John Deere 230 and 295-Amp Welders

JOHN DEERE

OPERATORS MANUAL

John Deere 230 and
295-Amp Welders

OMTY4574 Issue I3 English

OMTY4574 Issue I3

LITHO IN U.S.A.
ENGLISH

To The Purchaser

Reading this operator's manual before using the welder will enable you to do a better, safer job.

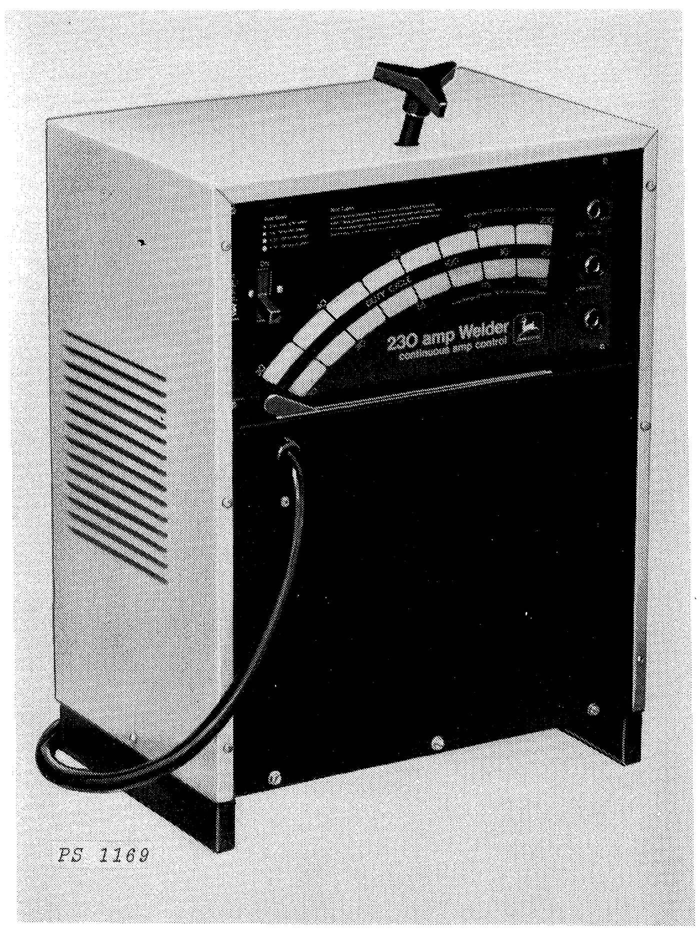
CAUTION: This safety alert symbol identifies important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.

After you have read this manual thoroughly, keep it handy for ready reference. When in need of parts and major service, see your authorized John Deere dealer.

Right-hand (R.H.) and left-hand (L.H.) references are determined by standing in front of and facing the welder.

The warranty on this welder is enclosed as an insert.

Record the transformer serial number of your welder. Provide this number to your John Deere dealer when ordering parts. He needs this information in order to give you the most prompt and efficient service. (See page 36.)



John Deere 230-Amp Welder

JOHN DEERE NEW EQUIPMENT WARRANTY
WELDERS

A. WHAT IS WARRANTED.

John Deere Company ("John Deere") makes the following warranties to the original retail purchaser of each new John Deere Welder.

1. Equipment Warranty.

All parts of each welder which are defective in materials or workmanship as delivered to the purchaser, will be repaired or replaced, as John Deere elects, without charge for parts or labor, if a defect appears within 12 months from the date of delivery to the original purchaser.

2. Replaced Parts Warranty.

Genuine John Deere parts, which are furnished under this Warranty and installed by an authorized John Deere dealer will be repaired or replaced, as John Deere elects, without charge for parts or labor if a defect in materials or workmanship appears within 90 days from the date of installation of such parts or before the expiration of the original warranty period, whichever is later.

B. SECURING WARRANTY SERVICE.

Warranty service is available from any John Deere dealer authorized to sell new John Deere Welders. At the time of requesting warranty service, the purchaser must present evidence of the date of delivery. The purchaser shall pay any charge for making service calls and for transporting the welders to and from the place where the warranty work is performed.

C. ITEMS NOT COVERED BY JOHN DEERE WARRANTY.

Products not bearing the name "John Deere" or the John Deere trademark, sold on or with John Deere Welders, and used products of any make are not warranted by John Deere and, if new, are ordinarily warranted by the selling dealer or by the manufacturers thereof.

D. UNAPPROVED SERVICE OR MODIFICATION.

All obligations of John Deere under this Warranty shall be terminated:

1. If service other than normal maintenance or normal replacement of service items is performed by someone other than an authorized John Deere dealer.

2. If the welder is modified or altered in ways not approved by John Deere.

E. ACCIDENTS AND NORMAL MAINTENANCE.

This Warranty covers only defective materials and workmanship. It does not cover depreciation or damage caused by normal wear, accident, improper maintenance, improper protection in storage, or improper use. The cost of normal maintenance shall be paid for by the purchaser. Failure to follow operating instructions or improperly using the welder may cause damage which will not be covered by this Warranty.

F. NO REPRESENTATIONS OR IMPLIED WARRANTY.

Neither John Deere nor any company affiliated with it makes any warranties, representations or promises expressed or implied, as to the quality or performance of its welders other than those set forth above and DOES NOT MAKE ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS.

G. REMEDIES EXCLUSIVE.

The only remedies the purchaser has in connection with the breach of performance of any warranty on John Deere Welders are those set forth above. In no event will the selling dealer, John Deere or any company affiliated with John Deere be liable for incidental or consequential damages or injuries.

H. NO DEALER WARRANTY.

The selling dealer makes no warranty of his own on any item warranted by John Deere, and makes no warranty on other items unless he delivers to purchaser a separate written warranty certificate specifically warranting the item. The dealer has no authority to make any representation or promise on behalf of John Deere or to modify the terms or limitations of this Warranty in any way.

Form No. TY4606 *Litho in U.S.A.*

Contents

Safety Suggestions

Improper use of the welder can be hazardous. To reduce the possibility of injury, give undivided attention to the job at hand and follow these safety suggestions.

Welding equipment should be installed according to provisions of the National Electric Code, and the circuit to welding machine should be equipped with a disconnect switch conveniently located at or near the machine.

Be sure the welding area has a cement or masonry floor.

Keep all combustible materials at a safe distance.

Do not use gloves or outer clothing which contain oil or grease

Be sure all power wiring is correctly installed and maintained. Don't overload the welding cables.

Keep welding cables dry and free from oil and grease.

Never coil a welding cable carrying power around the shoulders.

Always be sure your machine is properly grounded. Never work in a damp area. Keep hands and clothing dry at all times. (Dampness on the body may cause an electric shock.)

Never strike an arc on a compressed gas cylinder.

Keep the uninsulated portion of the electrode holder from touching the welding ground when the current is on. This will cause a flash.

To avoid shocks, shut off the welding machine before making repairs or adjustments.

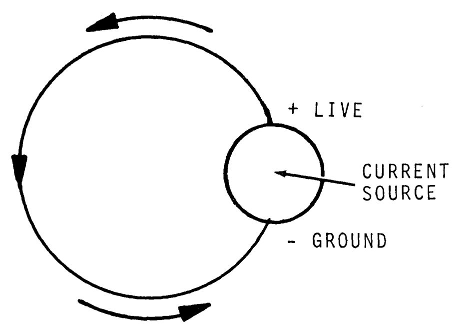
Follow the manufacturer's rules on operating switches and making adjustments.

Protect others and yourself. Flying sparks are a danger. Arc rays can also cause painful burns. Wear the recommended protective clothing and never weld without protecting your eyes.

Keep fire extinguisher handy at all times.

Operation

HOW THE WELDER WORKS



UNINTERRUPTED CIRCUIT

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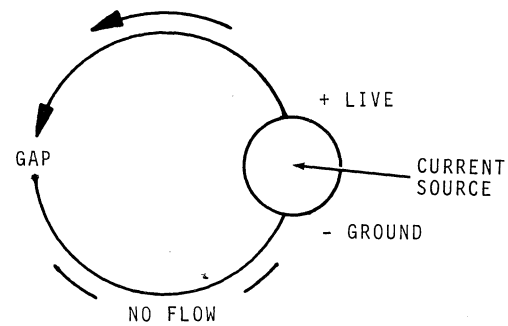
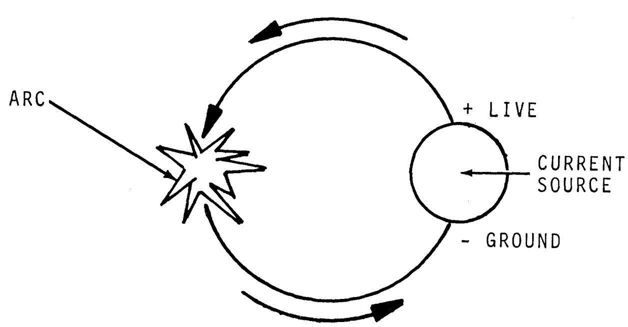


INTERRUPTED CIRCUIT

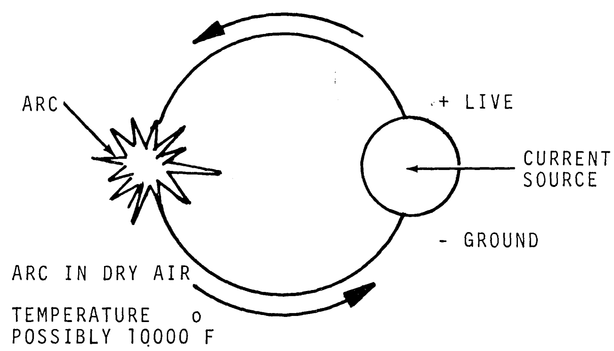
One of the basic principles of electricity is that electrical currents tend to flow in loops or circuits. The current tends to flow from the positive (+) pole at its source around through the circuit back to the negative (-) pole at the source. To shut off the flow in an electrical circuit, it is only necessary to open a gap in the current loop.



ARCING CIRCUIT

PS 1171

If the current is strong enough, however, and the gap is small enough, the current will leap, or "arc" across the gap and continue along the loop pathway to ground (-).



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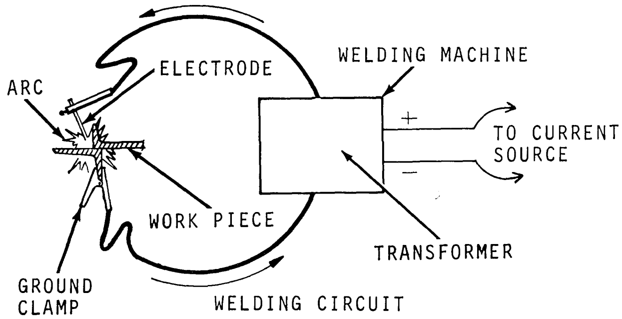
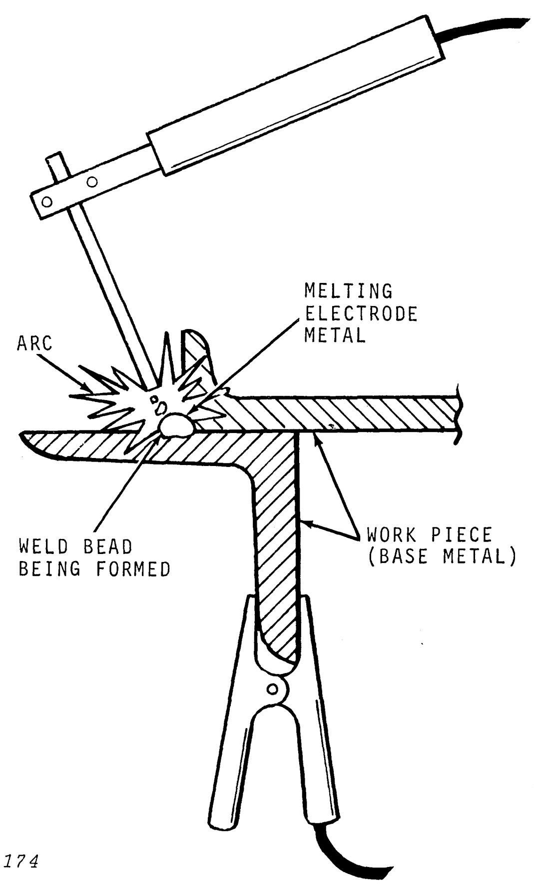
A second basic principle of electricity is that when an electrical current encounters resistance — that is, when it must flow through a substance which conducts it poorly — some of the energy in the electricity is converted to heat. Ordinary, reasonably dry air is a poor electrical conductor. When a relatively strong electrical current is made and jumps a small gap through dry air, a tremendous amount of heat is developed. The temperature at the center of an electric arc can easily reach 10,000°F — a temperature far in excess of that needed to melt most metals.



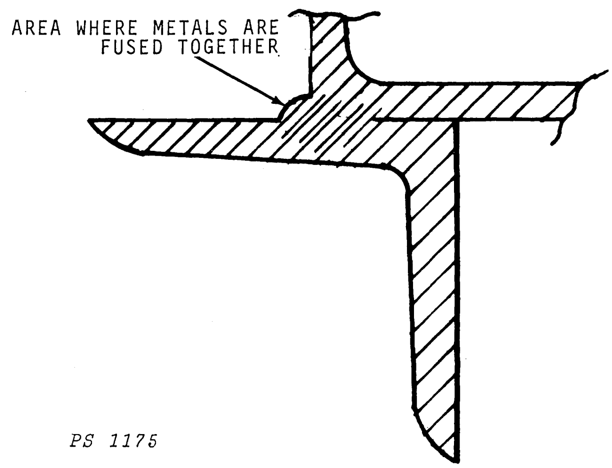
PS 1173

Electric arc, or "resistance" welding is simply a way of putting these two electrical principles to work. The welding machine transforms the line current into a working current capable of creating an arc. When the welder ground clamp is attached to the items to be welded and the welding electrode is brought close enough to the work piece, the resulting arc develops heat sufficient to melt any metal it contacts.



PS1174

The heat generated by the arc melts the metal in the work piece into a liquid puddle. The welding electrode is also melted. Molten electrode metal falls through the arc into the puddle of molten base metal and fuses with it. When the arc is moved away, the molten mixture cools and solidifies into a lump of new metal. When the arc is moved slowly along the work piece, a continuous strip of new metal is left behind to form the weld "bead."



PS 1175

If the weld is properly done, the base metals in the items being welded together and the material deposited by the melting electrode are solidly fused together.

INSTALLATION

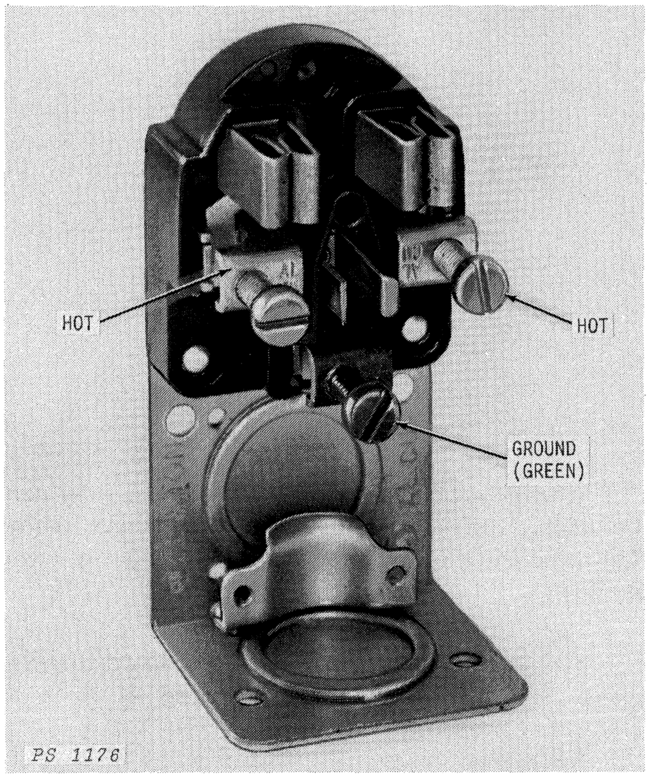
To install the welder, it is only necessary to plug the welder line cord into a suitable outlet, and to connect the electrode and ground clamp cables.

Power Source

The welder must be connected to a power source rated for the power requirements of the welder. The specification plate on the welder lists the electrical service required for proper operation. The Voltage, Amperage, Phase and Cycle descriptions of the service line must match those specified for the welder — as listed below.

	230-Amp.	295-Amp.
PRIMARY VOLTS	230	230
PRIMARY AMPS	48	72
SECONDARY AMPS	230	295
PHASE	Single	Single
CYCLES	60	60

Connections at the Receptacle



The ground terminal of the receptacle must be connected to either the system ground, or to a ground specified and approved by local electrical code. Red or black (Hot) service leads are to be connected to receptacle terminals as required by receptacle design. Each should be fused at a rating no less than that called for on the welder nameplate. (PRIMARY AMPS)

Extension Cords

If the welder is to be plugged into an extension cord, a No. 6, or heavier, 3-wire cord should be used. Extension cords over 50 feet in length should not be used at any time.

OPERATING THE WELDER

To operate the welder, connect the ground clamp to the work piece, insert a weld rod in the electrode holder, select a heat (amp) setting and turn the welder on. When the electrode (weld rod) is brought close to the work piece, the welding arc is generated. Although operation of the John Deere welder is simple, doing good work with it depends on (1), how carefully the work is prepared, and (2), the skill of the person doing the welding.

Connecting the Electrode and Ground Clamp Cables.

To obtain top performance from your welder, the panel connections for the electrode and ground clamp cables must be firm and secure. Giving the connector a slight twist as it is inserted in the socket will insure both a solid connection and make removal much easier.

Preparation for Welding

To properly prepare for welding, it is necessary to:

1. Provide protection for the eyes and skin of the person welding.

2. Set up the work piece and make the ground clamp connection.

3. Select the electrode (weld rod).

4. Adjust the heat control.

FOR YOUR OWN PROTECTION–

DON'T TAKE A CHANCE!

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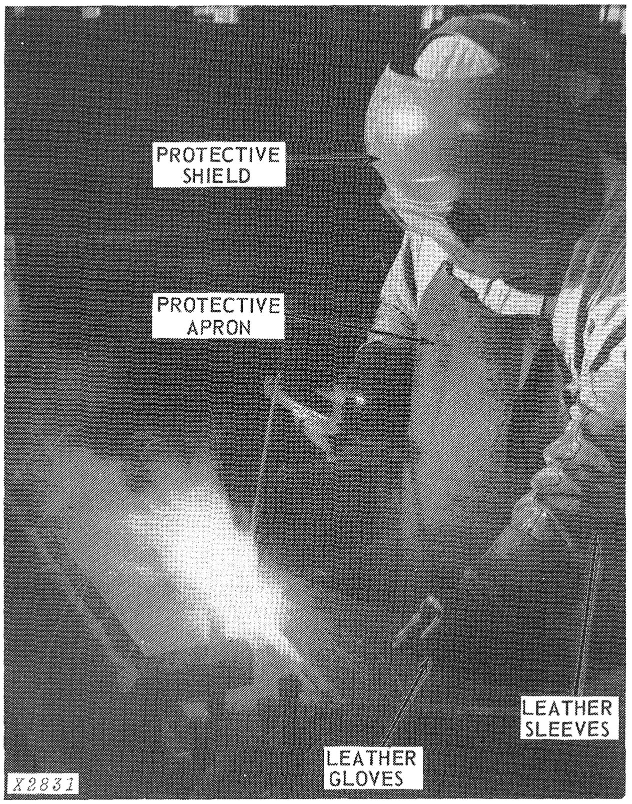
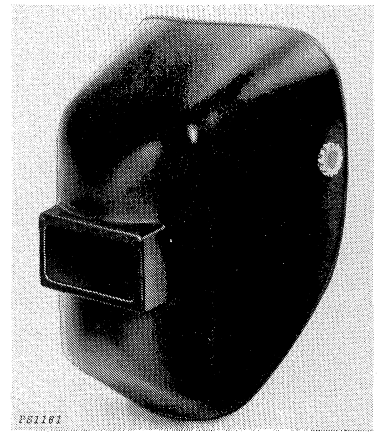
Protective Clothing

The heat and light radiating from a welding arc are much like intense sunlight. Prolonged exposure to the arc can result in painful burns to unprotected eyes or skin. Welding sparks are also dangerous.



While welding, a welding helmet or goggles must always be worn to protect the eyes. A protective cap, worn under the helmet, and flameproof gloves are also recommended. If hot material is to be handled, asbestos gloves should be worn.

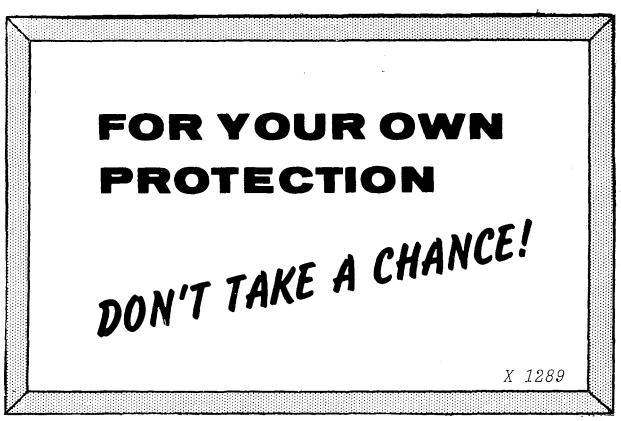
The Welding Helmet



The welding helmet furnished with the welder can be quickly and easily adjusted to any headsize. When not required, the mask may be tilted up away from the face.

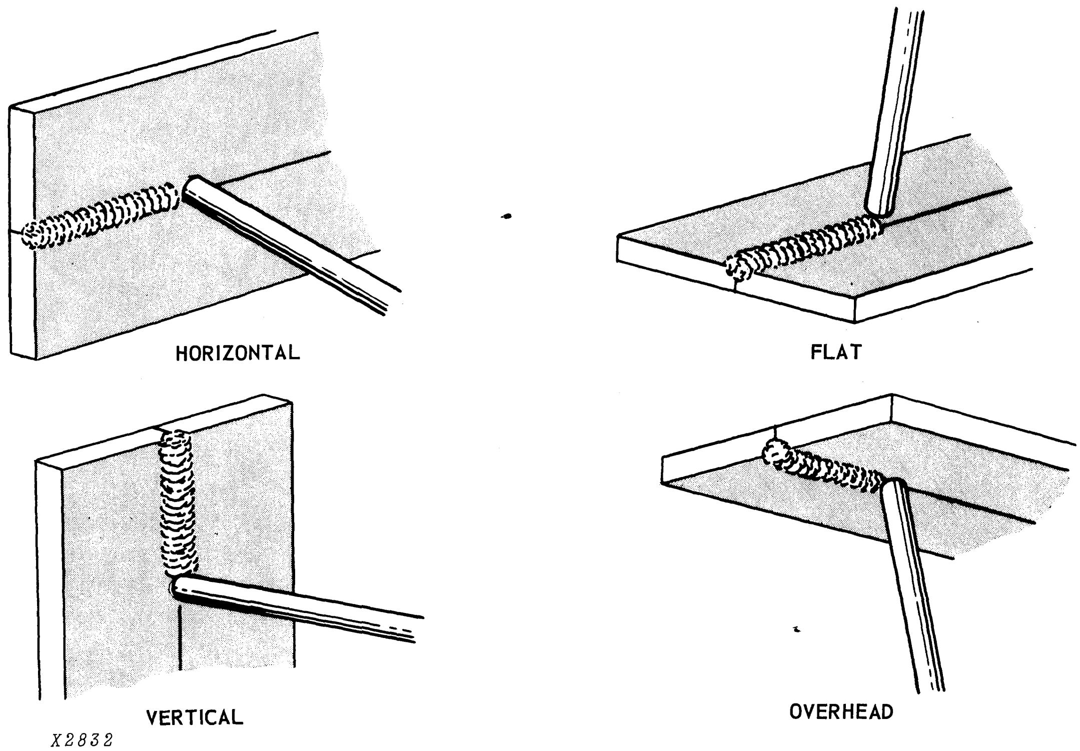
The helmet eyepiece is fitted with a replaceable glass. The glass should be replaced at once if cracked or broken.

CAUTION: Exposure to a welding arc is extremely harmful to the eyes. Prolonged exposure can cause blindness. Never strike an arc or begin welding unless your eyes are adequately protected.



Setting Up the Work Piece

Welding Positions

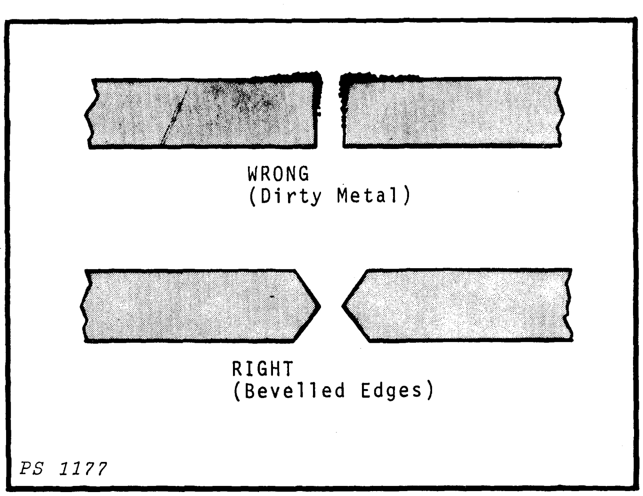


Arc welding can be done in any of four basic positions: flat, horizontal, vertical, and overhead. Flat welding is generally easier, faster, and allows for better penetration. Overhead welding is the most difficult. Both the heat (amps) and electrode (rod) selections will be affected by the welding position.

If possible, the work piece should be positioned so that the bead will be run on a flat surface.

Information on the welding technique required for the various positions will be found on page 19 of this manual.

Preparing the Joint



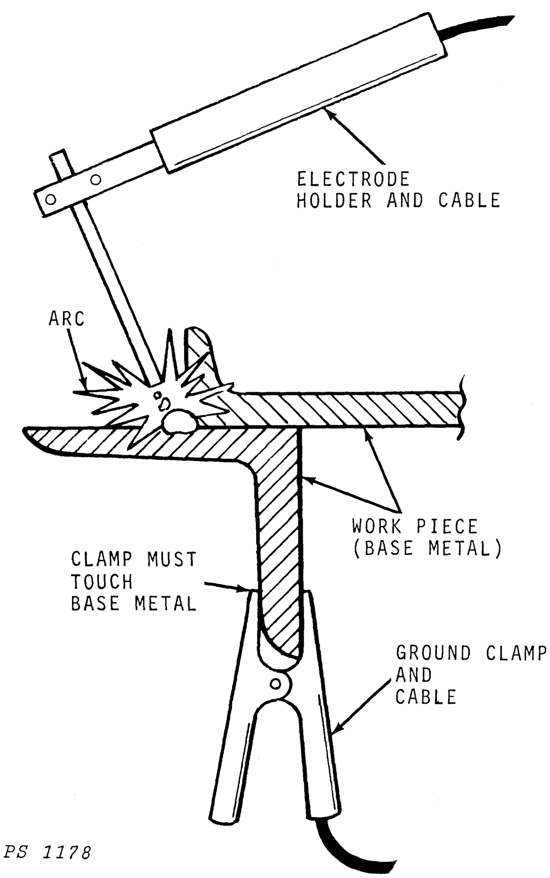
For effective welding the surfaces to be joined must be free of dirt, rust, scale, oil, or paint. Welding on metals not properly cleaned will cause a brittle and porous weld.

If the base metal pieces to be joined are thick or heavy, it may be necessary to bevel the edges at the point of contact. The angle of the bevel should be approximately 60 degrees.

Detailed instructions on setting up for various weld joints will be found on page 18 of this manual.

During the welding the work pieces will become hot and will tend to expand. The expansion may cause the pieces to shift from the regular position. If possible, the work pieces should be clamped into the position they are to occupy when the welding is completed.

Making the Ground Clamp Connection.



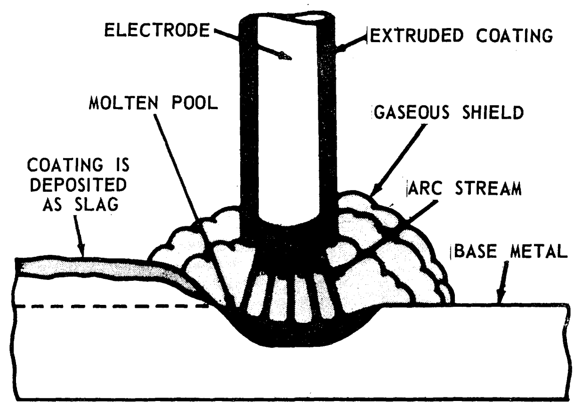
PS 1178

The ground clamp connection is part of the current circuit. A poor connection at the ground clamp will waste power, heat the clamp or both. Scrape away all dirt, rust, scale, oil or paint. Make sure the ground clamp touches base metal.

Selecting the Electrode

The type and thickness of the metal to be welded and the position of the work piece determine both the type of rod and the heat control setting required for the weld.

Electrodes



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The welding electrode is a rod or wire of electrically conductive metal coated with a layer of specially compounded insulating material. Electrical current flows through the rod from the welder to form the arc. The intense heat of the arc melts the rod and oxidizes the insulation. The rod metal joins with the base metal in the work piece to form the weld bead. The burning coating forms a gas shield around the arc and helps to control the flow of the fusing metals which form the weld bead.

Your welder kit includes a small supply of three basic welding electrodes.

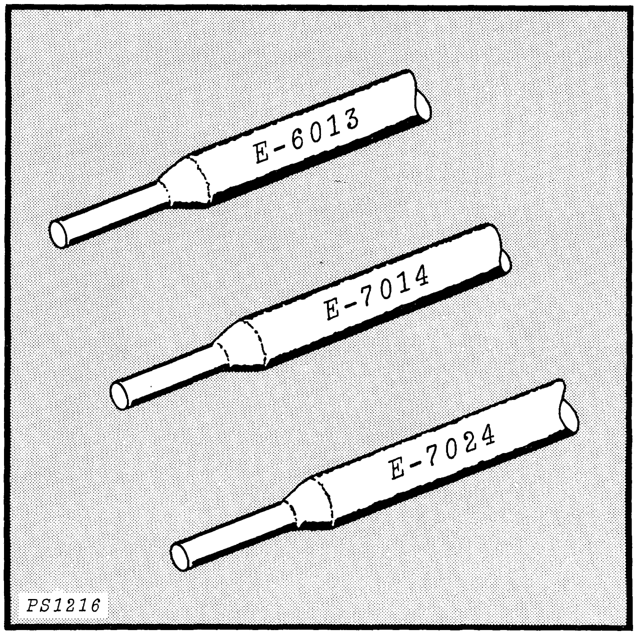
1. General Purpose — used for welding iron.

2. Cast Iron — used for welding cast iron.

3. Hard Surface — used to apply a wear resistant metal coating to softer base metals.

Electrodes for welding aluminum, stainless steel and other alloys are available. See the chart on page 10.

Electrode Marking



Electrode manufacturers have adopted a uniform marking code for welding electrodes. Each electrode is marked with a prefix letter and four numbers. Each of the numbers has a particular significance.

For example: A commonly used general purpose electrode is marked E-6013.

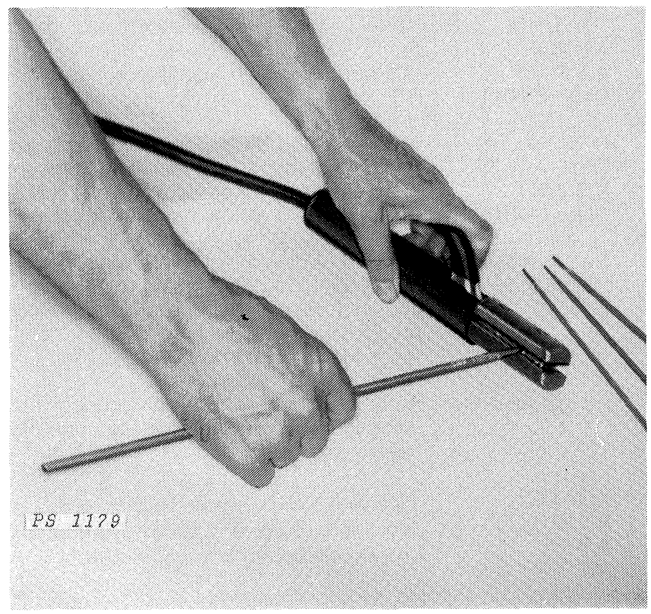
The E signifies the electrode is intended for Electric Arc applications.

The first two digits in the numbers indicate the minimum tensile strength of the deposited metal in thousands of pounds per square inch. In this instance, 60 indicates the metal deposited by the melting rod will have a minimum tensile strength of 60,000 psi.

The third number in the digit series indicates the welding position for which the rod is intended. A number 1 indicates a rod compounded for all-position welding. A number 2 indicates the rod is intended for flat and horizontal welding only. A number 3 indicates the rod should be used for flat welding only.

The fourth digit in the series indicates special rod characteristics such as weld quality, current type or depth of penetration.

Clamping the Electrode in the Holder



The electrode should be firmly fastened in the holder with the teeth or jaws of the clamp touching the rod metal. Never clamp the jaws of the holder on the coated surface of the rod.

WELDING ELECTRODES

The following chart is a guide for the proper electrode to use and for correct heat (amp) settings for most standard welding applications. Only a setting range is given: the precise setting will be determined by operator speed and the line voltage available.

Rod Type	Description	John Deere No.	Diam.	Amp. Rating
GENERAL PURPOSE	All-position, high tensile strength, smooth deposit rod, with low spatter. For all mild steel and general purpose work, including cutting and burning holes.* For hardened steels, see STAINLESS rod (below). A.W.S.-A.S.T.M. Class E-6013. * When cutting and burning, use max. amperage.	TY1598 ----- TY2323 TY2324 -----	1/16″ 3/32″ 1/8″ 5/32″ 3/16″	min.-60 min.-80 70-160 120-175 170-295
DEEP PENETRATING A.W.S.-A.S.T.M. Class E-6011	The strong arc force and rapid solidification of metal makes vertical and overhead welding easier with this rod. Ideal for poor fitups. Where time does not permit rust, scale, or paint removal, this rod penetrates rapidly and easily.	----- -----	1/8″ 5/32″	80-140 100-170
LOW HYDROGEN A.W.S.-A.S.T.M. Class E-7018	An all-position, mold steel electrode designed to produce low hydrogen content combined with excellent mechanical properties. This electrode has a mild steel core wire with an extruded coating. Use this type of rod for welding low-alloy, hard, or hardenable steels.	----- -----	1/8″ 5/32″	80-120 120-190
CAST IRON Machinable (Nickel)	To weld cast iron, or cast to steel, weld a little, and cool a lot. "Skip" welding in beads about an inch long, with light peening immediately after, will produce best results. This rod welds castings the EASY way, and may be filed or machined after deposit. A.W.S.-A.S.T.M. Class E-Ni.	----- -----	3/32″ 1/8″	50-70 80-120
HARDFACING	An all-position rod for applying deposits resistant to abrasion and impact. To make a wear resistant surface, hold a long arc, let rod "spray" on work.	-----	1/8″	80-140
COATED ALUMINUM A.W.S.-A.S.T.M.	Use with Twin Carbon Torch. For flat welding only. Flux coating floats to prevent puddle from oxidizing while welding. Not recommended for beginners. Class AL-43.	-----	1/8″	75-125
CAST IRON Non Machineable	This is a mild, steel-core wire, with special flux for cast work. If machinable deposits are required, use the MACHINABLE (nickel) rod described where results are less important than cost. (See directions above for "skip" welding).	-----	1/8″	80-120
GENERAL PURPOSE-IRON POWDER	A general purpose "drag" rod, all-position. The iron powder in the flux coating combines with the filler rod to make a smooth deposit with very little spatter. Ideal for ornamental work. A.W.S.-A.S.T.M. Class E-7014.	TY1782 TY1846 ----- -----	5/64″ 3/32″ 1/8″ 5/32″	min.-100 40-100 100-170 140-250
BRAZING ROD	Use with Twin Carbon Torch. No flux required on light work. Forms dense, sound, machinable weld. Especially suited to welding light gauge metals (such as machinery covers) which vibrate. Color marking: None. Melting point, 1019 degrees Centrigrade — 1866 degrees Fahrenheit.	TY1848 -----	3/32″ 1/8″	20-50 20-100
STAINLESS STEEL	HARDENED STEELS are easier to weld with this rod. When in doubt about the "Hardness" of your steel, use this rod for best results. STAINLESS STEELS come in a wide variety, and this rod handles most of them. Consult the original equipment manufacturer where expense warrants, as some of the "monel" type metals do not lend themselves to ordinary arc welding. A.W.S.-A.S.T.M. Class E-308-16.	----- -----	3/32″ 1/8″	50-100 90-150
ALUMINUM FOR T.I.G. TORCH	Use on most Aluminum metals and aluminum castings. A.W.S.-A.S.T.M. R4043 A5. 10-57T.	-----	3/32″ x 36″	
A.C. CARBON ELECTRODES	Copper coating carries power to the tip, where intense heat is concentrated. Provides useful heat for brazing, soldering, silver soldering, shaping, melting, burning, bending. Use carbon size in proportion to size of job.	----- TY1847 TY2322	1/2″ 1/4″ 3/8″	100-175 min.-40 min.-100

Setting the Heat Control

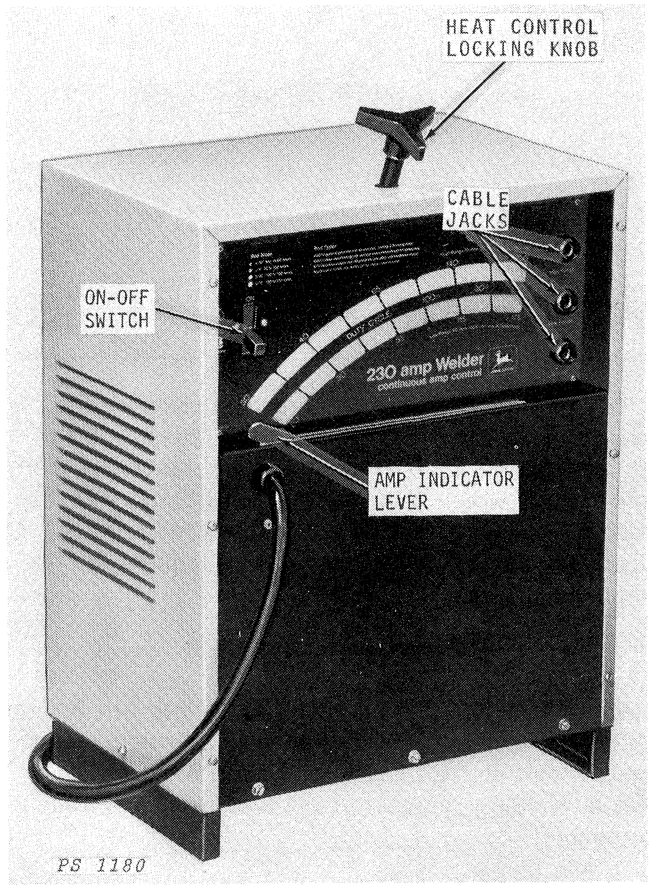
The electrode type and the thickness of the workpiece metal determines the amount of heat needed in the welding process. The heavier and thicker the metal, the more heat (amps) will be required. There is no hard and fast rule which sets out the exact amperage required for every situation. To check the heat requirements for particular applications, experiment on scrap metal.

1. If TOO MUCH heat is used:
   a. The arc will burn through light metals.
   b. The bead will be flat and porous.
   c. The bead will "undercut" the work.

2. If TOO LITTLE heat is used:
   a. The bead will be high.
   b. The bead will be irregular.

3. If PROPER HEAT is used:
   a. The bead will lay smoothly over the work without ragged edges.
   b. The base metal puddle will be as deep as the bead that rises above it.
   c. The welding operation will make a crackling sound similar to the sound of eggs frying.

NOTE: Rate of travel over the work also affects the weld. To insure proper penetration, and enough deposit of rod, the arc must be moved slowly and evenly along the weld seam.



To set the heat control:

1. Turn the locking knob to the left (counterclockwise), until the Ampere indicator lever moves freely.

2. Set the lever at the Amperage desired. Turn the locking knob to the right (clockwise) to hold the heat setting in the desired position.

R 2231

Welding Techniques

To be a good welder requires both knowledge of what can be done with welding equipment and the skills necessary to use the equipment effectively. The information which follows is an introduction to the basics of welding technology. Combined with practice it will enable you to use your equipment to maximum advantage.

STRIKING THE ARC

CAUTION: Exposure to a welding arc is extremely harmful to the eyes. Prolonged exposure can cause blindness. Never strike an arc or begin welding unless your eyes are adequately protected.

Striking and maintaining a satisfactory arc is the first step in welding. Although it is a simple process, it can be hazardous. Before you strike any arc:

1. Put on your helmet.

2. Inspect the electrode. (To insure good contact with the base metal, the exposed end of the rod should be clean and shiny.)

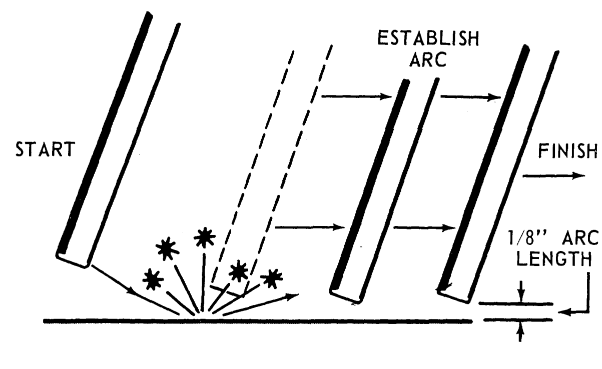
3. Set the heat control and turn the welder on.

4. Drop your helmet over your eyes.

To Strike the Arc

With a short stroke, rather like striking a match, move the electrode across the base metal surface. Almost at once you will hear a sputter and see an arc develop.

As soon as the arc has formed, lift the electrode away from the base metal until the arc is crossing a gap of approximately 1/8". It is important that the gap be maintained during the welding process, and that it be neither too wide or too narrow, If the gap becomes too wide, the arc will be extinguished; if the gap becomes too narrow, the electrode will "freeze" or stick to the work piece.



SCRATCHING METHOD

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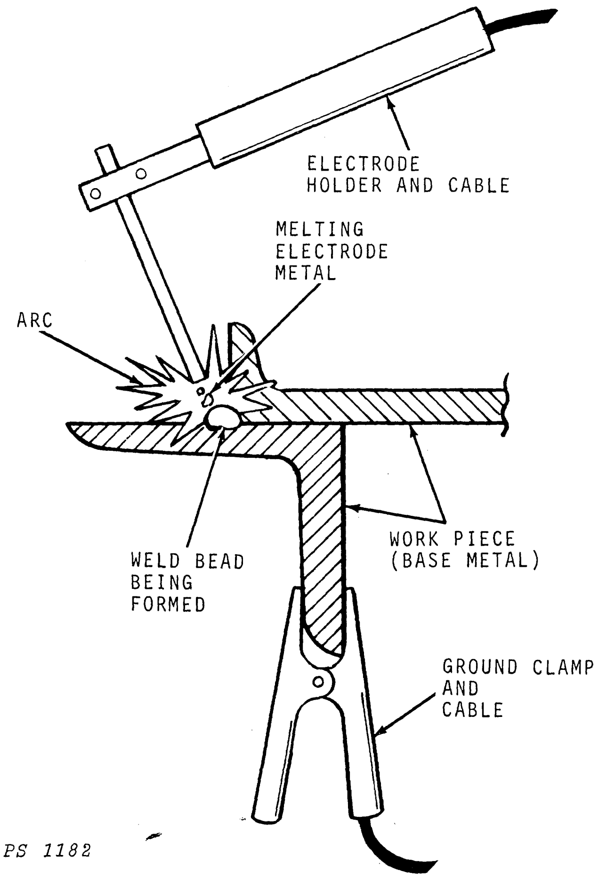
Striking a proper arc and maintaining the gap between the electrode and the base metal takes practice. A beginner may expect to extinguish any number of arcs and "freeze" more than a few electrodes before acquiring the necessary skill.

Knowing when the arc is just right is a matter of experience. A good arc is accompanied by a crisp, crackling sound. The sound is similar to that made by eggs frying.

LAYING THE BEAD



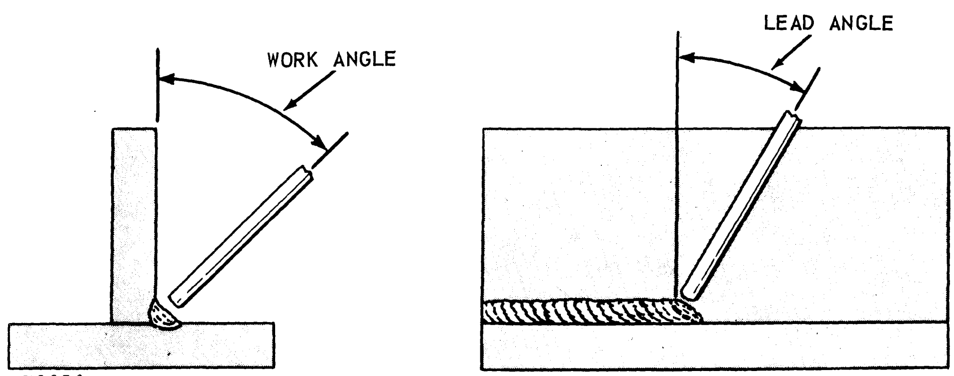
PS 1182

The object of welding is to distribute metal from the melting electrode in an even bead along the welding seam or joint. The bead is formed by moving the arc slowly along the work so that droplets of molten electrode metal fuse with the molten base metal in the "puddle" just beneath the arc.

Controlling the quality of the bead is a matter of (1) maintaining the proper electrode angle; (2) achieving maximum penetration of the arc; and (3) regulating the speed and pattern of electrode travel along the weld seam.

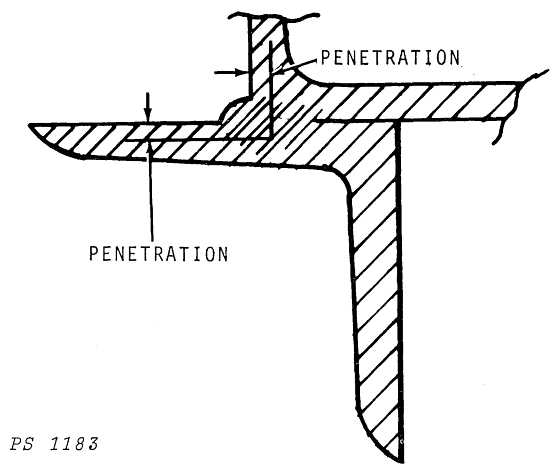
Electrode Angle

It is good practice to "lead" the weld with the arc. The electrode should be held so as to permit inspection of the "puddle" formed just behind the arc and of the newly deposited bead. The most effective electrode angle will be determined in part by the welding position. The illustration above shows the proper angle for a fillet weld. For suggestions on electrode angles for other positions, see page 19. and following.



X2839

Penetration



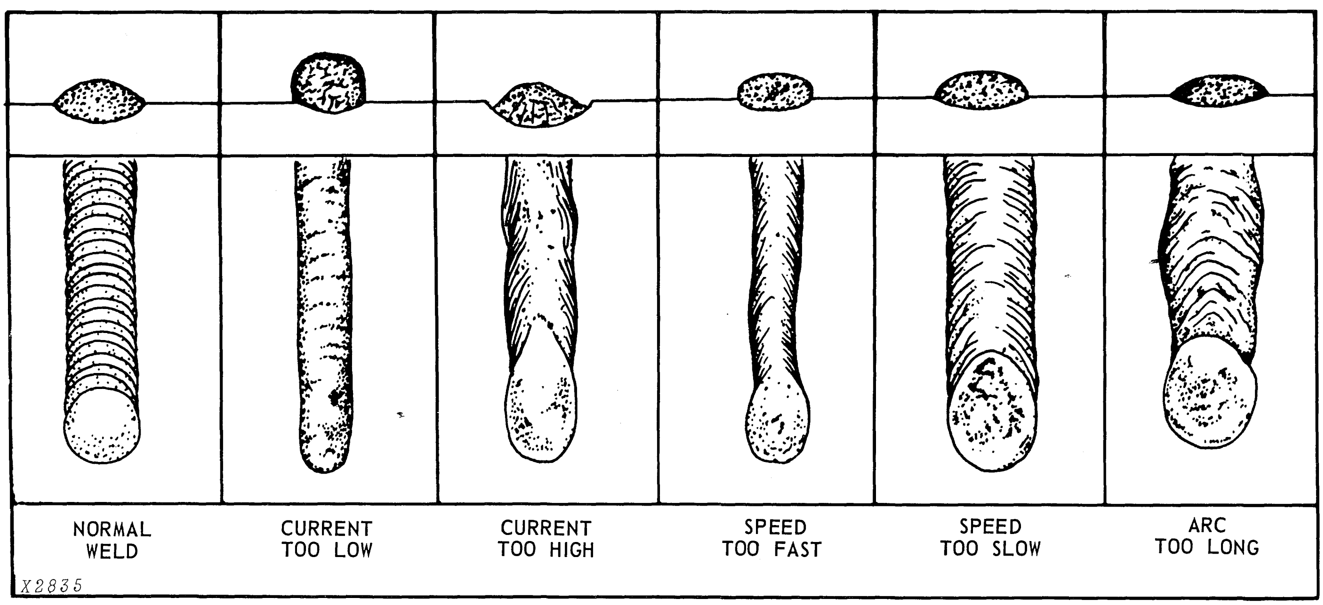
Welding depends on the fusing of base and electrode metals. To create a satisfactory weld the arc must "penetrate" the base metal and form a puddle of molten material into which the melting electrode can be fused. Since the depth of penetration is largely determined by the length of the arc, a short arc, achieved by holding the electrode tip close to the work piece, will produce the best results.

Remember that as the electrode melts, the holder must be brought closer and closer to the work.

Electrode Speed and Pattern

A solid weld bead requires that the electrode be moved slowly and steadily along the weld seam. Moving the electrode rapidly or erratically will prevent proper fusion or create a lumpy, uneven bead.

A good weld bead will appear as a series of closely spaced ripples or waves. The new metal will be smooth and even — without porosity or hollow spots. The height of the bead should be approximately equal to the diameter of the rod used.



Changing Electrodes — Starting and Stopping

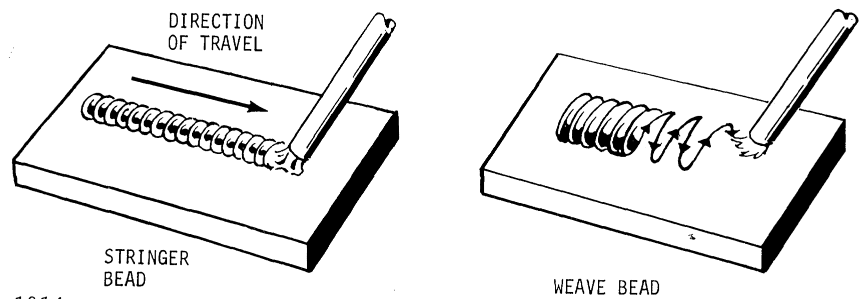
If it becomes necessary to change an electrode or extinguish the arc before a weld is completed, refer to the following instructions:

1. Raise end of electrode from base metal to break the arc. If required, remove and replace the electrode in the holder.

2. Before restarting the weld thoroughly clean the unfinished weld with a wire brush. It may be necessary to remove flux or slag with a chipping hammer.

3. Strike a new arc just ahead of the crater. Move the arc to the crater, and fill with electrode metal. The welding procedure can then be continued.

TYPES OF BEADS



PS 1214

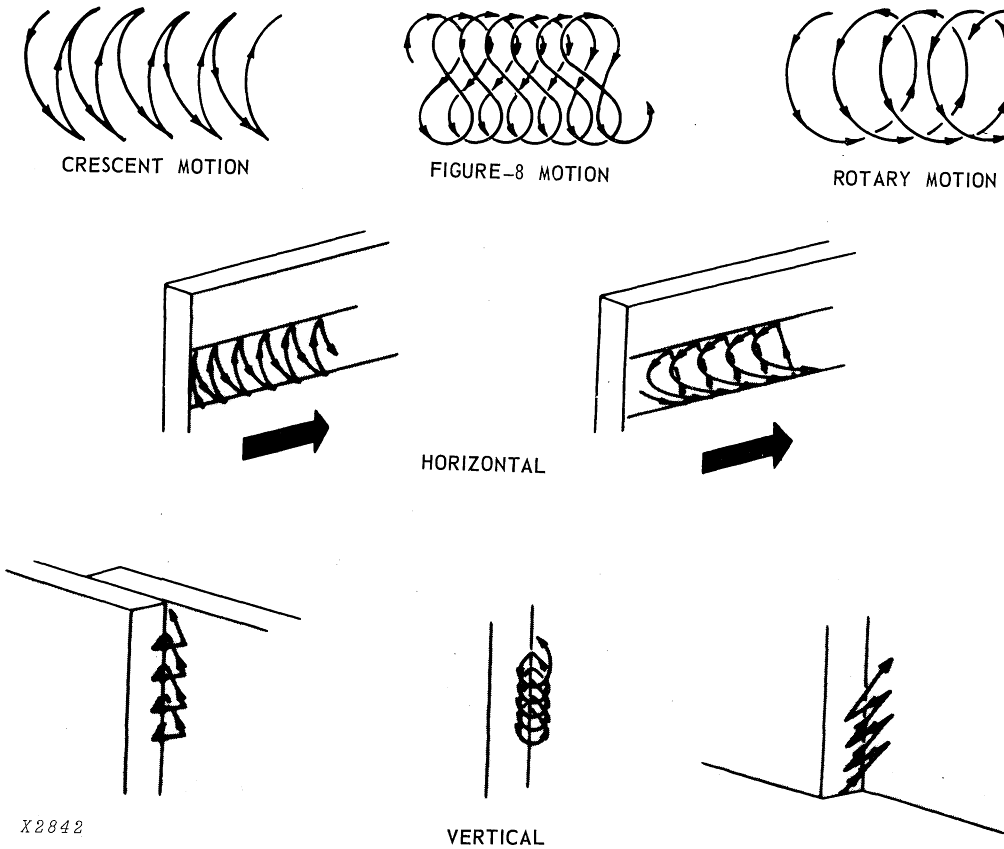
There are two basic patterns for laying in weld metal. Stringer Beads and Weave Beads.

Stringer Beads

A stringer bead is formed by laying down a continuous strip of new metal in one steady forward pass along the weld seam.

To lay a stringer bead: Strike a short (1/8") arc and hold at the start point. When a puddle is formed and the base of the bead begins to build, move the arc along the work without weaving or oscillating. Hold the electrode so that the holder is always slightly ahead of the arc. The action will pile the molten metal just behind the arc. If the electrode motion is smooth and even the bead will be of consistent height and width with a uniform closely spaced ripple.

Weave Bead



Weave Bead Patterns — To Increase Width and Volume of Weld Deposit

When the space to be filled with new metal is wider than can be filled by a stringer bead on a single pass, a weave bead (formed by oscillating the arc back and forth) is often used.

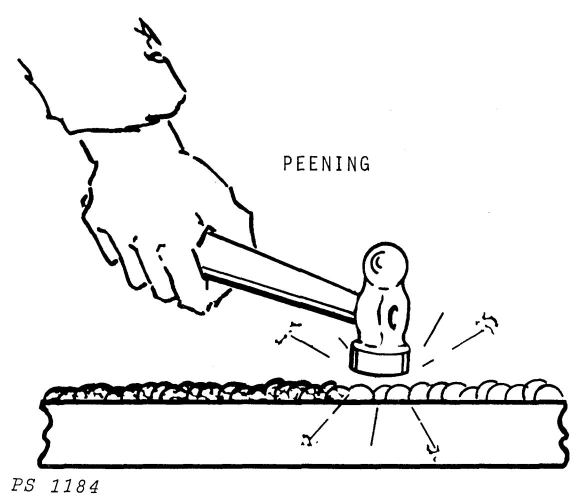
To lay a weave bead: Strike a short (1/8″) arc and hold at the start point. When a puddle is formed and the base of the bead begins to build, move the arc back and forth across the space to be filled, moving forward slightly each time the direction of travel is reversed. Hesitate momentarily at the outermost edge of each weave pass to insure that as much heat is reaching the outer edges as is reaching the middle.

FINISHING THE BEAD

As the coating on the outside of the electrode burns off, it forms an envelope of protective gases around the weld. This prevents air from reaching the molten metal and creating an undesirable chemical reaction.

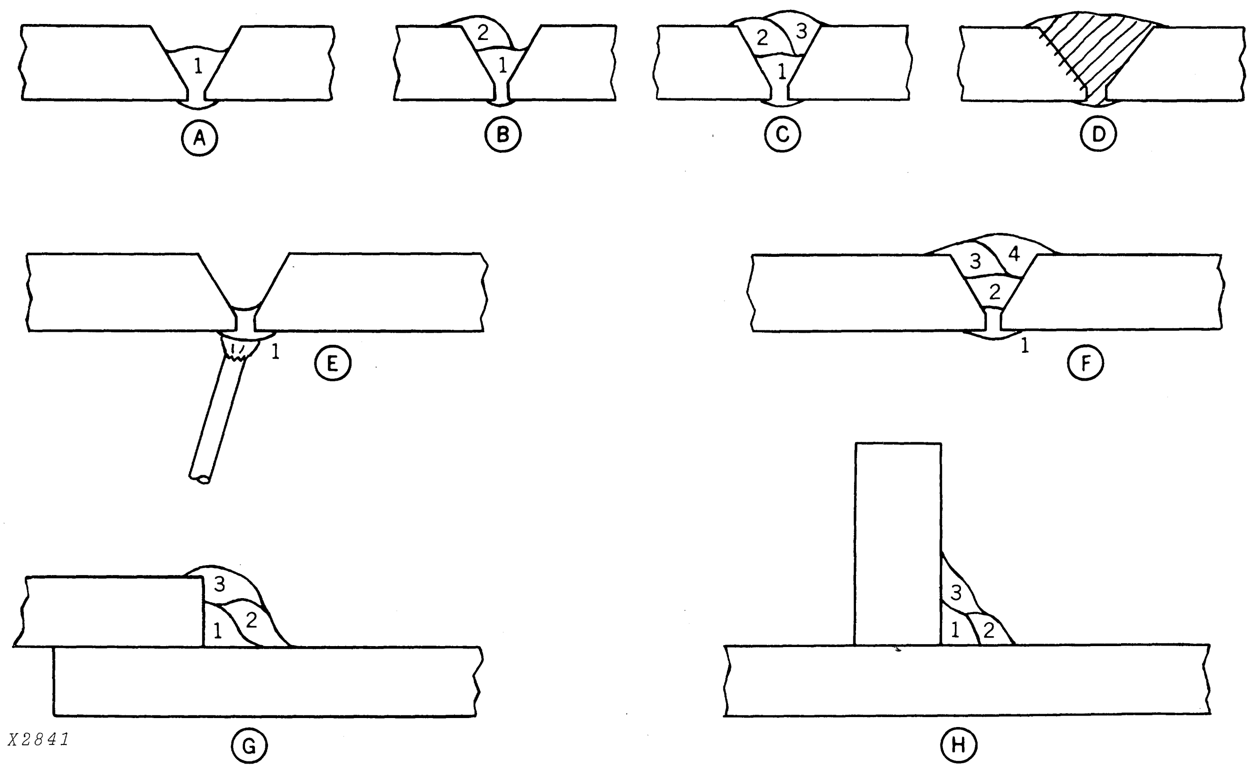
The burning coating, however, forms slag. The slag formation appears as an accumulation of dirty metal scale on the finished weld. The slag may be removed with a hammer or chisel after it has cooled.

Peening



The intense heat produced at the arc sets up strains in the metal joined by welding. Peening the weld — striking the weld bead with a hammer — not only removes the scale left behind in the welding, but relieves the internal strains developed by the heating and cooling process.

HEAVY BEADS — MULTIPLE PASSES



A-First or Root Pass In a Butt Joint
B-Second Pass
C-Third Pass
D-Finished Weld
E and F-Butt Joint Where Root Pass Is Welded From Penetration Side of Joint
G-Lap Joint Welded in Three Passes
H-T-Joint Welded in Three Passes

Joints Welded in Multiple Passes

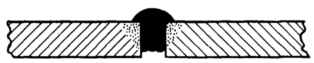
A complete weld may require more metal than can be laid in a single pass by either the stringer or weave method. Very heavy beads can be built up by making several passes along the weld seam.

When welds are to be laid one on top of another, slag left from the previous pass must be thoroughly cleaned away before the second pass is laid down.

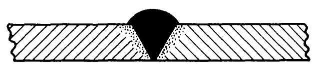
TYPES OF WELDED CONNECTIONS

Although there are many ways of setting up metal parts for welding, only a few basic methods are commonly used. The more frequently encountered joints and the welding procedures recommended for them are described below.

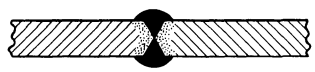
Butt Welds



OPEN



CLOSED VEE



DOUBLE VEE

PS 1185 BUTT WELDS

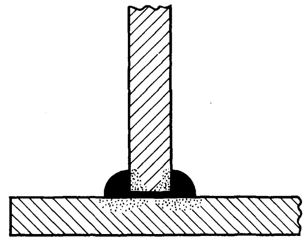
There are three types of butt welds: open, closed-Vee and double-Vee.

Open butt welds are generally used on sheet metal less than 3/8" thick. An open butt weld is not as strong as a closed-Vee or double-Vee butt weld, but it requires only very simple preparation. The edges of the sheet or plate need only be clean and parallel. The space between the edges should be equal to the diameter of the weld rod used. For most applications a single pass is sufficient. The joint can be made stronger by running a second pass down the reverse side.

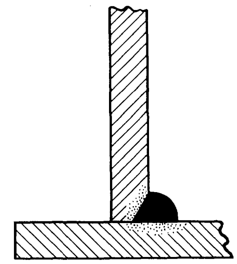
Closed-Vee butt welds are generally used on sheet or plate more than 3/8" thick where proper penetration can be achieved only if the edges have been ground or beveled into a Vee. The edges may be prepared with a file or grinder. In most applications, several passes will be required to close the seam.

Double-Vee butt welds are similar in application to closed-Vee welds, except that even heavier plate may be joined and that additional weld passes down both sides of the joint are required.

Fillet Welds

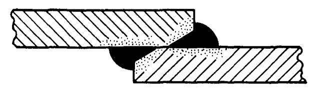


BUTT FILLET



VEE FILLET

TEE JOINTS



LAP JOINT-VEE FILLET

PS 1186 FILLET WELDS

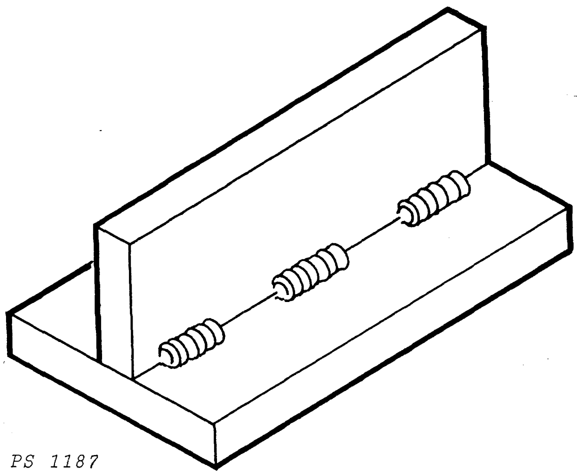
Fillet welds are most commonly used with Tee and Lap joints. The fillet is the new metal deposited along the intersection of a vertical surface on one piece and the horizontal surface of the other.

A short (1/8") arc should be used to lay in the weld. The electrode should be held at an angle equidistant to the surfaces being joined. To distribute the heat evenly, the arc should be directed toward the heavier or thicker of the work pieces.

Watch the puddle at the arc carefully. The molten metal will tend to crawl up the edge of the bead. Too much speed or too long an arc will result in "undercutting" and produce a weak weld.

If the base metal is thicker than 1/4", additional beads should be run along the joint to achieve maximum penetration and strength.

Tack Welds



Tack Welds Along a Tee Joint.

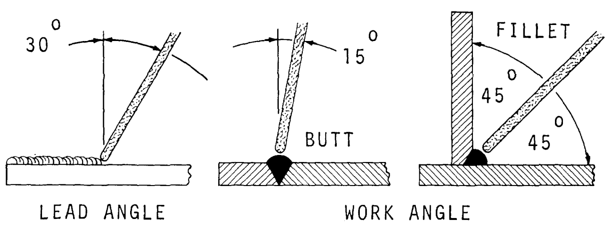
Tack welds are short, shallow welds placed at intervals along the seam or joint. Tack welds are used when strength is not a factor. Tack welds are often used to hold the work pieces in position while longer, deeper welds are being made.

Most tacks are simple, short stringer beads.

WELDING POSITIONS

There are four commonly recognized welding positions. In the order of increasing difficulty these are: flat, horizontal, vertical and overhead.

Flat Welding



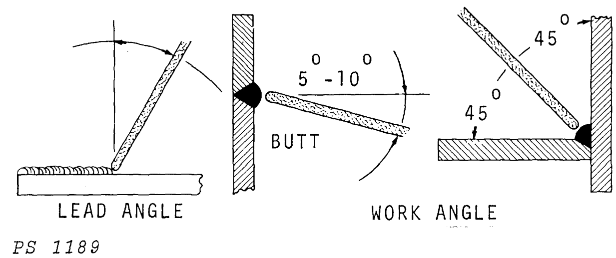
Electrode Angles For Flat Welding

In flat welding, the bead is run on a surface laid parallel to the ground.

Welding with the work in a flat position is by far the simplest and easiest. It also yields the best results. If the work can be so arranged, it should be set up for flat welding.

Flat welding requires no special techniques and any general purpose, flat-weld, or all position rod may be used.

Horizontal Welding



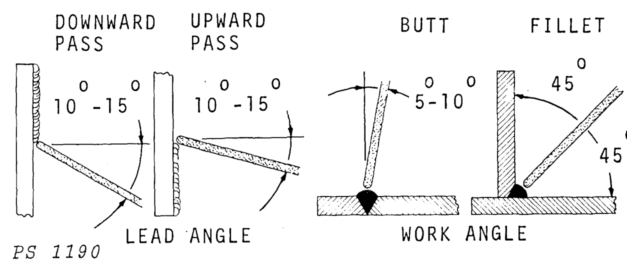
Electrode Angles For Horizontal Welding

In horizontal welding the bead is run parallel to the ground but on a vertical or near-vertical surface.

Horizontal welding is only slightly more difficult than flat welding. If the electrode is held at 90° to the work, the soft metal at the arc may droop, and, as it cools, form a bead which is thicker at the bottom. This can be corrected by playing the arc more to the top side of the bead.

Other than taking care to form an even bead, horizontal welding requires only ordinary skill. Any general purpose or all-position rod may be used for horizontal welding.

Vertical Welding



Electrode Angles For Vertical Welding

In vertical welding the bead is run vertically (up or down) on a vertical surface.

Vertical welding requires more skill than horizontal or flat welding. The metal left behind in the welding pass must not remain in a liquid state so long that the force of gravity pulls it away from the point where it was deposited.

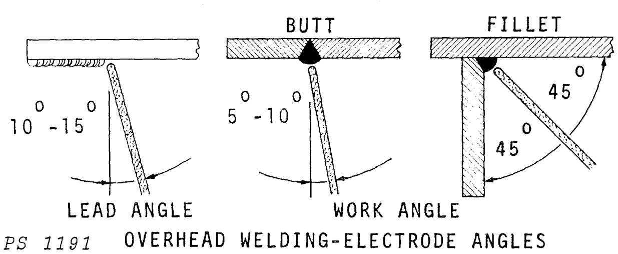
Vertical welding may be done from the bottom up or from the top down. No matter which direction is chosen a short arc should be used. The short arc will insure quick heating and good penetration of the base metal.

Vertical Welding (Continued)

For sheet metal or light work, welding from the top down is preferred. The electrode should be held perpendicular to the work. Because the penetration need not be great, the rate of travel may be faster than that used for flat work. This permits relatively rapid cooling of the bead and prevents it from falling away.

When heavier base metals must be joined along a vertical seam, welding from the bottom up is recommended. The electrode is held at a slight angle to lead the weld. The arc is kept short. When the bead begins to form, and enough metal has been added so that any more would tend to fall away from the weld, the arc is lengthened slightly and moved up along the seam a short distance. When the first deposit solidifies, the arc is brought back, shortened, and another deposit is laid on top of the first. The process is repeated, over and over, until the weld is completed.

Overhead Welding



Electrode Angles For Overhead Welding

Overhead welding requires that a bead be laid against an inverted flat or nearly flat surface.

Overhead welding is more difficult than any of the other positions. In overhead welding, the electrode metal must be forced through the arc into the puddle crater on the base metal. The bead must be built up a little at a time and the puddle at the arc restricted to a relatively small area. The molten bead must solidify quickly or it will fall away from the joint.

A very short arc, a small electrode, and a lower heat setting must be used. Hold the electrode perpendicular to the work and use a stringer bead. As the bead first begins to form, move the electrode away from the crater and lengthen the arc slightly to permit cooling of the deposited metal. Never break the arc; simply lengthen it during the momentary cooling. When the bead metal has solidified, return to the edge of the first deposit and add more metal. Repeat the process until the bead has been formed.

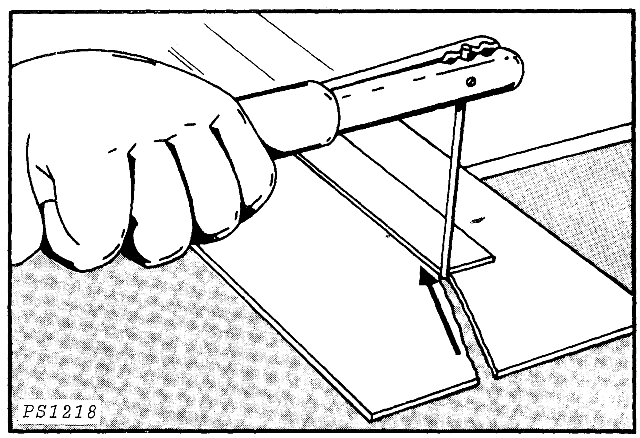
Overhead welding can be done only with all-position rod or with rod marked for overhead application.

CAUTION: Hot metal dropping from above can cause serious burns or start fires. Always protect the head, hands, feet and body during overhead welding. Do not overhead weld where hot metal can fall on or into flammable materials.

SPECIAL APPLICATIONS — SINGLE ELECTRODE TORCH

The Electric Arc can be used for a number of purposes other than welding steel sheets, plate or shapes. Fitted with an electrode of the proper type, the welder can be used to cut metal plates of brass, to burn holes in metal surfaces, to "hard-surface" metal objects, to build up gear teeth, to weld cast-iron and to thaw frozen pipes. For rod sizes and heat settings, see the chart on page 21.

Cutting and Burning



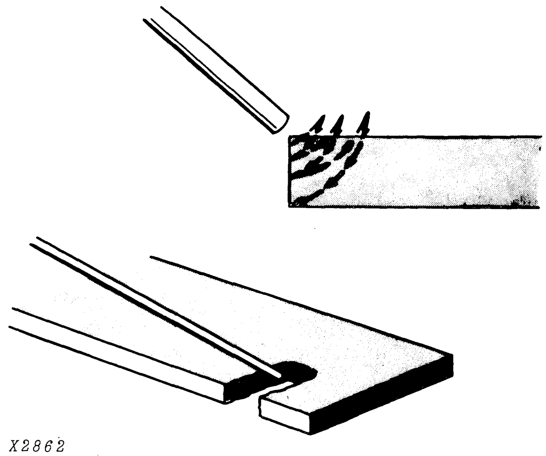
Cutting Thin Plate

In cutting or burning, the heat of the arc is used to melt or burn away the base metal. No attempt is made to add metal from the melting electrode.

Special cutting electrodes are available. If a general purpose rod is used for cutting, less of the electrode will be consumed if it is soaked in water for a few minutes prior to use.

CAUTION: Hot metal dropping from above can cause serious burns or start fires. Always protect the head, hands, feet and body when cutting or burning metal. Do not cut or burn where hot metal can fall on or into flammable materials.

Cutting Plates, Bars, Etc.

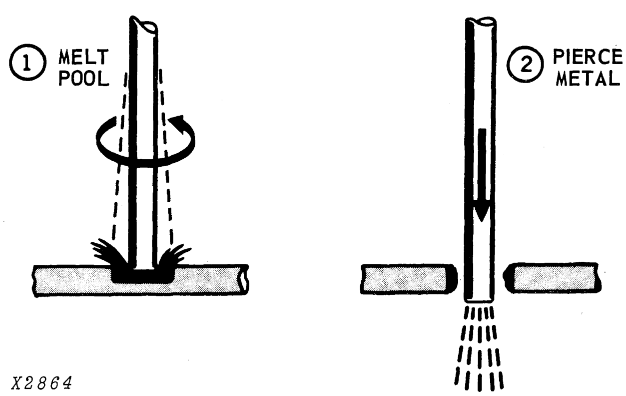


Cutting Thick Plate

Cuts should start at the edge of the work piece. Strike the arc and play the arc along the cut line. Concentrate the heat in a relatively small area. If the cut is long or if the material is heavy, make the cut as a series of short passes.

SUGGESTED AMPERAGE SETTING FOR ARC CUTTING		
Metal Thickness (Inch)	**Electrode Diameter (Inch)**	**Ampere Range**
up to 1/8	3/32	75-230
1/8 to 1/4	1/8	180-295
over 1/4	5/32	180-295

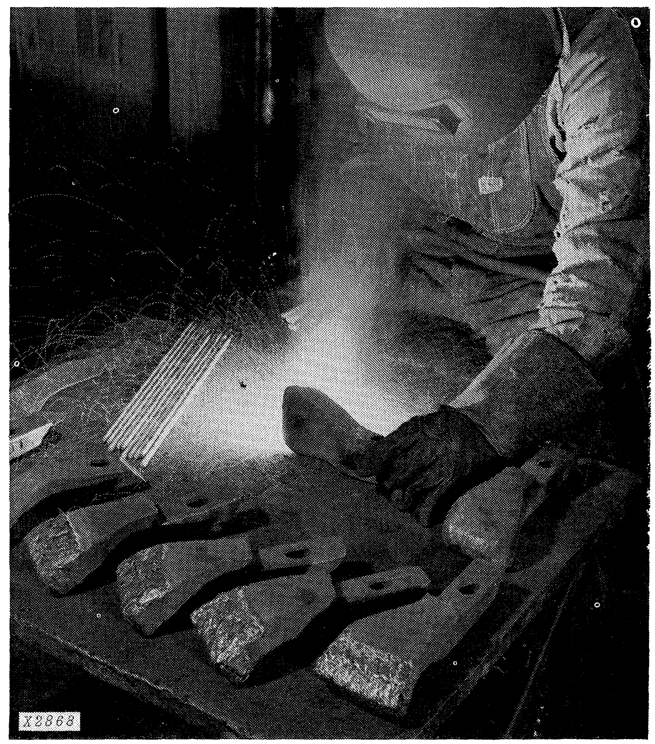
Burning Holes



To burn a hole in light material, strike the arc, hold the electrode perpendicular to the work piece and rotate the arc in a small circle until the base metal softens. Pushing or jabbing the soft spot with the electrode will open a hole through the metal. The pilot hole may be enlarged by burning away or melting the base metal around it.

Holes in heavier metal may be burned from the bottom. The melting base metal is permitted to drop away until the hole is opened or enlarged to the desired size.

Hard Surfacing



Surfacing Bucket Teeth

Hard surfacing is commonly used on cultivator points, plow shares, tractor rails and pads, and any other surfaces subject to abrasive action, friction, and hard wear. Usually it provides a new outer surface which is harder and has several times the lasting qualities of the original metal.

For most applications, use a 1/8" rod with a 80-140 amp heat setting.

Hard Surfacing (Continued)

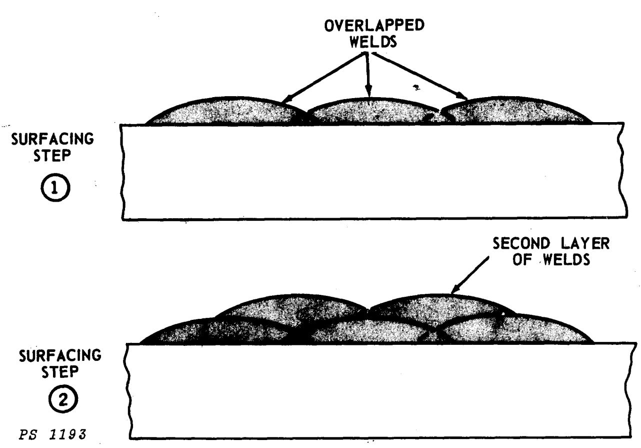
The worn part, or area to be surfaced, should be built up to within about 1/8" of its original dimension with a mild steel, low alloy, or high carbon electrode. Only one layer of hard surface electrode should be applied. If more layers are applied, the hard surface may scale off because of its high hardness.

The arc length best suited for a particular application can be determined readily by a series of brief tests. Burn the electrode at various arc lengths and observe the result of various arc length on the deposit. A fine spray type arc with no explosive interruptions in the arc stream and a medium-to-long arc is most desirable. This arc may be easily controlled and very thin, smooth, hole-free deposits may be applied.

Use a wide weave bead to lay on the new metal. Slag removal is not necessary; the arc force is sufficient and the nature of the slag is such that the previously deposited slag is easily penetrated and floated to the surface. Speed of travel and heat setting will be determined largely by the depth of deposit desired and the welding conditions.

IMPORTANT: Never use a hard surface electrode for a weld which requires tensile strength. Hard surface electrodes are for hard surfacing and for no other purpose.

Building Up Gear Teeth



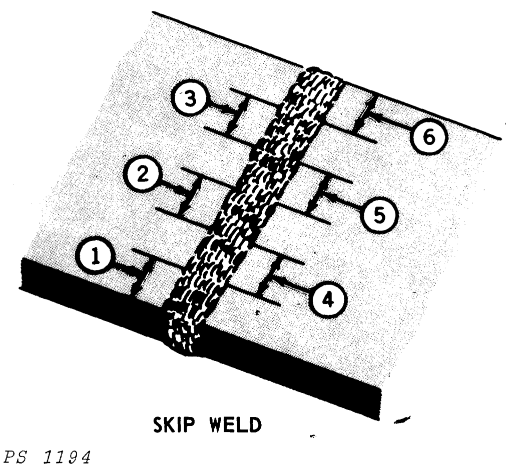
Building Up Gear Teeth.

Building up broken or worn gear teeth can easily be accomplished by depositing short beads, one on top of the other, until the general contour of the tooth is restored. The tooth can then be ground to correspond with the other teeth.

Use a 1/8" rod with a 80-140 amp heat setting.

Each bead should be allowed to cool and must be cleaned before the next bead is applied. Use a lower heat setting and smaller electrodes than would ordinarily be used. Care should be taken to prevent any excessive deposit which will require extra time for finish grinding. Nickel rod is recommended for this use.

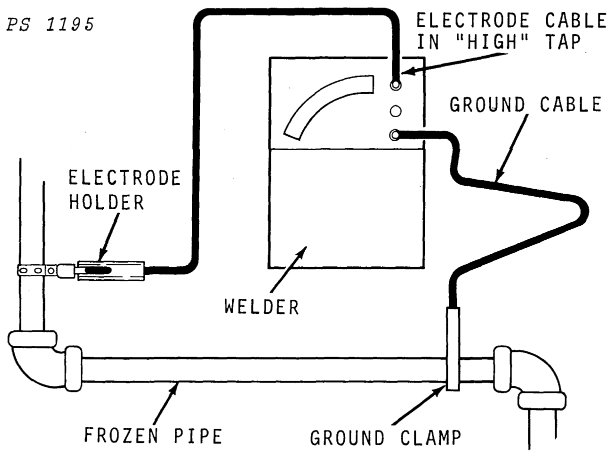
Welding Cast Iron



Cast iron to be welded should be well cleaned. Unless the item is thoroughly preheated do not weld continuously. "Skip" welding in beads 2" to 3" long is recommended wherever possible. Keep the work cool. Light peening immediately after breaking the arc tends to reduce formation of new cracks or continuance of old ones. Do not try to hurry the process; concentrated overheating will tend to extend any crack.

Machineable welds may be made with the use of high nickel-content rod made for this purpose. In cold weather, the casting should be warmed to indoor temperature before welding.

Thawing Water Pipes



Used wisely, the welder will provide thawing service unavailable by any other means without harm to the welder. However, you must understand the principle of the treatment before proceeding.

Thawing frozen pipes, either underground or exposed, is accomplished by distributing the heat normally generated at the "arc" of the arc welder throughout the water (ice) inside the frozen pipe. The water and the pipe act as conductors. In conducting the current, they present resistance to the flow of electrical energy, thus generating heat. If an attempt is made to thaw a very large pipe, however, the pipe may present less resistance than the cable, and the cables will heat, leaving the pipe relatively cool. COPPER PIPE, being an excellent conductor, does NOT thaw with this treatment.

Observe the following points for a successful operation:

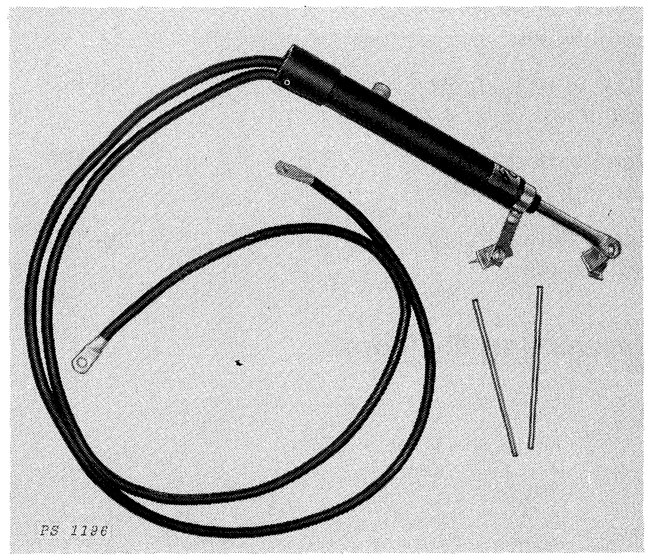
1. If possible, pressure must be kept on the system until the water thaws and begins to flow.

2. Connect the welder ground cable to one end of the frozen section, and the electrode to the other. The welder should be plugged in on "high range" tap with the control set on minimum amperage.

3. Where the length to be thawed is longer than can be reached with the ground and electrode cables, it may be necessary to use an extension. If you must use longer wire, check it occasionally. If it becomes hot to the touch, all the heat is being generated in the wire, and the frozen pipe is remaining cool.

4. The size and length of pipes which may be thawed cannot be accurately fixed. The operator must use judgment in determining whether a pipe, properly connected to the welder, will present more resistance than the connecting cables. The final test is in the welder itself. If the welder becomes hot to the touch (bearing in mind that it normally operates "warm") try to thaw a longer section of pipe, or occasionally give the welder time to cool.

USING THE CARBON ARC TORCH



The carbon arc torch is an accessory that greatly facilitates the pre-heating required for bending and shaping operation. It is also used to solder, braze and weld aluminum, brass, bronze, monel metal, cast iron, malleable iron and steel by the flame method.

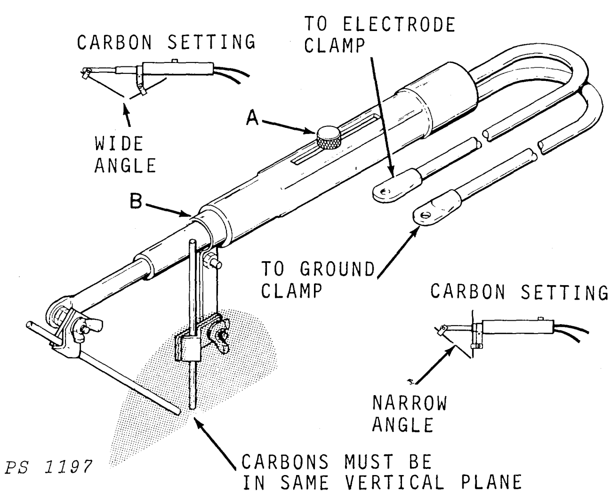
In the carbon arc torch the arc is created by the electrical current leaping the gap between two carbon electrodes. The arc produces a temperature of approximately 10,000°F at its center. Although the electrodes become very hot, they burn slowly and leave no metal deposits behind. Because the current passes from electrode to electrode and does not flow through the work piece, a ground clamp connection from the work piece to the welder is unnecessary.

Applications — Carbon Sizes and Heat Settings

The size and intensity of the arc flame is determined by the size of the carbon electrodes and heat setting used. Different rods and settings are used for various applications.

Application	Carbon Electrode Size	Heat (AMP) Setting
Fine work, silver soldering, tin plate, small detail	1/4	30-40
Light brazing, heavy soldering	5/16	30-60
General purpose brazing, light heating	3/8	30-100
Heavy duty heating and bending	1/2	80-175

Assembling the Torch

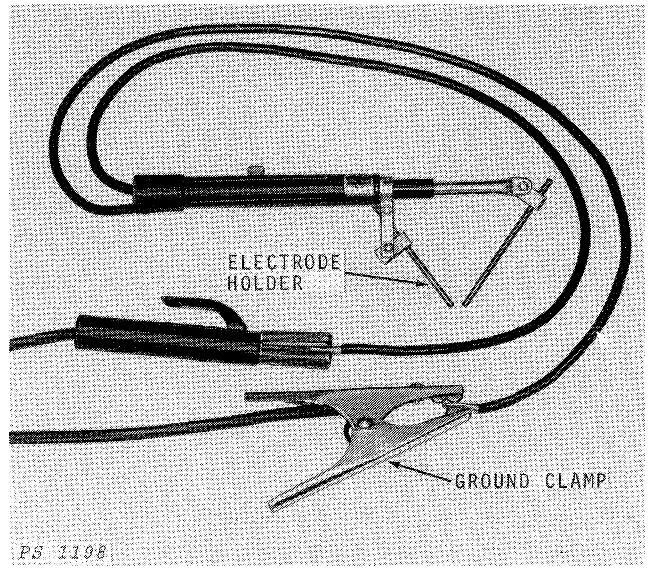


Loosen the thumbscrew (A) and move the slide in or out until the thumbscrew is about midway along the slot. Tighten the thumbscrew very lightly. Properly set, the slide will position but will move easily when pressure is applied at the thumbscrew.

Always use two carbons of the same size.

Fix the carbons in the clamps and adjust for alignment and angle. Alignment is regulated by adjusting the friction ring (B) right or left. The carbons should be aligned to be in the same plane. The angle at the tip may be set by adjusting the wing nuts at the electrode clamps. A wide angle will produce a fine arc. A shallow angle will produce a heavy arc. The torch is properly set when the thumbscrew is midway along the slot and the electrodes are just touching.

Connecting the Torch



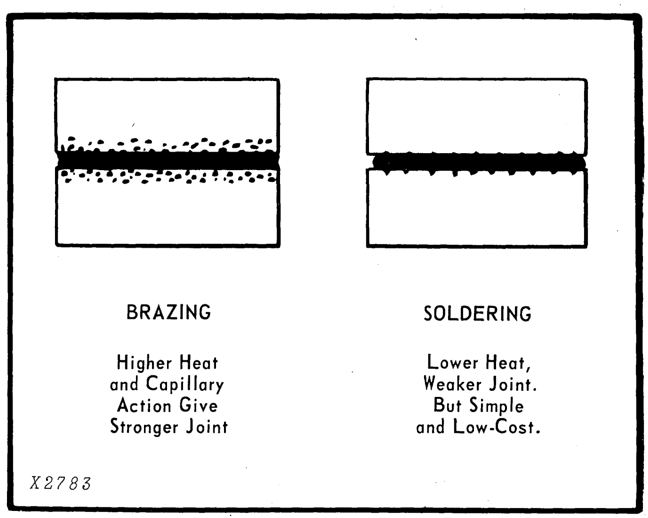
Clip one of the torch cable lugs in the jaws of the electrode holder. Clip the other in the ground clamp.

Maintenance

Keep the torch clean and dry. Remove carbons when not in use. If the torch must be disassembled for cleaning, the nylon thumbscrew may be removed.

Warning: Never replace the nylon thumbscrew with a metal fastener of any kind.

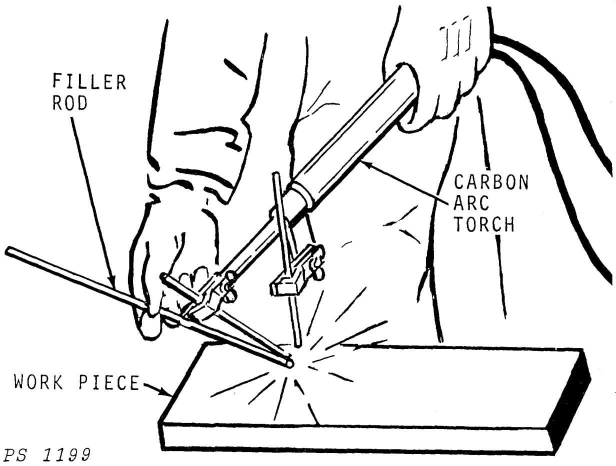
Brazing



Brazing and Soldering Compared

Brazing is recommended where light metals must be joined or where arc welding is impractical. Brazing is similar to soldering in that the added metal is not fused to the base metals. It is different in that greater heat is used. The bonding metal is made to flow between the surfaces being joined. The resulting connection is superior in both strength and appearance.

Brazing (Continued)



PS 1199

For general purpose brazing a bronze rod is used. The rod and the surfaces to be joined are heated with the arc flame. As the rod melts it spreads over the heated base metals, attracted to the area of greatest heat. By manipulating the torch, the rod metal may be made to flow in a particular direction.

To braze:

CLean the surfaces to be joined. Make sure all areas are free of dirt, rust, scale, oil or paint.

Strike the torch, and using the brazing rod, tack the work pieces to one another in finished position.

CAUTION: Exposure to electric arc is extremely harmful to the eyes. Prolonged exposure can cause blindness. Never strike an arc unless your eyes are adequately protected.

Play the torch along the seam to be closed to heat the base metal. When the base metal is hot enough, melt the filler rod in the arc and distribute the molten metal along the joint.

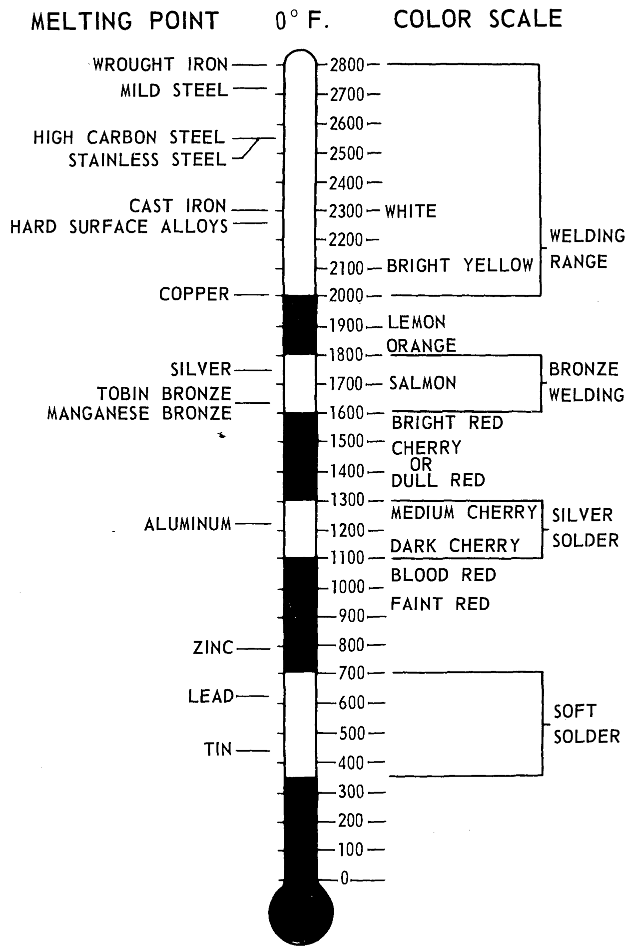
If the filler metal forms into balls or rolls away, the base metal is too cool. To raise the temperature, move the arc closer to the work. When the rod metal spreads into a flat puddle on contact, the base metal temperature is correct.

Bond is made when the molten filler rod and the base metal reach about the same temperature.

Care must be taken not to overheat the base metal. If the base metal shows signs of distorting, sagging or burning through, reduce the temperature by moving the arc away from the surface. The base metal must not be hot enough to show color when the torch is off and the helmet is raised.

When working at an angle, or in a vertical position, tack both ends, then work from the top down. By manipulating the torch, apply just enough heat to allow rod to sag or creep down the joint with the heat. Use rod sparingly. A large ball of molten filler metal will have a tendency to roll off.

Bending and Shaping



NOTE: To Convert Fahrenheit to Centigrade:
Deg. C.= 5/9 x (Deg. F.– 32)

X2878

Heated to the proper temperature, most metals become soft enough to bend easily. For some metals, however, the critical bending and shaping temperature range is extremely narrow — only a few degrees separate the temperature at which the metal remains stiff and unpliable and that at which it liquifies, boils or burns away. The carbon arc torch develops more than enough heat to bring any metal up to bending temperature but care must be used in its application.

Consult the chart above for the melting point of most common metals and alloys.

Working Iron or Steel

The working temperature range for iron and steel is relatively wide. The metals may be bent or shaped easily when they are heated to a cherry red glow.

Secure the work piece in a vise or clamp. Use 1/2" carbons set at a shallow angle. Strike the arc and play the arc flame over the area to be bent or shaped.

CAUTION: Exposure to an electric arc is extremely harmful to the eyes. Prolonged exposure can cause blindness. Never strike an arc unless your eyes are adequately protected.

Keep the torch in motion over the entire working surface. Avoid concentrating the heat. Too much heat in one spot may cause the metal to liquify, boil and become porous and brittle when cooled.

When the metal glows cherry red it may be bent, stretched or shaped with a hammer or other tools.

Working Other Metals

Any malleable metal may be worked by the above described means. Metals with extremely high melting temperatures or those which liquify quickly should be handled with great care.

Aluminum Welding

Aluminum welding is not difficult. The procedures used are similar to those used for welding ferrous metals. Aluminum welding requires a special flux coated weld rod. Because aluminum conducts heat very readily, and liquifies quickly when the critical temperature is reached the work piece metal must be preheated and handled carefully during the welding.

To weld aluminum:

Clean the work pieces thoroughly. Use a wire brush or file. The surfaces to be joined must be clean, bright and shiny.

Use 3-8 inch carbons set at a relatively shallow angle. Play the flame over the work piece until the work area and the surrounding metal is thoroughly heated, then add aluminum filler rod as you would brazing rod.

CAUTION: Exposure to an electric arc is extremely harmful to the eyes. Prolonged exposure can cause blindness. Never strike an arc unless your eyes are adequately protected.

Use standard carbon-arc torch welding techniques for laying in aluminum beads.

RECOGNIZING METALS

Most irons and steels look alike. So do various alloys of other metals. Even a careful surface examination may be usually insufficient to distinguish one metal from another. Yet each may have distinctive welding characteristics; the welding procedure that is satisfactory for one may not work at all for the other. To weld successfully, a welder must be able to identify the base metals being joined.

Methods of Identification

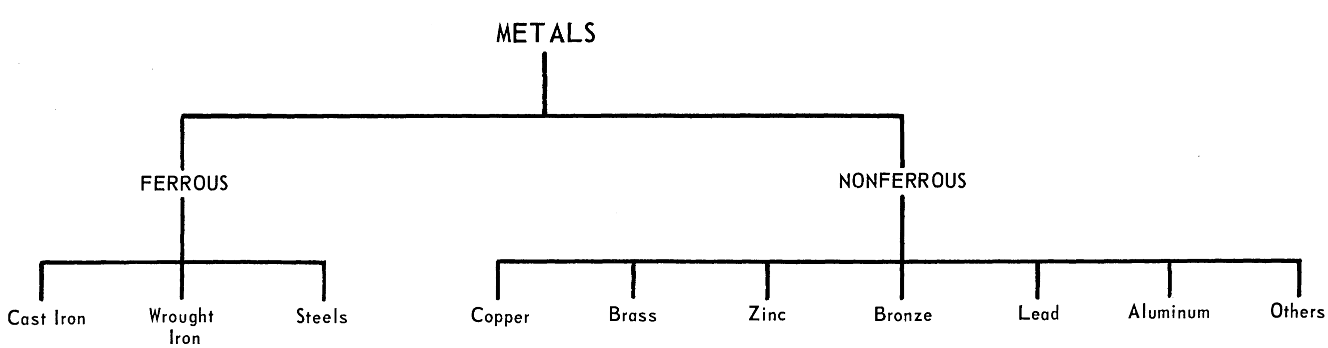
The most desirable identification for metals is the mill specification. Where mill specifications are unavailable, other methods of identification must be relied upon.

The most common methods of identification are:

1. Magnetic test.
2. Color test.
3. Spark test.

Magnetic Test

The capacity for magnetic attraction is a basic characteristic of most ferrous metals (iron and steel). Non-ferrous metals (aluminum, brass, copper, etc.) are not magnetic. Although some stainless steels are non-magnetic, a metal which will attract or hold a magnet is a ferrous metal — an iron or steel of some kind.



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Types of Metals

Color Test

Ferrous metals (irons and steels) have a typical medium-to-dark gray color. Non-ferrous metals (aluminum, brass, copper, etc.) tend to be light gray-to-white, yellow or red. Most people are familiar with the distinctive appearance of brass, bronze and copper. Aluminum, aluminum alloys, zinc, white metal., etc., are not always easy to distinguish from one another. The color test is usually a rough test useful only in the absence of other criteria.

Spark Test

Short of laboratory analysis, the most reliable method for identifying iron or steel types is the spark test. The method is widely used by experienced welders.

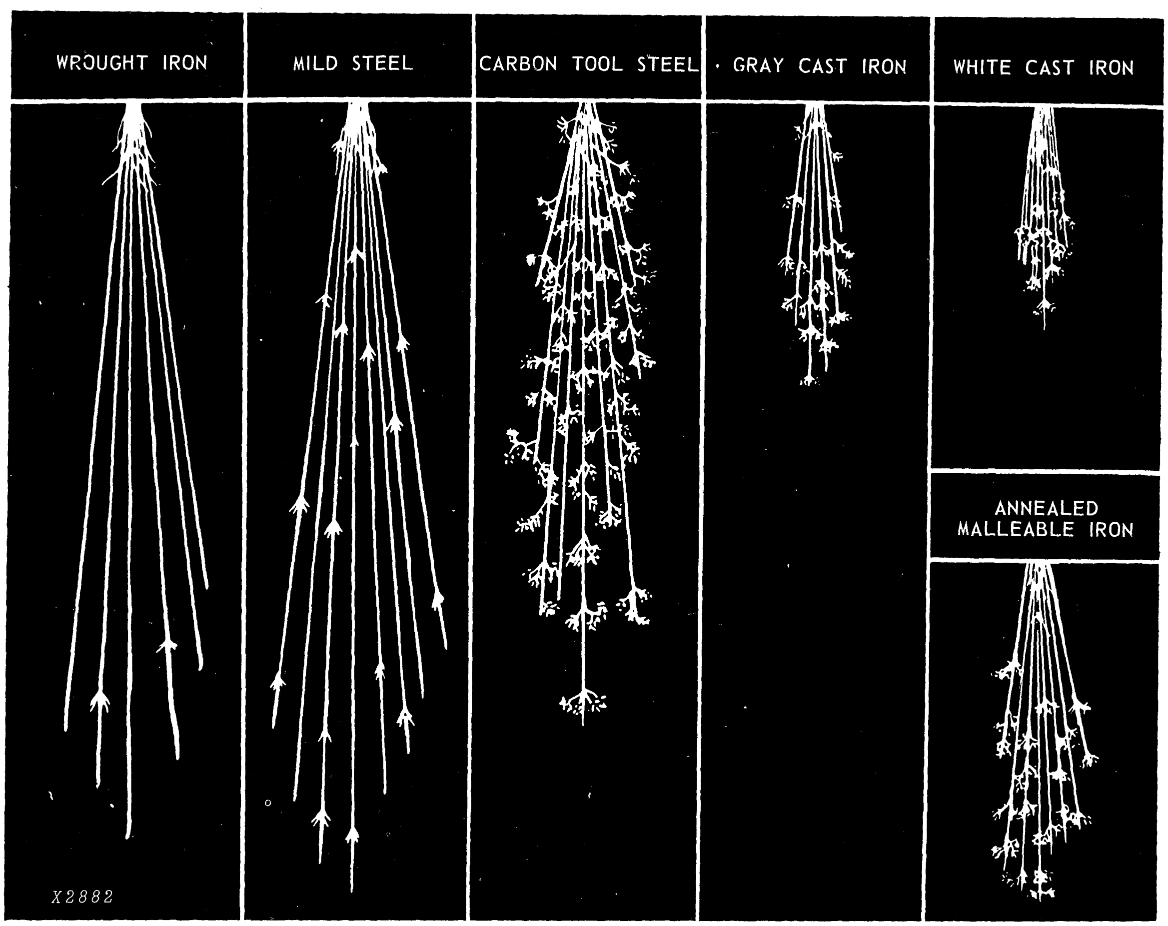
To run a spark test, the metal to be tested is touched with a rapidly spinning grinding wheel. The tiny metal bits removed by the wheel are heated to incandesence by the friction and become visible. Since the characteristics of the spark and spark pattern differ with each type of steel, it is possible to identify the metal being tested.

Spark tests are usually run against a dark background. A high speed power grinder with a 10 or 12 inch grinding wheel is used. The wheel is touched to the test metal very lightly. The lighter the touch, the better the spark.

CAUTION: When running a spark test, make sure the grinding wheel is sound. Wear clear safety goggles to protect your eyes.

The theory of spark testing is that each metal has a distinctive rate of oxidization and, if made hot enough, will burn with a distinctive color.

For example: Relatively pure iron does not oxidize rapidly. Touched with a whirling grinder, it displays long reddish sparks which fade slowly. When carbon and other metals are added to make steel or iron for casting, the characteristics of the spark display change.



Spark Test (Continued)

Each spark display has four distinctive characteristics:

1. Color of spark.

2. Length of spark.

3. Number of spurts or explosions appearing along the length of the spark.

4. Pattern of the spurts or explosions (forking or repeating).

In general, as the content of carbon in iron and steel increases, the spark grows brighter and shorter and the number and pattern of spark explosions becomes more complex and dissipates more rapidly.

For example: The sparks from a 20 point mild steel (steel with a 0.20 percent carbon content) are whitish, about 70 inches long, and show only a limited number of short explosions along their length. Sparks from high carbon tool steel (80 point steel) are brighter and shorter and display a pattern of rapidly dissipating explosions and sub-explosions.

Although generally reliable the spark test can be confusing. For example: cast iron, which has a high carbon content, shows a dull red spark and the spark pattern for most metal is affected by heat-treatment. Like the data from other test procedures, the results of spark testing should be considered carefully before critical decisions are made.

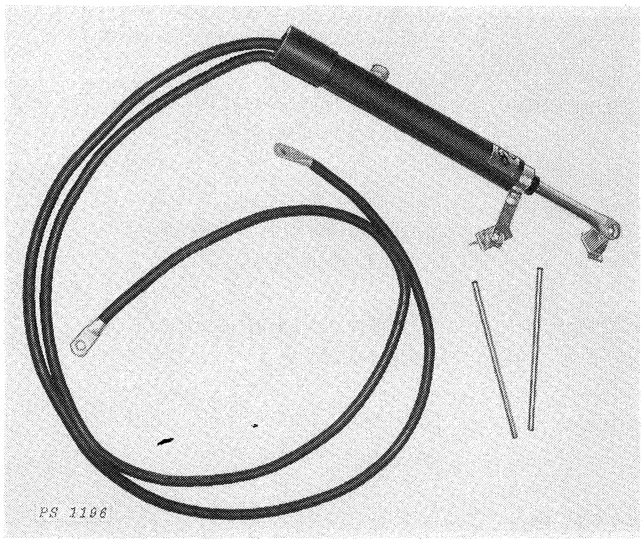
GAUGE AND DECIMAL THICKNESS OF METAL — US STANDARD

GAUGE	THICKNESS
3	0.250″ (1/4″)
4	0.234″
5	0.218″
6	0.203″
7	0.187″
8	0.171″
9	0.156″
10	0.141″
11	0.125″ (1/8″)
12	0.109″
13	0.093″
14	0.078″
15	0.070″
16	0.062″ (1/16″)

GAUGE	THICKNESS
17	0.056″
18	0.050″
19	0.044″
20	0.037″
21	0.034″
22	0.031″ (1/32″)
23	0.028″
24	0.025″
25	0.022″
26	0.019″
27	0.017″
28	0.016″ (1/64″)
30	0.012″

Attachments and Accessories

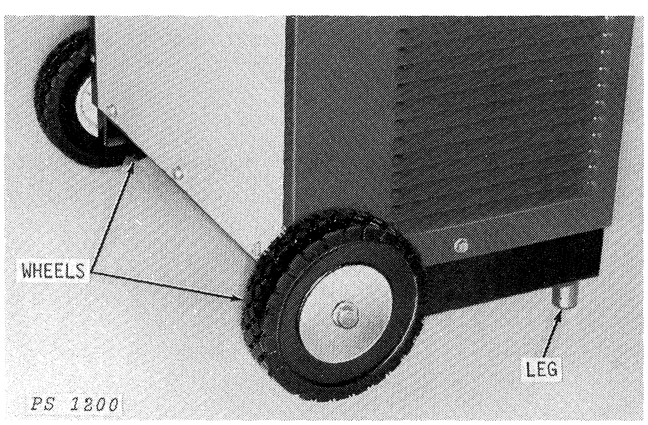
CARBON ARC TORCH



The carbon arc torch is an accessory that greatly facilitates the pre-heating required for bending and shaping operations. It is also used to solder, braze and weld aluminum, brass, bronze, monel metal, cast iron, malleable iron and steel by the flame method.

See page 23 for information on use and operation of the carbon arc torch.

WHEEL KIT



The wheel kit consists of two 6 x 1.50 wheels, two legs, and attaching hardware.

The wheel kit makes moving the welder from place to place much easier.

Assembly

The wheels are installed at the front of the welder base. Insert the 3/8 x 2-1/4-inch bolts through the 5/16-inch flat washers and the 1-1/2-inch bushings. Install through the wheel hubs.

Place flat washers on the inside of the wheels and install the wheel assemblies in the holes on the side of the welder base. Secure the 3/8-inch nut.

The legs are attached at the rear of the welder base. Insert the 3/8-inch carriage bolts through the 3/4 x 1-inch spacers and through the holes at the rear corners of the base frame. Secure with the 3/8-inch nuts.

ELECTRODES

A variety of electrodes and carbon rods may be used with your welder. See page 10 for a detailed description of electrodes and their uses.

Trouble Shooting

Trouble	Possible Cause	Possible Remedy
Welder does not hum when turned on.	No power at receptacle.	Check circuit and fuses or circuit-breakers back to meter.
	Broken or damaged power cable.	Replace power cable. (See your John Deere dealer.)
	Faulty switch.	Replace switch. (See your John Deere dealer.)
	Loose or broken connection or wiring inside transformer.	Tighten or repair connections inside welder.
	Faulty transformer element.	Replace transformer. (See your John Deere dealer.)
Welder hums but does not weld.	Inadequate power at receptacle.	Check power source (220-230 volt, single-phase current required).
	Inadequate current at the arc.	Check ground clamp cable and connection to work piece; check electrode cable and clamp at electrode.
	Poor connections at welder.	Check welding cable connections at jacks. Check connections of transformer leads to jack receptacles inside welder.
Welder gives shocks.	Incorrect connections at power cord receptacle. ("Hot" wire connected to "ground" terminal)	Rewire power cord receptacle (See page 33.)
	Welder wired to 3-phase current.	Check power source for 220-230 volt single phase current.
Welder gives trickle shocks.	Accidental contact with work piece.	Avoid contact with work piece.
	Current is grounding through electrode holder.	Stand or work from dry surface when welding.

Trouble	Possible Cause	Possible Remedy
Welder heat setting difficult to adjust	Linkage assembly too tight.	Adjust linkage assembly retaining nut.
	Dust or dirt in shunt assembly track.	Clean and lubricate shunt track.
Welder output is inconsistent.	Shunt moving inside transformer.	Tighten or repair shunt clamp (See your John Deere dealer.)
Welder overheats — blows fuses.	Fan blades not turning — blades bent, loose or obstructed.	Straighten and/or tighten fan blades — clear obstructions.
	Fan blades not turning — fan motor burned out.	Replace fan motor.
	Fan turning too slowly — loose blade or misaligned bearings.	Tighten blade — tap motor housing to realign bearings.
Arc hard to strike.	Wrong type of electrode.	Check to be sure electrode is not a direct current type. Direct current electrodes require higher voltage and will not operate successfully on alternating current welders. (See page 9.)
	Electrode too large.	Try an electrode with a smaller diameter.
	Base metal not grounded properly.	Check ground carefully.
	Voltage from power line low due to heavy loads.	Schedule welding when less current is being used.

Trouble	Possible Cause	Possible Remedy
Bead too thin in places.	Uneven speed when moving electrode across base metal.	Slow down; try to maintain a steady rate of travel across the surface to be welded. (See page 13.)
Bead too thick in places.	Holding the electrode too long in one place or moving it too slowly across the base metal.	Speed up; maintain a uniform rate of speed along the bead. (See page 13.)
Excessive spatter.	Too long an arc.	Shorten the arc; as the welding progresses, feed the electrode down into the arc. (See page 12.)
Ragged depressions at edge of weld.	Moving the electrode too rapidly or holding too short an arc.	Slow down; lengthen the arc slightly. (See page 12.)
Overlapping beads.	Arc too long or rate of travel too fast.	Shorten the arc; slow the electrode movement. (See page 12.)
Electrode sticks to work.	Electrode is held in contact with base metal while arc is struck.	Move electrode away from the base metal immediately after the arc is struck. (See page 12.)
Poor electrode performance. Electrodes sputter and stick.	Damp electrodes.	Store electrodes in a dry location.

Service

Your John Deere welder may require service or replacement of parts after long service or if accidentally damaged. Generally, repairs or replacement of parts can be done without special tools. Refer to the instructions on the following pages and to the PARTS LISTS on pages 38 through 41 for detailed information

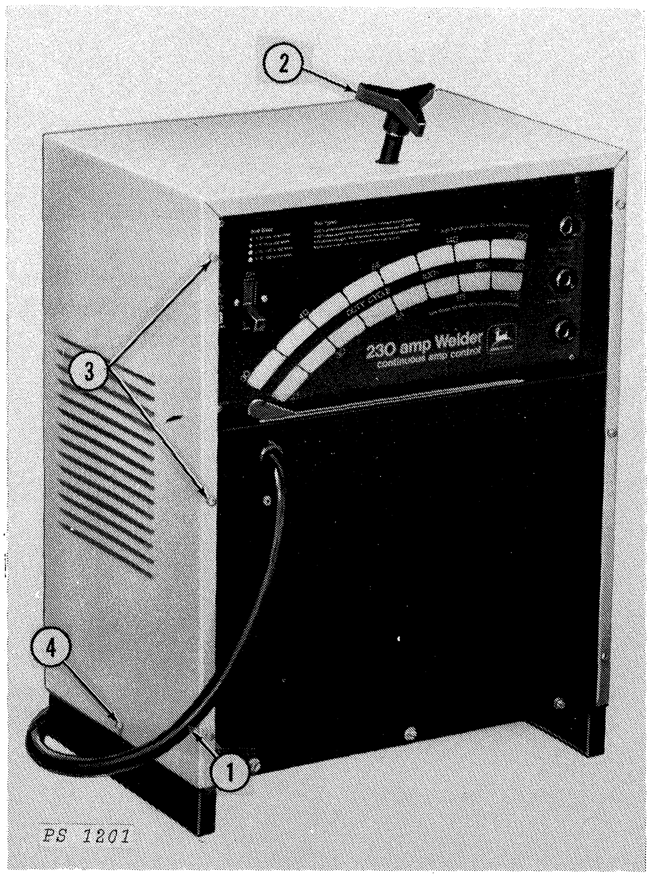
If further information is required, or if parts or service assistance is needed, see your John Deere dealer.

CAUTION: Disconnect the welder from the electrical outlet before disassembly for service or repair.

DISASSEMBLY — REPAIR — REASSEMBLY

Carefully used and well maintained, the John Deere Welder will require little service. Most service operations will be limited to replacing parts accidentally damaged or worn out by heavy use. The service instructions given below cover the disassembly and reinstallation sequence for *all* service components. Should your welder require service, disassemble and repair or replace only those components requiring attention. All assembly should be in reverse order of disassembly.

Removing the Cover



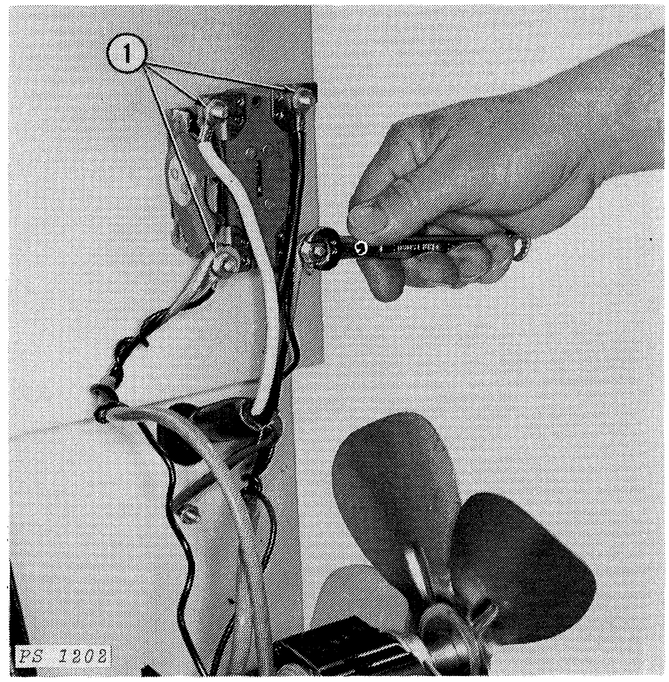
1. Disconnect the power cable plug from the power source receptacle.

2. Remove the shunt clamping lever knob.

3. Remove the Phillips head screws securing the cover to the front plate.

4. Remove the 5 capscrews securing the cover to the base assembly; remove the cover.

Removing and Replacing the Switch

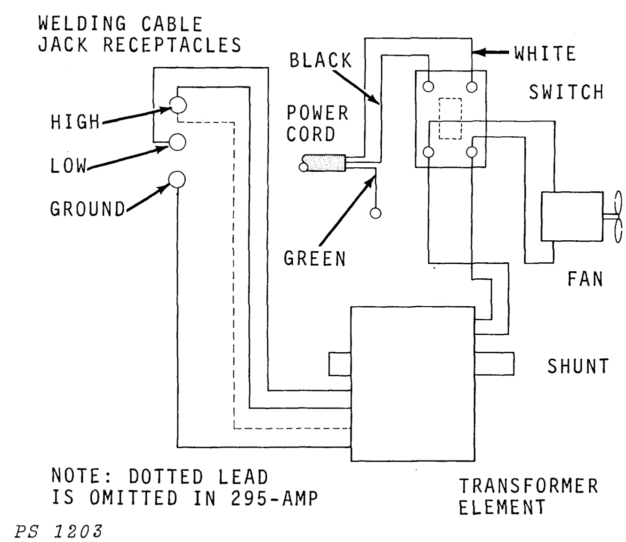


Removing the Switch

1. Mark all wires for reconnection and release all connections at the terminals behind the switch.

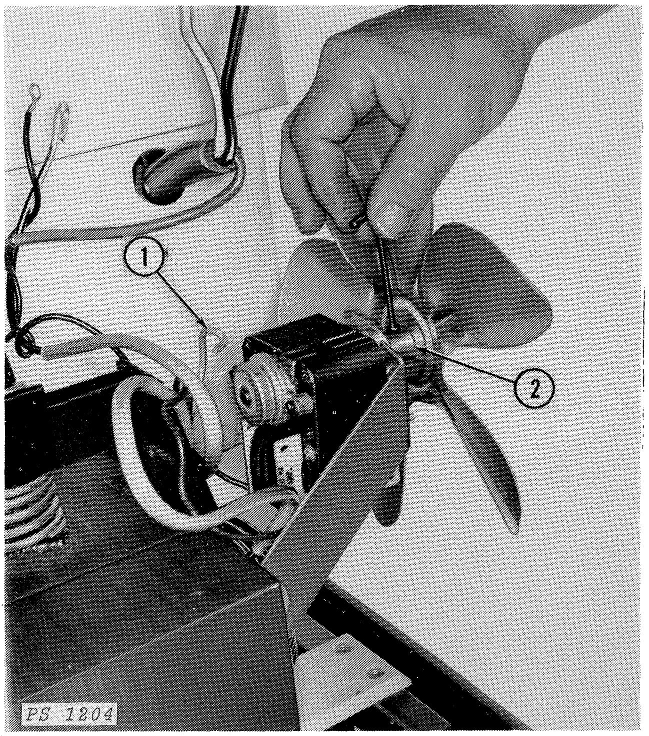
2. (Not Illustrated.) Release the screws securing the switch to the front panel; then remove the switch.

3. Install new switch and reconnect all wires. Check connections against the wiring diagram below.



Wiring Diagram

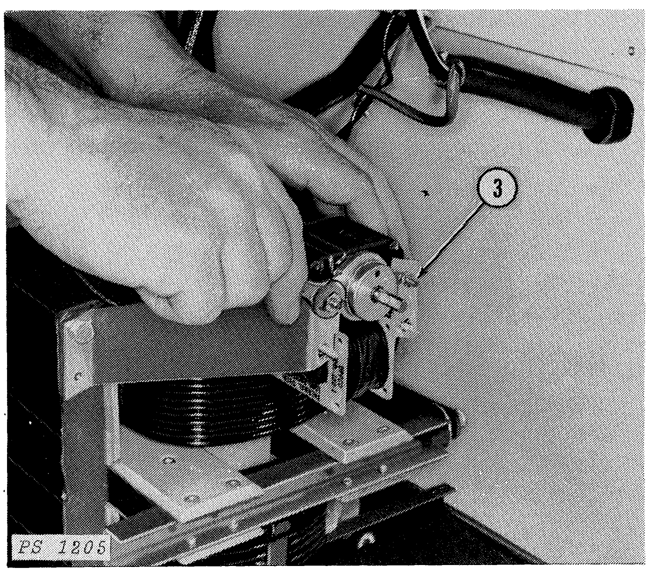
Removing and Replacing the Fan Motor



Removing the Fan Blade

1. Mark all wires for reconnection and release all connections at the fan motor terminals.

2. Release the set screw and remove the fan blade.

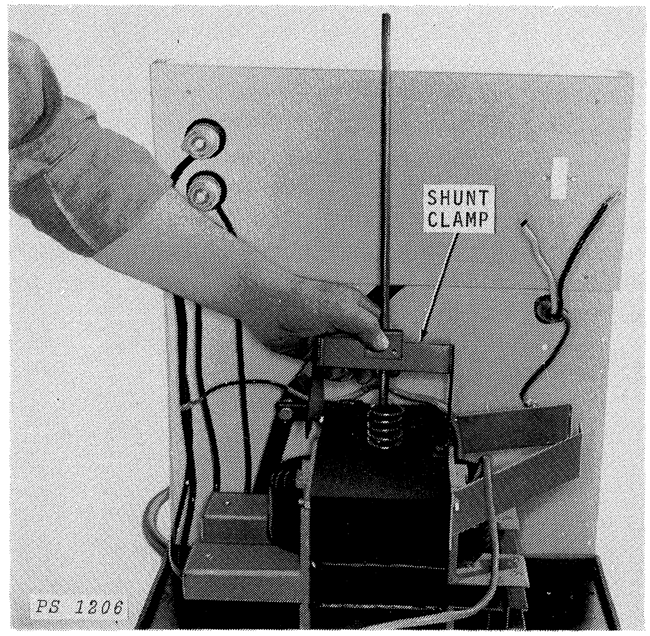


Removing the Fan Motor

3. Remove the nuts and washers securing the fan motor to the fan mounting brackets; remove the motor.

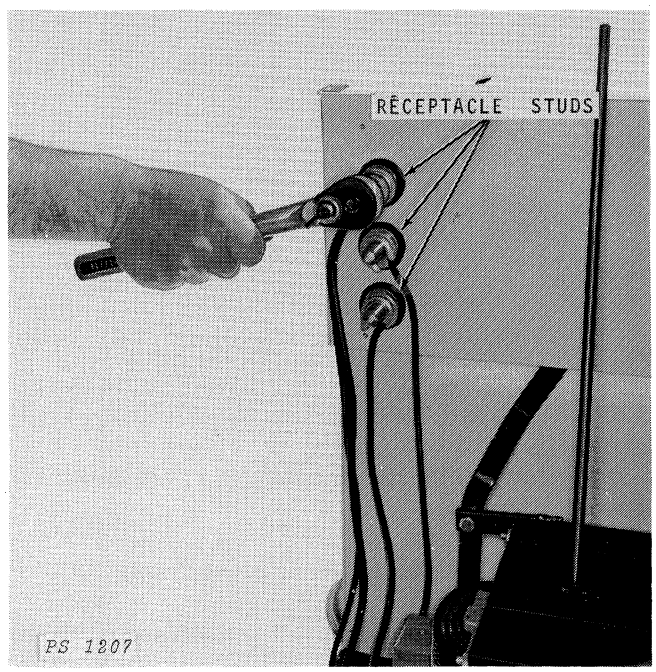
NOTE: If the entire fan assembly is to be replaced, the long screws securing the motor mounting brackets to the transformer element may be removed to release the fan motor and mounting bracket assembly as one piece.

Removing the Shunt Clamp



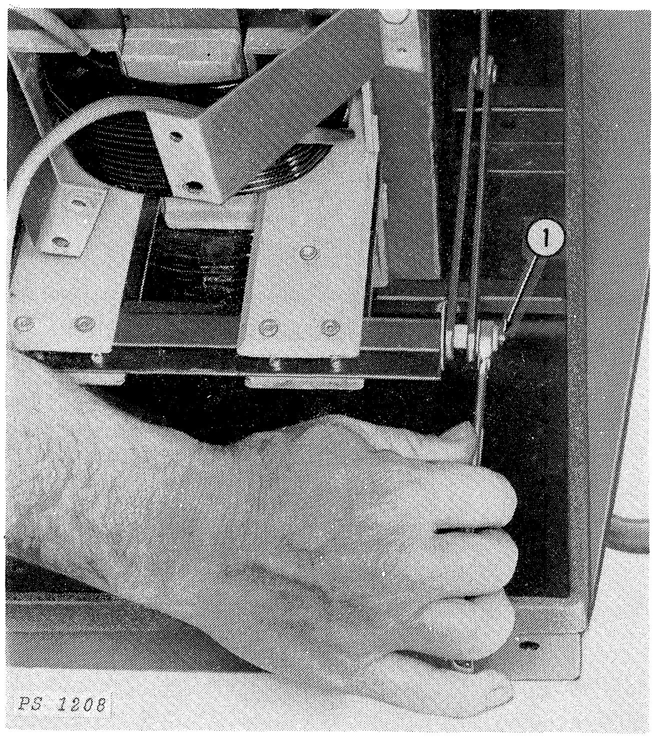
Remove the shunt clamp tube and bearing washer. Lift the shunt clamp free of the transformer element. Slide the clamp and spring off the element rod.

Releasing the Welding Cable Wiring and Receptacles

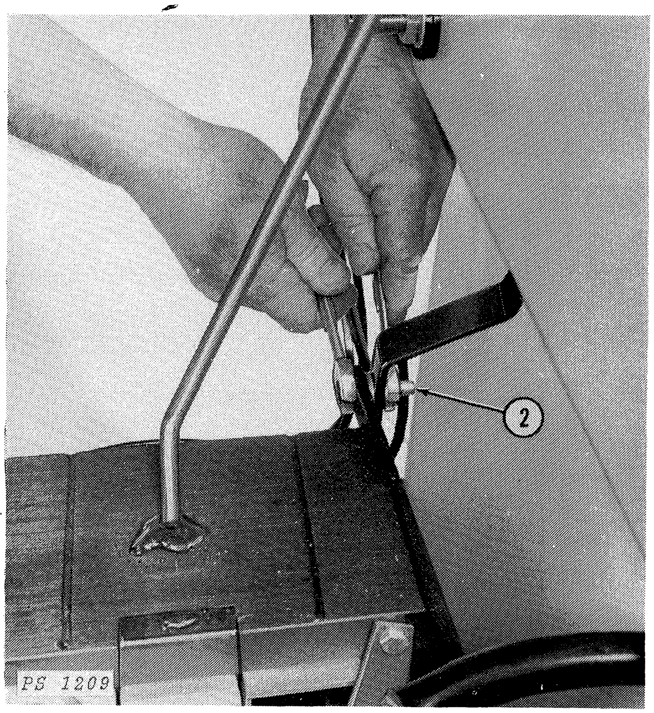


Mark all wires for reconnection; release and remove the nuts and washers securing the transformer leads to the receptacle studs; release and remove the receptacle nuts; remove the receptacles from the front of the panel.

Removing the Shunt Linkage



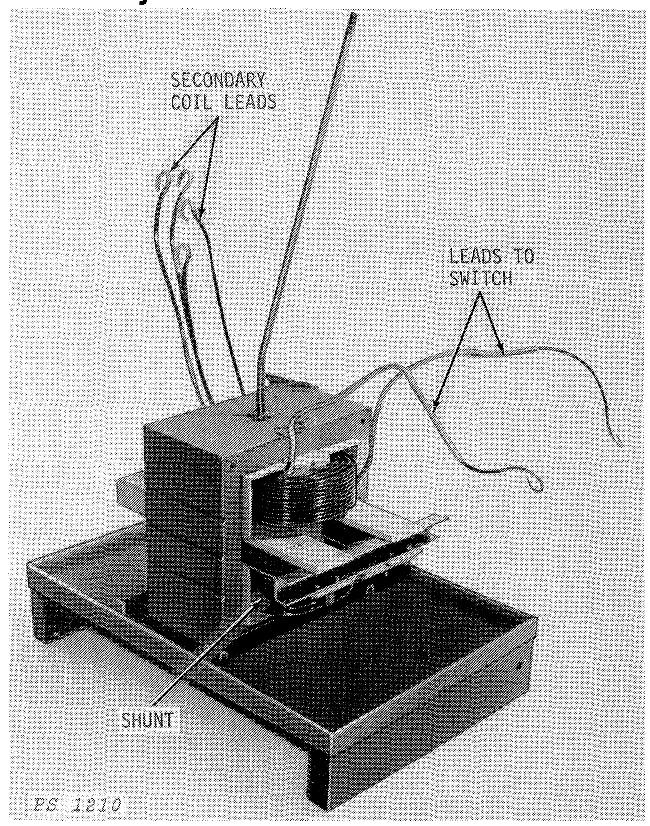
1. Release and remove the nut, washer and spacer securing the shunt linkage to the shunt.



2. Release the lock nut and washers securing the linkage to the transformer element; remove the linkage.

NOTE: When reassembling, the lock nuts securing the linkage to the shunt and transformer element must not be made too tight. The linkage must be free to move smoothly and without binding.

Removing and Replacing the Shunt Assembly



Slip the shunt assembly out of the track in the transformer element from the fan end.

NOTE: When assembling the shunt and transformer, the track should be greased lightly with either a silicone grease or petroleum jelly compound.

Reconnecting the Transformer Element

230-Amp Welder

The 230 amp Welder transformer element has 4 leads which connect the secondary coil to the cable jacks. The lowermost lead (start lead) is connected to the GROUND jack. The two leads from the center of the coil go to the HIGH jack. The lead from the outer surface of the coil (finish lead) is connected to the LOW jack.

295-Amp Welder

The 295 amp Welder transformer element has three leads which connect the secondary coil to the cable jacks. The lowermost lead (start lead) is connected to the GROUND jack. The lead from the center of the coil is connected to the HIGH jack. The lead from the outer surface of the coil (finish lead) is connected to the LOW jack.

Specifications

	230 Amp	295 Amp
Primary Volts	230	230
Primary Amps	48	72
Open-Circuit Volts	80	80
Secondary Amps	230	295
Cycles (Hz)	60	60
Phase	Single	Single
Arc Volt	25	30
Temperature Rise	115°C	115°C
Duty Cycle	20-100%	20-100%
Dimensions:		
Height	27-1/2 in.	27-1/2 in.
Width & Depth	12x18 in.	12x18 in.
Weight (approximate)	125 lbs.	138 lbs.

(Specifications and design are subject to change without notice.)

SERIAL NUMBER

The serial number is stamped on the transformer. You will have to remove the cover to read the serial number. (See page 33.)

When ordering parts, always refer to the serial number given on the serial number plate. By doing so, you will assist your John Deere dealer to give you prompt, efficient service. For your convenience, a space is provided to the right for recording this information.

TRANSFORMER SERIAL NO. ____________________

DATE PURCHASED ____________________

(To be filled in by purchaser)

Glossary

ALL TERMS

Arc — Term given to the flow of electricity through a gaseous space or air gap. In arc welding, this flow of electricity through the air produces the high temperatures.

Arc Welding — Fusing two metals together using an electric arc as the source of heat.

Base Metal — Metal to be welded, cut or brazed. Also called the "work."

Bead — Denotes the appearance of the finished weld; describes neatness of the ripples formed by the metal in a semiliquid state.

Bevel — Angling the metal edge where welding is to take place.

Bond — Junction of the weld metal and the base metal.

Braze Welding — Making an adhesion groove, fillet or plug connection with a brazing alloy.

Brazing — Making an adhesion connection with a minimum of alloy which melts above 800°F and which flows by capillary between close-fitting parts.

Butt Joint — An assembly in which the two pieces joined are in the same plane, with the edge of one piece touching the edge of the other.

Carbon Electrode — Carbon in solid form used for arc welding.

Covered Electrode — Metal rod used in arc welding which has a covering of materials to aid in arc welding process.

Electrode — A substance which brings electricity up to the point where the arc is to be formed. In electric arc welding the electrode is usually melted and becomes a part of the weld.

Filler Rod — Metal wire that is melted and added to the welding puddle to produce the necessary increase in bead thickness.

Fillet Weld — Metal fused into a corner formed by two pieces of metal whose welded surfaces are approximately 90° to each other.

Flux — A chemical used to promote fusion of metals during the welding process.

Fusion — Mixing of molten metals.

Horizontal Position — A weld performed on a horizontal seam at least partially on a vertical surface.

Joint — Where two pieces meet when a structure is made of smaller pieces.

Lead Wire — Electric wire from the power source to the electrode holder or to the ground clamp.

Overhead Position — A weld made on the underside of the joint with the face of the weld in a horizontal plane.

Penetration — Depth of fusion into the base metal as measured from the surface of the base metal.

Puddle — Portion of a weld that is molten at the place the heat is supplied.

Soldering — Means of fastening metals together by adhering another metal to the two pieces of these metals. The joining metal only is melted during this process.

Tack Weld — Small weld used to temporarily hold together components of an assembly.

Undercut — A depression at the toe of the weld which is below the surface of the base metal.

Vertical Position — Type of weld where welding is done on a vertical plane and on a vertical surface.

Welding — Art of fastening metal together by means of interfusing metals.

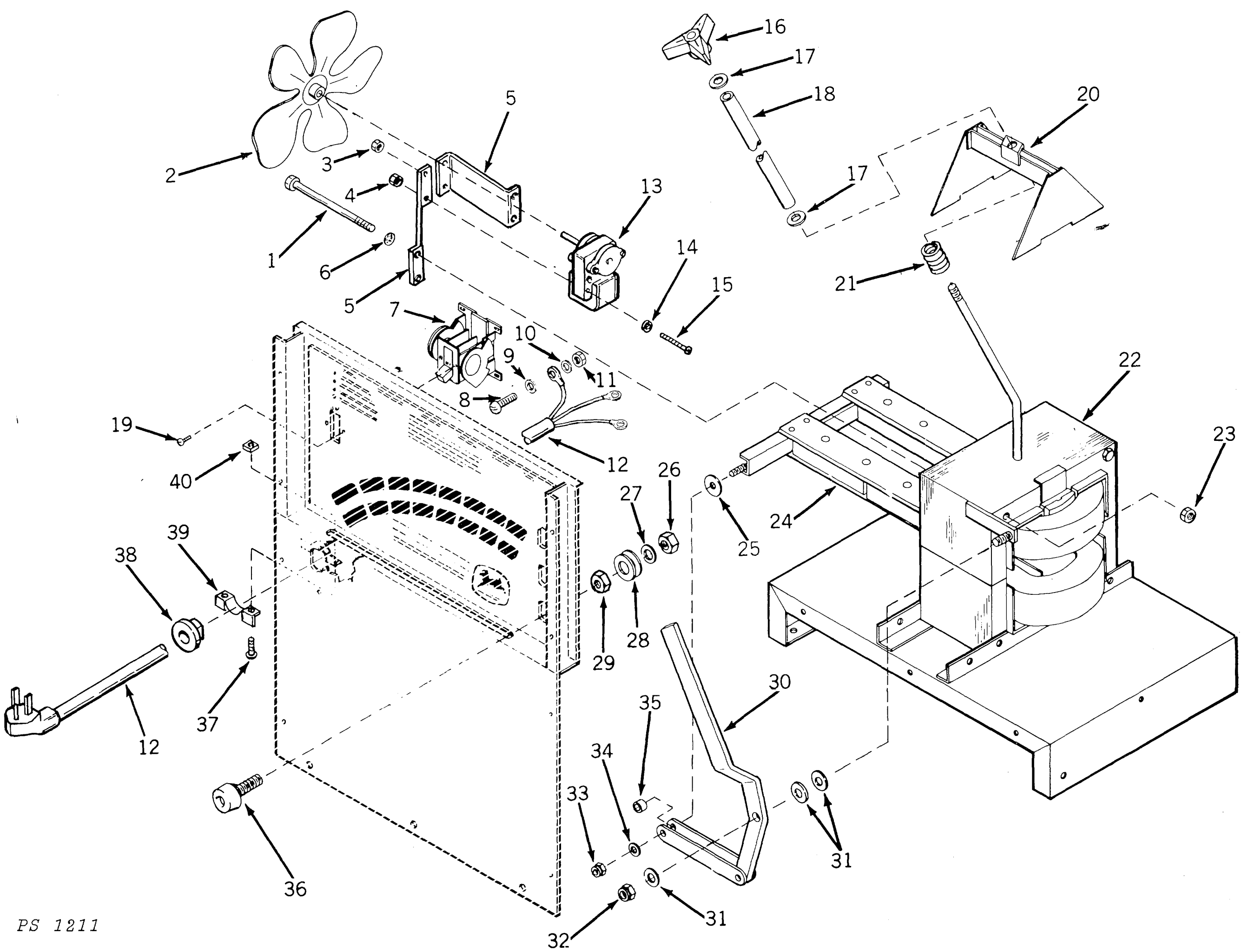
Welding Rod — Wire which is melted into the weld metal.

Parts List

The "exploded view" method of illustrating parts is used in this parts list.

Each available part has been given a key number which is used only as a reference to the exploded view. The key number is not a part number. Do not use it when ordering parts.

TRANSFORMER, FAN, AND MOTOR



PS 1211

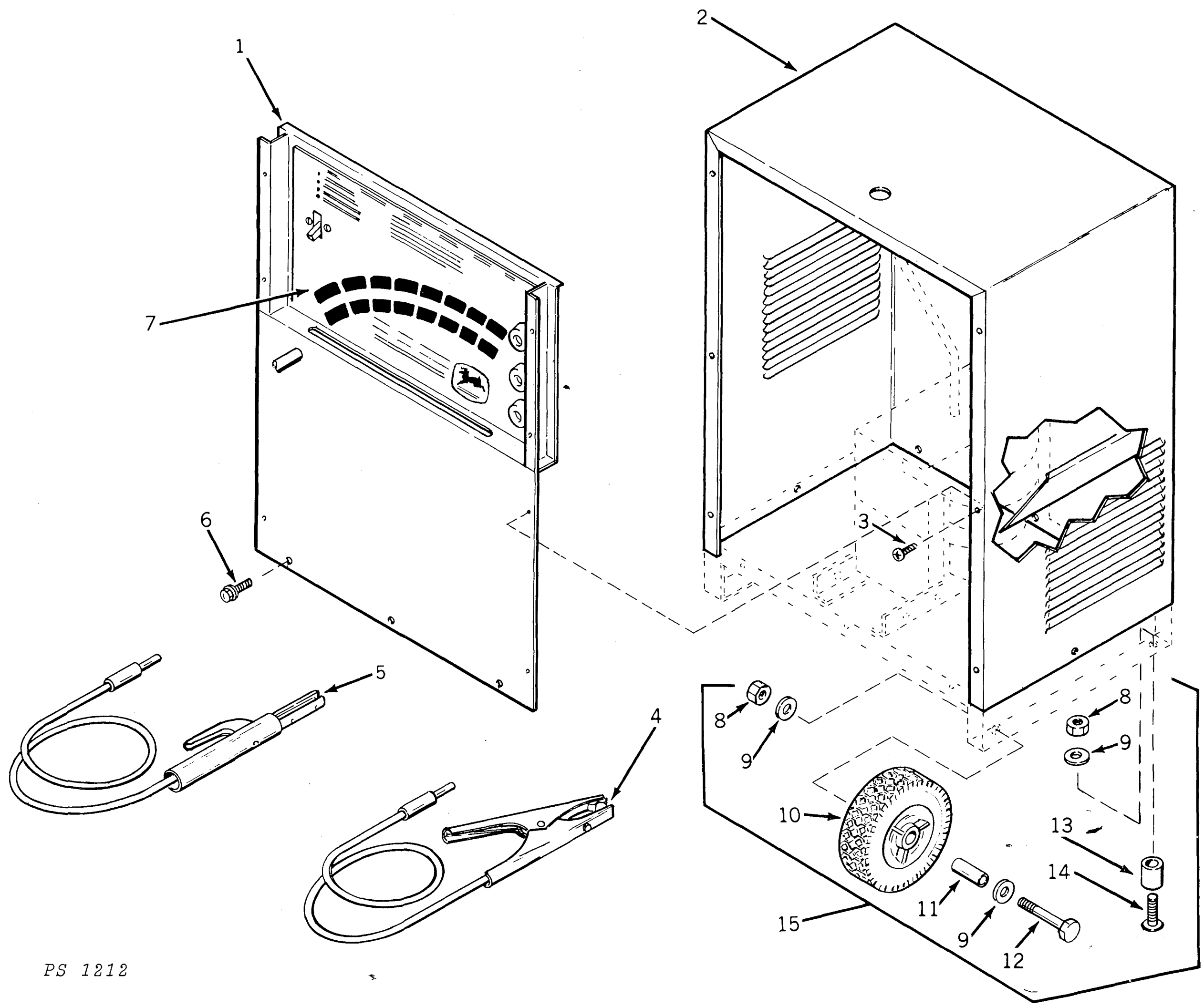
TRANSFORMER, FAN, AND MOTOR — Continued

Key	*Part No.*		*Serial No.*	*Description*
1	19H	2339	(-)	Screw, cap, 1/4" x 5" (2 used)
2	TY	4608	(-)	Fan with set screw
3	14H	605	(-)	Nut, hex., No. 8 (2 used)
4	14H	1026	(-)	Nut, hex., No. 6 (2 used)
5	TY	4069	(-)	Bracket, fan (2 used)
6	12H	297	(-)	Washer, lock, internal tooth, 1/4" (2 used)
7	TY	4607	(-)	Switch, 60 Amp.
8	21H	983	(-)	Screw, mach., No. 10 — 5/8" (2 used)
9	12H	295	(-)	Washer, lock, internal tooth, No. 10 (2 used)
10	24H	1722	(-)	Washer, 7/32" x 5/8" x .048" (5 used)
11	14H	778	(-)	Nut, hex, No. 10 (5 used)
12	TY	4622	(-)	Cord, power (230-amp)
--	TY	4623	(-)	Cord, power (295-amp)
13	TY	4610	(-)	Motor, fan
14	12H	315	(-)	Washer, lock, No. 8 (2 used)
15	---	----	(-)	Screw, mach., No. 6 x 2-1/4" (2 used)
16	TY	4611	(-)	Knob, dial
17	---	----	(-)	Washer (2 used)
18	TY	4612	(-)	Tube, clamping
19	21H	1309	(-)	Screw, mach. No. 6 x 1/4" (2 used)
20	TY	4613	(-)	Clamp, Shunt
21	TY	4614	(-)	Spring, counter
22	TY	4615	(-)	Core and base assembly, transformer (230-amp)
--	TY	4616	(-)	Core and base assembly, transformer (295-amp)
23	14H	786	(-)	Nut, hex., 1/4" (2 used)
24	TY	4617	(-)	Shunt assembly
25	24H	1695	(-)	Washer, 9/32" x 1-3/8" x .060"
26	14H	888	(-)	Nut, hex., 9/16", fine thread
27	12H	317	(-)	Washer, lock, 9/16" (3 used)
28	24H	1806	(-)	Washer, 37/64" x 7/8" x .036" (9 used)
29	TY	4621	(-)	Nut, jack receptacle (3 used)
30	TY	4619	(-)	Linkage assembly
31	24H	1136	(-)	Washer, 11/32" x 11/16" x .060" (3 used)
32	---	----	(-)	Nut, hex., self-locking, 5/16"
33	---	----	(-)	Nut, hex., self-locking, 1/4"
34	24H	1287	(-)	Washer, 9/32" x 5/8" x .060"
35	TY	4618	(-)	Spacer
36	TY	4620	(-)	Receptacle, jack (3 used)
37	---	----	(-)	Screw, strain relief clamp
38	TY	4624	(-)	Bushing, strain relief
39	TY	4625	(-)	Clamp, strain relief
40	---	----	(-)	Nut, strain relief clamp

ELECTRODES

Key	*Part No.*		*Serial No.*	*Description*
--	TY	1598	(-)	Rod, welding, 1/16" (1/2 lb. pkg.)
--	TY	1782	(-)	Rod, welding, 5/64" (1/2 lb. pkg.)
--	TY	1846	(-)	Rod, welding, 3/32" (5 lb. pkg.)
--	TY	1847	(-)	Rod, carbon, 1/4" (pkg. of 8 rods)
--	TY	1848	(-)	Rod, brazing, 3/32" (1 lb. pkg.)
--	TY	2322	(-)	Rod, carbon, 3/8" (pkg. of 6 rods)
--	TY	2323	(-)	Rod, welding, 1/8" (5 lb. pkg.)
--	TY	2324	(-)	Rod, welding, 5/32" (5 lb. pkg.)

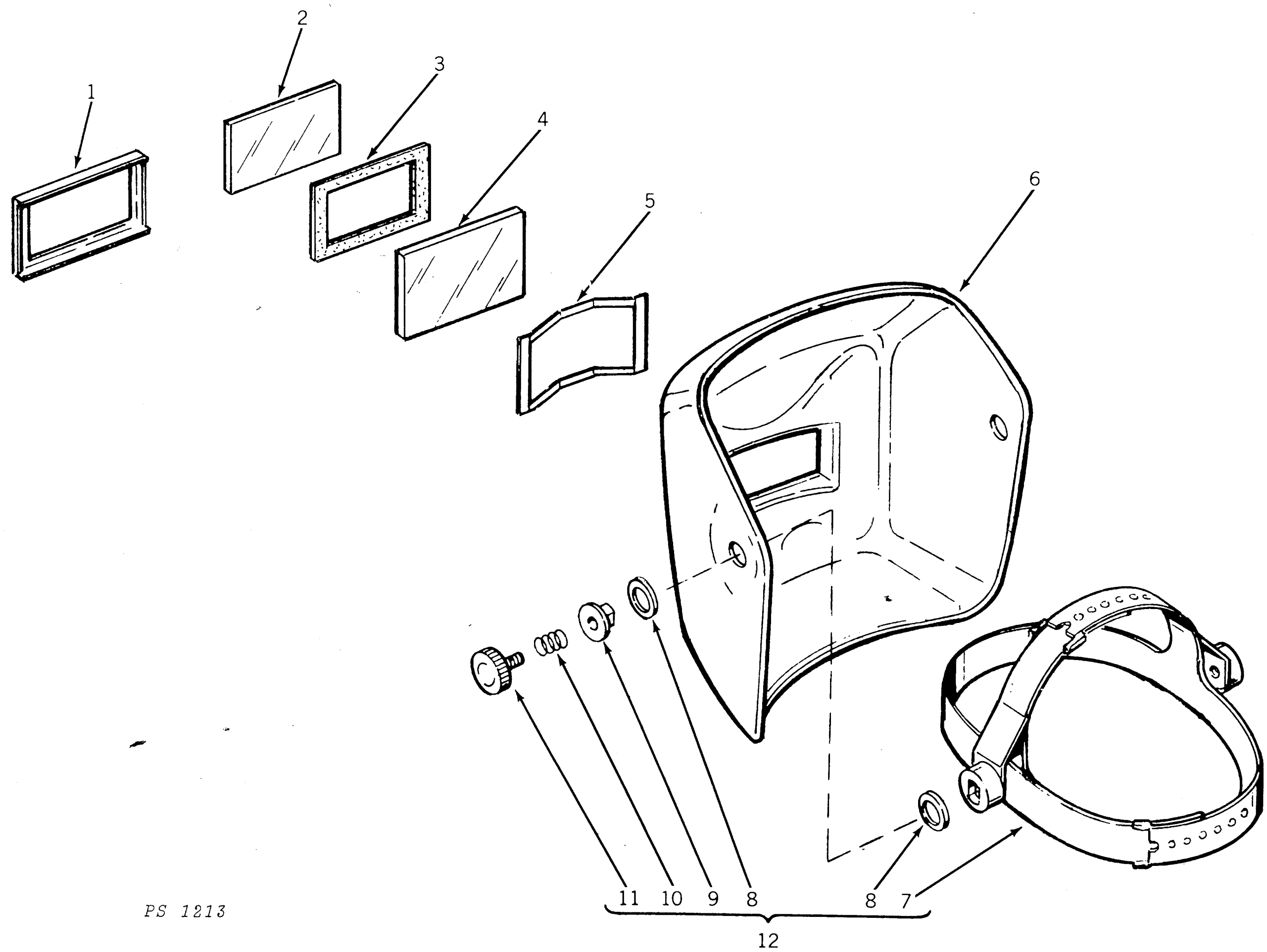
COVER, CLAMPS, AND WHEEL KIT



PS 1212

Key	Part No.		Serial No.	Description
1	TY	4626	(-)	Panel, front (230-amp)
	TY	4627	(-)	Panel, front (295-amp)
2	TY	4628	(-)	Cover, case
3	21H	1158	(-)	Screw, mach., No. 8 x 1/2" (6 used)
4	TY	4629	(-)	Ground clamp and cable assembly (230-amp)
	TY	4630	(-)	Ground clamp and cable assembly (295-amp)
5	TY	4631	(-)	Electrode holder and cable assembly (230-amp)
	TY	4632	(-)	Electrode holder and cable assembly (295-amp)
6	19H	1227	(-)	Screw, cap, 1/4" x 1/2" (8 used)
	24H	1287	(-)	Washer, 9/32" x 5/8" x .060"
7	TY	4633	(-)	Plate, dial (230-amp)
	TY	4634	(-)	Plate, dial (295-amp)
8	14H	812	(-)	Nut, hex., 3/8" (4 used)
9	24N	1302	(-)	Washer, 13/32" x 11/16" x .036"
10	---	----	(-)	Wheel, 6 x 1.50 (2 used)
11	---	----	(-)	Bushing, 1/2" x 1-1/2" (2 used)
12	19H	1726	(-)	Screw, cap, 3/8" x 2-1/4" (2 used)
13	---	----	(-)	Spacer, 3/4" x 1"
14	3H	1558	(-)	Bolt, carriage, 3/8" x 1-1/2"
15	TY	2326	(-)	Wheel kit

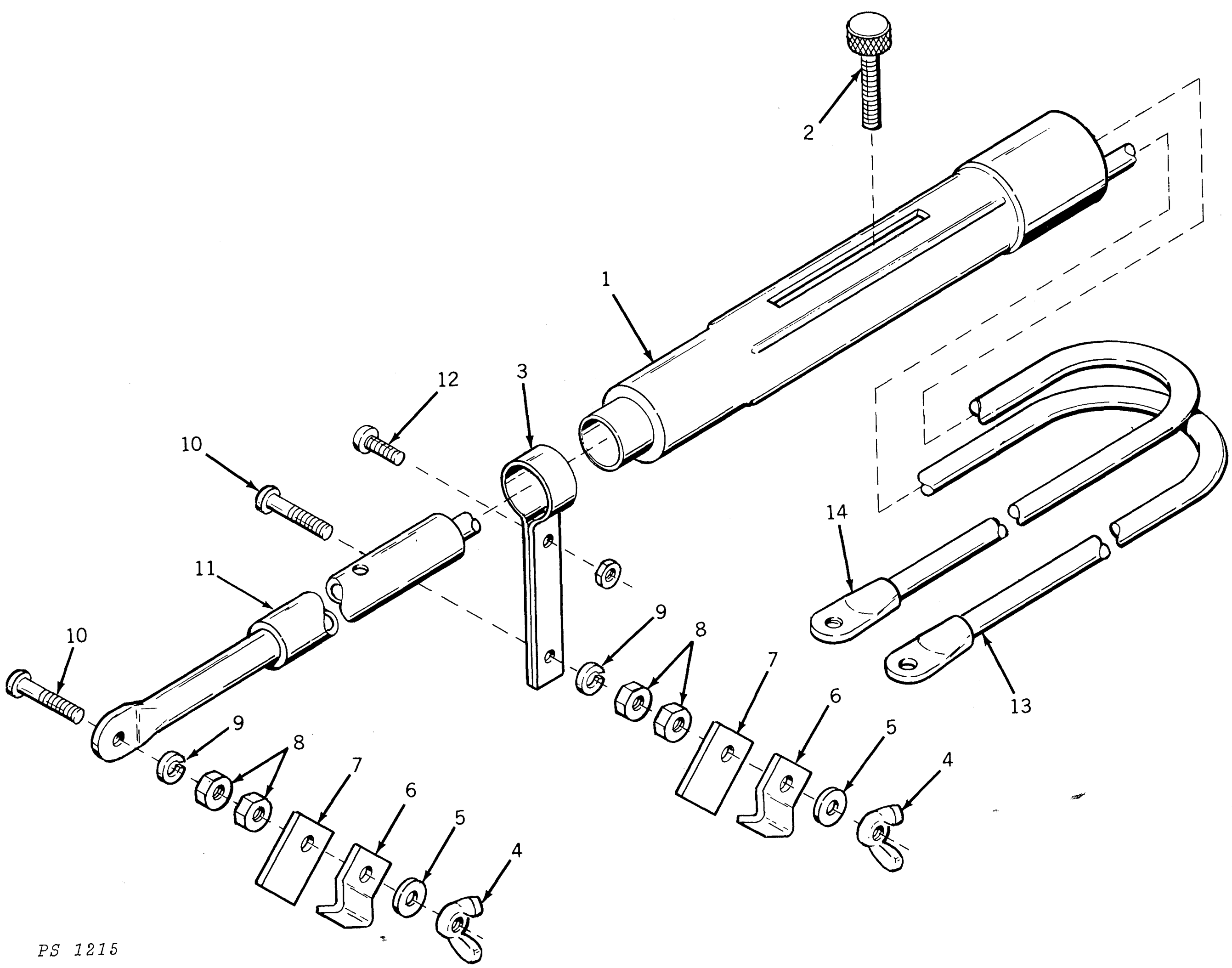
HELMET



PS 1213

Key	Part No.	Serial No.	Description
1	... .	(-)	Retainer, lens
2	TY 4635	(-)	Cover, plastic, clear
3	... .	(-)	Gasket
4	TY 4636	(-)	Lens, No. 10 Shade
5	... .	(-)	Holder, spring, lens
6	... .	(-)	Shield, helmet
7	... .	(-)	Headband
8	... .	(-)	Washer, fiber (4 used)
9	... .	(-)	Spacer (2 used)
10	... .	(-)	Spring (2 used)
11	... .	(-)	Knob, adjusting (2 used)
12	TY 4637	(-)	Headband assembly
..	TY 4605	(-)	Helmet, complete

CARBON ARC TORCH



Key	Part No.		Serial No.	Description
1	TY	4638	(-)	Conducter assembly, outer
2	TY	4640	(-)	Bolt, nylon
3	TY	4641	(-)	Bracket, ring
4	14H	952	(-)	Nut, wing, 1/4" (2 used)
5	24H	753	(-)	Washer, 9/32" x 5/8" x .048" (2 used)
6	TY	4642	(-)	Clamp, carbon, formed (2 used)
7	TY	4643	(-)	Clamp, carbon, flat (2 used)
8	14H	786	(-)	Nut, hex., 1/4" (4 used)
9	12H	302	(-)	Washer, lock, 1/4" (2 used)
10	21H	1287	(-)	Screw, mach., rd. hd., 1/4" x 1-1/4" (2 used)
11	TY	4639	(-)	Conducter assembly, inner
12	21H	1301	(-)	Screw, mach., rd. hd., No. 10 x 1/2"
	14H	778	(-)	Nut, hex., No. 10
13	. . .	. . . .	(-)	Cable assembly, No. 6 (Sub. TY 2325)
14	. . .	. . . .	(-)	Cable assembly, No. 6 (Sub. TY 2325)
. .	TY	2325	(-)	Torch assembly, complete

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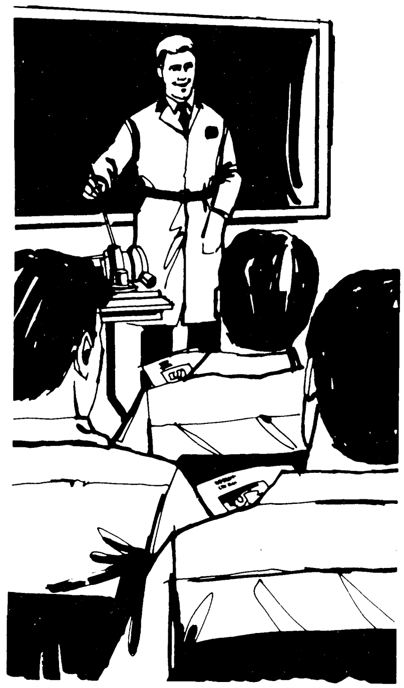

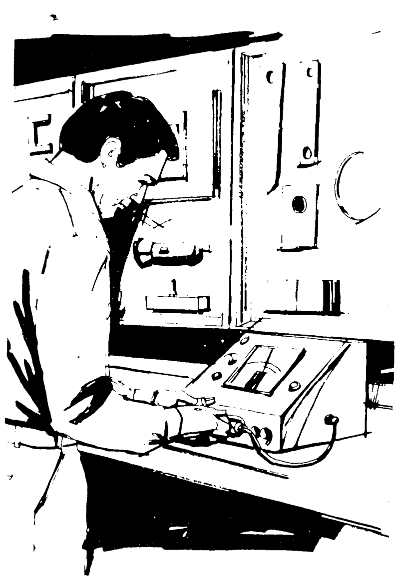

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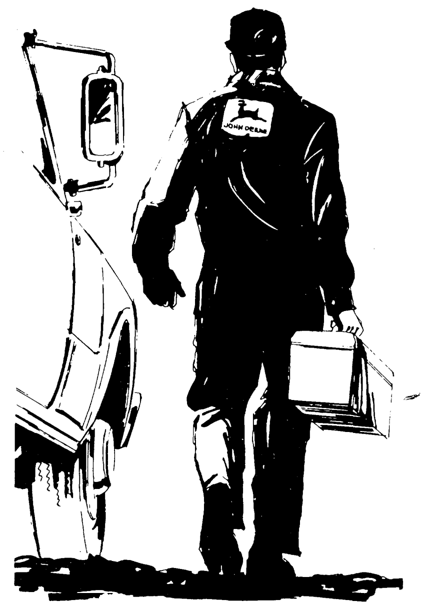

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