Miniarc 150 APS

Instruction Manual

F15-725 10 / 2006

BE SURE THIS INFORMATION REACHES THE OPERATOR.
YOU CAN GET EXTRA COPIES THROUGH YOUR SUPPLIER.

CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding and cutting equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Form 52-529. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Malfunctioning or poorly maintained equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom it was purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.

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SAFETY PRECAUTIONS

WARNING: These Safety Precautions are for your protection. They summarize precautionary information from the references listed in Additional Safety Information section. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below as well as all other manuals, material safety data sheets, labels, etc. Failure to observe Safety Precautions can result in injury or death.

PROTECT YOURSELF AND OTHERS -- Some welding, cutting, and gouging processes are noisy and require ear protection. The arc, like the sun, emits ultraviolet (UV) and other radiation and can injure skin and eyes. Hot metal can cause burns. Training in the proper use of the processes and equipment is essential to prevent accidents. Therefore:

1. Always wear safety glasses with side shields in any work area, even if welding helmets, face shields, and goggles are also required.
2. Use a face shield fitted with the correct filter and cover plates to protect your eyes, face, neck, and ears from sparks and rays of the arc when operating or observing operations. Warn bystanders not to watch the arc and not to expose themselves to the rays of the electric-arc or hot metal.
3. Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high-topped shoes, and a welding helmet or cap for hair protection, to protect against arc rays and hot sparks or hot metal. A flameproof apron may also be desirable as protection against radiated heat and sparks.
4. Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned, and open pockets eliminated from the front of clothing
5. Protect other personnel from arc rays and hot sparks with a suitable non-flammable partition or curtains.
6. Use goggles over safety glasses when chipping slag or grinding. Chipped slag may be hot and can fly far. Bystanders should also wear goggles over safety glasses.

FIRES AND EXPLOSIONS -- Heat from flames and arcs can start fires. Hot slag or sparks can also cause fires and explosions. Therefore:

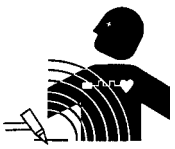
1. Remove all combustible materials well away from the work area or cover the materials with a protective non-flammable covering. Combustible materials include wood, cloth, sawdust, liquid and gas fuels, solvents, paints and coatings, paper, etc.
2. Hot sparks or hot metal can fall through cracks or crevices in floors or wall openings and cause a hidden smoldering fire or fires on the floor below. Make certain that such openings are protected from hot sparks and metal."
3. Do not weld, cut or perform other hot work until the workpiece has been completely cleaned so that there are no substances on the workpiece which might produce flammable or toxic vapors. Do not do hot work on closed containers. They may explode.
4. Have fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket, or portable fire extinguisher. Be sure you are trained in its use.
5. Do not use equipment beyond its ratings. For example, overloaded welding cable can overheat and create a fire hazard.
6. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire. Use fire watchers when necessary.
7. For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

ELECTRICAL SHOCK -- Contact with live electrical parts and ground can cause severe injury or death. DO NOT use AC welding current in damp areas, if movement is confined, or if there is danger of falling.

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.
2. Connect the workpiece to a good electrical ground.
3. Connect the work cable to the workpiece. A poor or missing connection can expose you or others to a fatal shock.
4. Use well-maintained equipment. Replace worn or damaged cables.
5. Keep everything dry, including clothing, work area, cables, torch/electrode holder, and power source.
6. Make sure that all parts of your body are insulated from work and from ground.
7. Do not stand directly on metal or the earth while working in tight quarters or a damp area; stand on dry boards or an insulating platform and wear rubber-soled shoes.
8. Put on dry, hole-free gloves before turning on the power.
9. Turn off the power before removing your gloves.
10. Refer to ANSI/ASC Standard Z49.1 (listed on next page) for specific grounding recommendations. Do not mistake the work lead for a ground cable.

ELECTRIC AND MAGNETIC FIELDS — May be dangerous. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and cutting current creates EMF around welding cables and welding machines. Therefore:

1. Welders having pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.



2. Exposure to EMF may have other health effects which are unknown.
3. Welders should use the following procedures to minimize exposure to EMF:

A. Route the electrode and work cables together. Secure them with tape when possible.

B. Never coil the torch or work cable around your body.

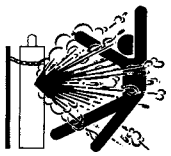
C. Do not place your body between the torch and work cables. Route cables on the same side of your body.

D. Connect the work cable to the workpiece as close as possible to the area being welded.

E. Keep welding power source and cables as far away from your body as possible.

FUMES AND GASES -- Fumes and gases, can cause discomfort or harm, particularly in confined spaces. Do not breathe fumes and gases. Shielding gases can cause asphyxiation. Therefore:

1. Always provide adequate ventilation in the work area by natural or mechanical means. Do not weld, cut, or gouge on materials such as galvanized steel, stainless steel, copper, zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
2. Do not operate near degreasing and spraying operations. The heat or arc rays can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gases.
3. If you develop momentary eye, nose, or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work area. Do not continue to operate if physical discomfort persists.
4. Refer to ANSI/ASC Standard Z49.1 (see listing below) for specific ventilation recommendations.
5. **WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code §25249.5 et seq.)**



CYLINDER HANDLING -- Cylinders, if mishandled, can rupture and violently release gas. Sudden rupture of cylinder, valve, or relief device can injure or kill. Therefore:

1. Use the proper gas for the process and use the proper pressure reducing regulator designed to operate from the compressed gas cylinder. Do not use adaptors. Maintain hoses and fittings in good condition. Follow manufacturer's operating instructions for mounting regulator to a compressed gas cylinder.
2. Always secure cylinders in an upright position by chain or strap to suitable hand trucks, undercarriages, benches, walls, post, or racks. Never secure cylinders to work tables or fixtures where they may become part of an electrical circuit.
3. When not in use, keep cylinder valves closed. Have valve protection cap in place if regulator is not connected. Secure and move cylinders by using suitable hand trucks. Avoid rough handling of cylinders.
4. Locate cylinders away from heat, sparks, and flames. Never strike an arc on a cylinder.
5. For additional information, refer to CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", which is available from Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

EQUIPMENT MAINTENANCE -- Faulty or improperly maintained equipment can cause injury or death. Therefore:

1. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
2. Before performing any maintenance work inside a power source, disconnect the power source from the incoming electrical power.
3. Maintain cables, grounding wire, connections, power cord, and power supply in safe working order. Do not operate any equipment in faulty condition.
4. Do not abuse any equipment or accessories. Keep equipment away from heat sources such as furnaces, wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.
5. Keep all safety devices and cabinet covers in position and in good repair.
6. Use equipment only for its intended purpose. Do not modify it in any manner.

ADDITIONAL SAFETY INFORMATION -- For more information on safe practices for electric arc welding and cutting equipment, ask your supplier for a copy of "Precautions and Safe Practices for Arc Welding, Cutting and Gouging", Form 52-529.

The following publications, which are available from the American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126, are recommended to you:

1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting"
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding"
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting"
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting"
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding"
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding""
7. AWS SP - "Safe Practices" - Reprint, Welding Handbook.
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."

MEANING OF SYMBOLS - As used throughout this manual: Means Attention! Be Alert! Your safety is involved.

DANGER **Means immediate hazards which, if not avoided, will result in immediate, serious personal injury or loss of life.**

WARNING **Means potential hazards which could result in personal injury or loss of life.**

CAUTION **Means hazards which could result in minor personal injury.**

PRECAUCION DE SEGURIDAD

ADVERTENCIA: Estas Precauciones de Seguridad son para su protección. Ellas hacen resumen de información proveniente de las referencias listadas en la sección "Información Adicional Sobre La Seguridad". Antes de hacer cualquier instalación o procedimiento de operación , asegúrese de leer y seguir las precauciones de seguridad listadas a continuación así como también todo manual, hoja de datos de seguridad del material, calcomanias, etc. El no observar las Precauciones de Seguridad puede resultar en daño a la persona o muerte.

PROTEJASE USTED Y A LOS DEMAS-- Algunos procesos de soldadura, corte y ranurado son ruidosos y requiren protección para los oídos. El arco, como el sol , emite rayos ultravioleta (UV) y otras radiaciones que pueden dañar la piel y los ojos. El metal caliente causa quemaduras. EL entrenamiento en el uso propio de los equipos y sus procesos es esencial para prevenir accidentes. Por lo tanto:

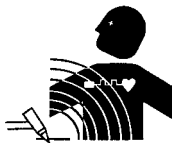
1. Utilice gafas de seguridad con protección a los lados siempre que esté en el área de trabajo, aún cuando esté usando careta de soldar, protector para su cara u otro tipo de protección.
2. Use una careta que tenga el filtro correcto y lente para proteger sus ojos, cara, cuello, y oídos de las chispas y rayos del arco cuando se esté operando y observando las operaciones. Alerte a todas las personas cercanas de no mirar el arco y no exponerse a los rayos del arco eléctrico o el metal fundido.
3. Use guantes de cuero a prueba de fuego, camisa pesada de mangas largas, pantalón de ruedo liso, zapato alto al tobillo, y careta de soldar con capucha para el pelo, para proteger el cuerpo de los rayos y chispas calientes provenientes del metal fundido. En ocaciones un delantal a prueba de fuego es necesario para protegerse del calor radiado y las chispas.
4. Chispas y partículas de metal caliente puede alojarse en las mangas enrolladas de la camisa , el ruedo del pantalón o los bolsillos. Mangas y cuellos deberán mantenerse abotonados, bolsillos al frente de la camisa deberán ser cerrados o eliminados.
5. Proteja a otras personas de los rayos del arco y chispas calientes con una cortina adecuada no-flamable como división.
6. Use careta protectora además de sus gafas de seguridad cuando esté removiendo escoria o puliendo. La escoria puede estar caliente y desprenderse con velocidad. Personas cercanas deberán usar gafas de seguridad y careta protectora.

FUEGO Y EXPLOSIONES -- El calor de las flamas y el arco pueden ocacionar fuegos. Escoria caliente y las chispas pueden causar fuegos y explosiones. Por lo tanto:

1. Remueva todo material combustible lejos del área de trabajo o cubra los materiales con una cobija a prueba de fuego. Materiales combustibles incluyen madera, ropa, líquidos y gases flamables, solventes, pinturas, papel, etc.
2. Chispas y partículas de metal pueden introducirse en las grietas y agujeros de pisos y paredes causando fuegos escondidos en otros niveles o espacios. Asegúrese de que toda grieta y agujero esté cubierto para proteger lugares adyacentes contra fuegos.
3. No corte, suelde o haga cualquier otro trabajo relacionado hasta que la pieza de trabajo esté totalmente limpia y libre de substancias que puedan producir gases inflamables o vapores tóxicos. No trabaje dentro o fuera de contenedores o tanques cerrados. Estos pueden explotar si contienen vapores inflamables.
4. Tenga siempre a la mano equipo extintor de fuego para uso instantáneo, como por ejemplo una manguera con agua, cubeta con agua, cubeta con arena, o extintor portátil. Asegúrese que usted esta entrenado para su uso.
5. No use el equipo fuera de su rango de operación. Por ejemplo, el calor causado por cable sobrecarga en los cables de soldar pueden ocasionar un fuego.
6. Después de termirar la operación del equipo, inspeccione el área de trabajo para cerciorarse de que las chispas o metal caliente ocasionen un fuego más tarde. Tenga personal asignado para vigilar si es necesario.
7. Para información adicional , haga referencia a la publicación NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", disponible a través de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

CHOQUE ELECTRICO -- El contacto con las partes eléctricas energizadas y tierra puede causar daño severo o muerte. NO use soldadura de corriente alterna (AC) en áreas húmedas, de movimiento confinado en lugares estrechos o si hay posibilidad de caer al suelo.

1. Asegúrese de que el chasis de la fuente de poder esté conectado a tierra através del sistema de electricidad primario.
2. Conecte la pieza de trabajo a un buen sistema de tierra física.
3. Conecte el cable de retorno a la pieza de trabajo. Cables y conductores expuestos o con malas conexiones pueden exponer al operador u otras personas a un choque eléctrico fatal.
4. Use el equipo solamente si está en buenas condiciones. Reemplaze cables rotos, dañados o con conductores expuestos.
5. Mantenga todo seco, incluyendo su ropa, el área de trabajo, los cables, antorchas, pinza del electrodo, y la fuente de poder.
6. Asegúrese que todas las partes de su cuerpo están insuladas de ambos, la pieza de trabajo y tierra.
7. No se pare directamente sobre metal o tierra mientras trabaja en lugares estrechos o áreas húmedas; trabaje sobre un pedazo de madera seco o una plataforma insulada y use zapatos con suela de goma.
8. Use guantes secos y sin agujeros antes de energizar el equipo.
9. Apage el equipo antes de quitarse sus guantes.
10. Use como referencia la publicación ANSI/ASC Standard Z49.1 (listado en la próxima página) para recomendaciones específicas de como conectar el equipo a tierra. No confunda el cable de soldar a la pieza de trabajo con el cable a tierra.



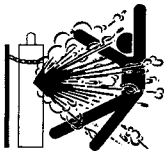
CAMPOS ELECTRICOS Y MAGNETICOS - Son peligrosos. La corriente eléctrica fluye através de cualquier conductor causando a nivel local Campos Eléctricos y Magnéticos (EMF). Las corrientes en el área de corte y soldadura, crean EMF alrrededor de los cables de soldar y las maquinas. Por lo tanto:

1. Soldadores u Operadores que use marca-pasos para el corazón deberán consultar a su médico antes de soldar. El Campo Electromagnético (EMF) puede interferir con algunos marca-pasos.
2. Exponerse a campos electromagnéticos (EMF) puede causar otros efectos de salud aún desconocidos.
3. Los soldadores deberán usar los siguientes procedimientos para minimizar exponerse al EMF:
   A. Mantenga el electrodo y el cable a la pieza de trabajo juntos, hasta llegar a la pieza que usted quiere soldar. Asegúrelos uno junto al otro con cinta adhesiva cuando sea posible.
   B. Nunca envuelva los cables de soldar alrededor de su cuerpo.
   C. Nunca ubique su cuerpo entre la antorcha y el cable, a la pieza de trabajo. Mantega los cables a un sólo lado de su cuerpo.
   D. Conecte el cable de trabajo a la pieza de trabajo lo más cercano posible al área de la soldadura.
   E. Mantenga la fuente de poder y los cables de soldar lo más lejos posible de su cuerpo.

HUMO Y GASES -- El humo y los gases, pueden causar malestar o daño, particularmente en espacios sin ventilación. No inhale el humo o gases. El gas de protección puede causar falta de oxígeno.

Por lo tanto:

1. Siempre provea ventilación adecuada en el área de trabajo por medio natural o mecánico. No solde, corte, o ranure materiales con hierro galvanizado, acero inoxidable, cobre, zinc, plomo, berílio, o cadmio a menos que provea ventilación mecánica positiva . No respire los gases producidos por estos materiales.
2. No opere cerca de lugares donde se aplique substancias químicas en aerosol. El calor de los rayos del arco pueden reaccionar con los vapores de hidrocarburo clorinado para formar un fosfógeno, o gas tóxico, y otros irritant es.
3. Si momentáneamente desarrolla inrritación de ojos, nariz o garganta mientras est á operando, es indicación de que la ventilación no es apropiada. Pare de trabajar y tome las medidas necesarias para mejorar la ventilación en el área de trabajo. No continúe operando si el malestar físico persiste.
4. Haga referencia a la publicación ANSI/ASC Standard Z49.1 (Vea la lista a continuación) para recomendaciones específicas en la ventilación.
5. **ADVERTENCIA-- Este producto cuando se utiliza para soldaduras o cortes, produce humos o gases, los cuales contienen químicos conocidos por el Estado de California de causar defectos en el nacimiento, o en algunos casos, Cancer. (California Health & Safety Code §25249.5 et seq.)**



MANEJO DE CILINDROS-- Los cilindros, si no son manejados correctamente, pueden romperse y liberar violentamente gases. Rotura repentina del cilindro, válvula, o válvula de escape puede causar daño o muerte. Por lo tanto:

1. Utilize el gas apropiado para el proceso y utilize un regulador diseñado para operar y reducir la presión del cilindro de gas . No utilice adaptadores. Mantenga las mangueras y las conexiones en buenas condiciones. Observe las instrucciones de operación del manufacturero para montar el regulador en el cilindro de gas comprimido.
2. Asegure siempre los cilindros en posición vertical y amárrelos con una correa o cadena adecuada para asegurar el cilindro al carro, transportes, tablilleros, paredes, postes, o armazón. Nunca asegure los cilindros a la mesa de trabajo o las piezas que son parte del circuito de soldadura . Este puede ser parte del circuito elélectrico.
3. Cuando el cilindro no está en uso, mantenga la válvula del cilindro cerrada. Ponga el capote de protección sobre la válvula si el regulador no está conectado. Asegure y mueva los cilindros utilizando un carro o transporte adecuado. Evite el manejo brusco de los

MANTENIMIENTO DEL EQUIPO -- Equipo defectuoso o mal mantenido puede causar daño o muerte. Por lo tanto:

1. Siempre tenga personal cualificado para efectuar l a instalación, diagnóstico, y mantenimiento del equipo. No ejecute ningún trabajo eléctrico a menos que usted esté cualificado para hacer el trabajo.
2. Antes de dar mantenimiento en el interior de la fuente de poder, desconecte la fuente de poder del suministro de electricidad primaria.
3. Mantenga los cables, cable a tierra, conexciones, cable primario, y cualquier otra fuente de poder en buen estado operacional. No opere ningún equipo en malas condiciones.
4. No abuse del equipo y sus accesorios. Mantenga el equipo lejos de cosas que generen calor como hornos, también lugares húmedos como charcos de agua , aceite o grasa, atmósferas corrosivas y las inclemencias del tiempo.
5. Mantenga todos los artículos de seguridad y coverturas del equipo en su posición y en buenas condiciones.
6. Use el equipo sólo para el propósito que fue diseñado. No modifique el equipo en ninguna manera.

INFORMACION ADICIONAL DE SEGURIDAD -- Para más información sobre las prácticas de seguridad de los equipos de arco eléctrico para soldar y cortar, pregunte a su suplidor por una copia de "Precautions and Safe Practices for Arc Welding, Cutting and Gouging-Form 52-529.

Las siguientes publicaciones, disponibles através de la American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126, son recomendadas para usted:

1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting"
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding"
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting"
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting"
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding"
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding""
7. AWS SP - "Safe Practices" - Reprint, Welding Handbook.
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."

SIGNIFICADO DE LOS SIMBOLOS -- Según usted avanza en la lectura de este folleto: Los Símbolos Significan ¡Atención! ¡Esté Alerta! Se trata de su seguridad.

PELIGRO **Significa riesgo inmediato que, de no ser evadido, puede resultar inmediatamente en serio daño personal o la muerte.**

ADVERTENCIA **Significa el riesgo de un peligro potencial que puede resultar en serio daño personal o la muerte.**

CUIDADO **Significa el posible riesgo que puede resultar en menores daños a la persona.**

PRÉCAUTIONS DE SÉCURITÉ

AVERTISSEMENT: Ces règles de sécurité ont pour objet d' assurer votre protection. Veillez à lire et à observer les précautions énoncées ci-dessous avant de monter l' équipement ou de commercer à l'utiliser. Tout défaut d'observation de ces précautions risque d'entraîner des blessures graves ou mortelles.

1. PROTECTION INDIVIDUELLE-- Les brûlures de la peau et des yeux dues au rayonnement de l'arc électrique ou du métal incandescent, lors du soudage au plasma ou à l'électrode ou lors du gougeage à l'arc, peuvent s'avérer plus graves que celles résultant d'une exposition prolongée au soleil. Aussi convient-il d'observer les précautions suivantes:

a. Portez un écran facial adéquat muni des plaques protectrices et des verres filtrants appropriés afin de vous protéger les yeux, le visage, le cou et les oreilles des étincelles et du rayonnement de l'arc électrique lorsque vous effectuez des soudures ou des coupes ou lorsque vous en observez l'exécution.

AVERTISSEZ les personnes se trouvant à proximité de façon à ce qu'elles ne regardent pas l'arc et à ce qu'elles ne s'exposent pas à son rayonnement, ni à celui du métal incandescent.

b. Portez des gants ignifugés à crispins, une tunique épaisse à manches longues, des pantalons sans rebord, des chaussures à embout d'acier et un casque de soudage ou une calotte de protection, afin d'éviter d'exposer la peau au rayonnement de l'arc électrique ou du métal incandescent. Il est également souhaitable d'utiliser un tablier ininflammable de façon à se protéger des étincelles et du rayonnement thermique.

c. Les étincelles ou les projections de métal incandescent risquent de se loger dans des manches retroussées, des bords relevés de pantalons ou dans des poches. Aussi convient-il de garder boutonnés le col et les manches et de porter des vêtements sans poches à l'avant.

d. Protégez des étincelles et du rayonnement de l'arc électrique les autres personnes travaillant à proximité à l'aide d'un écran ininflammable adéquat.

e. Ne jamais omettre de porter des lunettes de sécurité lorsque vous vous trouvez dans un secteur où l'on effectue des opérations de soudage ou de coupage à l'arc. Utilisez des lunettes de sécurité à écrans ou verres latéraux pour piquer ou meûler le laitier. Les piquetures incandescentes de laitier peuvent être projetées à des distances considérables. Les personnes se trouvant à proximité doivent également porter des lunettes de protection.

f. Le gougeage à l'arc et le soudage à l'arc au plasma produisent un niveau de bruit extrêmement élevé (de 100 à 114 dB) et exigent par conséquent l'emploi de dispositifs appropriés de protection auditive.

2. PRÉVENTION DES INCENDES-- Les projections de laitier incandescent ou d'étincelles peuvent provoquer de graves incendies au contact de matériaux combustibles solides, liquides ou gazeux. Aussi faut-il observer les précautions suivantes:

a. Éloigner suffisamment tous les matériaux combustibles du secteur où l'on exécute des soudures ou des coupes à l'arc, à moins de les recouvrir complètement d'une bâche non-inflammable. Ce type de matériaux comprend notamment le bois, les vêtements, la sciure, l'essence, le kérosène, les peintures, les solvants, le gaz naturel, l'acétylène, le propane et autres substances combustibles semblables.

b. Les étincelles ou les projections de métal incandescent peuvent tomber dans des fissures du plancher ou dans des ouvertures des murs et y déclencher une ignition lente cachée. Veiller à protéger ces ouvertures des étincelles et des projections de métal.

c. N'exécutez pas de soudures, de coupes, d'opérations de gougeage ou autres travaux à chaud à la surface de barils, bidons, réservoirs ou autres contenants usagés, avant de les avoir nettoyés de toute trace de substance susceptible de produire des vapeurs inflammables ou toxiques.

d. En vue d'assurer la prévention des incendies, il convient de disposer d'un matériel d'extinction prêt à servir immédiatement, tel qu'un tuyau d'arrosage, un seau à eau, un seau de sable ou un extincteur portatif.

e. Une fois le travail à l'arc terminé, inspectez le secteur de façon à vous assurer qu'aucune étincelle ou projection de métal incandescent ne risque de provoquer ultérieurement un feu.

3. CHOC ÉLECTRIQUE-- Le gougeage à l'arc et à l'arc au plasma exige l'emploi de tensions à vide relativement importantes; or, celles-ci risquent de causer des dommages corporels graves et même mortels en cas d'utilisation inadéquate. La gravité du choc électrique reçu dépend du chemin suivi par le courant à travers le corps humain et de son intensité.

a. Ne laissez jamais de surfaces métalliques sous tension venir au contact direct de la peau ou de vêtements humides. Veillez à porter des gants bien secs.

b. Si vous devez effectuer un travail sur une surface métallique ou dans un secteur humide, veillez à assu-rer votre isolation corporelle en portant des gants secs et des chaussures à semelles de caoutchouc et en vous tenant sur une planche ou une plate-forme sèche.

c. Mettez toujours à la terre le poste de soudage/coupage en le reliant par un câble à une bonne prise de terre.

d. N'utilisez jamais de câbles usés ou endommagés. Ne surchargez jamais le câble. Utilisez toujours un équipement correctement entretenu.

e. Mettez l'équipement hors tension lorsqu'il n'est pas en service. une mise à la masse accidentelle peut en effet provoquer une surchauffe de l'équipement et un danger d'incendie. Ne pas enrouler ou passer le câble autour d'une partie quelconque du corps.

f. Vérifiez si le câble de masse est bien relié à la pièce en un point aussi proche que possible de la zone de travail. Le branchement des câbles de masse à l'ossature du bâtiment ou en un point éloigné de la zone de travail augmente en effet le risque de passage d'un courant de sortie par des chaînes de

levage, des câbles de grue ou divers chemins électriques.

g. Empêchez l'apparition de toute humidité, notamment sur vos vêtements, à la surface de l'emplacement de travail, des câbles, du porte-électrode et du poste de soudage/coupage. Réparez immédiatement toute fuite d'eau.

4. VENTILATION-- La respiration prolongée des fumées résultant des opérations de soudage/coupage, à l'intérieur, d'un local clos, peut provoquer des malaises et des dommages corporels. Aussi convient-il d'observer les précautions suivantes:

a. Assurez en permanence une aération adéquate de l'emplacement de travail en maintenant une ventilation naturelle ou à l'aide de moyens mécaniques. N'effectuez jamais de travaux de soudage ou de coupage sur des matériaux de zinc, de plomb, de beryllium ou de cadmium en l'absence de moyens mécaniques de ventilation capables d'empêcher l'inhalation des fumées dégagées par ces matériaux.

b. N'effectuez jamais de travaux de soudage ou de coupage à proximité de vapeurs d'hydrocarbure chloré résultant d'opérations voisines de dégraissage ou de pulvérisation. La chaleur dégagée ou le rayonnement de l'arc peut déclencher la formation de phosgène -- gaz particulièrement toxique -- et d'autres gaz irritants, à partir des vapeurs de solvant.

c. Une irritation momentanée des yeux, du nez ou de la gorge constatée au cours de l'utilisation de l'équipement dénote un défaut de ventilation. Arrêtez-vous de travailler afin de prendre les mesures néces- s a i r e s à l'amélioration de la ventilation. Ne poursuivez pas l'opération entreprise si le malaise persiste.

d. Certaines commandes comportent des canalisations où circule de l'hydrogène. L'armoire de commande est munie d'un ventilateur destiné à empêcher la formation de poches d'hydrogène, lesquelles présentent un danger d'explosion; ce ventilateur ne fonctionne que si l'interrupteur correspondant du panneau avant se trouve placé en position ON (Marche). Veillez à manœuvrer cette commande en vérifiant si le couvercle est bien en place, de façon à assurer l'efficacité de la ventilation ainsi réalisée. Ne jamais débrancher le ventilateur.

e. Les fumées produites par l'opération de soudage ou de coupage peuvent s'avérer toxiques. Aussi est-il nécessaire de disposer en permanence d'un dispositif adéquat de ventilation de type aspirant, afin d'élimi-ner du voisinage de l'opérateur tout dégagement de fumée visible.

f. Consultez les recommandations particulières en matière de ventilation indiquées à l'alinéa 6 de la norme Z49.1 de l'AWS.

5. ENTRETIEN DE L'ÉQUIPEMENT-- Un équipement entretenu de façon défectueuse ou inadéquate risque non seulement de réaliser un travail de mauvaise qualité mais, chose plus grave encore, d'entraîner des dommages corporels graves, voire mortels en déclenchant des incendies ou des chocs électriques. Observez par conséquent les précautions suivantes:

a. Efforcez-vous de toujours confier à un personnel qua-lifié l'installation, le dépannage et l'entretien du poste de soudage et de coupage. N'effectuez aucune réparation électrique sur l'équipement à moins d'être qua-lifié à cet effet.

b. Ne procédez jamais à une tâche d'entretien quelconque à l'intérieur du poste de soudage/coupage, avant d'avoir débranché l'alimentation électrique.

c. Maintenez en bon état de fonctionnement les câbles, le câble de masse, les branchements, le cordon d'alimentation et le poste de soudage/coupage. N'utilisez jamais le poste ou l'équipement s'il présente une défectuosité quelconque.

d. Prenez soin du poste de soudage et de coupage et des équipements accessoires. Gardez-les à l'écart des sources de charleur, notamment des fours, de l'humidité, des flaques d'eau maintenez-les à l'abri des traces d'huile ou de graisse, des atmosphères corrosives et des intempéries.

e. Laissez en place tous les dispositifs de sécurité et tous les panneaux de l'armoire de commande en veillant à les garder en bon état.

f. Utilisez le poste de soudage/coupage conformément à son usage prévu et n'effectuez aucune modification.

6. INFORMATIONS COMPLÉMENTAIRES RELATIVES À LA SÉCURITÉ--

Pour obtenir des informations complémentaires sur les règles de sécurité à observer pour le montage et l'utilisation d'équipements de soudage et de coupage électriques et sur les méthodes de travail recommandées, demandez un exemplaire du livret N° 52529 "Precautions and Safe Practices for Arc Welding, Cutting and Gouging" publié par ESAB. Nous conseillons également de consulter les publications sui-vantes, tenues à votre disposition par l'American Welding Society, 550 N.W. LeJuene Road, Miami, FL 32126:

a. "Safety in Welding and Cutting" AWS Z49.1

b. "Recommended Safe Practices for Gas-Shielded Arc Welding "AWS A6. 1.

c. "Safe Practices for Welding and Cutting Containers That Have Held Combustibles" AWS-A6.0.

d. "Recommended Safe Practices for Plasma Arc Cutting" AWS-A6. 3.

e. "Recommended Safe Practices for Plasma Arc Welding" AWS-C5. 1.

f. "Recommended Safe Practices for Air Carbon Arc Gouging and Cutting" AWS-C5. 3.

g. "Code For Safety in Welding and Cutting" CSA-Standard W117. 2.

INTRODUCTION

The Miniarc 150 APS is a small, portable, inverter based power source for MMA or TIG welding using the scratch start method. The unit provides up to 140A welding current and operates from either 230V or 115V single phase AC electricity supplies. The unit contains automatic supply voltage sensing circuitry so that no tap changes are required. The Miniarc 150 APS is housed in an all metal enclosure, a small fan at the rear providing cooling for the internal semiconductor components. A thermal sensor built into the unit will shut the unit down should the unit overheat due to exceeding the duty cycle. A front panel warning light illuminates under such circumstances. Wait approximately 10 minutes for unit to cool and it will reset itself.
In combination with an optional HW17V TIG torch and Argon gas supply the Miniarc 150 APS can be used for DC TIG welding.

Specifications

Primary Input Voltage/Phase .....115/208/230Vac, 1 ph., 50/60 Hz.
Voltage Tolerance..... +/- 10%

115V Operating Data:
Output Range (Stick)..... 5A/20V to 85A/23.5V
Stick Duty Cycle & Rated Output .....100% - 85 amps @ 23.4 v
Output Range (Tig)..... 5A/20V to 100A/14V
TIG Duty Cycle & Rated Output .....100% - 100 amps @ 14.0 v
TIG Duty Cycle & Rated Output .....60% - 130 amps @ 15.0 v
Primary Input Current @ 100% Duty Cycle .....19 Amps
Primary Input Current @ 60% Duty Cycle.....26 Amps
Open Circuit Voltage (max) 80v

230V Operating Data:
Output Range..... 5A/20V to 150A/26V
Stick Duty Cycle ..... 110 amps/24.5 v @ 100%
Stick Duty Cycle .....140 amps/25.6 v @ 60%
TIG Duty Cycle ..... 110 amps/14.5 v @ 100%
TIG Duty Cycle ..... 150 amps/16 v @ 60%
Primary Input Current @ 100% Duty Cycle .....17 Amps
Primary Input Current @ 60% Duty Cycle.....23 Amps
Open Circuit Voltage (max) 80v

Efficiency..... 83%
Power Factor ..... .81
Net Weight.....18 lbs. (8.2 kg)
W x L x H .....5.75in. (146mm) x 15in. (381mm) x 11in. (279mm)

1. **POWER ON/OFF SWITCH**

This switch when pushed to the "ON" position energizes the Output Receptacles on the front panel and puts the MiniArc-150aps in the ready to weld state. The light inside the switch will illuminate indicating that welding output is present at the welding output receptacles.

2. **WELDING CURRENT CONTROL**

The welding output current is continuously adjustable and can be set anywhere within the range of 10 to 100Adc.

3. **PROCESS SELECTOR**

The Process Selector Switch is used to select the desired out put process and output characteristic.

MODES:

STICK MODE

The STICK mode can be used for most all general Stick (SMAW) welding applications. This mode is optimized to give a very consistent, uniform arc with minimal spatter.

STICK WITH ARC FORCE MODE
The STICK with ARC FORCE mode can be used for Stick (SMAW) welding applications that require a more digging, penetrating arc. In this mode, as the arc length is decreased and the electrode is pushed closer to the weld pool, the output current automatically increases to give more penetration into the work piece

TIG WITH TOUCH-LIFT START MODE
This position is used for DC TIG (GTAW) applications. It features the TOUCH-LIFT START method of establishing the welding arc. In the TOUCH-LIFT START mode, the open circuit voltage is limited to 6Vdc and the output current is limited to 18 amps. This allows the electrode to be touched to the work piece, then lifted to create the welding arc without getting an explosive arc start.

NEGATIVE AND POSITIVE OUTPUT TERMINALS
The Miniarc 150 comes with a 10-foot electrode cable and electrode holder, and a 10-foot work cable and work clamp. Each cable is equipped with a male Quick Connector so the desired electrode polarity may be chosen by interchanging the electrode and work cables through the use of the output receptacles.

4. For reverse polarity (SMAW) welding, the electrode cable is connected to the positive (+) output receptacle, and the work cable is connected to the negative (-) output receptacle.

5. For straight polarity (GTAW & SMAW) welding, the electrode cable is connected to the negative (-) output receptacle, and the work cable is connected to the positive (+) output receptacle.

6. **25A CIRCUIT BREAKER**
This Circuit Breaker protects the input power line if an over current condition occurs. If tripped, just press to reset.

7. **OVER-TEMPERATURE INDICATOR**
The Miniarc incorporates a thermal overload circuit in order to prevent damage to the unit if the operating temperature becomes excessive. The fault light on the front panel will illuminate if this condition occurs. This overload protection circuit resets automatically when the operating temperature has fallen to a safe level.

8. **REMOTE RECEPTACLE**
This receptacle is located on the front panel of the Miniarc and allows for connecting a remote control accessory such as a foot control or a thumb operated, torch mounted thumb control. See the sales catalog page ARC-23118 for a listing of compatible accessories.

INSTALLATION

A. ESAB welding power sources have been designed to high standards of electromagnetic compatibility. However, arc welding, by its very nature, generates radio-frequency energy and may cause interference. By installing and using the equipment correctly, in accordance with these instructions, the problems of interference may be minimized.
B. If this equipment is used in domestic areas, eg. for repair or maintenance, particular care should be taken. The time of day should be chosen and the duration of welding limited, to minimize any potential problems.
C. If this equipment caused interference the guidance given below should be considered. If a solution cannot be found please contact your distributor or the manufacturer.
D. Before installing this welding equipment an assessment should be made of potential problems that may occur. It is good practice not to install welding equipment next to computers or safety critical control circuits, eg electronic machine guards, unless they have been suitably protected.
E. Primary cabling and welding cables should be kept separate from other main wiring and control, signalling or communications (eg telephone) cables. If interference occurs then greater separation or re-routing should be considered. Welding cables should be kept as short as practically possible.
F. Interference may also be reduced by separating the welding equipment from the other equipment affected. A partition, brick wall or particularly, a metal screen will also reduce interference. Earthing and equi-potential bonding should also be considered but guidance should be sought from a competent person, the distributor or manufacturer.
G. This equipment should be routinely maintained according to the manufacturers instructions and using only approved spare parts.
H. All access and service door and covers should be closed and properly fastened when the equipment is being used. This equipment should not be modified in any way except for those changes and adjustments approved by the manufacturer.

Connection to Primary Power

The Miniarc 150 APS can be used on 230V or 115V single phase electricity supplies.

The unit contains sensing circuiting which automatically adjusts itself to match the mains input supply, 230V or 115V as necessary. No internal adjustments are required.

233 VAC:

On 230V a standard 20A breaker is adequate for most MMA or TIG welding applications. For higher duty work, with 1/8" (3.2mm) electrodes at 140A for example, A 30A breaker or slow fuse must be used.

115VAC:

On 115V supplies a 20A circuit breaker should be used corresponding with a supply of not less than 2.5KVA.

IMPORTANT!

The green earth lead must be connected to a good earth ground.

Main Extension Cables

Care must be taken when supplying the unit via long power extension cables. On 230V supplies the recommended cable is a 10AWG, 3-conductor. On 115V supplies extension cables are not recommended.

Placing or Positioning the Unit

Position the unit to give good all-round ventilation. Do not block the air inlet on the rear panel or the front or side panel louvers. Preferably choose an off-floor location away from dust, dirt or damp.

THERMAL OVERLOAD INDICATOR
Indicates 'overload' condition. If the lamp lights, leave the unit switched on with the fan running and allow to cool. Reset is automatic after the unit cools.

WELDING CURRENT CONTROL

PROCESS SELECTOR

POSITIVE OUTPUT TERMINAL

POWER ON/OFF SWITCH/INDICATOR

OVER-TEMPERATURE INDICATOR

25A CIRCUIT BREAKER

NEGATIVE OUTPUT TERMINAL

REMOTE RECEPTACLE (current control only)

WARNING **THE POWER/INPUT VOLTAGE SELECTOR SWITCH ON THIS EQUIPMENT DOES NOT ISOLATE THE UNIT FROM THE MAIN ELECTRICAL SUPPLY. AC POWER IS PRESENT ON THE SWITCH TERMINALS.**

MMA Welding

While welding try to adopt a relaxed attitude

1. Always commence with a last minute check for safety and protection.
2. In the Process Selector Switch, select Standard Stick or Arc Force Stick.
3. Check that the electrode holder and work return lead connections are secure.
4. Fit the appropriate size of electrode
5. Using the current control, set the welding current.
6. Hold the electrode away from the work, trailing the welding lead over the shoulder to reduce the weight on the hand doing the welding.
7. Keeping the electrode clear of any exposed metal surface, switch on the unit.
8. Position the electrode close to the point where welding is to commence, without actually touching the work.
9. Cover the eyes with a headscreen or handshield and warn bystanders.
10. (a) Scrape the electrode on the work surface at the start point (as though striking a match). The arc should strike.

(b) Carry on scraping the electrode across the surface of the workpiece until the arc is almost continuous, then feed the electrode into the hot pool of molten metal keeping the electrode at approximately 65-80° to the workpiece.

If the electrodes 'freezes', i.e. sticks to the workpiece, gently twist the electrode and pull it free. If this is not possible, switch off the supply, release the electrode from the holder, and cut the electrode free with a chisel. Freezing will occur if heavy contact is made with the workpiece at too low a current setting.

(c) Once the arc is successfully struck adjust the arc length to about the size of the electrode diameter.

(d) The correct length of arc, (size of weld 'bead') is acquired by feeding the electrode backwards and downwards into the weld.

This combination of backward and downwards movement requires a little skill which will be acquired after a few practice welds.

11. Allow the weld to cool.

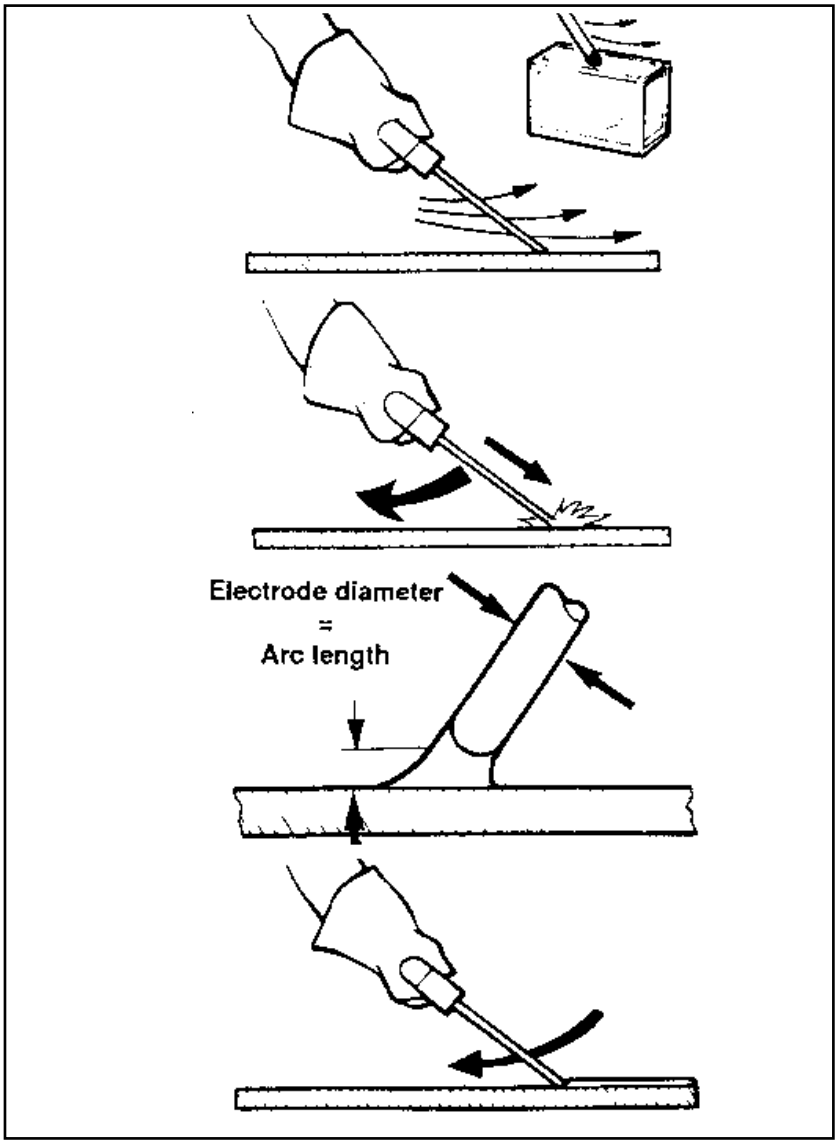


Figure 3.2

TIG WELDING

Preparation

Read again the Safety Notes at the front of this manual

1. Select Lift Tig in the Process Selector Switch
2. Connect the work return lead to the positive socket.
3. Connect the torch power lead to the negative 'work' socket.
4. Fit the regulator and gas flow meter to the gas cylinder and, using a cylinder key, turn on the gas and adjust the gas flow for a 6 to 7.5 litres/minute (12-15cu.ft/hr.) indication on the flow meter.
5. Connect the torch gas lead to the regulator, and turn on the gas supply.
6. Fit an appropriate sized 2% thoriated electrode to the torch - see 'Electrode Guide' and set the electrode 'stickout' to between 1/16" - 1/4" (4-7mm). Check the electrode is correctly ground.
7. Clean the material to be welded with a wire brush or grinder.
8. Clamp the work return lead to the work piece ensuring good electrical contact.
9. Clear the welding area and check that a fire extinguisher is available.

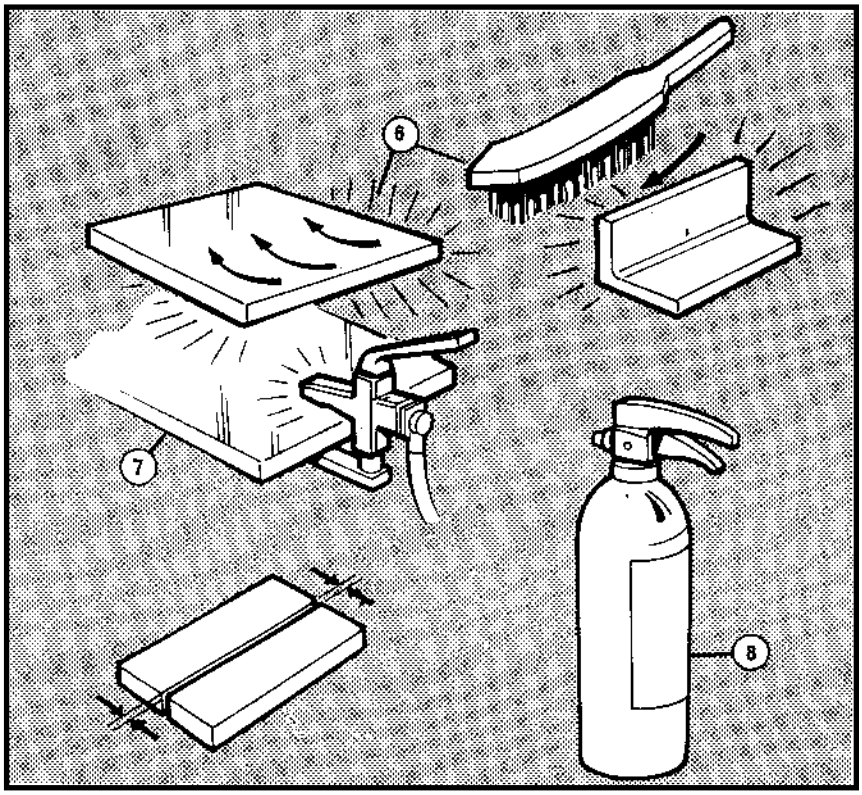


Figure 3.3

Technique

1. Set the output current control as required. Once the arc is struck the current can be lowered as required.
2. Switch on the unit
3. Switch on the gas flow to 'purge' the gas lines, adjust the gas flow for a 12-15 cu.ft/hr (6-7.5 ltrs/per min.) indication on the flow meter.
4. Adopt a good welding position and hold the torch and filler rod at the correct angles. Holding the rod and torch at these angles is necessary to ensure satisfactory results.
5. Position the torch over the welding area, about 1" (25mm) above. Warn bystanders to shield their eyers and lower your headscreen.
6. Strike the arc by scratching the tungsten electrode on the workpiece in the same manner as that described for manual metal arc. Improved striking will be obtained by striking the arc on a carbon block and then transferring the arc to the workpiece.
7. Wait for a pool to form and, when the edges of the molten material flow together, move the torch from right to left (right handed welder) adding filler wire as necessary. (Keep the filler rod tip inside the gas shroud).

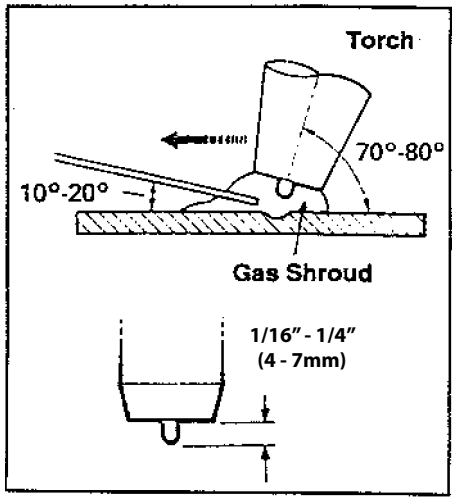


Figure 3.4 - **Torch and filler rod angles and Electrode stick-out**

TIG ELECTRODES

In order to obtain the optimum arc striking performance with the Miniarc 150 APS it is recommended that 2% Thoriated tungstens are exclusively used (red tip).

Maximum Electrode Ratings d.c.

Electrode Dia.	Current Range
.040"	5A -70A
1/16"	50A - 150A

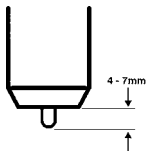


Figure 3.5

Shielding Gas

To prevent oxidation, always purge the argon hose before welding and maintain the argon flow until the tungsten has cooled sufficiently after welding has ceased.

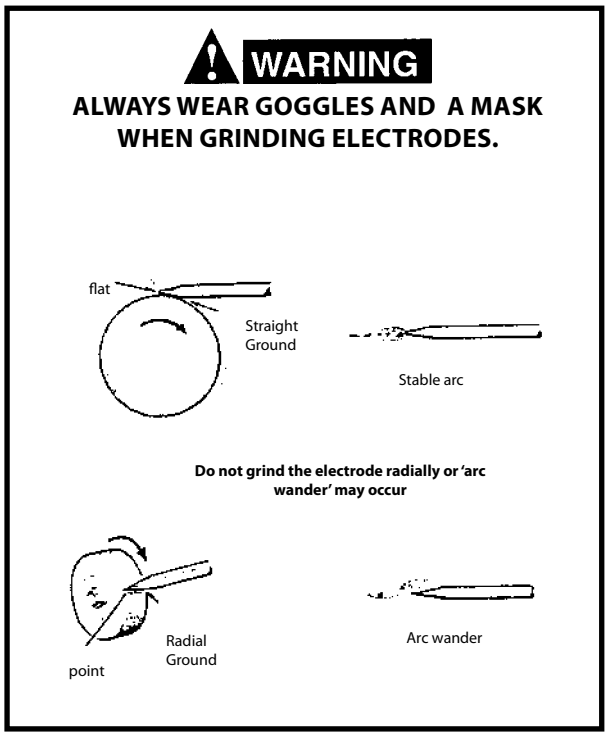


Figure 3.6

Principles of Shielded Metal Arc Welding

GENERAL

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

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

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

TABLE 3.1 - CURRENT REQUIREMENTS FOR MILD STEEL ELECTRODES

Electrode Diameter Inches/Meteric	Amperage	
	Minimum	Maximum
5/64" (2.0mm)	20	50
3/32" (2.4mm)	40	80
1/8" (3.2mm)	65	125

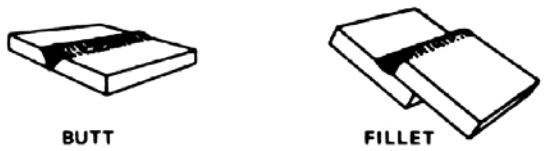


Figure 3.7. Flat Position Welds

The importance of welding in the flat position, whenever possible, cannot be stressed too strongly. The quality of the weld is better, the operation easier and faster (Figure 3.7). However, occasions will arise when it is necessary to work on parts

positioned horizontally, vertically and overhead as shown in Figure 3.8, 3.9, and 3.10 respectivily. It must be realized at the very beginning that welding in these positions is difficult and will require constant practice to develop skill. Generally, under these conditions it is helpful to reduce the current from the value used on welding in the flat position.

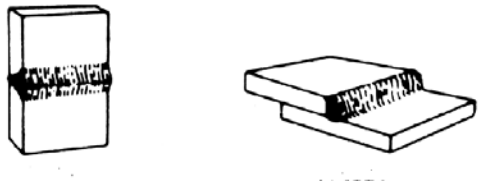


Figure 3.8 Horizontal Position Welds

Figure 3.9 Vertical Position Welds

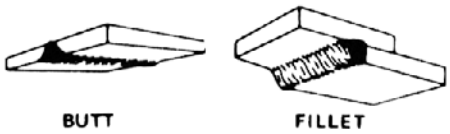


Figure 3.10 Overhead Position Welds

STRIKING THE ARC-RUNNING BEADS

In learning to weld there are certain fundamental steps which must be mastered before one can attempt to weld on actual work. Prior to striking an arc, insert the electrode in the holder, as shown in Figure 3.11. To strike an arc, Figure 3.12 illustrates what is commonly known as the scratch start technique. In this method the striking end of the electrode is dragged across the work in a manner much the same as striking a match.

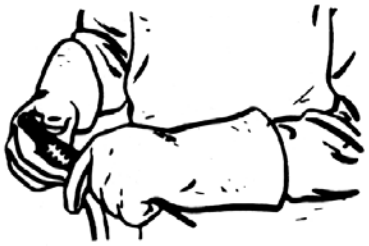


Figure 3.11 Electrode insertion

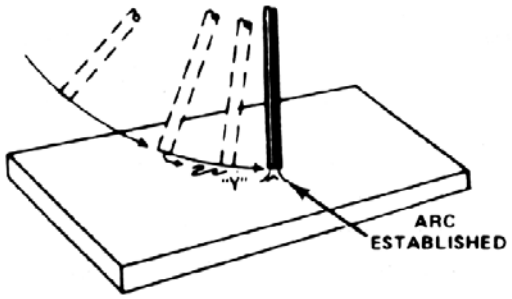


Figure 3.12 Arc Initiation - Scratch Start

When the electrode touches the work, the welding starts. If held in this position, the electrode would freeze or weld itself to the work. To overcome this, the electrode should be slightly withdrawn from the work immediately after contact has been made. The distance that the electrode is withdrawn is small and depends upon the diameter of the electrode; this distance is known as the arc length. If in striking an arc, the electrode freezes, it may be freed by a quick twist of the wrist. Practice striking the arc until the knack of arc starting has become second nature.

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

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

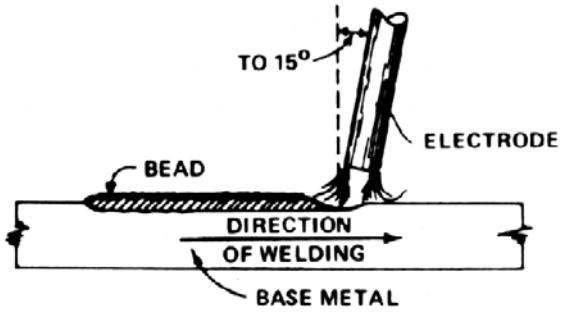


Figure 3.13 - Electrode Position

Once the knack of establishing and holding an arc has been learned, the next step is learning to run a good weld bead. In the beginning it is best to run beads of weld metal on flat plates using a full electrode. Practice moving from left to right and from right to left. The electrode should be held less than perpendicular to the work, tilting it in the direction of travel. The correct position is shown in Figure 3.13.

A proper weld bead is illustrated in Figure 3.14. This shows a cross section through the bead and identifies the various terms used in describing a weld. To produce these results it is necessary to hold a short arc, travel at a uniform speed, and feed the electrode downward at a constant rate as it melts.

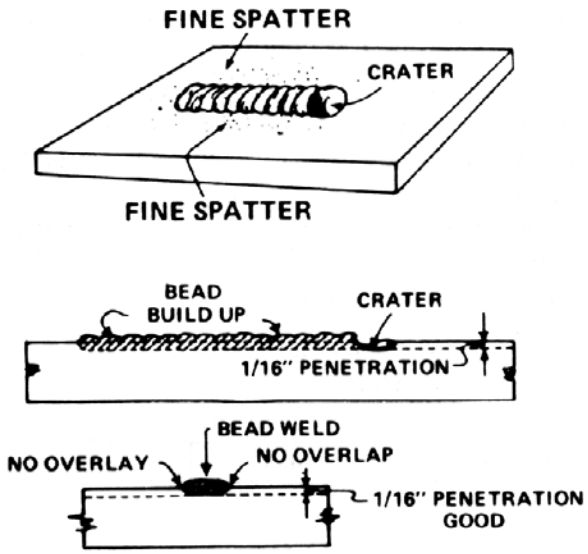


Figure 3.14 Proper Weld Bead

Probably the first attempts in the practice will fail short of the results shown. Too long an arc will be held or the travel speed will vary from slow to fast and the welds will look as illustrated in Figure 3.15 showing a cross section through a poor welding bead. In addition, the weld will probably be spongy (porous) and of low strength.

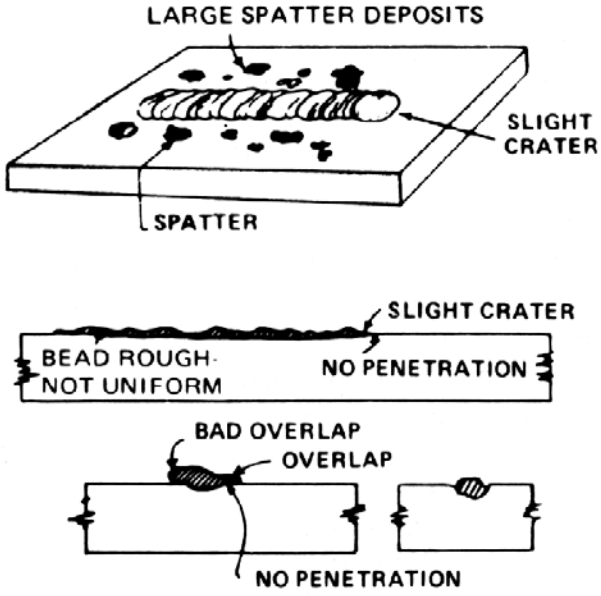


Figure 3.15 Poor Weld Bead

Continue practicing until uniform beads as shown in Figure 3.14 can be produced. A good method of practicing is to deposit a series of beads, one next to the other until the plate is covered. The slag must be thoroughly removed between each pass. Then deposit another series of beads at right angles to the first, thus holding up the plate to a greater thickness.

WEAVING

When it is necessary to cover a wider area in one pass of the electrode, a method known as weaving is employed. In this the electrode is moved or oscillated from side to side in a set pattern. In order to be sure of uniform deposits, it is necessary to use a definite pattern such as those illustrated in Figure 3.16. While weaving is helpful, particularly when building up metal, it should be limited to weaves not exceeding 2-1/2 times the diameter of the electrode.

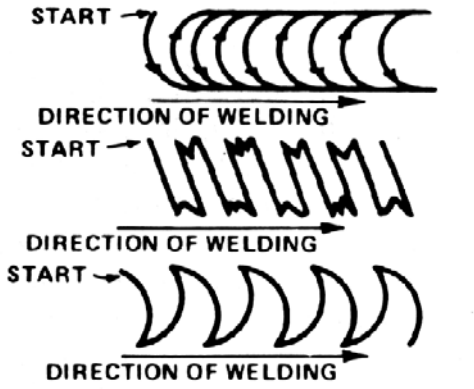


Figure 3.16 Weave Patterns

BUTT JOINTS

Up to this point the discussion has covered only the deposit of beads on flat plate. Such operations are helpful in building up worn parts or applying hardfacing materials. The next step is learning to weld two pieces of metal together. For this purpose, other types of welds are illustrated in Figure 3.17.

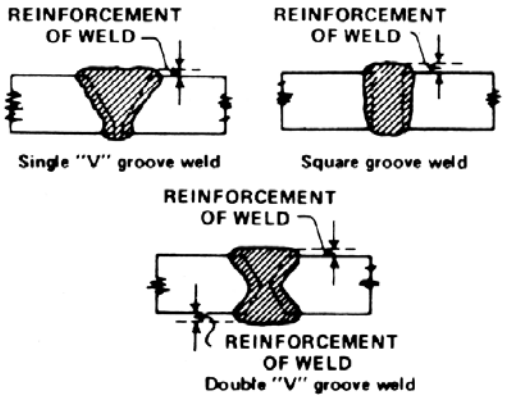


Figure 3.17 Butt Joints

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

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

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

One method for beveling steel for V groove welding is by means of using an oxyacetylene cutting torch. The work may be done with a hand guided torch or special oxyacetylene cutting machine. However, in performing this cutting, a scale will develop on the plates. This must be removed by grinding or chipping before welding as it is likely to become entrapped in the weld bead and produce an unsound weld. Where oxyacetylene cutting equipment is not available, grinding will probably be the best means of preparing bevels. The angles of these bevels should be about 30 degrees and the bottom edge may be left square for a distance of about 1/16". See Figure 3.18.

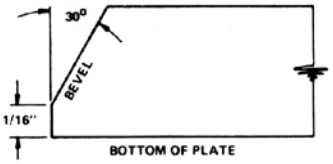


Figure 3.18 Single Bevel

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

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

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

WARNING **CAUTION SHOULD BE OBSERVED IN HANDLING WELDED PIECES OF METAL, SINCE WELD HEAT ABSORBED BY THE METAL IS INTENSE AND CAN CAUSE SERIOUS BURNS.**

Grip a short, welded piece with the weld just above the jaws of the vise. Hammer it in a direction that tends to open the bottom, root side of the weld, in the manner shown in Figure 3.19. A good weld will not break under this test, but will bend over. If the weld breaks, examine it to determine the cause. If there are a large number of holes (the weld looks spongy) it is porous.

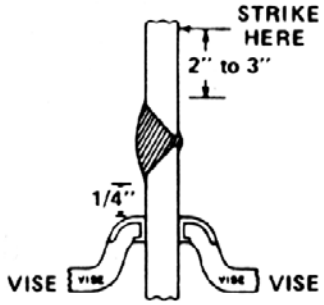


Figure 3.19 Weld Test

This is probably due to holding too long an arc. If there are bits of slag in the weld perhaps the arc was too short or the electrode was manipulated incorrectly thus permitting molten slag from the electrode coating to be trapped. This is quite likely to happen on a V joint made in several layers and calls for thorough cleaning between layers. Perhaps on breaking it will be found that the original surface of the bevel is still evident. That means that it was not melted and the cause is quite likely to be found in too fast a travel speed or insufficient heat.

TEE AND LAP JOINTS

The &her bast type of weld, the fillet weld, is used for making tee and lap joints, For this type of welding, no special preparation, other than squared edges, is necessary. Typical welded tee and lap joints are pictured in Figures 3.20 and 3.21 respectively.

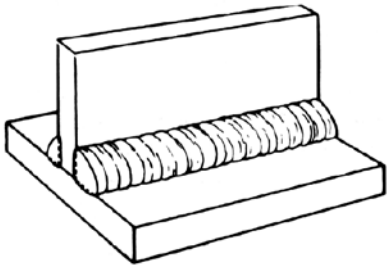


Figure 3.20 Tee Joint

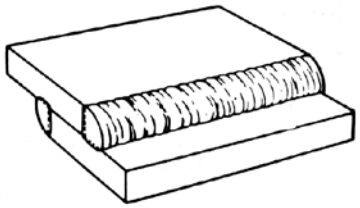


Figure 3.21 Lap Joint

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

To deposit a single pass fillet weld, hold the electrode as shown in Figure 3.22. This will provide fusion into the corner and a fillet, the sides of which will be approximately equal. For maximum strength a fillet weld should be deposited on each side of the upright section. When a heavier fillet is needed, deposit a second layer as indicated in Figure 3.23, using any of the weaving patterns shown in Figure 3.24.

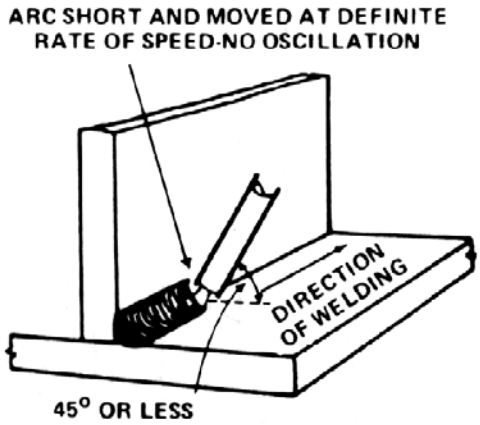


Figure 3.22 Tee Joint Fillet Weld

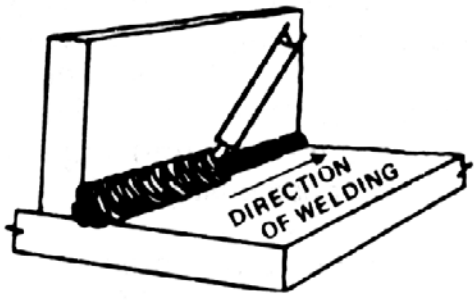


Figure 3.23 Multilayer Tee Joint

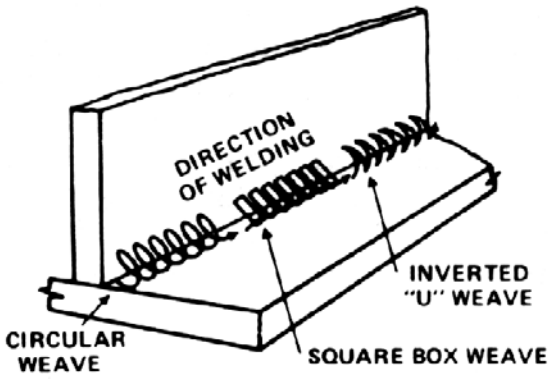


Figure 3.24 Tee Joint Fillet Weld Weave Patterns

The lap joint, while involving the same fundamental weld type, the fillet, has metal distributed differently and therefore requires still another technique. The details of the application are given in Figure 3.25, for a single pass weld. For a two pass weld, Figure 3.26 provides the details.

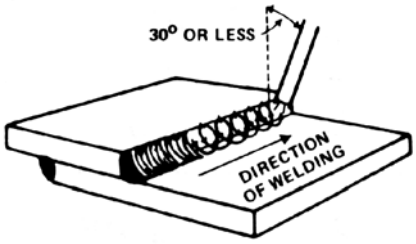


Figure 3.25 Lap Joint Fillet Weld

Figure 3.26 Multilayer Lap Joint

WELDING VERTICALLY, HORIZONTALLY AND OVERHEAD

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

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

One of the first facts to be noted when welding in these positions is that the force of gravity tends to cause the molten metal to drip (fall) down. The technique used, therefore, must be acquired to overcome this. Start by making horizontal weld beads on plates inclined at 45 degrees as shown in Figure 3.27. When this has been mastered so that uniform beads can be made consistently, practice on welding vertically may be started. Again begin with an easy operation such as running beads vertically on plates set at 45 degrees. (See Figure 3.28.)

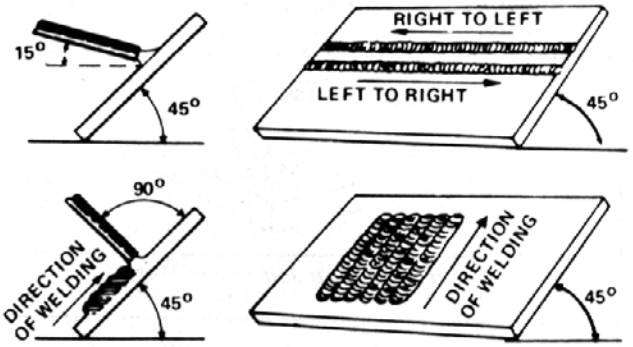


Figure 3.27 Horizontal Weld Beads - Inclined Plate
Figure 3.28 Vertical Weld Beads - Inclined Plate

To progress with this practice it is necessary now to move the plates into vertical position. The details of horizontal weld beads are given in Figure 3.29.

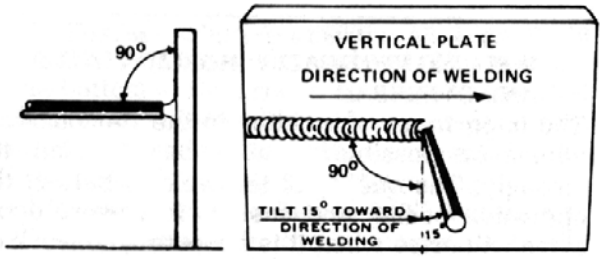


Figure 3.29. Horizontal Weld Beads - Vertical Plate

Welding vertically may be performed either by welding upward or starting from the top and welding down. It is generally conceded that working upward is easier and therefore, weld beads in this manner should be practiced. A method for making weave weld beads is illustrated in Figure 3.30.

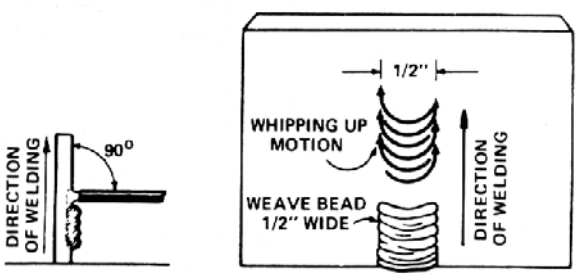


Figure 3.30 - Weave Pattern

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

Figure 3.31 provides information suitable for a single pass vertical butt weld or the first pass of a multiple layer deposit. Two methods of depositing the subsequent layers are given in Figure3.32.

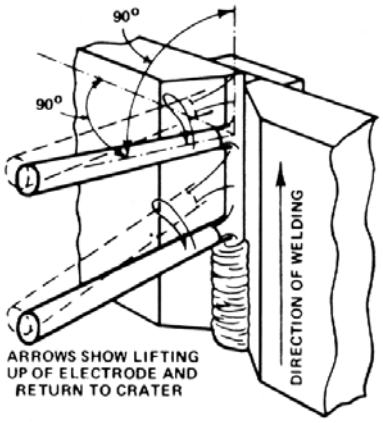
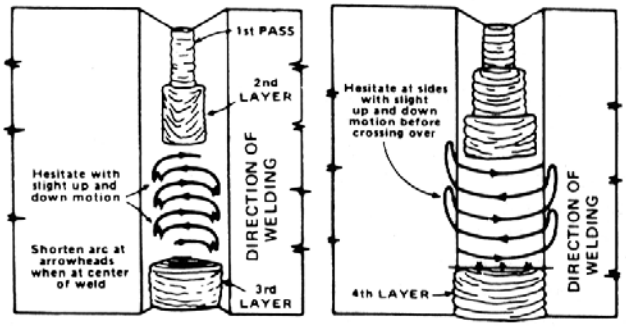


Figure 3.31 - Single Pass Vertical Butt



Weld

Figure3-32 Multilayer Deposit. Vertical Weld

For horizontal welds the details are shown in Figure 3.33 and 3.34. Note that a strip of metal is shown at the foot of the weld. This is known as the backing strip. Its use permits securing a sound root pass without great difficulty. In use, the beveled plate edges should be centered on the backing strip and the strip tack welded to the plates on the reverse side.

For fillet welds on tee and lap joints the technique is shown in Figure 3.35. When depositing a multilayer fillet weld, the same method would be used to deposit the first layer on both lap and tee joints. For depositing subsequent layers on tee joints two means are used and are shown in Figure 3.36. For additional layers on lap joints a somewhat similar weave may be seen in Figure 3.37.

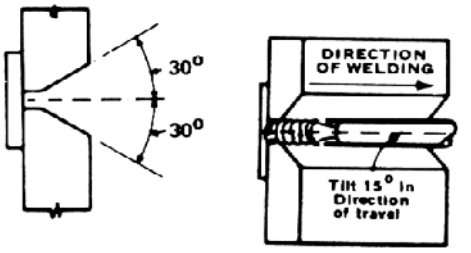


Figure 3.33 Root Pass

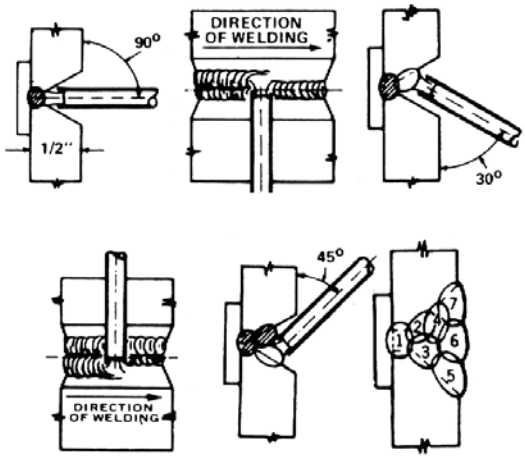


Figure 3.34 Multilayer Deposit. Horizontal Butt Weld

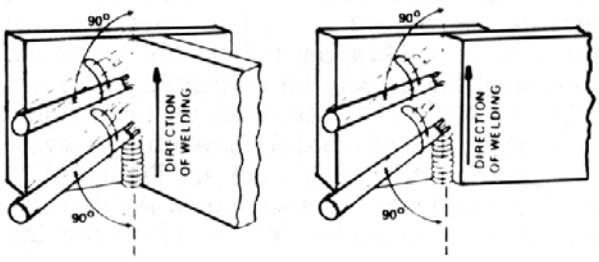


Figure 3.35 Fillet Weld - Vertical Tee Joint

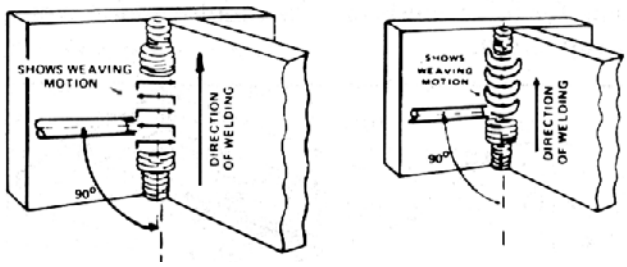


Figure 3.36 Multilayer Deposit - Lap Joint

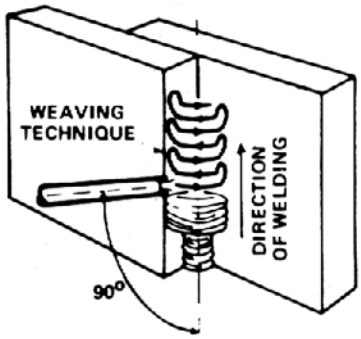


Figure 3.37 Multilayer Deposir - Lap Joint

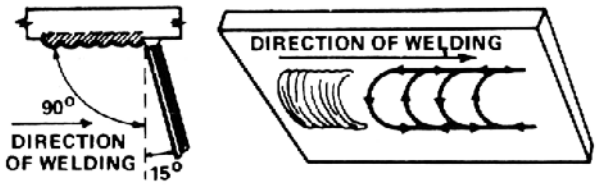


Figure 3.38 Electrode Position & Weave Pattern

Welding in the overhead position is the final problem to master. Again proceed through the steps of making weld beads, the making of butt welds and finally the making of fillet welds. For overhead welding, the electrode position, Figure 3.38, will prove helpful. When weaving is necessary, the pattern in Figure 3.38 may be used. The technique for overhead butt welds is illustrated in Figure 3.40; this covers single pass welds or the first pass of multilayer welds Subsequent beads may be deposited as shown in Figure 3.41. For depositing single layer fillets or the first layer of multiple fillets in the over- head position the technique in Figure 3.42 should be employed. The sequence for depositing beads on a multilayer fillet weld is provided in Figure 3.43. Note that single beads are recommended and for that reason use the same technique shown in Figure 3.42. Again the technique for fillet welds may be employed for welding lap joints.

Figure 3.40 Overhead Butt Weld - Root Pass

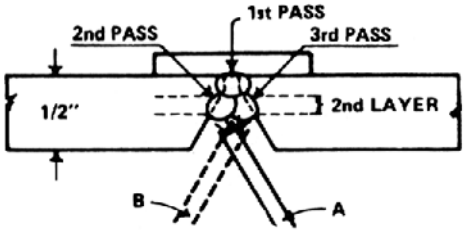


Figure 3.41 Multilayer Deposit - Overhead Butt Weld

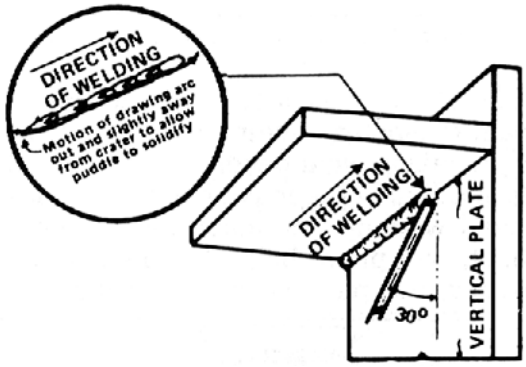


Figure 3.42 Overhead Tee Weld - Single Pass

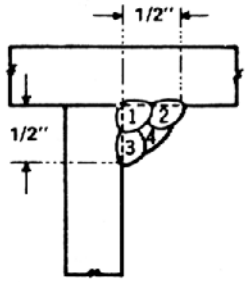


Figure 3.43 Multilayer Deposit - Overhead Tee Weld

CONCLUSION

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

MAINTENANCE

WARNING

MAINTENANCE INVOLVING THE REMOVAL OF THE OUTER COVER MUST ONLY BE UNDERTAKEN BY QUALIFIED OR SUITABLY TRAINED PERSONNEL. BEFORE REMOVING THE COVER FOR MAINTENANCE, ISOLATE THE UNIT FROM THE MAINS SUPPLY.

Switch off and disconnect the unit from the main supply before under-taking any maintenance tasks.

Daily (Operator task)

I. Check all welding and electrical cables for signs of cracking or general deterioration.

2. Check that all electrical (and gas) connections are in good physical condition.

3. Check the torch or electrode holder for damage. Replace any suspect part(s).

ALWAYS CHECK THE WELDING AREA DAILY FOR POSSIBLE SAFETY HAZARDS. IF IN DOUBT CONSULT YOUR SAFETY OFFICER.

Monthly (Maintenance Department Task)

l. Switch off the unit and disconnect from the main electrical supply.

2. Remove the cover (retain the fixing screws)

3. Using a soft brush, remove any dust or dirt from the interior of the unit. If compressed air is used to the unit the pressure must not exceed 30 psig, and the air must be dry.

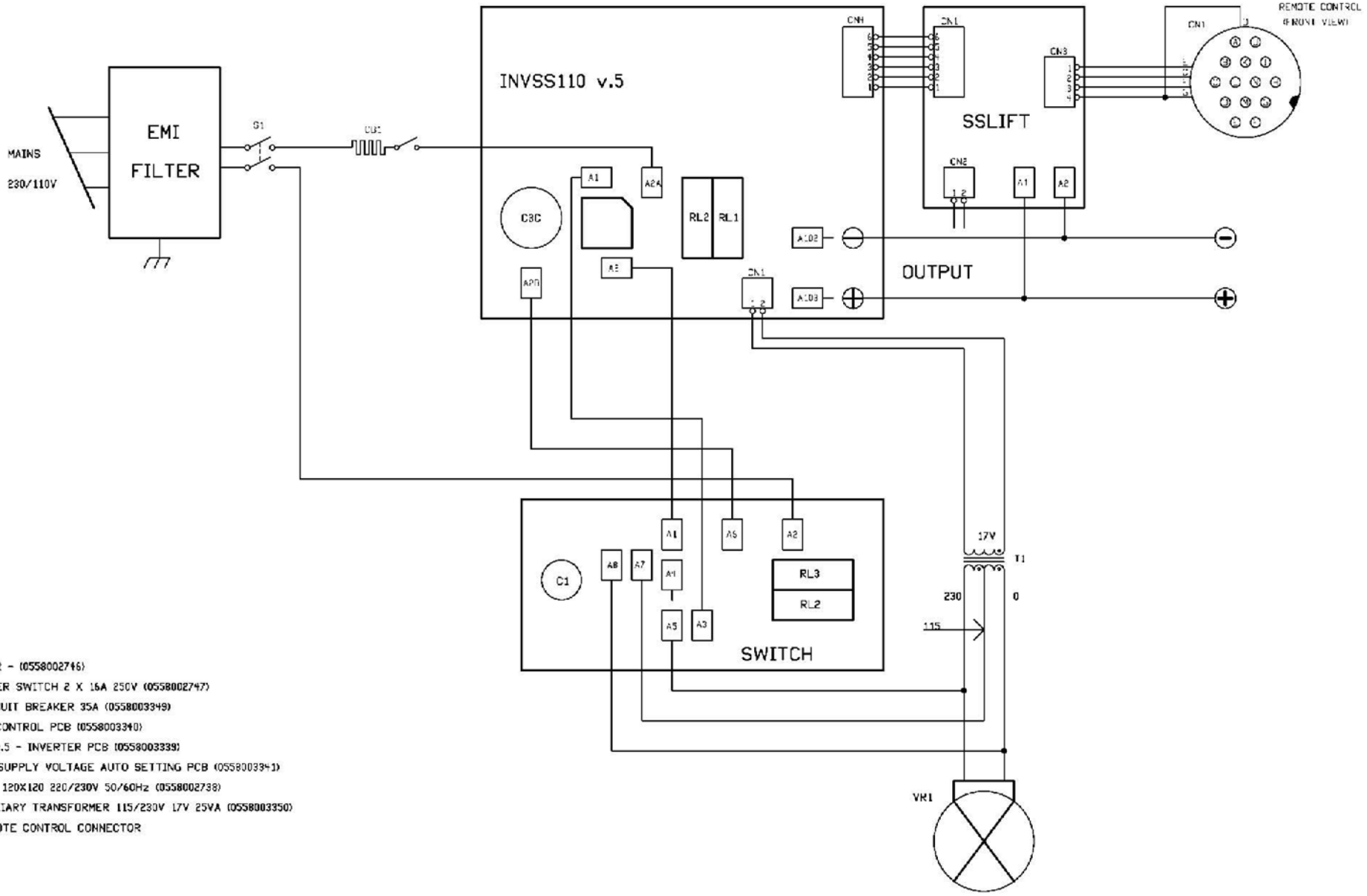
SUITABLE EYE AND MOUTH PROTECTION SHOULD BE WORN.

4. Replace the cover.

5. Reconnect the unit to the main supply.

WELDING AND GENERAL FAULTS

	Fault	Remedies
Surface porosity	a) Insufficient shielding gas (TIG). b) Bore of nozzle too small (TIG). c) Surplus degreasing agent (MMA & TIG) d) Arc too long (MMA and TIG). a) Incorrect torch or rod angle (TIG). f) Poor quality materials (MMA and TIG)	a) Check shielding gas flow. b) Fit larger ceramic nozzle. c) Remove degreasing agent and dry. d) Shorten the arc. a) Correct the angles -see TIG welding f) Use better quality materials.
Undercut (MMA and TIG)	a) Incorrect welding technique. b) Current too high. c) Incorrect welding speed. d) Wrong electrode (MMA).	a) Correct rod handling. b) Reduce current setting. c) Increase hand travel speed. d) Change to correct size (type).
Lack of penetration (MMA and TIG)	a) Insufficient current. b) Welding too fast.	a) Increase current setting. b) Decrease hand travel speed.
Cracking and Inclusions	These faults are difficult to detect without the use of specialized equipment. If cracking shows, seek the advice of a welding engineer.	
No welding	a) Thermostat tripped b) Circuit Breaker tripped c) Main input fuses blown.	a) Cease welding and allow the fan to continue to **output run** thereby cooling the unit. Decrease welding duty cycle (welding on to off time). b) press to reset c) Replace with the same value fuse.
No Arc Strike In TIG	a) Contaminated Tungsten b) Poor welding circuit c) Current set below 15A	a) Regrind/Replace Tungsten b) Check cables c) Increase current setting



EMI FILTER - (0558002746)
S1 - ROCKER SWITCH 2 X 16A 250V (0558002747)
CB1 - CIRCUIT BREAKER 35A (0558003349)
SSLIFT - CONTROL PCB (0558003340)
INVSS110 v.5 - INVERTER PCB (0558003339)
SWITCH - SUPPLY VOLTAGE AUTO SETTING PCB (0558003341)
VR1 - FAN 120X120 220/230V 50/60Hz (0558002738)
T1 - AUXILIARY TRANSFORMER 115/230V 17V 25VA (0558003350)
CN1 - REMOTE CONTROL CONNECTOR

A. REPLACEMENT PARTS

Replacement Parts are illustrated on the following figures. When ordering replacement parts, order by part number and part name, as illustrated on the figure. Always provide the series or serial number of the unit on which the parts will be used. The serial number is stamped on the unit nameplate.

B. ORDERING

To assure proper operation, it is recommended that only genuine ESAB parts and products be used with this equipment. The use of non-ESAB parts may void your warranty.

Replacement parts may be ordered from your ESAB distributor or from:

ESAB Welding & Cutting Products
Attn: Customer Service Dept.
P.O. Box 100545, 411 S. Ebenezer Road
Florence, SC 29501-0545

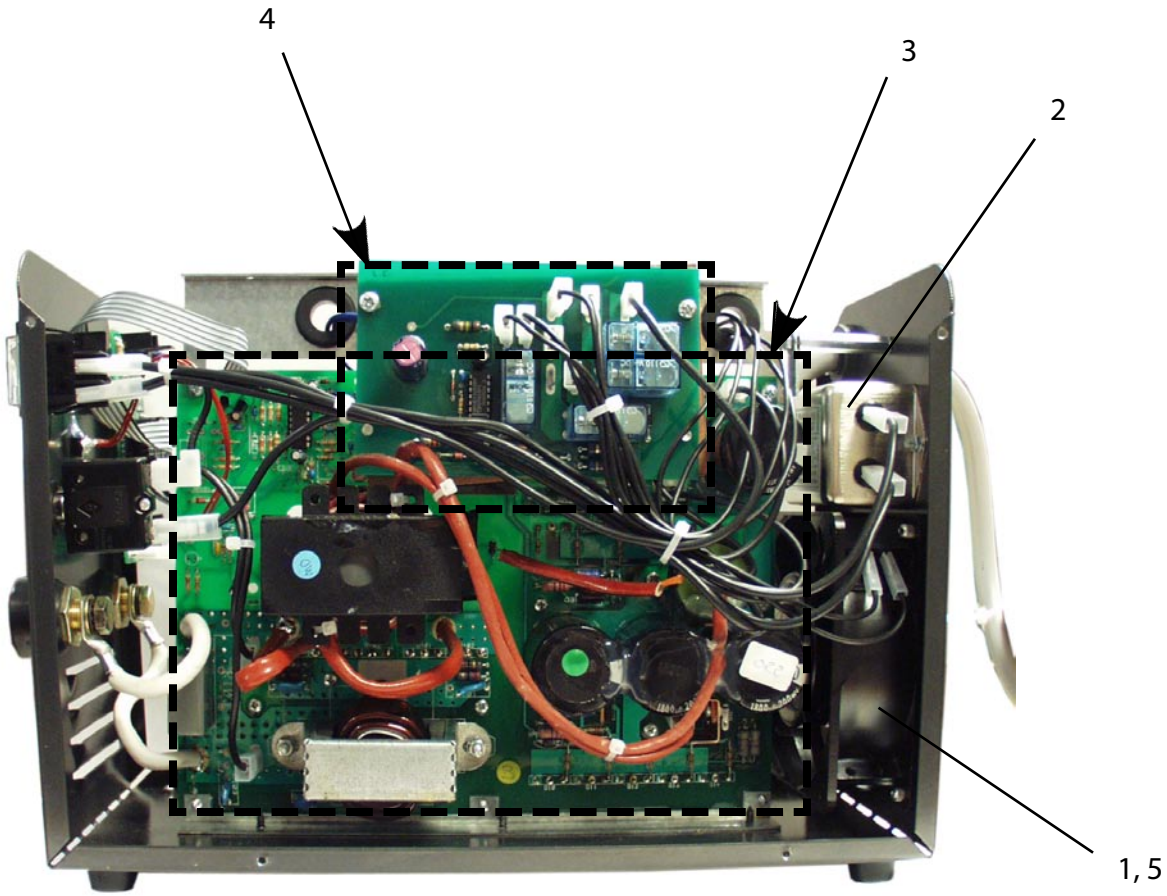
Be sure to indicate any special shipping instructions when ordering replacement parts.

To order parts by phone, contact ESAB at 1-843-664-5540. Orders may also be faxed to 1-800-634-7548. Be sure to indicate any special shipping instructions when ordering replacement parts.

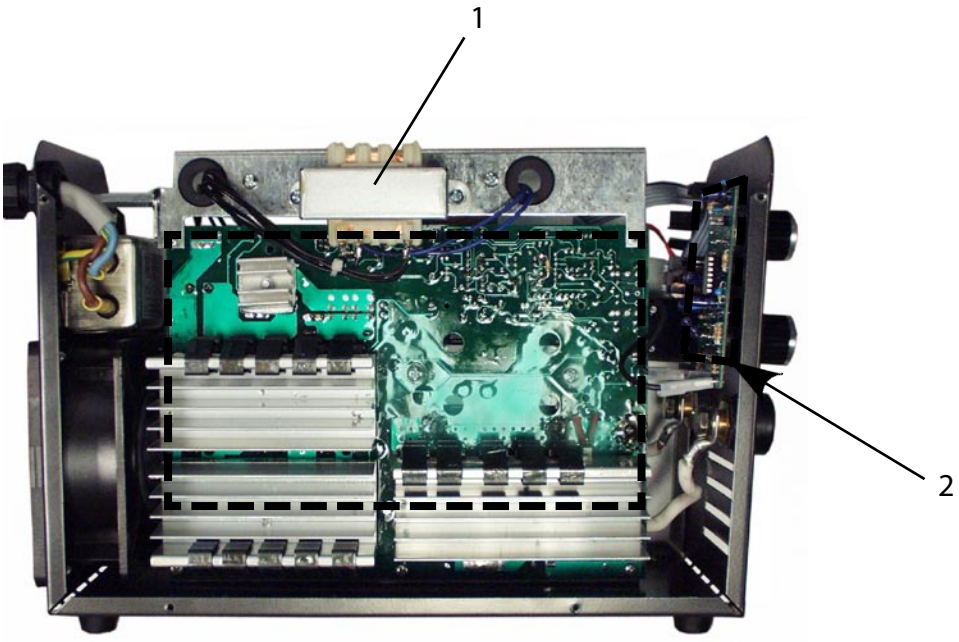
Refer to the Communication Guide located on the last page of this manual for a list of customer service phone numbers.

ITEM NO.	QTY. REQ.	PART NO.	DESCRIPTION	CIRCUIT SYMBOL
1	1	0558003351	Plastic Carrying Case	

ITEM NO.	QTY. REQ.	PART NO.	DESCRIPTION	CIRCUIT SYMBOL
1	1	0558002747	Power Switch	S1
2	2	0558002735	Knobs	-
3	2	0558002707	Dinse Socket	-
4	1	0558003349	Circuit Breaker	CB
5	1	951916	Remote Receptacle	CN1



ITEM NO.	QTY. REQ.	PART NO.	DESCRIPTION	CIRCUIT SYMBOL
1	1	0558002738	Fan	VR1
2	1	0558002746	EMC Filter	-
3	1	0558003339	Inverter pcb ass'y	PCB2
4	1	0558003341	Voltage autoswitch PCB	PCB1
5	1	0558002739	Grid, Fan	



ITEM NO.	QTY. REQ.	PART NO.	DESCRIPTION	CIRCUIT SYMBOL
1	1	0558003350	Control Transformer	T1
2	1	0558003340	Control P/C Board	PCB3

Notes

Revision History

07 / 2004 - Updated part numbers on Pages 38, 41, 42 and 43 to reflect latest Florence numbers to be used for ordering. Added Page 40 to illustrate plastic carrying case.

02 / 2006 - Updated entire manual format and replaced Schematic with latest revision.

10 / 2006 - Added text to describe functionality of machine controls. Updated illustrations. Done from Bob Bitzky inputs.

ESAB Welding & Cutting Products, Florence, SC Welding Equipment
COMMUNICATION GUIDE - CUSTOMER SERVICES

A. CUSTOMER SERVICE QUESTIONS:
Telephone: (800)362-7080 / Fax: (800) 634-7548 **Hours: 8:00 AM to 7:00 PM EST**
Order Entry | Product Availability | Pricing | Order Information | Returns

B. ENGINEERING SERVICE:
Telephone: (843) 664-4416 / Fax : (800) 446-5693 **Hours: 7:30 AM to 5:00 PM EST**
Warranty Returns | Authorized Repair Stations | Welding Equipment Troubleshooting

C. TECHNICAL SERVICE:
Telephone: (800) ESAB-123/ Fax: (843) 664-4452 **Hours: 8:00 AM to 5:00 PM EST**
Part Numbers | Technical Applications | Specifications | Equipment Recommendations

D. LITERATURE REQUESTS:
Telephone: (843) 664-5562 / Fax: (843) 664-5548 **Hours: 7:30 AM to 4:00 PM EST**

E. WELDING EQUIPMENT REPAIRS:
Telephone: (843) 664-4487 / Fax: (843) 664-5557 **Hours: 7:30 AM to 3:30 PM EST**
Repair Estimates | Repair Status

F. WELDING EQUIPMENT TRAINING
Telephone: (843)664-4428 / Fax: (843) 679-5864 **Hours: 7:30 AM to 4:00 PM EST**
Training School Information and Registrations

G. WELDING PROCESS ASSISTANCE**:**
Telephone: (800) ESAB-123 **Hours: 7:30 AM to 4:00 PM EST**

H. TECHNICAL ASST. CONSUMABLES**:**
Telephone : (800) 933-7070 **Hours: 7:30 AM to 5:00 PM EST**

IF YOU DO NOT KNOW WHOM TO CALL

Telephone: (800) ESAB-123
Fax: (843) 664-4452
Hours: 7:30 AM to 5:00 PM EST

or
visit us on the web at http://www.esabna.com
The ESAB web site offers
Comprehensive Product Information
Material Safety Data Sheets
Warranty Registration
Instruction Literature Download Library
Distributor Locator
Global Company Information
Press Releases
Customer Feedback & Support

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