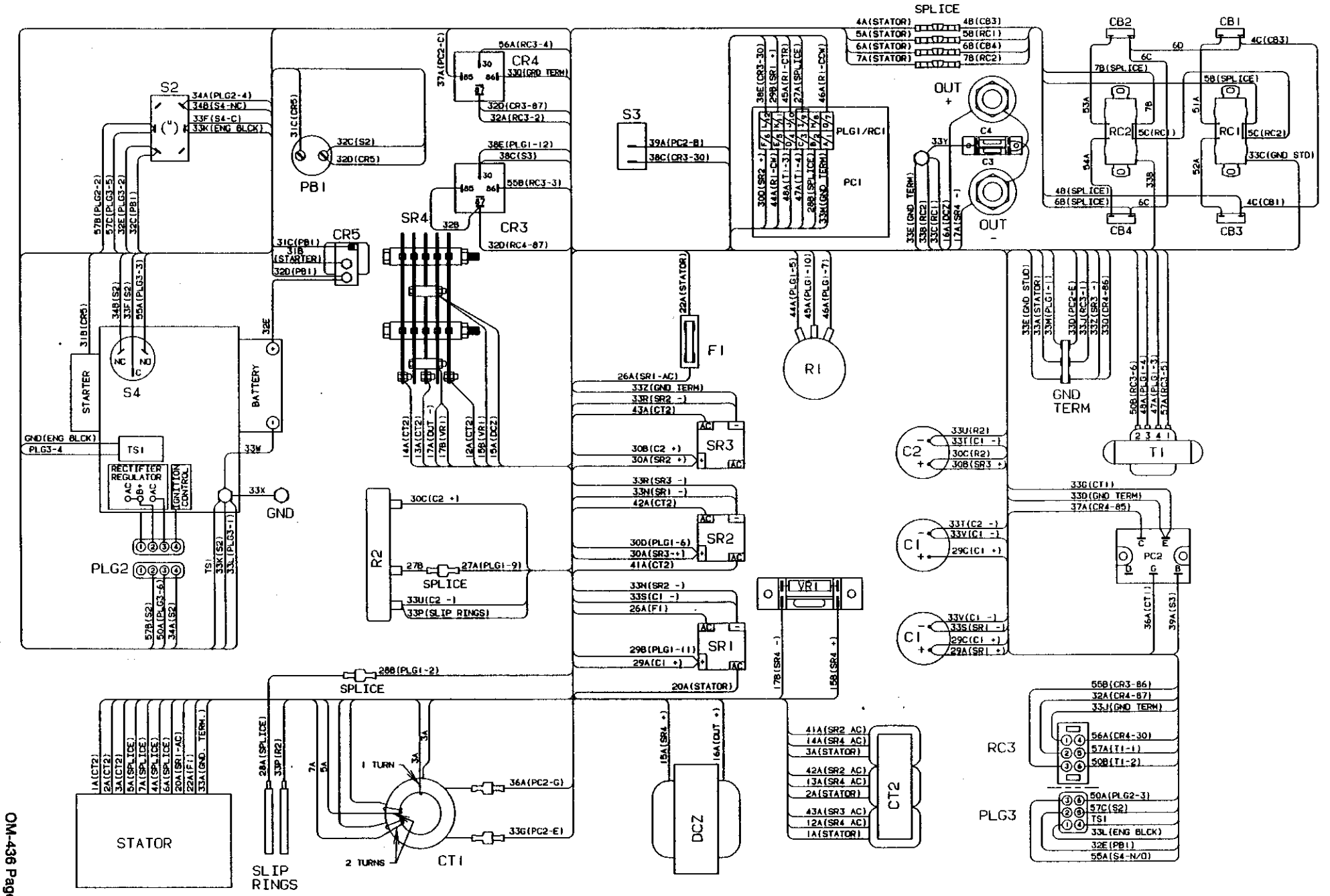
Circuit Diagram No. SB-142 013-C

Diagram 11-3. Circuit Diagram For Field Current Regulator Board PC1



Circuit Diagram No. SC-147 173

Diagram 11-1. Circuit Diagram Effective With Serial No. KB110692



Wiring Diagram No. SC-146 982

Diagram 11-2. Wiring Diagram Effective With Serial No. KB110692

AMENDMENT TO SECTION 13 – PARTS LIST

Amend Parts List as follows:

**	Dia. Mkgs.	Part No.	Replaced With	Description	Quantity
43-12		141 027	146 981	BASE, (Eff w/KB110692)	1
43-32	PB1	141 670	046 433	SWITCH, PB MC NO 36VDC w/black cap (Eff w/KB110692)	1
43-51		142 157	148 418	KIT, fuel tank replacement (consisting of)	1
. 43-6			126 239	. . SCREEN	1
. 43-7			127 405	. . TUBING	1
. 43-8			124 253	. . BUSHING	1
. 43-9			084 173	. . CLAMP	2
43-10			107 816	. . HOSE, (order by ft)	2ft
. 43-11			124 252	. . FITTING	1
. 43-		Added	148 332	. . STRIP, rbr adh back .125 x 1.000 x 1.000	2
. 43-	CR5	Added	119 722	CONTACTOR, solenoid 12VDC 400A SPNO (Eff w/KB110692)	1
. 43-		Added	114 923	BOOT, insulator term post (Eff w/KB110692)	1
. 43-		Added	147 713	KIT, label	1
. 45-6		136 927	147 898	STAND-OFF SUPPORT, PC card No. 6 scr	4
. 45-		122 723	122 723	CAPACITOR, (qty chg added C8-10)	6
. 45-		092 648	092 648	RESISTOR, (qty chg deleted J1 added J2-5)	4
. 48-6	SR4	141 781	142 502	RECTIFIER, si 3ph 200A 400PIV (Eff w/KB110692)	1
48-15	PC2	123 056	142 724	MODULE, pull to idle 5 pin	1

**First digit represents page no – digits following dash represent item no.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

RECEIVING-HANDLING

Before unpacking equipment, check carton for any damage that may have occurred during shipment. File any claims for loss or damage **with the delivering carrier**. Assistance for filing or settling claims may be obtained from the distributor and/or the equipment manufacturer's Transportation Department.

When requesting information about this equipment, always provide the Model Description and Serial or Style Number.

Use the following spaces to record the Model Designation and Serial or Style Number of your unit. The information is located on the data card or the nameplate.

Model _____

Serial or Style No. _____

Date of Purchase _____

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SECTION 1 – SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

1-1. INTRODUCTION

We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

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

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1-General Precautions, common to arc welding and cutting; and 2-Arc Welding (and Cutting) (only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

1-2. GENERAL PRECAUTIONS

Different arc welding processes, electrode alloys, and fluxes can produce different fumes, gases, and radiation levels. In addition to the information in this manual, be sure to consult flux and electrode manufacturers Material Safety Data Sheets (MSDSs) for specific technical data and precautionary measures concerning their material.

A. Burn Prevention

Wear protective clothing-gauntlet gloves designed for use in welding, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles and glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a MUST for welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

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

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

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

B. Toxic Fume Prevention

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed in Standards Index. NEVER ventilate with oxygen.

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

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

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

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.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidentally opened or left open. Check to be sure that the space is safe before re-entering it.

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 can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to

atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

C. Fire and Explosion Prevention

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

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

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

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

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

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

a. appreciable combustibles (including building construction) are within 35 feet

b. appreciable combustibles are further than 35 feet but can be ignited by sparks

c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks

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

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

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

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 7 in Standards Index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

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

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 11 in Standards Index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is 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). The following symptoms indicate a faulty regulator:

Leaks-if gas leaks externally.
Excessive Creep-if delivery pressure continues to rise with downstream valve closed.
Faulty Gauge-if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt to repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

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

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

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

Identifying gas content. Use only cylinders with name of gas 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. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

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

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

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

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

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

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

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

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

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT tape.

4. Proper Connections

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

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

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

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is 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.

5. Pressurizing Steps:

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

Stand to side of regulator while opening cylinder valve.

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

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

Check for leaks on first pressurization and regularly there-after. Brush with soap solution (capfull of Ivory Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

*Trademark of Proctor & Gamble.

1-3. ARC WELDING

Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

A. Burn Protection

Comply with precautions in 1-2.

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

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). 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.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. NEVER look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should NOT be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

B. Toxic Fume Prevention

Comply with precautions in 1-2B.

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

C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a 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 such a rupture under rough handling.

D. Compressed Gas Equipment

Comply with precautions in 1-2D.

E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH a wet surface when welding, without suitable protection.

To protect against shock:

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 can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part or grounded metal reduces the electrical resistance, and could enable dangerous and possibly lethal currents to flow through the body.

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 the electrode and any metal object unless the welding power source is off.**

1. Grounding the Equipment

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 shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirements of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT-a dangerous condition that can shock, possibly fatally.

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 prong.

2. Electrode Holders

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

3. Connectors

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

4. Cables

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

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

5. Terminals And Other Exposed Parts

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

6. Electrode

a. Equipment with output on/off control (contactor)

Welding power sources for use with the 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 the welding gun switch is closed. Never touch the electrode wire or any conducting object in contact with the electrode circuit unless the welding power source is off.

b. 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.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

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

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

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

F. Protection For Wearers of Electronic Life Support Devices (Pacemakers)

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

1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

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 the 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 the 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 the 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.
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 the American National Standards Institute, 1430 Broadway, New York, NY 10018.

SECTION 2 – SAFETY PRECAUTIONS AND SIGNAL WORDS

2-1. GENERAL INFORMATION AND SAFETY

A. General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

The nameplate of this unit uses international symbols for labeling the front panel controls. The symbols also appear at the appropriate section in the text.

B. Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 – Safety Rules For Operation Of Arc Welding Power Source.

2-2. SAFETY ALERT SYMBOL AND SIGNAL WORDS

The following safety alert symbol and signal words are used throughout this manual to call attention to and identify different levels of hazard and special instructions.

This safety alert symbol is used with the signal words WARNING and CAUTION to call attention to the safety statements.

WARNING statements identify procedures or practices which must be followed to avoid serious personal injury or loss of life.

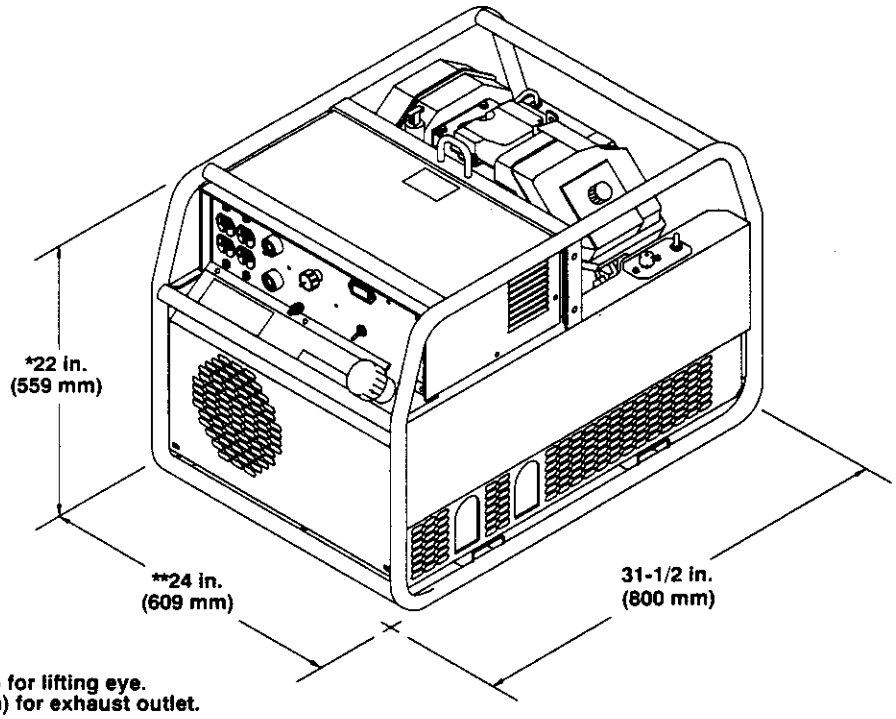
CAUTION statements identify procedures or practices which must be followed to avoid minor personal injury or damage to this equipment.

IMPORTANT *statements identify special instructions necessary for the most efficient operation of this equipment.*

SECTION 3 – SPECIFICATIONS

Table 3-1. Specifications

Amperes Output 60% Duty Cycle	Amperes Output 100% Duty Cycle	Welding Current Range In Amperes	Open-Circuit Voltage	Single-Phase AC Auxiliary Power	Weight	
					Net	Ship
180 At 25 Volts DC	140 At 25 Volts DC	50-180	75 Volts DC	5 kW 120 Volts 42 Amperes, 60 Hz	346 lbs. (157 kg)	360 lbs. (164 kg)



*Add 2 in. (51 mm) for lifting eye.
**Add 1 in. (25 mm) for exhaust outlet.

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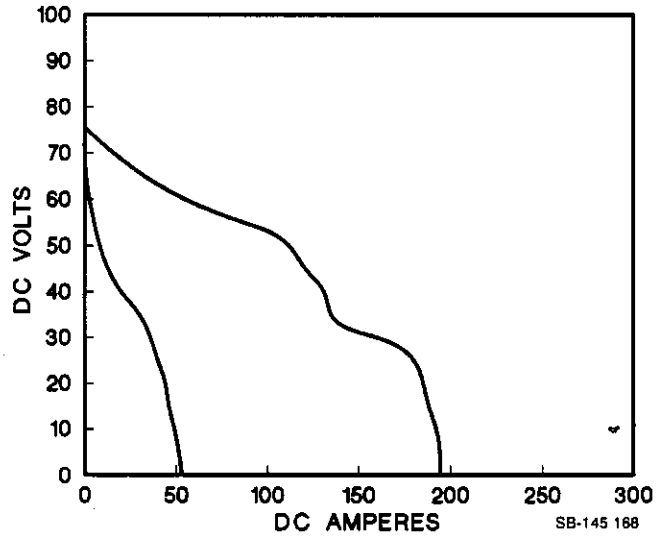
Figure 3-1. Overall Dimensions

Chart 3-1. Volt-Ampere Curves



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3-1. VOLT-AMPERE CURVES (Chart 3-1)

RATED OUTPUT

The volt-ampere curves show the voltage and amperage output capabilities of the welding generator. Amperage adjustment is provided by the AMPERAGE control. Curves of other settings fall between the curves shown.

3-2. DUTY CYCLE (Chart 3-2)

The duty cycle is the percentage of a ten minute period that a welding generator can be operated at a given output without overheating and damaging the unit. This welding generator has dual duty cycle ratings, each for a specific amperage output. See Chart 3-2 for various amperage output settings and associated duty cycles. If the unit is operated in the 180 ampere setting, this unit is rated at 60 percent duty cycle; therefore, the unit can be operated at 180 amperes for six consecutive minutes to

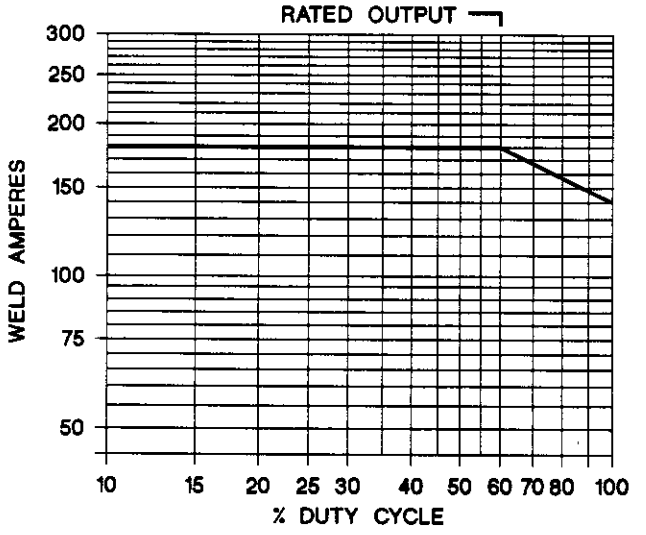
allow proper cooling. If the welding amperes decrease, the duty cycle increases. When the welding generator is operated in the 140 ampere setting, the unit is rated at 100 percent duty cycle; therefore, the unit can be operated continuously without causing damage to the unit.

Refer to the Duty Cycle Chart (Chart 3-2) to determine the output of the welding generator at various duty cycles.

CAUTION: EXCEEDING DUTY CYCLE RATINGS will damage welding generator.

- *Do not exceed indicated duty cycles.*

Chart 3-2. Duty Cycle



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3-3. DESCRIPTION

This unit is a constant current, engine driven DC arc welding generator designed for use with the Shielded Metal Arc Welding (SMAW) process. The welding generator is powered by a 12.5 HP KOHLER CH 12.5 gasoline engine with electric start and automatic idle.

In addition to welding capability, this unit can provide up to 5 kW of 120 volts ac single-phase power for operating plug-connected auxiliary equipment.

The following optional equipment (see Options And Accessories on back page) is available for this unit:

* Hour Meter
* Spark Arrestor
* Hand Running Gear
* Trailer With Mounting Kit
* Recoil Start
* 240 VAC Duplex Receptacle
* Full KVA 240 VAC Twistlock Receptacle
* Welding Accessory Kit
* Canvas Cover

SECTION 4 – INSTALLATION OR RELOCATION

4-1. LOCATION

A proper installation site should be selected for the welding generator if the unit is to provide dependable service and remain relatively maintenance free.

WARNING: ENGINE EXHAUST GASES can kill.

- *Operate in open, well ventilated areas, or if operated indoors, vent engine exhaust outside the building.*
- *Keep engine exhaust outlet away from building air intakes.*

CAUTION: RESTRICTED AIRFLOW causes overheating and possible damage to internal parts.

- *Maintain at least 18 inches (457 mm) of unrestricted space on all sides of unit, and keep underside free of obstructions.*
- *Do not place any filtering device over the intake air passages of this welding generator.*

Warranty is void if any type of filtering device is used.

The service life and operating efficiency of this unit are reduced when the unit is subjected to high levels of dust, dirt, moisture, corrosive vapors, and extreme heat.

A. Lifting Of Equipment

WARNING: FALLING EQUIPMENT can cause serious personal injury and equipment damage.

- *Use lifting eye to lift unit only, NOT running gear, gas cylinders, trailer, or any other heavy options, accessories, or devices.*
- *Use equipment of adequate capacity to lift the unit.*
- *If using lift forks to handle this unit, be sure the lift forks are long enough to extend out of the opposite side of the base.*

Using lift forks too short will expose internal components to damage should the tips of the lift forks penetrate the bottom of the unit.

This welding generator is provided with a lifting eye for moving the unit.

B. Trailer Mounting

CAUTION: UNCONTROLLED TILTING OF TRAILER can result in personal injury or equipment damage.

- *Install welding generator onto trailer with engine end toward hitch end of trailer.*
- *Distribute weight so that trailer tongue weight is approximately 10% of the gross trailer weight.*
- *Follow trailer manufacturer's instructions when mounting welding generator onto trailer.*

OPERATION ON UNLEVEL SURFACE can cause improper lubrication and result in severe engine damage.

- *Operate unit in an approximately level position.*
- *See Figure 4-1 for maximum allowable tilt for proper operation.*
- *Check crankcase oil level with unit on a level surface.*

Exceeding these limits can cause severe engine damage.

The mounting location should allow sufficient room to remove the top cover and access the engine for maintenance and repair.

Use a properly fitting canvas cover (optional) over the welding generator when not in operation to protect the unit from the environment. Be sure unit is cool before installing any cover.

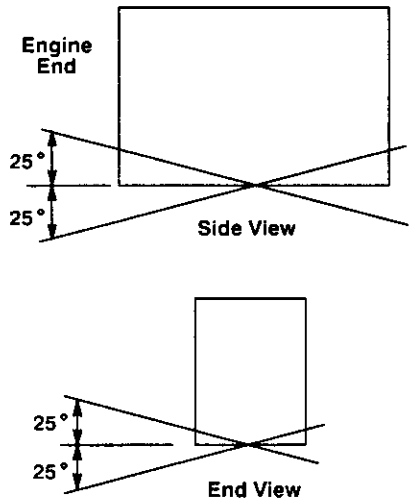


Figure 4-1. Allowable Tilt Angles For Welding Generator Engine

C. Spark Arrestor Considerations

WARNING: ENGINE EXHAUST SPARKS can cause fire.

- *Exhaust spark arrestor must be installed in accordance with local, state, and federal regulations.*

The engine exhaust system on this welding generator is not equipped with a spark arrestor. A spark arrestor, maintained in effective working order, is mandatory if this welding generator is to be operated in a National Forest or on California Grasslands, brush, or forest covered land (see Section 4442 of California Public Resources Code). For other areas, check your state and local laws. If a spark arrestor (optional) is desired, contact your dealer/distributor.

4-2. CONNECTING THE BATTERY

WARNING: BATTERY ACID can burn eyes, skin, destroy clothing, and damage other material.

- *Wear a face shield and proper protective clothing when working with batteries.*

ABNORMAL VOLTAGE can cause damage to engine electrical components.

- *Do not operate engine without battery connected.*
- *Do not disconnect battery while engine is running.*

This unit is equipped with a maintenance-free battery. To place the unit in service, make sure that the Engine ON-OFF switch is in the OFF position, and then connect the negative (–) battery cable to the negative battery terminal. No other preparation should be required. If the battery does not supply enough power to crank the engine, the battery will require charging. See Section 9-7 for battery charging procedures.

4-3. FUEL (Chart 4-1)

WARNING: ENGINE FUEL can cause fire or explosion.

- *Stop engine before checking or adding fuel.*
- *Do not spill fuel; if spilled, wipe up.*
- *Do not refuel if engine is hot or running.*
- *Do not refuel near sparks or open flame.*
- *Do not smoke while refueling.*
- *Do not fill fuel tank to top; allow room for expansion.*

REMOVE FUEL CAP SLOWLY; FUEL SPRAY may cause injury; FUEL may be under pressure.

- *Rotate fuel cap slowly and wait until hissing stops before removing cap.*

The capacity of the fuel tank is 3.8 gallons U.S. Measure (14.4 liters). See the Engine Manufacturer's Manual for fuel recommendations.

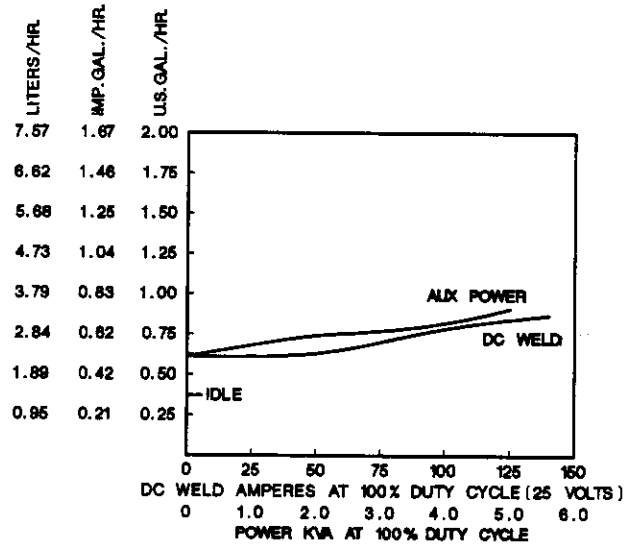
Chart 4-1 illustrates typical fuel consumption under specific load conditions. Fuel consumption varies from one engine to another. Different brands of fuel, operating conditions, condition of the engine, etc., also affect the fuel consumption rate.

CAUTION: POOR QUALITY, LOW OCTANE FUEL can damage engine.

- *Use clean, fresh, unleaded gasoline meeting engine manufacturer's specifications (see engine maintenance label for minimum octane rating).*
- *Do not mix oil with gasoline.*

Gasoline with a lower octane rating than specified may cause detonation (knocking) which could damage the engine. Regular gasoline may be used; however unleaded gasoline is preferred because it reduces pollution and combustion chamber deposits. See engine Owner's Manual (KOHLER CH 12.5 Engine) for complete fuel information.

Chart 4-1. Fuel Consumption



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4-4. LUBRICATION

The engine is shipped with its crankcase filled with SAE 20 break-in oil. If the oil level is not up to the full mark on the dipstick, add oil according to the recommendations in the engine Owner's Manual (KOHLER CH 12.5 Engine) before starting the engine (see Section 9-2 for break-in information).

IMPORTANT: *This engine is equipped with a low-oil pressure shutdown device. If oil pressure drops below a safe operating pressure, the engine shuts down. Remedy oil problem before attempting to start engine.*

4-5. EQUIPMENT GROUNDING TERMINAL (Figure 7-1)

This unit is equipped with a grounding terminal for grounding the generator case. Since the generator neutral is connected to the frame, the equipment grounding terminal must be connected to a proper earth ground.

For detailed grounding instructions, consult your national, regional, and local codes. If additional information regarding your operating circumstances and/or grounding requirements is needed, consult a qualified electrician or your dealer. After determining the extent to which any grounding requirements apply to your particular situation, follow them explicitly.

4-6. WELD OUTPUT CONNECTIONS (Figures 4-2 And 7-1 And Table 4-1)

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

A. Weld Cables (Table 4-1)

Follow the steps listed to ensure the best welding performance:

1. Use cables as short as possible, and place cables close together. Excessive cable length adds resistance which may reduce output or cause overloading of the unit.
2. Use weld cable with an insulation voltage rating equal to or greater than the maximum open-circuit voltage (OCV) of the welding generator (see Table 3-1 for unit maximum OCV rating).

Table 4-1. 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

*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.

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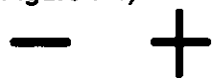
3. Select adequate size welding cable for the anticipated maximum weld current. Use total length of welding cable in the circuit to determine cable size. For example, if the cable to the electrode holder is 25 ft. (7.5 m) long and work cable is 25 ft. (7.5 m) long, select the cable size recommended in Table 4-1 for 50 ft. (15 m).
4. Do not use damaged or frayed cables.
5. Install correct size lugs of adequate amperage capacity onto ends of both cables for connecting to work clamp and electrode holder.

B. Connector Installation (Figure 4-2)

IMPORTANT: *Both weld cables require the installation of a connector to match weld output receptacles on the welding generator.*

1. Push weld cable through insulator as shown in Figure 4-2.
2. Remove 1 in. (25 mm) of insulation from end of cable.
3. Install supplied sleeve on stripped end of cable.
4. Insert cable with sleeve into connector body so that cable is snug and against bottom of connector body.
5. Install and tighten setscrew with supplied hex wrench to secure connector body onto cable.
6. Push insulator onto connector body to cover setscrew.

C. Installation (Figure 7-1)



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

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

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

Weld Output Connections (Electrode Positive/Reverse Polarity)

1. Connect end of electrode holder cable to POSITIVE (+) weld output receptacle as follows: align keyway, insert connector, and rotate fully clockwise.
2. Connect one end of work cable to NEGATIVE (–) weld output receptacle as follows: align keyway, insert connector, and rotate fully clockwise.

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

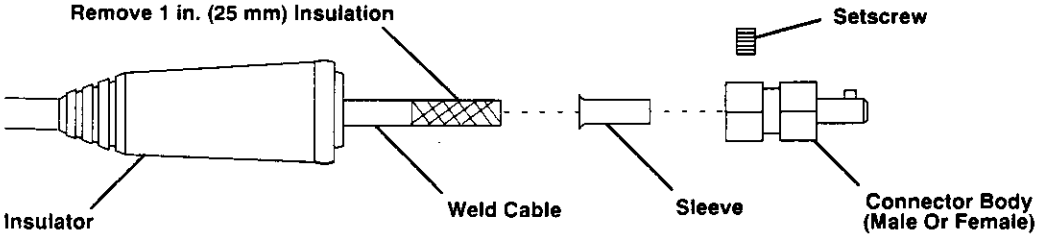


Figure 4-2. Connector Installation

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIRFLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (-) battery cable from battery before making internal inspection or reconnection.*
- *Ground generator according to all applicable national, state, and local electrical codes.*

The generator neutral is connected to the frame; therefore, the equipment grounding terminal must be connected to a proper earth ground.

- *Do not connect to any electrical distribution system normally supplied by utility power unless a proper transfer switch and grounding procedure are employed.*
- *Keep away from moving parts such as fans, belts, and rotors.*
- *Keep all covers and panels in place while operating.*

Warranty is void if unit is operated with any portion of the outer enclosure removed.

ELECTRIC SPARKS can cause fire.

- *Disconnect weld cables when using auxiliary power.*

The weld output terminals are electrically energized when the engine is running.

- *Watch for fire.*
- *Keep a fire extinguisher nearby, and know how to use it.*

LOW VOLTAGE AND FREQUENCY can damage electrical equipment.

- *Turn off or unplug all electrical equipment connected to auxiliary power before starting or stopping the engine.*

When starting or stopping, the engine has low speed which causes low voltage and frequency.

5-1. GENERAL

Calculate load requirements before connecting equipment to the auxiliary power receptacles. For best performance (voltage and frequency regulation), use only approximately 90% of available auxiliary power.

A brief period (less than 5 seconds) of large current draw is required for starting motor-driven equipment. This generator can supply up to 300% of rated current output at the receptacles for brief periods for motor starting. Remove motor load before starting engine. Use adequate size cords so that voltage drop at the motor is not excessive. Voltage at the receptacles drops significantly when motor-driven equipment is started.

5-2. AUXILIARY POWER GENERATOR

A total of 5 kW of auxiliary power is available from the auxiliary power receptacles when not welding. The auxiliary power supplied by the welding generator is for operating 60 Hz or 50/60 Hz, single-phase, cord-connected auxiliary equipment.

Limited auxiliary power is available while welding, but it is sufficient to power small drills, grinders, or incandescent lights. If performance is not satisfactory, reduce the auxiliary power load or wait until welding is stopped and full output is available.

5-3. 120 VAC DUPLEX RECEPTACLES WITH CIRCUIT BREAKERS (Chart 5-1)

120V~AC

15A

A. Specifications

Each half of the 120 volts ac duplex receptacles RC1 and RC2 is capable of supplying 15 amperes on a continuous load basis. The combined continuous load of all receptacles must not exceed the 5 kW rating of the generator.

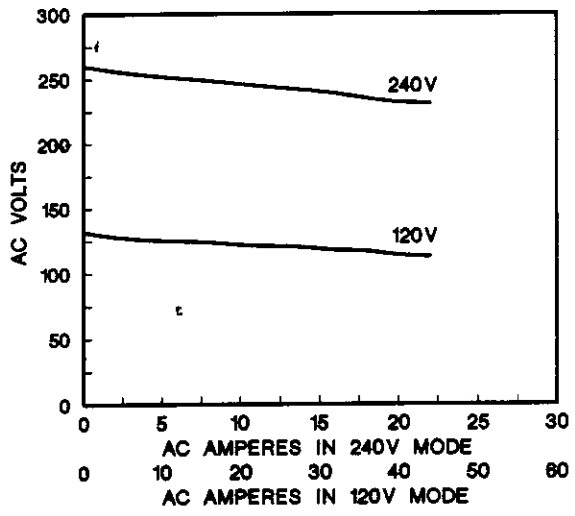
B. Receptacle Connections

The receptacles are for use with plug connected equipment. Plug in or turn on equipment when engine is running at weld/power speed.

C. Protection

Each half of the duplex receptacles is protected by a 15 ampere manual reset circuit breaker. If any receptacle is overloaded the respective circuit breaker will trip and stop output. See Section 10-3 for resetting procedures.

Chart 5-1. AC Auxiliary Power Curve



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5-4. OPTIONAL 240 VAC DUPLEX RECEPTACLE WITH CIRCUIT BREAKERS (Chart 5-1)

A. Specifications

240 volts ac receptacle RC2 can supply a maximum of 15 amperes on a continuous load basis (Each half of RC2 can supply up to 15 amperes, but not at the same time). However, power available is dependent on the amount of power being drawn from 120 volts ac receptacle RC1. The combined continuous load of all receptacles must not exceed the 5 kW rating of the generator.

B. Receptacle Connections

The receptacles are for use with plug connected equipment. Plug in or turn on equipment when engine is running at weld/power speed.

C. Protection

15 ampere circuit breakers CB1 and CB3 each protect one half of 120 volts ac receptacle RC1. 15 ampere circuit breakers CB2 and CB4 protect 240 volts ac receptacle RC2. If either CB2 or CB4 trips, output to both halves of receptacle RC2 is stopped.

If any receptacle is overloaded the respective circuit breaker will trip and stop output. See Section 10-3 for resetting procedures.

5-5. OPTIONAL FULL KVA 240 VAC TWISTLOCK RECEPTACLE WITH CIRCUIT BREAKERS (Chart 5-1 And Figure 5-1)

A. Specifications

240 volts ac twistlock receptacle RC2 has full kVA available from the welding generator. However, power available is dependent on the amount of power being drawn from 120 volts ac receptacle RC1. The combined continuous load from both receptacles must not exceed the 5 kW rating of the generator.

B. Receptacle Connections

The receptacles are for use with plug connected equipment. Plug in or turn on equipment when engine is running at weld/power speed.

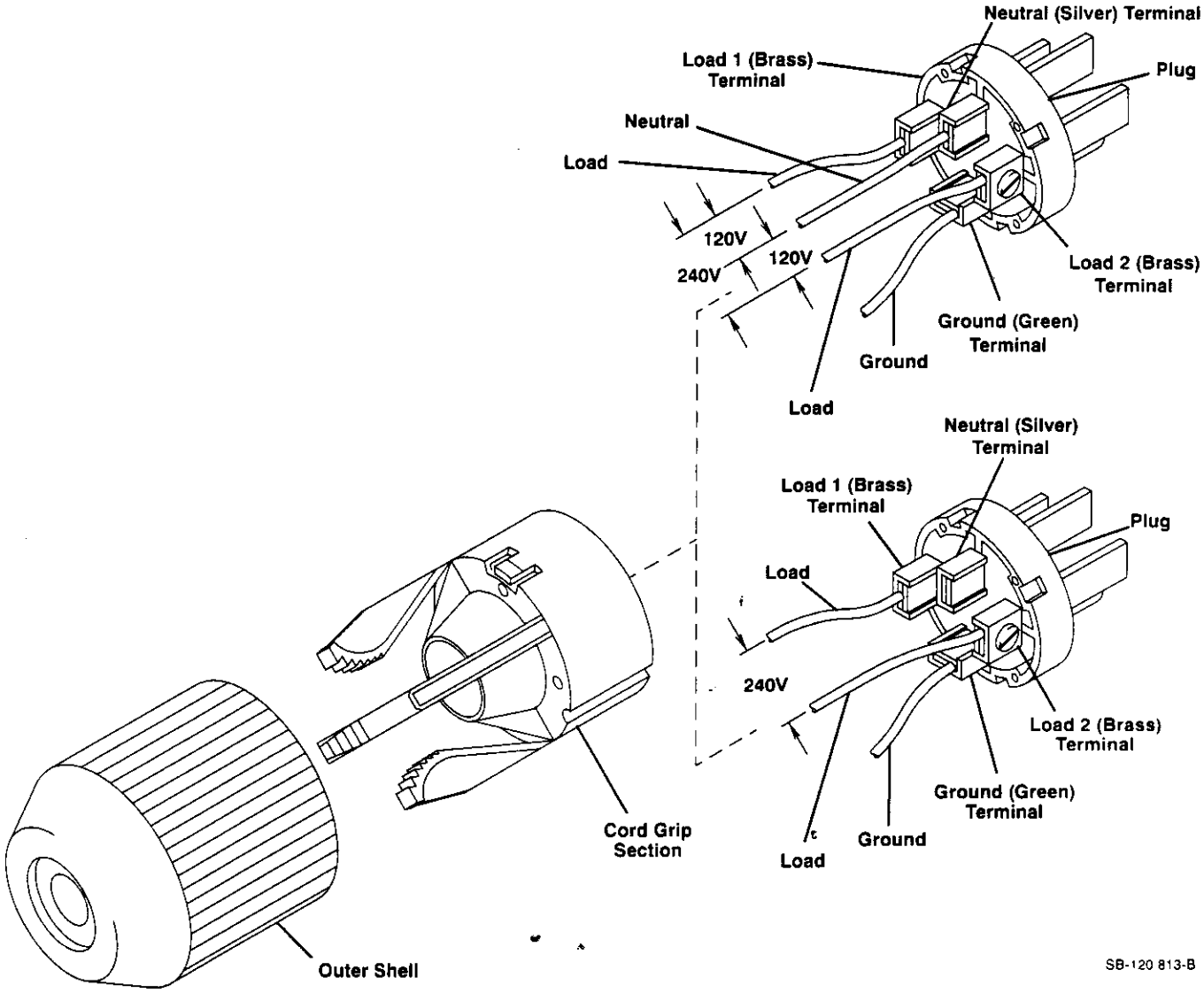


Figure 5-1. 120/240 VAC Plug Connections

C. Protection

Circuit breakers CB1 and CB3 each protect one half of 120 volts ac receptacle RC1. Circuit breakers CB2 and CB4 protect both receptacles. If circuit breaker CB2 trips, output to RC2 and the top half of RC1 will stop. If circuit breaker CB4 trips, output to RC2 and the bottom half of RC1 will stop.

If any receptacle is overloaded the respective circuit breaker will trip and stop output. See Section 10-3 for resetting procedures.

D. Wiring Instructions For Optional 120/240 Volt Plug (Figure 5-1)

The plug for connections to the 120/240 volts ac twist-lock receptacle RC2 can be wired to supply a 240 volts 2-wire load or a 120/240 volts 3-wire load (see Figure 5-1, Circuit Diagram 11-1, and Wiring Diagram 11-2 when wiring plug).

WARNING: ELECTRIC SHOCK can kill; IMPROPER CONNECTION can damage equipment.

- *Do not touch live electrical parts.*

Wire the 120/240 volt plug as follows:

1. Remove outer shell and cord grip section from plug.
2. Slide outer shell and cord grip section onto cord.
3. Strip cord jacket back only enough to separate conductors; strip conductors back only enough to make good contact with plug terminals.
4. Make load and ground connections to plug as illustrated.
5. Reinstall outer shell and cord grip section.
6. Tighten assembly screws evenly onto shell. Do not overtighten.

SECTION 6 – EVALUATING AUXILIARY POWER REQUIREMENTS

6-1. AUXILIARY POWER GENERATORS

A. Introduction

The auxiliary power generated from this unit is most commonly used in industrial, small business, and residential applications. For industrial applications, this portable unit can be moved to the job site to power portable tools, lights, compressors, etc. For small business and residential applications, the generator supplies standby power during power outages.

It is the installer's responsibility to follow all applicable codes when installing an auxiliary power generator. It is also the installer's responsibility to determine if the generator is capable of supplying adequate power for a specific application. The following sections provide some guidelines for the installation and operation of an auxiliary power generator.

IMPORTANT: *Consult qualified local personnel and follow all applicable codes for safe and proper installation.*

B. Safety Considerations

Before this generator may be used to supply auxiliary power, the installer must first become familiar with and meet all codes applicable to the installation of an auxiliary power generator. It is the installer's responsibility to follow the applicable rules from the National Electrical Code (NEC), state, local, and OSHA codes for the installation and use of auxiliary power generators. The following list includes major safety requirements of NEC for auxiliary power generator installation.

1. **Isolation** is always required between a portable generator and other sources of electric power. Proper isolation procedures prevent possible injury due to feedback from the generator to the primary source of electric power. Consult qualified local personnel and follow all applicable codes for safe and proper installation.
2. **Overcurrent protection**, such as fuses or circuit breakers, is required if a generator is supplying a permanent installation. Overcurrent protection may not be required for generators supplying portable, cord-connected equipment through receptacles mounted on the generator.

   Overcurrent protection may be factory installed if the generator design and/or receptacle(s) require overcurrent protection. If the generator design and receptacle(s) protect themselves from overcurrent conditions, circuit protection is not required and, thus, not factory installed.
3. **Grounding requirements** depend upon the operating setup for the generator. If the generator supplies only equipment mounted on the generator, or cord-connected equipment through generator-mounted receptacles, the generator frame does not require grounding. If the generator is mounted on a vehicle, the vehicle and generator frames must be connected. If the generator is supplying a permanent installation or some load that does not meet the mounting or receptacle connection exclusion, the generator frame and one of the supply conductors may have to be grounded (refer to local codes for specific requirements).

   A grounding terminal is normally provided on the generator for grounding the generator case. To ground the generator case, locate grounding terminal, connect one end of ground cable to grounding terminal, and connect remaining end to a proper earth ground using adequate size cable (refer to NEC for specific requirements).

   When a conductor within the generator requires grounding, a grounding terminal is normally provided within the generator.

4. **Ground fault protection** for personnel on construction sites must be provided with one of the following methods:

   a. **Ground fault circuit interrupters** (GFCI's) are required on all 15 and 20 ampere 120 volt receptacles not part of permanent wiring, and on all receptacles with a grounded neutral conductor.

      GFCI's are generally not required on portable and vehicle-mounted generators rated not more than 5 kW with circuit conductors isolated from the frame, and on generators not connected to 15 or 20 ampere, 120 volt receptacles.

   b. **An assured equipment grounding program** may be used instead of GFCI's to provide ground fault protection for personnel on construction sites. Refer to NEC for specific program procedures.

6-2. LOAD EVALUATION (Tables 6-1 And 6-2)

Before connecting or operating the auxiliary power generator, the installer must determine if the generator is capable of supplying adequate power for a specific application. Load and generator evaluation is essential for satisfactory generator and equipment operation (see Table 6-1).

A. Types Of Loads

Load requirements depend on the type of load connected to the generator. There are two types of loads, resistive and non-resistive. A resistive load, such as a light bulb, requires a constant amount of power from the generator. A non-resistive load, such as a portable grinder, requires variable amounts of power from the generator. Because a grinder requires more power for motor starting and is rarely used with a constant, even pressure, the load requirements can change greater than the operator anticipates.

The following sections provide information on how to determine running load and motor-starting requirements (see Sections 6-2B and C).

B. Running Load Requirements

The total running load applied to the generator is calculated by adding up all the individual loads. Some equipment is rated in amperes, others in watts. The requirements for most equipment are provided on its nameplate.

EXAMPLE 1: If a drill requires 4.5 amperes at 115 volts, calculate its running power requirement in watts.

VOLTS x AMPERES = WATTS (EQUATION 1)

(Equation 1 provides an actual power requirement for resistive loads, or an approximate running requirement for non-resistive loads.)

115V x 4.5A = 520W

Therefore, the individual load applied by the drill is 520 watts.

EXAMPLE 2: If a flood lamp is rated at 200 watts, the individual load applied by the lamp is 200 watts. If three 200 watt flood lamps are used with the drill from Example 1, add the individual loads to calculate total load.

(200W + 200W + 200W) + 520W = 1120W

Therefore, the total load applied by the three flood lamps and drill is 1120 watts.

C. Motor-Starting Requirements

Starting amperage requirements are many times the running amperage of the motor. Starting requirements must be determined to assure that the generator is capable of starting the motor without damaging it. This can be done by examining the motor nameplate and identifying the code letter specifying the starting kVA/HP required. Table 6-2 lists common motor start codes with their starting kVA/HP requirement.

If the kVA/HP requirement, motor horsepower, and voltage rating are known, the starting amperage can be calculated.

EXAMPLE 3: Calculate the starting amperage required for a 230V, 1/4 HP motor with a motor start code of G.

Calculate the starting amperage using the following equation:

(EQUATION 2)

$$\frac{\text{kVA/HP x HP x 1000}}{\text{VOLTS}} = \text{STARTING AMPERAGE}$$

Volts = 230

HP = 1/4

Using Table 6-2, Code G results in kVA/HP = 6.3

$$\frac{6.3 \times 1/4 \times 1000}{230} = 6.85\text{A}$$

Therefore, starting the motor requires 6.85 amperes.

Table 6-1. Single-Phase Induction Motor Starting KVA/HP Requirements

Motor Start Code Letter	KVA/HP
G	6.3
H	7.1
J	8.0
K	9.0
L	10.0
M	11.2
N	12.5
P	14.0

If a code letter is not present on the motor nameplate, approximate starting amperage is equal to six times running amperage. This is a reasonable approximation for all applications where the generator rated amperage is at least twice the motor requirement. If the generator-to-motor-size ratio is less than 2:1, acquire the needed information to properly determine the motor-starting requirement.

Table 6-2. Power Requirements*

INDUSTRIAL MOTORS	RATING	APPROXIMATE STARTING WATTS	APPROXIMATE RUNNING WATTS	FARM EQUIPMENT	RATING	APPROXIMATE STARTING WATTS	APPROXIMATE RUNNING WATTS
Split Phase	1/8 HP	800	300	Stock Tank De-Icer		1000	1000
	1/6 HP	1225	500	Grain Cleaner	1/4 HP	1650	650
	1/4 HP	1600	600	Portable Conveyor	1/2 HP	3400	1000
	1/3 HP	2100	700	Grain Elevator	3/4 HP	4400	1400
	1/2 HP	3175	875	Milk Cooler		2900	1100
				Milker (Vacuum Pump)	2 HP	10500	2800
Capacitor Start-	1/3 HP	2020	720				
Induction Run	1/2 HP	3075	975	**FARM DUTY MOTORS**	1/3 HP	1720	720
	3/4 HP	4500	1400	Std. (e.g. Conveyors,	1/2 HP	2575	975
	1 HP	6100	1600	Feed Augers, Air	3/4 HP	4500	1400
	1-1/2 HP	8200	2200	Compressors)	1 HP	6100	1600
	2 HP	10550	2850		1-1/2 HP	8200	2200
	3 HP	15900	3900		2 HP	10550	2850
	5 HP	23300	6800		3 HP	15900	3900
					5 HP	23300	6800
Capacitor Start-	1-1/2 HP	8100	2000	High Torque (e.g. Barn	1-1/2 HP	8100	2000
Capacitor Run	5 HP	23300	6000	Cleaners, Silo Unloaders,	5 HP	23300	6000
	7-1/2 HP	35000	8000	Silo Hoists, Bunk Feeders)	7-1/2 HP	35000	8000
	10 HP	46700	10700		10 HP	46700	10700
				3-1/2 Cu. Ft. Mixer	1/2 HP	3300	1000
Fan Duty	1/8 HP	1000	400	High Pressure 1.8 Gal/Min	500 PSI	3150	950
	1/6 HP	1400	550	Washer 2 Gal/Min	550 PSI	4500	1400
	1/4 HP	1850	650	2 Gal/Min	700 PSI	6100	1600
	1/3 HP	2400	800				
	1/2 HP	3500	1100				

CONTRACTOR	RATING	APPROXIMATE STARTING WATTS	APPROXIMATE RUNNING WATTS	RESIDENTIAL	RATING	APPROXIMATE STARTING WATTS	APPROXIMATE RUNNING WATTS
Hand Drill	1/4"	350	350	Coffee Maker		1750	1750 Typ.
	3/8"	400	400	Elec. Range	6" Element	1500	1500
	1/2"	600	600		8" Element	2100	2100
Circular Saw	6-1/2"	500	500		Oven	6000	6000
	7-1/4"	900	900	Microwave	625W	2800	2000
	8-1/4"	1400	1400	Television (Solid-State)	B & W	100	100
Table Saw	9"	4500	1500		Color	300	300
	10"	6300	1800	Radio		50-200	50-200
Band Saw	14"	2500	1100	Refrig. Or Freezer		3100	800
Bench Grinder	6"	1720	720	Shallow Well Pump	1/3 HP	2150	750
	8"	3900	1400		1/2 HP	3100	1000
	10"	5200	1600	Sump Pump	1/3 HP	2100	800
Air Compressor	1/2 HP	3000	1000		1/2 HP	3200	1050
	1 HP	6000	1500	Dishwasher	(Cool Dry)	2100	700
	1-1/2 HP	8200	2200		(Hot Dry)	2850	1450
	2 HP	10500	2800	Clothes Dryer	Gas	2500	700
Electric Chain Saw	1-1/2 HP, 12"	1100	1100		Electric	7550	5750
	2 HP, 14"	1100	1100	Automatic Washer		3450	1150
Electric Trimmer	Standard 9"	350	350	Gas Or Fuel Oil			
	Heavy Duty 12"	500	500	Furnace Blower	1/8 HP	800	300
Electric Cultivator	1/3 HP	2100	700		1/6 HP	1250	500
Elec. Hedge Trimmer	18"	400	400		1/4 HP	1600	600
Flood Lights	HID	125	100		1/3 HP	2100	700
	Metal Halide	313	250		1/2 HP	3225	875
	Mercury & Sodium	1000 1400		Central Air Conditioner	10,000 BTU	3700	1500
	Vapor	1250	1000		20,000 BTU	5800	2500
Submersible Pump	400 GPH	600	200		24,000 BTU	8750	3800
Centrifugal Pump	900 GPH	900	500		32,000 BTU	11500	5000
Floor Polisher	3/4 HP, 16"	4500	1400		40,000 BTU	13800	6000
	1 HP, 20"	6100	1600	Garage Door Opener	1/4 HP	1650	550
High Pressure Washer	1/2 HP	3150	950		1/3 HP	2125	725
	3/4 HP	4500	1400	Electric Blanket	Portable	400	400
	1 HP	6100	1600	Dehumidifier		1450	650
55 Gal. Drum Mixer	1/4 HP	1900	700	Vacuum Cleaner	Standard	800	800
Wet & Dry Vac	1.7 HP	900	900		Deluxe	1100	1100
	2-1/2 HP	1300	1300	Lights			As Indicated On Bulb
				Toaster	2 Slice	1050	1050
					4 Slice	1650	1650
				Hair Dryer		300-1200	300-1200
				Iron		1200	1200

*Motors require up to two or three times their starting wattage when starting under load.

6-3. GENERATOR CAPABILITY

A. Auxiliary Power Output

Different types of loads require different types of output. When a nonmotor load is applied, generator output goes to the ampere requirement of the equipment. When a motor load is applied, the generator attempts to supply motor-starting amperage causing output to drop to a low voltage because the starting amperage is many times the running amperage.

The total load requirements must not exceed the generator capability. When combining motor (non-resistive) and resistive loads, compare the total load required by the equipment to the generator output. Limit load requirements to the capabilities of the generator. For best performance and load handling, only use approximately 90% of the available output. The 10% margin allows for more satisfactory engine governor response to changing load situations. When loading the generator, always apply the largest non-resistive (motor) load first, add non-resistive loads in succession from largest to smallest, and add resistive loads last.

B. Operation

It is the installer's responsibility to follow all applicable safety codes and guidelines for the installation and operation of an auxiliary power generator. Always start engine and bring up to speed before starting any auxiliary equipment connected to the auxiliary power receptacles or junction box. Before stopping the engine, be sure to turn off the auxiliary equipment.

The installer should check for proper generator/load operation. If a motor does not start within 5 seconds, turn off power to it or the motor will be damaged. This 5-second-maximum-time rule should be applied to all motor-starting situations to prevent damage to the start winding. **If 90% of rated voltage is present across the motor terminals when running under load, then it is safe to assume that it is properly running within the capabilities of the generator.**

6-4. STANDBY POWER CONNECTIONS (Diagram 6-1)

The block diagram shown in Diagram 6-1 includes the proper equipment and connections required for the generator to supply standby power during emergencies or power outages.

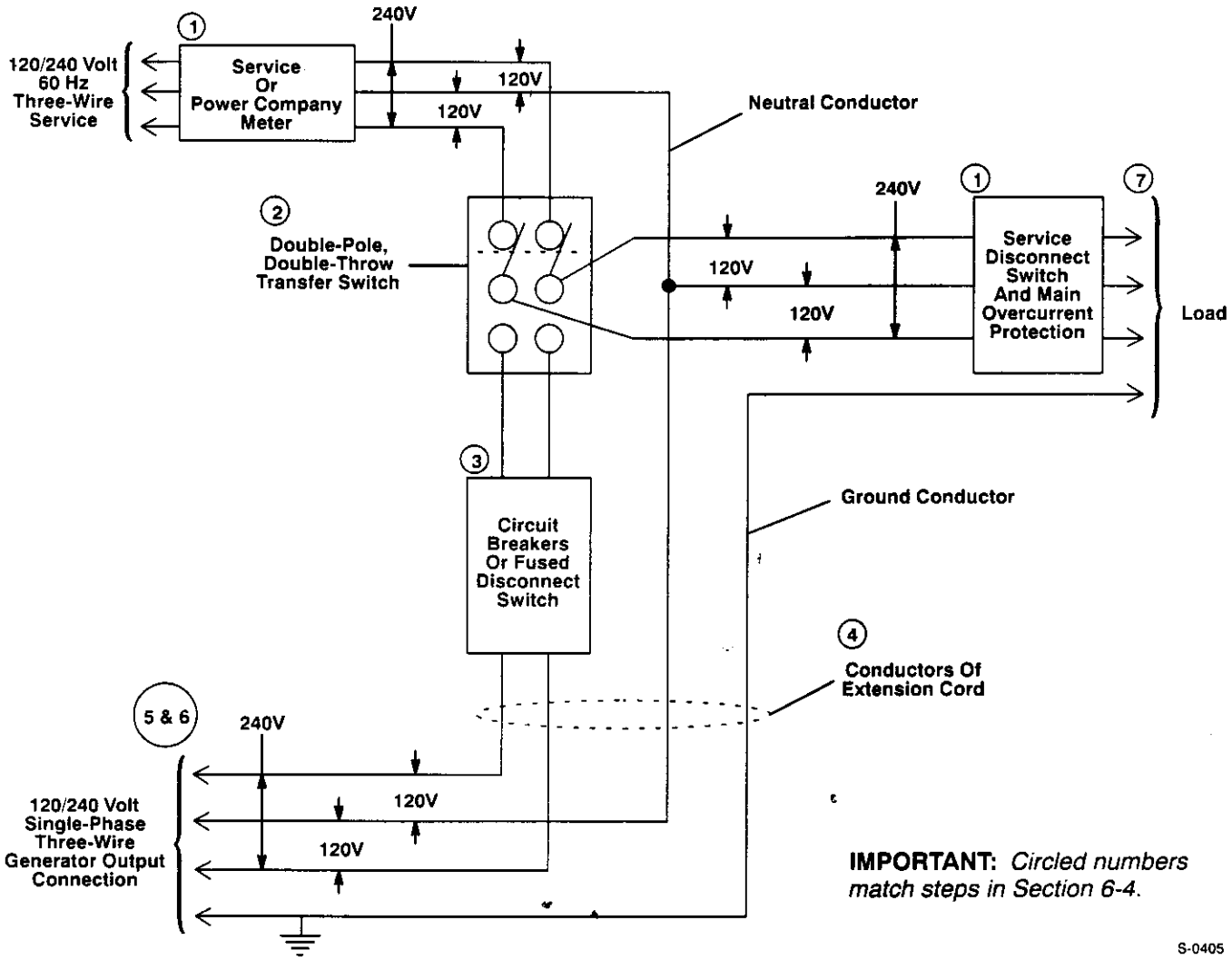


Diagram 6-1. Standby Power Equipment And Connections

IMPORTANT: *Consult qualified local personnel and follow all applicable codes for safe and proper installation. The following step numbers match the circled numbers within Diagram 6-1.*

1. Locate the power company or service meter, disconnect switch, and main overcurrent protection.
2. If necessary, obtain and install a double-pole, double-throw transfer switch between the service meter and disconnect switch.

IMPORTANT: *Double-pole, double-throw transfer switch rating must be the same as or greater than the main overcurrent protection.*

3. If necessary, obtain and install circuit breakers or fused disconnect switch to protect generator from overload conditions.
4. Select conductors of adequate amperage capacity for the current rating of the generator and overcurrent protection (see Section 6-5).
5. Install terminals or plug of adequate amperage capacity onto end of cable.
6. Make connections according to all codes and safety practices.
7. Turn off or unplug all auxiliary equipment connected to generator before starting or stopping engine. When starting or stopping, the engine has low speed which causes low voltage and frequency. For best performance and load handling, limit load to approximately 90% of the available output.

6-5. AUXILIARY POWER EXTENSION CORD SELECTION (Tables 6-3 And 6-4)

Extension cords may be necessary if power is supplied to tools or load a distance from the generator. Select cords of adequate amperage capacity, and use the following Tables 6-3 and 6-4 to select conductor size according to cord length. Use the shortest cords possible because excessive cord lengths may reduce output or cause unit overload due to added resistance.

Table 6-3. Cord Lengths For 120 Volt Loads

Current In Amperes	Load In Watts	Maximum Allowable Cord Length In Feet (Meters) For Conductor Size (AWG)*					
		4	6	8	10	12	14
5	600			350 (106)	225 (68)	137 (42)	100 (30)
7	840		400 (122)	250 (76)	150 (46)	100 (30)	62 (19)
10	1200	400 (122)	275 (84)	175 (53)	112 (34)	62 (19)	50 (15)
15	1800	300 (91)	175 (53)	112 (34)	75 (23)	37 (11)	30 (9)
20	2400	225 (68)	137 (42)	87 (26)	50 (15)	30 (9)	
25	3000	175 (53)	112 (34)	62 (19)	37 (11)		
30	3600	150 (46)	87 (26)	50 (15)	37 (11)		
35	4200	125 (38)	75 (23)	50 (15)			
40	4800	112 (34)	62 (19)	37 (11)			
45	5400	100 (30)	62 (19)				
50	6000	87 (26)	50 (15)				

*Conductor size is based on maximum 2% voltage drop

Table 6-4. Cord Lengths For 240 Volt Loads

Current In Amperes	Load In Watts	Maximum Allowable Cord Length In Feet (Meters) For Conductor Size (AWG)*					
		4	6	8	10	12	14
5	1200			700 (213)	450 (137)	225 (84)	200 (61)
7	1680		800 (244)	500 (152)	300 (91)	200 (61)	125 (38)
10	2400	800 (244)	550 (168)	350 (107)	225 (69)	125 (38)	10 (31)
15	3600	600 (183)	350 (107)	225 (69)	150 (46)	75 (23)	60 (18)
20	4800	450 (137)	275 (84)	175 (53)	100 (31)	60 (18)	
25	6000	350 (107)	225 (69)	125 (38)	75 (23)		
30	7000	300 (91)	175 (53)	100 (31)	75 (23)		
35	8400	250 (76)	150 (46)	100 (31)			
40	9600	225 (69)	125 (38)	75 (23)			
45	10,800	200 (61)	125 (38)				
50	12,000	175 (53)	100 (31)				

*Conductor size is based on maximum 2% voltage drop

SECTION 7 – OPERATOR CONTROLS

7-1. AMPERAGE CONTROL (Figure 7-1)

The AMPERAGE control permits the operator to select a weld amperage between 50 and 180 amperes. The scale surrounding the control is calibrated in amperes.

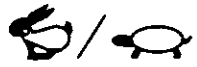
IMPORTANT: *The AMPERAGE control may be adjusted while welding.*

7-2. RUN/IDLE SWITCH (Figure 7-1)

A. RUN Position

When the RUN/IDLE switch is in the RUN position, engine speed remains at governed weld rpm (3750). This position is used when the generator is operating under load the majority of the time.

B. RUN/IDLE Position



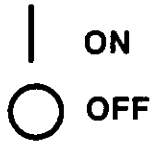
When the RUN/IDLE switch is in the IDLE position, the engine remains at idle rpm (2400) until an arc is struck or a load is applied to the auxiliary receptacles. The engine speed increases to weld rpm (3750) when an arc is struck or a load is applied to the auxiliary power receptacles.

Approximately 12 seconds after the arc is broken or power load is removed, the engine will return to idle rpm. This time delay is nonadjustable.

7-3. CHOKE LEVER (Figures 7-1 and 9-2)

A CHOKE lever is provided for varying the fuel-air mixture to the engine. When the CHOKE lever is placed fully to the right in the full choke position (towards the rear of the welding generator), very little air will be admitted to the engine through the carburetor thereby supplying a richer mixture of fuel. This position is required if the engine is cold when started. As the engine warms up, move the CHOKE lever to the left (towards the front of the welding generator) slowly until it is as far as it will go in the no choke position. Allow the engine to warm up for a few minutes before applying a load. The choke control can remain in the no choke position when restarting a warm engine.

7-4. ENGINE ON-OFF SWITCH (Figure 7-1)



The two-position Engine ON-OFF switch must be in the ON position to start the engine. Placing the switch in the OFF position stops the engine. Place the switch in the OFF position when the unit is not in use.

7-5. ENGINE START BUTTON (Figure 7-1)

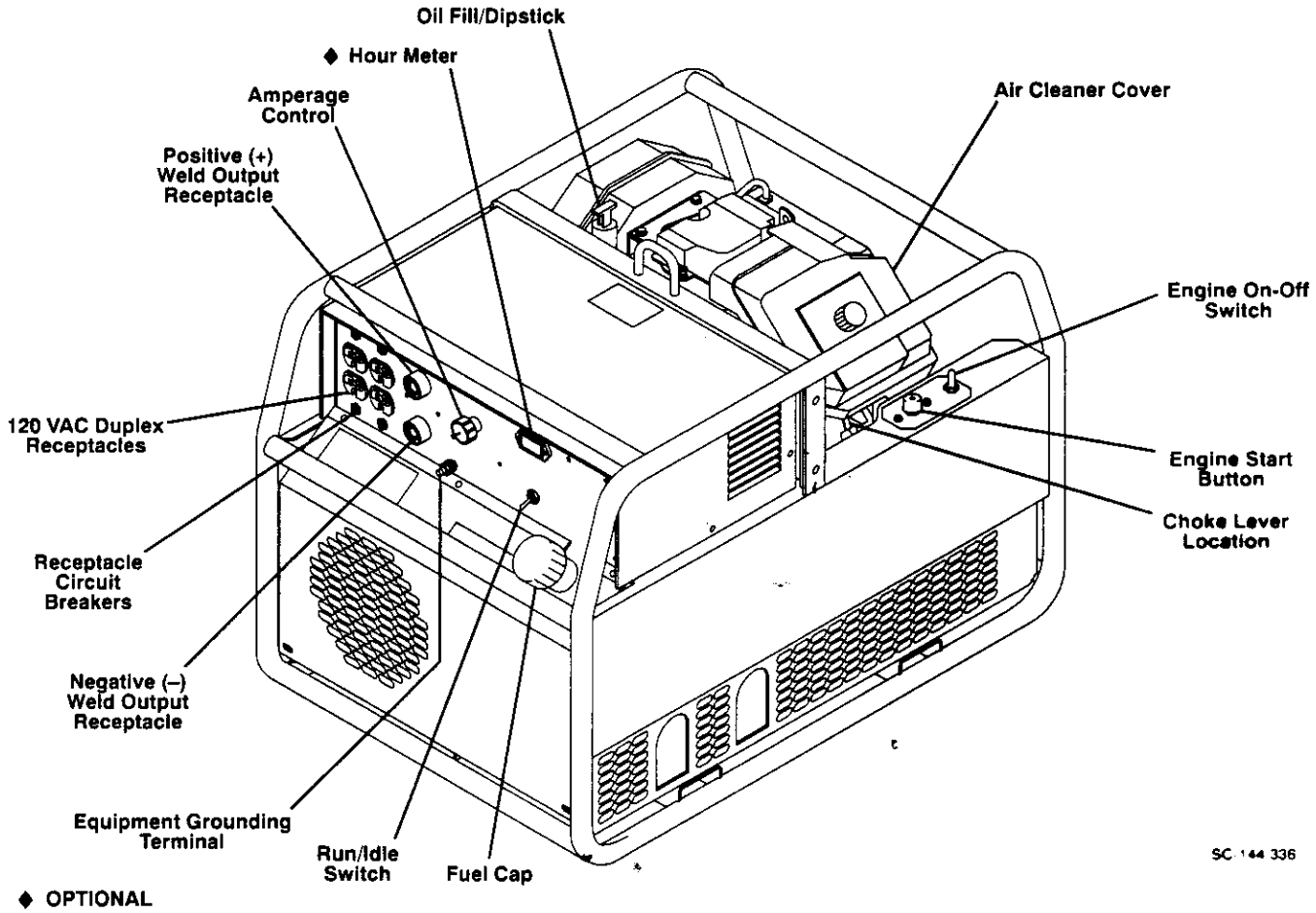
START

Pushing the START button (the Engine ON-OFF switch must be in the ON position for the engine to start) will activate the starter motor. Release the button as soon as the engine starts. Do not push START button while flywheel is rotating.

7-6. HOUR METER (Optional) (Figure 7-1)

ENGINE HOURS

The meter, labeled ENGINE HOURS, registers the total hours of engine operation. This information is useful for routine engine maintenance.



♦ OPTIONAL

Figure 7-1. Welding Generator Controls

SECTION 8 – SEQUENCE OF OPERATION

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIRFLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (-) battery cable from battery before inspecting or servicing.*
- *Keep away from moving parts such as fans, belts, and rotors.*
- *Keep all covers and panels in place while operating.*

Warranty is void if the welding generator is operated with any portion of the outer enclosure removed.

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

- *Wear correct eye, ear, and body protection.*

FUMES AND GASES can seriously harm your health.

- *Ventilate to keep from breathing fumes and gases.*
- *If ventilation is inadequate, use approved breathing device.*
- *Use in open, well ventilated areas, or vent exhaust out of doors.*

HOT METAL, SPATTER, SLAG, AND EXHAUST can cause fire and burns.

- *Watch for fire.*
- *Keep a fire extinguisher nearby, and know how to use it.*
- *Allow work and equipment to cool before handling.*

ENGINE FUEL can cause fire or explosion.

- *Stop engine before checking or adding fuel.*
- *Do not spill fuel; if spilled, wipe up.*
- *Do not refuel if engine is hot or running.*
- *Do not refuel near sparks or open flame.*
- *Do not smoke while refueling.*
- *Do not fill tank to top; allow room for expansion.*

MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.

- *Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.*

See Section 1-Safety Rules For Operation Of Arc Welding Power Source for basic welding safety information.

8-1. SHIELDED METAL ARC WELDING (SMAW)

WARNING: Read and follow safety information at beginning of entire Sections 5 and 8 before proceeding.

1. Install and prepare unit as instructed in Section 4.
2. Wear dry insulating gloves and clothing.
3. Connect work clamp to clean, bare metal at workpiece.
4. Select proper electrode.
5. Rotate AMPERAGE control to desired position (see Section 7-1).
6. Limited auxiliary power is available at 120 vac receptacles for use while welding. Make connections to receptacles (see Section 5-3).
7. Start the engine as instructed in Section 8-3.
8. Wear welding helmet with proper filter lens according to ANSI Z49.1.
9. Insert electrode into electrode holder and begin welding.

8-2. AUXILIARY POWER OPERATION

WARNING: Read and follow safety information at beginning of entire Sections 5 and 8 before proceeding.

1. Install and prepare unit as instructed in Section 4.
2. Connect auxiliary equipment to auxiliary power receptacles only.
3. Start engine as instructed in Section 8-3.
4. Turn on auxiliary equipment and begin operation.

8-3. STARTING THE ENGINE

IMPORTANT: *Read entire engine Owner's Manual (KOHLER CH 12.5) before operating.*

1. Engine Prestart Checks

   a. Oil Level

   Check engine oil level. Fill to top mark on dipstick if necessary (see engine manual for oil selection specifications). Follow break-in maintenance procedure according to Section 9-2.

   b. Fuel Level

   Check fuel level. Fill tank with fresh, clean gasoline if necessary (see engine manual for fuel specifications).

WARNING: REMOVE FUEL CAP SLOWLY; FUEL SPRAY may cause injury; FUEL may be under pressure.

- *Rotate fuel cap slowly and wait until hissing stops before removing cap.*

2. Place CHOKE lever in the full choke position if engine is cold and in the off position if the engine is warm (see Section 7-3).

3. Place the RUN/IDLE switch in the desired position (see Section 7-2).

IMPORTANT: *The engine will run quieter and more efficiently when used in the automatic idle (IDLE) position.*

4. Place the Engine ON-OFF switch in the ON position (see Section 7-4).

5. Proceed with step a or b depending on type of starter:

   a. Electric Start: Push the START button to activate the starter motor. Release the button as soon as the engine starts (see Section 7-5).

CAUTION: REENGAGING THE STARTER MOTOR while flywheel is rotating or EXCEEDING RATED CRANKING TIME can damage starting components.

- *Do not reengage starter motor until starter pinion and flywheel have stopped rotating.*
- *Do not exceed engine manufacturer's maximum cranking time.*

Allow 1 minute cooling time before attempting to restart engine.

   b. Optional Retractable Starter: Pull starter rope handle with a smooth, steady motion. Pull the handle straight out to avoid excessive rope wear from the starter rope guide.

6. For cold engines: Gradually return the choke lever to the no choke position after the engine starts and warms up.

7. Allow the engine to run for a few minutes before applying a load. This is necessary to enable the engine to warm up and ensure proper lubrication.

8-4. SHUTTING DOWN

1. Stop welding, and turn off or disconnect any auxiliary equipment.

2. Place the RUN/IDLE switch in the IDLE position.

3. Operate the engine at idle speed for a few minutes to allow internal engine temperatures to equalize.

4. Place Engine ON-OFF switch in the OFF position.

SECTION 9 – MAINTENANCE

9-1. ROUTINE MAINTENANCE (Table 9-1)

IMPORTANT: *Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See the Parts List for part numbers of precautionary labels.*

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (-) battery cable from battery before inspecting, maintaining, or servicing.*

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

HOT ENGINE PARTS can cause severe burns.

- *Wear protective gloves and clothing when working on a hot engine.*

Maintenance to be performed only by qualified persons.

A. Cables And Wiring

WARNING: Read and follow safety information at beginning of entire Section 9-1 before proceeding.

Check interconnecting wiring and connections for tightness and flaws. Be sure that the weld output cable connections are clean and tight. Check the insulation for breaks or other signs of damage. Repair or replace cables or wiring as necessary.

B. Battery

WARNING: Read and follow safety information at beginning of entire Section 9-1 before proceeding.

Inspect the battery for loose connections, damaged cables, corrosion, cracked case or cover, loose hold downs, and loose or deformed terminal posts.

Clean and tighten connections, replace cables, or replace battery if necessary.

C. Cleaning And Inspecting

WARNING: Read and follow safety information at beginning of entire Section 9-1 before proceeding.

When performing routine oil changes at intervals specified on the unit maintenance label, clean and inspect the unit as follows:

1. Keep the inside of the welding generator clean by blowing out the unit with clean, dry compressed air.

2. Wipe oil and fuel spills immediately to avoid accumulation of dust.

3. Check for fluid leaks indicating loose oil or fuel connections. Tighten loose connections, and clean oil or fuel spills off engine.

IMPORTANT: *See the engine Owner's Manual (KOHLER CH 12.5 Engine) for complete engine care.*

D. Maintenance And Inspection Of The Spark Arrestor

WARNING: ENGINE EXHAUST SPARKS can cause fire.

- *Exhaust spark arrestor must be installed in accordance with local, state, and federal regulations.*
- *Stop engine before cleaning spark arrestor.*
- *Clean spark arrestor in a noncombustible environment.*

HOT ENGINE PARTS can cause severe burns.

- *The exhaust system must be cold when servicing the spark arrestor.*

Internal combustion engines operating in a highly combustible environment are a common fire hazard. Glowing carbon particles blown out with the exhaust can retain sufficient heat to ignite materials. While no practical spark arresting device will stop all sparks, this device will minimize fire hazards by removing and trapping most solid particles provided that it is properly maintained.

The spark arrestor should be inspected weekly or every 20 operating hours, whichever occurs first. There should be no openings in the screen greater than 0.023 in. (0.58 mm) wide. If after cleaning and inspecting, there are any missing or eroded wires, the spark arrestor should be replaced.

9-2. OIL AND FILTER

WARNING: Read and follow safety information at beginning of Sections 9-1 and 9-6 before proceeding.

IMPORTANT: *When draining oil use the oil drain plug located directly below the starter motor on left side of unit. The engine is equipped with three oil drain plugs, but this one is the most accessible.*

A. During Break-In Period

Replace break-in oil after the first 5 hours of engine operation with proper type and grade of oil as recommended in the engine Owner's Manual (KOHLER CH 12.5 Engine).

B. After Break-In Period

IMPORTANT: *The battery must be removed to replace the oil filter. Follow Section 9-6 for battery removal and installation procedure.*

Change the oil after every 100 hours of engine operation and the filter after every 200 hours of engine operation. Use correct type and grade of oil as listed in the engine Owner's Manual for expected temperature range before next oil change.

Table 9-1. Maintenance Schedule

Frequency	Maintenance
After first 5 operating hours (engine break-in).	Replace break-in oil (see Section 9-2).
Every day or before starting engine.	Check fuel and oil levels (see Sections 4-3 and 4-4, and engine Owner's Manual, KOHLER CH 12.5). Check oil level at each fueling.
	Check air cleaner for dirty, loose, or damaged parts (see engine Owner's Manual, KOHLER CH 12.5).
	Check air intake and cooling areas, clean as necessary (see engine Owner's Manual, KOHLER CH 12.5).
Every 20 hours.	Service spark arrestor, if applicable (see Section 9-1D).
Every 25 hours.	Service air precleaner element (see engine Owner's Manual, KOHLER CH 12.5).
Every 100 hours.	Change oil, (see engine Owner's Manual, KOHLER CH 12.5).
	Check spark plug and air filter (see engine Owner's Manual, KOHLER CH 12.5).
	Check cables, wiring (see Section 9-1A), and battery (see Section 9-1B).
	Units in heavy service environments: check labels; clean and inspect unit (see Section 9-1C).
Every 200 hours.	Change oil filter (see engine Owner's Manual, KOHLER CH 12.5).
	Replace fuel filter (see Section 9-4).
Annually or every 500 hours.	Have starter motor drive serviced (see engine Owner's Manual, KOHLER CH 12.5).
Every 1000 hours.	Check brushes and slip rings (see Section 9-5). Check all labels (see IMPORTANT block, Section 9-1). Clean and inspect unit (see Section 9-1C).

9-3. AIR CLEANER

CAUTION: DIRTY AIR can damage engine.

- *Do not operate engine with dirty air cleaner element in place.*
- *Do not operate engine without air cleaner element in place.*

The air cleaner is one of the most important parts of the engine from the standpoint of engine life. If dirty air gets into the engine, it can cause major engine damage within a few operating hours.

This engine is equipped with a dry paper type filter element and an oiled foam precleaner. Service air filter and precleaner according to maintenance label and engine Owner's Manual (KOHLER CH 12.5 Engine).

9-4. FUEL FILTER

WARNING: ENGINE FUEL can cause fire or explosion.

- *Stop engine before working on fuel system.*
- *Do not spill fuel; if spilled, wipe up.*
- *Do not service fuel filter if engine is hot or running.*
- *Do not service fuel filter near sparks or open flame.*
- *Do not smoke while servicing fuel filter.*
- *Keep a fire extinguisher nearby, and know how to use it.*

Maintenance to be performed only by qualified persons.

This welding generator is equipped with an in-line fuel filter located near the fuel pump. The fuel filter should be replaced after every 200 hours of operation, or more often depending on the quality of gasoline used and how dusty and dirty the location is in which the engine is being used. To replace the in-line fuel filter, proceed as follow:

1. Allow engine to cool. If tank contains fuel, carefully clamp fuel line between tank and filter to prevent leaking fuel while changing filter.
2. Release hose clamps, and remove filter. Wipe up fuel.
3. Inspect fuel line for any cracks or deterioration, and replace if necessary.
4. Install new fuel filter (make sure direction of fuel flow is correct), and secure with clamps.
5. If applicable, remove clamp attached in Step 1. Inspect fuel line connections for leaks; correct any leaks.
6. Wipe up any spilled fuel.
7. Start engine as instructed in Section 8-3.
8. Reinspect fuel line connections for leaks.
9. Stop engine, and correct any leaks.
10. Wipe up any spilled fuel, and resume operation.

9-5. BRUSHES AND SLIP RINGS (Figure 9-1)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (-) battery cable from battery before inspecting, maintaining, or servicing.*

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

HOT ENGINE PARTS can cause severe burns.

- *Wear protective gloves and clothing when working on a hot engine.*

Maintenance to be performed only by qualified persons.

Brush life is very good under most operating conditions. The brushes and slip rings should be inspected every 1000 hours or whenever excitation voltage is lost. Check for cleanliness of the slip rings and the freedom of motion of the brushes. If the welding generator has been operating under extremely dusty or dirty conditions, increase the frequency of inspection.

Under normal use the slip rings will discolor to a dark brown. If a buildup of brush material is noted, it may be necessary to clean the slip rings. Use a number 220 or finer sandpaper. Never use emery cloth as part of the emery will embed itself into the rings, and in turn destroy the carbon brushes.

Replace the brushes if they become chipped or broken or if less than 5/16 in. (8.0 mm) of brush material will be left at the next projected inspection interval.

To inspect or replace brushes, proceed as follows:

WARNING: Read and follow safety information at beginning of entire Section 9-4 before proceeding.

1. Remove spark plug wire from spark plug.
2. Remove lower front panel and plastic fan shroud from end of stator barrel.
3. Remove fan from rotor as follows:
   a. Remove clamp, 5/16 in. bolt, lock washer, and flat washer from rotor shaft.
   b. Gently work fan back and forth until it slides off.
4. Disconnect lead 28 (towards stator coils) and lead 33 (towards endbell) from brushes.
5. Remove brush bracket screws. Brush assembly is now free.

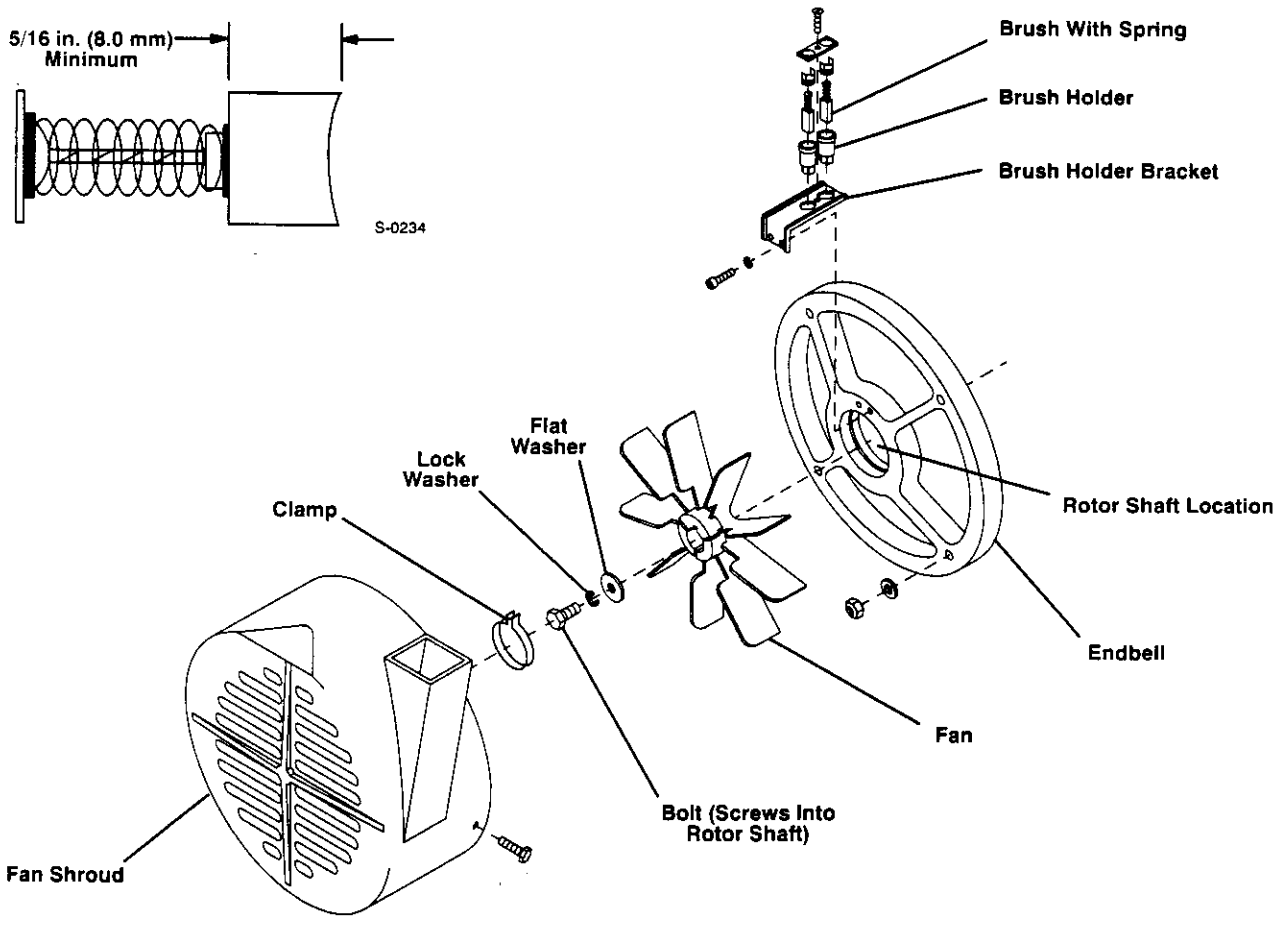


Figure 9-1. Brush Replacement Components

6. If necessary, clean the slip rings.
7. Remove brushes from holder bracket, and if necessary install new brushes.
8. Reinstall brush assembly, and reconnect leads 33 and 28.
9. Reinstall fan. Replace flat washer, lock washer, bolt, and clamp. Lightly grasp fan blade and tighten bolt to 12 ft-lbs. (N·m).

IMPORTANT: *When installing clamp, position clamp screw opposite (180 degrees) keyway on fan.*

10. Reinstall shroud and lower front panel. Reattach spark plug wire.

9-6. BATTERY REPLACEMENT PROCEDURE

WARNING: SPARKS OR FLAMES can cause BATTERY GASES to EXPLODE; BATTERY ACID can burn eyes and skin.

- *Stop engine before disconnecting or connecting battery cables.*
- *Keep sparks, flames, cigarettes, and other ignition sources away from batteries.*
- *Do not allow tools to cause sparks when working on a battery.*
- *Always wear a face shield and proper protective gloves and clothing when working on a battery.*
- *Do not allow positive (+) battery terminal to touch the frame and cause sparks during removal.*

Use the following procedure to prevent sparks when removing or installing a battery:

1. Be sure engine is fully stopped, and Engine Control switch is in the OFF position.
2. Locate battery in unit.
3. Disconnect negative (–) battery cable first and positive (+) cable last.
4. Remove hold down device.
5. Remove battery.
6. Install new (or charged) battery so that terminals are toward outside of unit.
7. Reinstall and secure hold down device.
8. Connect positive (+) cable first and negative (–) cable last.

9-7. MAINTENANCE-FREE BATTERY CHARGING

WARNING: CHARGING FROZEN BATTERY can cause the battery to explode and result in serious injury or damage to equipment; BATTERY ACID can burn eyes, skin, destroy clothing, and damage other material; BATTERY GASES can explode and shatter battery.

- *Allow battery to warm up to 60° F (16° C) before charging if battery is frozen.*
- *Wear a face shield, proper protective clothing, and remove all metal jewelry.*
- *Do not spill or splash battery fluid.*
- *Do not apply pressure to walls of filled battery – use battery carrier, or place hands on opposite corners when lifting battery.*
- *Keep sparks, flames, cigarettes, and other ignition sources away from batteries.*
- *Use enough ventilation to keep battery gases from building up during and for several hours after battery charging.*
- *Do not touch or move connections on battery while battery charger is on.*
- *Do not lean over battery when charging.*
- *Be sure battery charger connections to battery are clean and tight.*
- *Turn off battery charger before disconnecting charger from battery.*
- *Be sure battery charger output matches battery voltage.*
- *Turn off battery charger before disconnecting charger from battery.*

1. Remove battery from unit (see Section 9-6), and place on a level worktable or other suitable surface.
2. If battery has removable vent caps, check the condition of the electrolyte as follows:
   a. Check electrolyte temperature in one of the center cells with a battery thermometer. For each 10°F (6°C) increment above 80°F (27°C), a correction factor of 0.004 specific gravity must be added to the specific gravity reading taken in Step 2b. For each 10°F (6°C) increment below 80°F (27°C), 0.004 must be subtracted from the reading taken in Step 2b.
   b. Check the specific gravity of each cell with a hydrometer. (Draw in and expel the electrolyte two or three times from the first cell to be tested to adjust the temperature of the hydrometer to that electrolyte).
   c. If a corrected specific gravity reading of 1.225 at 80°F (27°C) is not obtained, replace the vent caps and recharge the battery following the battery charger manufacturer's instructions.
3. If the battery does not have removable vent caps, check the condition of the battery as follows:
   a. Check the stabilized open-circuit voltage of the battery. For a 12 volts battery any reading below 12.4 volts indicates the battery needs charging. Disconnect both battery cables from the battery, and allow battery voltage to stabilize for several hours.
   b. If the stabilized open-circuit voltage is below 12.4 volts, charge the battery following the battery charger manufacturer's instructions.
4. Reinstall battery in unit.
5. Replace battery hold down, and tighten securely. Do not overtighten.
6. Connect positive (+) battery cable to positive (+) battery terminal.
7. Connect negative (–) battery cable to negative (–) battery terminal.

9-8. ENGINE SPEED ADJUSTMENTS (Figure 9-2)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

HOT ENGINE PARTS can cause severe burns.

- *Wear protective gloves and clothing when working on a hot engine.*

IMPORTANT: *Clean and gap spark plug, and warm up engine before proceeding with the engine speed adjustments.*

The engine speeds have been factory adjusted and should not require frequent readjustment. After tuning the engine, check the speeds with a tachometer. With no load applied, the IDLE speed should be 2400 rpm (±100 rpm) and the RUN speed between 3725 and 3750 rpm. If necessary, adjust the speeds as follows:

A. RUN Speed Adjustment

1. Locate engine run speed adjustment bracket on right side of unit (see Figure 9-2).
2. Loosen both run speed adjustment bracket securing bolts approximately 1-1/4 turns using a 10 mm. socket or wrench.
3. Start engine as instructed in Section 8-3 and place RUN/IDLE switch in RUN position.
4. To lower engine speed slide run speed adjustment bracket towards front of unit. To raise engine speed slide bracket towards rear of unit. Adjust bracket until engine speed is between 3725 and 3750 rpm and retighten securing bolts.

5. Place RUN/IDLE switch in IDLE position and let engine idle down. Return RUN/IDLE switch to RUN position and recheck RUN speed. Engine should return to correct run speed. Do this several times. If necessary, repeat Steps 2 through 5 until RUN speed is correctly adjusted.

6. Recheck tightness of securing bolts and stop engine according to Section 8-4.

B. IDLE Speed Adjustment

1. Locate idle solenoid post and bracket, idle paddle, and governor arm (see Figure 9-2).

2. Push top of governor arm towards carburetor as far as it will go. This will swing the idle paddle towards the idle solenoid post and bracket. There should be approximately a 1/16 in. (2 mm) gap between the idle paddle and the idle solenoid post and bracket. Also, the idle paddle should align squarely with the idle solenoid bracket. If necessary, adjust as follows:

   a. Loosen the two screws securing idle paddle to the governor arm.

   b. With engine off, adjust idle paddle so that there is approximately a 1/4 in. (6 mm) gap between top of idle paddle and top of idle solenoid bracket, and approximately 5/16 in. (8 mm) gap between bottom of idle paddle and bottom of idle solenoid bracket. Retighten two securing screws.

   c. Push top of governor arm toward carburetor as far as it will go and recheck idle paddle/idle solenoid bracket gap and alignment. Readjust if necessary.

3. Remove air cleaner cover and locate carburetor idle speed adjusting screw by looking down from top of unit through the opening between the engine and air cleaner base (see Figure 9-2 for IDLE speed adjusting screw location).

IMPORTANT: *Do not remove the air cleaner base when making carburetor adjustments.*

4. Start engine as instructed in Section 8-3. Place RUN/IDLE switch in IDLE position and let engine idle down.

5. Adjust IDLE speed by turning idle speed adjusting screw clockwise to increase idle speed and counterclockwise to reduce idle speed.

6. If proper IDLE speed cannot be attained by adjusting idle speed adjusting screw, shut down engine and recheck idle paddle/idle solenoid bracket gap and alignment (see Step 2). If readjustment is necessary, repeat Steps 2 through 5.

7. Stop engine according to Section 8-4 and reinstall air cleaner cover.

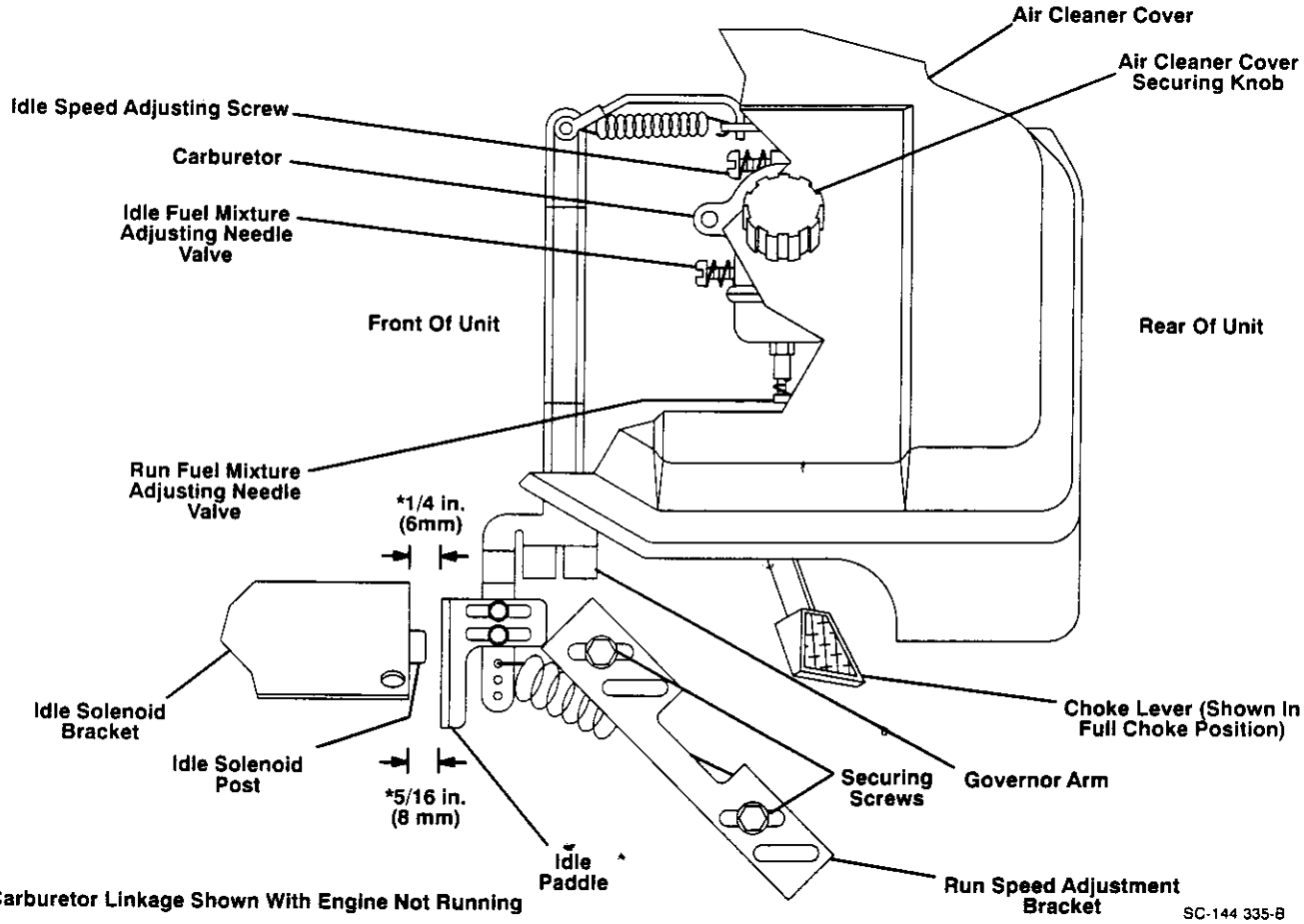


Figure 9-2. Engine Speed And Carburetor Adjustments With Components

10-1. GENERAL

It is assumed that proper installation has been made, according to Section 4 of this manual, the operator is familiar with the function of controls, the welding generator was functioning properly, and the trouble is not related to the welding process.

10-2. BOOSTER BATTERY JUMP STARTING

If jump starting is attempted, use the following safety precautions and the step-by-step procedures in order of appearance.

WARNING: BATTERY GASES OR A DAMAGED BATTERY can explode thereby shattering the battery; BATTERY ACID can burn eyes, skin, destroy clothing, and damage other material; MOVING PARTS AND IMPROPER CONNECTIONS can cause serious injury and damage equipment.

- *Keep sparks, flames, cigarettes, and other ignition sources away from battery.*
- *Be sure that all personnel are a safe distance from batteries and away from moving parts while starting.*
- *Do not jump start a frozen or completely discharged battery.*
- *Do not jump start a battery which has loose terminals or one having evidence of damage such as a cracked case or cover.*
- *Be sure that vent caps are tight and level on both batteries, and cover both batteries with a damp cloth.*
- *Wear correct eye and body protection, and remove all metal jewelry.*
- *Keep jumper cables away from moving parts.*
- *Do not jump start a trailer-mounted welding generator with the towing vehicle battery unless the trailer is completely disconnected from the towing vehicle.*
- *Do not jump start a vehicle-mounted welding generator from the vehicle battery.*
- *If booster battery is installed in a vehicle, do not allow vehicle to touch welding generator case or frame.*
- *Do not jump start by applying power to weld output receptacles or terminals.*
- *Do not allow jumper cable clamps to touch any other metal while attaching or removing cables.*

1. Use properly insulated jumper cables of adequate size.
2. Connect ends of one cable to positive (+) terminals of each battery.
3. Connect one end of other cable to negative (–) terminal booster battery.
4. Connect remaining end of cable to welding generator engine block at least 18 in. (457 mm) from battery (do not connect to welding generator case, frame, or equipment grounding terminals as damage to equipment can result).
5. Wait at least one minute after connecting cables before starting engine.
6. Start engine following procedures outlined in Section 8 (Sequence of Operation) of this manual and allow engine to return to idle speed. If the unit does not start after cranking for ten seconds, stop the jump starting procedure and allow a one minute starter motor cool-down period between starting attempts. More than ten seconds seldom starts the engine unless some mechanical adjustment is made.
7. Remove jumper cable from engine block.
8. Remove other end of same cable from booster battery negative (–) terminal.
9. Remove other jumper cable from welding generator battery positive (+) terminal.
10. Remove remaining end of cable from booster battery positive (+) terminal.
11. Discard damp cloths.

10-3. OVERLOAD PROTECTION

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (-) battery cable from battery before inspecting, maintaining, or servicing.*

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

HOT ENGINE PARTS can cause severe burns.

- *Wear protective gloves and clothing when working on a hot engine.*

INCORRECT FUSE can damage unit.

- *Use only replacement fuse of same size, type, and rating (see Parts List).*

A. Resetting Circuit Breakers

WARNING: Read and follow safety information at beginning of entire Section 10-3 before proceeding.

The circuit breakers are automatic-trip type breakers. When the circuit breaker button is in (on position), the

circuit breaker is functional. When the button is out (off position), the breaker is open and the related circuit does not work.

If a circuit breaker trips when equipment use begins, a fault is probably present in the equipment. If a breaker trips after prolonged equipment use, an overload condition is probably present. Should a breaker trip, proceed as follows:

1. Locate and repair fault or reduce receptacle load.
2. Reconnect equipment to receptacle and start engine.
3. Reset circuit breaker (depress button); it may be necessary to allow a cooling period before the breaker can be reset.

B. Exciter Excitation Winding Protection

WARNING: Read and follow safety information at beginning of entire Section 10-3 before proceeding.

The excitation winding is protected by fuse F1, located at the upper right corner on the component mounting panel. Should F1 open, there would be low weld and auxiliary power open circuit voltage.

IMPORTANT: *If fuse F1 opens, the fault is probably in rectifier SR1. Contact the nearest Factory Authorized Service Station.*

To replace F1, proceed as follows:

1. Remove top panel. Locate F1 in upper right corner of component mounting panel.
2. Check F1, and replace if necessary. Also check SR1.
3. Reinstall top panel.

10-4. LOW OIL PRESSURE SHUTDOWN

This unit is equipped with a low oil pressure shutdown switch S4. Should the oil pressure become too low, this switch would activate and make the unit completely inoperative. Should this occur, consult the engine Owner's Manual (KOHLER CH12.5 Engine), and add oil accordingly.

10-5. CIRCUIT BOARD PC1 AND IDLE MODULE PC2 HANDLING PRECAUTIONS

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (-) battery cable from battery before inspecting, maintaining, or servicing.*

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

HOT ENGINE PARTS can cause severe burns.

- *Wear protective gloves and clothing when working on a hot engine.*

Maintenance to be performed only by qualified persons.

CAUTION: ELECTROSTATIC DISCHARGE (ESD) can damage circuit boards.

- *Put on properly grounded wrist strap BEFORE handling circuit boards.*
- *Transport circuit boards in proper static-shielding carriers or packages.*
- *Perform work only at a static-safe work area.*

INCORRECT INSTALLATION or misaligned plugs can damage circuit board.

- *Be sure that plugs are properly installed and aligned.*

EXCESSIVE PRESSURE can break circuit board.

- *Use only minimal pressure and gentle movement when disconnecting or connecting board plugs and removing or installing board.*

If any of the circuit boards or modules are not working, follow the precautions above, and contact the nearest Factory Authorized Service Station.

10-6. TROUBLESHOOTING (Tables 10-1 Through 10-3)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Stop engine, and disconnect negative (–) battery cable from battery before inspecting, maintaining, or servicing.*

MOVING PARTS can cause serious injury.

- *Keep away from moving parts such as fans, belts, and rotors.*

HOT ENGINE PARTS can cause severe burns.

- *Wear protective gloves and clothing when working on a hot engine.*

Troubleshooting to be performed only by qualified persons.

The following tables are designed to diagnose and provide remedies for some of the troubles that may develop in this welding generator.

Use these tables in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, contact the nearest Factory Authorized Service Station. In all cases of equipment malfunction, strictly follow the manufacturer's procedures and instructions.

Table 10-1. Weld Troubleshooting

WELDING TROUBLE	PROBABLE CAUSE	REMEDY
Low weld and power open circuit voltage.	Fuse F1 open.	Check and replace F1 (see Section 10-3).
Low weld output; low auxiliary power present.	Current transformer CT2.	Contact nearest Factory Authorized Service Station.
	Integrated rectifiers SR2 and SR3.	Contact nearest Factory Authorized Service Station.
	Field Current Regulator Board PC1	See Section 10-5, and contact nearest Factory Authorized Service Station.
	Main rectifier SR4.	Contact nearest Factory Authorized Service Station.
Erratic weld and power output.	Dirty slip rings and/or worn brushes.	Clean slip rings and/or replace worn brushes (see Section 9-5, and contact nearest Factory Authorized Service Station).
Erratic welding arc.	Loose or dirty connections.	Check connections both inside and outside welding generator.
	Wrong electrode polarity.	Change to proper electrode polarity.
	Improper connection to workpiece.	Check and tighten work clamp connection.
	Field Current Regulator Board PC1.	See Section 10-5, and contact nearest Factory Authorized Service Station.
	Stabilizer DC-Z.	Contact nearest Factory Authorized Service Station.
	Low engine speed.	Adjust engine speed (see Section 9-8).
Weld output uncontrollable; auxiliary power present.	Improper connection to workpiece.	Check and tighten work clamp connection.
	AMPERAGE control R1.	Contact nearest Factory Authorized Service Station.
	Field Current Regulator Board PC1.	See Section 10-5, and contact nearest Factory Authorized Service Station.
Low weld output.	Engine running below required speed.	Check air filter; clean or replace as necessary.
		Clean and adjust spark plug (see engine Owner's Manual, KOHLER CH 12.5).
		Adjust engine speed (see Section 9-8).
	Engine not developing proper horsepower.	Perform necessary engine maintenance (see engine Owner's Manual, KOHLER CH 12.5).

Table 10-2. Auxiliary Power Troubleshooting

AUXILIARY POWER TROUBLE	PROBABLE CAUSE	REMEDY
No auxiliary power output at receptacles RC1 and RC2.	Receptacle circuit breaker(s) open.	Check receptacle circuit breakers (see Sections 5-3 thru 5-5 and 10-3).
	Receptacle or receptacle wiring.	Check connections at receptacles RC1 and RC2. Replace receptacle if necessary.
Erratic power output at receptacles RC1 and RC2.	Dirty slip rings and/or worn brushes.	Clean slip rings and replace worn brushes (see Section 9-5, and contact nearest Factory Authorized Service Station).
Low power output at receptacles RC1 and RC2.	Engine running below required speed.	Check air cleaner; clean or replace as necessary (see Section 9-3).
		Clean and adjust spark plug; adjust carburetor (see engine Owner's Manual, KOHLER CH 12.5).
		Adjust engine speed (see Section 9-8).
	Engine not developing proper horsepower.	Perform necessary engine maintenance (see engine Owner's Manual, KOHLER CH 12.5).

Table 10-3. Engine Troubleshooting

ENGINE TROUBLE	PROBABLE CAUSE	REMEDY
Engine will not start; starter turns over slowly or not at all.	Battery problem.	Check engine charging system according to engine service manual (not supplied with engine).
		Inspect electrical system. If trouble is isolated to battery, replace it (see Section 9-6).
		Jump start the engine using approved safety practices and booster battery (see Section 10-2).
Engine will not start; starter does not turn over.	Engine ON-OFF switch S2.	Check S2, and replace if necessary.
	Engine START button PB1.	Check PB1, and replace if necessary.
Engine will not start; starter turns over.	Low oil pressure shutdown switch S4 closed.	Check oil level (see Section 10-4, and engine Owner's Manual KOHLER CH 12.5).
	Engine trouble.	See engine Owner's Manual (KOHLER CH 12.5).
Battery discharges between uses.	Voltage regulator or alternator.	Check voltage regulator and alternator; and replace if necessary.
	Acid buildup, a white-grayish substance, on top of battery.	Clean battery, terminals, and posts with baking soda solution; rinse with clear water.
	Infrequent use.	Recharge battery (approximately every 3 months) (see Section 9-7).
	Battery.	Replace battery (see Section 9-6).
Engine idles, but does not come up to weld speed.	RUN speed requires adjustment.	Adjust RUN speed (see Section 9-8).
	Loose or dirty connections to Auto Idle Module PC2 or current transformer CT1.	Check connections to PC2 and CT1.
	Current transformer CT1.	Contact nearest Factory Authorized Service Station.
	Auto Idle Module PC2.	See Section 10-5, and contact nearest Factory Authorized Service Station.
Unstable or sluggish engine speeds.	Idle solenoid linkage binding.	Inspect and readjust linkage if necessary (see Section 9-8).
	Idle solenoid paddle not properly adjusted.	Inspect and readjust paddle if necessary (see Section 9-8).
	Engine requires tune-up.	Refer to engine Owner's Manual (KOHLER CH 12.5 Engine), and tune-up engine.

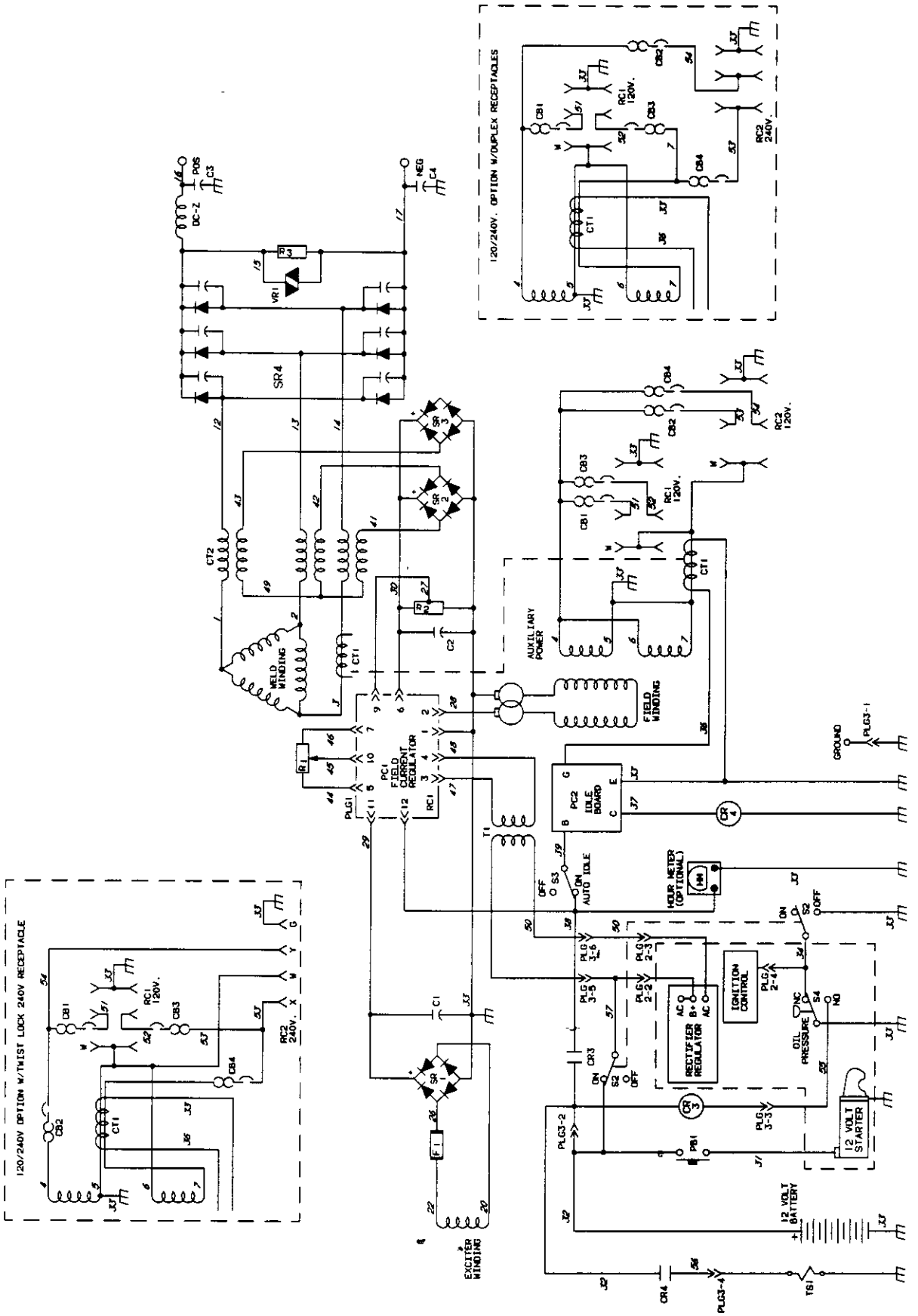
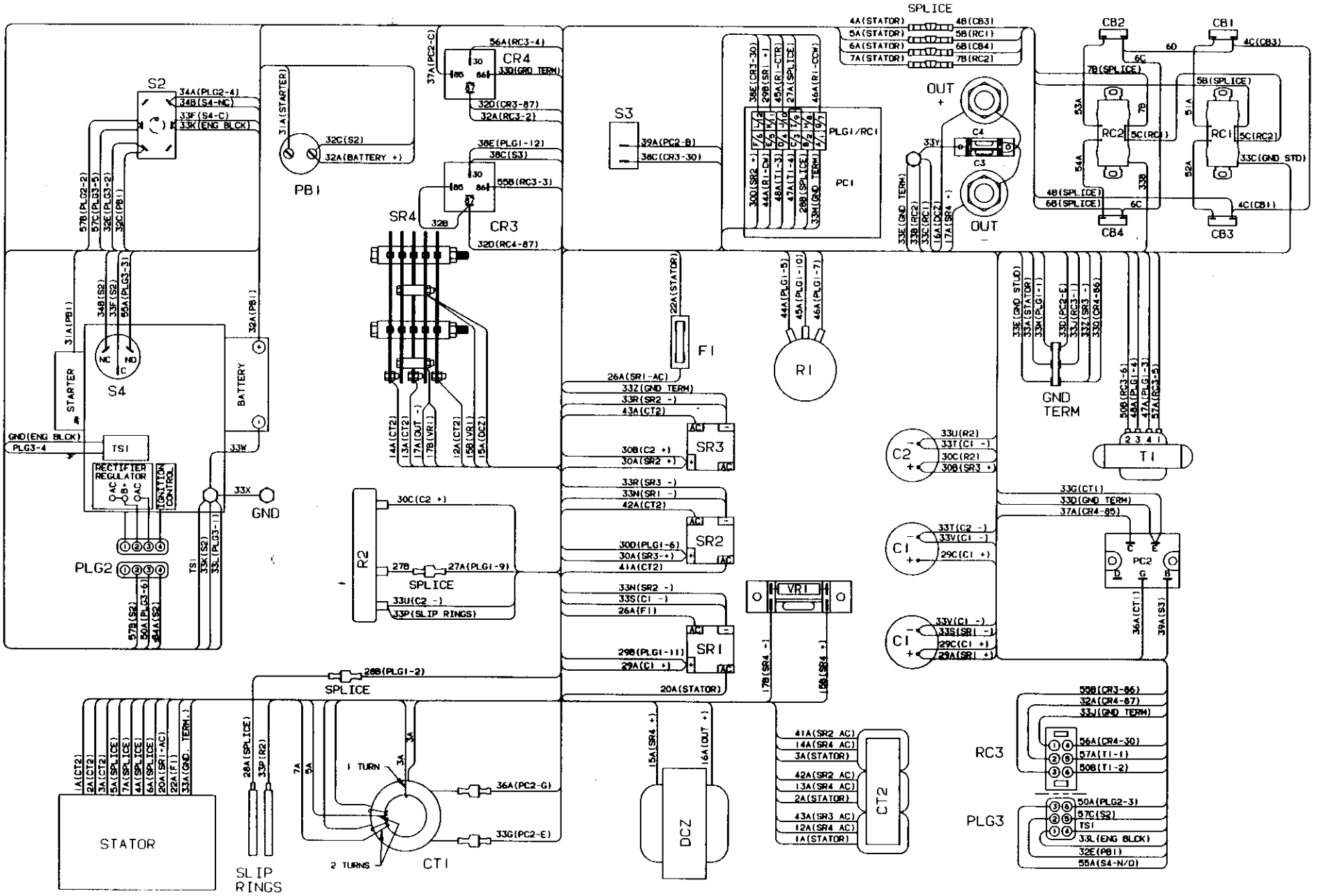


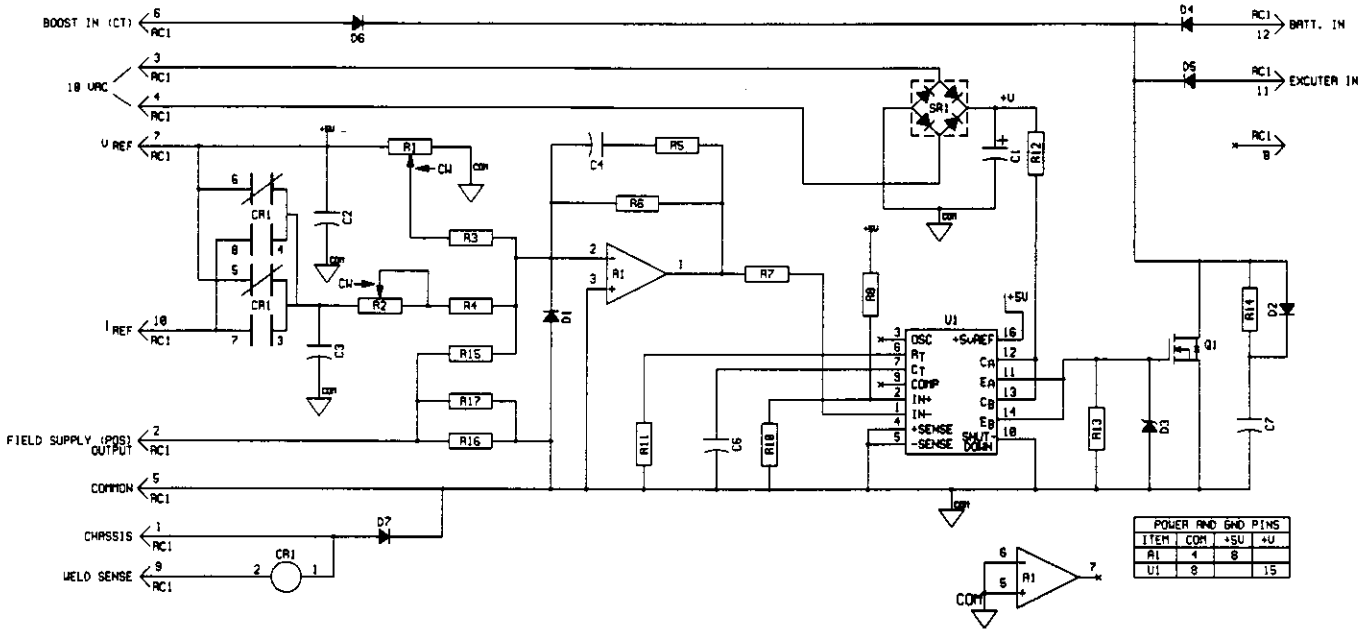
Diagram 11-1. Circuit Diagram

Circuit Diagram No. SC-141 329-B



Wiring Diagram No. SC-142 117-A

Diagram 11-2. Wiring Diagram



Circuit Diagram No. SB-142 013

Diagram 11-3. Circuit Diagram For Field Current Regulator Board PC1

12-1. GENERAL

Shielded Metal Arc welding with a transformer welding machine depends upon the fundamental fact that when one side of the secondary welding circuit is attached to a piece of steel and the other side of the circuit is connected to an electrode, an arc will be established when the electrode touches the steel. If the arc is properly controlled, the metal from the electrode will pass through the arc and be deposited on the steel. When the electrode is moved along the steel at the correct speed, the metal will deposit a uniform layer called a bead. The electrodes used in welding are carefully manufactured to produce strong, sound welds. They consist of a core of steel wire, usually called mild since it contains a low (0.10-0.14) percentage of carbon. Around this core is applied a special coating which assists in creating the arc and at the same time protects the molten steel as it transfers across the arc.

In order to utilize these principles in shielded metal arc welding, some means of controlling the power is essential. The power in a welding circuit is determined by the voltage and current. The arc voltage is governed by the arc length and the electrode diameter. Therefore, the practical measure of the power or heat is in terms of the current, measured in amperes. A small electrode requires less current than a large one. To simplify operation, the scale on the front of the welding machine is marked off for the various current values.

The exact current required for a job depends upon the size of the pieces to be welded and the position of welding. Generally, a lower current will be sufficient for welding on a small part than would be necessary to weld on a large piece of the same thickness. Similarly, with a given size of electrode, a lower current should be used on thin metals than on the thicker sections. Most manufacturers of electrodes have ampere recommendation charts available.

Table 12-1. Current Requirements For Mild Steel Electrodes

Electrode Diameter	Amperage	
	Min.	Max.
5/64	20	50
3/32	40	80
1/8	65	125
5/32	90	160
3/16	120	180

Figure 12-1. Flat Position Welds

While it is always easier to weld on work in the flat position, as shown in Figure 12-1, occasionally, it is necessary to weld in a horizontal, vertical, or overhead position as shown in Figures 12-2, 12-3, and 12-4, respectively. Generally, under these conditions it is helpful to reduce the current from the value used on welding in the flat position.

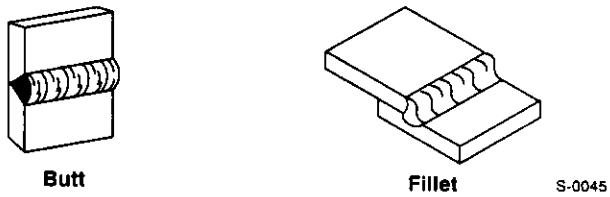


Figure 12-2. Horizontal Position Welds

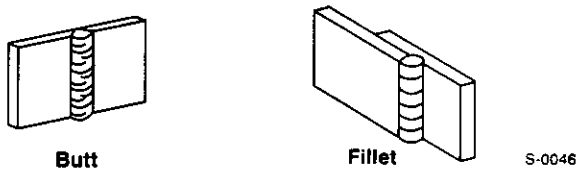


Figure 12-3. Vertical Position Welds

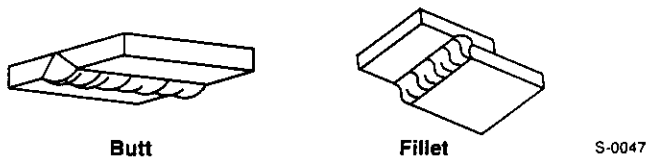


Figure 12-4. Overhead Position Welds

12-2. STRIKING THE ARC-RUNNING BEADS

In learning to weld there are certain fundamental steps which must be mastered before one can attempt to weld on actual work. Prior to striking an arc, insert the electrode in the holder as shown in Figure 12-5. To strike an arc, Figure 12-6 illustrates what is commonly known as the "scratch start technique". In this method the striking end of the electrode is dragged across the work in a manner much the same as striking a match. When the electrode touches the work, the welding current starts. If held in this position, the electrode would "freeze" or weld itself to the work. To overcome this, the electrode should be slightly withdrawn from the work immediately after contact has been made. The distance that the electrode is withdrawn is small and depends upon the diameter of the electrode; this distance is known as the arc length. If in striking an arc, the electrode freezes, it may be freed by a quick twist of the wrist.

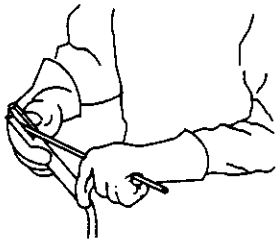


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Figure 12-5. Electrode Insertion

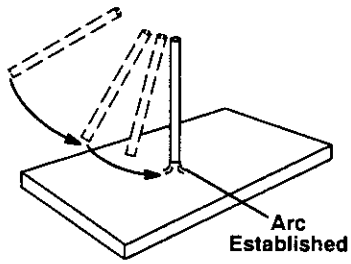

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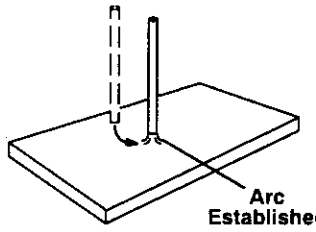
Figure 12-6. Arc Initiation – Scratch Start Technique

Another method of establishing the arc is known as the "tapping method" as shown in Figure 12-7. The electrode is brought straight down on the work and immediately after contact, is withdrawn to the proper arc length.



S-0050

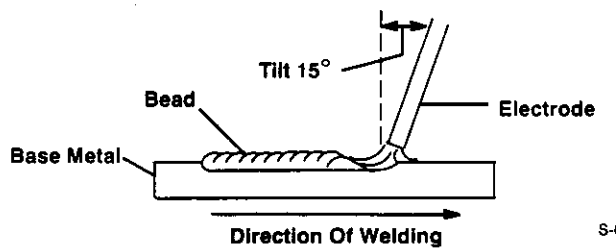
Figure 12-7. Arc Initiation – Tapping Technique

Practice striking the arc using both methods. Generally the scratch method is preferred for arc welding.

Determination of the correct arc length is difficult since there is no ready means of measuring it. As a preliminary guide, use about 1/16" arc length on 1/16" and 3/32" electrodes; for 1/8" and 5/32" electrodes use about 1/8" arc length. As skill is acquired, the sound of the arc will be a good guide. A short arc with correct current will give a sharp, crackling sound.

A portion of the electrode coating forms a protective coating called slag over the deposited weld metal. To examine the weld, remove the slag from the weld with a chipping hammer.

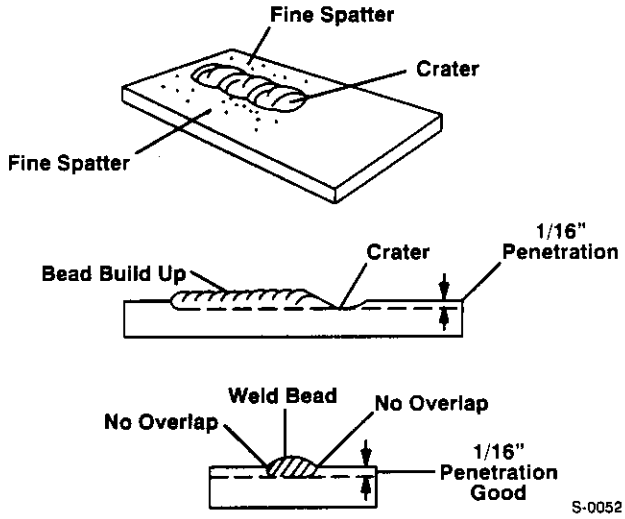
Once the knack of establishing and holding an arc has been learned, the next step is learning to run a good weld bead. In the beginning it is best to run beads of weld metal on flat plates using a full electrode. Practice moving from left to right and from right to left. The electrode should be held less than perpendicular to the work, tilting it in the direction of travel. The correct position is shown in Figure 12-8.



S-0051

Figure 12-8. Electrode Position

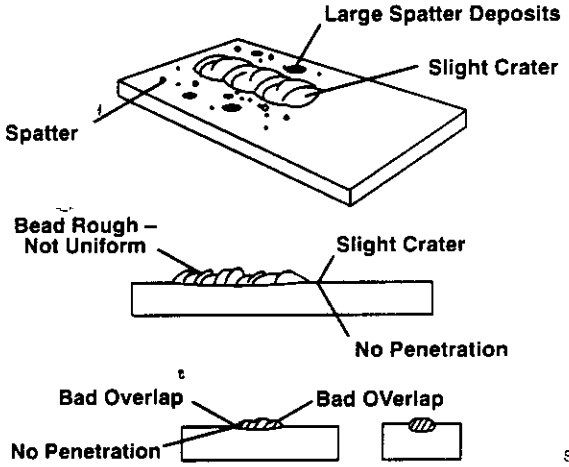
A proper weld bead is illustrated in Figure 12-9. This shows a cross-section through the bead and identifies the various terms used in describing a weld. To produce these results it is necessary to hold a short arc, travel at a uniform speed, and feed the electrode downward at a constant rate as it melts.



S-0052

Figure 12-9. Proper Weld Bead

Probably the first attempts in the practice will fall short of the results shown. Too long an arc will be held or the travel speed will vary from slow to fast and the welds will look as illustrated in Figure 12-10 showing a cross section through a poor weld bead. In addition, the weld will probably be spongy (porous) and of low strength.



S-0053

Figure 12-10. Poor Weld Bead

Continue practicing until uniform beads as shown in Figure 12-9 can be produced. A good method of practicing

is to deposit a series of beads, one next to the other until the plate is covered. The slag must be thoroughly removed between each pass. Then deposit another series of beads at right angles to the first, thus building up the plate to a greater thickness.

12-3. WEAVING

When it is necessary to cover a wider area in one pass of the electrode, a method known as weaving is employed. In this the electrode is moved or oscillated from side to side in a set pattern. In order to be sure of uniform deposits, it is necessary to use a definite pattern such as those illustrated in Figure 12-11. While weaving is helpful, particularly when building up metal, it should be limited to weaves not exceeding 2-1/2 times the diameter of the electrode.

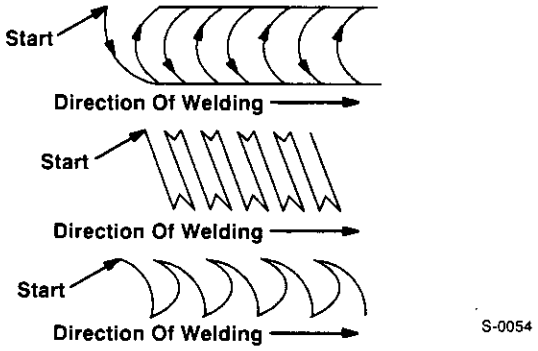


Figure 12-11. Weave Patterns

12-4. BUTT JOINTS

Up to this point the discussion has covered only the deposit of beads on flat plate. Such operations are helpful in building up worn parts or applying hardfacing materials. The next step is learning to weld two pieces of metal together. For this purpose, other types of welds are illustrated in Figure 12-12.

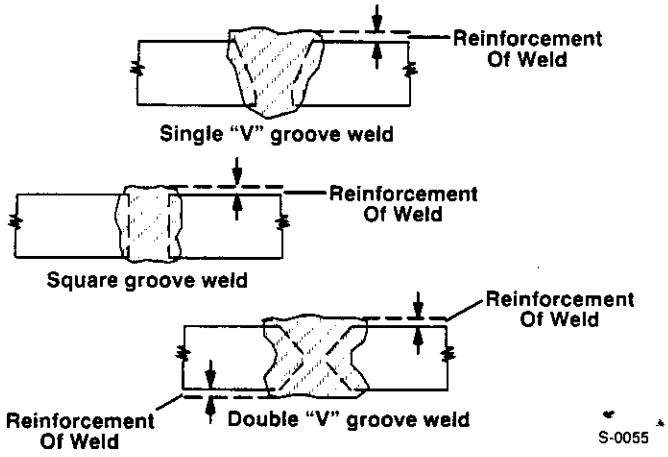


Figure 12-12. Butt Joint Welds

In making weld beads previously described, it was probably noted that depositing weld metal on one side of the plate, caused it to "curl" up towards the weld; this is called distortion and will almost always be found when heat is applied locally to a metal plate. Similarly in making a butt weld, distortion will cause the edges of the plate to draw together ahead of the electrode travel. This is caused by the contraction of the deposited weld metal on cooling. This may be overcome by spreading the edges of the joint apart on a taper of about 1/8" per foot.

Another procedure to avoid metal movement caused by weld heat is to make short welds, tying the two pieces together at spaced intervals. This is known as tack welding and holds the metal in position for welding.

In making welds in a butt joint, preparation of the edges may be necessary to insure good results. In shielded metal arc welding it is a common practice to weld thin materials up to 3/16" thick without any special preparation using the square groove butt joint. For thickness of 3/16" and over, either the single or double "V" groove is employed. Generally the single "V" groove will be satisfactory on thicknesses up to 3/4", regardless of thickness, where one can work on the weld from one side only.

One method for beveling steel for "V" groove welding is by means of using an oxyacetylene cutting torch. The work may be done with a hand guided torch or special oxyacetylene cutting machine. However, in performing this cutting, a scale will develop on the plates. This must be removed by grinding or chipping before welding as it is likely to become entrapped in the weld bead and produce an unsound weld. Where oxyacetylene cutting equipment is not available, grinding will probably be the best means of preparing bevels. The angles of these bevels should be about 30 degrees and the bottom edge may be left square for a distance of about 1/16". See Figure 12-13.

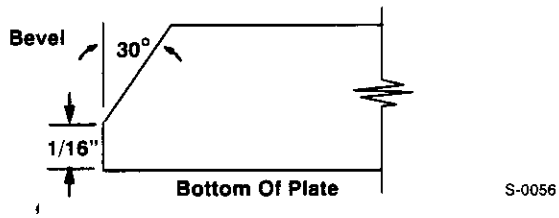


Figure 12-13. Single Bevel

Practice making butt welds starting on thin material about 1/8" thick (avoid very thin material, around 1/16" thick, in the beginning as this requires a fair degree of skill). Separate the squared edges of the 1/8" material about 1/16" and make a butt weld all the way through with a 1/8" electrode. Probably the first attempt will either fail to penetrate the sheet or burn through it. Keep trying, adjusting the current within the recommended range; also vary the electrode travel speed to give the desired weld. Having mastered 1/8" thick metal, proceed to a similar exercise on 1/4" thick metal. This time, however, deposit a bead on each side of the joint and try to fuse one to the other. Since the weld from one side is in effect an 1/8" thickness, no bevel is needed.

Next make a single "V" groove on 1/4" plate beveled 30 degrees. Start with a 1/8" electrode at the bottom of the groove and finish over that with a 5/32" electrode. Be sure to penetrate about 1/32" beyond the bottom of the "V" (called the root). When skill has been acquired on the 1/4" material, proceed to 3/8" and then to 1/2", also make the double "V" groove butt joints. Generally speaking, it will be necessary to deposit a bead or layer for each 1/8" thickness. On the heavier plates, weaving the top layers may be necessary to fill the groove completely.

When making practice butt welds it is wise to check the results occasionally. Where elaborate testing equipment is not available, this may be done with a hammer and vise.

Caution should be observed in handling welded pieces of metal, since heat absorbed by the metal is intense and can cause serious burns.

Grip a short, welded piece with the weld just above the jaws of the vise. Hammer it in a direction than tends to open the bottom root side of the weld, in the manner shown in Figure 12-14. A good weld will not break under this test, but will bend over. If the weld breaks, examine it to determine the cause. If there are a large number of holes (the weld looks spongy) it is porous. This is probably due to holding too long an arc. If there are bits of slag in the weld perhaps the arc was too short or the electrode was manipulated incorrectly thus permitting molten slag from the electrode coating to be trapped. This is quite likely to happen on a "V" joint made in several layers and calls for thorough cleaning between layers. Perhaps on breaking it will be found that the original surface of the bevel is still evident. That means that is was not melted and the cause is quite likely to be found in too fast a travel speed or insufficient heat.

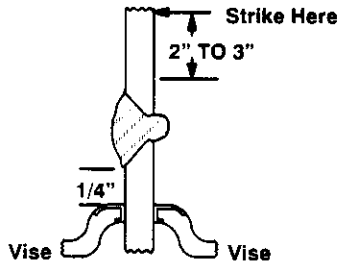


Figure 12-14. Weld Test

12-5. TEE AND LAP JOINTS

The other basic type of weld, the fillet weld, is used for making tee and lap joints. For this type of welding, no special preparation, other than squared edges, is necessary. Typical welded tee and lap joints are pictured in Figures 12-15 and 12-16 respectively.

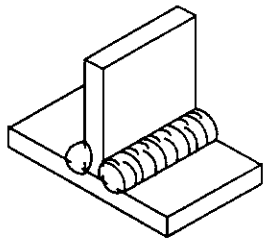


Figure 12-15. Tee Joint

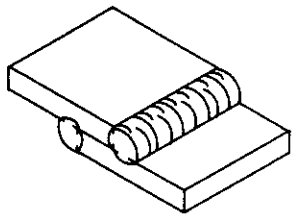


Figure 12-16. Lap Joint

Considering the tee joint first, it will be seen immediately that the position of the pieces requires a different method of electrode manipulation than for a butt weld. The method of holding the electrode for butt welds will not be satisfactory.

To deposit a single pass fillet weld, hold the electrode as shown in Figure 12-17. This will provide fusion into the corner and a fillet, the side of which will be approximately equal. For maximum strength a fillet weld should be deposited on each side of the upright section. When a heavier fillet is needed, deposit a second layer as indicated in Figure 12-18, using any of the weaving patterns shown in Figure 12-19.

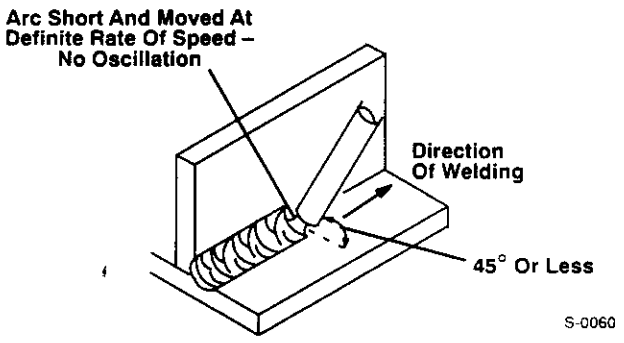


Figure 12-17. Tee Joint Fillet Weld

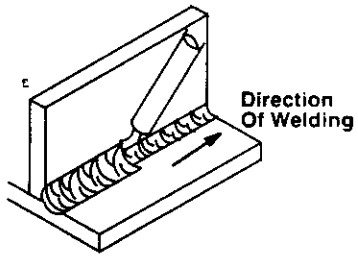


Figure 12-18. Multi-Layer Deposits – Tee Joint

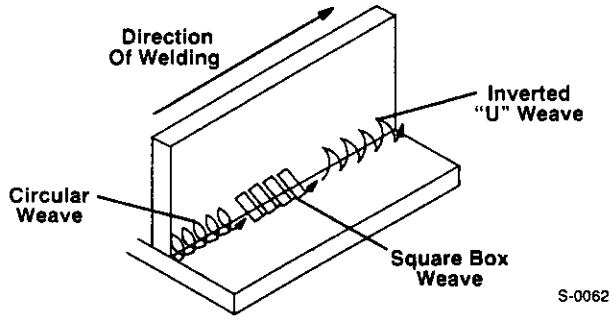


Figure 12-19. Tee Joint Fillet Weld Weave Patterns

The lap joint, while involving the same fundamental weld type, the fillet, has metal distributed differently and therefore requires still another technique. The details of the application are given in Figure 12-20, for a single pass weld. For a two pass weld, Figure 12-21 provides the details.

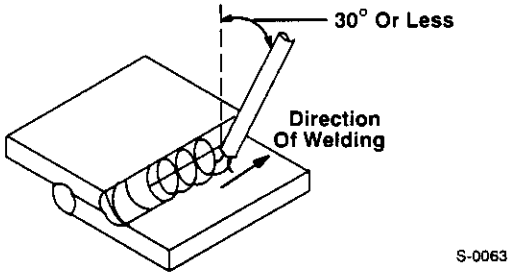


Figure 12-20. Lap Joint Fillet Weld

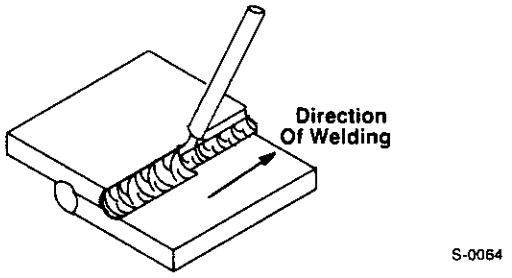


Figure 12-21. Multi-Layer Deposit Lap Joint

12-6. WELDING VERTICALLY, HORIZONTALLY, AND OVERHEAD

The importance of welding in the flat position, whenever possible, cannot be stressed too strongly. The quality of the weld is better, the operation easier and faster. However, occasions will arise when it is necessary to work on parts in a position in which welds must be deposited horizontally, vertically and overhead. It must be realized at the very beginning that welding in these positions is difficult and will require constant practice to develop skill.

As is the case of welding in the flat position, it is best to start practicing by first running weld beads in the various positions. Then as proficiency is gained on these operations, practice may be continued on butt and fillet welds (tee and lap joints) in these positions.

One of the first facts to be noted when welding in these positions is that the force of gravity tends to cause the molted metal to drip (fall) down. The technique used, therefore, must be acquired to overcome this. Start by making horizontal weld beads on plates inclined at 45 degrees as shown in Figure 12-22. When this has been mastered so that uniform beads can be made consistently, practice on welding vertically may be started. Again begin with an easy operation such as running beads vertically on plates set at 45 degrees. (See Figure 12-23.)

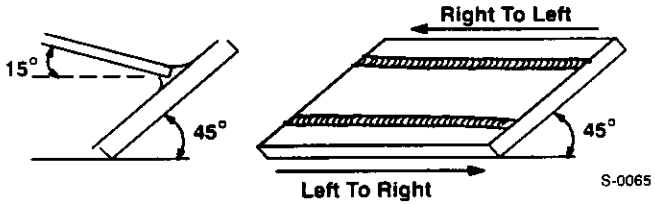


Figure 12-22. Horizontal Weld Beads – Inclined Plate

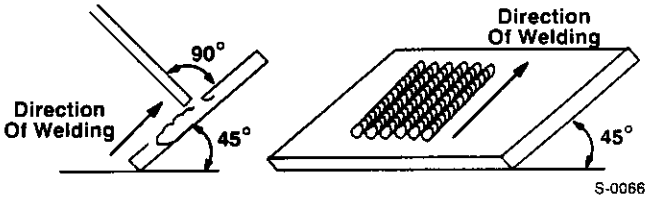


Figure 12-23. Vertical Weld Beads – Inclined Plate

To progress with this practice it is necessary now to move the plates into vertical position. The details of horizontal weld beads are given in Figure 12-24.

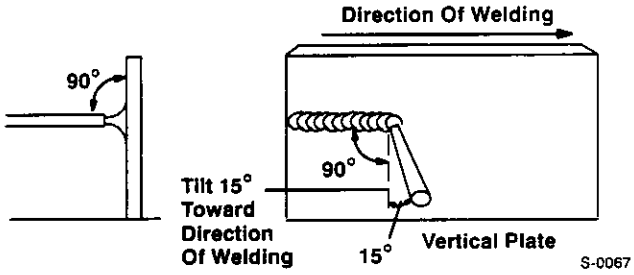


Figure 12-24. Horizontal Weld Beads – Vertical Plate

Welding vertically may be performed either by welding upward or starting from the top and welding down. It is generally conceded that working upward is easier and therefore, weld beads in this manner should be practiced. A method for making weave weld beads is illustrated in Figure 12-25.

Since single weld beads are of limited value, weaving weld beads must be practiced on butt welds in the vertical and horizontal positions.

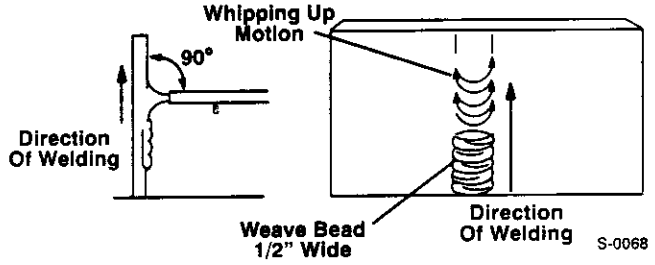


Figure 12-25. Weave Pattern – Vertical Plate

Figure 12-26 provides information suitable for single pass vertical butt weld or the first pass of a multiple layer deposit. Two methods of depositing the subsequent layers are given in Figure 12-27.

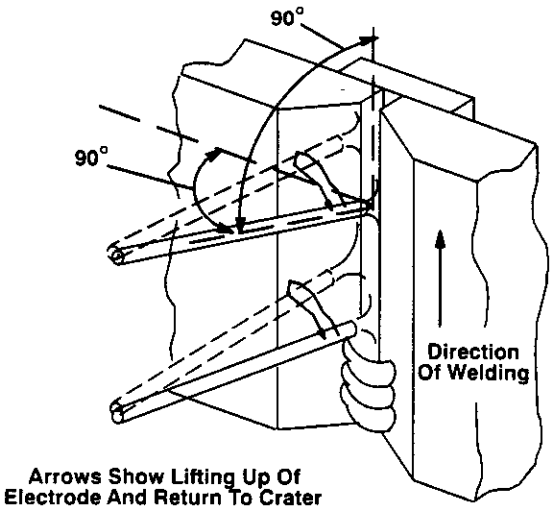


Figure 12-26. Single Pass – Vertical Butt Weld

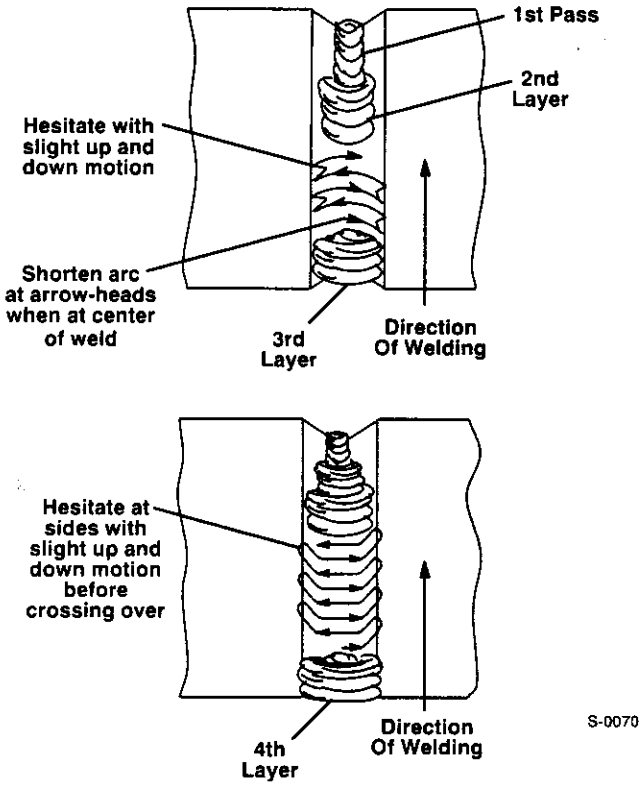


Figure 12-27. Multi-Layer Deposit – Vertical Butt Weld

The details for horizontal welds are shown in Figures 12-28 and 12-29. Note that a strip of metal is shown at the foot of the weld. This is known as the backing strip. Its use permits securing a sound root pass without great difficulty. In use, the beveled plate edges should be centered on the backing strip and the strip tack welded to the plates on the reverse side.

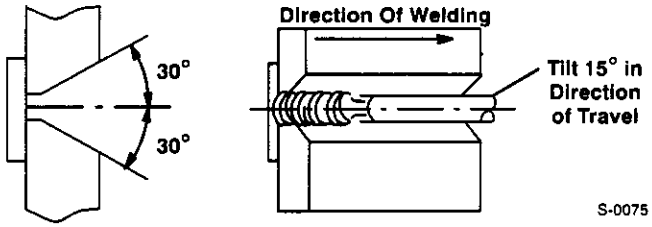


Figure 12-28. Root Pass

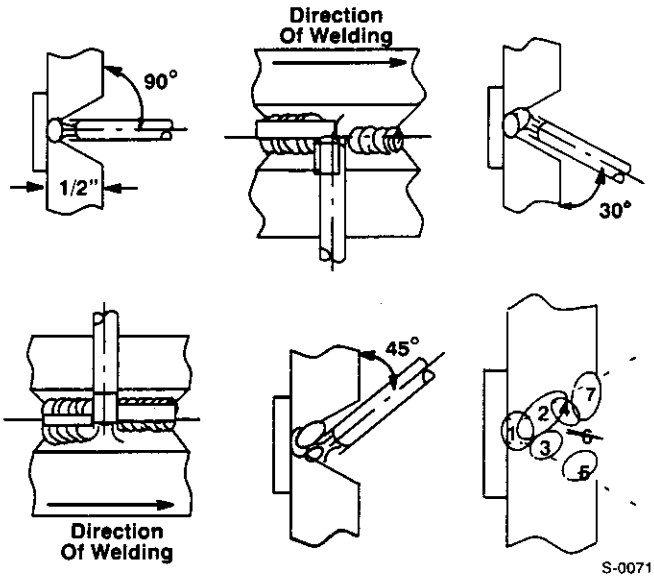


Figure 12-29. Multi-Layer Deposit – Horizontal Butt Weld

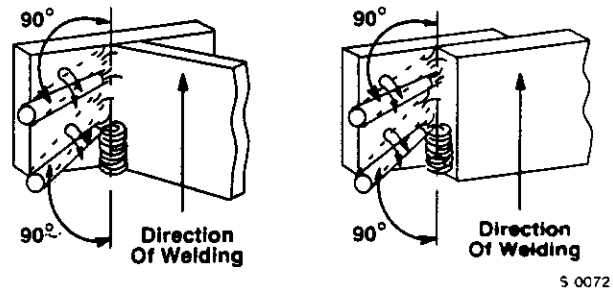


Figure 12-30. Fillet Weld – Vertical Tee Joint

For fillet welds on tee and lap joints the technique is shown in Figure 12-30. When depositing a multilayer fillet weld, the same method would be used to deposit the first layer on both lap and tee joints. For depositing subsequent layers on tee joints two means are used and are shown in Figure 12-31. For additional layers on lap joints a somewhat similar weave may be seen in Figure 12-32.

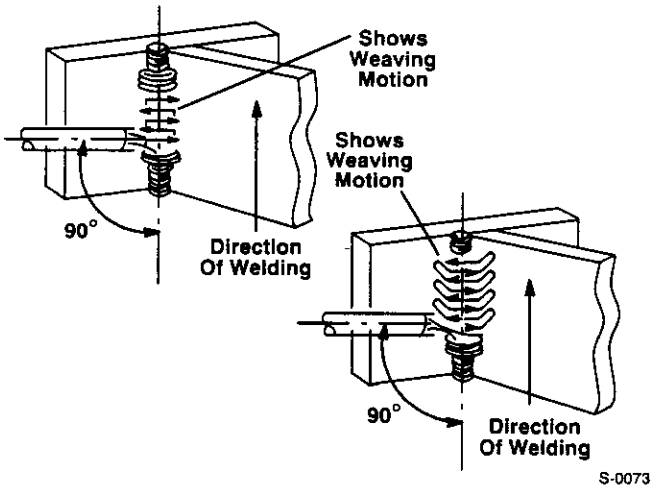


Figure 12-31. Multi-Layer Deposit – Tee Joint

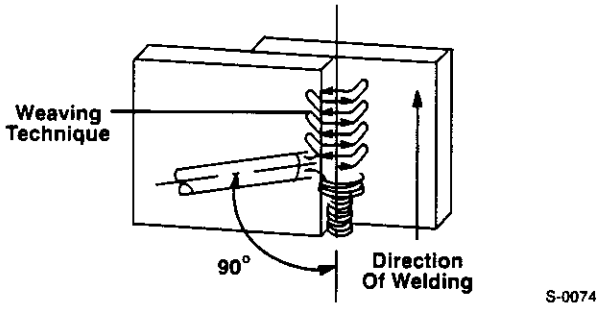


Figure 12-32. Multi-Layer Deposit – Lap Joint

Welding in the overhead position is the final problem to master. Again proceed through the steps of making weld beads, the making of butt welds and finally the making of fillet welds. For the electrode position of overhead welding Figure 12-33 will prove helpful. When weaving is necessary, the pattern in Figure 12-34 may be used. The technique for overhead butt welds is illustrated in Figure 12-35; this covers single pass welds or the first pass of multilayer welds. Subsequent beads may be deposited as shown in Figure 12-36. For depositing single layer fillets or the first layer of multiple fillets in the overhead position the technique in Figure 12-37 should be employed. The sequence for depositing beads on a multilayer fillet weld is provided in Figure 12-38. Note that single beads are recommended and for that reason use the same technique shown in Figure 12-37. Again the technique for fillet welds may be employed for welding lap joints.

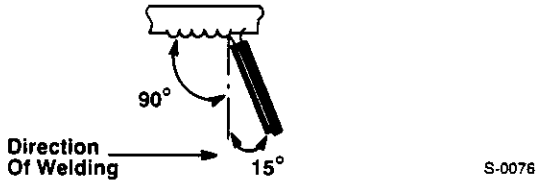


Figure 12-33. Electrode Position – Overhead Weld

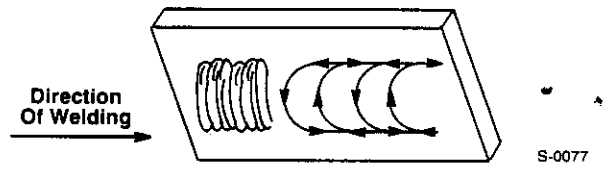


Figure 12-34. Weave Pattern – Overhead Weld

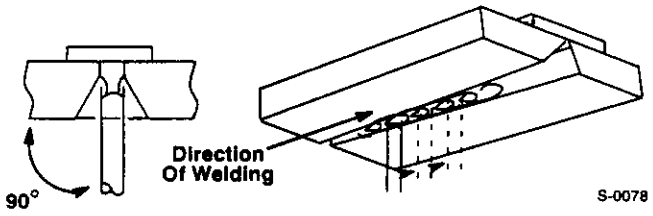


Figure 12-35. Overhead Butt Weld – Root Pass

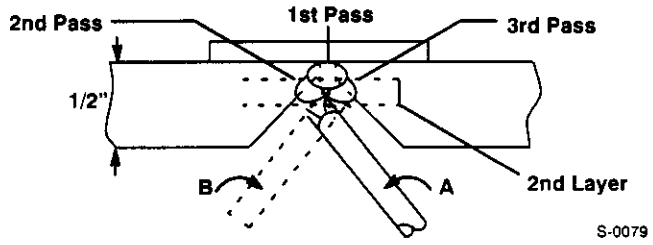


Figure 12-36. Multi-Layer Deposit – Overhead Butt Weld

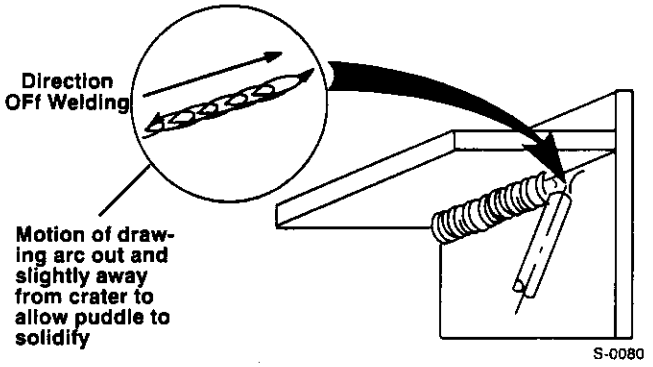


Figure 12-37. Overhead Weld Tee Joint – Single Pass

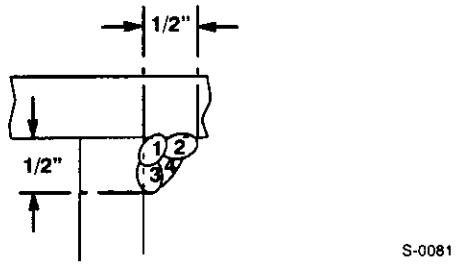


Figure 12-38. Multi-Layer Deposit – Overhead Tee Joint

12-7. CONCLUSION

It may be appreciated that no printed instruction can impart to the beginner all the skill necessary for successful welding. Personal instruction by an experienced welding operator is the best means for accomplishing this end. Therefore, an effort should be made to secure some facility for instruction and practice under competent supervision. In any event the beginner should at least secure the benefit of criticism of finished welds by a qualified welding operator.

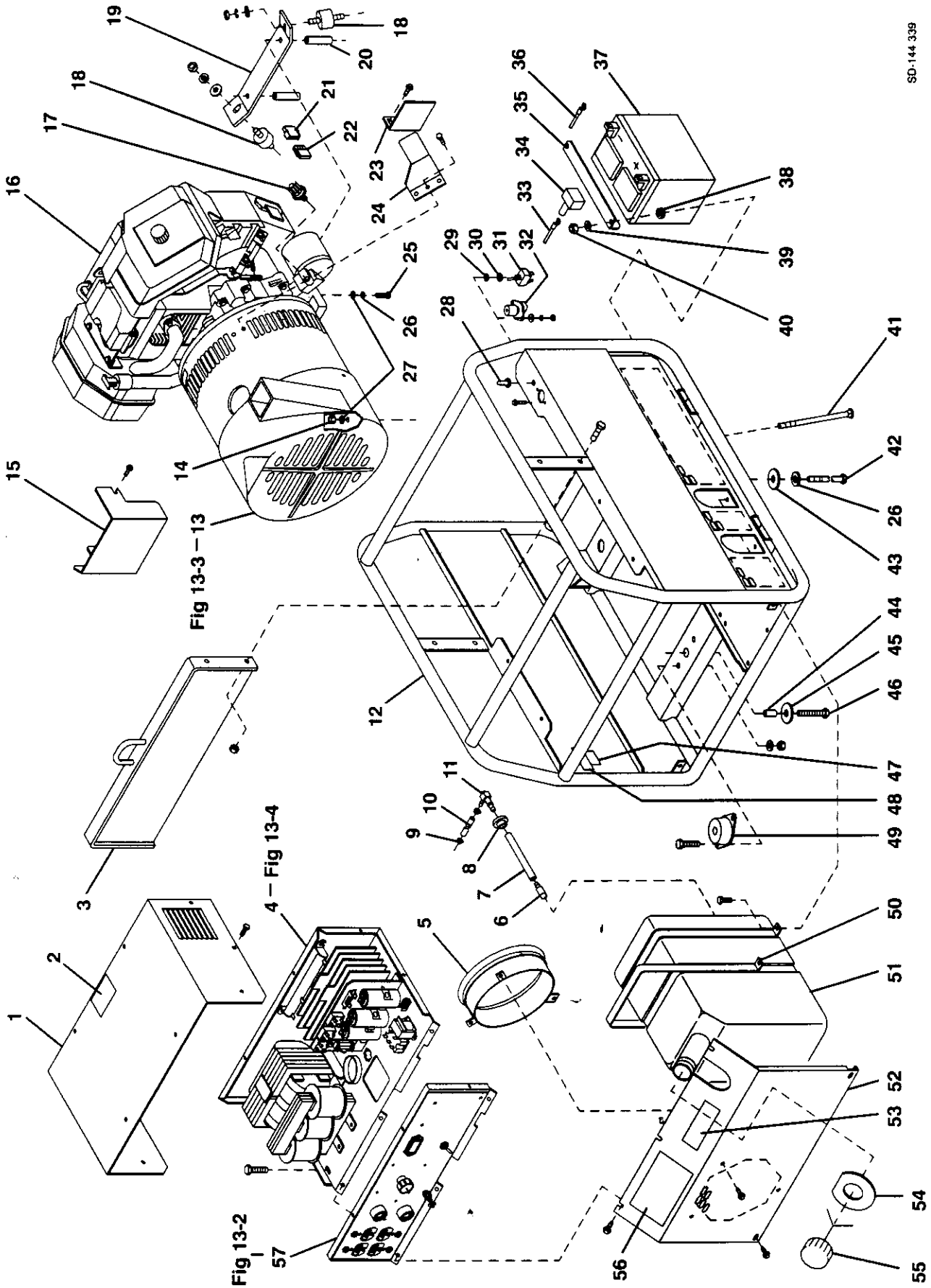


Figure 13-1. Main Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
			Figure 13-1. Main Assembly	
1		+141 036	COVER, top	1
2		108 487	LABEL, warning falling equipment	1
3		141 209	UPRIGHT, base	1
4		Fig 13-4	CONTROL BOX	1
5		128 333	BAFFLE, air intake	1
6		126 239	SCREEN, fuel line pick-up 5/16tbg	1
7		127 405	TUBING, urethane ester .250 ID x .312 OD x 5.000	1
8		124 253	BUSHING, tank fuel	1
9		084 173	CLAMP, hose .460-.545clp dia slfttng	2
10		107 816	HOSE, SAE .250 ID x .500 OD (order by ft)	2ft
11		124 252	FITTING, hose stl elb 1/4tbg	1
12		141 027	BASE	1
13		Fig 13-3	GENERATOR/SHROUD	1
14		010 909	NUT, stl slflkg hex reg .375-16	1
15		142 155	DUCT, air engine	1
16		141 453	ENGINE, Kohler gas elec	1
17	S4	142 095	SWITCH, pressure oil 4PSI	1
18		125 802	MOUNT, eng nprn .312-18 dual stud	2
19		141 033	BRACKET, mtg engine	1
20		141 029	TUBING, stl .625 OD x 12ga wall x 1.625 lg	2
21			HOUSING w/SOCKETS, (see engine parts list)	1
22	PLG2	114 063	HOUSING, term plug nyl 4cont 1 row	1
		113 633	TERMINAL, male 1 pin 20-14 wire	4
23		141 559	PADDLE, solenoid	1
24	TS1	142 291	SOLENOID, idle	1
25		601 965	SCREW, cap stl hexhd .375-16 x 1.000	1
26		602 213	WASHER, lock stl split .375	2
27		010 910	WASHER, flat stl SAE .375	2
28		021 385	BOOT, tgl switch lever	1
29		602 222	WASHER, lock stl intl tooth .437	1
30		605 321	NUT, stl hex .468-32	2
31	S2	011 611	SWITCH, tgl DPDT 15A 125V	1
32	PB1	141 670	SWITCH, starter push button	1
33		142 108	CABLE, bat pos	1
34		052 553	COVER, cable bat post red No. 4-10 wire	1
35		141 205	BRACKET, hold down battery	1
36		142 102	CABLE, bat neg	1
		142 103	CABLE, grd	1
37	BATT	003 426	BATTERY, stor 12V 230crk 32RSV	1
38		604 311	GROMMET, rbr .250 ID x .375mtg hole	2
39		604 538	WASHER, flat stl SAE .312	2
40		604 433	NUT, stl slflkg hex hvy .312-18	2
41		604 435	BOLT, crg stl .312-18 x 7.000	2
42		009 043	SCREW, cap stl hexhd .375-16 x 3.000	2
43		010 955	WASHER, flat stl .406 ID x 2.000 OD x .125thk	2
44		010 047	TUBING, stl .625 OD x 12ga wall x 1.000	1
45		010 954	WASHER, flat stl .406 ID x 1.250 OD x .125thk	1
46		127 595	SCREW, cap stl hexhd .375-16 x 2.500	1
47		011 198	LABEL, warning fan	1
48		013 367	LABEL, warning moving parts etc	1
49		127 593	MOUNT, gen nprn adapter	1
50		125 738	STRAP, hold down fuel tank	1
51		142 157	TANK, fuel 3.8gal	1
52		+141 037	PANEL, front lower	1
53		132 709	LABEL, engine fuel can cause fire or explosion	1
54		126 723	WASHER, neck tank fuel	1
55		126 994	CAP, fuel tank screw on	1
56		134 792	LABEL, warning general precautionary	1
57		Fig 13-2	PANEL, front w/components	1

+When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

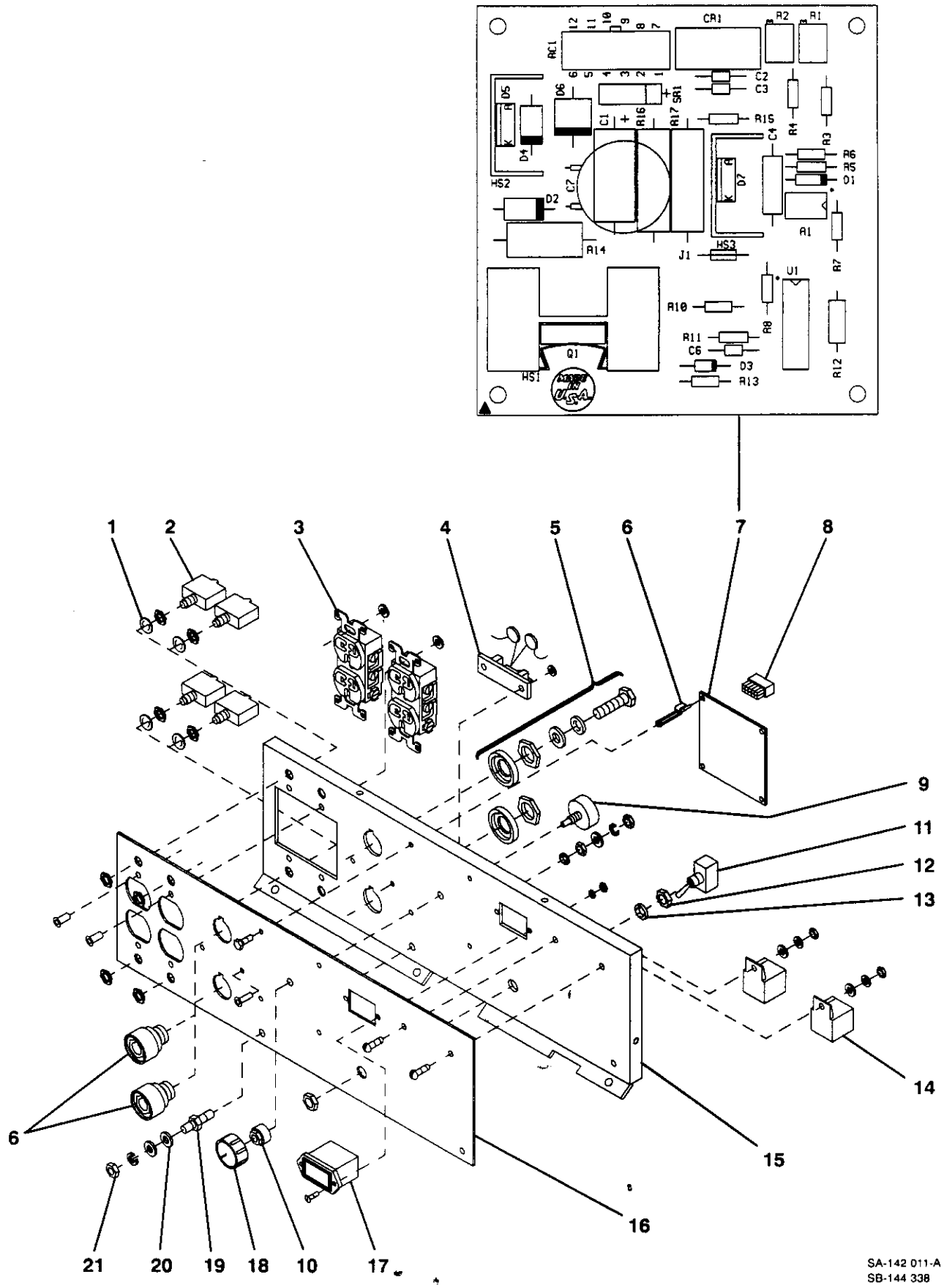


Figure 13-2. Panel, Front w/Components

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
			Figure 13-2. Panel, Front w/Components (Fig 13-1 Item 57)	
1		602 221	WASHER, lock stl intl tooth .375	4
2	CB1-4	+125 524	CIRCUIT BREAKER, man reset 1P 15A 250V	4
	CB2,4	♦144 474	CIRCUIT BREAKER, man reset 1P 25A 250V	2
3	RC1,2	++039 684	RECEPTACLE, str dx grd 2P3W 15A 125V	2
		073 690	PLUG, str grd armd 2P3W 15A 125V	
	RC2	♦129 067	RECEPTACLE, twlk grd 3P4W 30A 125/250V	1
		088 898	PLUG, twlk grd 3P4W 30A 125/250V	
	RC2	♦♦604 103	RECEPTACLE, str dx grd 2P3W 15A 250V	1
		025 234	PLUG, str grd 2P3W 15A 250V	
4	C3,4	131 646	CAPACITOR ASSEMBLY	1
5	Neg, Pos	129 525	RECEPTACLE, jack 400A	2
		042 418	CONNECTOR KIT, Dinse male 50 series (consisting of)	2
		134 746	· WRENCH, hex 5mm short	1
6		136 927	STAND-OFF SUPPORT, PC card No. 6scr	4
7	PC1	142 010	CIRCUIT CARD, field current regulator (consisting of)	1
	A1	009 159	· IC, linear 358	1
	C1	000 859	· CAPACITOR, elctlt 220uf 35VDC	1
	C2,3,6	122 723	· CAPACITOR, cer mono .1uf 50VDC	3
	C4	031 699	· CAPACITOR, polye film .0022uf 200VDC	1
	C7	028 291	· CAPACITOR, cer disc .1uf 500VDC	1
	CR1	093 192	· RELAY, encl 24VDC DPDT	1
	D1	037 399	· DIODE, sig .0085A 60V	1
	D2	087 294	· DIODE, fast recovery 3A 400V	1
	D3	037 243	· DIODE, zener 18V 1W	1
	D4	070 250	· DIODE, rect 3A 600V	1
	D5,7	129 310	· DIODE, fast recovery 8A 400V	2
	D6	117 566	· DIODE, rect 6A 600V	1
	HS1	126 906	· HEAT SINK, case	1
	HS2,3	105 489	· HEAT SINK, solderable tap .960mtg	2
		126 907	· CLIP, spring heat sink	1
	J1	092 648	· RESISTOR, WW fxd zero ohm	1
	Q1	126 069	· TRANSISTOR, mosfet 16A 400V	1
	R1	035 848	· POTENTIOMETER, cermet trmr 25/T .5W 10K ohm	1
	R2	009 391	· POTENTIOMETER, cermet trmr 25/T .5W 50K ohm	1
	R3	039 332	· RESISTOR, CF .25W 15K ohm	1
	R4	039 331	· RESISTOR, CF .25W 4.7K ohm	1
	R5	039 335	· RESISTOR, CF .25W 47K ohm	1
	R6	052 145	· RESISTOR, MF .25W 475K ohm	1
	R7	000 885	· RESISTOR, MF .25W 10K ohm	1
	R8,10	044 789	· RESISTOR, MF .25W 100K ohm	2
	R11	035 886	· RESISTOR, CF .25W 22K ohm	1
	R12	074 056	· RESISTOR, C .5W 390 ohm	1
	R13	108 432	· RESISTOR, MF .25W 2.21K ohm	1
	R14	604 178	· RESISTOR, C 2W 100 ohm	1
	R15	035 825	· RESISTOR, CF .25W 1K ohm	1
	R16	089 318	· RESISTOR, WW fxd 5W .1 ohm	1
	R17	133 711	· RESISTOR, WW fxd .5W .05 ohm	1
	RC1	116 512	· TERMINAL, hdr 12 pin	1
	SR1	021 939	· RECTIFIER, integ 1.5A 400V	1
	U1	095 710	· IC, linear 3524B	1
8	PLG1	130 203	HOUSING PLUG & SOCKETS, (consisting of)	1
		113 746	· TERMINAL, female 1skt 24-18 wire	12
9	R1	072 462	POTENTIOMETER, w/shaft lock (consisting of)	1
10		072 590	· LOCK, shaft pot .375-32 x .250dia shaft	1
11	S3	089 085	SWITCH, tgl SPST 20A 125VAC	1
12		605 321	NUT, stl hex .468-32	2
13		602 222	WASHER, lock stl intl tooth .437	1
14	CR3,4	090 104	RELAY, encl 12VDC SPST 30A	2
15		141 038	PANEL, front	1

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
			Figure 13-2. Panel, Front w/Components (Fig 13-1 Item 57)	
16			NAMEPLATE, (order by model & serial number)	1
		♦♦♦042 367	HOUR METER, (consisting of)	1
17	HM	032 936	· METER, hour 4-40VDC	1
		604 784	· SCREW, mach brs rdh 6-32 x .500	2
		601 829	· NUT, brs hex 6-32reg	2
18		097 924	KNOB, pointer	1
19		083 030	STUD, brs grd .250-20 x 1.750	1
20		010 915	WASHER, flat brs .250 ID x .625 OD x .031thk	2
21		601 836	NUT, brs hex .250-20 jam hvy	3

+Circuit Breaker (CB1,3) (CB1-4) remains the same for Option 042 625 and 042 627 Receptacle Kits respectively.
++Receptacle (RC1) remains the same for Option 042 625 and 042 627 Receptacle Kits.
♦Part of Option 042 625 240V Twistlock Receptacle Kit.
♦♦Part of Option 042 627 240V Duplex Receptacle Kit.
♦♦♦OPTIONAL
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Part No.	Description	Quantity

Figure 13-3. Generator/Shroud (Fig 13-1 Item 13)

1	125 548	HOLDER, brush elect	1
2	005 614	HOLDER, brush	2
3	*126 984	BRUSH w/SPRING	2
4	047 885	CAP, brushholder	2
5	047 879	BAR, retaining brushholder 2 brushes	1
6	143 220	O-RING, 2.859 ID x .139CS	1
7	013 367	LABEL, warning moving parts etc	1
8	142 153	ROTOR, generator (consisting of)	1
9	024 617	· RING, retaining ext 1.272 shaft x .050thk	1
10	053 390	· BEARING, ball rdl sgl row 1.370 x 2.830 x .6	1
11	127 786	KEY, stl .250 x .250 x 1.000	1
12	142 156	SCREW, cap stl hexhd .375-16 x 1.750	4
13	602 213	WASHER, lock stl split .375	4
14	010 910	WASHER, flat stl SAE .375	4
15	141 129	ADAPTER, engine	1
16	141 042	STUD, stl .312-18 x 10.625	4
17	020 279	CLAMP, stl cush .750dia x .281mtg hole	3
18	+142 216	STATOR, gen (consisting of)	1
	004 214	· BUSHING, snap-in nyl 1.625 ID x 2.000mtg hole	1
19	142 980	ENDBELL, gen	1
20	128 154	FAN, rotor	1
21	127 596	WASHER, flat stl .344 ID x 1.500 OD x .125thk	1
22	128 341	CLAMP, hose 1.880-2.060clp dia	1
23	126 582	SHROUD, fan	1

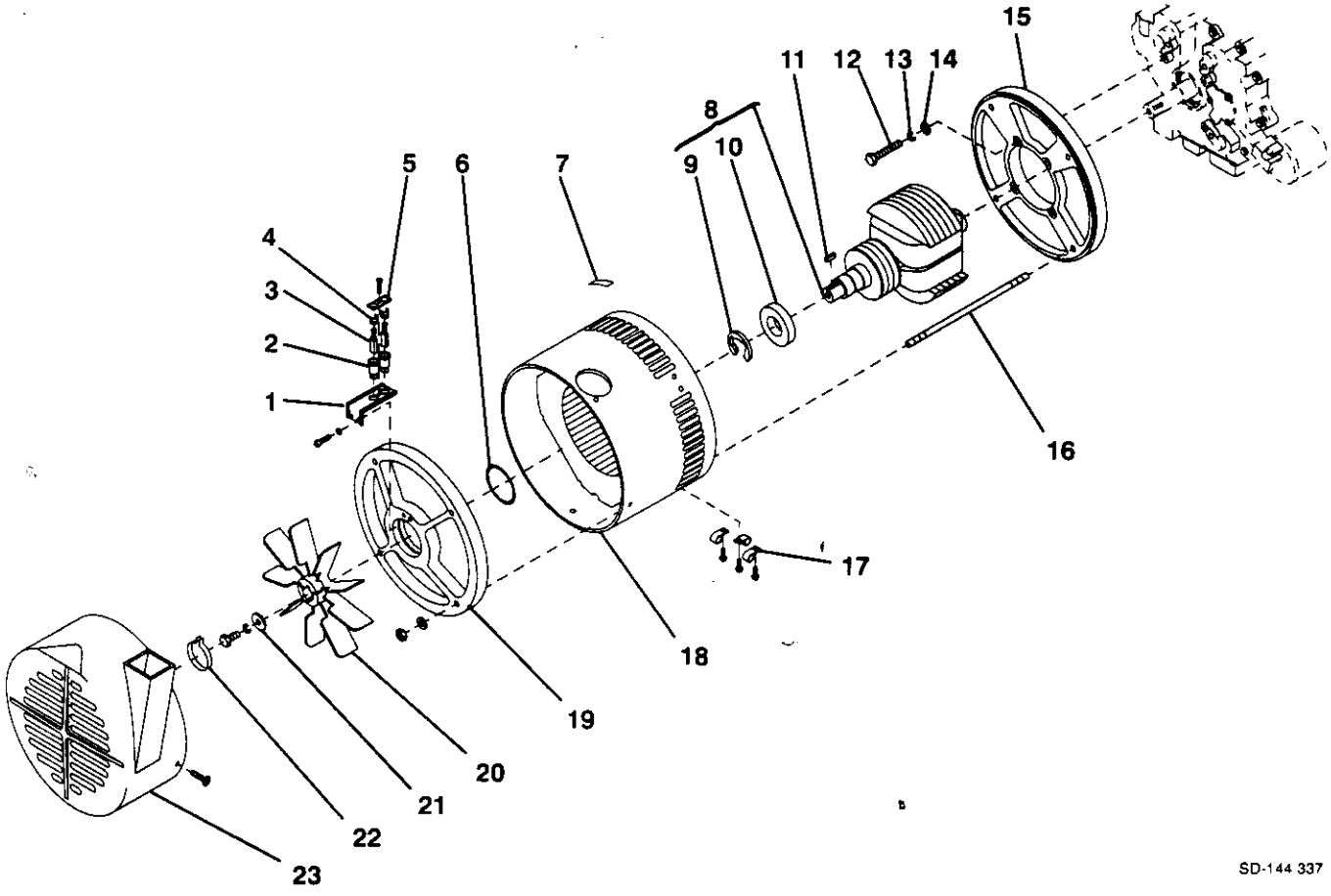


Figure 13-3. Generator/Shroud

*Recommended Spare Parts.
+When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity

Figure 13-4. Control Box (Fig 13-1 Item 4)

1	DCZ	128 183	STABILIZER	1
2	CT1	105 370	TRANSFORMER, current	1
3	SR1-3	035 704	RECTIFIER, integ 40A 800V	3
4	R3,VR1	046 819	SUPPRESSOR	1
5		127 783	BRACKET, mtg rect	1
6	SR4	141 781	RECTIFIER, si 3ph 200A 400PIV	1
7		012 571	HOLDER, fuse mintr .250 x 1.250 clip	1
8	F1	*027 419	FUSE, mintr cer 15A 250V	1
9		087 111	CLAMP, capacitor 1.375dia clip	3
10	C1,2	087 110	CAPACITOR, elctlt 240uf 200VDC	3
11		141 035	ENCLOSURE, mtg components	1
12	R2	142 277	RESISTOR, WW fxd 100W 250 ohm	1
13		129 524	TERMINAL, frict male .250 x .032 3 pair	1
14	T1	141 210	TRANSFORMER, control isolation	1
15	PC2	123 056	MODULE, pull to idle 5 pin	1
16	PLG3	135 556	HOUSING PLUG & SOCKETS, (consisting of)	1
		114 066	· TERMINAL, female 1skt 20-14 wire	6
17		004 214	BUSHING, snap-in nyl 1.625 ID x 2.000mtg hole	1
18	RC3	116 045	HOUSING PLUG & PINS, (consisting of)	1
		113 633	· TERMINAL, male 1 pin .084dia 20-14 wire	6
19	CT2	126 296	TRANSFORMER, current	1

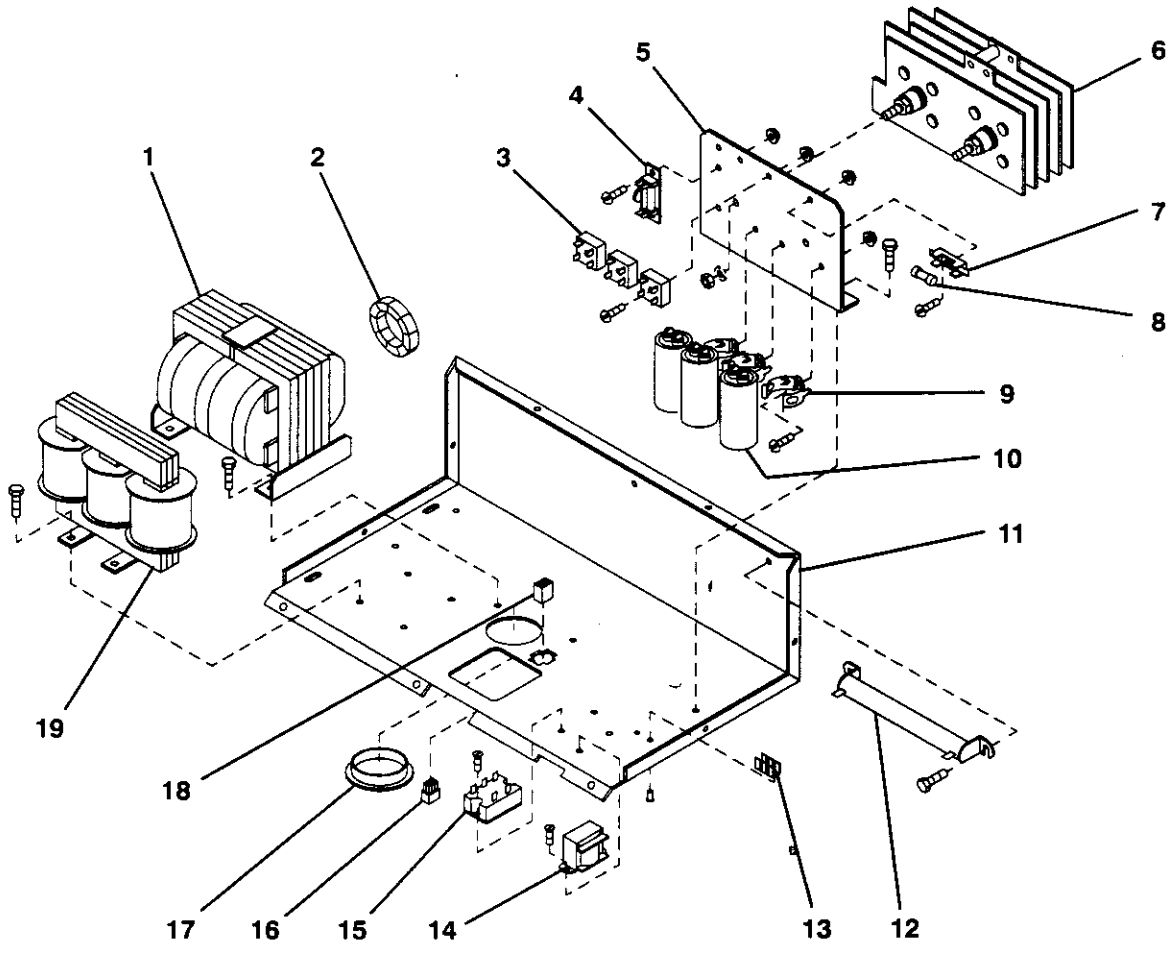


Figure 13-4. Control Box

*Recommended Spare Parts.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Dia. Mkgs.	Part No.	Description	Quantity
		Optional Equipment	
HM	042 367	HOUR METER, (see Fig 13-2)	1
	042 625	RECEPTACLE KIT, twlk 240V (see Fig 13-2)	1
	042 627	RECEPTACLE KIT, duplex 240V (see Fig 13-2)	1
	042 618	RECOIL STARTER KIT	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.