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Pulse+ Add-on Pulse system

OWNERS MANUAL



SAFETY CONSIDERATIONS

ELECTRIC ARC WELDING EQUIPMENT

CAUTION : READ BEFORE ATTEMPTING INSTALLATION, OPERATION OR MAINTENANCE OF THIS EQUIPMENT

1-1 INTRODUCTION

This equipment is intended for ultimate application by commercial/industrial users and for operation by persons trained and experienced in the use and maintenance of welding equipment. Operation should not be undertaken without adequate training in the use of such equipment. Training is available from many public and private schools or similar facilities.

Safe practices in the installation, operation and maintenance of this equipment requires proper training in the art, a careful study of the information provided with the equipment, and the use of common sense. Rules for safe use are generally provided by suppliers of welding power sources, compressed gas suppliers, and electrode suppliers. Careful compliance with these rules will promote safe use of this equipment.

The following Safety Rules cover some of the more generally found situations. READ THEM CAREFULLY. In case of any doubt, obtain qualified help before proceeding.

1-2 GENERAL PRECAUTIONS

A. Burn Prevention

ELECTRIC ARC WELDING PRODUCES HIGH INTENSITY HEAT AND ULTRAVIOLET RADIANT ENERGY WHICH MAY CAUSE SERIOUS AND PERMANENT EYE DAMAGE AND WHICH MAY DAMAGE ANY EXPOSED SKIN AREAS.

Wear helmet with safety goggles or 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.

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.

Wear protective clothing - leather (or asbestos) gauntlet gloves, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

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

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

Hot metal such as electrode stubs and

work pieces should never be handled without gloves.

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

B. Toxic Fume Prevention

WARNING: The use of this product may result in exposure to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Adequate ventilation. 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. NEVER ventilate with oxygen.

Lead-, cadmium-, zinc-, mercury-, 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, or the operator wears 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 reentering 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 can fly many 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:

1. Appreciable combustibles (including building construction) are within 35 feet.
2. Appreciable combustibles are further than 35 feet, but can be ignited by sparks.
3. Openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks.
4. 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 in accordance with industry standards.

This includes: a thorough steam or caustic cleaning (or a solvent of water washing, depending on the combustible's solubility), followed by

purging and inerting with nitrogen or carbon dioxide, and using protective equipment.

Water-filling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see paragraph above). 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

The safe handling of compressed gas equipment is detailed in numerous industry publications. The following general rules cover many of the most common situations.

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 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 stuck.

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 55 degrees C (130 degrees 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 cannot 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. Do NOT use 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 agree, 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 shut-off.

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

Check for leaks on first pressurization and regularly thereafter. Brush with soap solution. Bubbles indicate leaks. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

Follow all Safety Rules.

Remove leaky or defective equipment from service immediately for repair. Read and follow user manual instructions.

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.

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.

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 in addition to gloves, hat, and shoes. As necessary, use additional protective clothing such as leather jacket or sleeves, flameproof 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. Eyes may be damaged by radiant energy when exposed to the electric arc, even when not looking in the direction of the 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 be passed 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

Enclose the welding area. For production welding, a separate room or enclosed

bay is best. In open areas, surround the operation with low-reflective, noncombustible 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 later under rough handling.

D. Compressed Gas Equipment

Comply with precautions in 1-2D.

E. Shock Prevention

Exposed electrically 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:

Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat cannot be avoided. Sweat, sea water, or moisture between body and an electrically HOT part - or grounded metal - reduces the body surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

1. Grounding the Equipment

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

Three-phase connection. Check phase requirement of equipment before installing. If only three-phase power is available, connect single-phase equipment to only two wires of the three-phase line. **DO NOT**

connect the equipment ground lead to the third (live) wire, or the equipment will become 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 switch box, connect the ground lead to the grounded switch box. 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 ground prong.

2. Connectors

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

3. 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.

4. Terminals & Other Exposed Parts

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

5. Electrode Wire

Electrode wire becomes electrically HOT when the power switch of gas metal-arc welding equipment is ON and welding gun trigger is pressed. Keep hands and body clear of wire and other HOT parts.

6. 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.

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INTRODUCTION

MK Products' patented Pulse+ is a transistorized pulse-generating attachment which converts a conventional constant voltage (CV) D.C. power supply into a variable pulsed arc welding machine.

The Pulse+ is exceptionally simple to operate and may be used with any conventional constant voltage (CV) machine, up to 60 open circuit volts and 300 amperes continuous current output. It provides pulse rates continuously variable from 500 pulse per second, down to approximately 30 pulses per second. This of course, includes the frequencies of 60 and 120 pulse per second, available from thyristor supplies operating at line frequencies.

The power supply voltage control set the peak voltage, and the background level is a fixed value by design. The "On time" control is used to adjust the length of the pulse during metal transfer and can be used to apply more heat to the weld. The "Off time" control regulates how close the "on" pulses are together, which can reduce the amount of heat into the weld.

The Pulsed-arc process is a transfer process wherein spray transfer occurs at regular intervals rather than at random intervals. The welding current rapidly switches from high pulsed current to low background current level.

The background current sustains the arc, while each pulse supplies just enough power to free one droplet from the wire tip. In the time between pulses, the welding current is reduced, and no metal transfer occurs.

Pulsed spray uses a lower average current than in regular spray transfer. This lower average current makes it possible to weld out of position. By using a lower average, less heat is put into the metal, causing less distortion of the material being welded. Thin metal sections may also be welded more easily with pulsed spray, and it creates very little metal spatter. In addition, the pulse agitation aids in cleaning action and outgassing, which reduces porosity.

The pulsed spray transfer method can use larger diameter electrode wire and still produce a small weld. This is a great advantage, because larger diameter electrode are less expensive than smaller ones. Also, nonferrous wire of a larger diameter can be fed through the wire feeder much easier without risk of bending or jamming. This also allows using one size wire for a variety of jobs using many different thicknesses of metal and joint designs with just one setup in the wire feeder!

At MK Products, we stand behind every product manufactured and ensure that it is free from defects and will perform to the specification contained in this manual. If for ANY reason you are not completely satisfied with your purchase, we will make every effort to repair, replace, or refund your purchase.

That is my guarantee.

Douglas M Kensrue

President

MK Products

Section 1

SPECIFICATIONS

- PRIMARY POWER INPUT - 115VAC 50-60 Hz 1 Ampere
- WELDING POWER INPUT - D.C. 10-60 Volts 0 to 300 Amperes
- WELDING POWER OUTPUT - D.C. 10-58 Volts 0 to 300 Amperes
- PULSE CAPACITY
- Pulsed "On" Period - 1 to 10 milliseconds
 - Pulse "Off" Period - 1 to 20 milliseconds
 - Pulse Frequency Variable from 30 - 500 pps
- SIZE - 18"W x 8-3/4"H x 14"L
- WEIGHT - 31 lbs.
- ENVIRONMENT - 20 to 105 degrees F, 90% humidity without condensation 0 - 10,000 feet elevation. Units may be stacked vertically up to four high.
- AREA REQUIRED - Access required both front and back for connectors and four inches on sides for air circulation.
- PULSE OUTPUT VOLTAGE - Equals connected power supply output voltage, minus approximately a two volt drop.
- BACKGROUND LEVEL - Is automatically adjusted depending on connected power supply output voltage, wire characteristics, wire feed rate, and other welding characteristics. It will typically be 30 to 130 amperes.
- CONTROLS
- On/Off Switch
 - Pulse "On" Time - Controls high current density pulse duration which should be adjusted to achieve welding metal droplet formation, detachment, and axial transfer to work.
 - Pulse "Off" Time - Controls the average welding heat (energy) and should be adjusted to be consistent with wire feed speed used.
 - Voltmeter - Reads average voltage while welding.

Section 2

INSTALLATION INSTRUCTIONS

2.1 LOCATION

The Pulse+ should be located to provide adequate ventilation for cooling. There should be a minimum of four inches on each side.

CAUTION: Overheating of unit can cause possible damage to internal components.

There should be access to both the front and rear of the unit to allow quick disconnection of welding cables for applications not requiring pulse capabilities. For standard welding, the connectors can be locked together, thus removing the Pulse+ from the circuit.

CAUTION: DO NOT operate the Pulse+ in the OFF position. Doing so will cause damage to internal parts.

2.2 AUXILIARY POWER REQUIREMENTS

The Pulse+ is designed to operate on 220 volt 1 Ampere 50-60 Hz circuit. This circuit could be a wall outlet or from an outlet on the power supply, if one is provided.

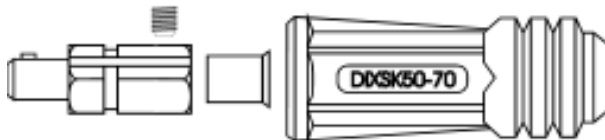
2.3 WELD CABLE CONNECTIONS

Provided with the Pulse+ are two Dinse 400 Amp male weld cable connectors (P/N 153-0755) and two Dinse 400 Amp female weld cable connectors (P/N 153-0813).

Select adequate size welding cable for the anticipated maximum weld current. Keep the cables as short as possible and as close together as possible. Excessive cable length adds resistance which may reduce the output.

To install the connectors, use **Fig. 1** for proper part orientation.

NOTE: Place the connector boot over the cable before cutting back the insulation. This will keep the copper strands from becoming frayed.



CONNECTOR PART ORIENTATION - Fig. 1

Section 3

CABLE CONNECTIONS

Connect the Pulse+ in series with the power source as show in **Figure 2**.

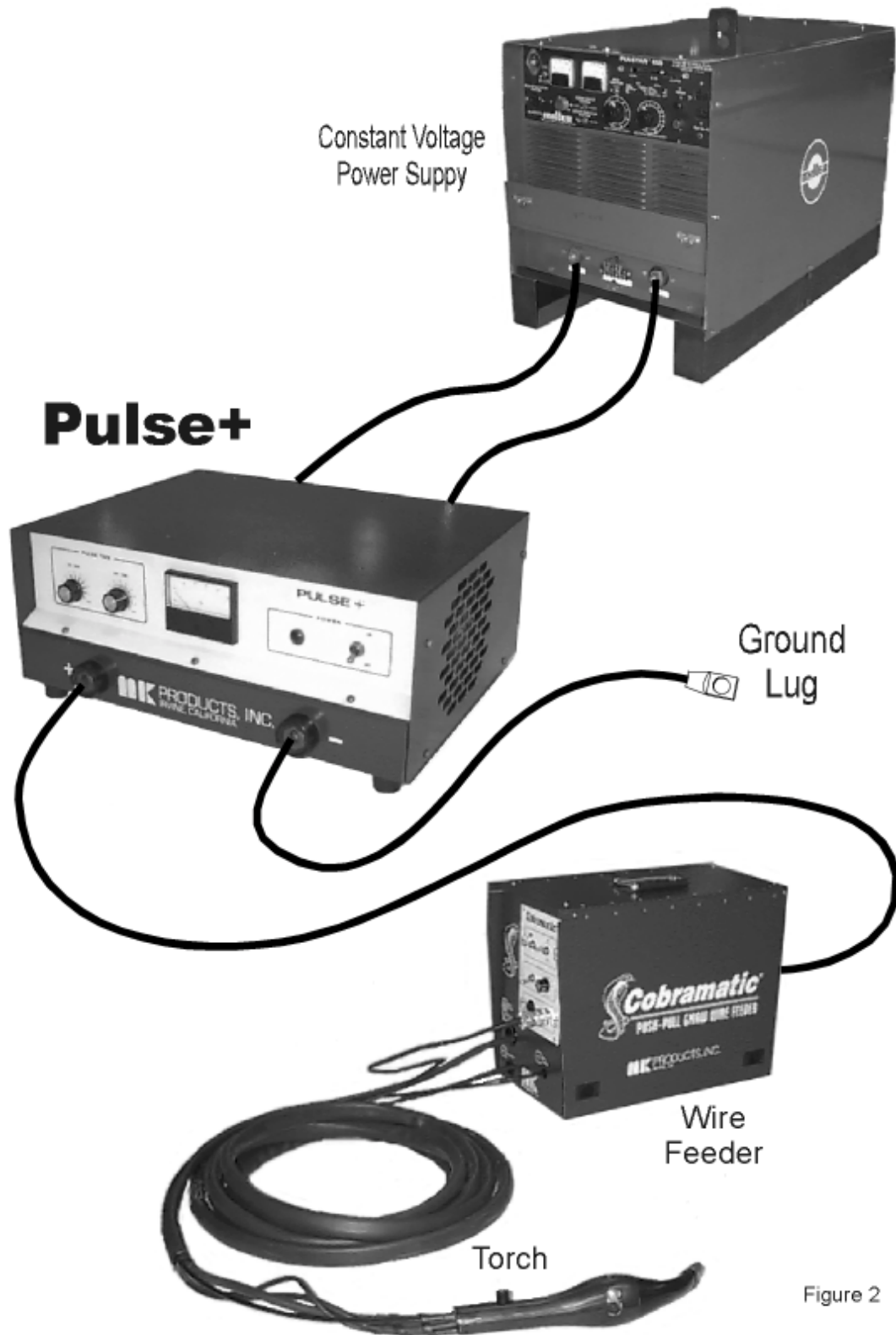


Figure 2

Connect between any conventional D.C. constant voltage power source (with a maximum output voltage of 60 volts) and the wire feeder. Plug Pulse+ into a 115 V. AC outlet.

Section 4

OPERATION

CAUTION: DO NOT ATTEMPT TO WELD WITH THE PULSE+ TURNED OFF

For non-pulsed operation, the connectors can be locked together, thus removing the Pulse+ from the circuit.

4.1 POWER SWITCH

Placing the power switch in the On position energizes the fan and control circuitry. The red indicator lamp should be on at this time.

CAUTION: If the fan does not operate when the power switch is in the On position,

DO NOT attempt to weld. Without proper air flow, unit can overheat and cause damage to internal parts.

4.2 VOLTMETER

The voltmeter on the front of the Pulse+ will read average voltage during welding. Average amperage can be read off of the power supply amp meter.

4.3 PULSE OPERATION

In pulsed spray welding, the current is varied from the background level to a peak level. The background level is well below the transition current, while the peak level is well into the spray arc region, **Figure 3**. During the peak level, one droplet is transferred to the work. The current then drops to the background level, which allows the puddle to cool, at which time no metal is transferred.

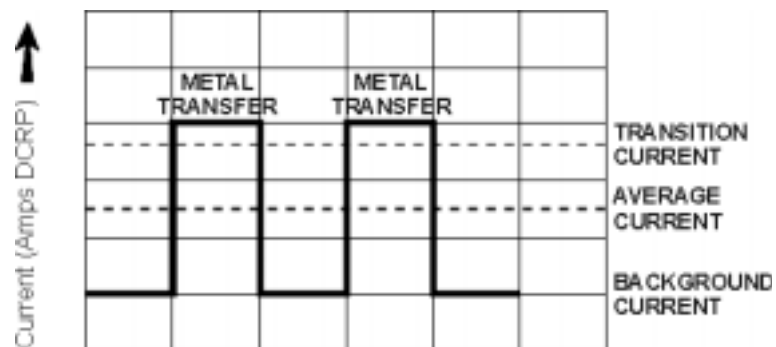


Figure 3

4.3.1. Peak Level

The peak level is set by the voltage control at the power supply. Because the peak level must be well into the spray arc region, it must be set substantially higher than non-pulsed operation (typically 30-40 volts).

4.3.2. Background Level

The background level (typically 30 to 130 amps) is the result of the fixed design values in the Pulse+, together with the power supply input voltage, wire feed rate, and other parameters.

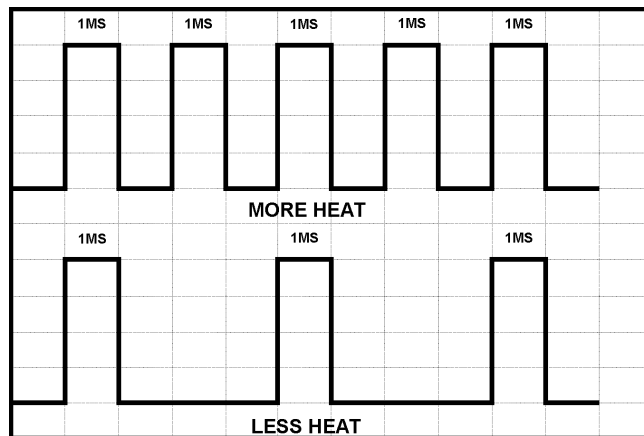
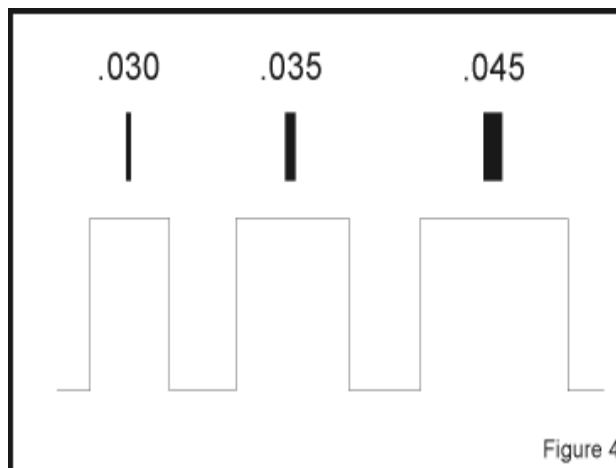
4.3.3. "On Time"

To obtain the one drop transfer during the peak level, the "On" time must be varied, depending on the wire diameter. As the wire size is increased, so must the "On" time be increased to burn off the larger size wire, **Figure 4**.

The "On" time is variable from 1 to 10 Ms.

4.3.4. "Off Time"

With the "On" time set to provide a smooth transfer, the "Off" time is used to control the amount of heat. Decreasing the "Off" time moves the pulses closer together (more heat), while increasing the "Off" time moves the pulses further apart (less heat), **Figure 5**.



The "Off" time is variable from 1 to 20 ms.

4.3.5. Pulse Frequency

The pulse frequency is determined by adding the "On" time and the "Off" time and dividing it into 1000. Pulse frequency is measured in pulses per second (PPS). For example:

3 ms on and 5 ms off equals $1000/3+5 = 1000/8 = 125$ pps

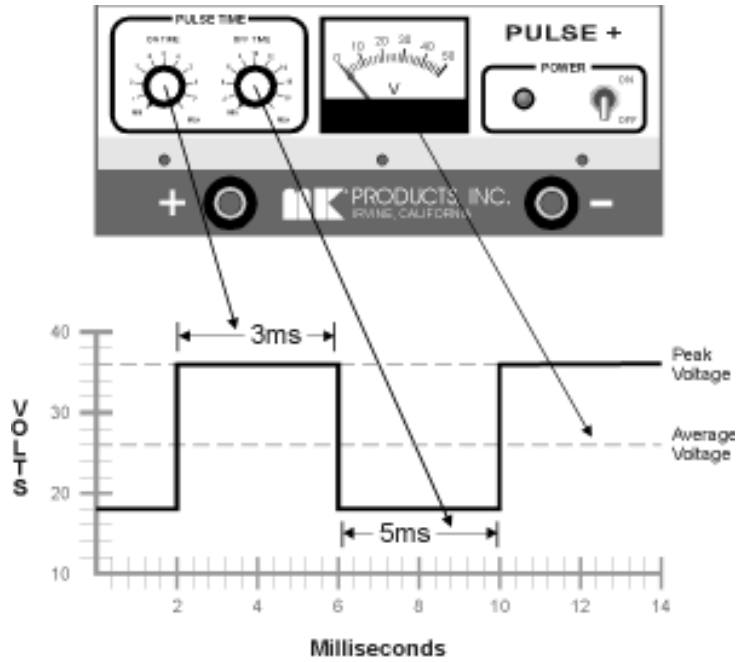


Figure 6

Section 5

PARAMETER SET-UP

5.1 Peak Level

The voltage control on the power supply is used to set the peak level. The melting temperature of the filler wire used determines at what point the voltage should be set. For example, 4043 aluminum may require as little as 30 peak welding volts, whereas steel and stainless may require 35-38 peak welding volts, **Figure 7**. When trying to weld thin material the peak voltage should be kept as low as possible without losing the spray transfer.

5.2 "ON" Time

The "On" time dial is used to obtain a smooth transfer. Start with an "On" time of 2 ms, and adjust until the correct transfer is achieved.

5.3 "OFF" Time

Start with an "Off" time of 6 ms. If the weld is too cold, decrease the "Off" time. If the weld is too hot, increase the "Off" time. Remember that the wire feed speed must also be increased and decreased accordingly

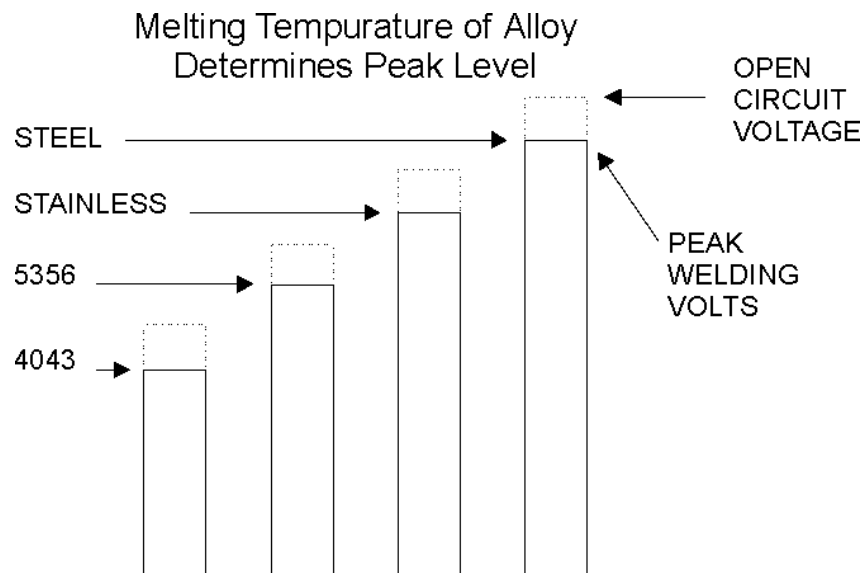


Figure 7

NOTE: The required open circuit voltage (OCV) may vary from one power supply to another, depending on the slope of the power supply. Sample parameters can be found on the next page.

SAMPLE WELDING PARAMETERS

WIRE SIZE	WIRE TYPE	WIRE IPM	WELDING VOLTS	AVERAGE VOLTS	WELD AMPS	PULSE ON	PULSE OFF	PLATE THICKNESS	BASE METAL	GAS USED
.030	4043	228	29.5	16.8	52	1	10	.060	6061	Argon
.035	4043	200	29.5	17.9	67	2	11	.090	6061	Argon
.035	4043	220	31	18.7	89	2	8	1/8	6061	Argon
3/64	4043	180	33	19.1	108	3	8	1/8	6061	Argon
3/64	4043	214	33	20.3	117	3	5	1/4	6061	Argon
1/16	4043	15	36	22.5	187	4	2	3/8	6061	Argon
.030	5356	308	30	20	59	1	6	.060	6061	Argon
.035	5356	360	30	18	80	2	10	.090	6061	Argon
.035	5356	390	30	17.5	88	2	8	1/8	6061	Argon
3/64	5356	250	34	19.5	110	3	8	1/8	6061	Argon
3/64	5356	300	35	20	125	3	5	1/4	6061	Argon
1/16	5356	260	36	23.5	190	4	2	3/8	6061	Argon
.030	E70S-3	190	33	18.5	65	1.5	15	.050	Steel	98-2
.035	E70S-3	211	34	19.8	99	2	9	.060	Steel	98-2
.045	E70S-3	150	36	21.8	133	3	5	3/16	Steel	98-2
.030	308L	279	34	20.3	78	2	8	.060	S/S	98-2
.035	308L	268	34	20.3	105	2.75	6	.080	S/S	98-2
.045	308L	145	34	20.9	123	3	5	1/8	S/S	98-2

Section 6

TROUBLE SHOOTING

SOME FACTORS TO CONSIDER:

The Pulse+ can only reduce the power supply output voltage and current, so be sure the CV power supply is operating properly without the Pulse+.

The power supply sets the peak level and, therefore, must be set substantially higher than non-pulsed operation.

When an arc is initiated, the Pulse+ is always in the pulse "on" mode to provide maximum current to initiate the arc. After welding current is flowing, a current switch is utilized to start the pulse timer.

If there appears to be too little output to weld with, be sure the pulse "on" is at the proper value (or increase it) and that the pulse "off" is not excessive.

Be sure there is a good ground connection to the work and a good cable connection to the Wire Feeder.

TROUBLE SHOOTING PROCEDURE

Trouble	Cause	Remedy/Explanation
Have welding output but no pulse	Current switch failure or bad PC board	The current switch, connected to J4, is located on the negative buss bar next to the capacitor bank. Disconnect J4 and short between pins. If the unit now pulses, replace the current switch. If it does not pulse, check PC board.
Pilot lamp works , Fan works, No weld output	J2 connector disconnected from PC board	Replace J2 on board
	Thermostat open	Check Thermostat for continuity
	Power Supply voltage too low	Increase supply voltage
	Open CR1 or R1, Bad PC board	Disconnect 115 vac. With a ohm-meter check resistance between input + and output + terminals. Should read 5 ohms. If open, check CR1 and R1 separate. If OK, check PC board.
Completely Inoperative	Open line fuse (F1)	Replace fuse 2A 250V
	Defective power switch (S1)	Replace switch
	Improper line voltage	Check line voltage for 115vac

6.1 TESTING THE CURRENT SWITCH

When current flows through the buss bar, it creates a magnetic field. This magnetic field causes the current switch, which is normally open, to close and turn on the pulse timer circuit. To test, remove the current switch from the unit. Using an ohm meter on Rx1 scale, check to see that the switch is open, indicating no continuity. Using a common magnet, move it to within one to one-half inch from the current switch while watching the ohm meter. As the magnet nears the current switch, it should close, and continuity should be read on the meter.

6.2 TESTING THE PC BOARD

An oscilloscope is required to test the PC board. Set the oscilloscope second/div to 2 ms and the volts/div to 5V. Place the negative lead on pin 7 of the transformer and the positive lead to connector J2 pin 3. The current switch must be closed so jumper between pins 1 and 2 on the J4 connector, or place a magnet next to the current switch, if you know it works correctly. Turn the Pulse+ on. A square wave should appear on the oscilloscope. The "on" and "off" time controls should vary the wave form on the oscilloscope. A bad thermostat will also prevent the PC board from operating.

6.3 TESTING THE THERMOSTAT

The thermostat is located on the back of the heat sink and is connected to J5. It is normally closed and, if the fan malfunctions or if the duty cycle is exceeded, the thermostat will open at 180 degrees F and shut down the unit. To test, use an ohm meter to check for continuity across the thermostat leads.

6.4 TESTING CR1 AND R1

CR1 is the main diode coming off the + input and mounts to the heat sink. R1 is the power resistor inside the heat sink. If either is open, the Pulse+ will not operate. To test, place an ohm meter on DC+ in the Rx1 scale. Attach the positive lead to the + input and the negative lead to the + output. The meter should read from 4 to 5 ohms. If open, check CR1 and R1 separately.

NOTE: The following conditions were used through-out the above test.

WELDING GAS: Aluminum (Argon), Steel & Stainless (98% Argon - 2% Oxygen)

POWER SUPPLY: Flat Slope C.V.

WELD POSITION: Flat

WELD TYPE: Fillet

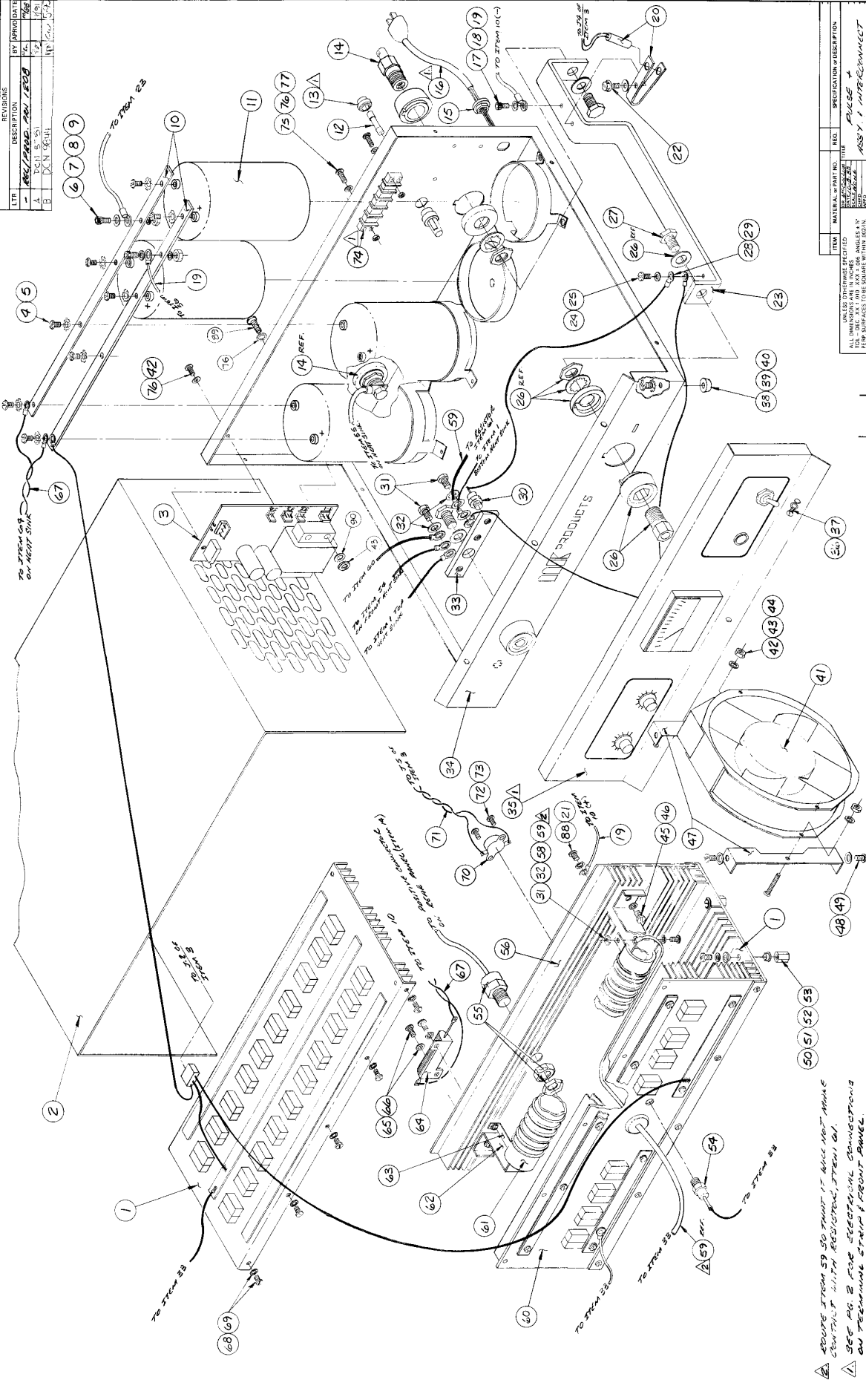
Section 7

PARTS LIST - PULSE+ WITH METER

<u>ITEM</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	003-0661	Assy. - Top & Bottom Heat Sinks
2	003-0666	Assy. - Cover
3	003-0481	PCB Ctrl Mod.
4	325-0225	10-32 x 3/8 Pan. HD. Scr
5	333-0007	#10 Lock Washer
6	341-0008	#10-32 Hex Nut
7	328-0229	10-32 x 1/2 Soc. Hd. Scr.
8	331-0044	#10 Flat Washer
9	333-0045	#10 Lock Washer
10	435-0821	Connector Strip
11	104-0051	Capacitor - 25,000 mf
12	151-0001	Fuse 2 Amp.
13	152-0058	Fuse Holder
14	153-0809	Connector - Male
15	315-0696	Strain Relief
16	844-0019	A.C. Power Cable 6ft bare leads
17	328-0236	8 - 32 x 3/8 Sosc. HD. cr.
18	333-0006	#8 Lock Washer
19	843-0272	Cable Assy
20	003-0780	Sensor Assembly
21	333-0024	#8 Lock Washer
22	327-0073	8 - 32 x 1/4 Self Tapping Scr.
23	435-0830	Bus Bar
24	325-0167	8 - 32 x 3/8 Pan. Hd. Scr.
25	333-0024	#8 Lock Washer
26	153-0754	Connector - Female
27	329-0221	M-10 Hx. Hd. Scr. (Metric)
28	185-0082	Ring Lug #8 Hole, 12 Ga. Wire
29	845-0100	12 Ga. Wire (Black) 10" Lg.
30	124-0062	Diode - VHE804
31	447-0006	1/4 - 20 x 1/2 Hex Hd. Scr. Brass
32	333-0072	1/4" Lock Washer (Silicon Bronze)
33	435-0827	Diode Plate
34	435-0005	Base
35	003-0561	Assy. - Front Panel
36	325-0167	8 - 32 x 3/8 Pan Hd. Scr.
37	333-0044	#8 Lock Washer
38	301-0104	Rubber Feet
39	325-0230	10 - 32 x 3/4 Pan Hd. Scr.
40	333-0025	#10 Lock Washer
41	201-0005	Fan - 220 volts A.C.
42	324-0135	6 - 32 x 1/2 Flt. Hd. Scr.
43	341-0005	6 - 32 Hex Nut
44	333-0023	#6 Lock Washer
45	327-0112	#10 x 1/2 Self Tapping Scr.
46	333-0045	#10 Lock Washer
47	435-0831	Fan Mounting Bracket
48	327-0110	6 - 32 x 3/8 Selft Tappin Scr.
49	333-0023	#6 Lock Washer
50	342-0372	Standoff 7/8" Lg.
51	325-0229	10 - 32 x 5/8 Pan Hd. Scr.
52	332-0004	#10 Flat Washer
53	332-0018	Shoulder Washer

54	003-0494	S/A Diode
55	124-0022	Diode Rectifier - R610
56	003-0662	Assy. Diode Heatsink
57	333-0072	1/4" Lock Washer (Silicon Bronze)
58	449-0001	1/4 - 20 Hex Nut (Brass)
59	843-0256	Cable Assy.
60	003-0660	Assy. - Heat Sink
61	113-0045	Resistor .3 ohm
62	435-0828	Resistor Mounting Bracket
63	435-0836	Contacto Bar
64	113-0042	Resistor 50 ohm
65	327-0109	#4 x 1/4 Self Tapping Screw
66	333-0041	#4 Lock Washer
67	843-0254	Cable Assy.
68	327-0111	#8 x 1/4 Self Tapping Screw
69	333-0044	#8 Lock Washer
70	170-0003	Temperature Sensor
71	843-0255	Cable Assy. - Temp. Sensor
72	327-0108	#2 1/4 Self Tapping Scr.
73	333-0039	#2 Lock Washer
74	186-0164	Terminal Strip
75	325-0137	6 - 32 x 5/8 PN Hd. Scr.
76	333-0043	#6 Lock Washer
77	341-0005	6 -32 Hex Nut
78	159-0051	"ON - "OFF" Switch
79	333-0154	Lock Washer
80	117-0060	200K Potentiometer
81	401-0012	Knob
82	333-0156	Lock Washer
83	341-0050	Nut
84	117-0002	100K Potentiometer
85	431-1251	Back-up Plate
86	169-0043	Volt Meter
87	003-0547	220v pilot lamp
88	327-0022	#8 x 3/8 Self Tapping Screw

REV.	DESCRIPTION	BY	DATE
1	REVISED PER 1203	ML	12/82
2	REVISED PER 1203	ML	12/82
3	REVISED PER 1203	ML	12/82

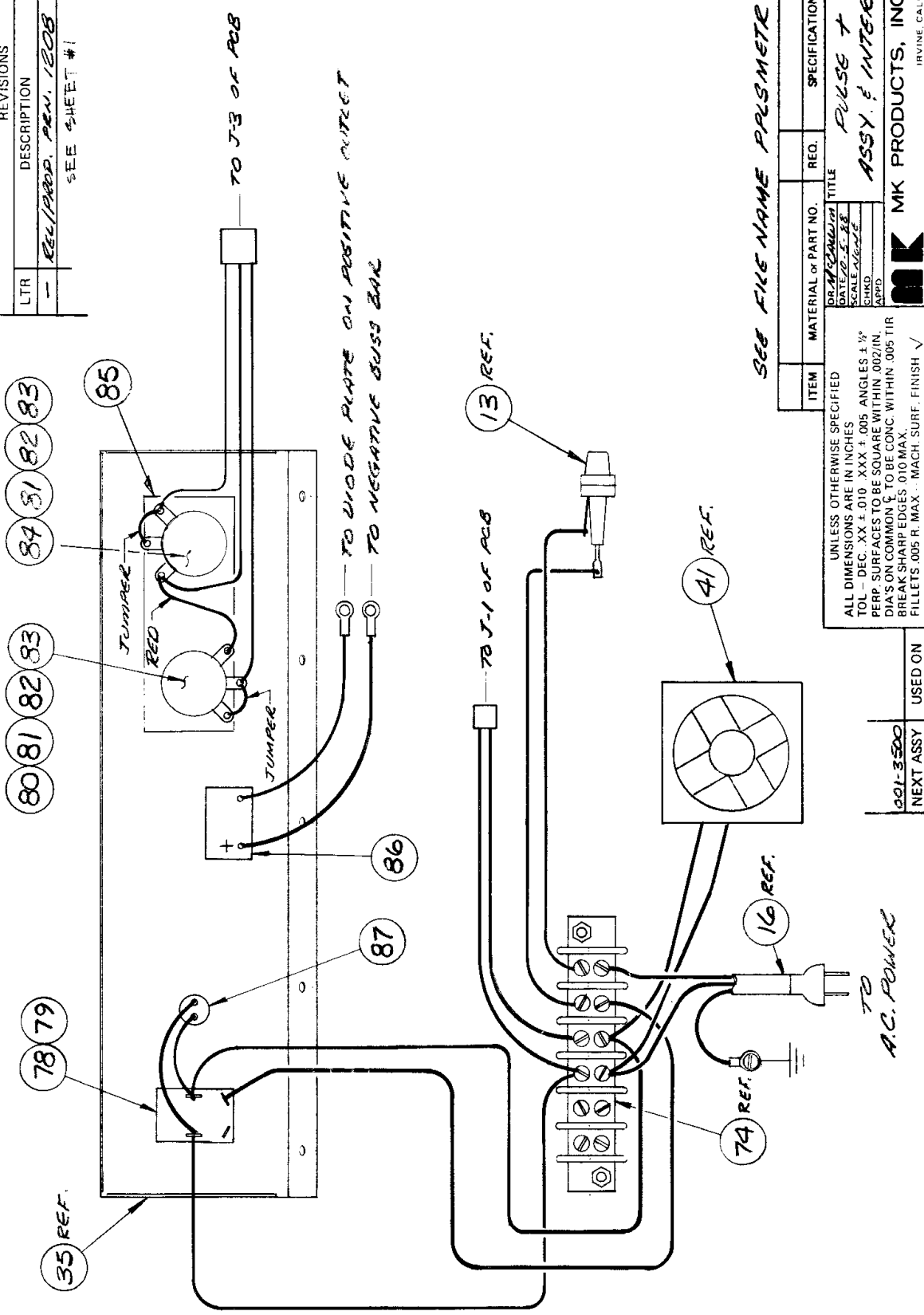


ITEM	QUANTITY	DESCRIPTION
1	1	TERMINAL UNIT
2	1	KEYBOARD
3	1	KEYBOARD ASSEMBLY
4	1	KEYBOARD COVER
5	1	KEYBOARD SUPPORT
6	1	KEYBOARD BRACKET
7	1	KEYBOARD SCREW
8	1	KEYBOARD NUT
9	1	KEYBOARD WASHER
10	1	KEYBOARD SPRING
11	1	TERMINAL CHASSIS
12	1	TERMINAL COVER
13	1	TERMINAL BRACKET
14	1	TERMINAL SCREW
15	1	TERMINAL NUT
16	1	TERMINAL WASHER
17	1	TERMINAL SPRING
18	1	TERMINAL BRACKET
19	1	TERMINAL SCREW
20	1	TERMINAL NUT
21	1	TERMINAL WASHER
22	1	TERMINAL SPRING
23	1	TERMINAL BRACKET
24	1	TERMINAL SCREW
25	1	TERMINAL NUT
26	1	TERMINAL WASHER
27	1	TERMINAL SPRING
28	1	TERMINAL BRACKET
29	1	TERMINAL SCREW
30	1	TERMINAL NUT
31	1	FRONT PANEL
32	1	FRONT COVER
33	1	FRONT BRACKET
34	1	FRONT SCREW
35	1	FRONT NUT
36	1	FRONT WASHER
37	1	FRONT SPRING
38	1	FRONT BRACKET
39	1	FRONT SCREW
40	1	FRONT NUT
41	1	FRONT WASHER
42	1	FRONT SPRING
43	1	FRONT BRACKET
44	1	FRONT SCREW
45	1	FRONT NUT
46	1	FRONT WASHER
47	1	FRONT SPRING
48	1	FRONT BRACKET
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54	1	FRONT SCREW
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57	1	FRONT SPRING
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62	1	FRONT SPRING
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83	1	FRONT BRACKET
84	1	FRONT SCREW
85	1	FRONT NUT
86	1	FRONT WASHER
87	1	FRONT SPRING
88	1	FRONT BRACKET
89	1	FRONT SCREW
90	1	FRONT NUT

▲ SCREW FROM 59 SO FRONT AT ALL NOT MAKE CONTACT WITH RECEPTOR, STRIP 61.
 ▲ SEE PG. 2 FOR ELECTRICAL CONNECTIONS ON TERMINAL STRIP & FRONT PANEL.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS. DIMENSIONS IN PARENTHESIS TO BE OBTAINED FROM DRAWING. BREAKS AND DIMENSIONS TO BE OBTAINED FROM DRAWING. MK PRODUCTS, INC. 1203 S. 10TH ST. MILWAUKEE, WI 53211. MK-1203-0172 (REV. 12/82)

REVISIONS		BY	APRVD	DATE
LTR	DESCRIPTION			
—	REC/PROP. REV. 1E08	M/L		10/88
	SEE SHEET #1			



SEE FILE NAME PULSEMETER FOR B/M

ITEM	MATERIAL or PART NO.	REQ.	SPECIFICATION or DESCRIPTION
	DR. 10-5-88		
	DATE 10-5-88		
	SCALE ANGLE		
	CHKD		
	APPD		
			PULSE +
			ASSY. & INTERCONNECT

UNLESS OTHERWISE SPECIFIED
 ALL DIMENSIONS ARE IN INCHES
 TOL - DEC. XX ± 0.10 .XXX ± 0.05 ANGLES ± 1/2°
 PERP SURFACES TO BE SQUARE WITHIN .002/IN.
 DIA'S ON COMMON C. TO BE CONC. WITHIN .005 TIR
 BREAK SHARP EDGES 0.10 MAX.
 FILLETS .005 R. MAX. - MACH. SURF. FINISH ✓

901-3500
 NEXT ASSY
 USED ON

TO
 A.C. POWER

MK
 MK PRODUCTS, INC. IRVINE, CALIF.
 DWG. NO. 033-0172

LIMITED WARRANTY

Effective April 1, 1998

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

LIMITED WARRANTY - MK Products, Inc., Irvine, California warrants that all new and unused equipment furnished by MK Products is free from defect in workmanship and material as of the time and place of delivery by MK Products. No warranty is made by MK Products with respect to trade accessories or other items manufactured by others. Such trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any.

MK Products' warranty does not apply to components having normal useful life of less than one (1) year, such as relay points, wire conduit, tungsten, and welding torch parts that come in contact with the welding wire, including nozzles, nozzle insulators, and contact tips where failure does not result from defect in workmanship or material.

In the case of MK Products' breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be at MK Products' option: **(1)** repair; **(2)** replacement; **(3)** where authorized in writing by MK Products, the reasonable cost of repair or replacement at our Irvine, California plant; 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. Upon receipt of notice of apparent defect or failure, MK Products shall instruct the claimant on the warranty claim procedures to be followed.

As a matter of general policy only, MK Products may honor an original user's 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. **Torches and Weldheads** **1 year**
2. **All Other Equipment** **3 years**
3. **Repairs** **90 days**

Classification of any item into the foregoing categories shall be at the sole discretion of MK Products. Notification of any failure must be made in writing within 30 days of such failure.

A copy of the invoice showing the date of sale must accompany products returned for warranty repair or replacement.

All equipment returned to MK Products for service must be properly packaged to guard against damage from shipping. MK Products will not be responsible for any damages resulting from shipping.

Normal surface transportation charges (both ways) for products returned for warranty repair or replacement will be borne by MK Products, except for products sold to foreign markets.

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FORM: LW-8
DATE: April 1, 1998



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