m3 G2 (ICH) Plasma System

Instruction Manual

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- 2011 - Original Release

The equipment described in this manual is potentially hazardous. Use caution when installing, operating, and maintaining this equipment.

The purchaser is responsible for the safe operation and use of all products purchased, including compliance with all applicable standards in the country of use. See standard ESAB terms and conditions of sale for a specific statement of ESAB's responsibilities and limitations on liability.

This manual is ESAB part number 0558011509.

Information in this document is subject to change without notice. This manual is for the convenience and use of the cutting machine purchaser. It is not a contract or any obligation on the part of ESAB Global Cutting Technology.

Preface

This product was designed to provide years of dependable, accurate, repeatable part cutting, with a high degree of reliability and ease of operation. There are optional features and configurations available which may or may not be included in this manual. In addition, more capabilities and features may be added in the future, which are not covered in this manual. ESAB Global Cutting Technology reserves the right to change or add features and capabilities without notice. Before operating the machine, one should become familiar with this manual in its entirety, with special attention to the ***SAFETY*** section.

m3 G2 (ICH) Plasma System

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SAFETY

Be sure this information reaches the operator.

You can get extra copies through your supplier.

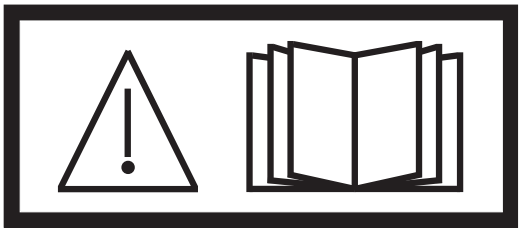
⚠ CAUTION

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.



READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

PROTECT YOURSELF AND OTHERS!

1.0 Safety

Introduction

ESAB cutting machines are designed to operate both safely and effectively. Sensible attention to operating procedures, precautions, and safe practices is required to achieve a full measure of usefulness. Whether an individual is involved with operation, servicing, or as an observer, compliance with established precautions is mandatory. Failure to observe precautions could result in equipment damage, serious injury, or death. The following precautions are guidelines when working with cutting machines and associated equipment. More explicit precautions are found within the instruction literature. For specific safety information, obtain and read publications listed in ***Recommended References***.

The following words and symbols are used throughout this manual to indicate different levels of required safety involvement:

DANGER	**Used to call attention to high risk hazards, which if not avoided, <u>will</u> result in death or serious injury.**
WARNING	**Used to call attention to medium risk hazards, which if not avoided, <u>could</u> result in death or serious injury.**
CAUTION	**Used to call attention to low risk hazards, which if not avoided, <u>could</u> result in minor or moderate injury.**
!	**Used to call attention to important information not directly related to safety hazards or could potentially cause equipment damage.**

SAFETY

Safety - English

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 work piece has been completely cleaned so that there are no substances on the work piece 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, Battery march 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.

SAFETY

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.

2. Connect the work piece to a good electrical ground.

3. Connect the work cable to the work piece. 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 work piece 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.

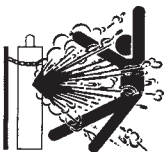
2. Do not operate near degreasing and spraying operations. The heat or arc rays can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gases.

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.

SAFETY

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."
9. CSA Standard - W117.2 = Safety in Welding, Cutting and Allied Processes.

SAFETY

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.**

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

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

Enclosure Class

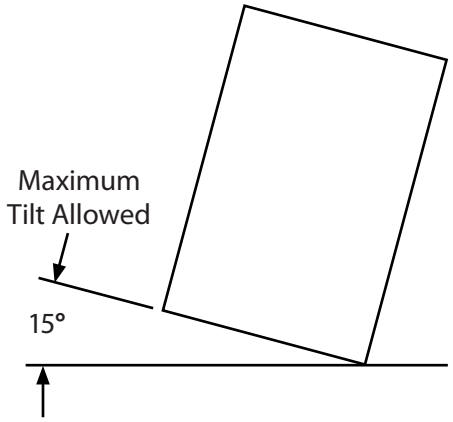
The **IP** code indicates the enclosure class, i.e. the degree of protection against penetration by solid objects or water. Protection is provided against touch with a finger, penetration of solid objects greater than 12mm and against spraying water up to 60 degrees from vertical. Equipment marked **IP23S** may be stored, but is not intended to be used outside during precipitation unless sheltered.

CAUTION

This product is solely intended for plasma cutting. Any other use may result in personal injury and / or equipment damage.

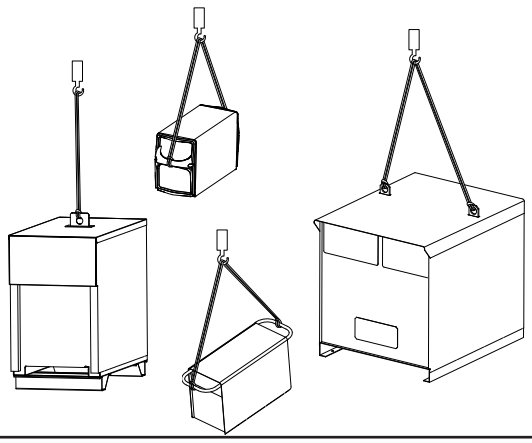
CAUTION

If equipment is placed on a surface that slopes more than 15°, toppling over may occur. Personal injury and / or significant damage to equipment is possible.



CAUTION

To avoid personal injury and/or equipment damage, lift using method and attachment points shown here.



SAFETY

Safety - Spanish

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.

SAFETY

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.

SAFETY

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 la 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."
9. CSA Standard - W117.2 = Safety in Welding, Cutting and Allied Processes.

SAFETY

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.**

Clase de envolvente

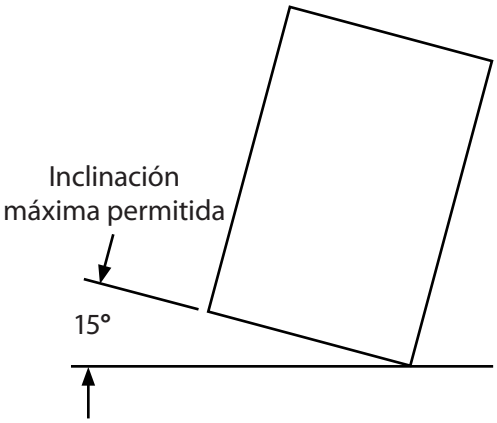
El código **IP** indica la clase de envolvente, es decir, el grado de protección contra la penetración de objetos sólidos o agua. Se provee protección contra el toque con un dedo, penetración de objetos sólidos de un tamaño superior a 12 mm y contra rocío de agua de hasta 60 grados de la vertical. El equipo marcado **IP23S** se puede almacenar, pero no se debe usar en el exterior durante periodos de precipitaciones a menos que esté protegido.

ADVERTENCIA

Este producto sólo se debe usar para corte por plasma Cualquier otro uso puede causar lesiones físicas y/o daños en los equipos.

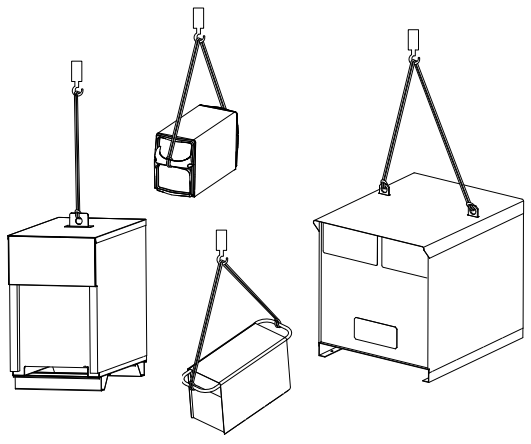
ADVERTENCIA

Si el equipo se coloca sobre una superficie con una inclinación superior a 15°, se puede producir un volcamiento. Es posible que se produzcan lesiones físicas y/o daños importantes en los equipos.



ADVERTENCIA

Para evitar lesiones físicas y/o daños en los equipos, levante mediante el método y los puntos de sujeción que se indican en esta ilustración.



SAFETY

Safety - French

AVERTISSEMENT : Ces règles de sécurité ont pour but d'assurer votre protection. Ils récapitulent les informations de précaution provenant des références dans la section des Informations de sécurité supplémentaires. Avant de procéder à l'installation ou d'utiliser l'unité, assurez-vous de lire et de suivre les précautions de sécurité ci-dessous, dans les manuels, les fiches d'information sur la sécurité du matériel et sur les étiquettes, etc. Tout défaut d'observer ces précautions de sécurité peut entraîner des blessures graves ou mortelles.

PROTÉGEZ-VOUS -- Les processus de soudage, de coupage et de gougeage produisent un niveau de bruit élevé et exige l'emploi d'une protection auditive. L'arc, tout comme le soleil, émet des rayons ultraviolets en plus d'autre rayons qui peuvent causer des blessures à la peau et les yeux. Le métal incandescent peut causer des brûlures. Une formation reliée à l'usage des processus et de l'équipement est essentielle pour prévenir les accidents. Par conséquent:

1. Portez des lunettes protectrices munies d'écrans latéraux lorsque vous êtes dans l'aire de travail, même si vous devez porter un casque de soudeur, un écran facial ou des lunettes étanches.
2. Portez un écran facial muni de verres filtrants et de plaques protectrices appropriées afin de protéger vos yeux, votre visage, votre cou et vos oreilles des étincelles et des rayons de l'arc lors d'une opération ou lorsque vous observez une opération. Avertissez les personnes se trouvant à proximité de ne pas regarder l'arc et de ne pas s'exposer aux rayons de l'arc électrique ou le métal incandescent.
3. Portez des gants ignifugiés à crispin, une chemise épaisse à manches longues, des pantalons sans rebord et des chaussures montantes afin de vous protéger des rayons de l'arc, des étincelles et du métal incandescent, en plus d'un casque de soudeur ou casquette pour protéger vos cheveux. Il est également recommandé de porter un tablier ininflammable afin de vous protéger des étincelles et de la chaleur par rayonnement.
4. Les étincelles et les projections de métal incandescent risquent de se loger dans les manches retroussées, les rebords de pantalons ou les poches. Il est recommandé de garder boutonnés le col et les manches et de porter des vêtements sans poches en avant.
5. Protégez toute personne se trouvant à proximité des étincelles et des rayons de l'arc à l'aide d'un rideau ou d'une cloison ininflammable.
6. Portez des lunettes étanches par dessus vos lunettes de sécurité lors des opérations d'écaillage ou de meulage du laitier. Les écailles de laitier incandescent peuvent être projetées à des distances considérables. Les personnes se trouvant à proximité doivent également porter des lunettes étanches par dessus leur lunettes de sécurité.

INCENDIES ET EXPLOSIONS -- La chaleur provenant des flammes ou de l'arc peut provoquer un incendie. Le laitier incandescent ou les étincelles peuvent également provoquer un incendie ou une explosion. Par conséquent :

1. Éloignez suffisamment tous les matériaux combustibles de l'aire de travail et recouvrez les matériaux avec un revêtement protecteur ininflammable. Les matériaux combustibles incluent le bois, les vêtements, la sciure, le gaz et les liquides combustibles, les solvants, les peintures et les revêtements, le papier, etc.
2. Les étincelles et les projections de métal incandescent peuvent tomber dans les fissures dans les planchers ou dans les ouvertures des murs et déclencher un incendie couvant à l'étage inférieur Assurez-vous que ces ouvertures sont bien protégées des étincelles et du métal incandescent.
3. N'exécutez pas de soudure, de coupe ou autre travail à chaud avant d'avoir complètement nettoyé la surface de la pièce à traiter de façon à ce qu'il n'ait aucune substance présente qui pourrait produire des vapeurs inflammables ou toxiques. N'exécutez pas de travail à chaud sur des contenants fermés car ces derniers pourraient exploser.
4. Assurez-vous qu'un équipement d'extinction d'incendie est disponible et prêt à servir, tel qu'un tuyau d'arrosage, un seau d'eau, un seau de sable ou un extincteur portatif. Assurez-vous d'être bien instruit par rapport à l'usage de cet équipement.
5. Assurez-vous de ne pas excéder la capacité de l'équipement. Par exemple, un câble de soudage surchargé peut surchauffer et provoquer un incendie.
6. Une fois les opérations terminées, inspectez l'aire de travail pour assurer qu'aucune étincelle ou projection de métal incandescent ne risque de provoquer un incendie ultérieurement. Employez des guetteurs d'incendie au besoin.
7. Pour obtenir des informations supplémentaires, consultez le NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", disponible au National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

CHOC ÉLECTRIQUE -- Le contact avec des pièces électriques ou les pièces de mise à la terre sous tension peut causer des blessures graves ou mortelles. NE PAS utiliser un courant de soudage c.a. dans un endroit humide, en espace restreint ou si un danger de chute se pose.

SAFETY

1. Assurez-vous que le châssis de la source d'alimentation est branché au système de mise à la terre de l'alimentation d'entrée.
2. Branchez la pièce à traiter à une bonne mise de terre électrique.
3. Branchez le câble de masse à la pièce à traiter et assurez une bonne connexion afin d'éviter le risque de choc électrique mortel.
4. Utilisez toujours un équipement correctement entretenu. Remplacez les câbles usés ou endommagés.
5. Veillez à garder votre environnement sec, incluant les vêtements, l'aire de travail, les câbles, le porte-électrode/torche et la source d'alimentation.
6. Assurez-vous que tout votre corps est bien isolé de la pièce à traiter et des pièces de la mise à la terre.
7. Si vous devez effectuer votre travail dans un espace restreint ou humide, ne tenez vous pas directement sur le métal ou sur la terre; tenez-vous sur des planches sèches ou une plate-forme isolée et portez des chaussures à semelles de caoutchouc.
8. Avant de mettre l'équipement sous tension, isolez vos mains avec des gants secs et sans trous.
9. Mettez l'équipement hors tension avant d'enlever vos gants.
10. Consultez ANSI/ASC Standard Z49.1 (listé à la page suivante) pour des recommandations spécifiques concernant les procédures de mise à la terre. Ne pas confondre le câble de masse avec le câble de mise à la terre.

CHAMPS ÉLECTRIQUES ET MAGNÉTIQUES — com-

portent un risque de danger. Le courant électrique qui passe dans n'importe quel conducteur produit des champs électriques et magnétiques localisés. Le soudage et le courant de coupage créent des champs électriques et magnétiques autour des câbles de soudage et l'équipement. Par conséquent :

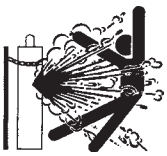
1. Un soudeur ayant un stimulateur cardiaque doit consulter son médecin avant d'entreprendre une opération de soudage. Les champs électriques et magnétiques peuvent causer des ennuis pour certains stimulateurs cardiaques.
2. L'exposition à des champs électriques et magnétiques peut avoir des effets néfastes inconnus pour la santé.
3. Les soudeurs doivent suivre les procédures suivantes pour minimiser l'exposition aux champs électriques et magnétiques :
   A. Acheminez l'électrode et les câbles de masse ensemble. Fixez-les à l'aide d'une bande adhésive lorsque possible.
   B. Ne jamais enrouler la torche ou le câble de masse autour de votre corps.
   C. Ne jamais vous placer entre la torche et les câbles de masse. Acheminez tous les câbles sur le même côté de votre corps.
   D. Branchez le câble de masse à la pièce à traiter le plus près possible de la section à souder.
   E. Veillez à garder la source d'alimentation pour le soudage et les câbles à une distance appropriée de votre corps.

LES VAPEURS ET LES GAZ -- peuvent causer un malaise ou des dommages corporels, plus particulièrement dans les espaces restreints. Ne respirez pas les vapeurs et les gaz. Le gaz de protection risque de causer l'asphyxie. Par conséquent :

1. Assurez en permanence une ventilation adéquate dans l'aire de travail en maintenant une ventilation naturelle ou à l'aide de moyens mécanique. N'effectuez jamais de travaux de soudage, de coupage ou de gougeage sur des matériaux tels que l'acier galvanisé, l'acier inoxydable, le cuivre, le zinc, le plomb, le berylliym ou le cadmium en l'absence de moyens mécaniques de ventilation efficaces. Ne respirez pas les vapeurs de ces matériaux.
2. N'effectuez jamais de travaux à proximité d'une opération de dégraissage ou de pulvérisation. Lorsque la chaleur
   ou le rayonnement de l'arc entre en contact avec les vapeurs d'hydrocarbure chloré, ceci peut déclencher la formation de phosgène ou d'autres gaz irritants, tous extrêmement toxiques.
3. Une irritation momentanée des yeux, du nez ou de la gorge au cours d'une opération indique que la ventilation n'est pas adéquate. Cessez votre travail afin de prendre les mesures nécessaires pour améliorer la ventilation dans l'aire de travail. Ne poursuivez pas l'opération si le malaise persiste.
4. Consultez ANSI/ASC Standard Z49.1 (à la page suivante) pour des recommandations spécifiques concernant la ventilation.

SAFETY

5. AVERTISSEMENT : Ce produit, lorsqu'il est utilisé dans une opération de soudage ou de coupage, dégage des vapeurs ou des gaz contenant des chimiques considéres par l'état de la Californie comme étant une cause des malformations congénitales et dans certains cas, du cancer. (California Health & Safety Code §25249.5 et seq.)



MANIPULATION DES CYLINDRES -- La manipulation d'un cylindre, sans observer les précautions nécessaires, peut produire des fissures et un échappement dangereux des gaz. Une brisure soudaine du cylindre, de la soupape ou du dispositif de surpression peut causer des blessures graves ou mortelles. Par conséquent :

1. Utilisez toujours le gaz prévu pour une opération et le détendeur approprié conçu pour utilisation sur les cylindres de gaz comprimé. N'utilisez jamais d'adaptateur. Maintenez en bon état les tuyaux et les raccords. Observez les instructions d'opération du fabricant pour assembler le détendeur sur un cylindre de gaz comprimé.
2. Fixez les cylindres dans une position verticale, à l'aide d'une chaîne ou une sangle, sur un chariot manuel, un châssis de roulement, un banc, un mur, une colonne ou un support convenable. Ne fixez jamais un cylindre à un poste de travail ou toute autre dispositif faisant partie d'un circuit électrique.
3. Lorsque les cylindres ne servent pas, gardez les soupapes fermées. Si le détendeur n'est pas branché, assurez-vous que le bouchon de protection de la soupape est bien en place. Fixez et déplacez les cylindres à l'aide d'un chariot manuel approprié. Toujours manipuler les cylindres avec soin.
4. Placez les cylindres à une distance appropriée de toute source de chaleur, des étincelles et des flammes. Ne jamais amorcer l'arc sur un cylindre.
5. Pour de l'information supplémentaire, consultez CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", mis à votre disposition par le Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

ENTRETIEN DE L'ÉQUIPEMENT -- Un équipement entretenu de façon défectueuse ou inadéquate peut causer des blessures graves ou mortelles. Par conséquent :

1. Efforcez-vous de toujours confier les tâches d'installation, de dépannage et d'entretien à un personnel qualifié. N'effectuez aucune réparation électrique à moins d'être qualifié à cet effet.
2. Avant de procéder à une tâche d'entretien à l'intérieur de la source d'alimentation, débranchez l'alimentation électrique.
3. Maintenez les câbles, les fils de mise à la terre, les branchements, le cordon d'alimentation et la source d'alimentation en bon état. N'utilisez jamais un équipement s'il présente une défectuosité quelconque.
4. N'utilisez pas l'équipement de façon abusive. Gardez l'équipement à l'écart de toute source de chaleur, notamment des fours, de l'humidité, des flaques d'eau, de l'huile ou de la graisse, des atmosphères corrosives et des intempéries.
5. Laissez en place tous les dispositifs de sécurité et tous les panneaux de la console et maintenez-les en bon état.
6. Utilisez l'équipement conformément à son usage prévu et n'effectuez aucune modification.

INFORMATIONS SUPPLÉMENTAIRES RELATIVES À LA SÉCURITÉ -- Pour obtenir de l'information supplémentaire sur les règles de sécurité à observer pour l'équipement de soudage à l'arc électrique et le coupage, demandez un exemplaire du livret "Precautions and Safe Practices for Arc Welding, Cutting and Gouging", Form 52-529.

Les publications suivantes sont également recommandées et mises à votre disposition par l'American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126 :

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.”
9. CSA Standard - W117.2 = Safety in Welding, Cutting and Allied Processes.

SAFETY

SIGNIFICATION DES SYMBOLES

Ce symbole, utilisé partout dans ce manuel, signifie "Attention" ! Soyez vigilant ! Votre sécurité est en jeu.

DANGER — **Signifie un danger immédiat. La situation peut entraîner des blessures graves ou mortelles.**

AVERTISSEMENT — **Signifie un danger potentiel qui peut entraîner des blessures graves ou mortelles.**

ATTENTION — **Signifie un danger qui peut entraîner des blessures corporelles mineures.**

Classe de protection de l'enveloppe

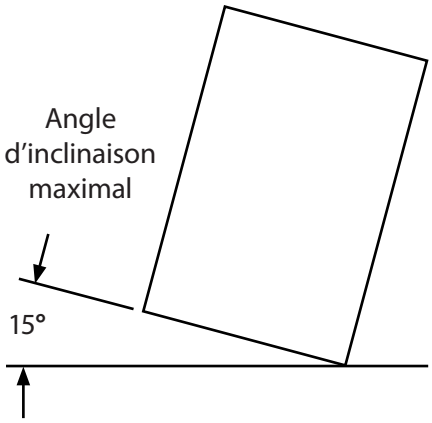
L'indice de protection (codification **IP**) indique la classe de protection de l'enveloppe, c'est-à-dire, le degré de protection contre les corps solides étrangers ou l'eau. L'enveloppe protège contre le toucher, la pénétration d'objets solides dont le diamètre dépasse 12 mm et contre l'eau pulvérisée à un angle de jusqu'à 60 degrés de la verticale. Les équipements portant la marque **IP23S** peuvent être entreposés à l'extérieur, mais ne sont pas conçus pour être utilisés à l'extérieur pendant une précipitation à moins d'être à l'abri.

AVERTISSEMENT

Ce produit a été conçu pour la découpe au plasma seulement. Toute autre utilisation pourrait causer des blessures et/ou endommager l'appareil.

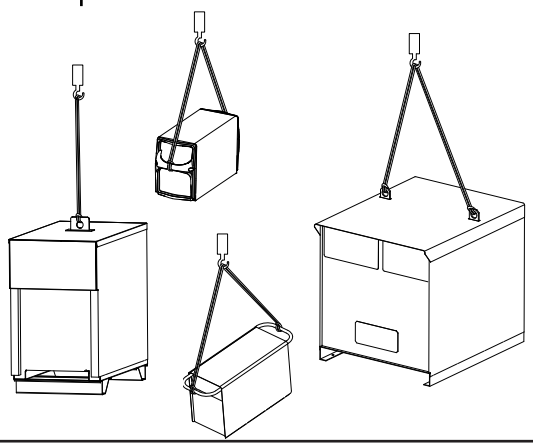
AVERTISSEMENT

L'équipement pourrait basculer s'il est placé sur une surface dont la pente dépasse 15°. Vous pourriez vous blesser ou endommager l'équipement de façon importante.



AVERTISSEMENT

Soulevez à l'aide de la méthode et des points d'attache illustrés afin d'éviter de vous blesser ou d'endommager l'équipement.



SAFETY

DESCRIPTION

DESCRIPTION

Below are some abbreviations used throughout this manual.

ABBREVIATIONS:

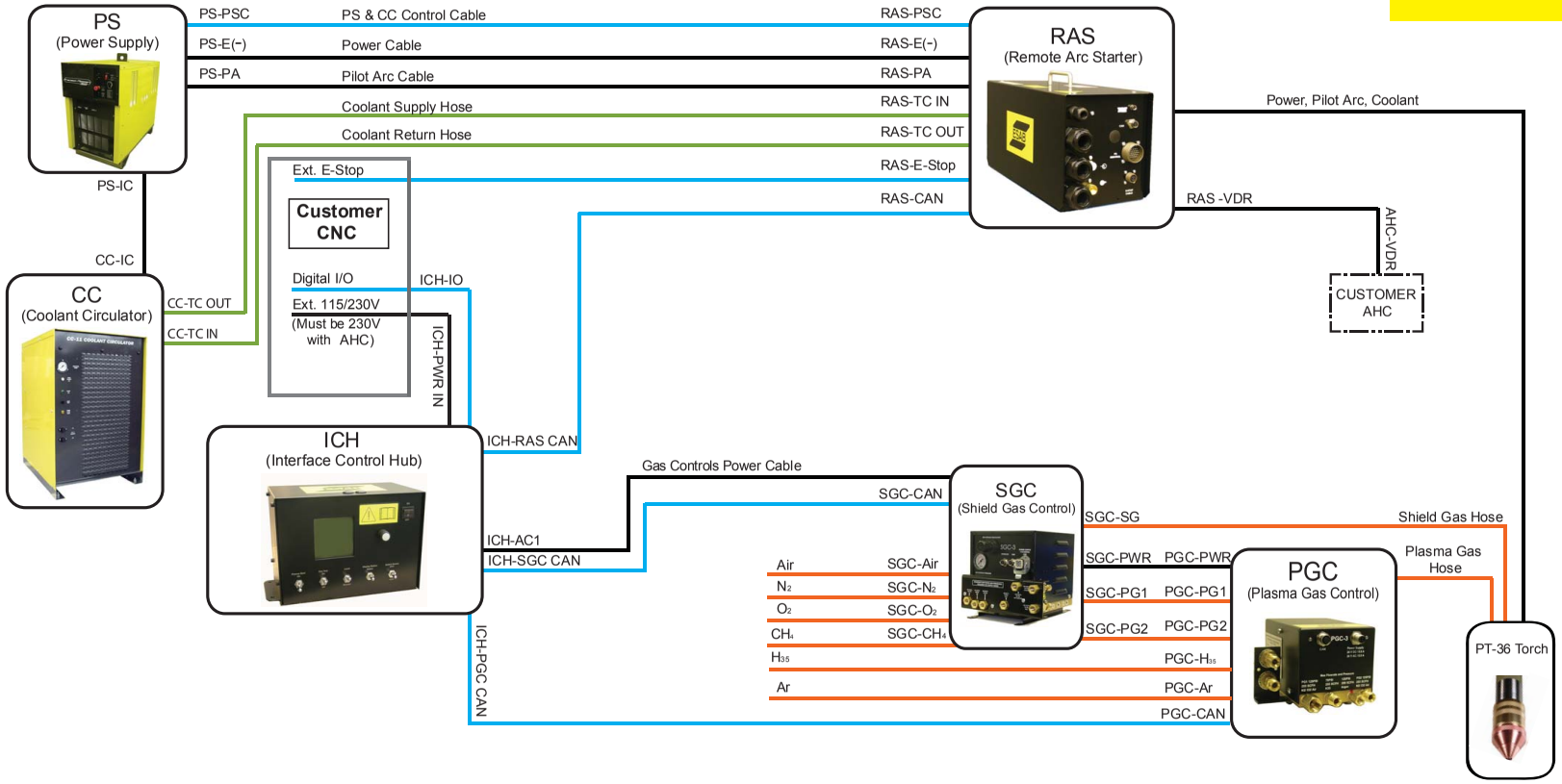
m3 G2 - m3 Generation 2
A/C - Air Curtain
AHC - Automatic Height Control
ICH - Interface Control Hub
PGC - Plasma Gas Control
SGC - Shield Gas Control
WIC - Water Injection Control

2.0 System Diagrams

The following pages illustrate different system configurations available on the M3 Generation 2 (m3 G2). With this system, ESAB offers 8 different configurations to meet customer's requirements. Below are the descriptions of each configuration.

1. **Base System**
   This system is the basic configuration for the m3 G2 Plasma System. It contains the major components, such as the Power Supply (EPP201/360/450/601), Coolant Circulator, PT-36 Torch, Remote Arc Starter (RAS), Plasma Gas Control (PGC), Shield Gas Control (SGC), and Interface Control Hub (ICH). This system will meet most customers' needs in cutting carbon steel, stainless steel, and aluminum. It also has the functionality of marking on carbon steel and stainless steel with the same torch and the same consumables. By simply alternating cutting and marking mode on the fly, this system is capable of cutting and marking in the same part program without changing the consumables. To use this system, customer CNC needs to send start signal and corner signal while in geometric corner; at the same time, customer CNC needs to monitor the fault signal and motion enable signal from ICH. This base system does not come with Automatic Height Control (AHC). Customer will have to provide AHC and control its sequence.
2. **Base System + AHC**
   This system includes the Base System plus the ESAB AHC, called a "B4 lifter". In this configuration, ICH will control plasma sequence, and also the AHC sequence. Customer CNC needs to provide the start signal and corner signal for normal cutting.
3. **Base System + A/C**
   This system includes the above Base System and ESAB Air Curtain (A/C). Air Curtain is a device used to improve the performance of plasma arc when cutting underwater. ICH from the Base System will control the sequence and turn on/off the air.
4. **Base System + WIC**
   This system is configured to introduce the Water Injection Control (WIC), a module used to regulate cut water flow to shield the cutting process. This configuration is to meet needs of a customer who wants to cut stainless steel without using H35. This system still uses the standard PT-36 torch, but a different set of consumables. Similar to the dry system, this WIC system can also do marking with water shield.
5. **Base System + AHC + WIC**
   This system provides customer the Base System, AHC (Automatic Height Control), and WIC (Water Injection Control). With this system, customer needs only to provide start signal and corner signal for cutting stainless steel with water injection.
6. **Base System + AHC + A/C**
   This system gives the customer the ability to cut under water with ESAB Automatic Height Control (AHC).
7. **Base System + WIC + A/C**
   This system is the Base System adding Water Injection Control (WIC) and Air Curtain (A/C). Customer needs to provide their own Height Control and control its sequence.
8. **Base System + AHC + WIC + A/C**
   This complete system gives the opportunity for customer to cut carbon steel, stainless steel, and aluminum with ESAB Auto Height Control (AHC). Customer has the capability to cut stainless steel with the Water Injection Control (WIC), and underwater with the help of Air Curtain (A/C).

m3 plasma G2 Systems Interconnect Diagram



POWER
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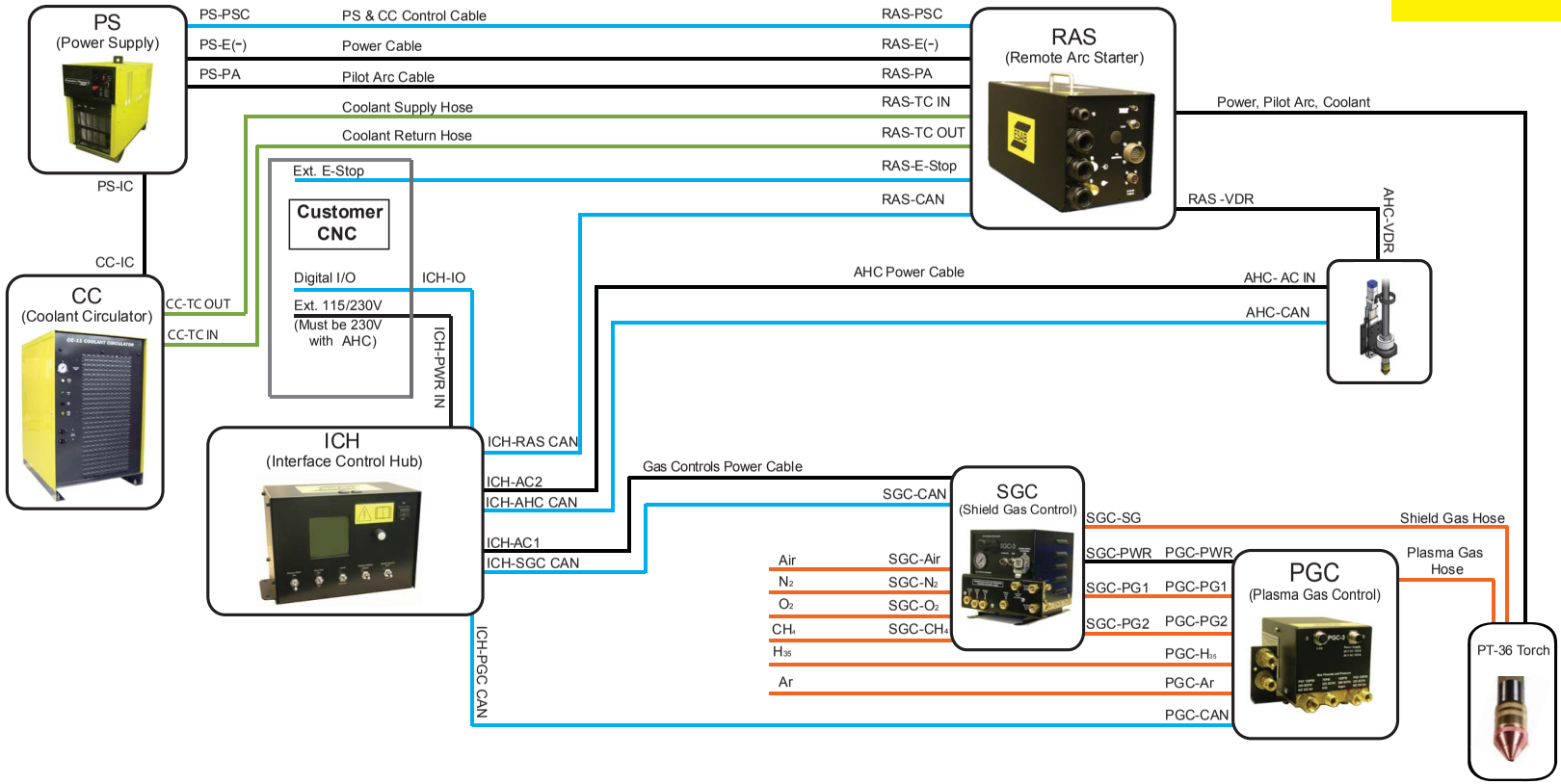
m3 plasma G2 Systems Interconnect Diagram



POWER
DATA
LIQUID
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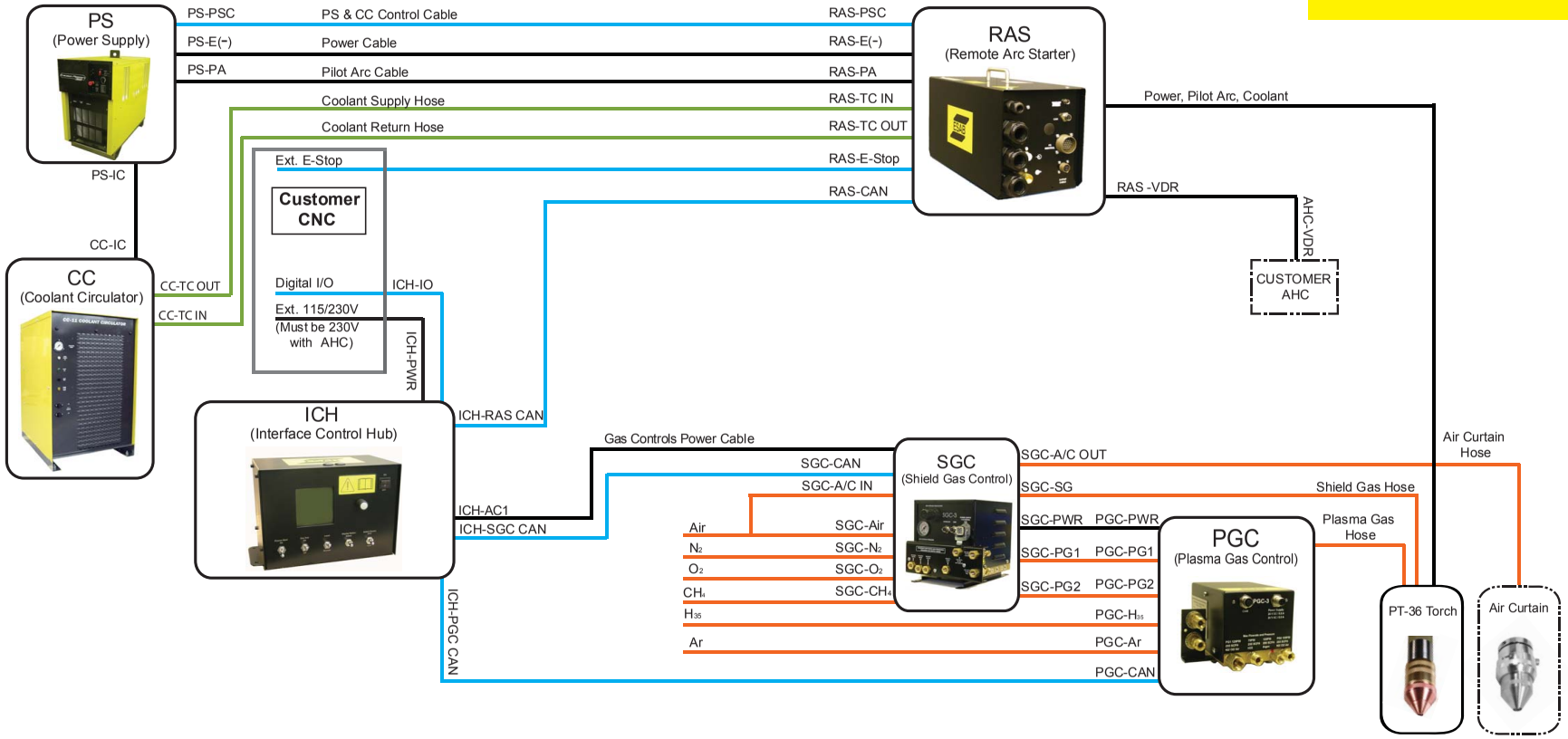
DESCRIPTION

m3 plasma G2 Systems Interconnect Diagram



POWER
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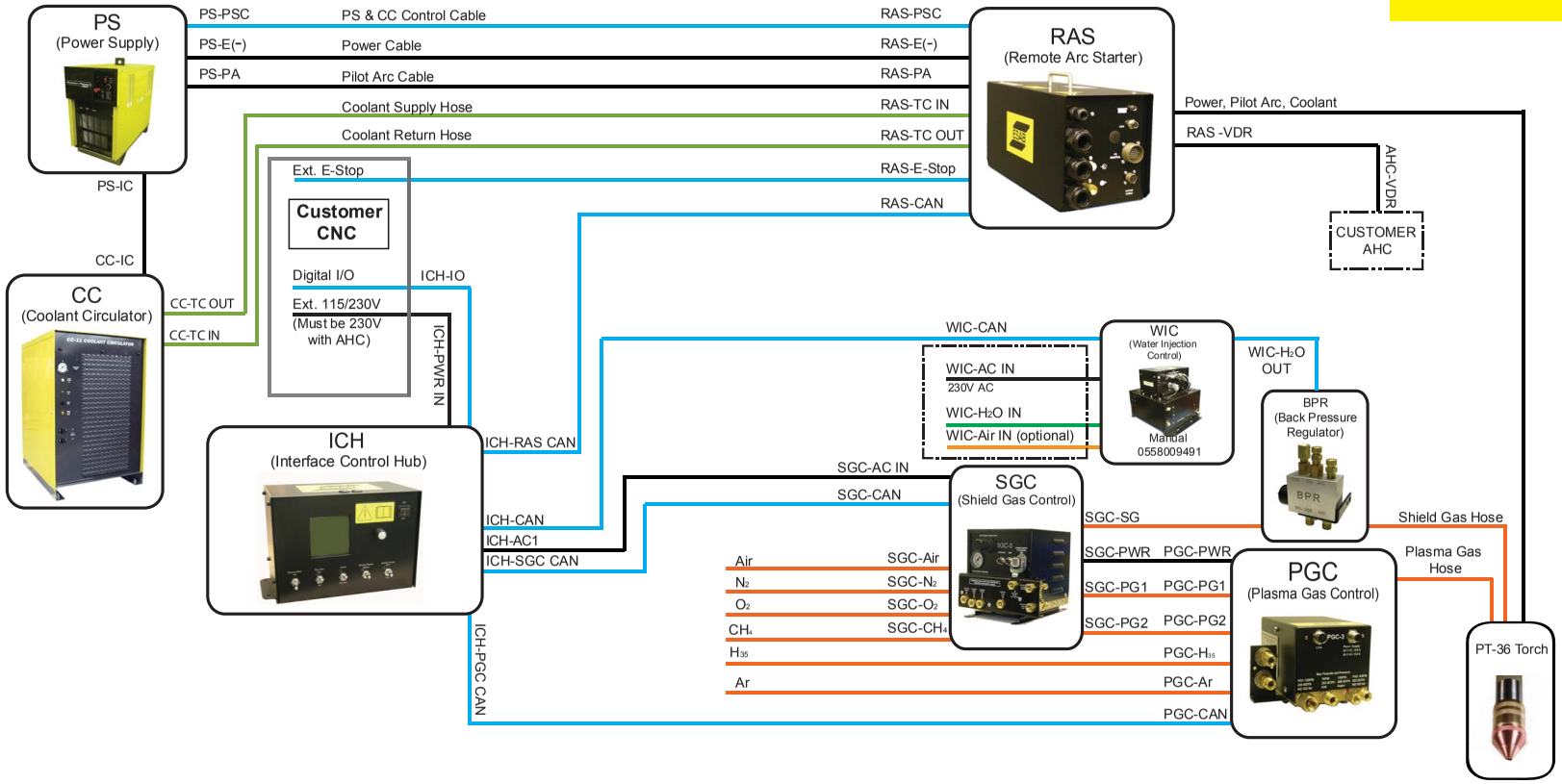
Phone 1-800-ESAB-123

m3 plasma G2 Systems Interconnect Diagram



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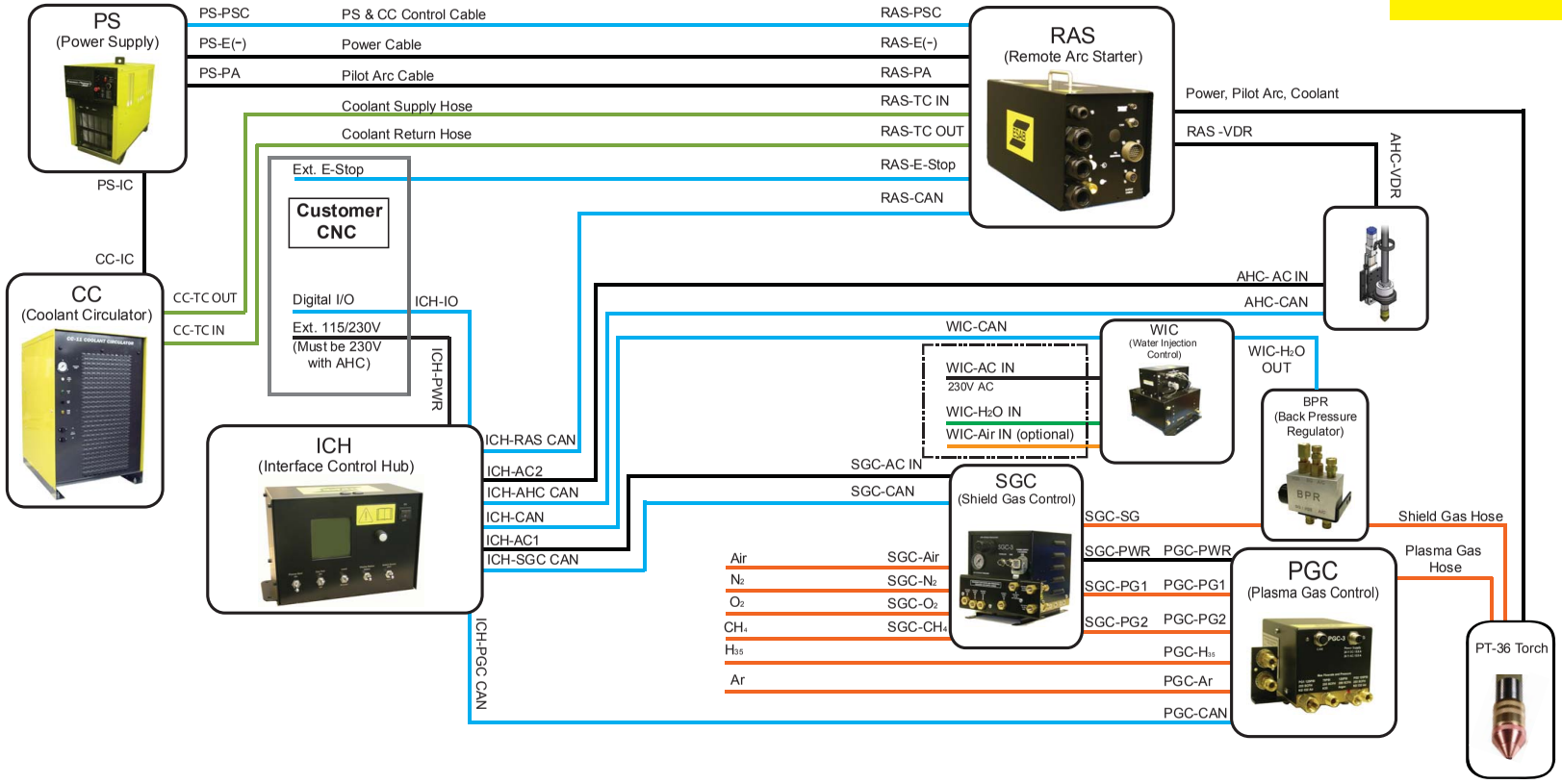
DESCRIPTION

m3 plasma G2 Systems Interconnect Diagram



POWER
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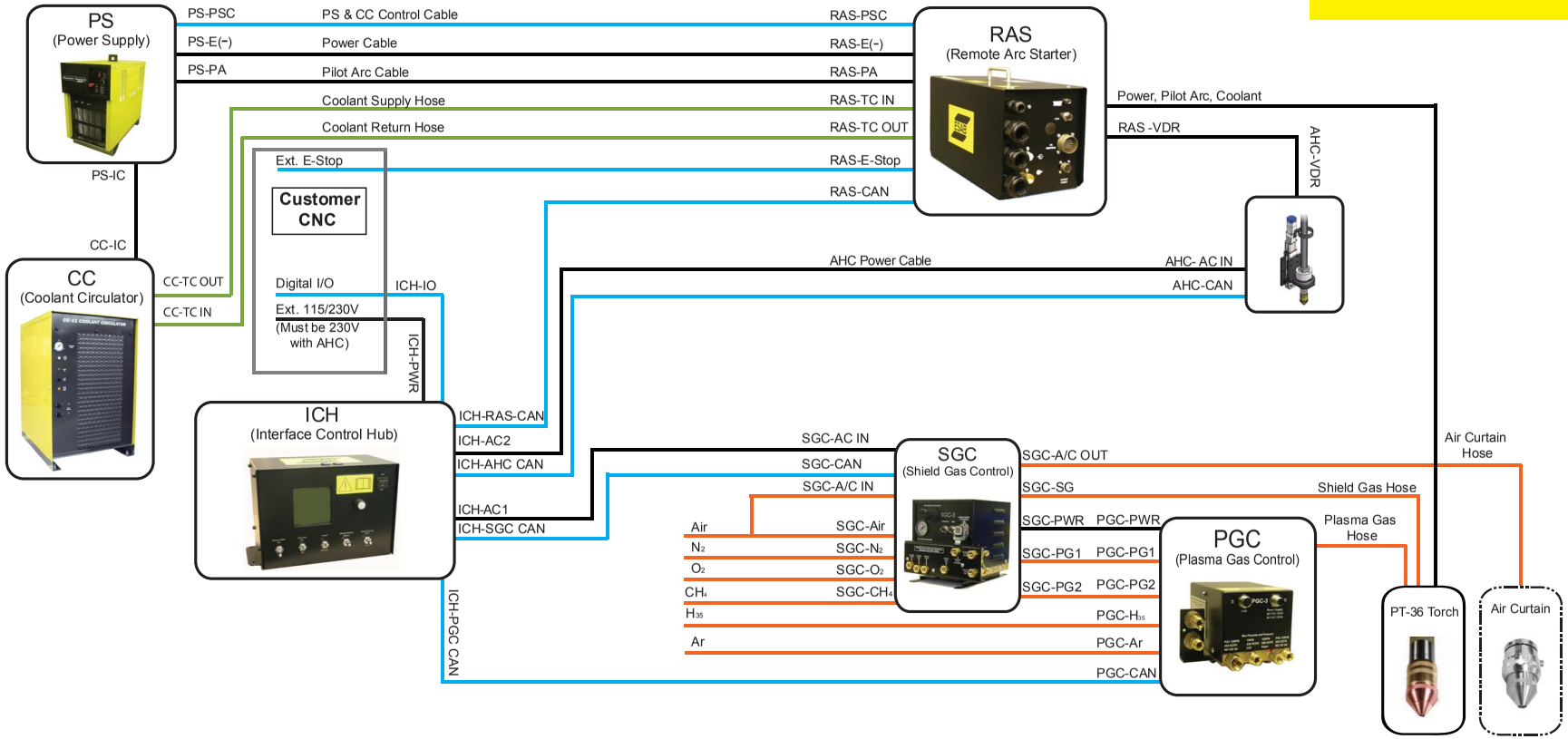
LIQUID
GAS
Optional

G2 Systems Interconnect Diagram



POWER
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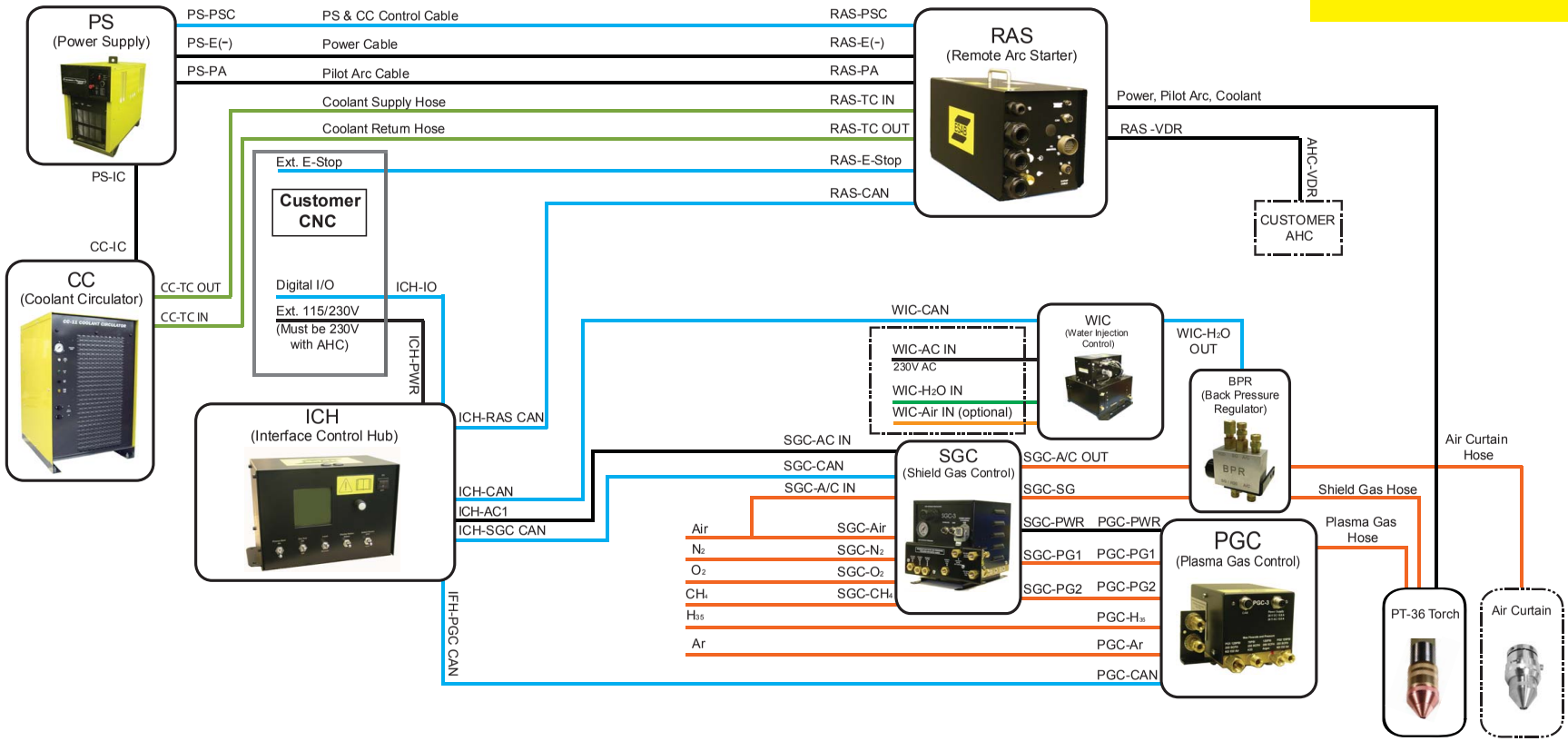
GAS
Optional

DESCRIPTION

G2 Systems Interconnect Diagram



POWER
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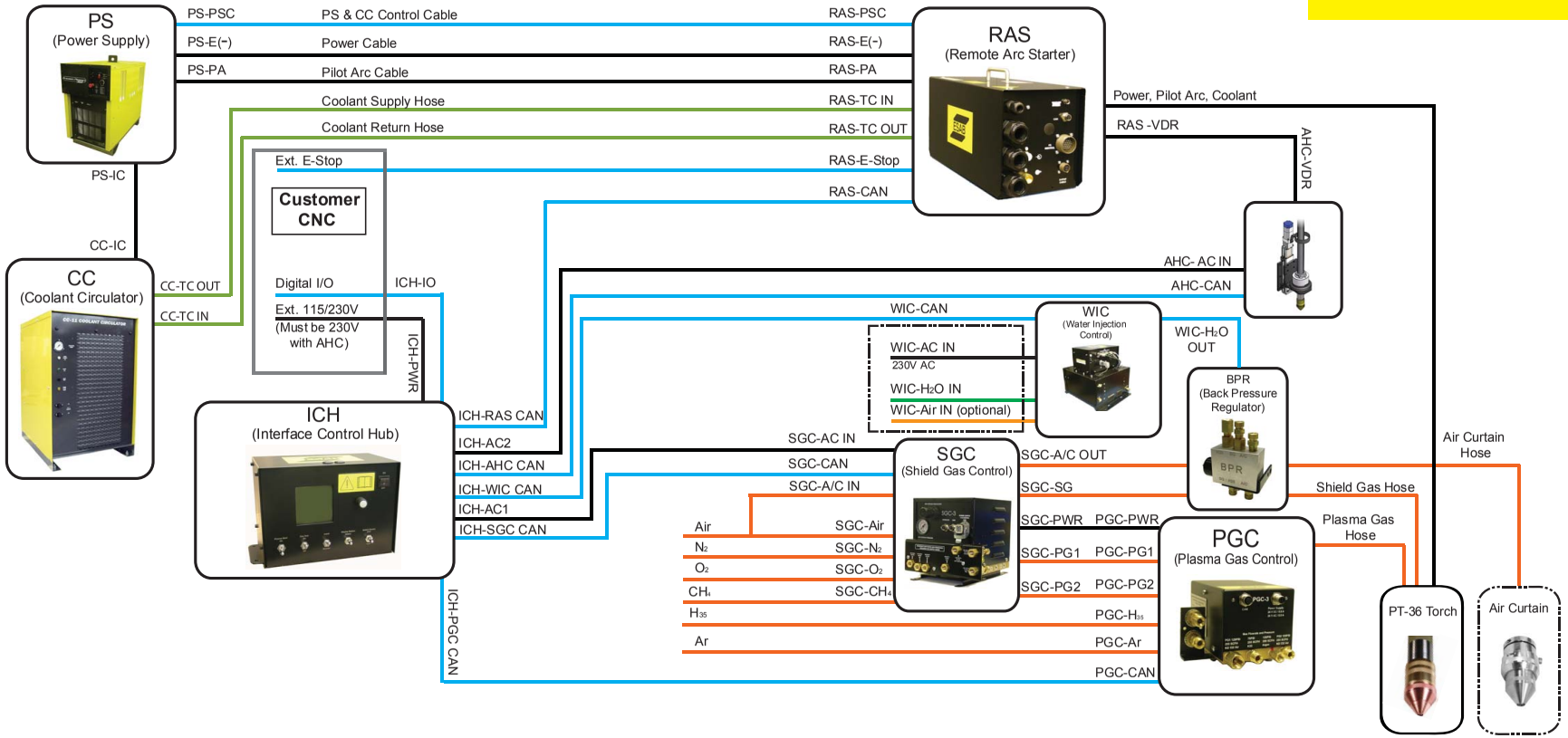
Optional

G2 Systems Interconnect Diagram



POWER
DATA
LIQUID
GAS
Optional

Phone 1-800-ESAB-123

DESCRIPTION

2.1 Power Supply

The m3 G2 system can use different plasma power supplies. ESAB provides the EPP-201/360/450/601, with various input voltages and current output for your requirements. For details about our power supplies, please refer to the power supply's specific manual.

380/400V Power Supplies




		m3 Plasma Power Supply Input/Output Information							
		m3 201, 380 / 400V, 50 / 60Hz	**m3 360, 380 / 400V, 50 / 60Hz**	**m3 450 380V 50/60HZ 380V TAPS**	**m3 450 380V 50/60HZ 400V TAPS**	**m3 450 400V 50/60HZ**	**m3 601 380V 50/60HZ 380V TAPS**	**m3 601 380V 50/60HZ 400V TAPS**	**m3 601 400V 50/60HZ**
Input	**Input Voltage (3-Phase)**	380 / 400V	380 / 400V	380VAC	380VAC	400VAC	380VAC	380VAC	400VAC
	Input Current (3-Phase)	60 / 57A RMS	140 / 132A RMS	167A RMS	167A RMS	159A RMS	217A RMS	217A RMS	206A RMS
	Input Frequency	50 / 60 HZ	50 / 60 HZ	50/60 HZ	50/60 HZ	50/60 HZ	50/60 HZ	50/60 HZ	50/60 HZ
	Input KVA	39.5 KVA	91.6 KVA	109.9 KVA	109.9 KVA	110.2 KVA	142.8 KVA	142.8 KVA	142.7 KVA
	Input Power	35.5 KW	82.5 KW	98.9 KW	98.9 KW	99.1 KW	128.5 KW	128.5 KW	128.4 KW
	Input Power Factor	90.0 %	90.0 %	90%	90%	90%	90%	90%	90%
	Recommended Input Power Cable	2/0 AWG	2/0 AWG	2/0 AWG	2/0 AWG	2/0 AWG	4/0 AWG	4/0 AWG	4/0 AWG
	Input Fuse (Recommended)	100A	200A	200A	200A	200A	250A	250A	250A
Output	**Output Open Circuit Voltage (OCV) (High Range Cutting)**	360 VDC	360 VDC	430VDC	406VDC	427VDC	430VDC	406VDC	427VDC
	Output Cutting Range (100% Duty)	30A to 200A	30A to 360A	35A to 450A			35A to 600A		
	Output Marking Range (100% Duty)	10A to 36A	10A to 36A	10A to 100A			10A to 100A		
	Output Power (100% Duty)	32 KW	72 KW	90 KW			120 KW		
	Protection Class	IP 21	IP 21	IP 21			IP 21		
	Dimensions	585 x 1040 x 1195 mm	585 x 1040 x 1195 mm	950 x 1050 x 1150 mm			950 x 1050 x 1150 mm		
	Weight	493 kg	493 kg	850 kg			850 kg		

460/575V Power Supplies

									
		m3 Plasma Power Supply Input/Output Information							
		m3 201 460V, 60Hz	**m3 201 575V, 60Hz**	**m3 360 460V, 60Hz**	**m3 360 575V, 60Hz**	**m3 450 460V, 60HZ**	**m3 450 575V, 60HZ**	**m3 601 460V, 60HZ**	**m3 601 575V, 60HZ**
Input	**Input Voltage (3-Phase)**	460V	575V	460V	575V	460VAC	575VAC	460VAC	575VAC
	Input Current (3-Phase)	51A RMS	41A RMS	115A RMS	92A RMS	138A RMS	110A RMS	179A RMS	143A RMS
	Input Frequency	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ
	Input KVA	40.6 KVA	40.6 KVA	91.6 KVA	91.6 KVA	110.0 KVA	109.6 KVA	142.6 KVA	142.4 KVA
	Input Power	35.5 KW	35.5 KW	82.5 KW	82.5 KW	99.0 KW	98.6 KW	128.4 KW	128.2 KW
	Input Power Factor	90.0 %	90.0 %	90.0 %	90.0 %	90%	90%	90%	90%
	Recommended Input Power Cable	2/0 AWG	2/0 AWG	2/0 AWG	2/0 AWG	1/0 AWG	2/0 AWG	1/0 AWG	1/0 AWG
	Input Fuse (Recommended)	100A	60A	150A	125A	200A	150A	250A	200A
Output	**Output Open Circuit Voltage (OCV) (High Range Cutting)**	360 VDC		360 VDC		431VDC		431VDC	
	Output Cutting Range (100% Duty)	30A to 200A		30A to 360A		35A to 450A		35A to 600A	
	Output Marking Range (100% Duty)	10A to 36A		10A to 36A		10A to 100A		10A to 100A	
	Output Power (100% Duty)	32 KW		72 KW		90 KW		120 KW	
	Protection Class	IP 21		IP 21		IP 21		IP 21	
	Dimensions	585 x 1040 x 1195 mm		585 x 1040 x 1195 mm		950 x 1050 x 1150 mm		950 x 1050 x 1150 mm	
	Weight	493 kg		493 kg		850 kg		850 kg	

DESCRIPTION

2.2 Coolant Circulator (CC-11)

p/n 0558007515

The Coolant Circulator (CC-11) recirculates coolant to cool the torch, electrode and nozzle. For more specific details, please refer to the CC-11 Instruction manual.

Specifications		
Dimensions: 34.00" (864 mm) high x 21.75" (552 mm) wide x 28.00 (711 mm) deep		
Weight: 215 lb. dry (97.5 kg) / 249 lb. wet (113 kg)		
Pump Type: Positive displacement, rotary vane type with adjustable by-pass valve (200 psi / 13.8 bars max.), CW rotation as viewed from nameplate.		
Radiator Type: Copper tubing, aluminum finned air-to-water type with galvanized steel frame.		
AC Input Voltages	**50Hz, 1 Phase Input Power**	**60Hz, 1 Phase Input Power**
	200 / 230 / 400 / 460 / 575 V, + / - 10%	
AC Input Amperage	9 / 8 / 5 / 4 / 3 Amperes	
Pump Capacity	1.60 gpm at 175 psi (6.0 l/min at 12 bars)	1.60 gpm at 175 psi (6.0 l/min at 12 bars)
Cooling Capacity @ 1.60 gpm (6.0 l/min)	16,830 BTU / hr. (4900 watts)	20,200 BTU / hr. (5900 watts)
at 45° F (25° C) temperature difference between high coolant temperature and ambient air temperature using ESAB coolant p/n 0558004297 (25% propylene glycol / 75% distilled water).		
Max. Delivery Pressure	175 psig (12 bars)	
Reservoir Capacity	4 gallons (15.2 liters)	

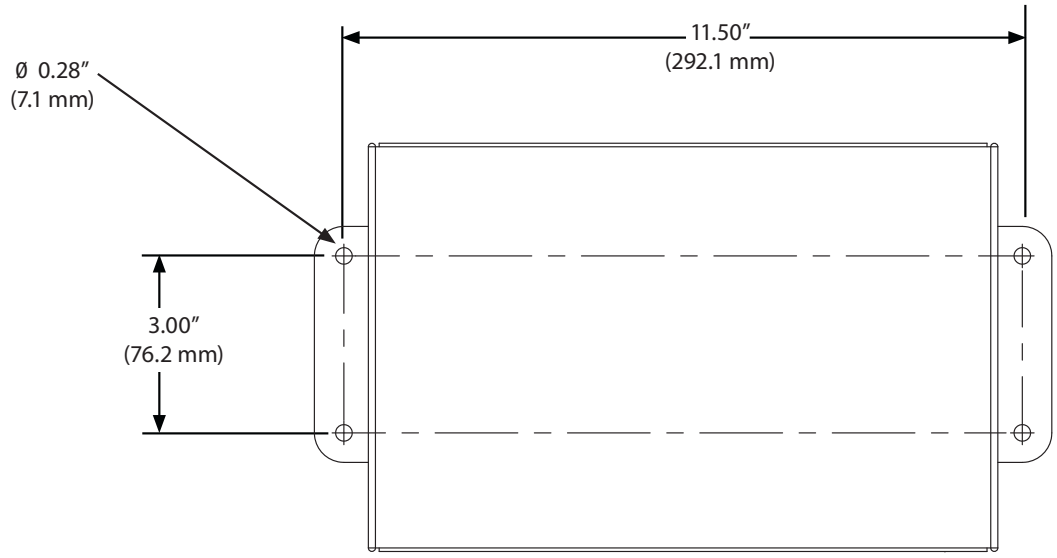
2.3 Interface Control Hub (ICH)

p/n 0558009607

The Interface Control Hub (ICH) provides the plasma process control including current, gas and torch height (if applicable). It also serves as the interface between the customer CNC and the ESAB m3 G2 plasma system. At the same time, it functions as a hub for CAN communication.

Specifications	
Dimensions: 7.50" (190.5 mm) high x 10.125" (257.2 mm) wide x 6.50" (165.1 mm) deep	
Weight: 8.5 lbs. (3.9 kg)	
Operating Temperature	5-40°C (41-104°F)
Max Humidity	95% non-condensing
Enclosure Degree of Protection	IP54
Input Power Reduction	230 VAC, 5 Amps
	120 VAC, 3 Amps

ICH Mounting Dimensions

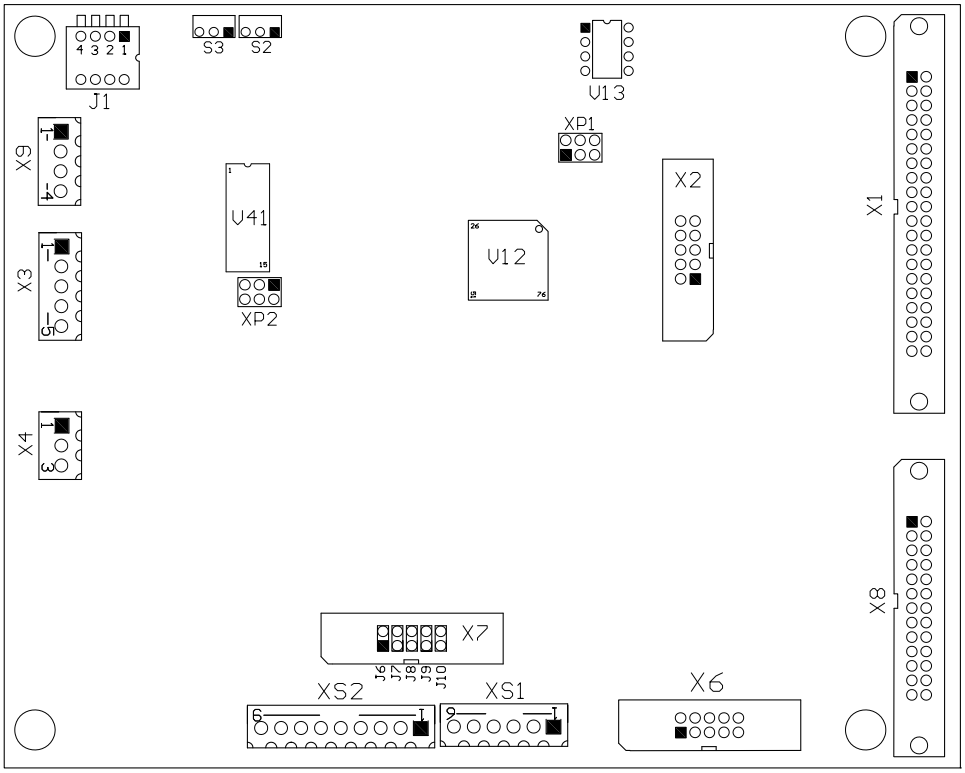


DESCRIPTION

CNC Direct Board

p/n 0558009991

The CNC Direct board is the control and interface board inside the ICH. It provides the process control, interface to customer CNC, system setup, panel interface, etc. Below is a skeleton of this CNC board. It shows the major components and the major connectors on the board. The table below gives the functions of these connections.



Port	Function	Port	Function
X1	CNC Control, DB37	XS2	Switches: Local/Remote, Station Select and Screen Select
X2	RS232		
X3	CAN1 and 24VDC input	XP1	Programming port 1
X4	CAN2	XP2	Programming port 2
X6	Spare I/O	S2, S3	ID switches, by default S2=1, S3=4
X7	Reserved	V12	IC, Main processor
X8	Aux Control, DB25	V13	EEPROM, Save data for system configuration, error history, etc.
X9	ASIOB1 Communication	V41	IC for ASIOB1
XS1	Switches: Plasma Start, Gas Test	J1	DIP switches: 1- 120R for CAN1, 2- 120R for CAN2, 3- VCC to ASIOB1, 4- GND to ASIOB1 Default: 1 - ON, 2 - ON, 3 - OFF, 4 - OFF

2.4 Plasma Gas Control (PGC)

p/n 0558010156

NOTE:

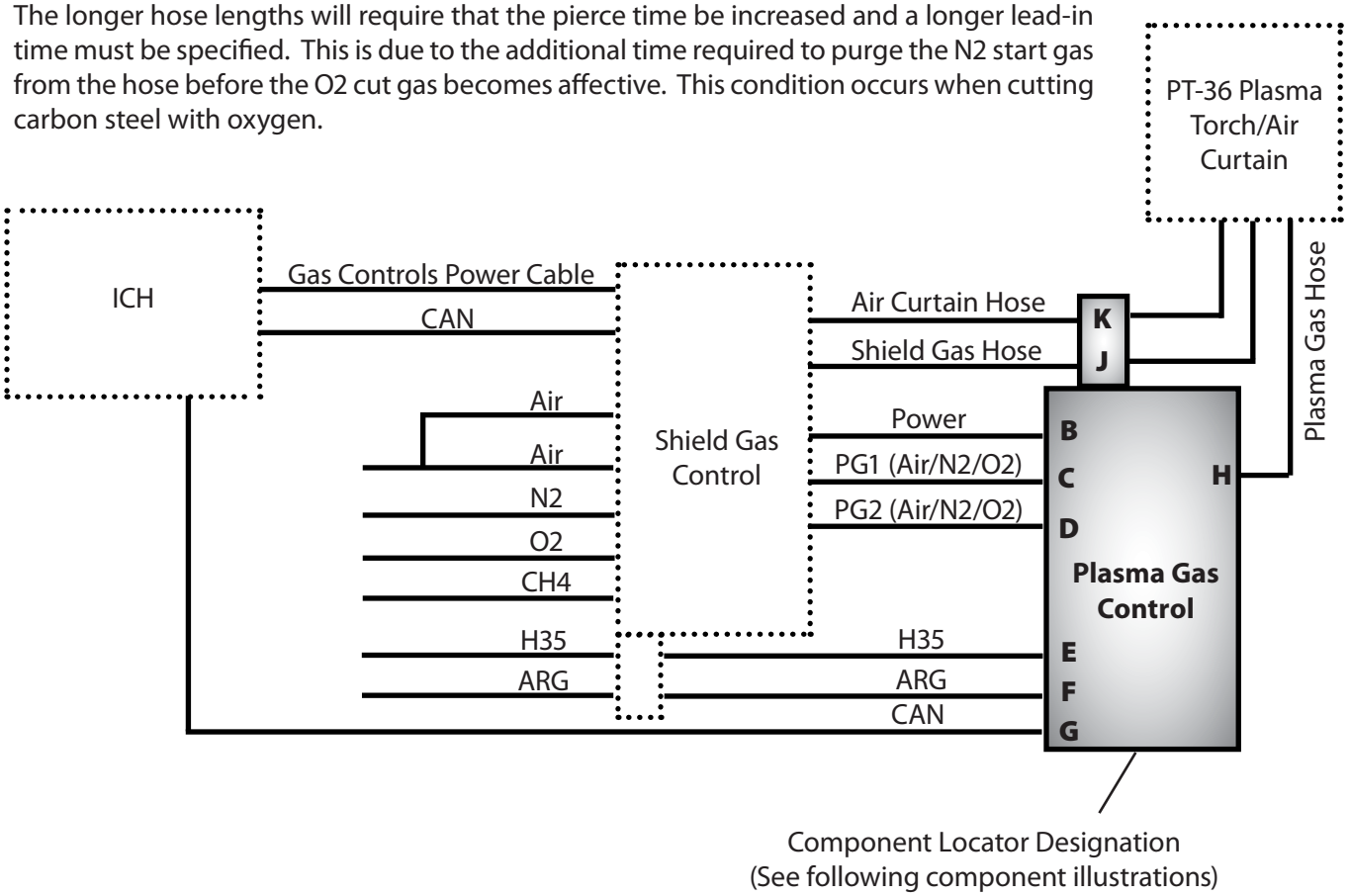
The PT-36 Torch is shipped with hose lengths that will not allow the Plasma Gas Control to be mounted more than two meters (6.6 feet) away from the torch. Please make sure the routing of the standard hoses will allow them to bend and connect properly before permanently mounting the Plasma Gas Control.

If additional distance between the torch and box is required the standard torch hose assembly will need extension hoses to create longer lengths. Extension hoses can be ordered to connect to the existing hose assembly.

BOTH HOSES MUST BE ORDERED

Extension Hose, Plasma Gas, 1M (3.3 ft.) ESAB P/N 0558008996
Extension Hose, Shield Gas, 1M (3.3 ft.) ESAB P/N 0558008997

The longer hose lengths will require that the pierce time be increased and a longer lead-in time must be specified. This is due to the additional time required to purge the N2 start gas from the hose before the O2 cut gas becomes affective. This condition occurs when cutting carbon steel with oxygen.

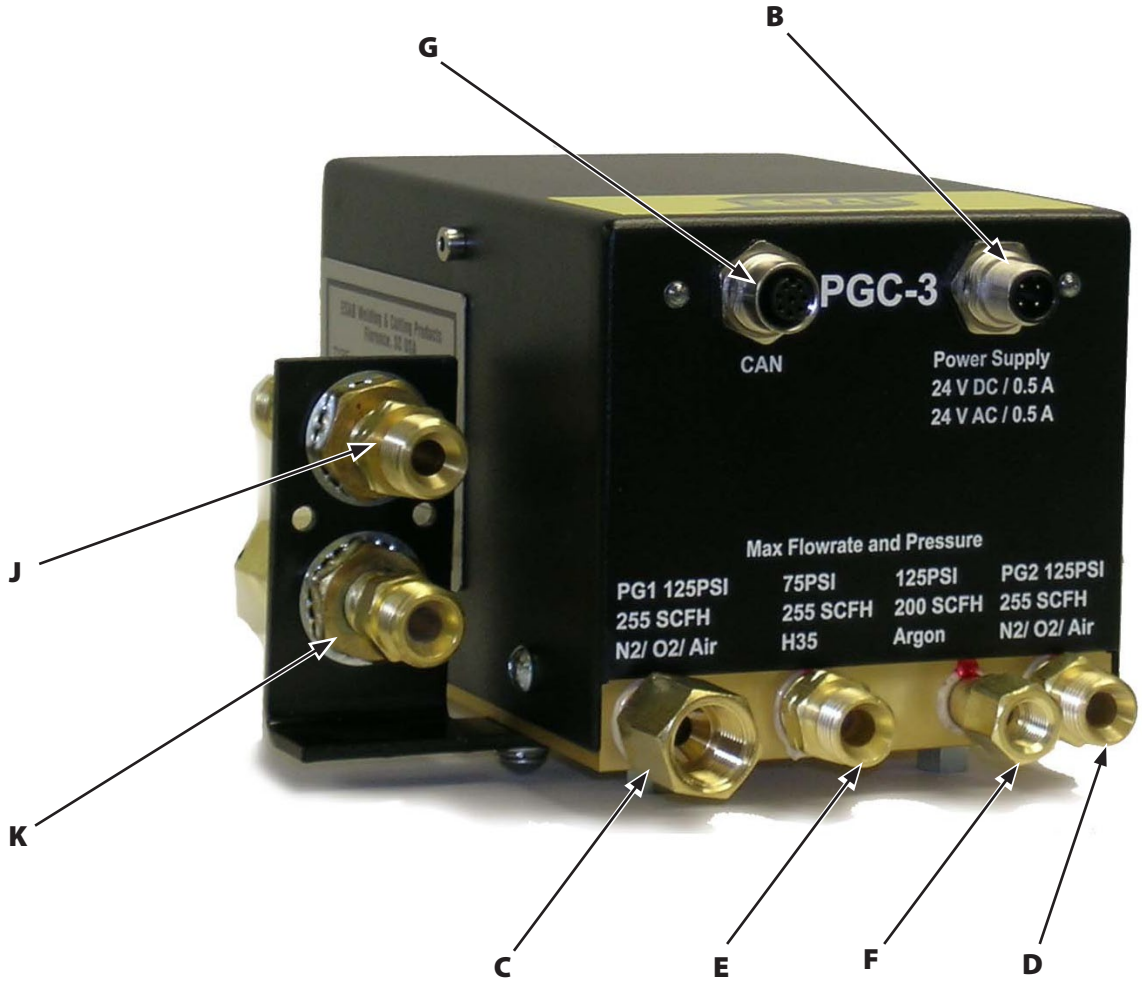


Plasma Gas Control Component Locator Designations

Note:

Refer to enclosed tables for all available hoses and cables.

DESCRIPTION

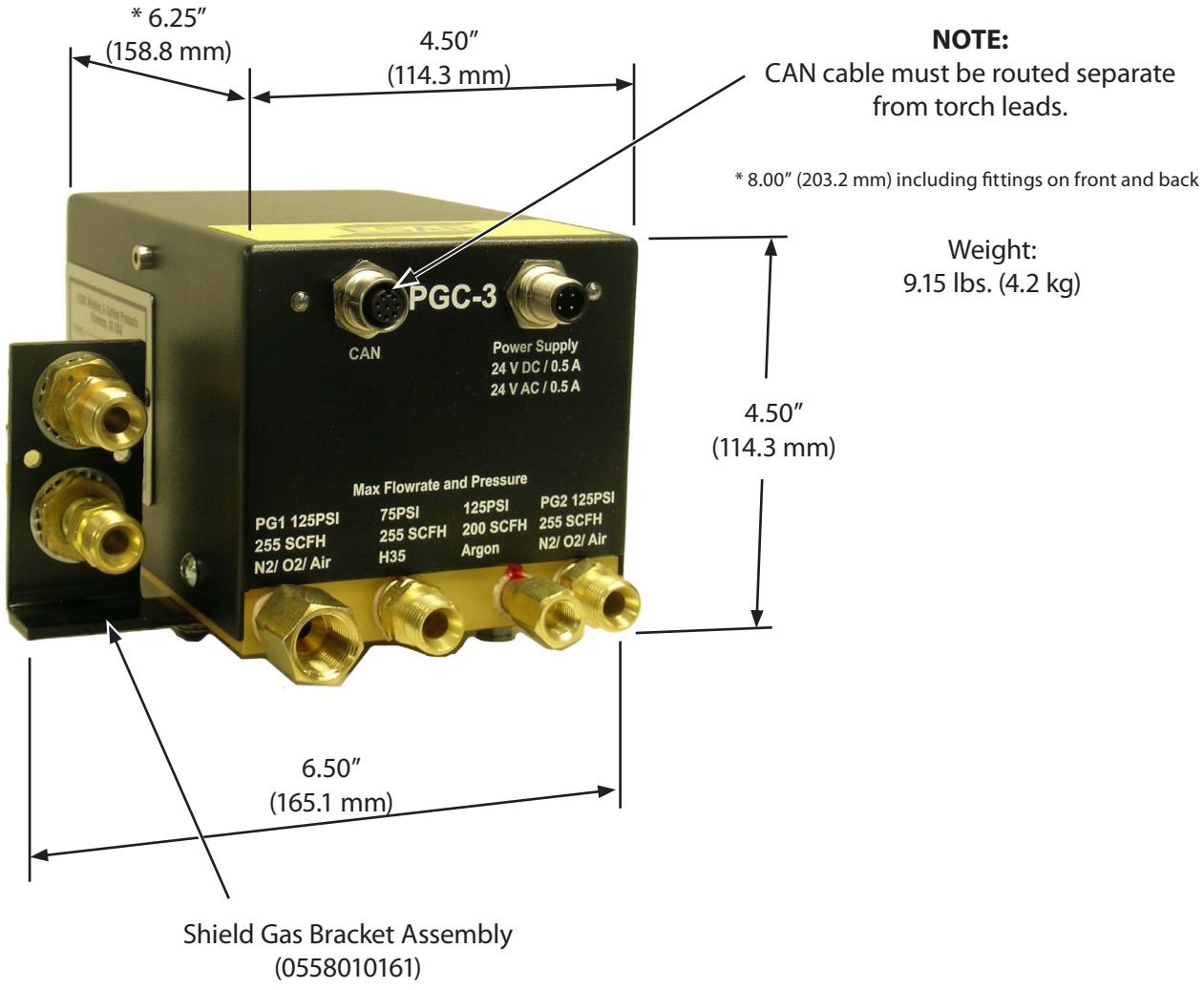


Functions and Features

The Plasma Gas Control regulates the output of the plasma gas (PG) selected from the four gas inlets (Argon, H35, PG1 and PG2). It is powered by 24 Volts (AC and DC) from the Shield Gas Control and receives commands via the CAN-bus directly from the CNC.

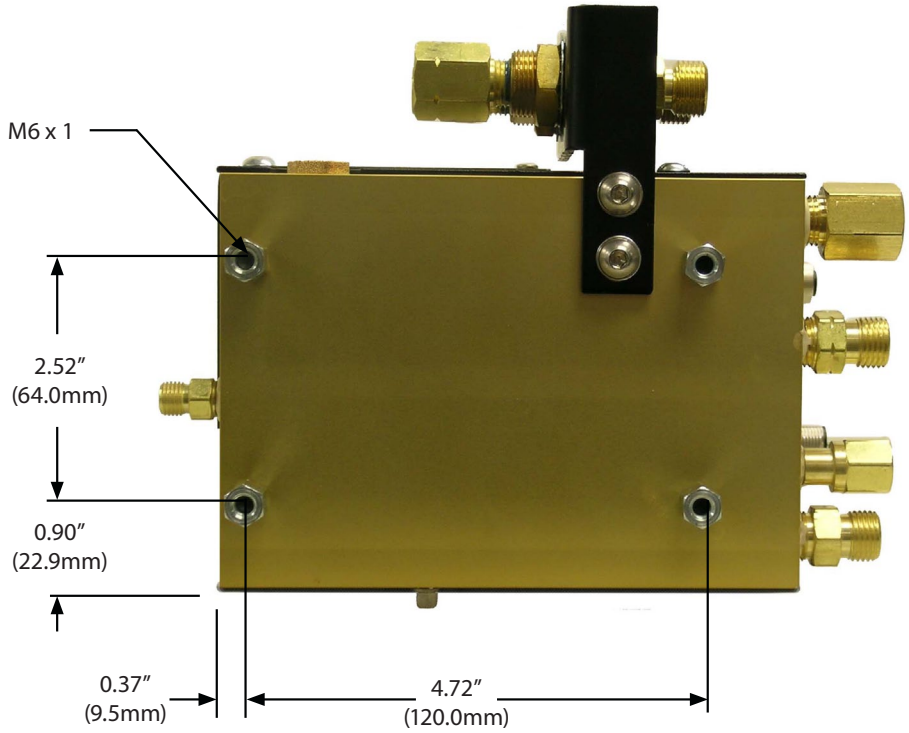
Like the Shield Gas Control, the gas output of the Plasma Gas Control is monitored and fed back through the CAN-bus to CNC for self-diagnosis.

Note: For required gas specifications see manual 0558008682, Subsection 7.1



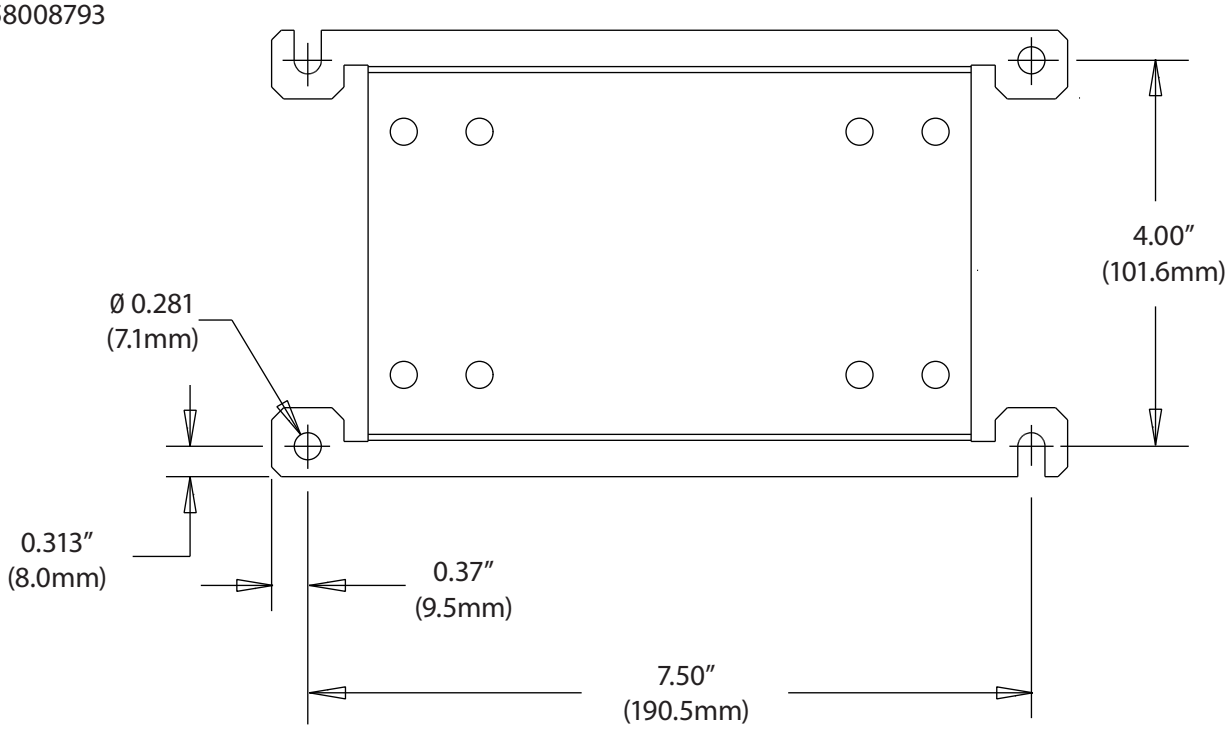
DESCRIPTION

Plasma Gas Control Mounting Hole Locations (Bottom View)

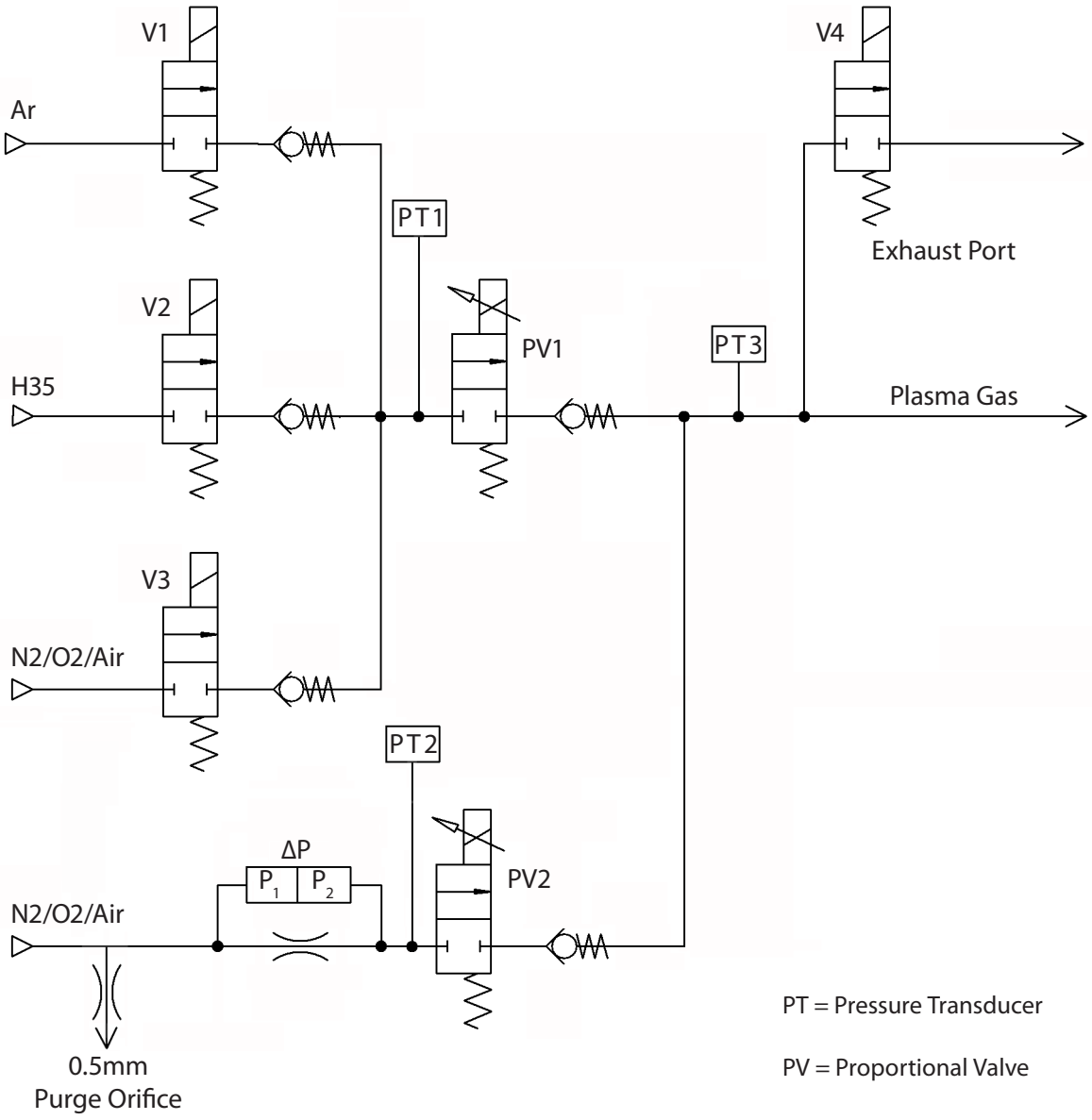


Plasma Gas Control Mounting Plate Hole Locations

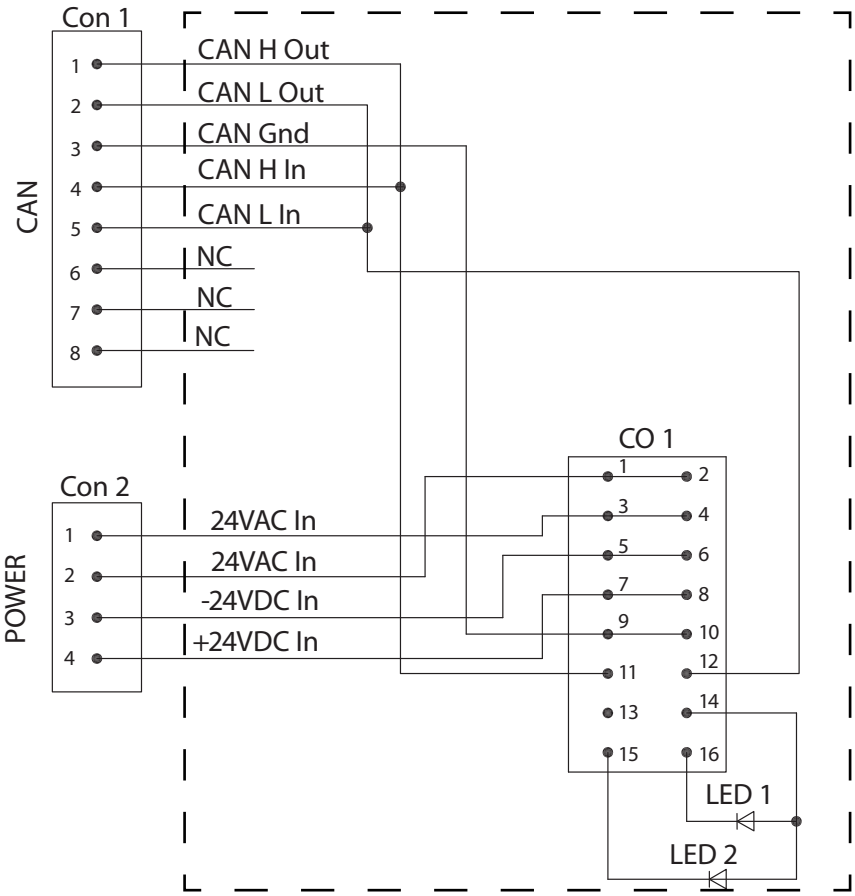
p/n 0558008793



Plumbing Schematic



Electrical Schematic



DESCRIPTION

Connections

There are two cables connected to the Plasmas Gas Box: one is 24V power, the other is CAN. There are four gas inputs (Argon, H35, PG1 and PG2) and one gas output (PG). The gas fittings are listed below.

Note:
Chassis must be connected to the machine ground.

Gas		Fitting	ESAB P/N
Inputs	Argon	1/8" NPT x "A" Inert Gas RH Female	631475
	H-35	1/4" NPT x "B" Fuel LH Male	3390
	PG1	1/4" NPT x "B" Inert Gas RH Female	74S76
	PG2	1/4" NPT x "B" Oxygen RH Male	3389
Output	PG	Connection, Male 0.125NPT to "A" Size	2064113

Troubleshooting

The Plasma Gas Control has two visible LEDs that indicate its' status. When the GREEN LED is on, this indicates power is applied to the unit and the rate at which it is flashing shows the operational status of the unit (refer to the chart below). If the Green LED is not ON, check the power cable, which should carry 24VDC and 24VAC from the Shield Gas Control.

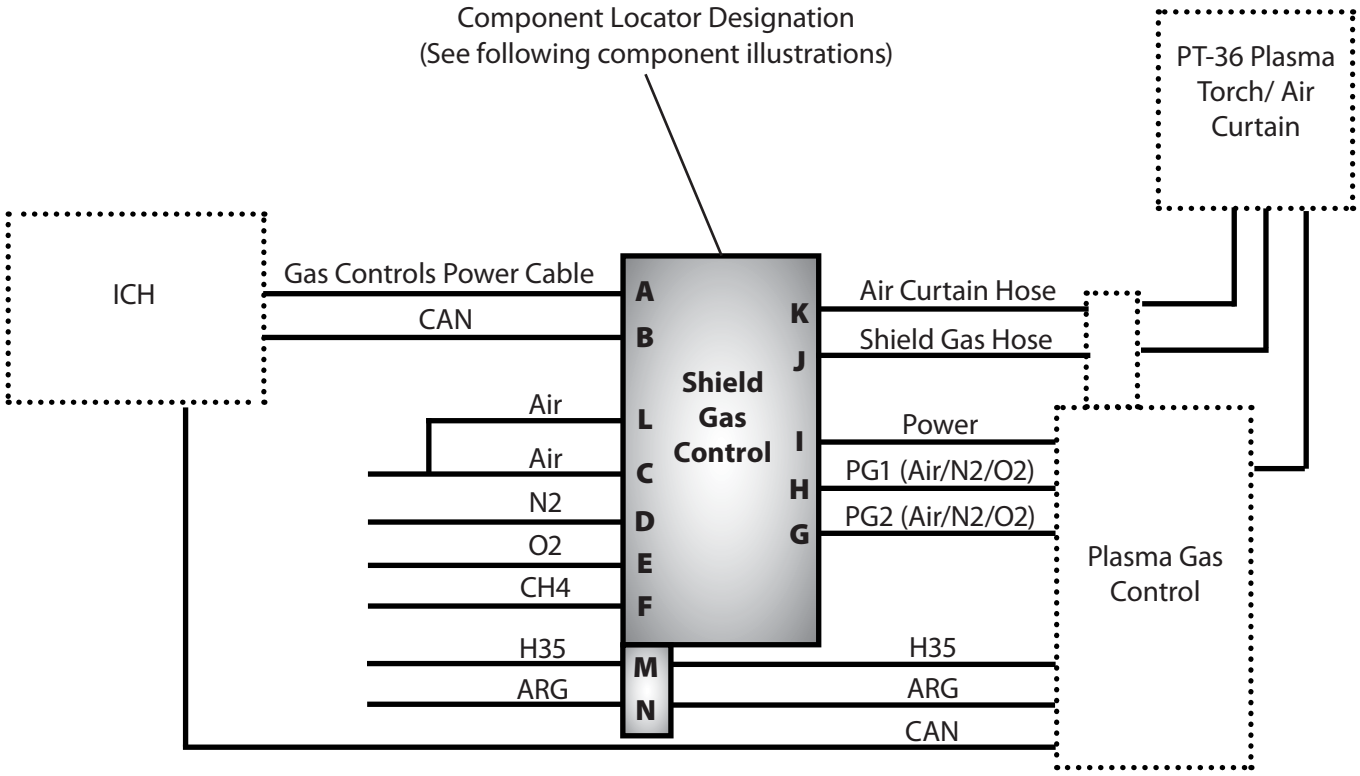
If the Yellow LED is not ON, either there is no power to the unit or the station is not selected.

The Plasma Gas Control is highly integrated and is treated as a "Black Box". If one or more functions of the unit stop working, the unit must be returned for repair. Contact technical support for troubleshooting and RMA assistance.

LED	Status	Meaning
Green	OFF	Power OFF
	10% ON, 90% OFF	Boot loader is running
	50% ON, 50% OFF	Application is running
	90% ON, 10% OFF	Application is running, CAN is available
Yellow	ON	Station is selected

2.5 Shield Gas Control (SGC)

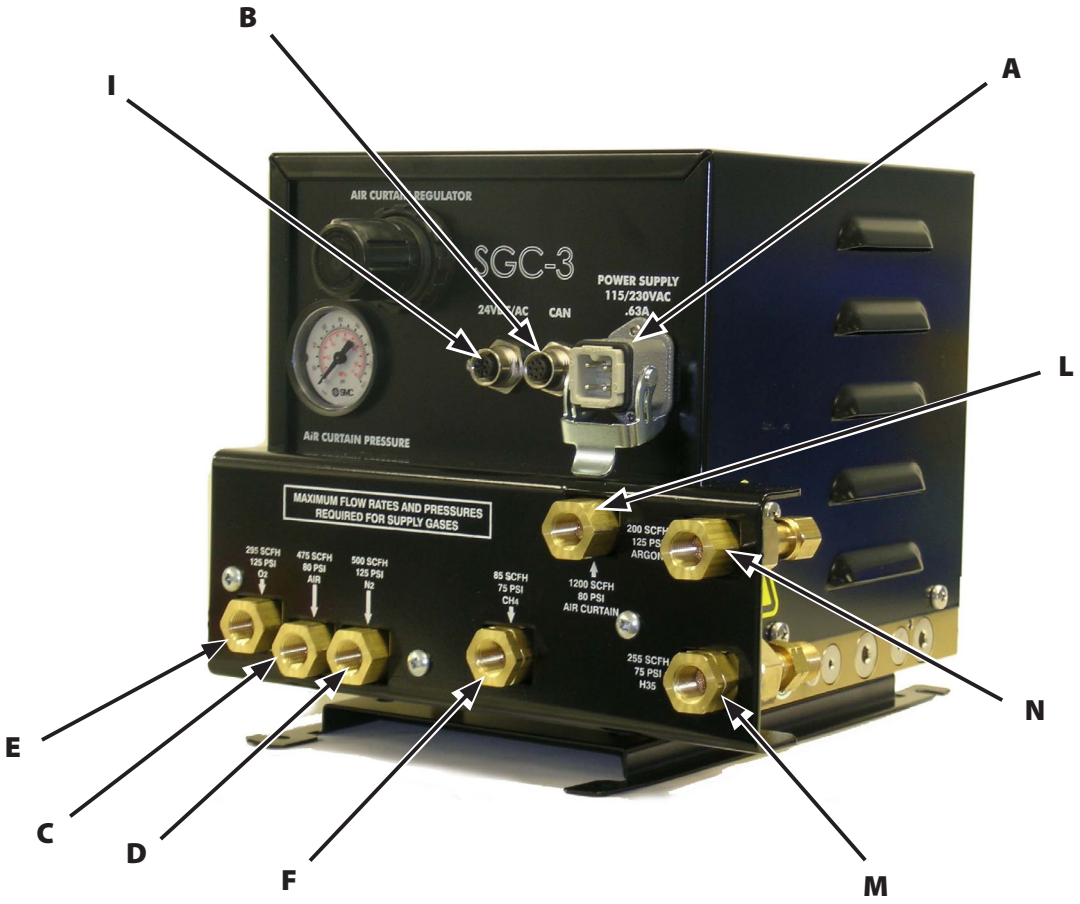
p/n 0558010155



Shield Gas Control Component Locator Designations

Note:
Refer to enclosed tables for all available hoses and cables.

DESCRIPTION

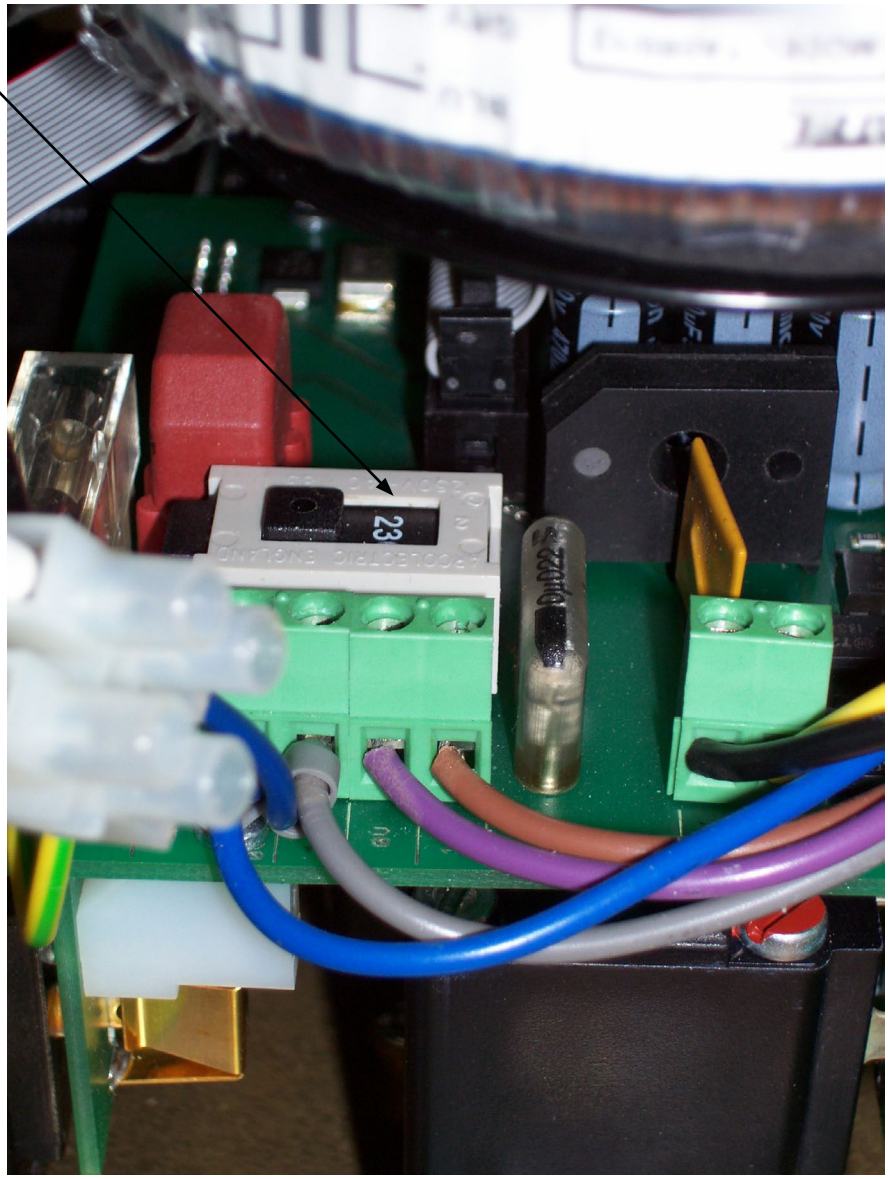


DESCRIPTION

CAUTION

Voltage Select Switch MUST be set to the proper input voltage (115 or 230 volts - default setting is 230 volts) before energizing system. Failure to do so could result in personal injury or equipment damage.

Voltage Select Switch
(cover must be removed to access switch)



Functions and Features

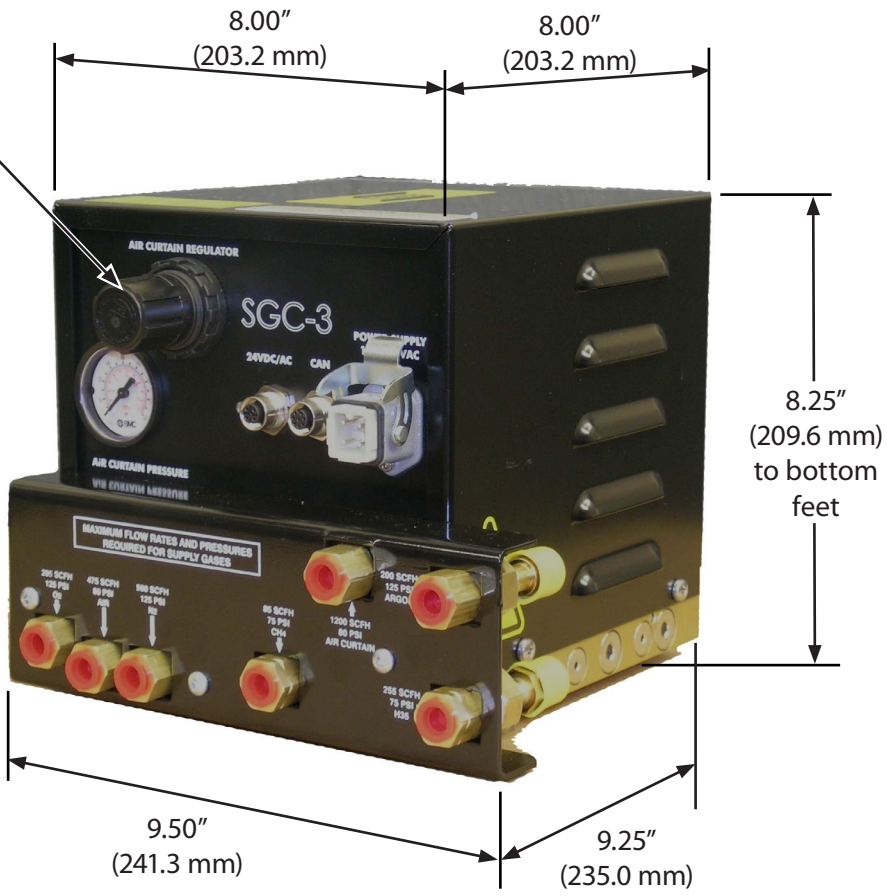
The Shield Gas Control selects different gases (Air, N2, O2, CH4) to mix shield gas (SG), plasma gas 1 (PG1), and plasma gas 2 (PG2). The selections are done through a group of solenoids integrated on a manifold. The CNC sends commands through CAN-bus to operate all these solenoids. The gas output of the Shield Gas Control is monitored and fed back through the CAN-bus to CNC for self-diagnosis. Also, the Shield Gas Control controls the solenoid for operation of the Air Curtain.

The default power input to Shield Gas Control is 230VAC. However, the Shield Gas Control input power is customer selectable, between 115 VAC and 230 VAC. This is accomplished by changing the input power switch inside the Shield Gas Control. The Shield Gas Control provides 24VDC and 24VAC power for the Plasma Gas Control.

Note:
Pressure Regulator is factory set for carbon steel at 40 psi (2.8 bar). If cutting stainless steel or aluminum set at 20 psi (1.4 bar).

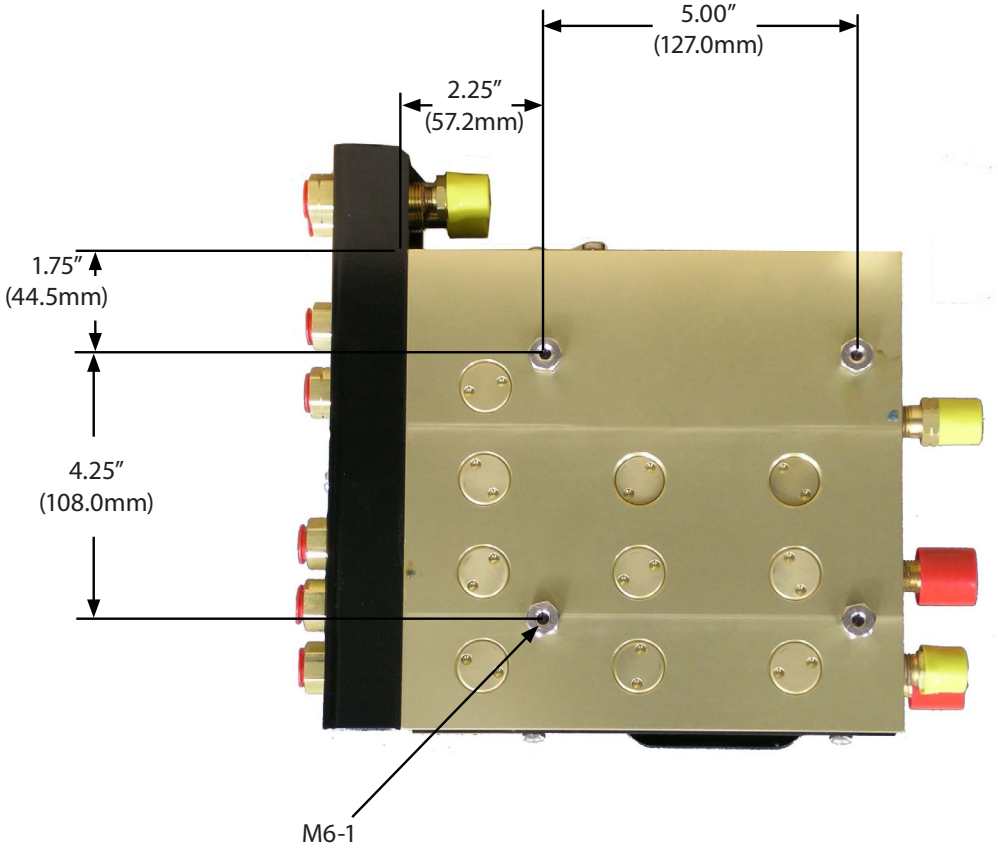
Weight:
30.0 lbs. (13.6 kg)

Note:
For required gas specifications see manual 0558008682, Subsection 7.1



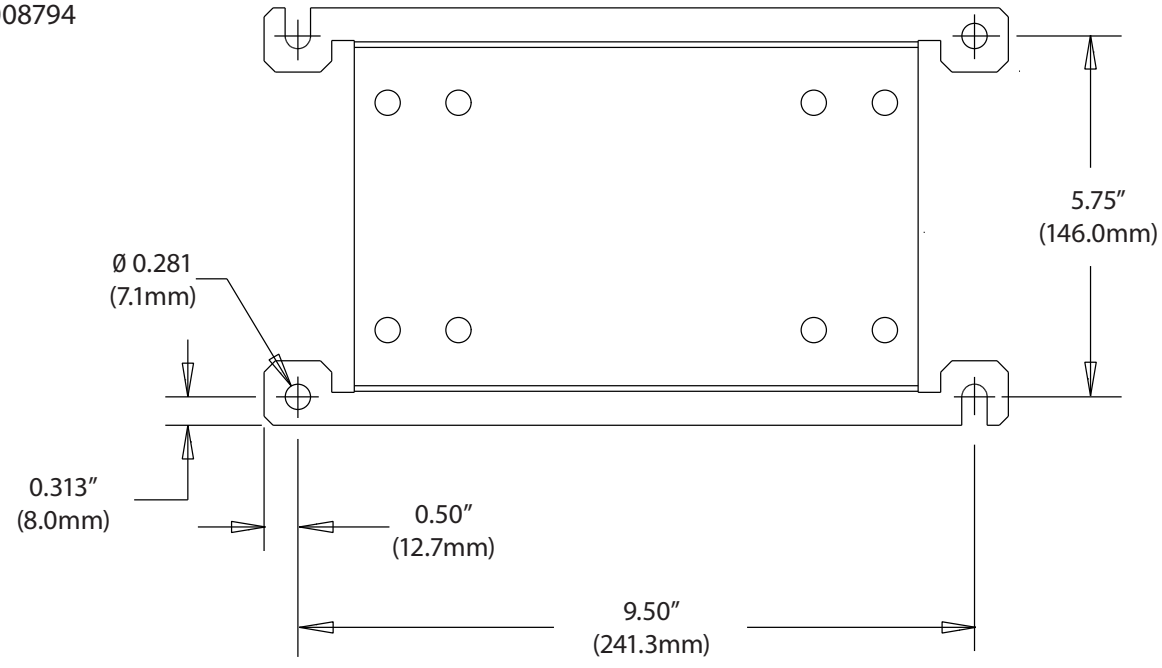
DESCRIPTION

Shield Gas Control Mounting Hole Locations (Bottom View)

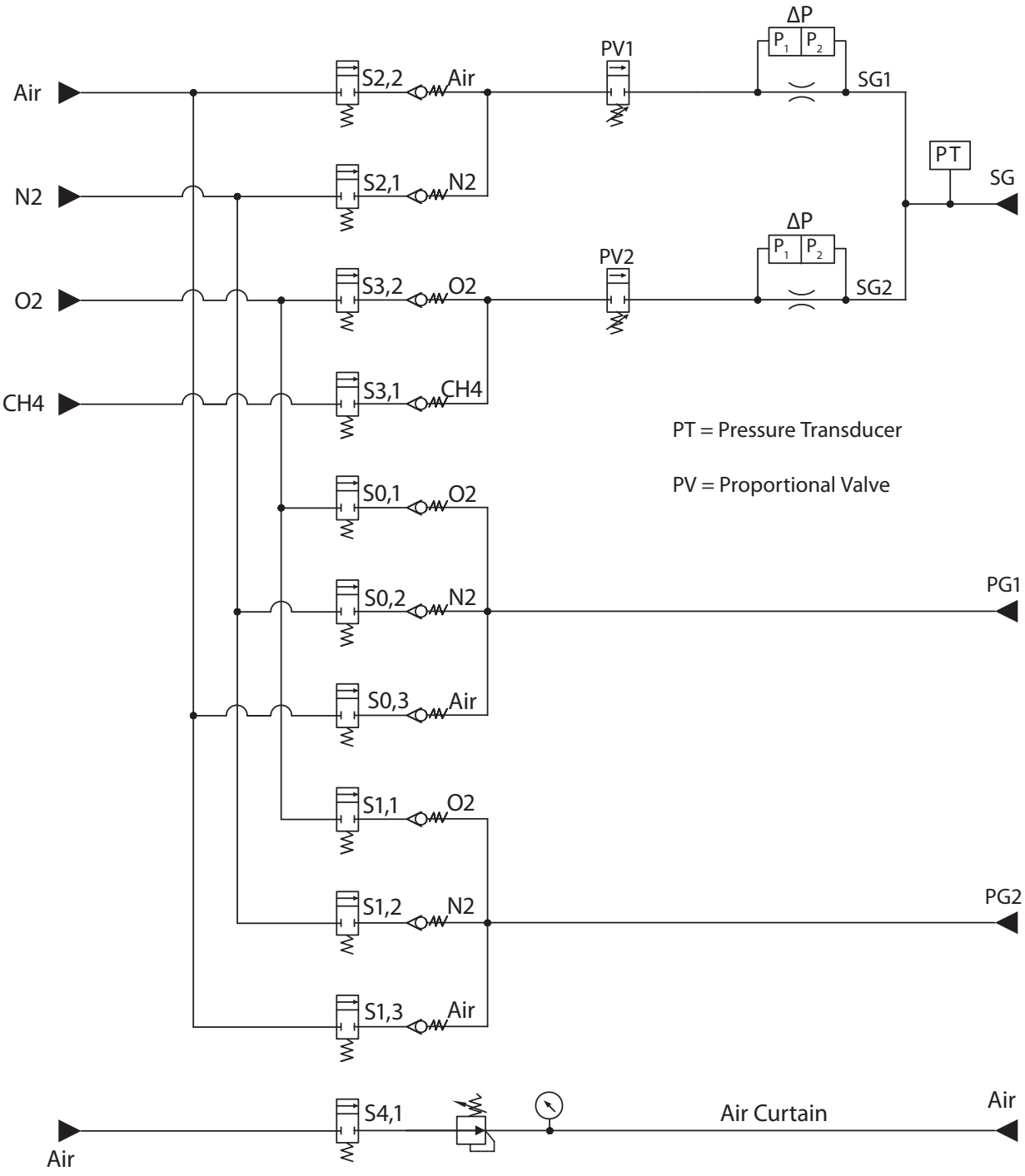


Shield Gas Control Mounting Plate Hole Locations

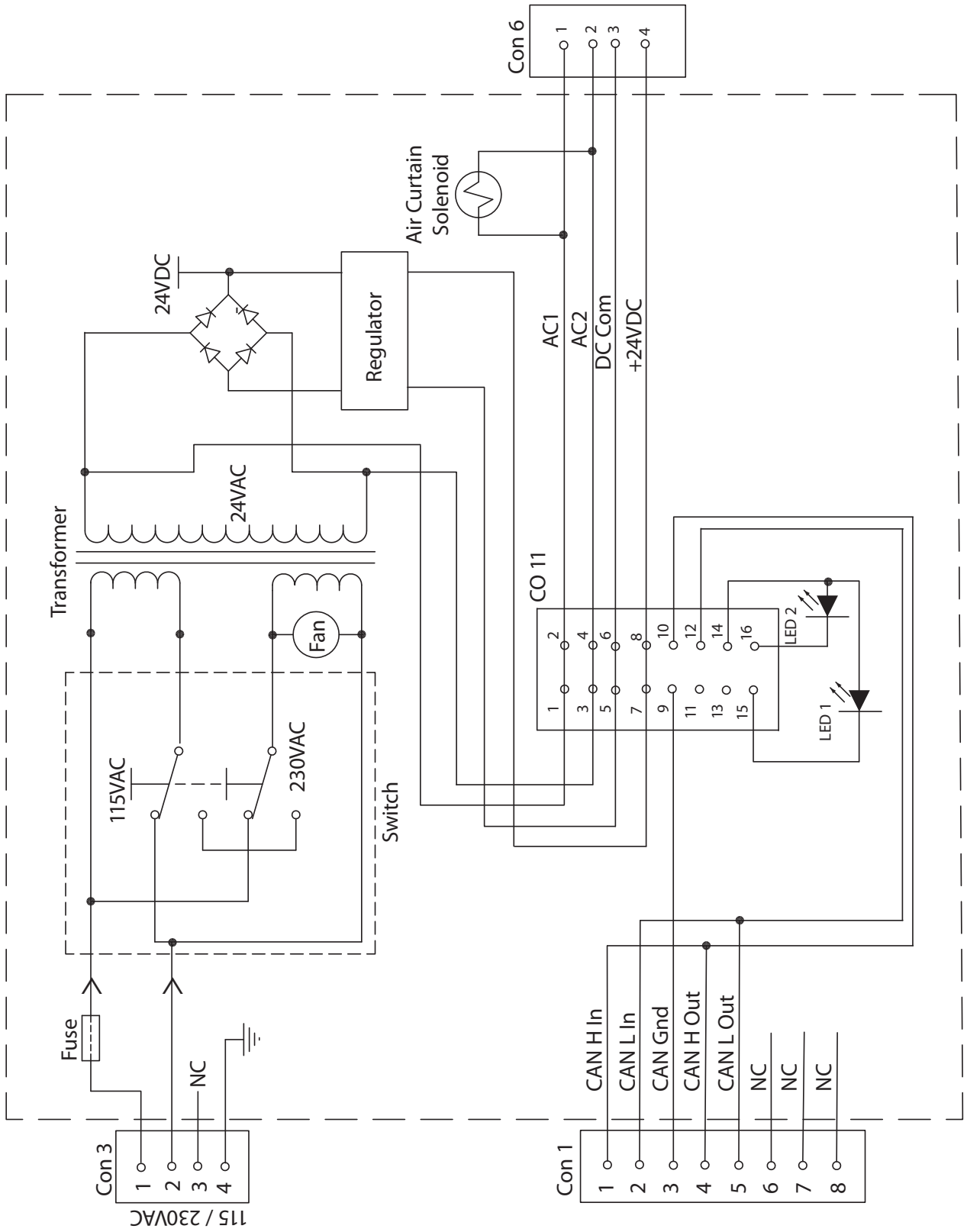
p/n 0558008794



Plumbing Schematic



Electrical Schematic



DESCRIPTION

Connections

There are three cables connected to the Shield Gas Control. They are 115/230 VAC power input, 24V power output, and CAN. There are five gas inputs (Air, N2, O2, CH4 and Air Curtain), four gas outputs (SG, PG1, PG2 and Air Curtain), and two outboard connections (H35 and Argon). The five inputs and two outboard connections are fitted with porous bronze filters and "G-1/4" (BSPP) female RH or LH thread. Either of two adaptor fitting kits are available to adapt standard metric or CGA hose connections. The gas fittings and adaptors are listed below.

Note:
Chassis must be connected to the machine ground.

Gas		Fitting	ESAB P/N
Metric Input Adaptors	Air	G-1/4" RH Male x G-1/4" RH Male	0558010163
	N2	G-1/4" RH Male x G-1/4" RH Male	0558010163
	O2	G-1/4" RH Male x G-1/4" RH Male	0558010163
	CH4	G-1/4" LH Male x G-1/4" LH Male	0558010164
	Air Curtain	G-1/4" RH Male x G-1/4" RH Male	0558010163
	H-35 (outboard)	G-1/4" LH Male x G-1/4" LH Male	0558010164
	Argon (outboard)	G-1/4" RH Male x G-1/4" RH Male	0558010163
CGA Input Adaptors	Air	G-1/4" RH Male x "B" Air/Water RH Male	0558010165
	N2	G-1/4" RH Male x "B" Inert Gas RH Female	0558010166
	O2	G-1/4" RH Male x "B" Oxygen RH Male	0558010167
	CH4	G-1/4" LH Male x "B" Fuel RH Male	0558010168
	Air Curtain	G-1/4" RH Male x "B" Air/Water RH Male	0558010165
	H-35 (outboard)	G-1/4" LH Male x "B" Fuel RH Male	0558010168
	Argon (outboard)	G-1/4" RH Male x "B" Inert Gas RH Female	0558010166
Outputs	SG	1/4" NPT x 5/8"-18 LH Male	0558010223
	PG1	1/4" NPT x "B" Inert Gas RH Female	74S76
	PG2	1/4" NPT x "B" Oxygen RH Male	3389
	Air Curtain	1/4" NPT x "B" Inert Gas LH Female	11N16
	H-35 (outboard)	1/8" NPT x "B" Fuel LH Male	11Z93
	Argon (outboard)	1/8" NPT x "A" Inert Gas RH Female	631475

DESCRIPTION

Troubleshooting

On the Shield Gas Control, there are two LEDs displaying the status of the CAN-bus module. The states of these lights are shown in the table below.

LED	Status	Meaning
Green	OFF	Power OFF
	10% ON, 90% OFF	Boot loader is running
	50% ON, 50% OFF	Application is running
	90% ON, 10% OFF	Application is running, CAN is available
Yellow	ON	Station is selected

In normal operation, the green LED indicating the power must be ON. When the station is selected, the yellow LED should be ON all the time; and green LED will flash 90% ON and 10% OFF. Otherwise, there is a problem.

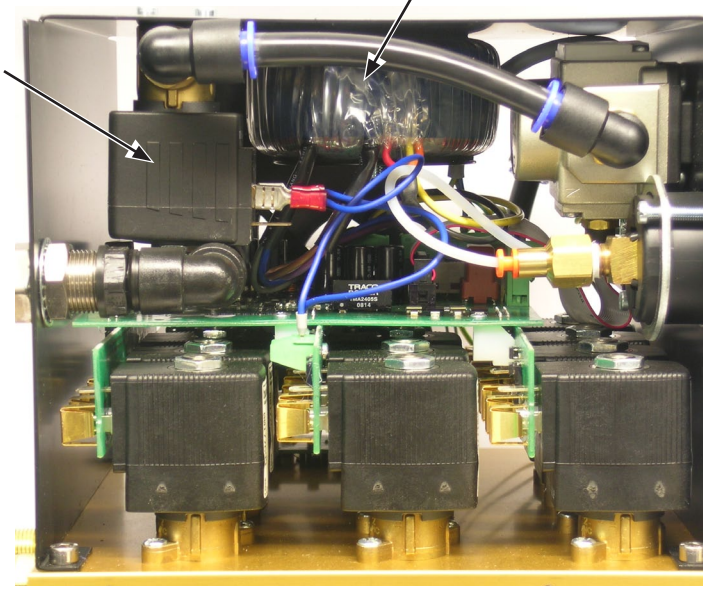
1. If the green light is not on, check the power input (cale connection) and fuse.
2. If the yellow light is not on and the green light is on, check can-bus connection. Make sure the station is selected.

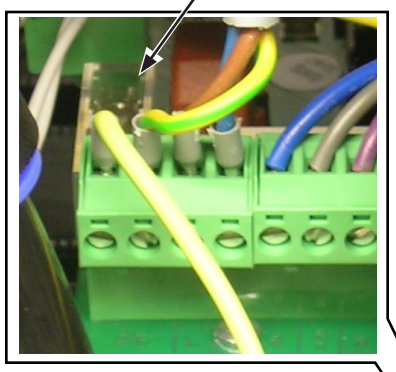
Replacement Parts

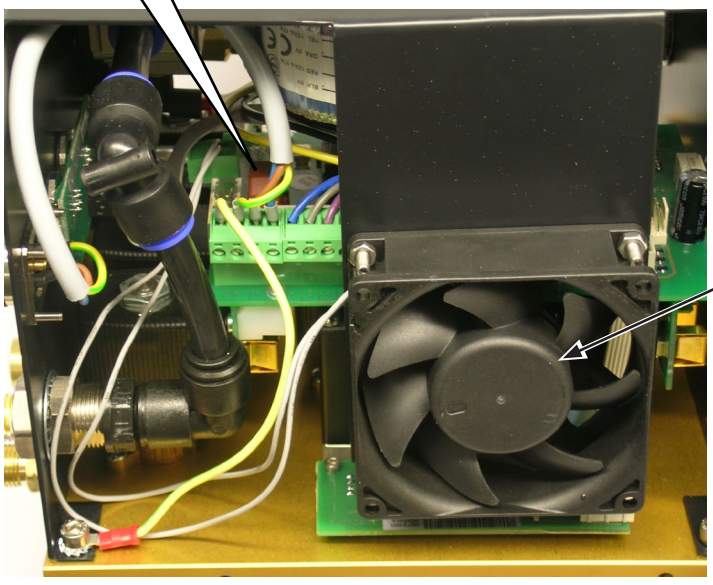
The Shield Gas Control is highly integrated and only a few parts can be replaced by a qualified service engineer or by the customer. These parts are listed below. Otherwise, the entire Shield Gas Control needs to return for repair. It is recommended that customers contact Technical Support before attempting repairs on these units.

Item No.	Description	ESAB PN
1	Transformer	0558008612
2	Fan	0558008614
3	Fuse - T630mA 250V, 5 x 20mm	0558008613
4	Solenoid 6240 for Air Curtain	0558008615
5	Pressure Gauge	0558008616
6	Pressure Regulator	0558008617

DESCRIPTION







2.6 Remote Arc Starter (RAS)

p/n 0558008150

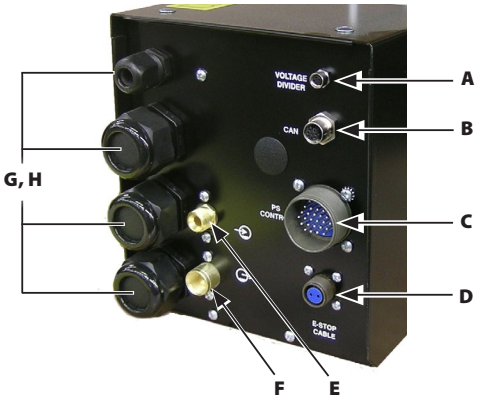
The Remote Arc Starter is more commonly referred to as the RAS Box. The RAS box serves as an interface between the plasma controller and the EPP family of plasma power supplies, helping to deliver a stable plasma arc. The RAS box also provides a voltage feedback to the plasma torch lift. This voltage is used to regulate the torch height while cutting, maintaining the proper height of the torch above the work piece.

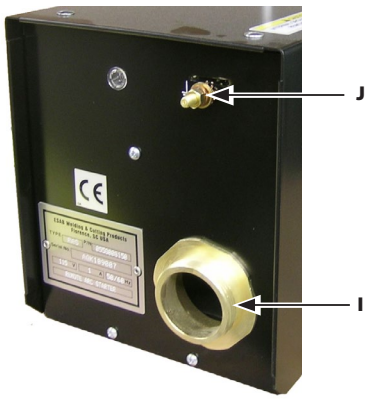
Within the RAS box there is an I/O module for communicating with the plasma controller, a High Frequency/Voltage Divider circuit board which provides pilot arc ionization and voltage divider functions to regulate torch height.

Coolant connections and torch power connections are made within the RAS box and provide an interface between the power supply, coolant circulator and the torch.

Specifications
Dimensions: 8.75" (222.3 mm) high x 7.50" (190.5 mm) wide x 17.00" (431.8 mm) deep
Weight: 28.5 lbs. (12.9 kg)

Remote Arc Starter Connections





Note:
Chassis must be connected to the machine ground.

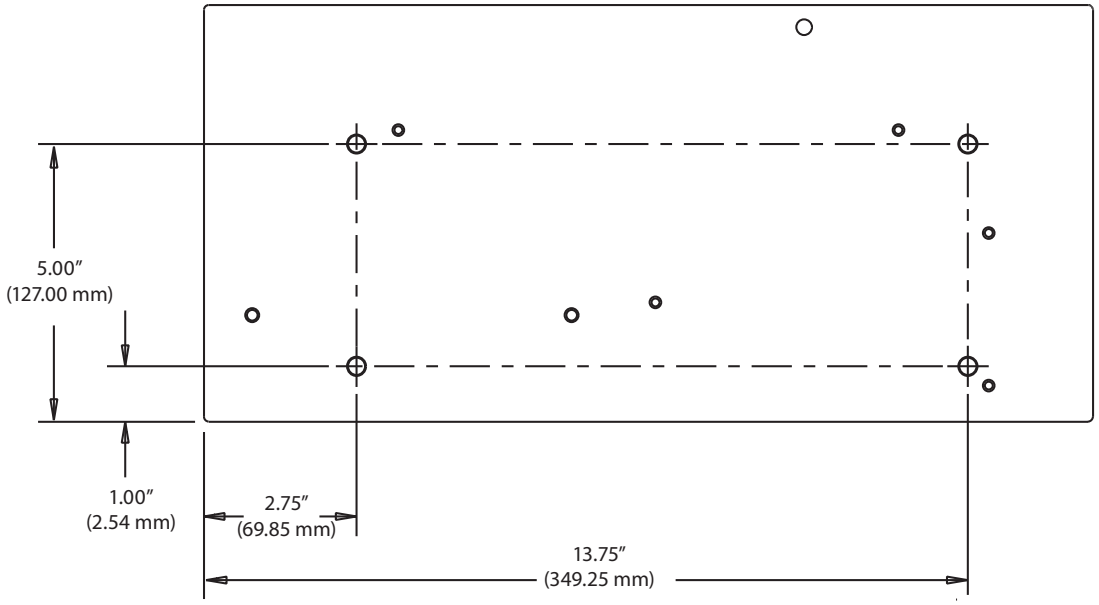
Letter	Description
A	3 Pin Voltage Divider Connection to the Lift
B	8 Pin Can Bus Connection to the CNC or Interface
C	24 Pin Amphenol Power Supply Connection
D	E-Stop
E	Coolant Inlet - Flowing to the Torch
F	Coolant Return - Flowing back to the Coolant Circulator from the Torch
G, H	Strain Relief Fittings
I	Torch Shroud Connection
J	Machine Ground Connection

RAS Box Mounting Dimensions

The box has four M6 x 1 threaded mounting holes shown in pattern below.

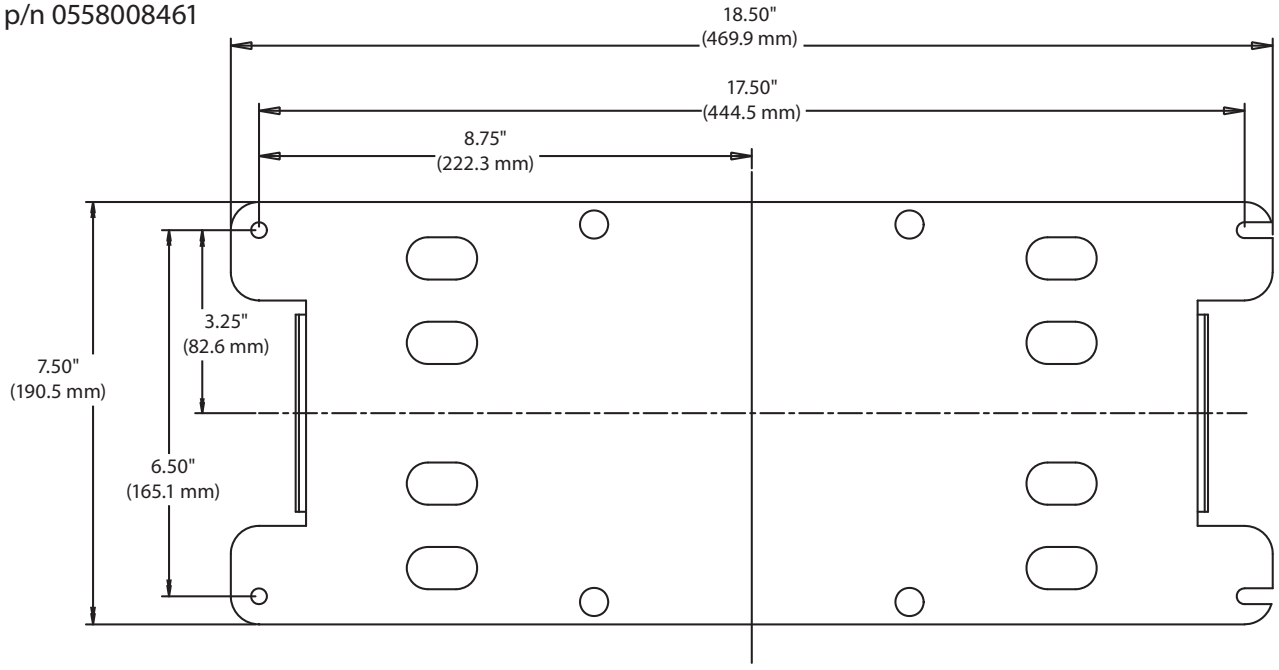
CAUTION

If fasteners are threaded into the box from below, the length of the fasteners must not allow them to extend more than 0.25" beyond the edge of the internal female threads. If fasteners are too long they can interfere with the components inside the box.



RAS Box Mounting Plate Dimensions

p/n 0558008461

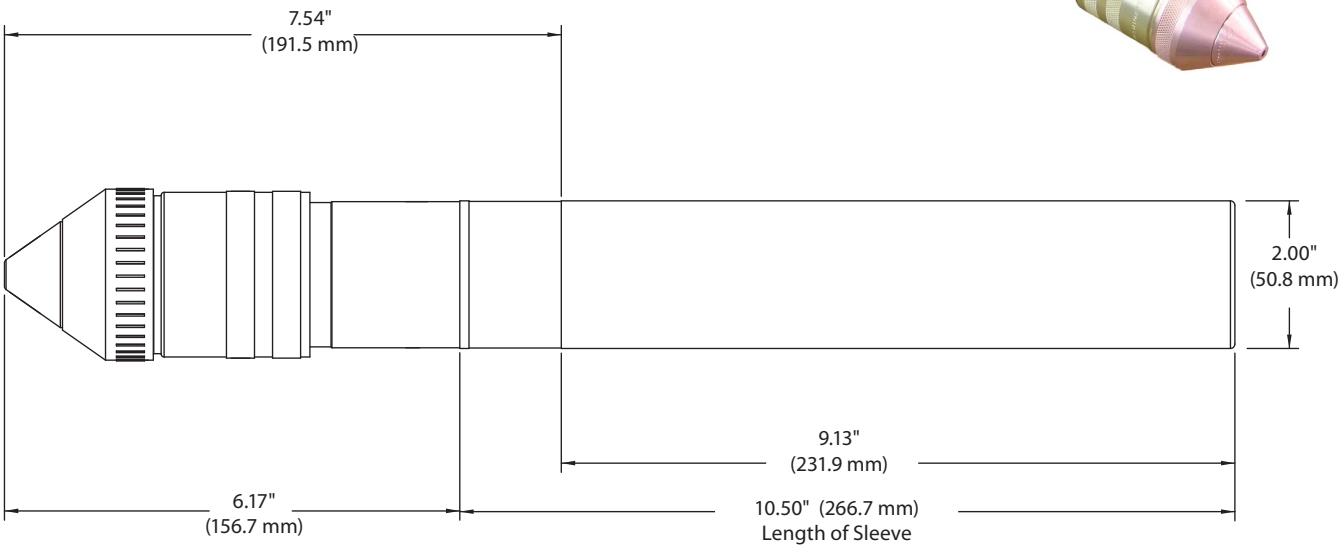


DESCRIPTION

2.7 PT-36 Plasma Torch

p/n 0558008300

The PT-36 Mechanized Plasmarc Cutting Torch is a plasma arc torch factory assembled to provide torch component concentricity and consistent cutting accuracy.



Specifications
Type: Water cooled, Dual gas, mechanized plasmarc cutting torch
Current Rating: 1000 Amps @ 100% duty cycle
Mounting Diameter: 2 "(50.8 mm)
Length of Torch without leads: 16.7 "(42 cm)
IEC 60974-7 Voltage Rating: 500 volts peak
Striking Voltage (maximum value of HI-FREQUENCY voltage): 8000 VAC
Minimum Coolant Flowrate: 1.3 GPM (5.9 L/min)
Minimum Coolant Pressure at Inlet: 175 psig (12.1 bar)
Maximum Coolant Pressure at Inlet: 200 psig (13.8 bar)
Minimum Acceptable Rating of Coolant Recirculator: 16,830 BTU/HR (4.9 kW) at High Coolant Temperature - Ambient = 45˚F (25˚C) and 1.6 USGPM (6 L/min)
Maximum Safe Gas Pressures at Inlets to Torch: 125 psig (8.6 bar)
Safety Interlocks: This torch is intended for use with ESAB plasmarc cutting systems and controls employing a water flow switch on the coolant return line from the torch. Removal of the nozzle retaining cup to service the torch breaks the coolant return path.

2.8 Air Curtain (A/C)

p/n 37440

The Air Curtain is a device used to improve the performance of plasma arc when cutting underwater. The device mounts onto the torch and produces a curtain of air. This allows the plasma arc to operate in a relatively dry zone to reduce noise, fume, and arc radiation, even though the torch has been submerged.

The Air Curtain requires a source of compressed air that needs to be clean, dry and oil-free. It should be delivered at 80 psi @ 1200 cfh (5.5 bar @ 34 CMH).

2.9 Water Injection Control (WIC)

p/n 0558009370

The Water Injection Control (WIC) regulates the flow of cut water supplied to the plasma torch. This water is used as a shield in the cutting process. This shield assists in forming the plasma arc and also cools the cut surface. The selection and output of cut water is performed and controlled by the CNC. The WIC consists of a water regulator, pump and a closed feedback loop between proportional valve and flow sensor. This is controlled by a local Process Control Unit (PCU). The PCU communicates via CAN to the ICH while controlling the proportional and solenoid valves. The WIC is monitored and sends feedback signals through the CAN bus to the ICH for diagnostic purposes.

Specifications	
Dimensions (Electrical module)	163 mm x 307 mm x 163 mm (6.4 in x 12.1 in x 6.4 in)
Dimensions (Pump Module)	465 mm x 465 mm x 218 mm (18.3 in x 18.3 in x 8.6 in)
Weight (Electrical module)	15 lb. dry (6.8 kg)
Weight (Pump Module)	60 lb. dry (27.2 kg)
Water Requirements	Tap water with an allowable water hardness of <2 ppm as CaCO3 and Conductivity: Resistivity must be at least 200,000 ohm/cm, Conductivity can be no more than (5 µ S/cm) >200,000 ohms per inch, filtered at 5 microns. 1 gpm (3.8 l/min) minimum flow rate @ at 20 psi (1.4 bar).
Air Supply (anti-freezing function)	250 CFH @ 80 psi (7.1 cmh @ 5.5 bar)
Pump	Positive displacement, rotary vane with adjustable by-pass valve (250 psi / 17.2 bars maximum), CW rotation, Capacity: 1.33 GPM @ 150 psi (5.04 l/min @ 10.3 bar), Nominal speed: 1725 rpm, Temperature rating: 150° F (66° C)
Motor	1/2 HP, 230 VAC single phase, 60 Hz, 1725 RPM, 3.6A current, Temperature rating: 150° F (66° C)
Pressure Regulator	Inlet water pressure: 100 psi (6.9 bar) maximum Outlet water pressure: 20 psi (1.4 bar) factory set
Pressure Transducer	Maximum pressure range: 0 - 200 psi (0 - 13.8 bar) Temperature range: -40° - 257° F (-40° - 125° C) Supply voltage: 24 VDC Pressure signal output: 4 mA for 0 psi, 20 mA for 200 psi (13.8 bar). Regulated to 1 to 5 VDC with 250 ohm resistor.
Proportional Valve	Supply voltage: 24 VDC Full load current: 500 mA, Input control signal: 0-10 VDC. Coil: Standard Voltage: 24 VDC, Operating current: 100-500 mA, Valve: Orifice size: 3/32", Cv:0.14 (fully open) Operating differential pressure: 115 psi (8.0 bar) ; Max. flow 1.5 gpm Maximum fluid temperature: 150° F (66° C)
Flow Sensor	Maximum operating pressure: 200 psi (13.8 bar), Operating temperature: -4° - 212° F (-20° - 100° C), Input power: 5 - 24 VDC @ 50 mA maximum, Output signal: 58 - 575 Hz, Flow range: 0.13 - 1.3 gpm
Air Solenoid	Supply voltage: 24 VDC, Maximum operating pressure: 140 psi (9.7 bar) , Operating temperature: 32° - 77° F (0 - 25° C)

2.10 Automatic Height Control (AHC)

p/n 0560947166

The B4 lift assembly provides vertical motion for the PT-36 plasma torch, using a typical motor, screw, and slide configuration. The motor turns an enclosed spindle screw, which in turn raises/lowers the lifting plate along linear rails. Directional commands given from the plasma controller determine the direction of the travel. Fixed limit switches are included to prevent upper and lower lift's over travel.

The lift assembly also contains components necessary to control height over work surfaces; initial, piercing, and cutting heights are encoder controlled during the plasma cycle. During part production, height is automatically controlled by taking voltage measurements between the torch electrode and work surface.

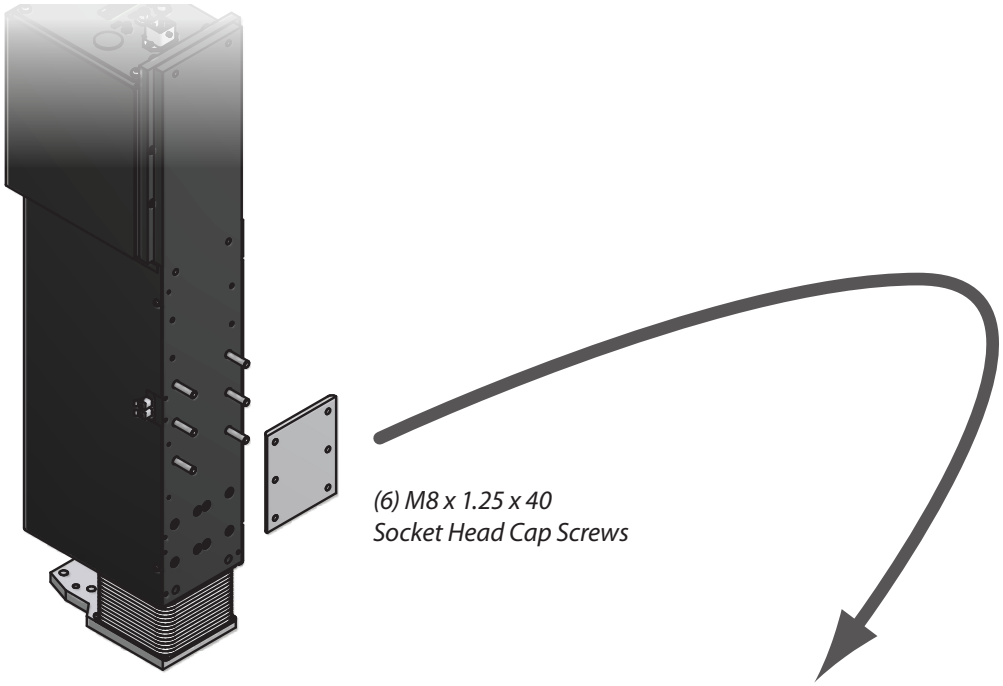
The B4 lifts utilize an Omni Soft Touch® assembly to protect the system during station crashes. Proximity switches monitor torch position in the torch holder. If the torch is jarred in any direction, the process will stop and an error report will be sent to the controller.

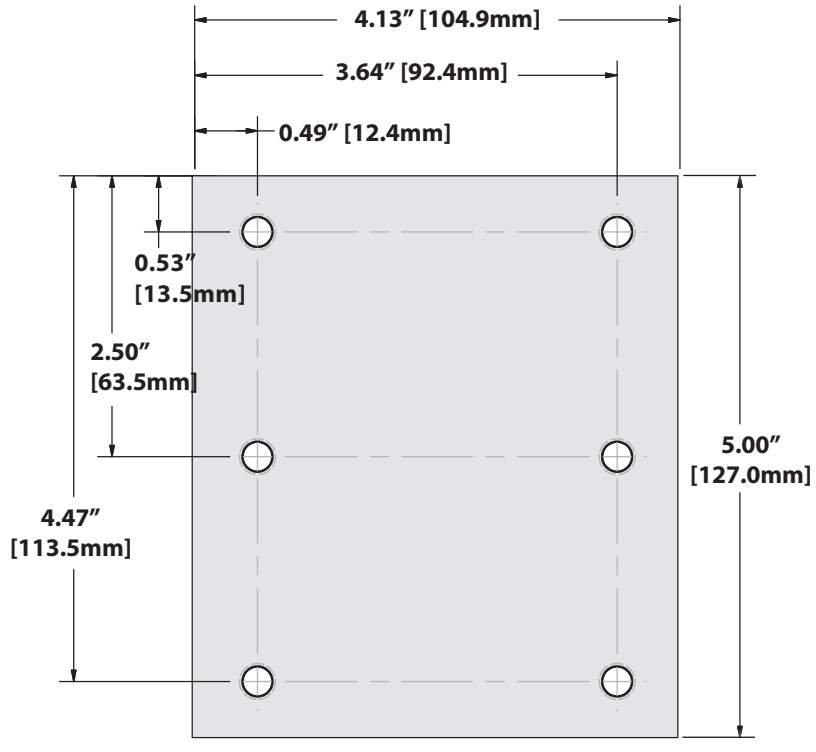
Specifications	
Dimensions: 6.0" (152.4 mm) wide x 8.5" (215.9 mm) deep x 31.5" (800.1 mm) high	
Lift Speed: 315 IPM [8.0m per minute]	
Vertical Travel: 8.00" [200.0 mm]	
Approximate Weight including torch holder: 85 lbs. [38.5 kg]	
Torch Barrel Size: 85.7 mm	
Component Tolerances	IHS Accuracy: ± 0.5 mm
	Encoder Accuracy: ± 0.25 mm
	Voltage Accuracy: ± 1 volt

DESCRIPTION

B4 Mounting Dimensions

B4 lift hole patterns are provided below to aid end users in mounting the plasma station. An optional plasma bracket/nut plate is available. For more specific details, please refer to the B4 Lift manual.





Recommended Monting Bracket/Nut Plate

DESCRIPTION

DESCRIPTION

INSTALLATION

INSTALLATION

3.0 Grounding

Introduction

Machine grounding is an important part of the installation process, which can be greatly simplified if prepared in advance. The most difficult part of the grounding process is designing and installing a low impedance Earth ground rod. However, the better the Earth ground rod, the less chance there is of having electromagnetic interference problems after the installation is complete.

Most national electric codes address grounding for the purpose of fire prevention and short circuit protection; they do not address equipment protection and electromagnetic interference noise reduction. Therefore, this manual presents more stringent requirements for machine grounding.

WARNING

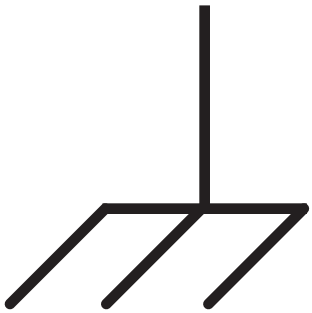
ELECTRIC SHOCK HAZARD.

Improper grounding can cause severe injury or death.

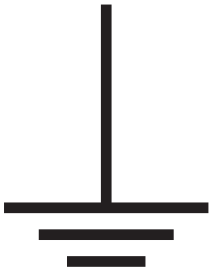
Improper grounding can damage machine electrical components.

Machine must be properly grounded before putting it into service.

The cutting table must be connected to machine earth grounding rod.



A common symbol used to identify a chassis ground on drawings.



A common symbol used to identify an earth ground on drawings.

A common symbol used to identify a protective earth (PE) ground.

Grounding Overview

There are three parts to a ground system;

- Component or "chassis" ground
- Earth ground
- Protective Earth ground

Component grounding connects all pieces to a single component, like the machine chassis, which is then connected to a common point known as the star point. This provides a path for electromagnetic interference (EMI) from the enclosure to ground.

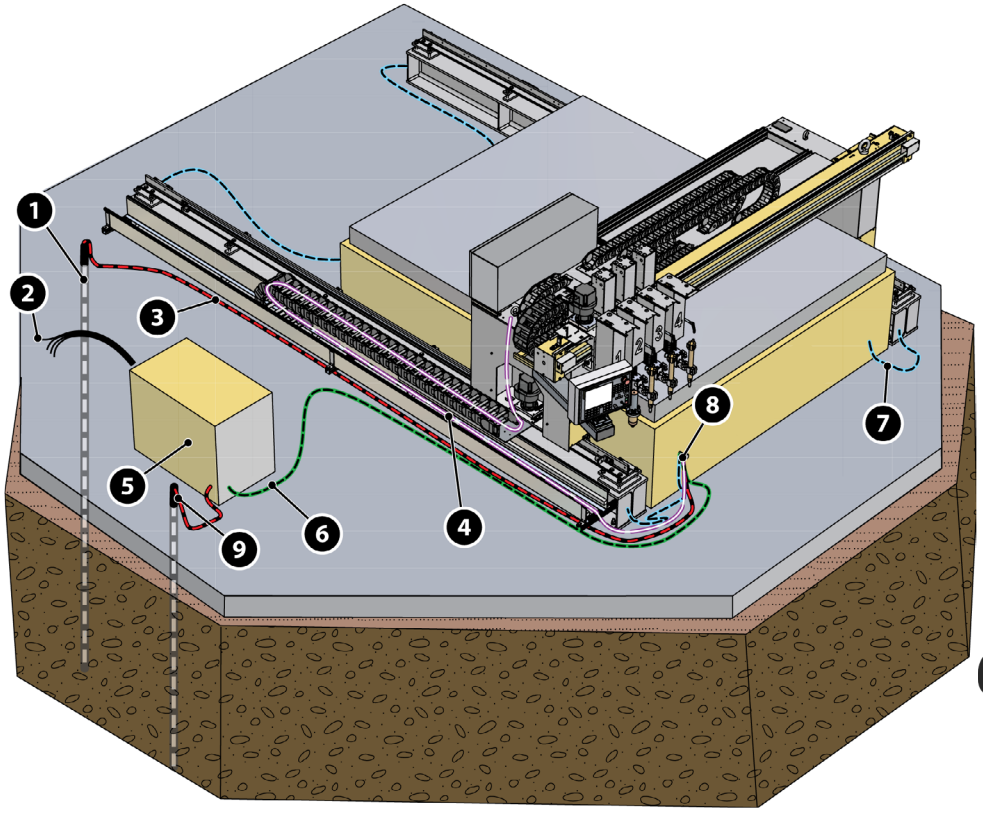
An earth ground provides a electromagnetic interference (EMI) to return to its source.

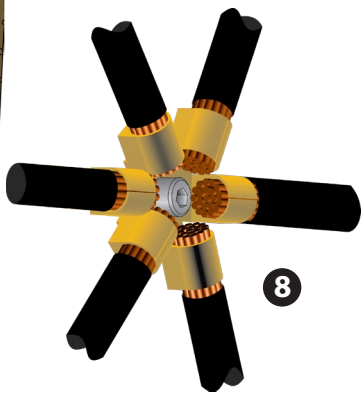
A protective earth (PE) ground provides a safe path for fault current. Without a properly grounded system, an unintended path through people or sensitive equipment may be found, resulting in serious injury, death, and/or premature equipment failure.

This section focuses on machines with a plasma cutting system. Machines with plasma cutting capability are particularly prone to electromagnetic interference problems and often utilize dangerous voltages and currents. All machines must have electrical components grounded and attached to an earth ground, regardless of process type (shape cutting, marking, or other material preparation).

Basic Layout

The electrical ground layout is similar for both large and small machines. The chassis ground 4, plasma positive electrical lead 6 and the rail ground cables 7 are attached to a common point 8 on the cutting table. This common connection is referred to as a ***star point*** (see illustration below). One cable 3 connects the star point to the Earth ground rod 1. The size of ground cables is dependant on the maximum current output of the plasma power supply 5. Specification of cable sizes is discussed later in this manual. Some country standards or directives require a separate ground rod 9 for the plasma power supply. Consult your machine schematics for more information.





Note: The three phase electrical input 2 to the plasma power supply must include an electrical ground.

This illustration demonstrates multiple ground cables fastened with a single bolt to create a star point 8. The location of the star point on the cutting table will vary.

INSTALLATION

Elements of a Ground System

The ground system consists of five main components:

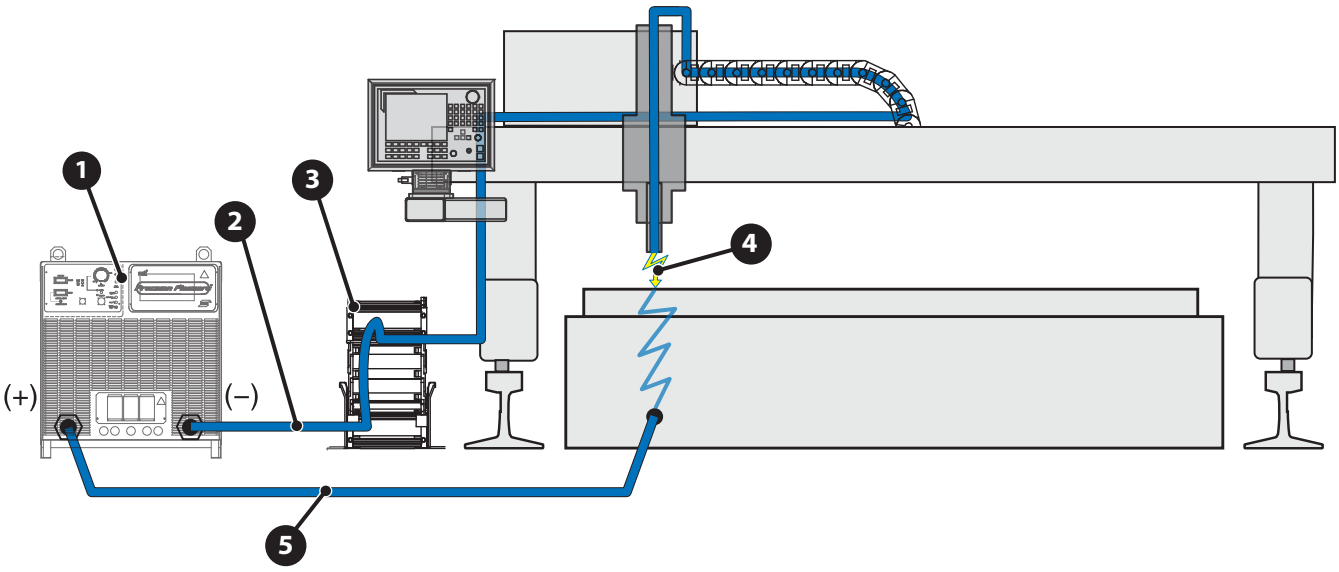
- plasma current return path
- plasma system safety ground
- utility power electrical ground
- cutting machine chassis ground
- rail system safety ground.

Ensure provisions are made during the installation for each of these elements for creating a complete ground system.

Plasma Current Return Path

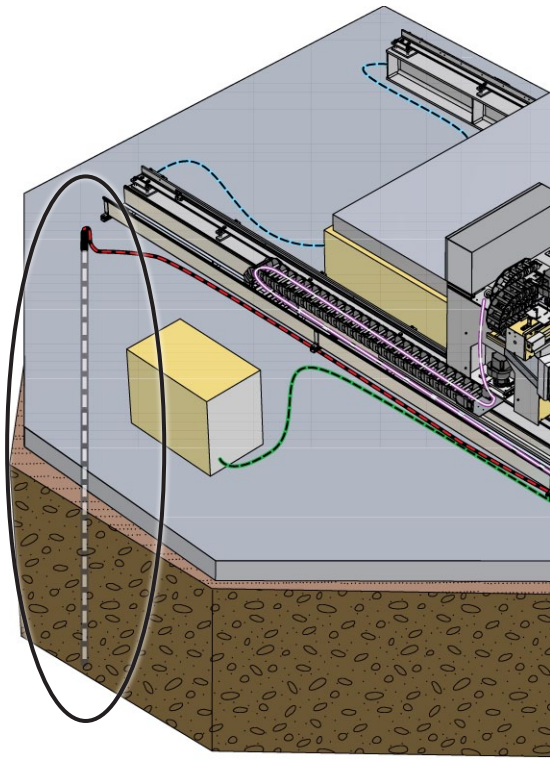
The return path ground cable is the most important element of the ground system. It completes the path for the plasma current. Solid, low impedance, well maintained electrical connections are a necessity.

The plasma cutting current is generated by the plasma power supply 1. A welding cable carries this current from the negative (-) connection 2 in the plasma power supply through the x axis cable chain 3 to the torch. The current then arcs 4 to the work piece on the cutting table. The current path must be closed so that the current can easily return to its source. This is done by connecting the cutting table to the positive (+) connection 5 on the plasma power supply. If the return path ground cable is not connected, the plasma system will not work. There will be no way for the arc to establish between the torch and the work piece. If the cable is connected, but the connections have a very high resistance, it will limit the current of the arc, and cause dangerous voltage levels between system components.



INSTALLATION

The only way to ensure that all components are at the same voltage level (same potential), and thus eliminate the possibility of being shocked, is to ensure that all interconnections are making good electrical contact. Good electrical contact requires that connections are made with bare metal to metal contact, the connections are very tight, and are protected from rust and corrosion. Use a grinder or wire wheel to clean all paint, rust, and dirt from the surface when connecting cable lugs to any metal surface. Use an electrical joint compound between cable lugs and metal surfaces to prevent future rust and corrosion. Use the largest size bolts, nuts, and washers possible, and tighten fully. Use lock washers to ensure that connections stay tight.



Plasma System Safety Ground

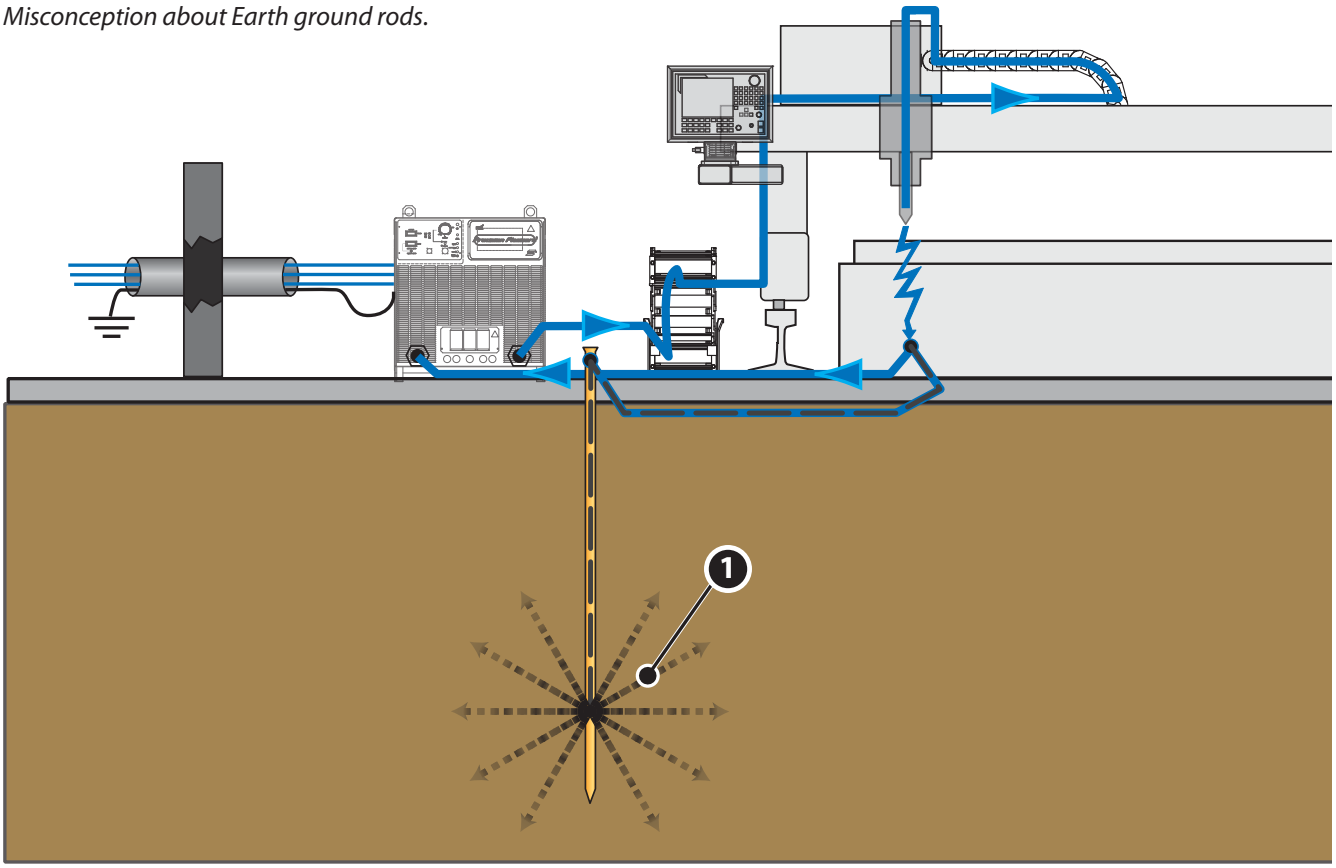
The plasma system safety ground (or ***ground rod***) serves several important purposes. It provides:

- Frame voltage for personnel safety by ensuring that there are no potential differences between system components and building components.
- A stable signal reference for all digital and analog electrical signals on the cutting machine.
- Helps control electromagnetic Interference (or EMI).
- Provides a discharge path for short circuits and high voltage spikes, such as those caused by lightening strikes.

INSTALLATION

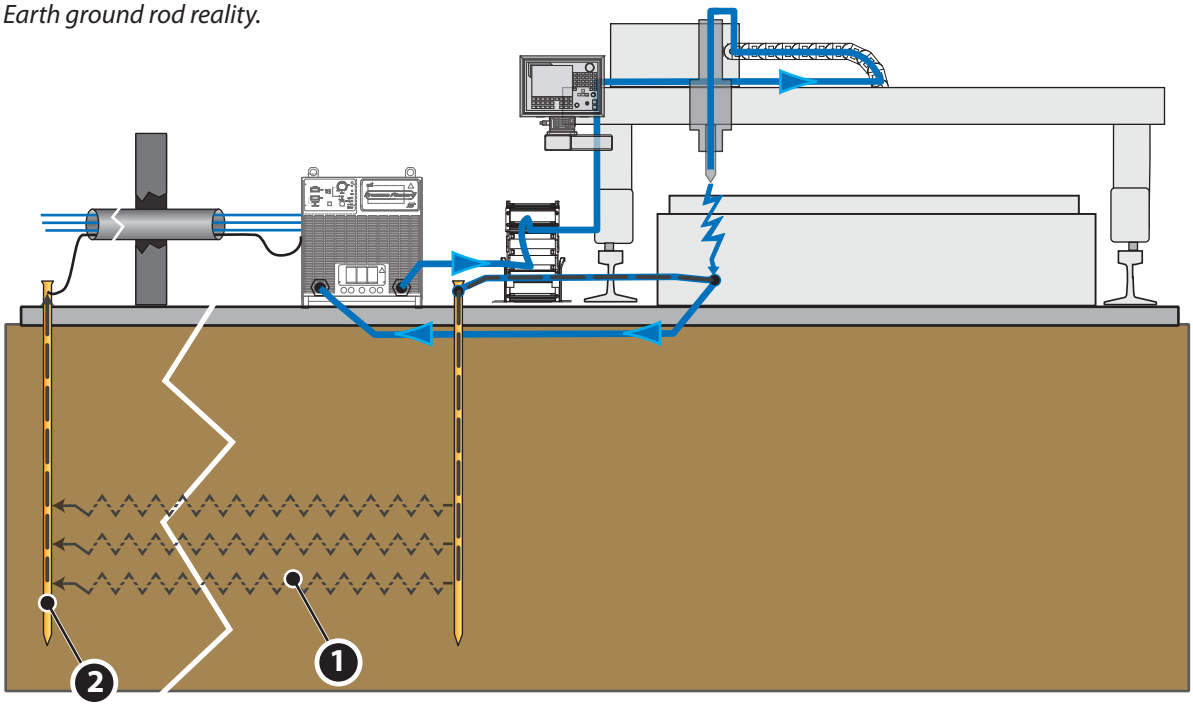
There are many misconceptions about the ground rod, and the role it plays in reducing electromagnetic interference. In theory, the ground rod is present to eliminate possible potential differences between equipment and building structures. However many people believe that the ground rod allows all radio frequency noise (1) to be absorbed and disappear into the Earth. Experience has shown that a good ground rod will eliminate radio frequency noise problems.

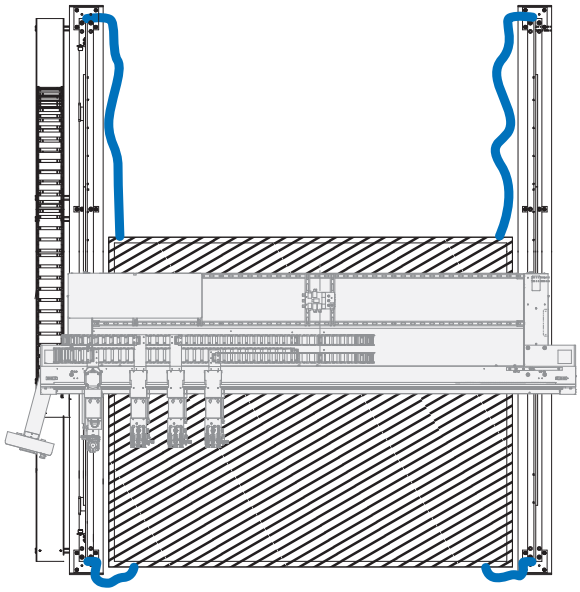
Misconception about Earth ground rods.



In reality the ground rod is providing a low impedance path by which noise currents ❶ may return to their source ❷.

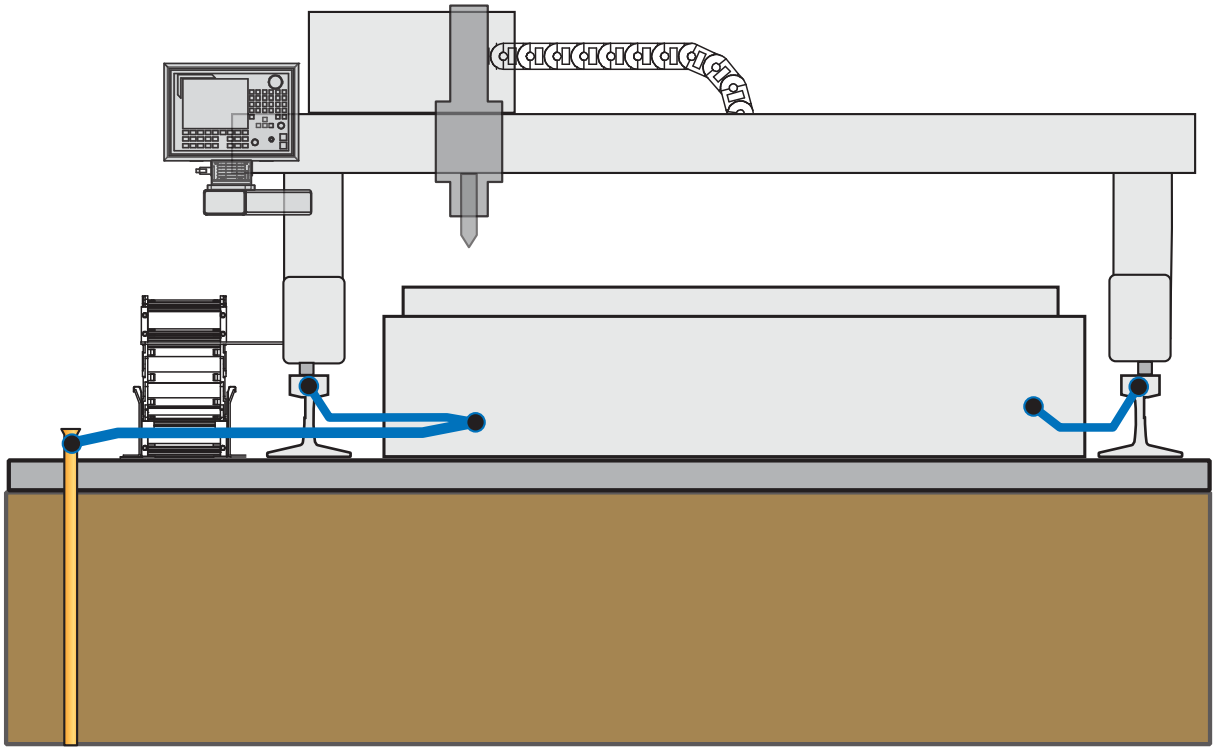
Earth ground rod reality.





Rail System Safety Ground

The rail system safety ground makes sure that the entire rail is at ground potential, eliminating any possible shock hazard, and providing backup for the machine chassis ground in case of a plasma current short circuit. All four corners of the rail system should be connected to the cutting table.



Earth Ground Rod

The best way to make sure that your Earth ground connection is optimized is to enlist the services of a professional. There are a number of engineering firms which specializes in designing and installing Earth grounding systems. However, if this option cannot be used, then there are several things which can be done to ensure that your Earth ground connection is good:

Ground Rod

The ground rod itself can be optimized in two ways: length and diameter. The longer the grounding rod, the better the connection. The same is true for diameter: the larger the diameter, the better the connection. However, if the soil resistance is very low, then a ground rod longer than 3m [10 feet] does not make a significant difference. Since soil resistivity is rarely as good as it could be, a standard grounding rod should be 25mm [1 inch] in diameter and 6m [20 feet] long.

Soil Resistivity

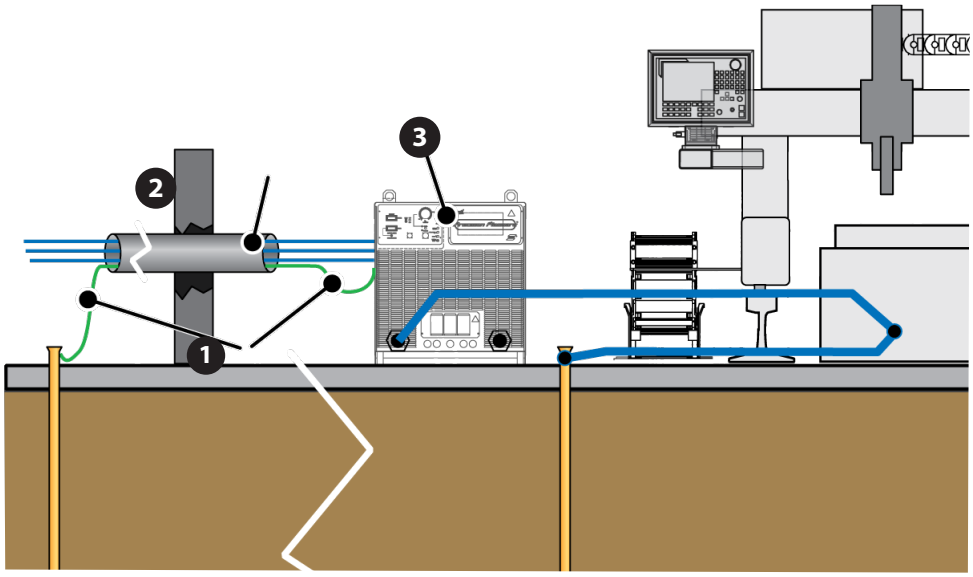
Soil resistivity can be changed in two ways: by altering the mineral content, the moisture content, or both. The ideal solution to poor soil resistivity is to excavate the immediate area and backfill with conditioned soil additives. In extremely dry areas, the moisture content can be improved by installing a drip system which continually moisturizes the soil surrounding the ground rod. A crude way of affecting soil moisture and content is to use salt water, or rock salt to condition the surrounding soil.

Utility Power Electrical Ground

The utility power electrical ground must accompany all 3 phase and single phase power feeds. This electrical ground provides the proper reference for all incoming power. Failure to provide this ground is a violation of most electrical codes, and a serious safety hazard.

Depending on the 3 phase power arrangement (either a “Delta” or a “Y”), the line to ground voltage may be equal to, or less than the line to line voltage. A problem exists any time the line to ground voltage exceeds any individual line to line voltage (difference in potential). Contact your local utility company if you are not sure that your 3 phase power has a proper electrical ground. Make sure that your electrical contractor properly installs the electrical ground wire with all 3 phase and single phase power feeds.

The electrical ground must be connected to the appropriate terminal inside of the plasma power supply. Size wire according to local electrical codes.

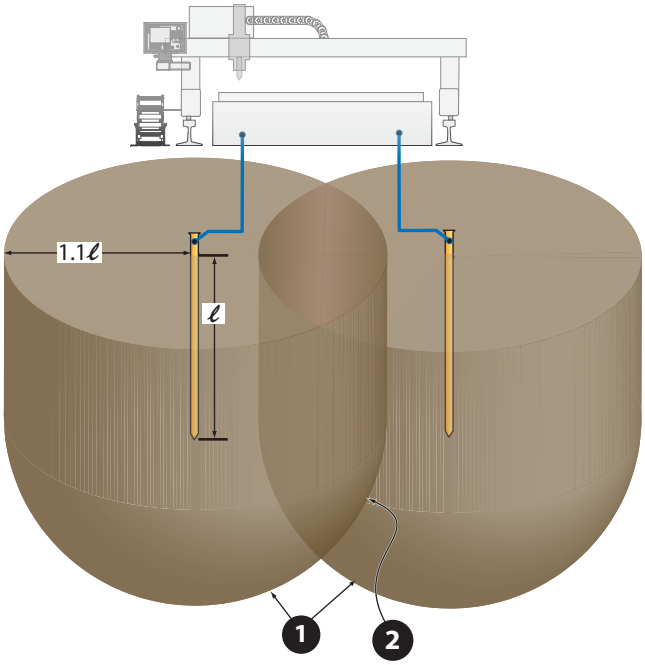


1. *Utility Power Electrical Ground*
2. *3 Phase Electrical Supply*
3. *Plasma Power Supply*

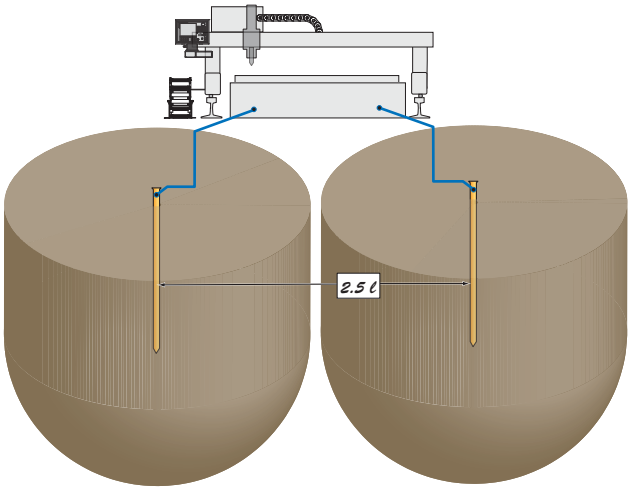
Multiple Ground Rods

There are a number of reasons why multiple ground rods should not be used. While installing multiple rods may improve a safety ground or lightening ground, it offers no advantage for electromagnetic interference reduction, and can cause more problems than it is worth.

The problem with multiple ground rods is that each rod uses an "interfacing Electromagnetic Interference sphere" 1 of earth, having a radius of 1.1 times the length of the rod. Overlapping of these Electromagnetic Interference spheres 2 causes a loss in grounding effectiveness proportional to the amount of overlap.



Multiple ground points can also create undetectable "sneak" pathways for radio frequency noise currents, actually causing more interference! Instead of considering multiple ground rods, take steps to make the single ground rod as good a ground connection as possible.

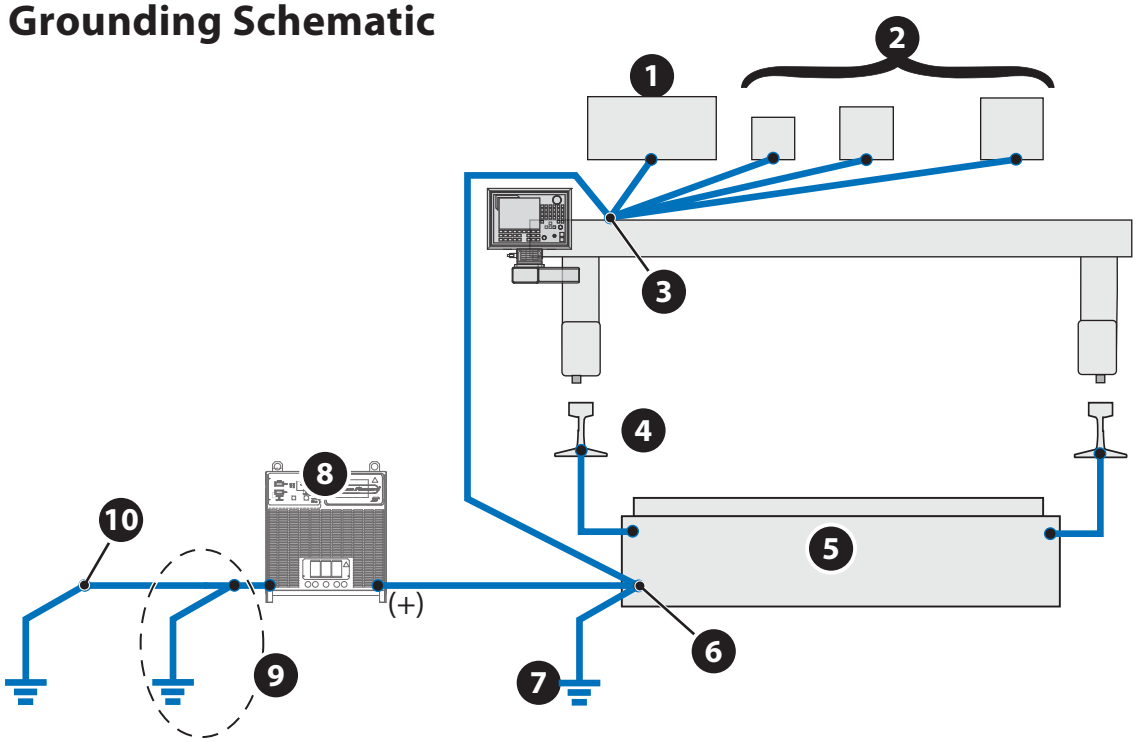


Multiple ground rods should be avoided if possible. However, if all other avenues have been explored to lessen your systems' electronic interferences, multiple ground rods are an option.

Such a system should be installed by a professional and the distance between the rods should exceed 2.5 times the length of the rods.

INSTALLATION

Machine Grounding Schematic



1. *Main Control Enclosure*
2. *Component Enclosures*
3. *Main Star Ground*
4. *Rails*
5. *Cutting Table*
6. *System Star Ground (on Table)*
7. *Earth Ground Rod*
8. *Plasma Power Supply*
9. *Plasma Power Supply Ground (required by EU Standards)*
10. *Electrical System Ground*

- **All electrical enclosures bolted to the machine chassis**
- **Machine chassis grounded to star point on cutting table.**
- **Rails grounded to cutting table**
- **Plasma ground connected to star point on cutting table**
- **Earth ground rod connected to star point on cutting table.**
- **A separate ground rod is required for the plasma power supply by some regulations and directives. Check with local regulations to determine if this additional ground rod is required.**

INSTALLATION

Check upon receipt

1. Verify all the system components on your order have been received.
2. Inspect the system components for any physical damage that may have occurred during shipping. If there is evidence of damage, please contact your supplier with the model number and serial number from the nameplate.

Before Installation

⚠ WARNING	**All installation and service of the electrical and plumbing systems must conform to national and local electrical and plumbing codes. Installation should be performed only by qualified, licensed personnel. Consult your local authorities for any regulation issues.**

Locate the major components to the right position prior to making electrical, gas, and interface connections. Refer to the system interconnection diagrams for major components placement. Ground all major components to earth at one point. To prevent leaks, make sure to tighten all gas and water connections with specific torque.

3.1 Placement of Power Supply

⚠ WARNING	**Failure to follow instructions could lead to death, injury or damaged property. Follow these instructions to prevent injury or property damage. You must comply with local, state and national electrical and safety codes.**

- A minimum of 1 meter (3 ft.) clearance on front and back for cooling air flow.
- Plan for top panel and side panels having to be removed for maintenance, cleaning and inspection.
- Locate the power supply relatively close to a properly fused electrical power supply.
- Keep area beneath power supply clear for cooling air flow.
- Environment should be relatively free of dust, fumes and excessive heat. These factors will affect cooling efficiency.

Input Power Connection

⚠ WARNING	**Electric shock can kill! Provide maximum protection against electrical shock. Before any connections are made inside the machine, open the line wall disconnect switch to turn power off.**

Input power must be provided from a line (wall) disconnect switch that contains fuses or circuit breakers in accordance to local or state regulations.

Input Conductors

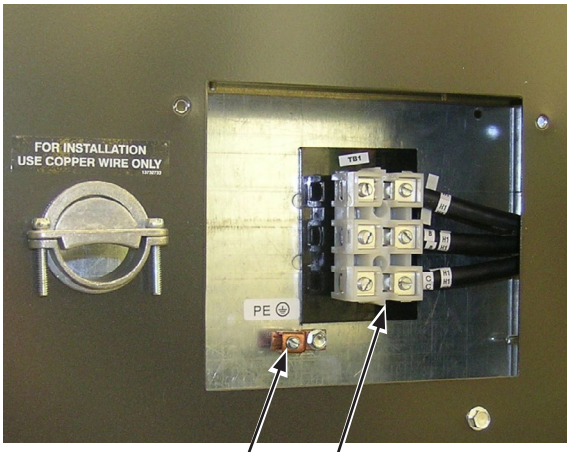
- Customer needs to supply the input conductors, which may consist either of heavy rubber covered copper conductors (three power and one ground) or run in solid or flexible conduit.
- Size of input conductors is dependent on the current. Please refer to the specific power supply manual for the size on input conductors.

INSTALLATION

Input Connection Procedure

1. Remove cover panel.
2. Thread cables through the access opening.
3. Secure cables with strain relief at the access opening.
4. Connect the ground lead to the stud on the chassis.
5. Connect the power leads to the primary terminals.
6. Connect the input conductors to the line (wall) disconnect.
7. Before applying power, replace the cover panel.

Connection example of EPP-360



⚠ WARNING

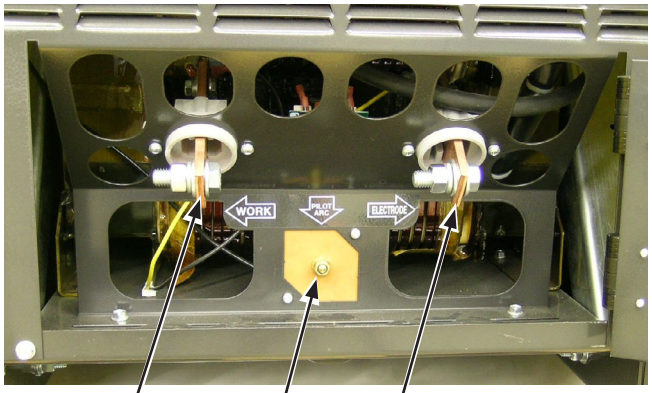
Electric shock can kill! Dangerous voltage and current may be present any time working around a plasma power source with covers removed:

- **DISCONNECT POWER SOURCE AT THE LINE (WALL) DISCONNECT.**
- **HAVE A QUALIFIED PERSON CHECK THE OUTPUT BUS BARS (POSITIVE AND NEGATIVE) WITH A VOLTMETER.**

Output Connection Procedure

1. Open access panel on the lower front of the power source.
2. Thread output cables through the openings at the bottom of the power source immediately behind the front panel.
3. Connect cables to designated terminals mounted inside the power source using UL listed pressure wire connectors.
4. Close front access panel.

Connection example of EPP-360



Interface Cables/Connections

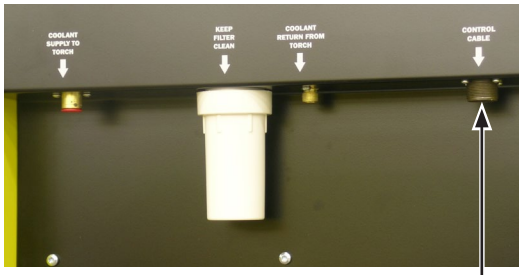
Connection example of EPP-360

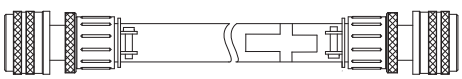
CNC Interface Cable

Water Cooler Interface Cable

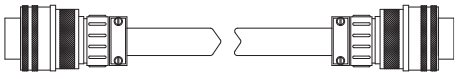
RAS Box front view

CC-11 rear view





CNC Interface Cables			
Part Number	Length	Part Number	Length
0558004651	7.6m	0558004654	30.5m
0558004652	15.0m	0558003978	38.1m
0558004653	22.8m	0558004655	45.7m



Water Cooler Interface Cables	
Part Number	Length
0558004837	5.0m
0558004838	10.0m
0558004839	20.0m

3.2 Placement of CC-11 Coolant Circulator

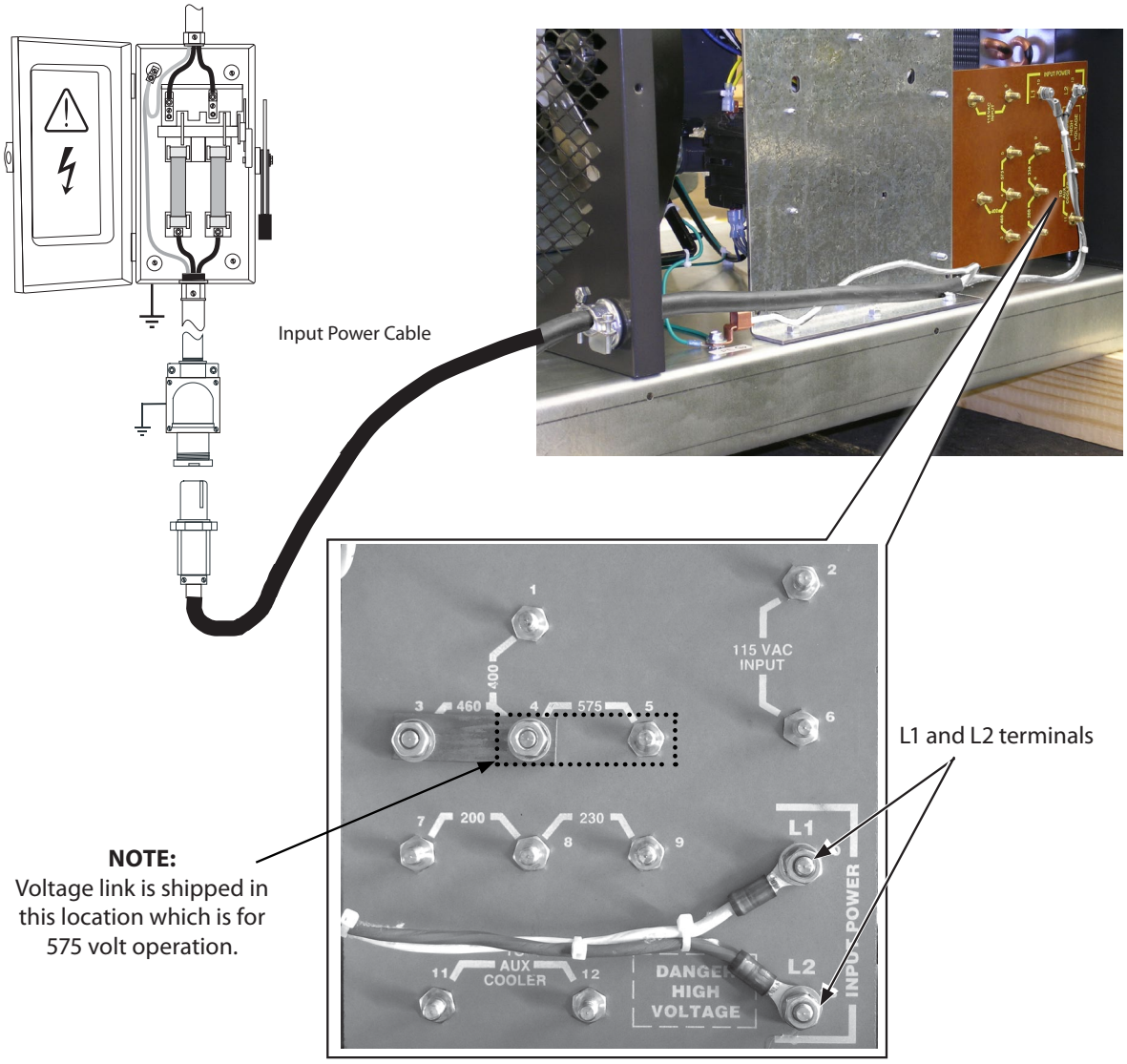
Install the CC-11 in an appropriate location so as to maintain adequate and unrestricted airflow into and out of the cabinetry.

Input Power Connection

A 3-conductor power cable suitable to meet the required input power must be installed. The cable must have 0.25" (6.4 mm) ring lugs installed on the machine end. Connect the power leads to the L1 and L2 terminals and the ground lead to the ground lug located on the base near the rear panel. A strain relief fitting is provided to feed a power cable through the rear panel of the cabinet. Please refer to the CC-11 Instruction manual for details. Electrical installation must be in accordance with local electrical codes for this type of equipment.

⚠ CAUTION

Voltage link MUST be moved if equipment is operated at any voltage other than 575V. Failure to move voltage link to location that matches input voltage can result in damage to equipment.



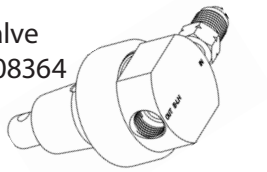
Typical connection for 460 VAC input

Coolant Connections and Optional Equipment

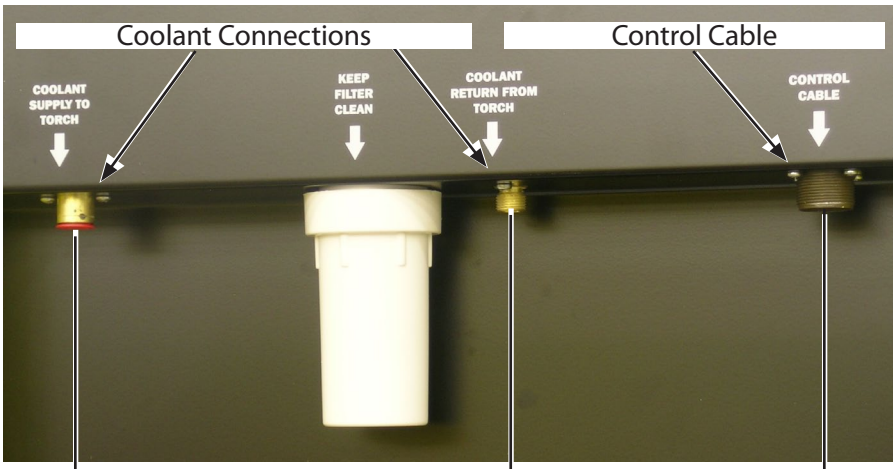
Connect the hoses to the CC-11 accordingly.

When the CC-11 unit is installed above the plasma torch location, Shut-off Valve (p/n 0558008364) should be ordered and installed. It is connected to the CC-11 using the "Coolant Supply To Torch" fitting located on the rear panel. The shut-off valve closes when delivery pressure falls below approximately 25 psig (1.7 bar). This will insure that water does not drain from the unit when changing consumables.

Shut-off Valve
p/n 0558008364



CC-11 rear view



RAS Box front view

An 8-pin receptacle J1 is provided on the rear panel to supply the CC-11 with 115 VAC control voltage for pump motor contactor control. The CC-11 is normally supplied with this control voltage in order for the pump and fan to operate. J1 also provides contact closure signals for a satisfied 1.00 gpm (3.8 l/min) flow switch (pins D and C) and coolant level switch satisfied (pins E and H).

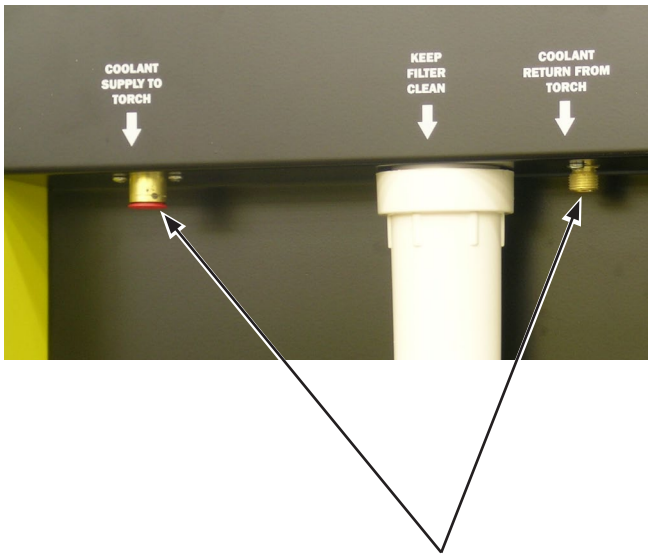
Connection example of EPP-360

INSTALLATION

These connectors are located on the back of the unit. Connect the hoses to the CC-11 accordingly. The torch hose ends should be fitted with one 5/8"-18 male left-hand air / water hose and one 5/8"-18 female right-hand air / water hose connector.

With the torch and the CC-11 connected, fill the reservoir with the specially formulated torch coolant. Do not use regular anti-freeze solutions, such as for an automobile, as the additives will harm the pump and torch. ESAB P/N 0558004297 is recommended for service down to 12° F (-11° C). ESAB P/N 156F05 is recommended for service below 12° F (-11° C) to -34° F (-36° C).

After filling the reservoir, run the pump with its cap removed in order to purge air from the radiator, hoses, and torch. Re-check coolant level to ensure reservoir is filled. Replace reservoir cap after purging and checking coolant level.



Coolant Connections

3.3 Placement of RAS Box

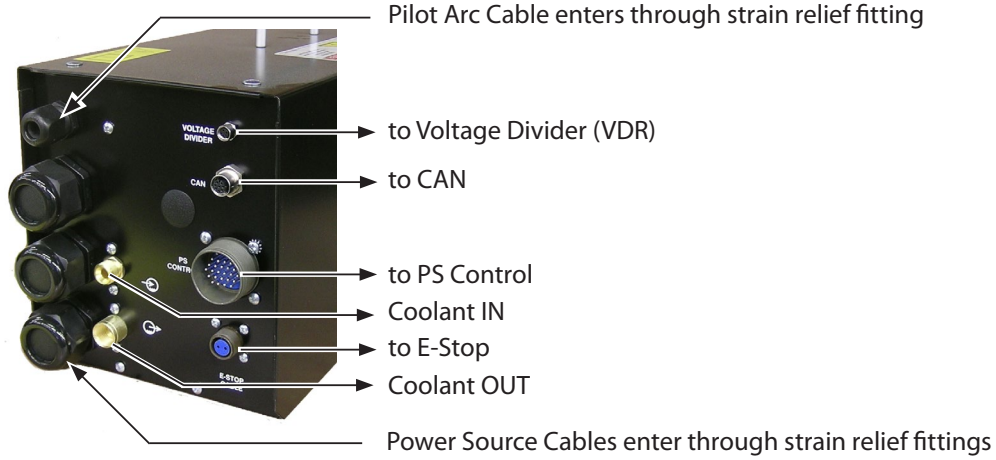
Connections on the RAS Box

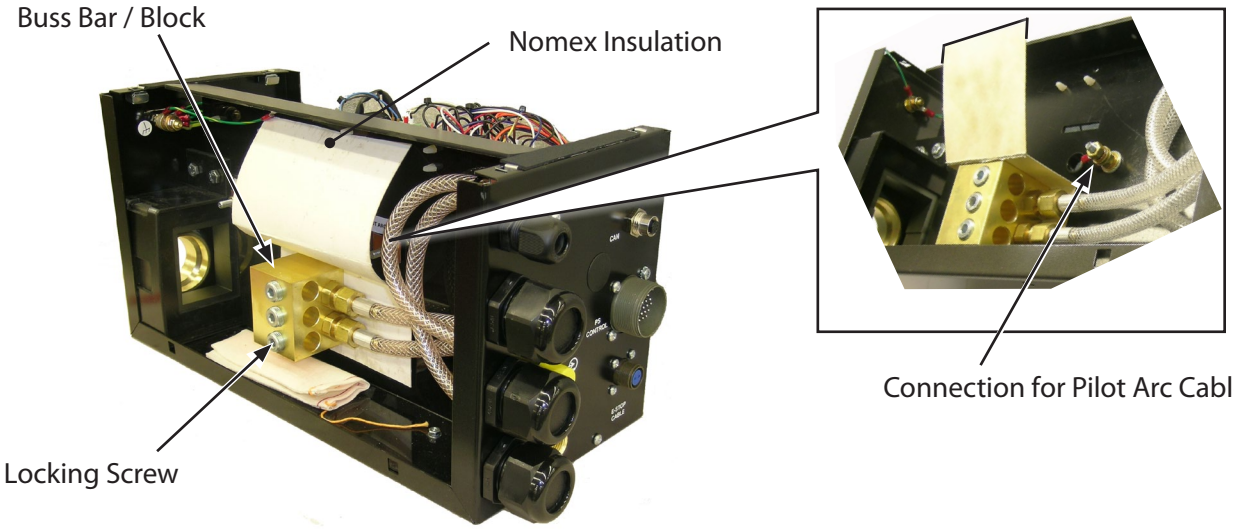
1. Remove or unlock the cover screws and lift the box cover off to expose internal components.

WARNING

The cover is grounded to the Remote Arc Starter Box internally with a short ground wire. Remove cover carefully to avoid damage to the wire or loosening of the ground wire.

2. Power cables pass through the strain relief fittings.





3. Strip back the insulation of the 4/0 (95 mm^2) cable, approximately 38 mm.
4. Insert the 4/0 (95 mm^2) cable in the buss bar/block hole until copper extends to the edge of the buss bar / block.
5. Tighten the locking screw(s) down on the cable.

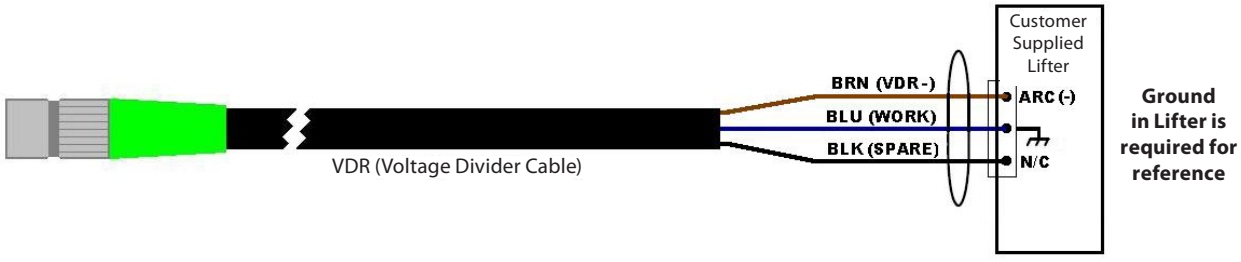
Standard VDR Cable

VDR Cable (with free end)

6. If a non-ESAB lifter is to be used with a system the supplied VDR cable will only have a connector on one end. The other end of the cable will have no connector. The end with the supplied connector is to be connected to the RAS box to its corresponding socket which is labeled "Voltage Divider."

   The free end of the VDR cable will be connected to the lifter. Although this is a three conductor cable, only two of the wires are used, BRN (VDR -) and BLU (WORK). The black wire is a spare and is to be terminated and capped inside of the lifter. The corresponding pin at the RAS box comes terminated from the factory. The RAS box is not to be modified.

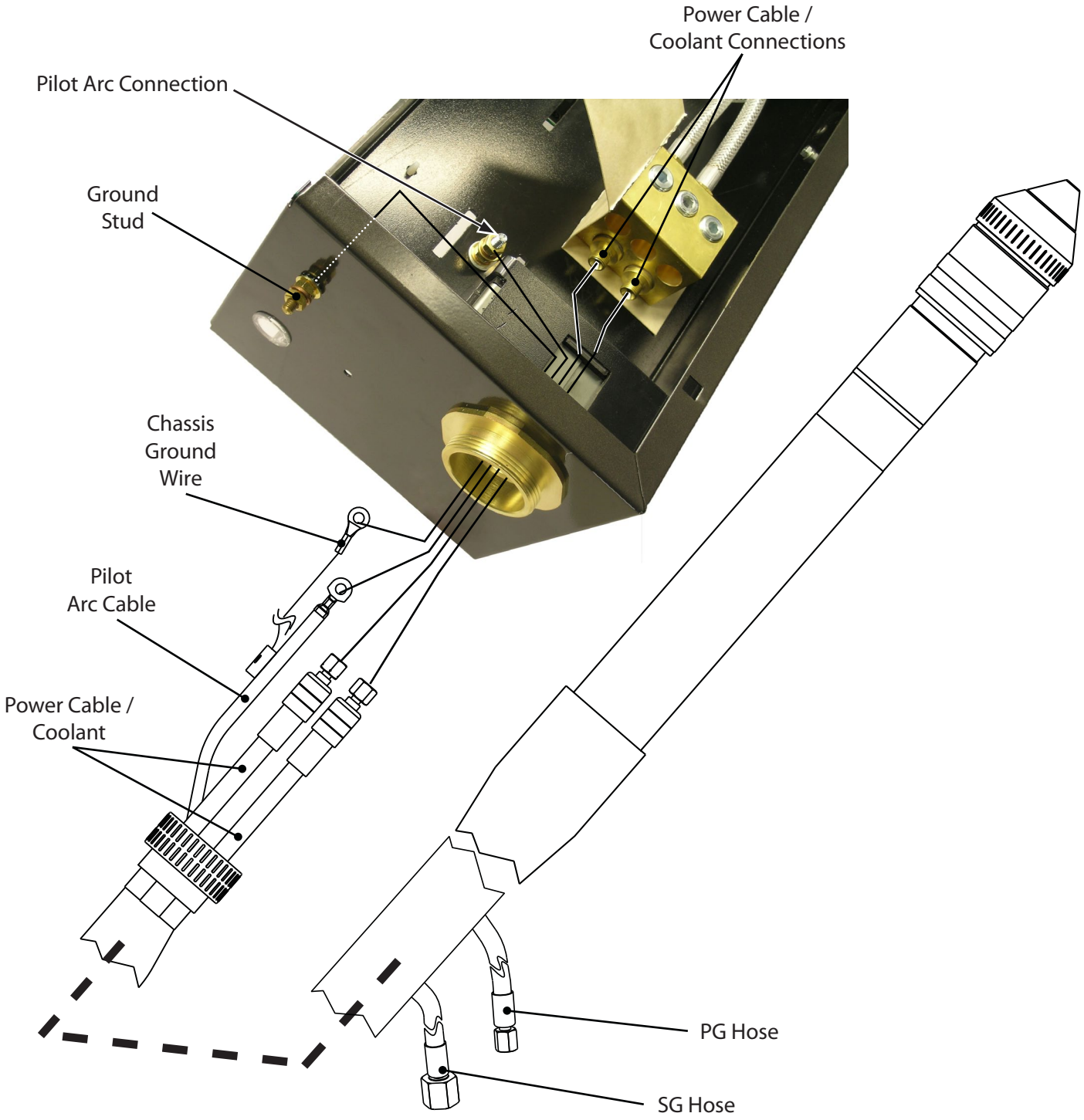
   It is imperative that the BLUE wire be connected to ground. The BROWN wire is the VDR(-) output.



3.4 Torch Connections

Torch hook-up requires the connection of power cables / coolant hoses, pilot arc cable and chassis ground. On the PT-36 torch, the coolant hoses from the RAS box to the torch also carry electrode power.

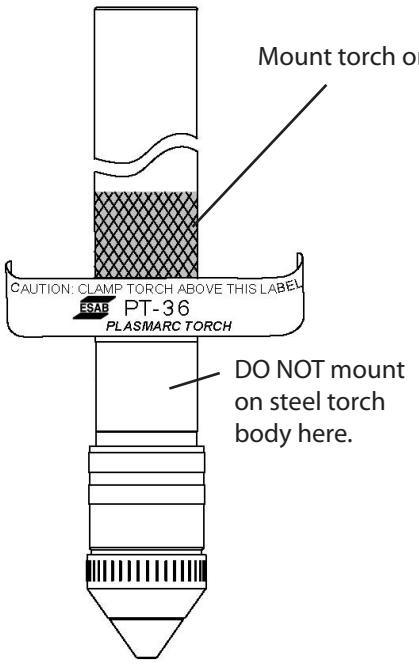
The pilot arc cable is connected inside the arc starter box. The pilot arc cable also has a green/yellow wire that is connected to a grounding stud.



3.5 Mounting Torch to Machine

WARNING

Clamping on Torch body may cause dangerous current to flow through machine chassis.



- Do not mount on stainless steel torch body.
- Torch body is electrically insulated, however high frequency start current may arc through to find a ground.
- Clamping near torch body may result in arcing between body and machine.
- When this arcing occurs, torch body may require non-warranty replacement.
- Damage to machine components may result.
- Clamp only on insulated torch sleeve (directly above label) not less than 1.25" (31.75 mm) from the torch end of the sleeve.
- PT-36 Torch has an outside diameter of 50mm for standard mounting.

3.6 Placement of ICH

The ICH should be located close to the operator for easy access.

Connect required CAN cables between ICH and other CAN nodes, such as Remote Arc Starter (RAS), B4 lifter, if applicable. CAN connection is always made from left to right, if one node is removed from CAN bus, all nodes on the right need to be shifted to left. After connecting all CAN nodes, a terminator is required. Leave all unused CAN ports open.

Connect DB37 cable to port "CNC" on ICH. The other side of DB37, is connected to the customer's CNC via a male DB37 connector. An optional breakout board may be used.

Connect power from ICH to SGC and B4 lifter, if applicable. Make sure the power switch on ICH is off.

Connect power to ICH box.

3.7 Placement of SGC

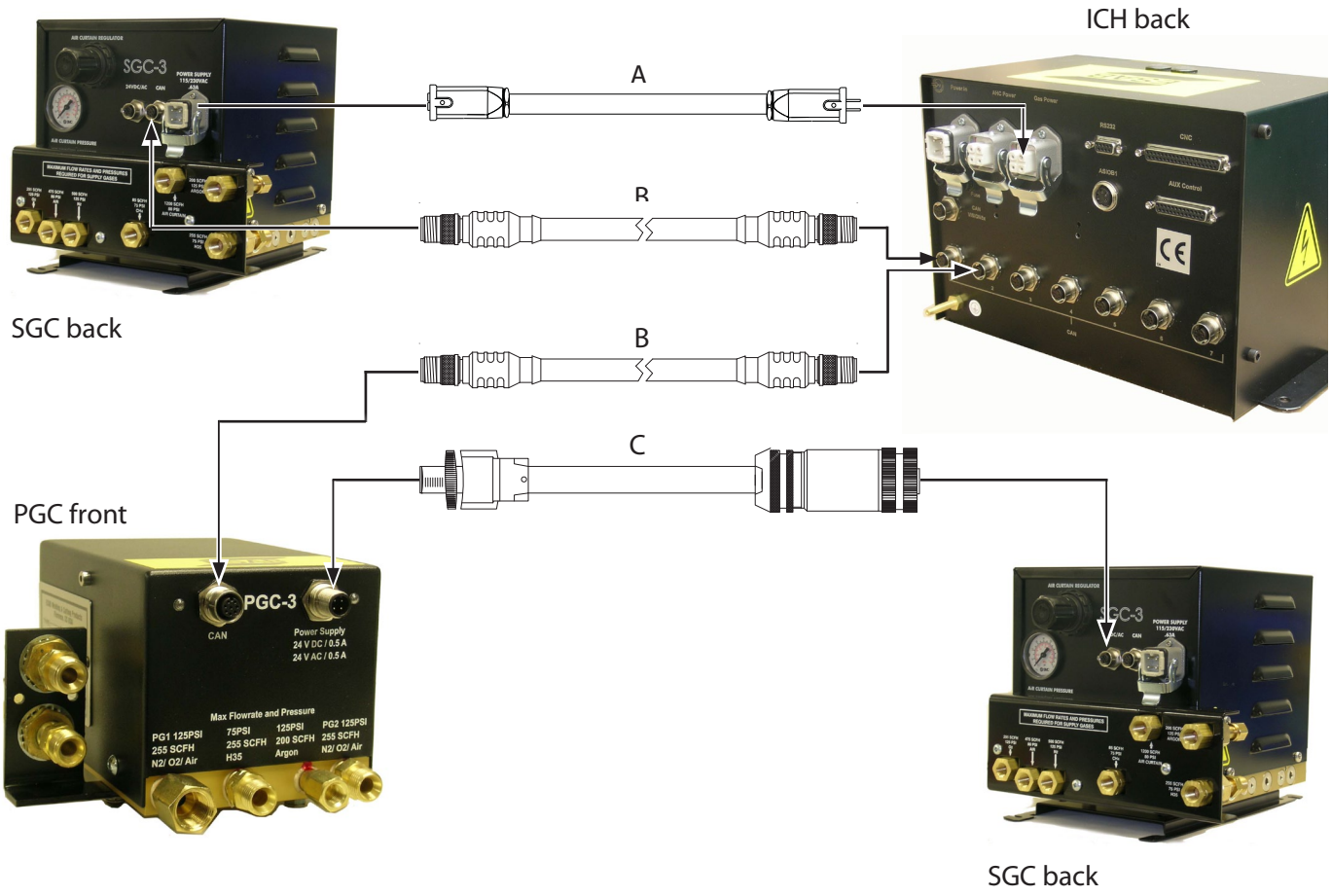
The Shield Gas Box selects different gases (Air, N2, O2, CH4) to mix shield gas (SG), plasma gas 1 (PG1), and plasma gas 2 (PG2). The selections are done through a group of solenoids integrated on a manifold. The CNC sends commands through CAN-bus to operate all these solenoids. The gas output of the Shield Gas Box is monitored and fed back through the CAN-bus to CNC for self-diagnosis. Also, the Shield Gas Box controls the solenoid for operation of the Air Curtain.

3.8 Placement of PGC

The Plasma Gas Box regulates the output of the plasma gas (PG) selected from the four gas inlets (Argon, H35, PG1 and PG2). It is powered by 24 Volts (AC and DC) from the Shield Gas Box and receives commands via the CAN-bus directly from the CNC.

Individual Component Connections

Part numbers and lengths for the cables shown below are provided on the following page.



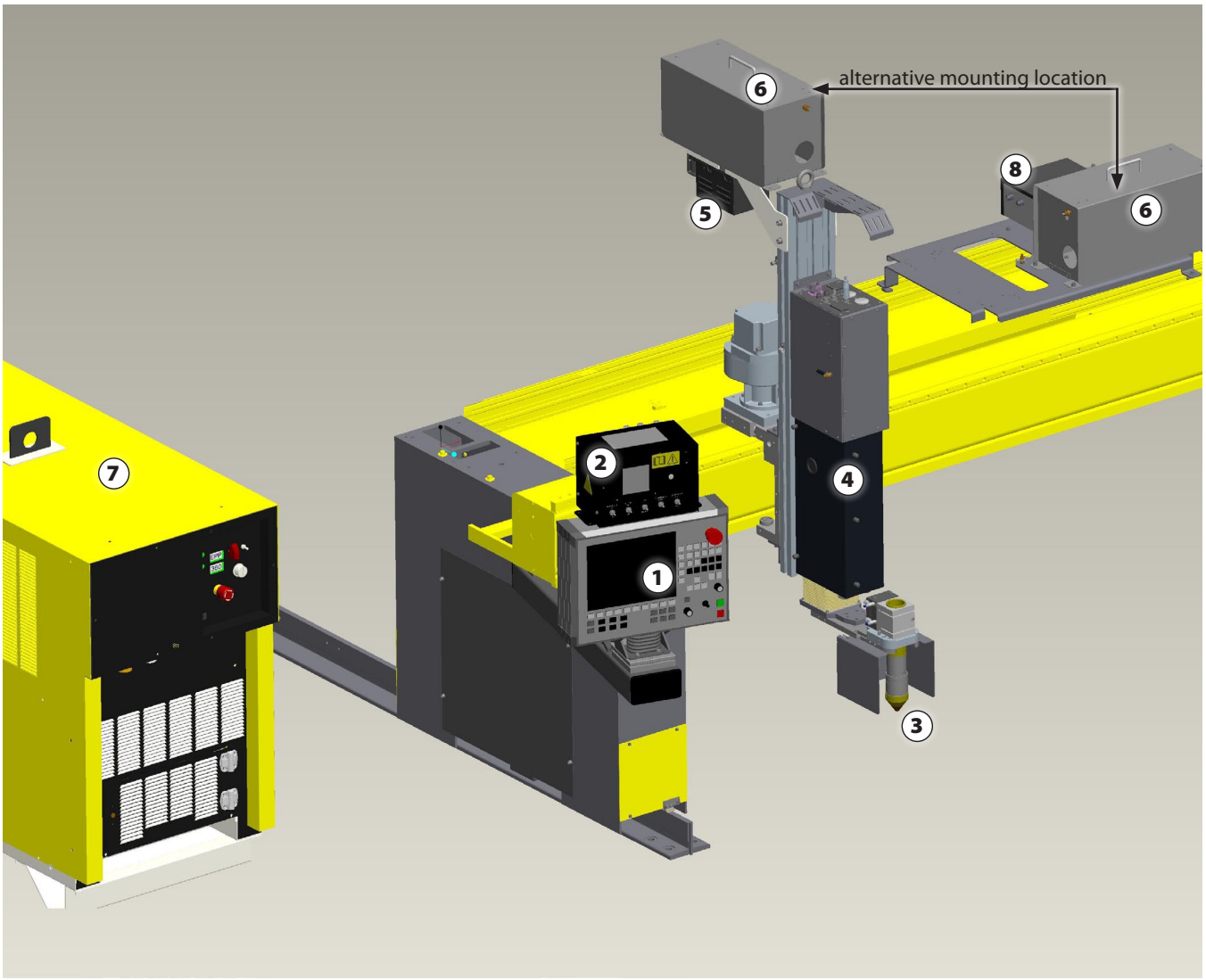
"A" - Power cable from ICH to SGC (115/230V)			
Part Number	**Length**	**Part Number**	**Length**
0560947962	1m (3.3')	0560947088	5m (16')
0560946776	2m (6.4')	0560947089	6m (19')
0560947964	3m (10')	0560947090	7m (23')
0560947087	4m (13')		

"B" - CAN cable from ICH to PGC/SGC			
Part Number	**Length**	**Part Number**	**Length**
0558008464	1m (3.3')	0558008473	10m (33')
0558008465	2m (6.5')	0558008474	11m (36')
0558008466	3m (10')	0558008475	12m (39')
0558008467	4m (13')	0558008476	13m (43')
0558008468	5m (16')	0558008477	14m (46')
0558008469	6m (19')	0558008478	15m (49')
0558008470	7m (23')	0558008479	20m (66')
0558008471	8m (26')	0558008809	25m (82')
0558008472	9m (30')	0558008480	36m (118')

"C" - Power cable SGC to PGC (24 VAC/DC)			
Part Number	**Length**	**Part Number**	**Length**
0560947079	1.5m (5')	0560947064	8m (26')
0560947080	3m (10')	0560947065	9m (30')
0560947061	4m (13')	0560947082	10m (33')
0560947081	5m (16')	0560946780	12.8m (42')
0560947062	6m (19')	0560947066	15m (49')
0560947063	7m (23')	0560947083	20m (66')

INSTALLATION

Component Placement Example



Components	
1	CNC
2	Interface Control Hub (ICH)
3	PT-36 Torch
4	B4 Lift
5	Plasma Gas Control (PGC)
6	Remote Arc Starter Box (RAS)
7	Power Supply
8	Shield Gas Control (SGC)

INSTALLATION

INSTALLATION

OPERATION

OPERATION

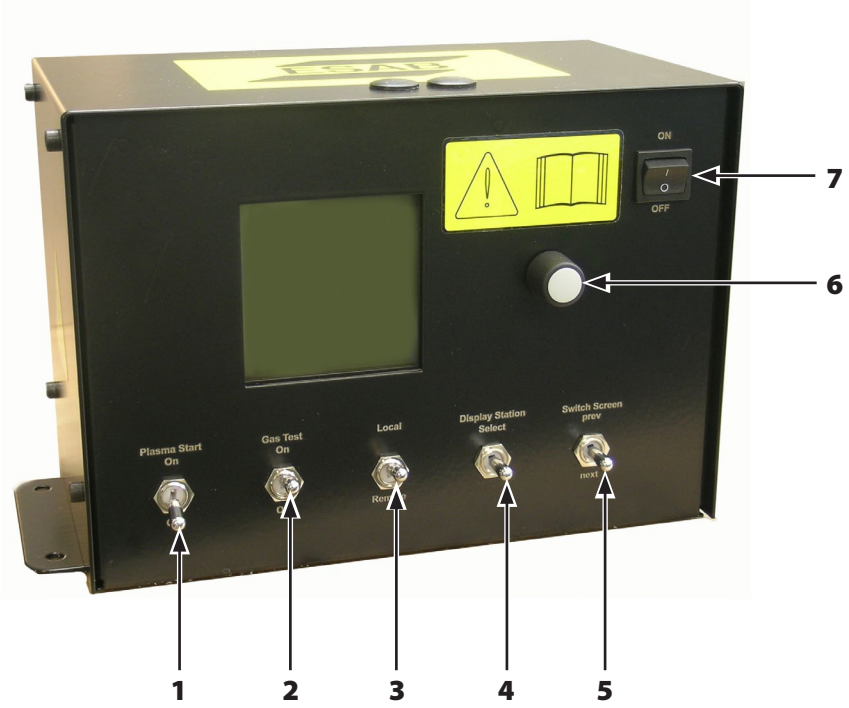
4.0 Interface Control Hub

The ICH (Interface Control Hub) is used to interface the ESAB m3 Process Control with the customer CNC using RS232/RS422/RS485 and digital I/O.

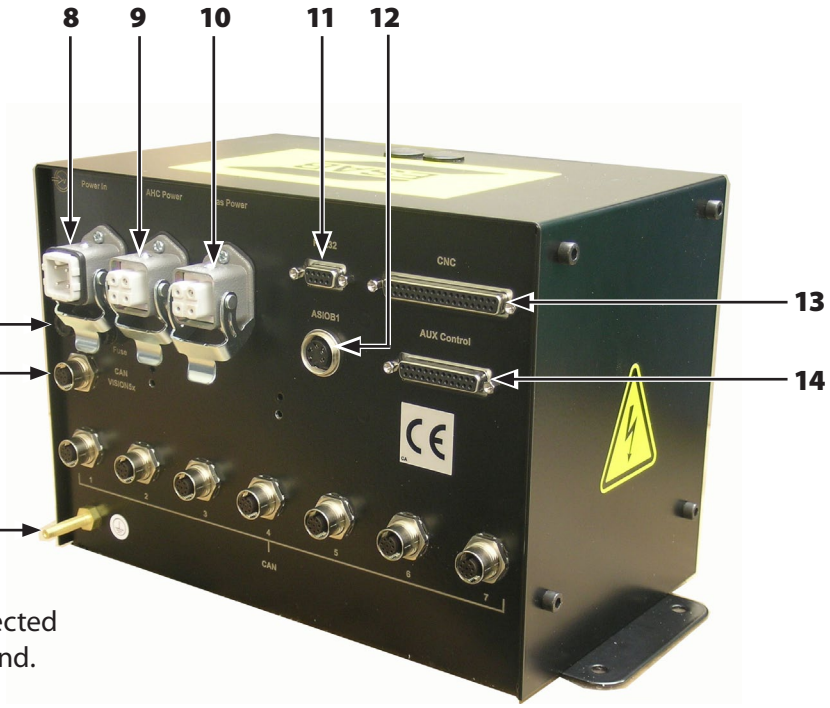
Operation of the m3 G2 system can be made via the ICH (Interface Control Hub) in the following modes.

1. Remote mode without serial communications. (Default)
2. Remote mode with serial communications.
3. Local mode - diagnostics only.

The following pages describe how to operate the ICH.



ICH front view



Note:
Chassis must be connected to the machine ground.

ICH back view

4.1 Operation

ICH Connectors

Item Number	Item	Description
1	**Plasma Start**	In Local mode, this switch will start the plasma process. If the Gas Test switch is set to on, then the process will go into TEST Mode. In TEST Mode the power supply faults, errors, and warnings are ignored while at the same time the steps for starting the power supply and turning HF on are skipped.
2	**Gas Test**	In Local mode, this switch will start the plasma gas and shield gas at their start values. If the plasma start switch is turned on after this one, the plasma process will start in TEST mode.
3	**Local/Remote**	This switch will change the ICH system from being remotely controlled, via the serial communications and digital inputs from the CNC, to locally controlled via the switches on the Interface Control Hub.
4	**Station Select**	This switch is a momentary switch which will change the station of which the information on the screen is displaying. If the system is in local mode, then the station selected will change to only the station displayed.
5	**Screen Select**	This switch will allow the user to select different screens.
6	**Encoder Wheel with Push Button**	This only has an effect in local mode under normal operation, when communication is set to none, and in the set up mode. This wheel will allow you to change the parameter the cursor is currently on. The button will also allow you to see a more detailed error message when on the error log screen. To work the wheel for editing a parameter, push the wheel, move the wheel to change the value, and then press the wheel again to lock in the value.
7	**Power Switch**	This switch will turn on the Interface Control Hub.
8	**Input Power**	Customer supplied input power to ICH. See specifications for power requirements.
9	**AHC Power**	Power connection for an ESAB lift (B4 or A6).
10	**Gas Power**	Power connection to the Shield Gas Control (SGC), which provides 24 VAC/DC to the Plasma Gas Control (PGC).
11	**RS232**	RS232 protocol for remote control if needed.
12	**ASIOB1**	ASIOB1 protocol for retrofitting older ESAB systems.
13	**CNC**	DB37 connector to interface to customer I/O. This also has the RS422/485 connections.
14	**AUX Control**	DB25 connector for auxiliary options such as Air Curtain.
15	**CAN Vision 5x**	Not used.
16	**Fuses**	Replace fuses with same type and size.

Display Screens

Startup Screen

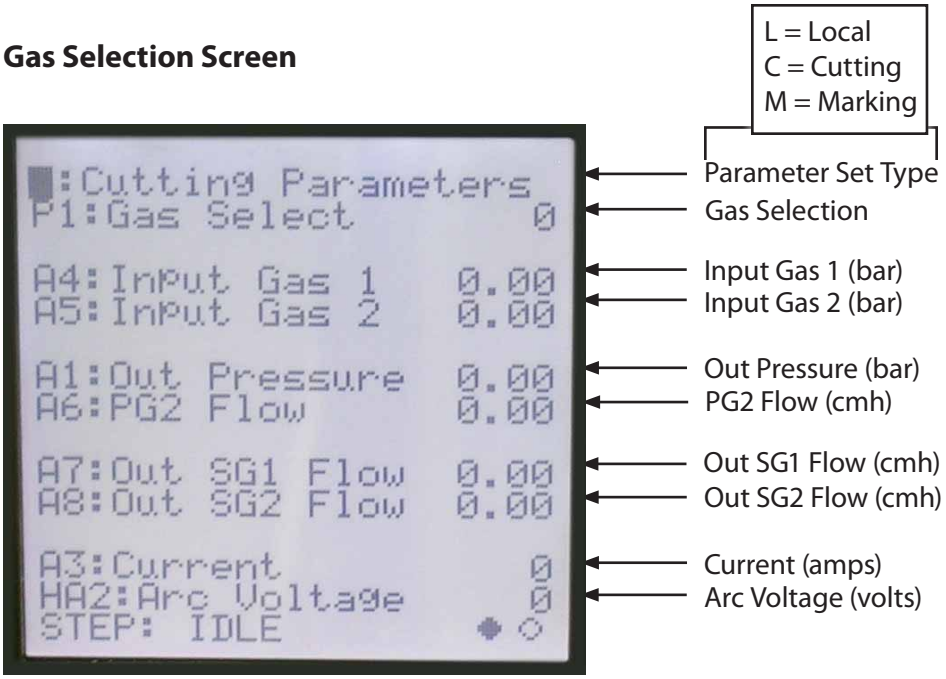
On powerup the ICH screen displays the following information for 3 seconds:

Editing a Parameter on the Display

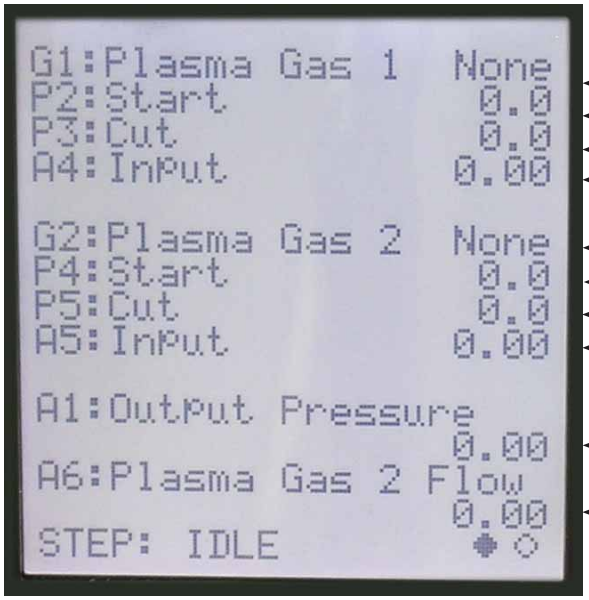
Only available when communication is set to none or Local/Remote switch is set to Local.

1. Use the encoder wheel to scroll to the parameter.
2. Push the wheel.
3. Turn the wheel to edit the value.
4. Push the wheel again to lock the value.

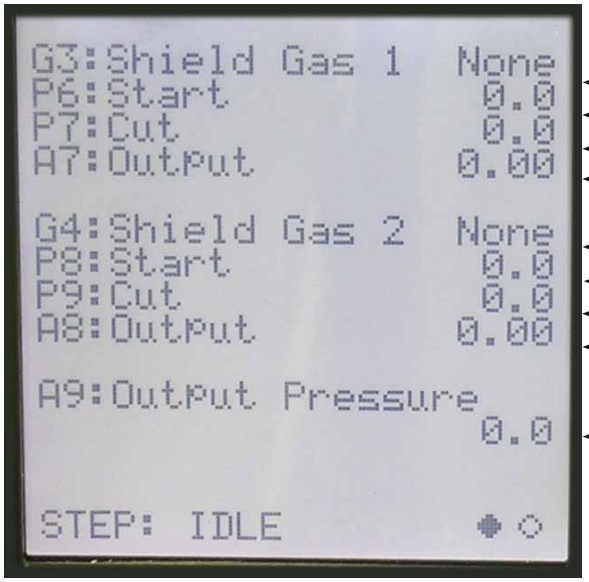
Gas Selection Screen



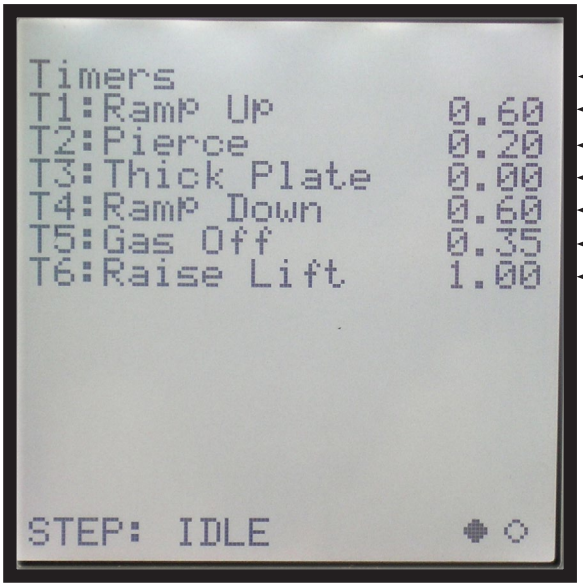
Plasma Gas Screen



Shield Gas Screen



Timers Screen

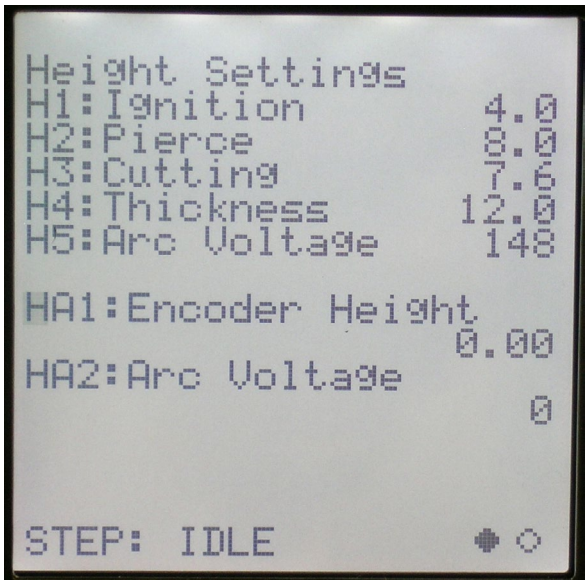


- Timers
- Current Ramp Up Time (seconds)
- Piercing Time (seconds)
- Second Ramp for Thick Plate (seconds)
- Current Ramp Down Time (seconds)
- Time to delay gas off from the time plasma start is removed. (seconds)
- Time to raise torch when cutting is complete (Height Control option required) (seconds)

Current Parameters

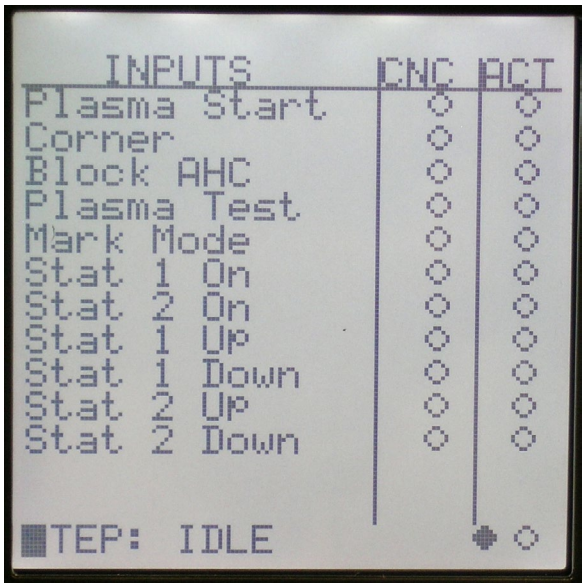
- Start Current (amps)
- Cut Current (amps)
- End Current (amps)
- Corner Current (amps)
- Pilot Arc Current (amps)
- Output Current (amps)
- Arc Voltage (Height Control Option) (volts)

Height Control Screen (Height Control option required)



- Height Settings
- Initial/Ignition Height (mm)
- Piercing Height (mm)
- Cutting Height (mm)
- Plate Thickness (mm)
- Arc Voltage (volts)
- Encoder Height (mm)
- Arc Voltage (volts)

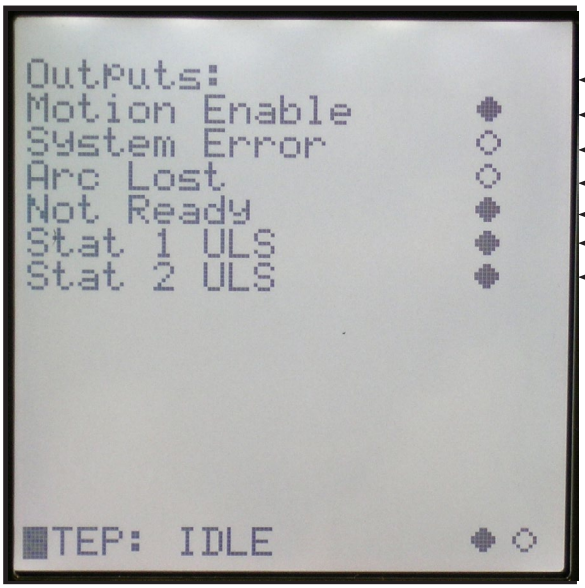
CNC Input Screen



Inputs	CNC's Direct Input	ACT (selection program is currently running)
Plasma Start	0	0
Corner	0	0
Block AHC	0	0
Plasma Test	0	0
Mark Mode	0	0
Stat 1 ON	0	0
Stat 2 ON	0	0
Stat 1 UP**	0**	0**
Stat 1 Down**	0**	0**
Stat 2 UP**	0**	0**
Stat 2 Down**	0**	0**

**only present when the Height Control option is present

CNC Output Screen



- Outputs
- Defined by motion signal
- System has faulted
- System has lost arc
- System is not ready
- Station 1 is on Upper Limit Switch
- Station 2 is on Upper Limit Switch

Motion Signal options:

Arc On - Motion Enable only goes high when arc is on. Normally used when no torch lifter is supplied with plasma system.

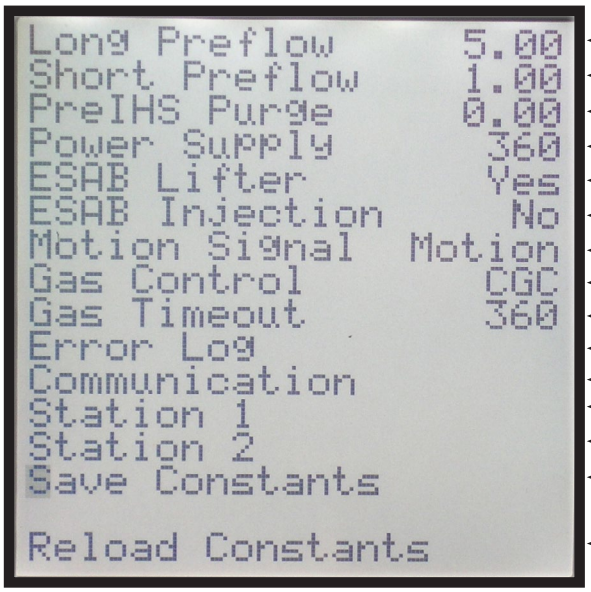
Motion - Motion Enable only goes high when motion is allowed. Normally used when a torch lifter is supplied with plasma system.

Setup Descriptions

Setup - The "setup screen" on the Interface Control Hub is accessed by having **"Plasma Start"** set to **"ON"** and **"Remote/ Local"** set to **"LOCAL"** when powering up the box. It is exited by turning the power off and then back on. Make sure to reset the switches back to the original state for parameter display. The encoder wheel with pushbutton, is used to select an item and change the values or to select a sub-menu.

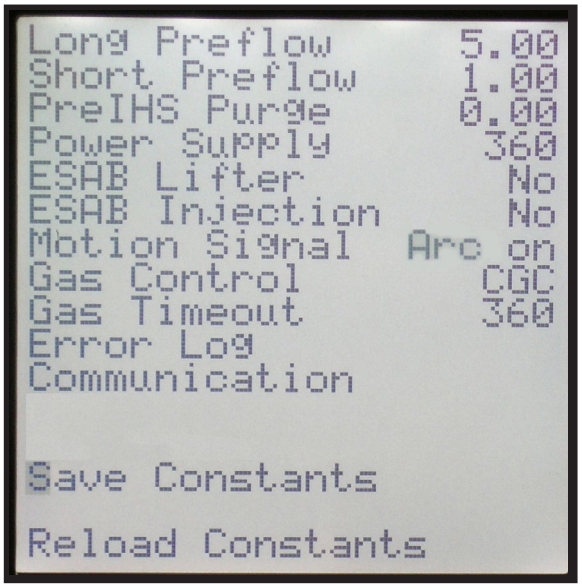
An example shown here, is for setting up a Plasma System configured for the following:

1. m3 Integrated Gas Control System
2. EPP-360 Plasma Power Supply
3. Supplied with ESAB Lifter
4. No Water Injection option



- Long Preflow Timer (seconds)
- Short Preflow Timer (seconds)
- Gas purge before Intial Height sensing (seconds)
- Power Supply type
- ESAB lifter installed
- ESAB Water Injection Module installed
- Motion Enable Signal meaning
- Gas Control type
- Gas Test timeout (seconds)
- Error Log
- Communication Options
- Station 1 Lift Options
- Station 2 Lift Options
- Save Constants
- Reload Constants

If the ESAB lifter has not been supplied with the system, the ICH setup screen for the above configuration would be as shown below:



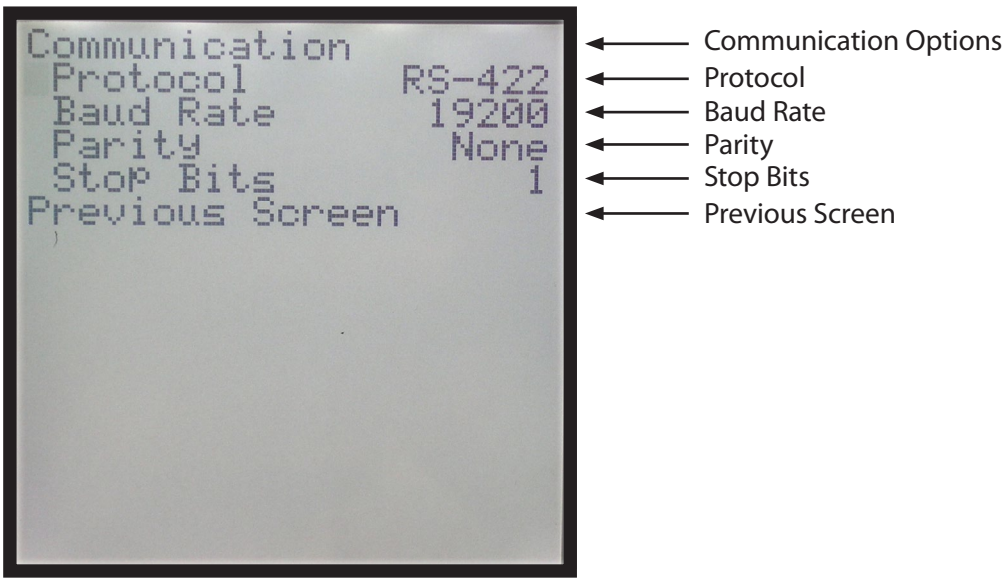
- Long Preflow Timer (seconds)
- Short Preflow Timer (seconds)
- Gas purge before Intial Height sensing (seconds)
- Power Supply type
- ESAB lifter installed
- ESAB Water Injection Module installed
- Motion Enable Signal meaning
- Gas Control type
- Gas Test timeout (seconds)
- Error Log
- Communication Options
- Save Constants
- Reload Constants

OPERATION

Described below are the various options to be modified before setting up the plasma system for operation:

Long Preflow	The long preflow is the time, in milliseconds, the system will wait for the gases to flow before starting the power supply. This time is only used for each start until there is a successful start (after power-up) or when the gas being used is not compatible with the previous gas being used.
Short Preflow	The short preflow is the time, in milliseconds, the system will wait for the gases to flow before starting the power supply. This time is only used for when it can be asserted that the last gas used and the current gas are compatible.
Power Supply	The power supply option is where the power supply attached to the system is specified. The EPP-201, EPP-360, EPP-450 and the EPP-601 are the available choices.
ESAB Lifter	The ESAB Lifter option is set to "YES" if an ESAB lifter was purchased for use with this system.
ESAB Injection	The ESAB Injection option specifies that the ESAB water injection module was purchased for use with this system.
Motion Signal	Arc On - Motion Enable only goes high when arc is on. Normally used when no torch lifter is supplied with plasma system. Motion - Motion Enable only goes high when motion is allowed. Normally used when a torch lifter is supplied with plasma system.
Gas Control	This option specifies which type of Gas Control is to be used. The options are: (1) Water - Water Injection is the only shield available, (2) PGC - Plasma Gas Control in use, (3) Full - The fully automatic gas control system is in use.
Gas Timeout	This specifies the maximum time, in seconds, which gases will be allow to flow during a gas test before they are automatically shut off.
Error Log	The error log stores up to 13 errors at a time reported by the ICH in the order they are detected. These errors are only cleared by selecting "CLEAR". Select the error, by pushing the pushbutton part of the encoder wheel, to see more details about the error.
Communication	The communication section is used to change the serial communications between the ICH and the CNC. **Protocol** - There are four options: None, RS-232, RS-422, and RS-485. Serial communications is disabled when none is selected. The RS-422 protocol uses four wire while the RS-485 uses two wire. **Baud Rate** - The baud rate must be set to the same rate as the CNC's serial communication transfer rate. Available options are: 300, 1200, 2400, 9600, 19200. **Parity** - The parity needs to match the CNC's serial communication parity. Available options are: None, Even, and Odd. **Stop Bits** - The stop bits needs to match the CNC's serial communication stop bits. Available options are: 1 or 2.

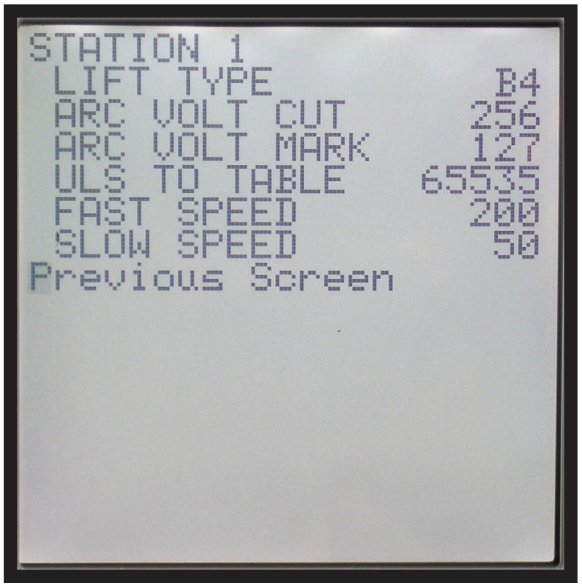
Communication Options



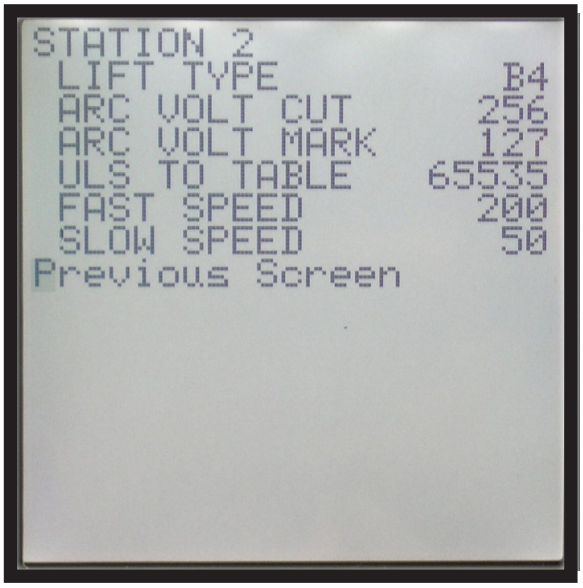
Station Options

The following are the options listed under station 1 and station 2:

Lift Type	The lifter type specifies which lift is being used. Available options are: A6 or B4.
Arc Volt Cut	The arc voltage calibration used when in CUTTING mode. Using a calibrated voltmeter, measure the voltage from the bus bar in the Remote Arc Starter Box to ground, while the process is active in cut mode. If that is higher than the arc voltage requested, then raise this number. If it is lower, then low this number.
Arc Volt Mark	The arc voltage calibration used when in marking mode. Using a calibrated voltmeter, measure the voltage from the bus bar in the Remote Arc Starter Box to ground, while the process is active in MARK mode. If that is higher than the arc voltage requested, then raise this number. If it is lower, then lower this number. The result should be around half of the "Arc Volt Cut" option.
ULS to Table	The distance from the torch tip, when on the upper limit switch, to the top of the table slats. This is in micrometers.
Fast Speed	This is the speed at which the lifter will move when not in the slowdown zone, when using height control, or when moving up. The slowdown zone is the plate thickness, plus 25 millimeter, above the table slats.
Slow Speed	This is the speed at which the lifter will move when in the slowdown zone or using height control. The slowdown zone is the plate thickness, plus 25 millimeter, above the table slats.

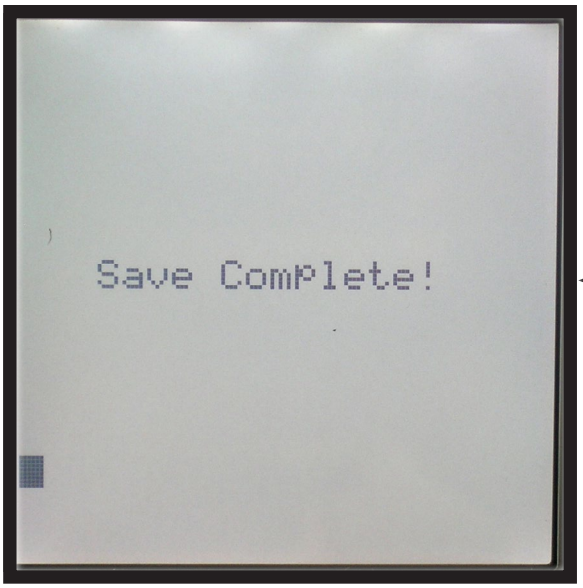


← Station 1 Lift Options
← Lift Type
← Arc Voltage for Cutting
← Arc Voltage for Marking
← Upper Limit Switch to Table (µm)
← Fast Speed (Relative speed 0-500)
← Slow Speed (Relative speed 0-500)
← Previous Screen



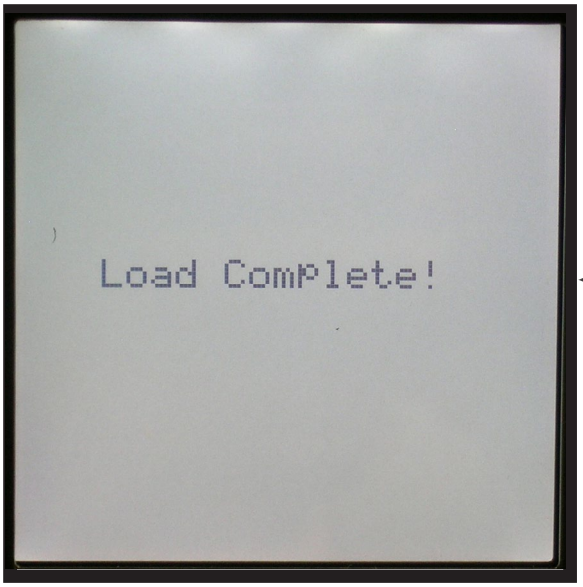
← Station 2 Lift Options
← Lift Type
← Arc Voltage for Cutting
← Arc Voltage for Marking
← Upper Limit Switch to Table (µm)
← Fast Speed (Relative speed 0-500)
← Slow Speed (Relative speed 0-500)
← Previous Screen

Once the setup is complete, make sure to save the constants by selecting the **"Save Constants"** tab. The following screen will be displayed for a couple of seconds to confirm that your changes have been taken.



Save Complete

If you do not want to keep the changes you have made and would like to revert back to the last saved settings then select the **"Reload Constants"** tab. The following screen will be displayed for a couple of seconds to confirm that your changes have been taken.



Load Complete

Digital I/O

Digital Inputs

Digital inputs are to be only turned on with 24 VDC. Any other voltage may damage the board or cause unpredictable results. The best method is to send the 24 VDC from the DB37 connector back on the input, via a relay or opto-isolator chip.

Signal Name	Description
Corner	Informs the ICH to reduce the current to the corner current and block height control (if enabled)
Block AHC	Block height control
Plasma Test	Prevents the ICH from sending the start signal to the high frequency unit and power supply during a plasma start. Power supply faults are ignored.
Plasma Start	Start the plasma process
Mark	Switch to marking mode and use the last loaded marking data
Station 1 Up	Move the station 1 lifter up (if installed)
Station 1 Down	Move the station 1 lifter down (if installed)
Station 2 Up	Move the station 2 lifter up (if installed)
Station 2 Down	Move the station 2 lifter down (if installed)
Station 2 On	Turn on station 2.
Station 1 On	Turn on station 1.

Digital Outputs

Digital outputs should only be 24 VDC with less than 80 milli-amperes current requirement.

Signal Name	Description
Motion Enable/Arc On	This signal is high when the arc is on or the process is off, when motion signal is set to Motion in the setup screen. This signal is high when the arc is on, when motion signal is set to Arc On in the setup screen.
System Fault	The ICH has detected a problem which required the process to stop. Send message 003 or check the error log to get the exact set of errors. These are reset with a 000 command, but will remain in the error log.
Arc Lost	The arc was lost during a cut/mark operation. This is reset on the next plasma start.
Not Ready	The ICH is not ready to start the process. Possible causes: no Station selected, not in Remote Mode, Plasma Start was high on boot up and is still high, Gas settings missing, Start Current missing, Cut Current missing, Timers missing, Height Control settings missing (if a lifter is installed).
Station 1 ULS	Station 1 is on the upper limit switch.
Station 2 ULS	Station 2 is on the upper limit switch.

4.2 Modes of Operation:

Remote Interface without Serial Communication

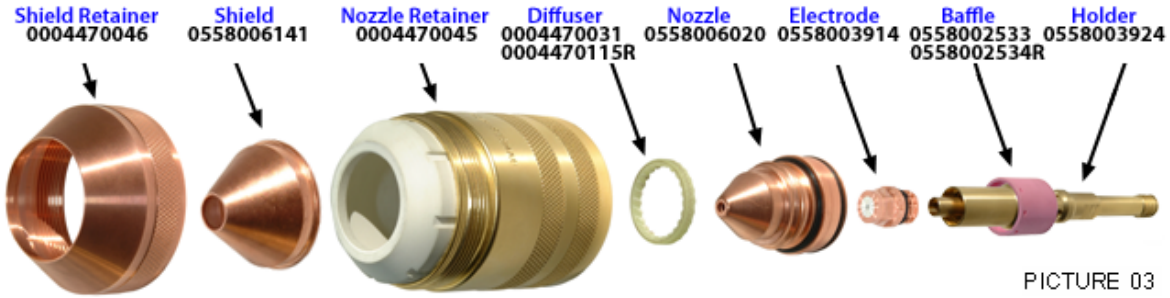
This mode describes the instance when the CNC controls everything except parameter selection via the digital inputs and outputs. To operate in this mode, go to the setup screen and change the **"Protocol"** to **"None"** under **"Communications"**.

- The process parameters need to be modified on the ICH screen every time the CNC needs to change the cutting or marking parameters. The ICH system supports a cutting parameter set and a marking parameter set. The last used set will be available upon restarting the ICH. This requires starting the process at least once with the set.
- The cutting parameters and marking parameters can be loaded into different tables in the ICH. After all the parameters are loaded, switching can be done by pressing the push button on the parameter line in the Gas Selection screen.
- Gas Test - The gas test function is designed to allow diagnostics of the gas control system. The gas test feature can be enabled by turning on the **"Plasma Test"** digital input and issuing a **"Plasma Start"**. The gases flowing in each test and the pressure/flow at which they are set to, is based on the currently loaded parameters on the ICH display.
- The ICH system has two possible sequences it can be running. One with the lifter height controlled by the ICH system and another with the lifter height controlled by the CNC.

Described below are examples for cutting a part from the CNC. The parameters from the cut data manual used for the setup below are detailed on the following page.

Material Type	Carbon Steel
Material Thickness	12 mm
Cut Quality	Production
Current	200 Amps
Start Gas	N2
Cut Gas	O2
Shield Gas	Air

PRODUCTION	
Gas Select	9
Material	Carbon Steel
Amperes	200
Start Gas	AIR/N2
Cut Gas	O2
Shield Gas	AIR/N2



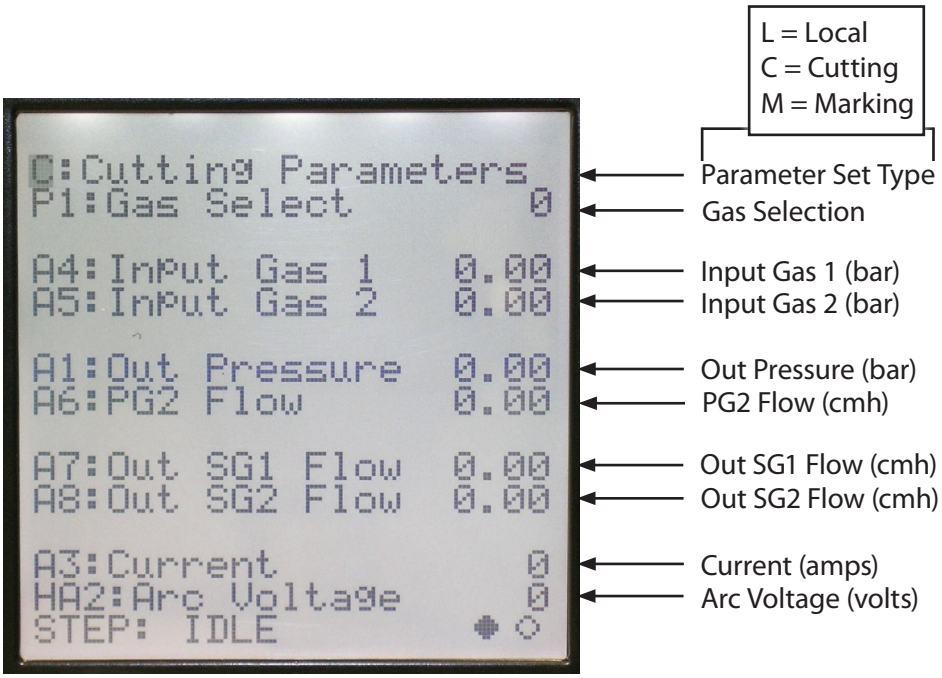
PICTURE 03

Code	Description	Material Thickness - mm (inch)												
		6(0.250)	10(0.375)	12(0.500)	16(0.625)	20(0.750)	25(1.000)	32(1.250)						
Gas Parameters:														
P1	Gas Select	9	9	9	9	9	9	9						
P2	Plasma Start - Bar	1.2	1.2	1.2	1.2	1.2	1.2	1.2						
P3	Shield Start - CMH	4.0	4.0	4.0	4.0	4.0	4.0	4.0						
P4	Plasma Cut - Bar	3.2	3.2	3.2	3.2	3.2	3.2	3.2						
P5	Shield Cut - CMH	4.0	4.0	4.0	4.0	4.0	4.0	4.0						
P6	Cut Current - Amps	200	200	200	200	200	200	200						
P7	Start Current - Amps	100	100	100	100	100	100	100						
Timers: (sec)														
T1	Ramp Up	0.6	0.6	0.6	0.6	0.6	0.6	0.6						
T2	Pierce	0.2	0.2	0.2	0.5	0.5	0.6	1.3						
T3	Thick Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
T4	Ramp Down	0.6	0.6	0.6	0.6	0.6	0.6	0.6						
T5	Gas Off	0.35	0.35	0.35	0.35	0.35	0.35	0.35						
T6	Raise Lift	1.0	1.0	1.0	1.0	1.0	1.0	1.0						
Height Parameters: mm (inch)														
H1	Ignition	4(0.160)	4(0.160)	4(0.160)	4(0.160)	4(0.160)	4(0.160)	4(0.160)						
H2	Pierce	4(0.140)	4(0.160)	8(0.300)	8(0.320)	9(0.340)	10(0.400)	10(0.400)						
H3	Cutting	2(0.090)	4(0.160)	8(0.300)	8(0.320)	9(0.340)	8(0.307)	7(0.270)						
H4	Thickness	6(0.250)	10(0.375)	12(0.500)	16(0.625)	20(0.750)	25(1.000)	32(1.250)						
H5	Arc Voltage - Volts	129	133	148	150	152	152	155						
Machine Parameters:														
Speed - mm/min (in/min)		6350(250)	3937(155)	3048(120)	2540(100)	1905(75)	1295(51)	889(35)						
Kerf - mm (inch)		2.3(0.090)	2.8(0.110)	2.3(0.090)	3.0(0.118)	2.5(0.100)	2.8(0.110)	2.5(0.100)						

P MS 200A GS9 ncode114 pic3

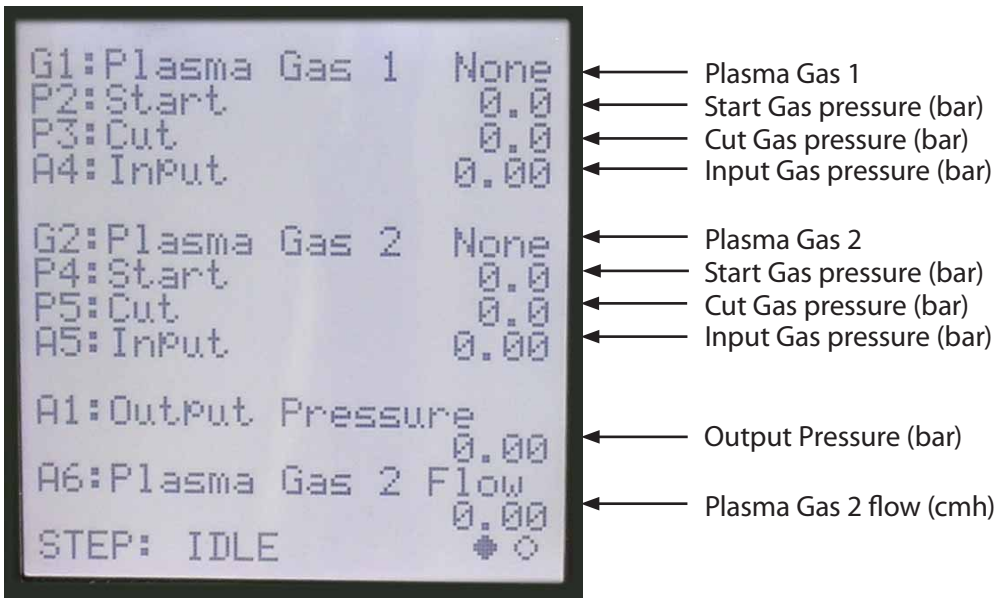
Operation sequence with ESAB supplied plasma lifter:

1. Setup the part program that needs to be cut from the CNC.
2. Go to the ICH screen for "**C:Cutting Parameters"** and setup the gas selection parameters according to the cut data manual:



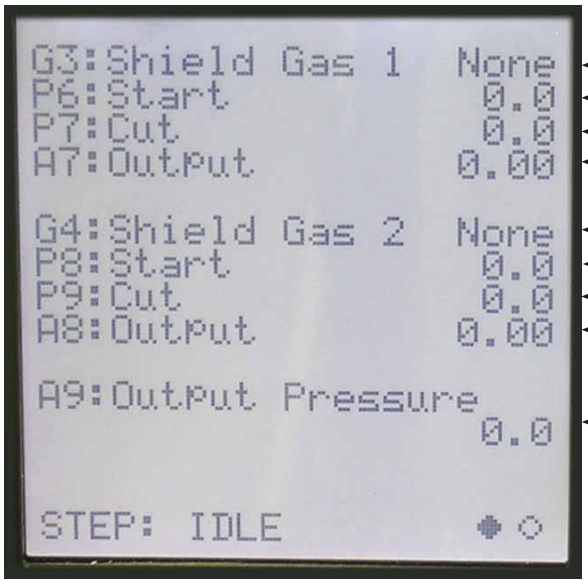
3. Set Plasma Gas pressure values according to the cut data manual.

Plasma Gas Screen



4. Set Shield Gas flow values according to the cut data manual.

Shield Gas Screen



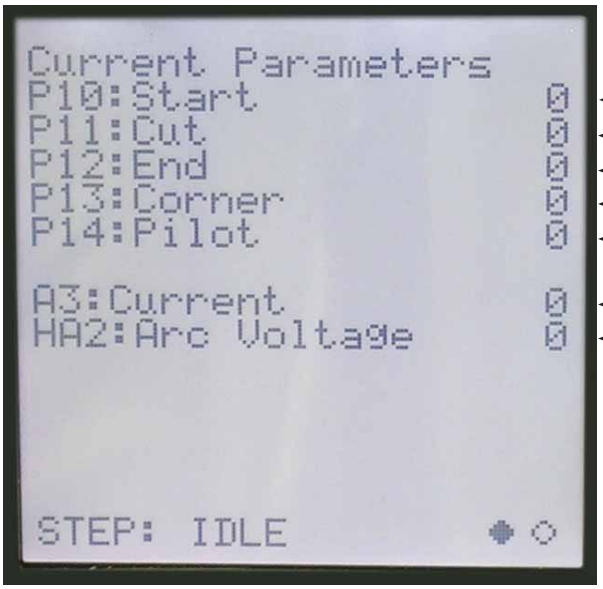
- Shield Gas 1
- Start Gas flow (cmh)
- Cut Gas flow (cmh)
- Output Gas flow (cmh)
- Shield Gas 2
- Start Gas flow (cmh)
- Cut Gas flow (cmh)
- Output Gas flow (cmh)
- Output Pressure (bar)

5. Next, go to the ICH screen for Timers and setup the timer values according to the cut data manual:

Timers Screen

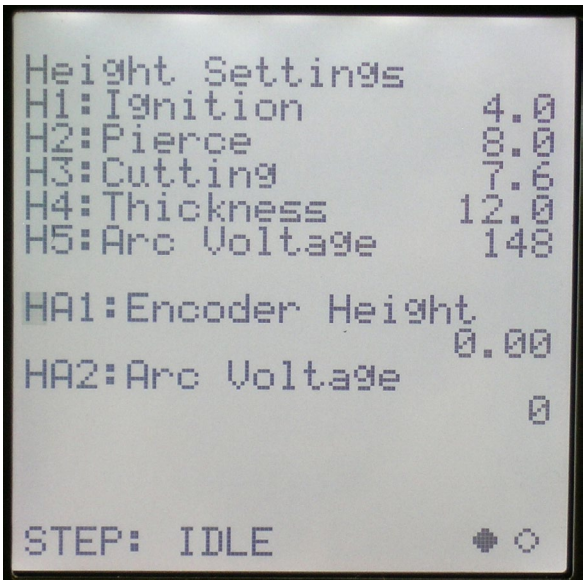
- Timers
- Current Ramp Up Time (seconds)
- Piercing Time (seconds)
- Second Ramp for Thick Plate (seconds)
- Current Ramp Down Time (seconds)
- Time to delay gas off from the time plasma start is removed. (seconds)
- Time to raise torch when cutting is complete (Height Control option required) (seconds)

6. Next, go to the ICH screen for Current Settings and setup the current parameters according to the cut data manual:



- Start Current (amps)
- Cut Current (amps)
- End Current (amps)
- Corner Current (amps)
- Pilot Arc Current (amps)
- Output Current (amps)
- Arc Voltage (Height Control Option) (volts)

7. Next, go to the ICH screen for Height Settings and setup the height parameters according to the cut data manual:

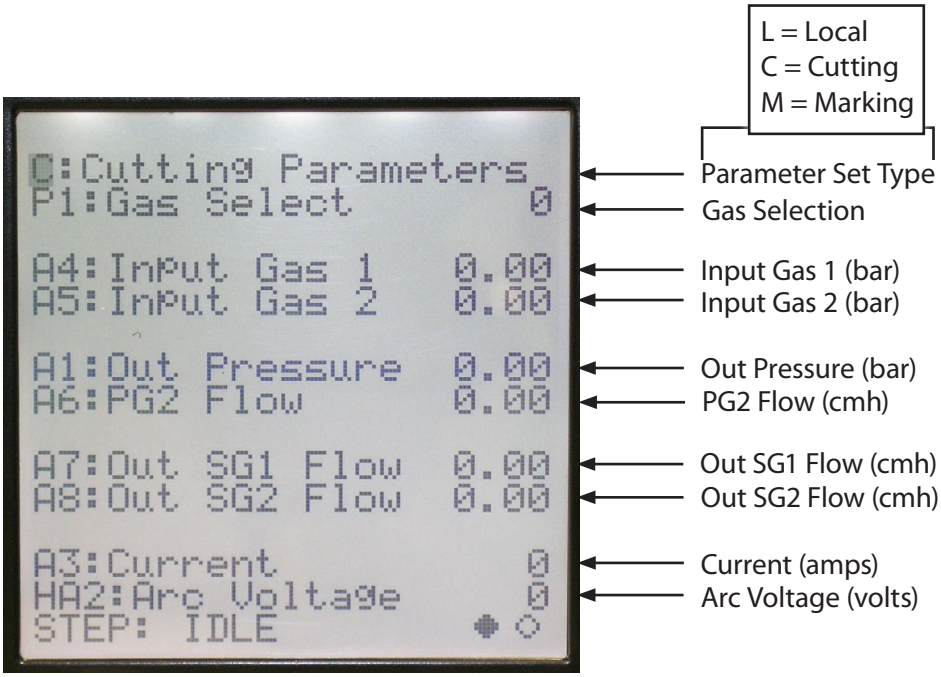


- Height Settings
- Initial/Ignition Height (mm)
- Piercing Height (mm)
- Cutting Height (mm)
- Plate Thickness (mm)
- Arc Voltage (volts)
- Encoder Height (mm)
- Arc Voltage (volts)

8. Once all of the setups have been completed on the ICH, refer to the cut data manual for the Speed and Kerf inputs to be made on the CNC part program.
9. Execute the program from the CNC and send a **"Plasma Start"** signal to the ICH.
10. The following happens while the CNC waits for motion enable.
    a. The ICH starts the purge before initial height sensing.
    b. The torch comes down, does the initial height sensing and finishes the preflow.
    c. The ICH starts the power supply.
    d. The ICH waits for the arc to transfer and the main current to start, turning the high frequency generator off once the arc has transferred. If the motion signal constant is set to **"Arc On"**, this is when the **"Motion Enable"** signal is returned to the CNC.
    e. The gas switches from start to cut values and gas.
    f. The ICH ramps the current up to the desired cutting/marking current.
    g. The ICH raises to the piercing height.
    h. The ICH waits a time, from the parameters, for the current to pierce the plate.
    i. The ICH lowers down to the cutting height. If the motion signal constant is set to **"Motion"**, this is when the **"Motion Enable"** signal is returned to the CNC.
11. Start moving the machine in the shape desired, turning the corner signal on when not going at full speed for the parameters sent.
12. Remove the **"Plasma Start"** signal to the ICH at the end of cut.
13. The following happens while the CNC waits for **"Motion Enable"** to be removed and come back (if the motion signal constant is set to **"Motion"**).
    a. **"Motion Enable"** is removed, if the motion signal constant is set to **"Motion"**.
    b. The current ramps down.
    c. The power supply is turned off and, after a time specified in the parameters, the gas stop flowing. If the motion signal constant is set to **"Arc On"**, this is when the **"Motion Enable"** signal is removed.
    d. The lift raises for an amount of time specified in the process parameters.
    e. If the motion signal constant is set to **"Motion"**, then this is when **"Motion Enable"** is returned.

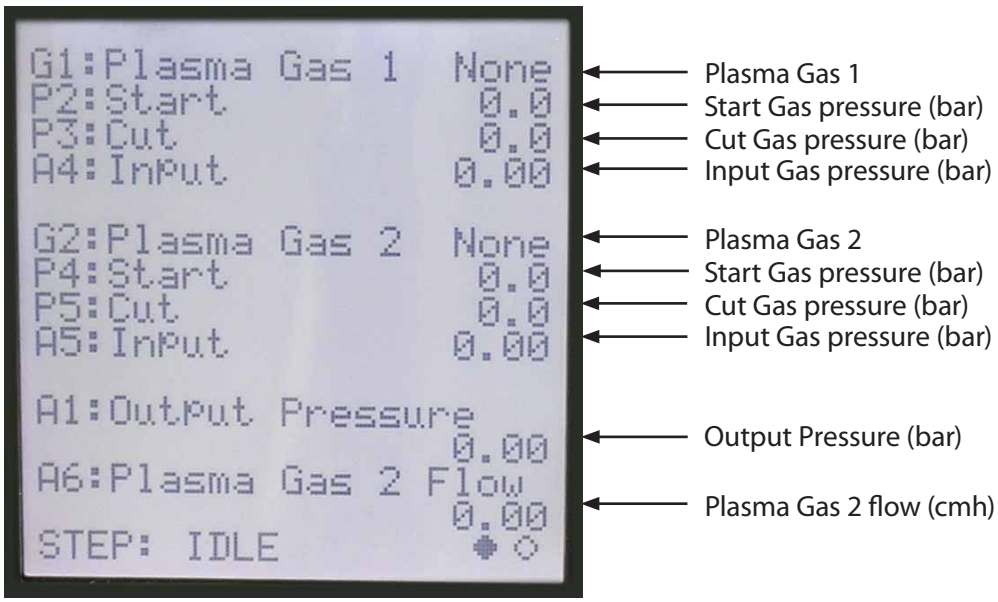
Operation sequence with customer supplied plasma lifter:

1. Setup the part program that needs to be cut from the CNC.
2. Go to the ICH screen for **"C:Cutting Parameters"** and setup the gas selection parameters according to the cut data manual:



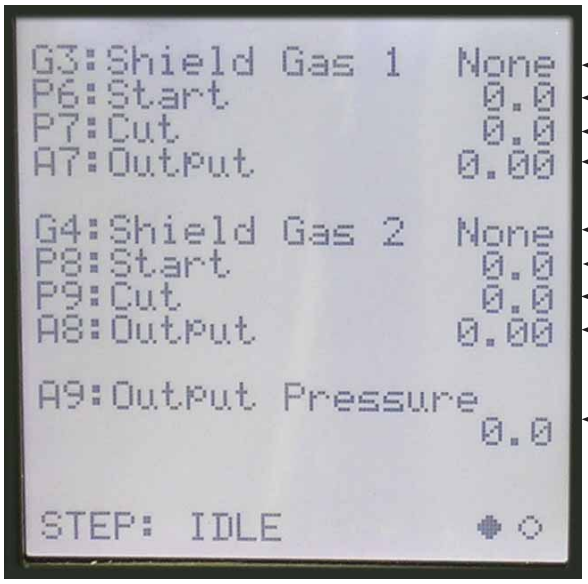
3. Set Plasma Gas pressure values according to the cut data manual.

Plasma Gas Screen



4. Set Shield Gas flow values according to the cut data manual.

Shield Gas Screen



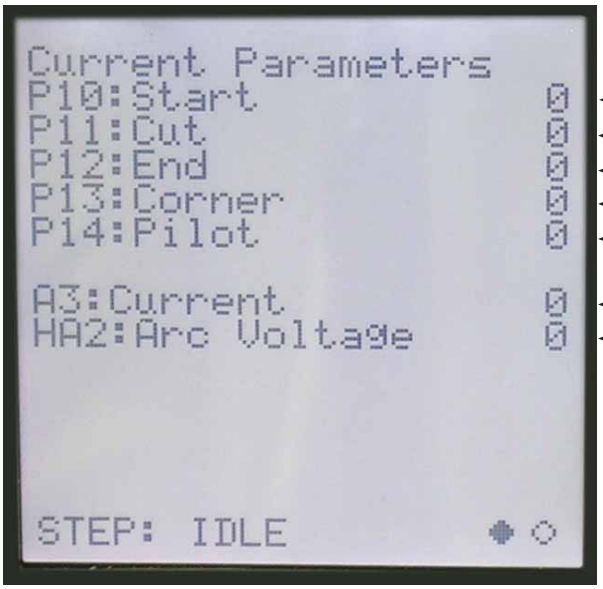
- Shield Gas 1
- Start Gas flow (cmh)
- Cut Gas flow (cmh)
- Output Gas flow (cmh)
- Shield Gas 2
- Start Gas flow (cmh)
- Cut Gas flow (cmh)
- Output Gas flow (cmh)
- Output Pressure (bar)

5. Next go to the ICH screen for Timers and setup the timer values according to the cut data manual:

Timers Screen

- Timers
- Current Ramp Up Time (seconds)
- Piercing Time (seconds)
- Second Ramp for Thick Plate (seconds)
- Current Ramp Down Time (seconds)
- Time to delay gas off from the time plasma start is removed. (seconds)
- Time to raise torch when cutting is complete (Height Control option required) (seconds)

6. Next, go to the ICH screen for Current Settings and setup the current parameters according to the cut data manual:



- Start Current (amps)
- Cut Current (amps)
- End Current (amps)
- Corner Current (amps)
- Pilot Arc Current (amps)
- Output Current (amps)
- Arc Voltage (Height Control Option) (volts)

7. Once all of the setups have been completed on the ICH, refer to the cut data manual for the Speed and Kerf inputs to be made on the CNC part program.
8. Also, setup the height parameters according to the cut data manual from the CNC.
9. Execute the program from the CNC.
10. The torch, controlled from the CNC, comes down and begins ignition height sensing. Block AHC and Corner can be set to start the purge and preflow. Send plasma start to start.
11. Send a **"Plasma Start"** signal to the ICH after the torch is at ignition height.
12. The following happens while the CNC waits for **"Motion Enable"**.
    a. The ICH starts the purge.
    b. The ICH starts the power supply.
    c. The ICH waits for the arc to transfer and the main current to start, turning the high frequency generator off once the arc has transferred. If motion signal constant is set to **"Arc On"**, then **"Motion Enable"** is sent back.
    d. The gas switches from start to cut values and gas.
    e. The ICH ramps the current up to the desired cutting/marking current. At this time, the torch needs to be raised to piercing height.
    f. The ICH waits a fixed time for the current to pierce the plate. If motion signal constant is set to **"Motion"**, then **"Motion Enable"** is sent back.
13. Start moving the machine in the shape desired, turning the corner signal on when not going the full speed for the parameters sent.
14. Remove the **"Plasma Start"** signal to the ICH at the end of cut.
15. The following happens while the CNC waits for **"Motion Enable"** to be removed and come back (if the motion signal constant is set to **"Motion"**).
    a. **"Motion Enable"** is removed, if the motion signal constant is set to **"Motion"**.
    b. The current ramps down.
    c. The power supply is turned off and, after a time specified in the parameters, the gas stop flowing. If the motion signal constant is set to **"Arc On"**, this is when the **"Motion Enable"** signal is removed.
    d. If the motion signal constant is set to **"Motion"**, then this is when **"Motion Enable"** is returned.

Remote Interface with Serial Communication

This mode of operation is used if the customer needs to have plasma parameter selection controlled from the CNC. There are two ways this can be achieved:

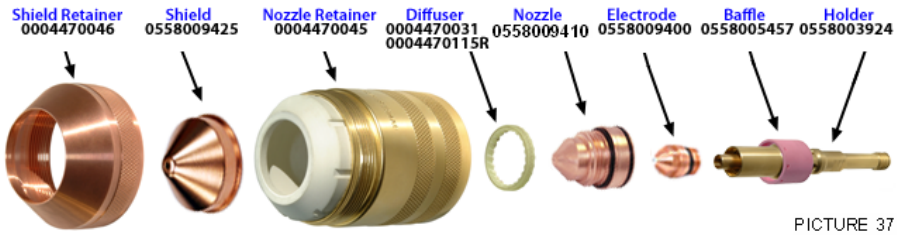
1. **ESAB Serial Communication Interface - ESCI.**
   ESCI is a an easy to use software with a graphical interface for downloading the necessary parameters to the ICH for the best cut quality. All the operator needs to know is the material type, thickness of the material, cut amperage and type of plasma gas. More details about the software and the system requirements are described in the appendix.
2. **Serial protocol controlled by customer CNC.**
   Detailed information on the protocol is described in the appendix.

Local Interface - Diagnostics Only

The local interface is used to test the plasma system for diagnostic purposes. This allows limited use of the system (i.e. only one station at a time) and is normally used for troubleshooting. This will disable the CNC's ability to control the system, but will still allow the CNC to get the status (including the gas pressures and flows) and errors.

Upon switching to local mode for the first time, since the last reboot, the parameters loaded are for 200 amp Carbon Steel Air Production cutting.

MARKING	
Gas Select	6
Material	Carbon Steel
Amperes	60
Start Gas	ARG
Cut Gas	ARG
Shield Gas-1	AIR
Shield Gas-2	NONE



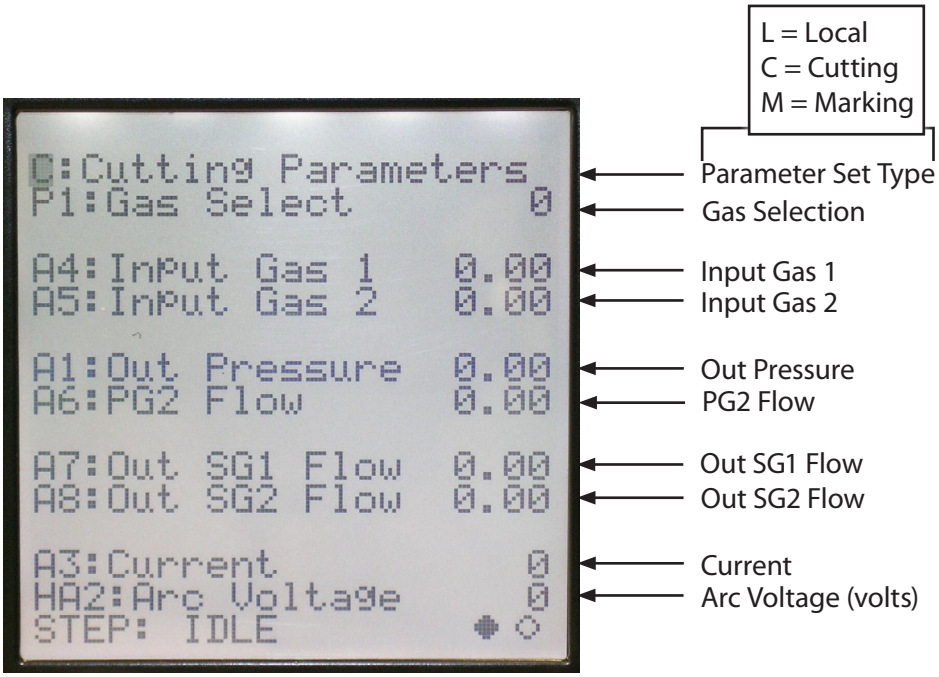
PICTURE 37

Code	Description													
P1	Gas Select	6												
P2	PG1 Start - Bar	5.2												
P3	PG1 Cut - Bar	5.2												
P4	PG2 Start - Bar	0.0												
P5	PG2 Cut - Bar	0.0												
P6	SG1 Start - CMH	2.0												
P7	SG1 Cut - CMH	2.0												
P8	SG2 Start - CMH	0.0												
P9	SG2 Cut - CMH	0.0												
P10	Start Current - Amps	8												
P11	Cut Current - Amps	8												
P12	End Current - Amps	8												
P13	Corner Current - Amps	7												
P14	Pilot Arc Current - Amps	20												
T1	Ramp Up Time - Sec	0.1												
T2	Pierce Time - Sec	0.0												
T3	Thick Plate Pierce Time - Sec	0.0												
T4	Ramp Down Time - Sec	0.1												
T5	Gas Off Time - Sec	0.35												
T6	Raise Lift Time - Sec	1.0												
H1	Ignition Height - mm(inch)	4(0.160)												
H2	Pierce Height - mm(inch)	3(0.100)												
H3	Cutting Height - mm(inch)	3(0.100)												
H4	→ **Thickness** - mm(inch)	25(1.000)												
H5	Arc Voltage - Volts	75												
Speed - mm/min(inch/min)		2540(100)												
Kerf - mm(inch)		0.0(0.000)												

M MS 60A GS6 ncode110 pic37

OPERATION

Note:
The actual operation of cutting should not be performed while in this mode as the CNC is not in control of the process.



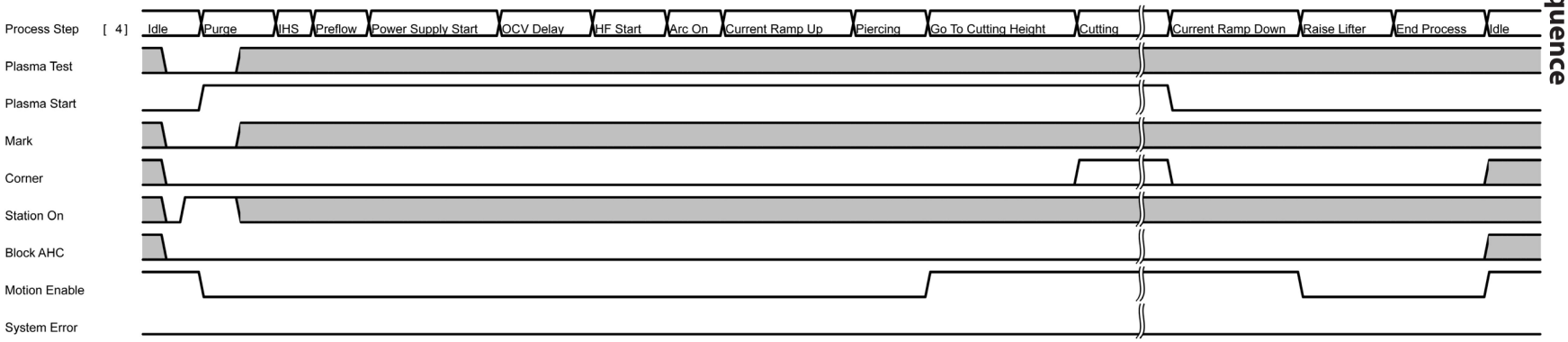
Operation sequence:

1. To enable the local interface, the **"Local/Remote"** switch needs to be in the **"Local"** position.
2. Set up the parameters for the process as needed from the cut data manual.
3. If plasma is to be turned on, then set the **"Plasma Start"** to **"ON"** and the gas test switch to the **"OFF"** position.
4. If the plasma lifter is supplied from ESAB, then the lifter will perform an initial height sense operation.
5. The following happens after the torch is at ignition height:

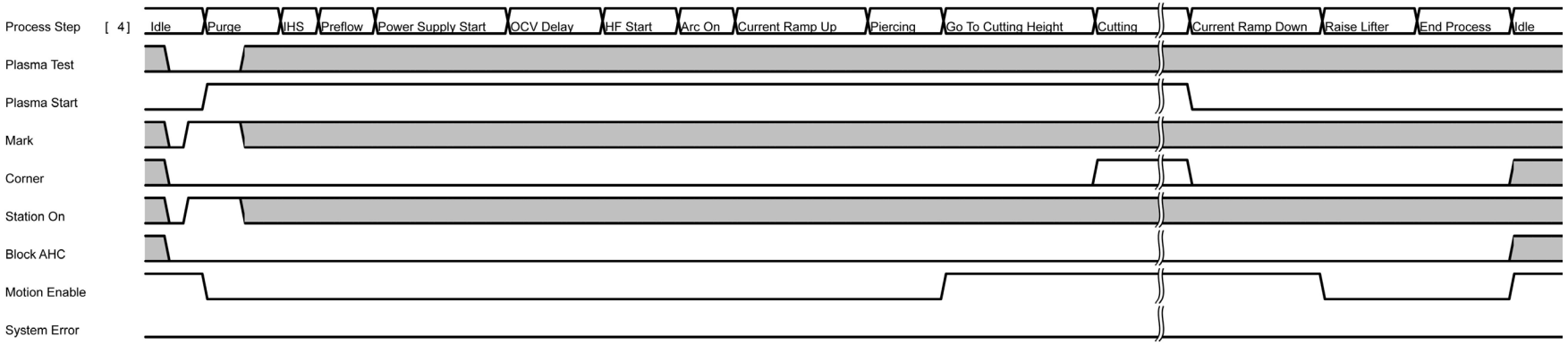
a. The ICH starts the purge.
b. The ICH starts the power supply.
c. The ICH waits for the arc to transfer and the main current to start, turning the high frequency generator off once the arc has transferred. If motion signal constant is set to **"Arc On"**, then **"Motion Enable"** is sent back.
d. The gas switches from start to cut values and gas.
e. The ICH ramps the current up to the desired cutting/marking current.
f. The ICH waits a fixed time for the current to pierce the plate.

6. If **"Gas Test"** is turned on before **"Plasma Start"** is on, then all the above steps are repeated except that a signal to the power supply is not sent from the ICH.

Cutting Mode with ESAB supplied lifter



Marking Mode with ESAB supplied lifter



Interface Wiring Descriptions

Interface Wiring

DB37 Connector

This cable should be a twisted pair cable with an overall shield attached to the shell on both ends of the cable. It has a DB37 male connector on each end.

Wire No.	Signal Name	Function
1	RS422 RX-	Serial receive negative
2	RS422/485 TX-	Serial transmit negative
3	RS422/485 GND	Communication Ground
4	Digital Output 1 (-)	Motion Enable Emitter
5	Digital Output 2 (-)	System Fault Emitter
6	Digital Output 3 (-)	Arc Lost Emitter
7	Digital Output 4 (-)	Not Ready Emitter
8	Digital Output 5 (-)	Station 1 ULS Emitter
9	Digital Output 6 (-)	Station 2 ULS Emitter
10	Digital Output 7 (-)	Spare Output Emitter
11	Digital Output 8 (-)	Spare Output Emitter
12	Digital Input 1	Corner
13	Digital Input 2	Block AHC
14	Digital Input 3	Plasma Test
15	Digital Input 4	Cycle Start
16	Digital Input 10	Station 2 On
17	24VDC	24 VDC Power
18	GND	Ground
19	Digital Input 5	Mark
20	RS422 RX+	Serial receive positive
21	RS422/485 TX+	Serial transmit positive
22	GND	Ground
23	Digital Output 1 (+)	Motion Enable Collector
24	Digital Output 2 (+)	System Fault Collector
25	Digital Output 3 (+)	Arc Lost Collector
26	Digital Output 4 (+)	Not Ready Collector
27	Digital Output 5 (+)	Station 1 ULS Collector
28	Digital Output 6 (+)	Station 2 ULS Collector
29	Digital Output 7 (+)	Spare Output Collector
30	Digital Output 8 (+)	Spare Output Collector
31	Digital Input 6	Station 1 Up (If installed)
32	Digital Input 7	Station 1 Down (If installed)
33	Digital Input 8	Station 2 Up (If installed)
34	Digital Input 9	Station 2 Down (If installed)
35	Digital Input 11	Station 1 On
36	GND	Ground
37	24VDC	24 VDC Power
FG	Field Ground	Cable Shield Ground (Connected via the connector shell)

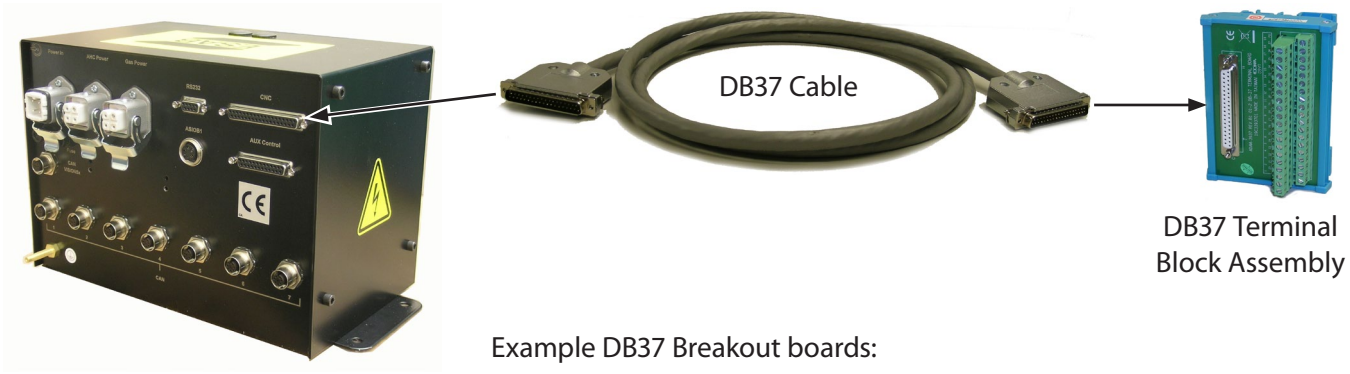
DB37 Connector

The customer has two options available for wiring to the DB37 connector shown below:

Connection assemblies for ICH and CNC interface.

Option 1:

ESAB provided DB37 cable (Male-Male) and terminal block assembly for connection to CNC.



ICH Box

Example DB37 Breakout boards:

Manufacturer	Part Number
Sea Level	TB02-KT
Winford	BRK37F series
Advantech *	**ADAM-3937**

*ESAB recommended part available as ESAB part number 0558009990.

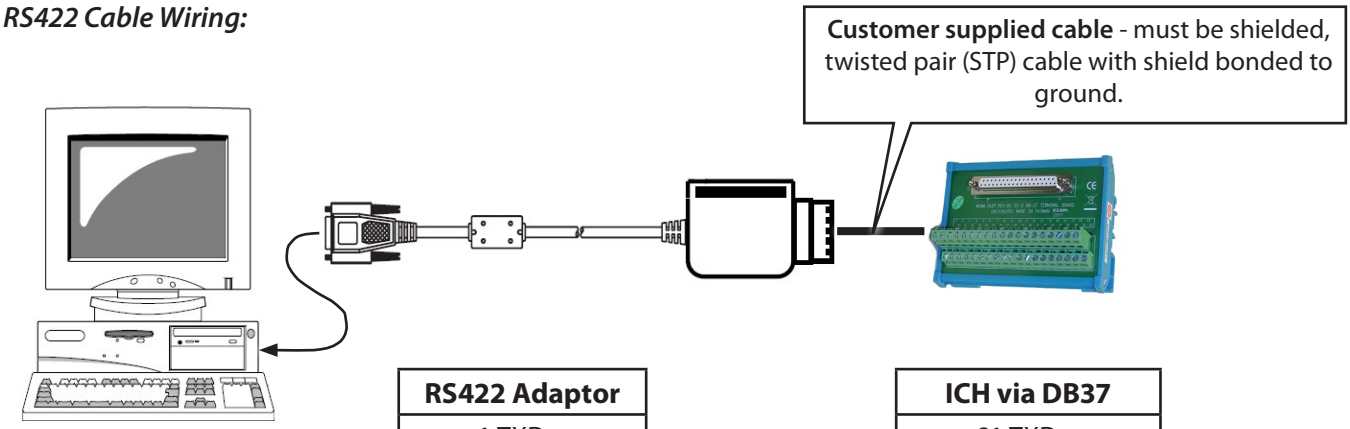
Option 2:

ESAB provided DB37 cable (Male-Male) and customer provided DB37 (Female) connector. Customer builds their own DB37 Interface for connection to CNC.

ICH Box

DB37 Cable			
Part Number	**Length**	**Part Number**	**Length**
0558010071	2 M	0558010076	7 M
0558010072	3 M	0558010077	10 M
0558010073	4 M	0558010078	15 M
0558010074	5 M	0558010079	20 M
0558010075	6 M	0558010080	25 M

RS422 Cable Wiring:



RS422 Adaptor	ICH via DB37
1 TXD +	21 TXD +
2 TXD -	2 TXD -
3 RXD +	20 RXD +
4 RXD -	1 RXD -
5 GND	3 GND

Example serial converters:

Manufacturer	Part Number
B & B Electronics	485DRCI
B & B Electronics	4WSSD9OTB
Comm Front	CVT-485-422-4
Axeon *	**STS-1915SI**

*ESAB recommended part available as ESAB part number 0558009988.

DB9 Connector

This is a standard DB9 RS232 cable. This communication port is not recommended for production use.

Wire No.	Signal Name	Function
1	NC	No Connect
2	RS232 RX	Receive
3	RS232 TX	Transmit
4	NC	No Connect
5	NC	No Connect
6	GND	Ground
7	RS232 RTS	Ready To Send
8	RS232 CTS	Clear To Send
9	NC	No Connect

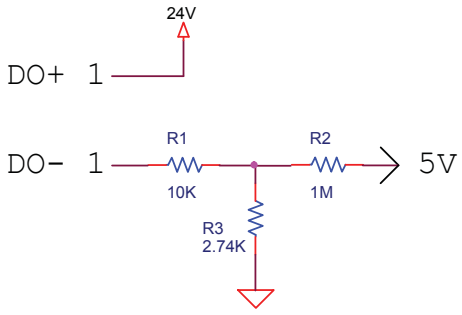
Power Connector

Wire No.	Signal Name	Function
1	Line 1	Line 1 of 230 VAC or Line of 115 VAC (No Height Control)
2	Line 2	Line 2 of 230VAC or Neutral of 115 VAC (No Height Control)
3	NC	No Connect
4	GND	Ground

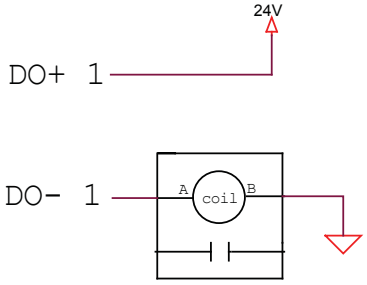
Digital Output Wiring Examples

Digital outputs should only be 24 VDC with less than 80 milli-amperes current requirement. There are two good methods for doing this. There is a small voltage drop across the opto-isolator in the Interface Control Hub, so it is recommended that a voltage of at least 12 VDC be used in order to protect against noise generated by the plasma system's starting circuit.

Method 1: Using the 24 VDC to drive a digital input circuit on the CNC's input.



Method 2: Using the 24 VDC to drive a relay coil and using the contact on the coil however the CNC needs it.



4.3 Maintenance/Troubleshooting

Communication Problems

Problem	Resolution
Unable to send and receive messages	Make sure the CNC's RX - is on pin 2, TX – is on pin 1, RX + is on pin 21, and TX + is on pin 20 of the DB37 connector. Also make sure the constant for the communication protocol is set properly. Communication ground should be connected to pin 3.
502 Error message	The command is not allowed in this state.

Digital Input Problems

Problem	Resolution
The wrong input on the screen is changing when the CNC turns on an input to the ICH	Make sure the inputs are wired to the proper input on the ICH.
No input on the screen is changing when the CNC turns on an input to the ICH	Make sure the CNC is only sending the 24 VDC from DB37 connector back to the ICH as the input when turning the input on.

Digital Output Problems

Problem	Resolution
The ICH shows the output turning on but there is no voltage on the output's emitter side.	Check for voltage on the collector side. If there is a DC voltage there greater than 10 volts, then call service.

Gas Problems

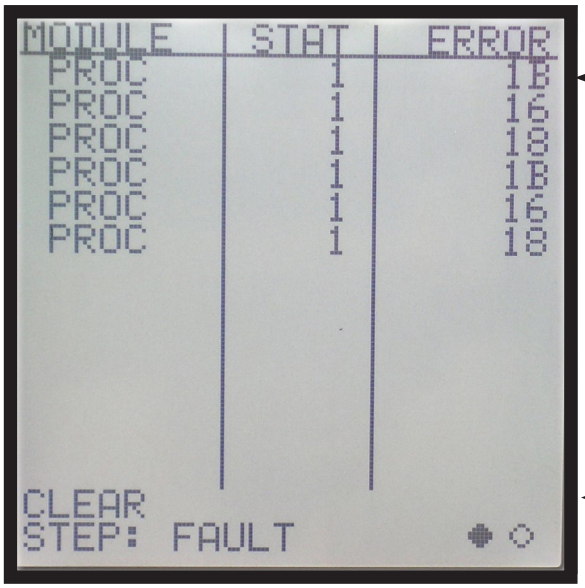
Problem	Resolution
The CNC turns on a gas test and no gas comes out of the torch.	Make sure the plasma gas box and shield gas box have power (green LED on the same side as the cable connections is lit).

Power Supply Problems

Problem	Resolution
Power supply will not start.	Make sure power is supplied. Check for an error code on the power supply display. Check for plasma test signal being low. Check for E-stop signal not connected to RAS Box.

Error Messages on the ICH Display

Error Log Screen



Last received error always shown at top.

Clear all errors on screen.

This screen can be accessed by using **"Switch Screen"** on the ICH and displays a log of the last 13 errors received by the ICH. By moving the cursor to the error and pressing the hand wheel, more details of the error are displayed.

Error Screen

Station number

Type of Error

Error ID

Error details

This screen can be accessed by scrolling down to the "fault" text and pressing the hand wheel or through the error log screen.

Process Errors

Process Errors from System Modules	
ID	**Description**
1	Input pressure is too high on plasma gas 1. Please turn down the pressure on the input gas. Maximum = 10 bar, Minimum = 3.5 bar.
2	Input pressure is too low on plasma gas 1. Please turn up the pressure on the input gas and check for a leak. Maximum = 10 bar, Minimum = 3.5 bar.
3	Plasma gas 2 input pressure is too high. Please turn down the pressure on the input gas. Maximum = 10 bar, Minimum = 3.5 bar.
4	Plasma gas 2 input pressure is too low. Please turn up the pressure on the input gas and checked for leaks. Maximum = 10 bar, Minimum = 3.5 bar.
5	Plasma gas output pressure is too high. Check for a pinched line after the Plasma Gas Control or a clogged hose.
6	Plasma gas pressure output is too low. Check for a leak in the line after the Plasma Gas Control or a missing nozzle.
9	Shield gas 1 output flow is too high. Check for a leak in the line after the Shield Gas Control or missing/incorrect Shield Cup.
A	Shield gas 1 output flow is too low. Check for a pinched line after the Shield Gas Control or clogged/incorrect Shield Cup.
B	Shield gas 2 output flow is too high. Check for a leak in the line after the Shield Gas Control or missing/incorrect Shield Cup.
C	Shield gas 2 output flow is too low. Check for a pinched line after the Shield Gas Control or clogged/incorrect Shield Cup.
D	Arc Voltage is too high. Check that the torch did not fall into a hole and that the arc voltage calibration is correct.
E	Arc Volt is too low. Check that the torch did not crash into the plate or ground and that the arc voltage calibration is correct.
F	Current output is too high. Check that the control cable to the power supply is not damaged and that the command voltage is not shorted to 10VDC.
10	Current output is too low. Check that the control cable to the power supply is not damaged and that the command voltage is not shorted to ground.
11	The torch has crashed. Please remove obstruction and reset the torch in the torch holder.
12	The arc was lost before plasma start signal was removed.
13	Initial Height Sensor (IHS) did not complete in the allowed time. Make sure the torch is over a plate and the amplifier is not faulted.
14	Plasma Gas Control is missing. Please make sure the CAN cable is securely plugged into both the Plasma Gas Control and the ICH Box.
15	Shield Gas Control is missing. Please make sure the CAN cable is securely plugged into both the Shield Gas Control and the ICH Box.
17	WIC is missing. Please make sure the CAN cable is securely plugged into both the WIC and the ICH Box.
18	The lifter is missing. Please make sure the CAN cable is securely plugged into both the lifter and the ICH Box.
19	Coolant flow is too low. Make sure the power supply is powered and the coolant level is above the minimum level line.
1A	The power supply is faulted. Please see the power supply for details of the fault.
1B	Remote Arc Starter is missing. Please make sure the CAN cable is securely plugged into both the Remote Arc Starter and the ICH Box.
1C	The system failed to start. Please make sure the torch is close enough to the work for the arc to transfer.
1D	The lower limit switch on the lifter has been tripped.
1E-24	Contact service. This is not an error a customer can fix.
25	Serial Communication parity error. This is normal during the plasma start sequence.
26	Serial Communication framing error. This is normal during the plasma start sequence.
27	Serial Communication overflow error. This is normal during the plasma start sequence.
28	Unknown Serial Communication error. This is normal during the plasma start sequence.
29	The display has reset. This can happen during the plasma start sequence. Try moving DB37 cable further away from the torch and power cables away from the power supply.
FF	The module's telegram counters did not match the ICH's telegram counters. This happens when the ICH misses a telegram, the module misses a telegram, or the module resets unexpectedly.

Communication Errors

Communication Errors from System Modules	
ID	**Description**
3	Wrong ID or wrong CRC checksum.
9	CRC error during transfer of the station constants.
B	Watchdog error.
11	CRC checksum is wrong.
12	Module carried out a reset.
1A	Watchdog counter has been exceeded.
1B	Output driver has a short circuit.
1C	Wrong or no expansion board.
1D	CRC error during transfer of the station constants.
1E	Send buffer overflow CAN.
1F	Receive buffer overflow CAN.
22	Difference between set value and actual value of the digital outputs.
23	CRC error in the calibration data.
2B	Junma amplifier reports "Alarm".
2C	CRC error in the calibration data.
2D	Varying signal statuses on the relay outputs.
2E	Over temperature at the heat sink.
2F	No motor voltage.
30	CRC checksum of the PLC is not correct.
31	Short circuit on the motor supply cable.
34	Cable fault.
35	Wrong CRC checksum from the printer.
53	CRC checksum of the PLC is not correct.
54	Varying signal statuses on the relay outputs .
59	CRC error during transfer of the station constants.
5A	Module carried out a reset.
5B	Wrong position sensor.
5C	No servo amplifier.
5D	Limit switch has been reached.
5E	Over current in the servo amplifier.
5F	Watchdog counter has been exceeded.

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ESAB Serial Communication Interface

Introduction

ESAB Serial Communication Interface (ESCI) is the software developed for operating the Interface Control Hub (ICH) remotely. This software is developed on the .NET Framework which will communicate with the ICH through a serial interface.

For customers who have RS232, instead of RS422, an RS232 to RS422 converter may be used to communicate via RS422 with the ICH.

System Requirements

There are certain requirements that need to be met in order to install and operate the ESAB Serial Communication Interface on your system.

Minimum Requirements:

1. CPU: 1.2GHz P4
2. Memory: 256MB
3. Operating System: Windows XP SP2
4. Hard disk: 30MB + Log Space
5. Serial Communication Port (RS232 or RS422)
6. Display: 800x600
7. Keyboard or Touch screen
8. Windows Installer 3.1 (Included in Redistro Folder)
9. .Net Framework 2.0 (Included in Redistro Folder)

Recommended Requirements:

1. CPU: 2GHz P4
2. Memory: 512MB
3. Operating System: Windows XP SP3
4. Hard disk: 30MB + Log Space
5. Serial Communication Port (RS232 or RS422)
6. Display: 800x600
7. Keyboard or Touch screen
8. Windows Installer 3.1 (Included in Redistro Folder)
9. .Net Framework 2.0 (Included in Redistro Folder)

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Installation

Installation of the ESCI software is straight forward. Insert the media containing the ESCI setup file into the system on which you want to install ESCI and run the setup.exe file. Then follow the instructions on screen. When installation is complete, run the configurator to setup the software for first use.

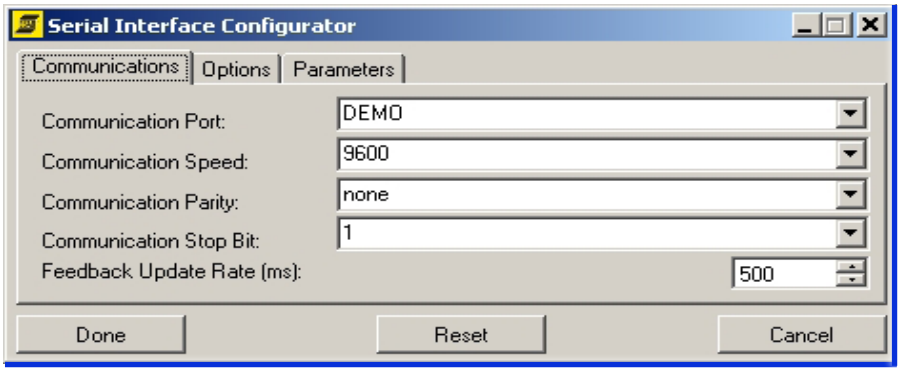

Figure 1: Communication Configurations

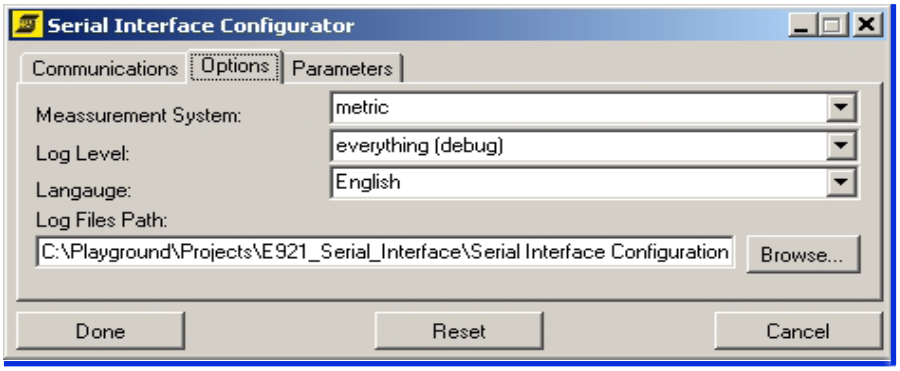

Figure 2: System Options

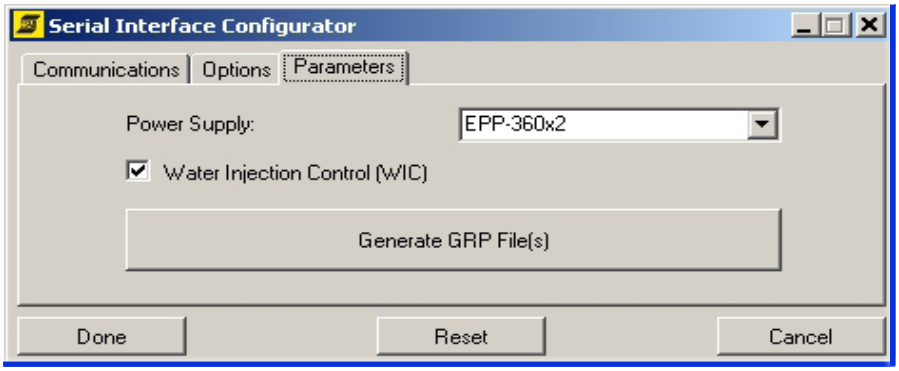

Figure 3: GRP File Generator

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The communication settings (shown in Figure 1), i.e., Port, Speed, Parity and Stop Bit, must match the ICH settings.

The different log levels (shown in Figure 2) available are:

None - Do not record any information.

Errors only - Record the communication errors.

Errors and warnings only - Record communication errors and warnings.

Errors, warnings and information - Record communication errors, warnings, and information about the parameter database etc.

Everything (debug) - Record all the information. This is not recommended unless there are serious problems and the customer wants to debug it.

The GRP generator (shown in Figure 3) allows for the recreation of the GRP file, based on the power supply and a WIC being present. Select the power supply installed, if there is a WIC present, and then click generate. When the file is created, a message will be displayed.

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Operation

This section shows how to operate the ESCI software with ICH for remote operation. Launch the ESCI software on your system, the ESAB logo, as shown in Figure 7, is displayed which states ESCI is loading parameters database.

Figure 7: ESCI Loading Screen

Once the ESCI has finished loading the parameter database, the user graphical interface screen, as shown in Figure 8 for m3 Gen2 and Figure 9 for IGC, will be displayed depending on the mode of operation.

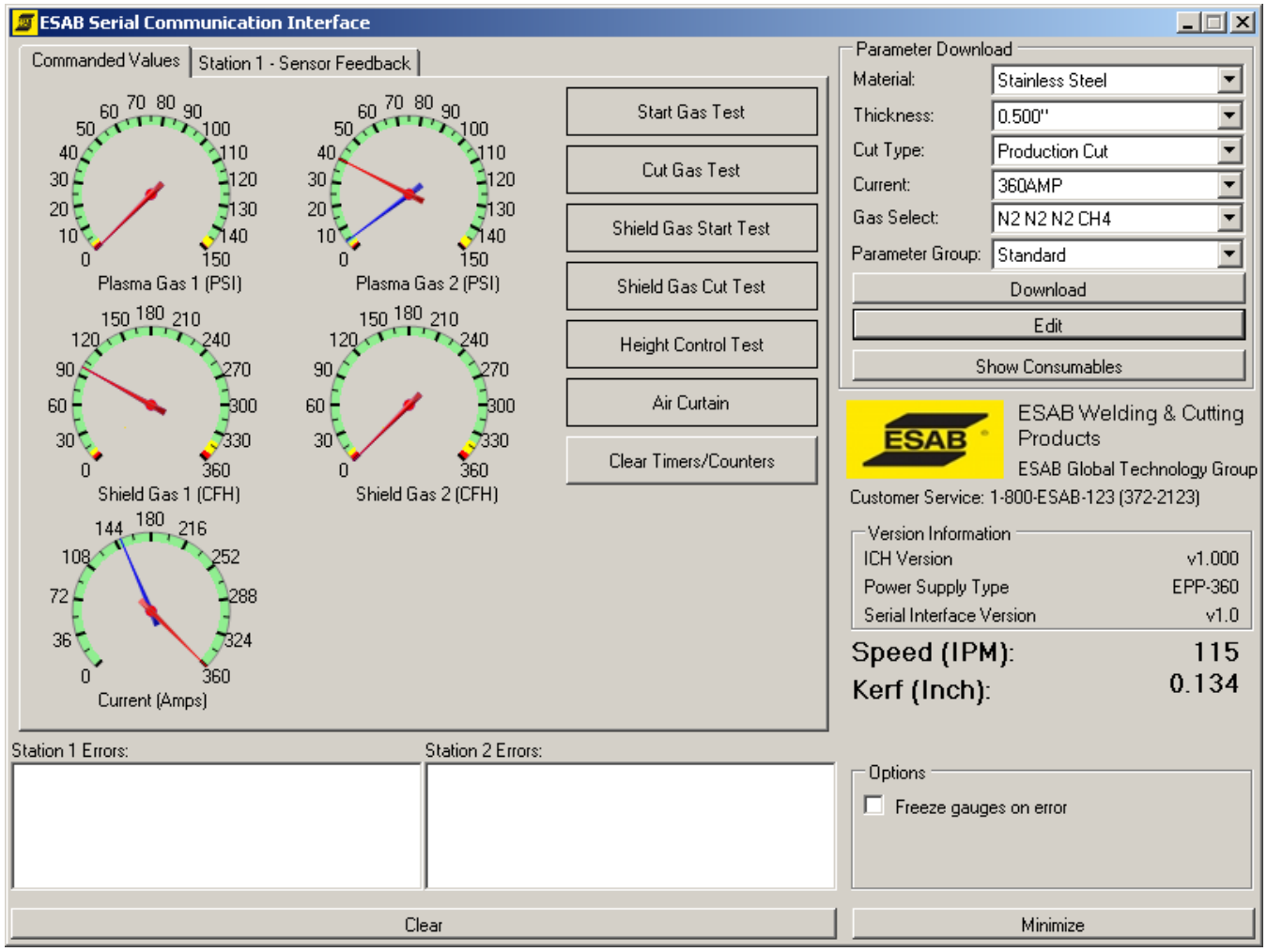

Figure 8: m3 Gen2 Parameter Screen with one station turned on

Figure 8 is with one station turned on. As stations are turned on, the tab for the station(s) will appear like they are in Figure 9 and 10.

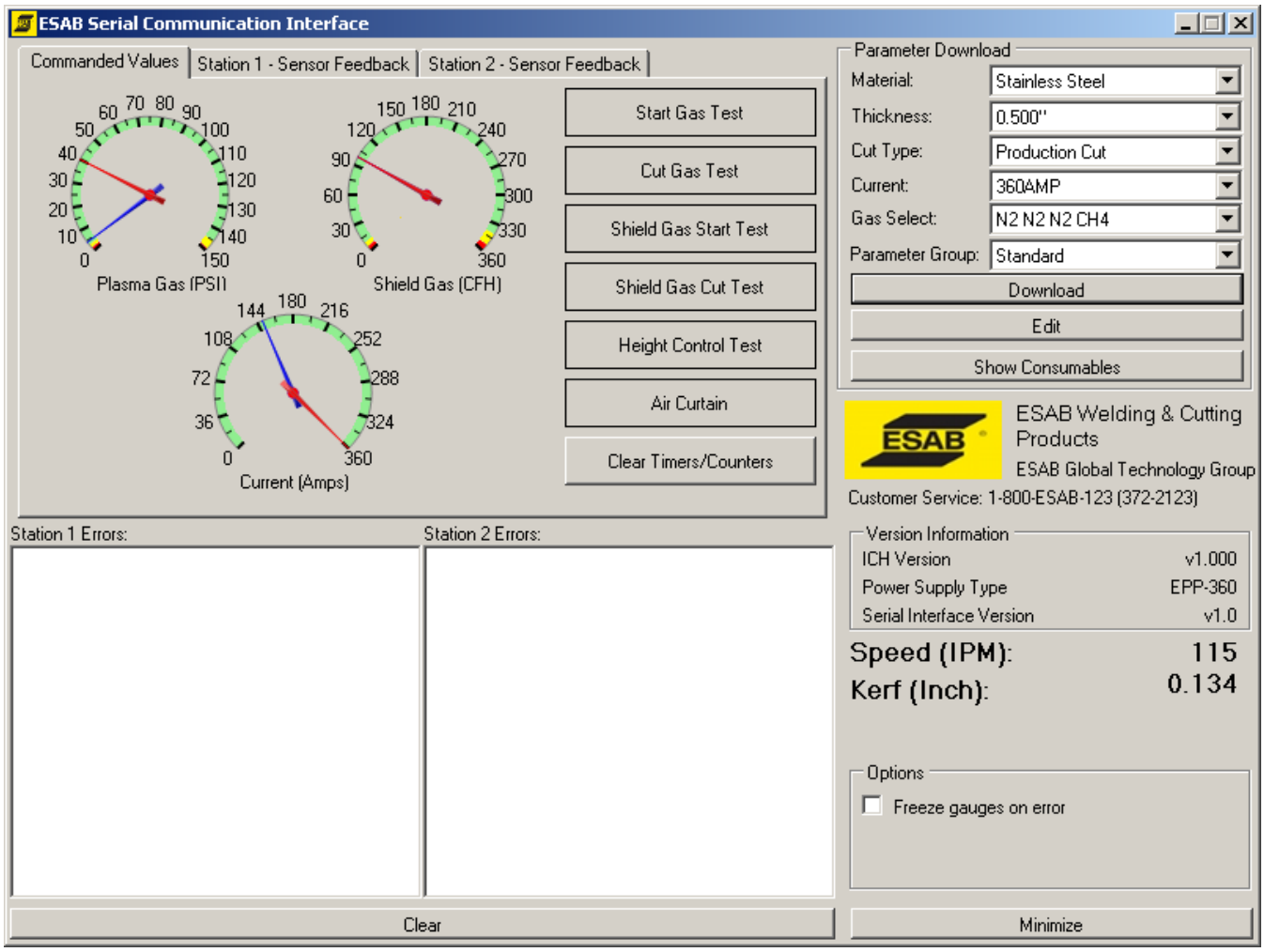

Figure 9: IGC Parameter Screen with all stations on

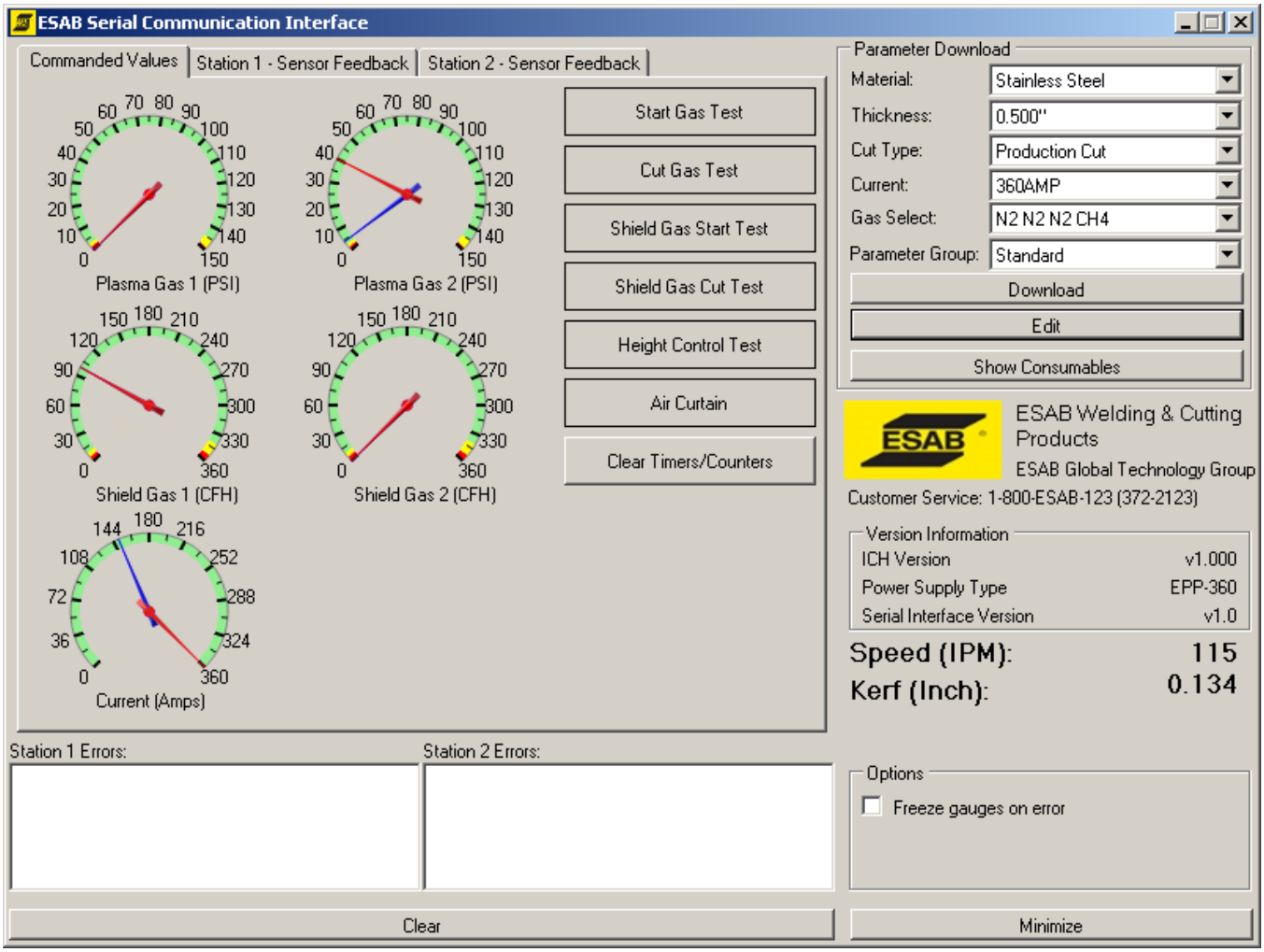

Figure 10: m3 Gen2 with all stations turned on

Throughout the application, this document will assume there is a mouse or touch screen attached to the computer/CNC running the software. If only a keyboard is attached, the tab key can be used to move between buttons and dropdown lists, the arrow keys can be used to change the dropdown lists, and the spacebar key can be used to "click" the buttons.

From all the tabs, it is possible to view the consumables, edit the parameters, freeze the gauges, clear errors, get version information, minimize the application, get the information needing to be loaded on the CNC, and download parameters to the ICH. To view the consumables needed for the currently selected parameters, click the SHOW CONSUMABLES button, Figure 11 will then be displayed. To get rid of the consumables screen click it or press any key. To download the parameters to the ICH, click on the DOWNLOAD button. Once the download is started, a progress bar (Figure 12) will appear and when complete, the progress bar will disappear and a message box (Figure 13) stating that the download is complete will appear for a few seconds. The speed, kerf, and arc voltage (if height control is not controlled by the ICH) will have the values, needing to be set on the CNC, displayed in the bottom right area of the screen.

Figure 11: Consumable Pictures

Figure 12: Parameter Download Status Bar

Figure 13: Parameter Download Complete

The freeze gauges on error option allows the gauges to be frozen in the state they were last in when an error occurs. The station error list will display the error reported by the ICH, which can be cleared by clicking the CLEAR button. This will also unfreeze the gauges. To get greater detailed information about the error, click on the error.

The version information will display the version of the ICH and the application's version. The power supply type will also be displayed in the same area.

The GAS TEST buttons on the parameter screen will allow for testing each gas output for the currently downloaded parameters, which is displayed on the gauges to the left. The blue arrow is the start value and the red arrow is the cut/mark value.

The HEIGHT CONTROL TEST button will only show up if the ICH controls the lifter. This button will cause the height control to find the initial height for cutting/marking.

The AIR CURTAIN button will enable/disable the air curtain output. The CLEAR TIMERS/COUNTERS button will reset the number of starts and the arc on time, which are displayed on the station's tab.

The EDIT PARAMETERS button will display the screen in Figure 14 (m3 Gen 2) or Figure 15 (IGC). This is where all the parameter editing occurs. On this screen all the parameters can be changed. When saving the parameters a parameter group must be specified and can not be the "Standard" group. The "Standard" group is reserved for the parameters from ESAB. The RELOAD button will reload the parameters on the screen back to what they were originally.

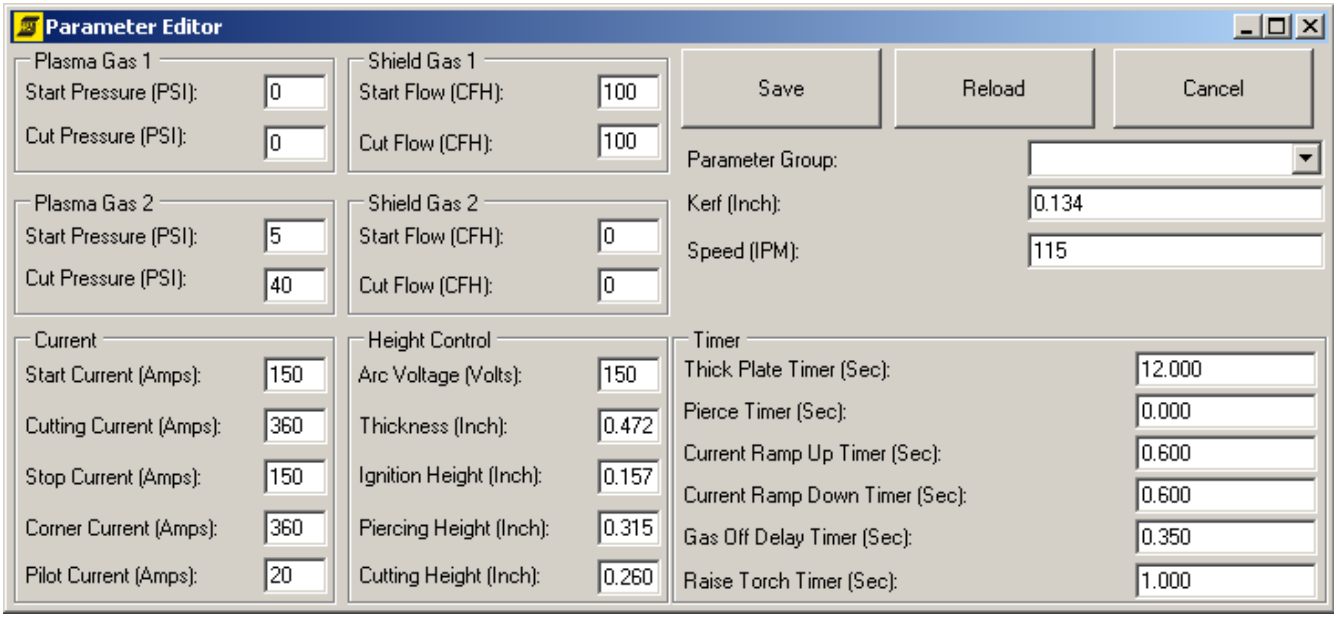

Figure 14: m3 Gen2 parameter edit screen

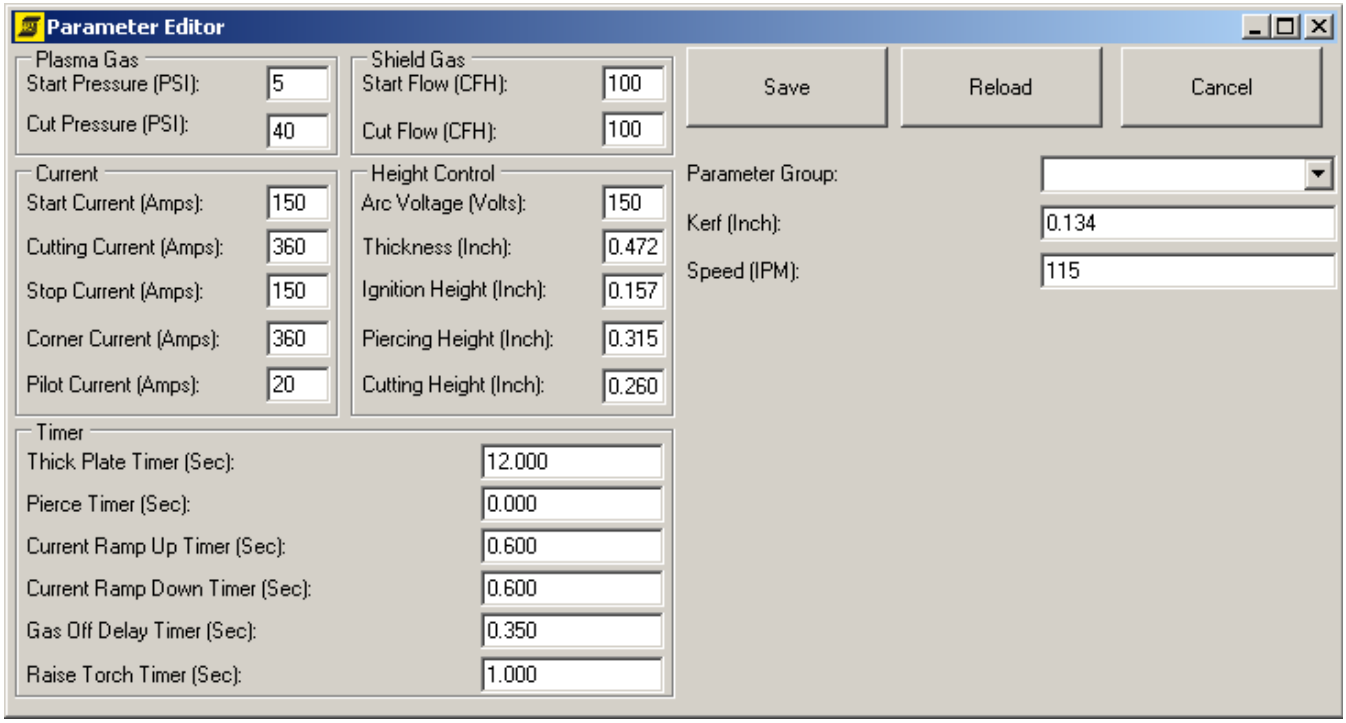

Figure 15: IGC parameter edit screen

The station's tab is where the feedback from the ICH is displayed, as shown in Figure 16 (m3 Gen2) and Figure 17 (IGC). The red area on the gauges is the area where an error will occur. The yellow area is the area where the performance of the plasma system will be degraded, but still work without producing an error. The green area is the ideal area to be in. Below the needle in each gauge, there is the digital value being read back from the ICH. The yellow and red areas on the gauges measuring the output pressures and flow will only appear when the process is active. This is indicated when the process step is not 0. The process step displays the step number the ICH is currently in. The step 0 is the idle step, where gas and height control tests can be done. The coolant level warning text will only appear when there is a low coolant level detected in the coolant circulator, it is recommended to check for coolant leaks and refill the coolant circulator when this occurs. The warning will not stop the plasma system from functioning. But the coolant flow error is more likely to occur during a cut/mark operation, which can damage the part being made by the plasma system when it shuts down.

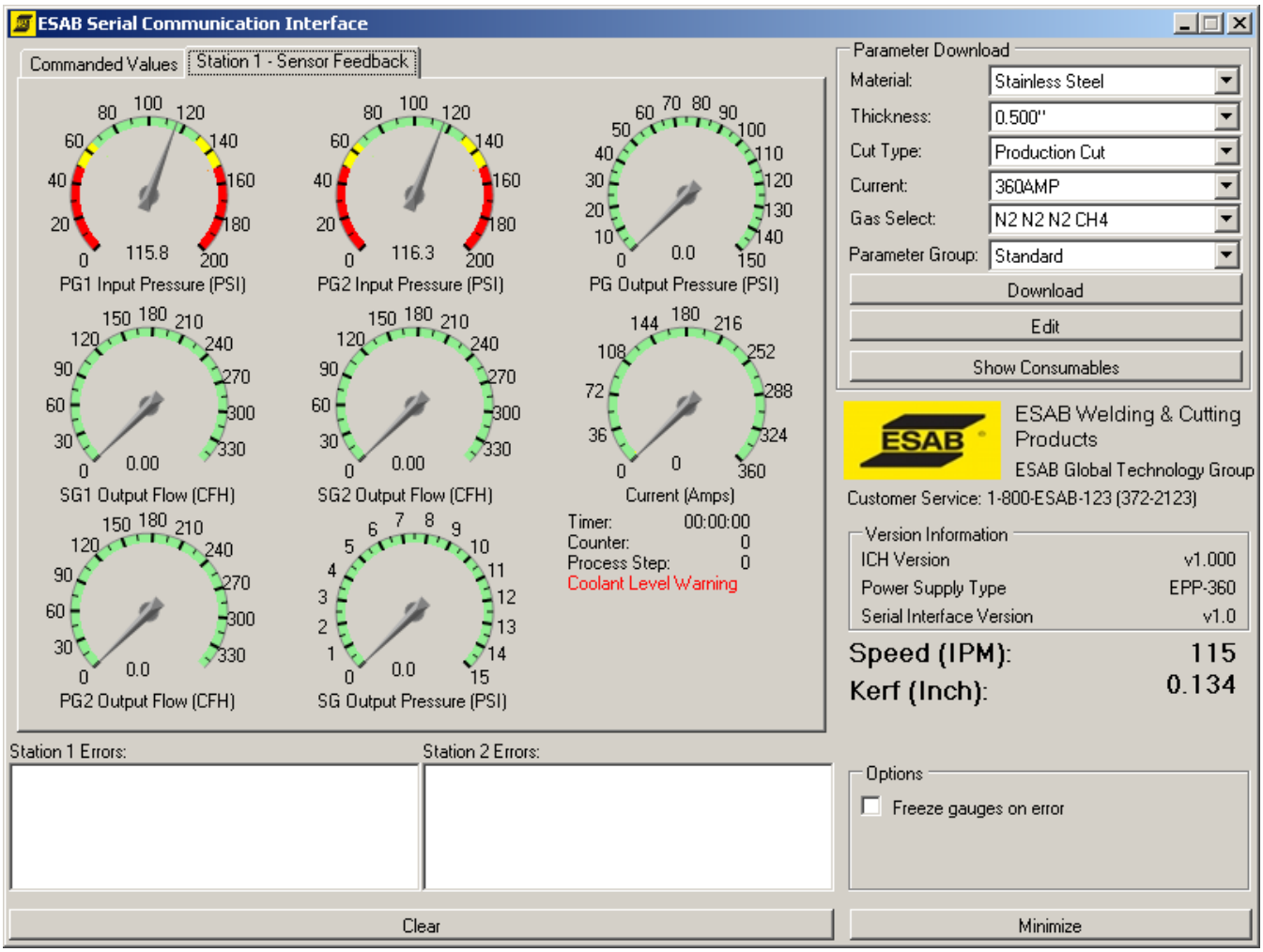

Figure 16: m3 Gen2 station tab

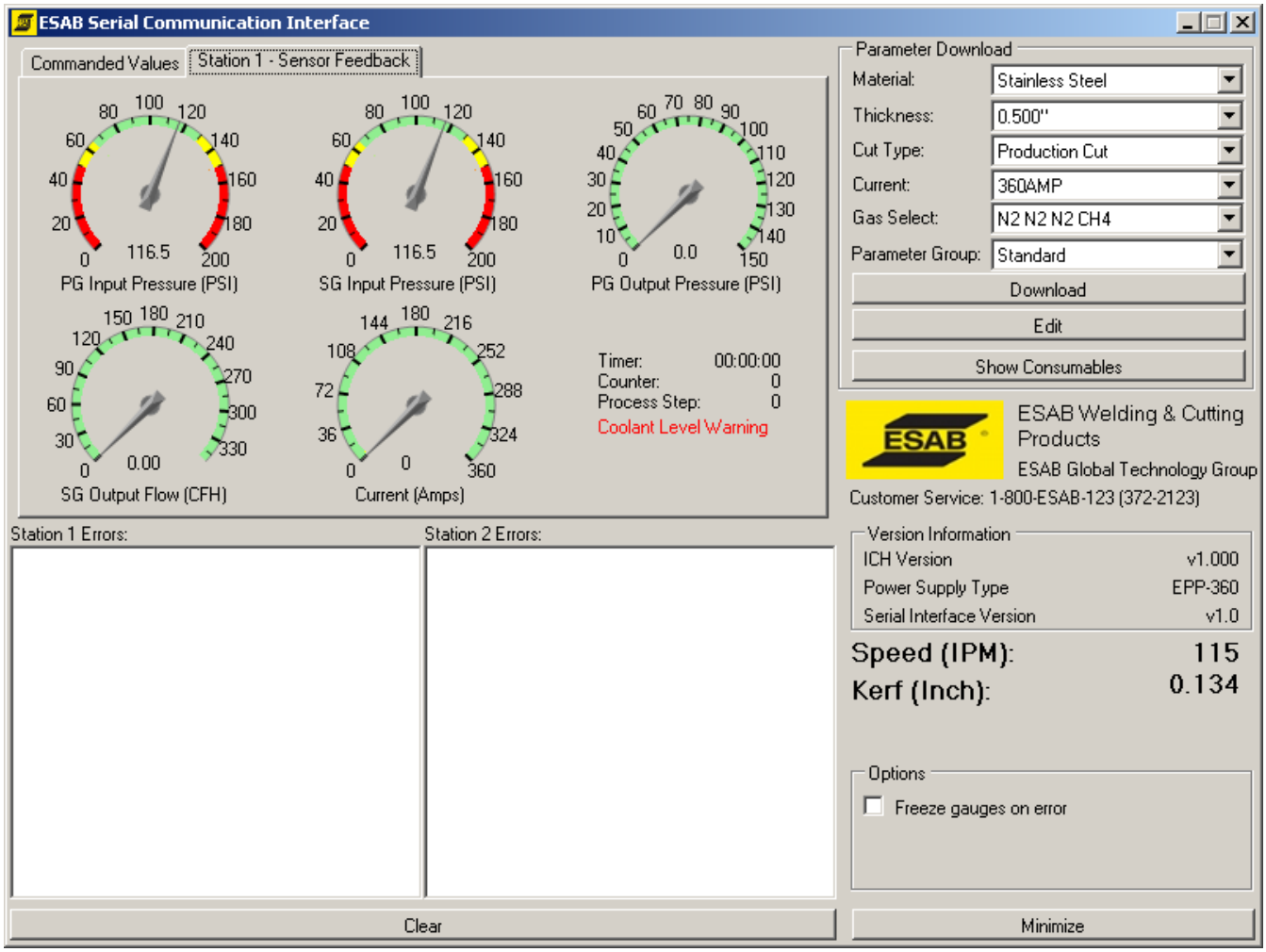

Figure 17: IGC station tab

Demo Server

This section shows how to operate the Demo Server. The demo server software will simulate an ICH via an Ethernet connection. The protocol used on the Ethernet connection is the same as the one used on the serial connection. Launch the Demo Server on your system and when it is loaded, the screen in Figure 18 will be displayed.

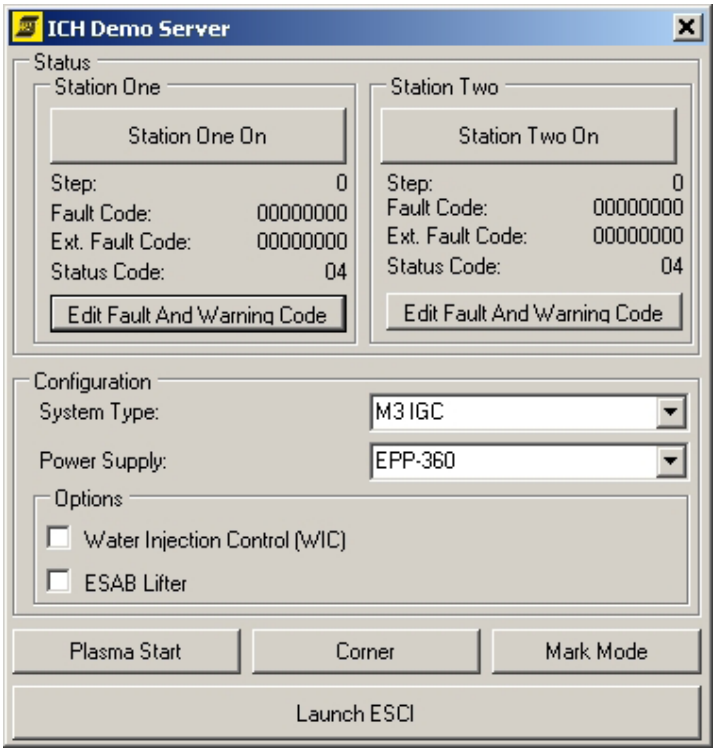

Figure 18: Demo Server Main Screen

From here the system type, power supply, lifter, and WIC options can be selected. Once these options are setup to simulate the ICH system desired, the ESCI software can be launched. This can be done by clicking the LAUNCH ESCI button or by running the ESCI software via other means. The recommended method is via the LAUNCH ESCI button on the demo server. Once the ESCI software is launched, via the launch ESCI button, the LAUNCH ESCI button will change to Quit ESCI. This button can be used to quit the ESCI software at any time.

The three buttons above the LAUNCH ESCI button simulate the digital inputs from the CNC to the ICH. The PLASMA START button will start the process and lock out the MARK MODE button. The MARK MODE button will put the simulator into Marking mode. The CORNER button will switch the simulator between corner current and cut/mark current. The STATION ON buttons will toggle the station on/off, simulating the station on digital input from the CNC to the ICH.

The step is the current process step being simulated. The warning code, fault code and extended fault code are the raw codes sent back to the ESCI software. The meaning of the code is explained in the serial protocol section of the manual. By clicking the EDIT FAULT AND WARNING CODE button, they can be edited by the name of the fault/warning. This can be seen in Figure 19. By clicking on the ADD button, Figure 20 will appear where the fault codes can be added. The CLEAR ALL FAULTS button will clear all of the faults.

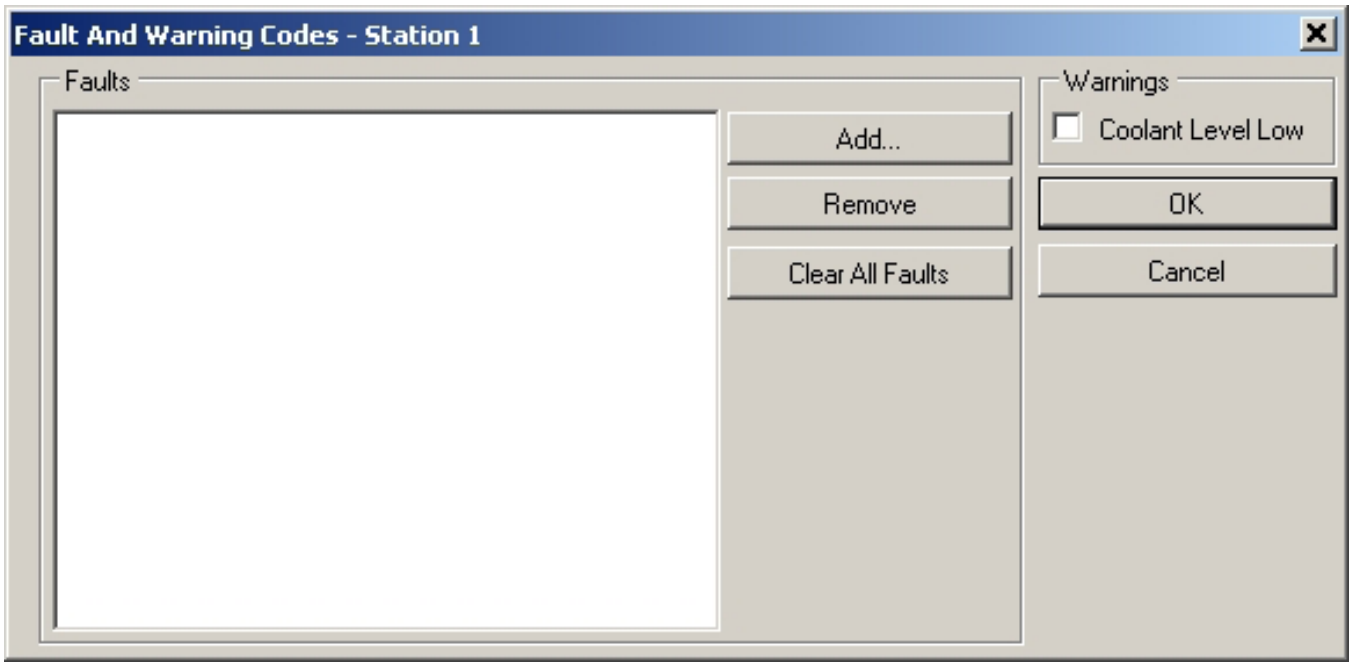

Figure 19: Demo Server Error Screen

Figure 20: Demo Server Error Selection Screen

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ICH Serial Communication Protocol

The serial communication with the ICH can be achieved by RS-232, RS-422, or RS-485. This is selectable via the constant editor mode. Each command and response from the Interface Control Hub has a two character checksum on the end. The checksum can be calculated with the following formula:

Checksum = Hex (Truncate ((ASCII (Character1) + ASCII (Character2) + … + ASCII (CharacterN)), 8 bits))

Where Character1 through CharacterN are the characters of the command/response and data to be sent with the command/response. Truncate is a function that drops all bits higher than the number of bits specified. Hex converts the number into its hexadecimal representation in a string.

Note:

During the starting of the plasma process a high frequency generator will become active for about one second. This will cause communication checksum errors on messages sent and received for up to three seconds. The ICH will automatically resume normal communication after this time.

Commands

000: Hello command

This will also reset all errors.

Command:

000<Checksum>

Response:

000ESAB m3-CAN OEM<Checksum>

001: Version request

Command:

001<Checksum>

Response:

001<Power Supply Version> <ICH Version><Checksum>

Power Supply Version is 4 characters long and in hexadecimal format. ICH Version is 4 characters long and in hexadecimal format. The first two characters are the major and the second two characters are the minor (e.g. Major.Minor)

002: Get station status

Command:

002<Checksum>

Response:

002<Station 1 Status> <Station 2 Status><Checksum>

Station 1 Status and Station 2 Status are 4 characters of hexadecimal, each in the following format:

Bit 11-15:	Spare
Bit 10:	Coolant Level OK
Bit 9:	Mark Mode
Bit 8:	Station Selected
Bit 0-7:	Process Step

003: Get station errors

Command:

003<Checksum>

Response:

003<Station 1 Errors> <Station 2 Errors><Checksum>

Station 1 Errors and Station 2 Errors are 8 characters of hexadecimal each in the following format:

Bit 31:	Spare
Bit 30:	Lower Limit Switch
Bit 29:	Spare
Bit 28:	Spare
Bit 27:	Spare
Bit 26:	Power Supply Fault
Bit 25:	Crash
Bit 24:	Coolant Flow OK
Bit 23:	Current too low
Bit 22:	Current too high
Bit 21:	Arc Voltage too low
Bit 20:	Arc Voltage too high
Bit 19:	Shield Gas 2 Flow too low
Bit 18:	Shield Gas 2 Flow too high
Bit 17:	Shield Gas 1 Flow too low
Bit 16:	Shield Gas 1 Flow too high
Bit 15:	Plasma Gas 2 Flow too low
Bit 14:	Plasma Gas 2 Flow too high
Bit 13:	Plasma Gas output pressure too low
Bit 12:	Plasma Gas output pressure too high
Bit 11:	Plasma Gas 2 input pressure too low
Bit 10:	Plasma Gas 2 input pressure too high
Bit 9:	Plasma Gas 1 input pressure too low
Bit 8:	Plasma Gas 1 input pressure too high
Bit 7:	Water Injection Module Missing
Bit 6:	Power Supply Missing
Bit 5:	Plasma Gas Box Missing
Bit 4:	Shield Gas Box Missing
Bit 3:	Lifter Missing
Bit 2:	Arc Lost
Bit 1:	Ignition Timeout
Bit 0:	IHS Timeout

004: Remote Mode

Command:

004<Checksum>

Response:

0040<Checksum> if in local mode and 0041<Checksum> if in remote mode

005: Get extended errors (only available on version 1.7 or later)

Command:

005<Checksum>

Response:

005<Station 1 Errors> <Station 2 Errors><Checksum>

Station 1 Errors and Station 2 Errors are 8 characters of hexadecimal each in the following format:

Bit 16-31:	Spare
Bit 15:	Lower limits switch
Bit 14:	Current feedback, inside RAS, too low
Bit 13:	Current feedback, inside RAS, too high
Bit 12:	WIC Error
Bit 11:	WIC Watchdog
Bit 10:	RAS Error
Bit 9:	RAS Watchdog
Bit 8:	CGC Error
Bit 7:	CGC Watchdog
Bit 6:	PGC Error
Bit 5:	PGC Watchdog
Bit 4:	SGC Error
Bit 3:	SGC Watchdog
Bit 2:	Sensor short on lifter
Bit 1:	Lifter Error
Bit 0:	Lifter Watchdog

006: Parameter Loading Mark/Cut

Command:

0061<Checksum> for mark parameters are being loaded and 0060<Checksum> for cut parameters.

Response:

0061<Checksum> at all times.

007: Air Curtain enable/disable

Command:

0071<Checksum> for enabled and 0070<Checksum> for disabled.

Response:

0070<Checksum> if action not allowed and 0071<Checksum> if the action was allowed.

008: Retrieve Options

Command:

008<Checksum>

Response: 008<Lifter><Water Injection><Gas Control><Checksum>

Each is 1 byte long. There is a ICH controlled lifter if Lifter is "1", otherwise there is no height control from the Interface Control Hub. There is a water injection module attached if Water Injection is "1", otherwise there is no water injection module.

The Gas Control determines which type of control there is.

"0" - Water Injection only.
"1" - Combined Gas Control is used.
"2" - Full Gas Control is used.

028: Read current

Command:

028<Checksum>

Response:

028<Station 1 Current> <Station 2 Current><Checksum>

Station 1 Current and Station 2 Current are both 4 characters long and in the unit amperes.

058: Set currents

Command:

058<Start Current> <Cut Current> <End Current> <Pilot Arc Current><Checksum>

All the currents are in amperes and 4 characters long.

Response:

0581<Checksum> if allowed and 0580<Checksum> if not

060: Shield Cut Gas Test Begin

Command:

060<Checksum>

Response:

0600<Checksum> if not allowed and 0601<Checksum> if allowed

061: Shield Cut Gas Test End

Command:

061<Checksum>

Response:

0611<Checksum>

062: Shield Start Gas Test Begin

Command:

062<Checksum>

Response:

0620<Checksum> if not allowed and 0621<Checksum> if allowed

063: Shield Start Gas Test End

Command:

063<Checksum>

Response:

0631<Checksum>

064: Start Gas Test Begin

Command:

064<Checksum>

Response:

0640<Checksum> if not allowed and 0641<Checksum> if allowed

065: Start Gas Test End

Command:

065<Checksum>

Response:

0651<Checksum>

066: Cut Gas Test Begin

Command:

066<Checksum>

Response:

0660<Checksum> if not allowed and 0661<Checksum> if allowed

067: Cut Gas Test End

Command:

067<Checksum>

Response:

0671<Checksum>

069: IHS Test

Command:

069<On/Off><checksum>

On is 1 and Off is 0.

Response:

0691<Checksum> if allowed and 0690<Checksum> if not allowed

070: Set Corner Current

Command:

070<Corner Current><Checksum>

The corner current is in amperes and is 4 characters long

Response:

0701<Checksum> if allowed and 0700<Checksum> if not allowed

078: Gas Pressure/Flow loading

Command:

078<PG1 Start> <PG1 Cut> <PG2 Start> <PG2 Cut> <SG1 Start> <SG1 Cut> <SG2 Start> <SG2 Cut><Checksum>

Plasma gases (PG) are in millibar (mBar) and 5 characters long, while shield gases (SG) are in 1000 times cubic meter per hour (1000 * CMH) or milliliters per minute (mLM) and 5 characters long.

Response:

0781<Checksum> if allowed and 0780<Checksum> if not allowed

087: Set height settings

Command:

087<Initial Height> <Cutting Height> <Pierce Height> <Arc Voltage> <Thickness><Checksum>

Initial Height, Cutting Height, Pierce Height, and Arc Voltage are in micrometers and 5 characters long. Thickness is in micrometers and is 6 characters long.

Response:

0871<Checksum> if allowed and 0870<Checksum> if not allowed.

094: Gas pressure/flow readings from sensors

Command:

094<Checksum>

Response:

094<Station 1 SG1 Flow> <Station 1 SG2 Flow> <Station 1 PG Output Pressure> <Station 1 PG2 Flow> <Station 1 PG1 Input Pressure> <Station 1 PG2 Input Pressure> <Station 1 SG Output Pressure> <Station 2 SG1 Flow> <Station 2 SG2 Flow> <Station 2 PG Output Pressure> <Station 2 PG2 Flow> <Station 2 PG1 Input Pressure> <Station 2 PG2 Input Pressure> <Station 2 SG Out put Pressure><Checksum>

All the readings are 5 characters each. Pressures are in millibar (mBar) and flows are in 1000 times cubic meter per hour (1000 * CMH). If water injection is in use than SG1 and SG2 flow are the water injection flow in milliliter per minute (mLM) and SG Output Pressure is the water injection pressure.

095: Load timers

Command:

095<Current Ramp Up> <Current Ramp Down> <Gas Off Delay> <Preflow> <Raise When Complete> <Piercing Timer><Checksum>

All timers are in milliseconds and 5 characters long.

Response:

0951<Checksum>

096: Gas select

Command:

096<Gas Select><Checksum>

Gas Select is 2 Characters long.

Response:

0961<Checksum> if allowed and 0960<Checksum> if not allowed

097: Load thick plate timer

Command:

097<Thick Plate Timer><Checksum>

The timer is in milliseconds and 5 characters long.

Response:

0971<Checksum>

099: Read current gas pressure/flow parameters

Command:

099<Checksum>

Response:

099<PG1 Cut> <PG1 Start> <PG2 Cut> <PG2 Start> <SG1 Cut> <SG1 Start> <SG2 Cut> <SG2 Start><Checksum>

Plasma gases (PG) are in millibar (mBar) and 5 characters long, while shield gases (SG) are in 1000 * cubic meter per hour (1000 * CMH) or milliliters per minute (mLM) and 5 characters long.

098 & 122: Read gas select

Command:

098<Checksum>
122<Checksum>

Response:

098<Gas Select><Checksum>
122<Gas Select><Checksum>

Gas Select is 2 Characters long.

124: Reset Timers/Counters

Command:

124<Checksum>

Response:

1241<Checksum> all the time

125: Read Timers/Counters

Command:

125<Checksum>

Response:

125<Station 1 Timer> <Station 1 Counter> <Station 2 Timer> <Station 2 Counter><Checksum>

Timers are in the format “hh:mm:ss” and counters are 4 characters long hexadecimal numbers. The counter represents the number of times the torch has been fired since the last reset and the timer is how long the process was running since the last reset.

APPENDIX

ICH Communication Errors

There are three possible communication errors:

500: Bad Checksum
The message was received but the checksum was incorrect. Wait one second and then retry. Another 500 will be transmitted after the one second is up.

501: Unknown Command
The command was received but the received command was not a recognized command.

502: Communication Not Allowed
Communication is not allowed because the Local/Remote toggle switch is set to local. Toggle the Local/Remote switch to remote, and try again.

ICH Login Sequence

The login sequence should be in the following order:

1. Hello (000)
2. Version (001)
3. Get status (002)
4. Get errors (003)
5. Get Timers/Counters (125)
6. Check remote mode status (004)
7. Retrieve options (008)

Example:

Send	Receive
00090	000ESAB m3-CAN OEM4B
00191	0010168 010041
00292	0020000 000032
00393	00300000000 00000000B3
12598	12500:00:00 0000 00:00:00 0000A0
00494	0041C5
00898	00800129

APPENDIX

ICH Communication Error Messages

Error	Resolution
IHS Timeout	Check that there is a plate below the torch and within the stroke of the lifter. Check the ICH display to see if the station is selected. Check the lift amplifier in the lift box for a fault. Call service if none of the above work.
Ignition Timeout	Check that the power supply is turned on. Check that the torch is within the specified distance to the plate. Check that the pilot arc cable is attached, in the Remote Arc Starter box, to the pilot arc connection point and on the other end to the power supply's pilot arc connection point. Check that the electrode cables are connected to the block in the Remote Arc Starter box. Check that the work cables are connected to the work piece, normally via a slat.
Arc Lost	Check that the machine did not stall over a small hole or try to cut across a large hole (or off the edge of the plate). Check that the input power to the power supply did not drop out.
Lifter Missing	Check that the lifter has the CAN cable connected and there are no empty plugs between the lifter's CAN plug and CAN 1 on the Interface Control Hub. If this setup has no lifter, then edit the constant, via the constant editing mode, to disable the lifter functions. Call service if there seems to be no cabling issues.
Shield Gas Box Missing	Check for 230/115 VAC on the power plug of the Shield Gas Box. Check that the Shield Gas Box has the CAN cable connected and there are no empty plugs between the Shield Gas Box's CAN plug and CAN 1 on the Interface Control Hub. Call service if there seems to be no cabling issues.
Plasma Gas Box Missing	Check for 24 VDC and 24 VAC on the power plug of the Plasma Gas Box. Check that the Plasma Gas Box has the CAN cable connected and there are no empty plugs between the Plasma Gas Box's CAN plug and CAN 1 on the Interface Control Hub. Call service if there seems to be no cabling issues.
Power Supply Missing	Check that the Remote Arc Starter has the CAN cable connected and there are no empty plugs between the Remote Arc Starter's CAN plug and CAN 1 on the Interface Control Hub. Call service if there seems to be no cabling issues.
Water Injection Module Missing	Check that the Water Injection Box has the CAN cable connected and there are no empty plugs between the Water Injection Box's CAN plug and CAN 1 on the Interface Control Hub. If this setup has no water injection box, then edit the constant, via the constant editing mode, to disable the water injection functions. Call service if there seems to be no cabling issues.
Plasma Gas 1 input pressure too high	Check the input gas regulator to insure the input pressure to the system is below 10 Bar (145 PSI). If the input pressure has been verified to be below 10 Bar (145 PSI), then call service.
Plasma Gas 1 input pressure too low	Check the input gas regulator to insure the input pressure to the system is above 4 Bar (60 PSI). Check for a clogged inline filter. Check for a gas leak or pinched hose between the regulator and the Plasma Gas Box. If the input pressure has been verified to be above 4 Bar (60 PSI), then call service.
Plasma Gas 2 input pressure too high	Check the input gas regulator to insure the input pressure to the system is below 10 Bar (145 PSI). If the input pressure has been verified to be below 10 Bar (145 PSI), then call service.
Plasma Gas 2 input pressure too low	Check the input gas regulator to insure the input pressure to the system is above 4 Bar (60 PSI). Check for a clogged inline filter. Check for a gas leak or pinched hose between the regulator and the Plasma Gas Box. If the input pressure has been verified to be above 4 Bar (60 PSI), then call service.

Error	Resolution
Plasma Gas output pressure too high	Check for a pinched hose between the Plasma Gas Box and the torch. Check consumables for correctness and damage. Call Service.
Plasma Gas output pressure too low	Check for a leak in the hose between the Plasma Gas Box and the torch. Check consumables for correctness and damage/wear. Check input pressure to be at least 1 Bar (14.5 PSI) above command output pressure. Call Service.
Plasma Gas 2 Flow too high	Check consumables for correctness and/or damage/wear. Check for correct gas on the input lines to the plasma gas box and shield gas box. Check for a leak in the hose between the Plasma Gas Box and the torch. Call Service.
Plasma Gas 2 Flow too low	Check consumables for correctness and/or damage/wear. Check for correct gas on the input lines to the plasma gas box and shield gas box. Check for a pinched hose between the Plasma Gas Box and the torch. Call Service.
Shield Gas 1 Flow too high	Check consumables for correctness and/or damage/wear. Check for correct gas on the input lines to the shield gas box. Check for a leak in the hose between the Shield Gas Box and the torch. Call Service.
Shield Gas 1 Flow too low	Check consumables for correctness and/or damage/wear. Check for correct gas on the input lines to the shield gas box. Check for a pinched hose between the Shield Gas Box and the torch. Call Service.
Shield Gas 2 Flow too high	Check consumables for correctness and/or damage/wear. Check for correct gas on the input lines to the shield gas box. Check for a leak in the hose between the Shield Gas Box and the torch. Call Service.
Shield Gas 2 Flow too low	Check consumables for correctness and/or damage/wear. Check for correct gas on the input lines to the shield gas box. Check for a pinched hose between the Shield Gas Box and the torch. Call Service.
Arc Voltage too high	Check that the torch did not just go over a hole in the plate. Adjust the arc voltage calibration for errors between read voltage and actual voltage. Check for a wavy plate. Call Service.
Arc Voltage too low	Check for a damaged or missing VDR cable. Adjust the arc voltage calibration for errors between read voltage and actual voltage. Check for a wavy plate. Call Service.
Current too high	Check commanded current on the display on the power supply matches the desired current. Call Service.
Current too low	Check commanded current on the display on the power supply matches the desired current. Call Service.
Coolant Flow OK	Check coolant level in the reservoir in the coolant circulator. Call Service.
Crash	Check for damage to the torch consumables; replace damaged consumables with new ones. Remove the obstacle(s) from the path of the torch.
Power Supply Fault	Check the fault on the display panel of the power supply and follow instructions in the power supply's manual.

Error	Resolution
Lifter Watchdog	The Lifter's control module has watchdogged. Check the CAN cables for damage. Make sure the terminating resistor is installed, if not, all 7 parts are in use. Make sure the switch on the ICH is set to have the 120 Ohm resistor installed on the CANbus.
Lifter Error	The Lifter's control module has reported an error. Check the ICH Error Log for exact error.
Plasma Gas Control Watchdog	The Plasma Gas Control's control module has watchdogged. Check the CAN cables for damage. Make sure the terminating resistor is installed, if not, all 7 parts are in use. Make sure the switch on the ICH is set to have the 120 Ohm resistor installed on the CANbus.
Plasma Gas Control Error	The Plasma Gas Control's control module has reported an error. Check the ICH Error Log for exact error.
Combined Gas Control Watchdog	The Combined Gas Control's control module has watchdogged. Check the CAN cables for damage. Make sure the terminating resistor is installed, if not, all 7 parts are in use. Make sure the switch on the ICH is set to have the 120 Ohm resistor installed on the CANbus.
Combined Gas Control Error	The Combined Gas Control's control module has reported an error. Check the ICH Error Log for exact error.
Remote Arc Starter Watchdog	The Remote Arc Starter's control module has watchdogged. Check the CAN cables for damage. Make sure the terminating resistor is installed, if not, all 7 parts are in use. Make sure the switch on the ICH is set to have the 120 Ohm resistor installed on the CANbus.
Remote Arc Starter Error	The Remote Arc Starter's control module has reported an error. Check the ICH Error Log for exact error.
Water Injection Control Watchdog	The Water Injection Control's control module has watchdogged. Check the CAN cables for damage. Make sure the terminating resistor is installed, if not, all 7 parts are in use. Make sure the switch on the ICH is set to have the 120 Ohm resistor installed on the CANbus.
Water Injection Control Error	The Water Injection Control's control module has reported an error. Check the ICH Error Log for exact error.
Sensor short on Lifter	The Lifter has a sensor short. Check the crash sensor for proper operation and adjust as needed.
Current Feedback, inside RAS, too high	The current feedback, inside the RAS box, is too high. Check the 24 pin cable to the power supply for a short. Verify the command to the power supply is greater than 10 volts.
Current Feedback, inside RAS, too low	The current feedback, inside the RAS box, is too low. Check the 24 pin cable to the power supply for a short.
Lower Limit Switch	The lower limit switch was tripped on the lifter.
Shield Gas Control Watchdog	The Shield Gas Control's control module has watchdogged. Check the CAN cables for damage. Make sure the terminating resistor is installed, if not, all 7 parts are in use. Make sure the switch on the ICH is set to have the 120 Ohm resistor installed on the CANbus.
Shield Gas Control Error	The Shield Gas Control's control module has reported an error. Check the ICH Error Log for exact error.

APPENDIX

ICH Parameter Loading

The sequence for loading a whole parameter set.

1. Parameter type (006)
2. Gas select (096)
3. Gas pressure and flows (078)
4. Current (058)
5. Corner current (070)
6. Timers (095)
7. Heights (087) (if lifter exists)

The sequence for loading a single parameter is to send the parameter type command (006) and then the command for the parameter to be updated (with all the fields populated with the updated values). One marking and one cutting parameter set is the maximum the ICH will store. The parameters are only stored until the next power cycle of the Interface Control Hub.

Example:
The following example is for loading the parameters to mark and cut a 6 mm (~0.250") plate with 200 Amps and only air for the gas when cutting.

Send	Receive
0060C6	0061C7
0960807	0961D0
07800000 00000 02000 03030 04270 04270 00000 0000021	0781D0
0580100 0200 0100 002003	0581CE
070020059	0701C8
09500600 00600 00350 00000 01000 00100F4	0951CF
08704000 03200 10000 00143 00600017	0871D0
0061C7	0061C7
0960605	0961D0
07802760 02760 00000 00000 02000 02000 00000 0000021	0781D0
0580012 0014 0014 00200C	0581CE
070001058	0701C8
09500100 00100 00350 00000 01000 00000E9	0951CF
08704000 04100 04000 00070 0250001A	0871D0

PT-36 Mechanized Plasmarc Cutting Torch

The PT-36 Mechanized Plasmarc Cutting Torch is a plasma arc torch factory assembled to provide torch component concentricity and consistent cutting accuracy. For this reason, the torch body can not be rebuilt in the field. Only the torch front-end has replaceable parts.

The purpose of this section is to provide the operator with all the information required to install and service the PT-36 Mechanized Plasmarc Cutting Torch. Technical reference material is also provided to assist in troubleshooting the cutting package.

Package Options Available

PT-36 package options available through your ESAB dealer. See Replacement Parts section for component part numbers.

DESCRIPTIONS FOR PT-36 TORCH ASSEMBLY'S	PART NUMBER
PT-36 Torch Assembly 4.5 ft (1,4m)	0558008301
PT-36 Torch Assembly 6 ft (1,8m)	0558008302
PT-36 Torch Assembly 12 ft (3,6m)	0558008303
PT-36 Torch Assembly 14 ft Mini-Bevel (4,3m)	0558008308
PT-36 Torch Assembly 15 ft (4,6m)	0558008304
PT-36 Torch Assembly 17 ft (5,2m)	0558008305
PT-36 Torch Assembly 20 ft (6,1m)	0558008306
PT-36 Torch Assembly 25 ft (7,6m)	0558008307

Optional Accessories

Bubble Muffler - When used in conjunction with a water pump recirculating water from the table and by using compressed air, this device creates a bubble of air which enables a PT-36 Plasmarc Cutting Torch to be used underwater with less sacrifice of cut quality. This system also permits operation above water as the flow of water through the muffler reduces fume, noise, and arc U.V. Radiation.
(for installation/operation instructions see manual 0558006722)..... 37439

Air Curtain - This device when supplied with compressed air is used to improve the performance of the PT-36 Plasmarc Cutting Torch when cutting underwater. The device mounts onto the torch and produces a curtain of air. This allows the plasma arc to operate in a relatively dry zone, even though the torch has been submerged to reduce noise, fume, and arc radiation. **To be used in underwater applications only.**
(for installation/operation instructions see manual 0558006404) 37440

APPENDIX

Speedloader assembly, handheld 0558006164

NOTE:
Cannot be used with vent hole nozzles.

Speedloader assembly, 5 fixtures 0558006165

PT-36 Torch Consumable Kits

PT-36 Repair & Accessories Kit 0558005221

Part Number	Quantity	Description
0558003804	1	Torch Body PT-36 w/O-rings
0004485648	10	O-ring 1.614 ID x .070
0558002533	2	Baffle, 4 Hole x .032
0558001625	2	Baffle, 8 Hole x .047
0558002534	1	Baffle, 4 x .032 Reverse
0558002530	1	Baffle, 8 x .047 Reverse
0558005457	1	Baffle, 4 Hole x .022
0558003924	3	Electrode Holder PT-36 w/O-ring
0004485671	10	O-ring .364 ID x .070
0004470045	2	Nozzle Retaining Cup, Standard
0004470030	1	Shield Gas Diffuser, Low Current
0004470031	5	Shield Gas Diffuser, Standard
0004470115	1	Shield Gas Diffuser, Reverse
0004470046	2	Shield Retainer, Standard
0558003858	2	Contact Ring w/screw
0004470044	6	Screw, Contact Ring
0004470049	2	Hex Key Wrench .109"
0558007105	1	Nut Driver 7/16" (Electrode tool)
0558003918	1	Electrode Holder Tool PT-36
0004470869	1	Silicon Grease DC-111 5.3oz

PT-36 Start-Up Kits .....

0558005224 600 amp	0558005223 360-450 amp	0558005222 200 amp	Part Number	Description
10	10	10	0558003914	Electrode O2 UltraLife, Standard
5	5	5	0558003928	Electrode N2/H35, Standard
5	5	5	0558005459	Electrode O2/N2, Low Current
5	5	5	0558006908	Nozzle PT-36 0.8mm (.030")
5	5	5	0558006010	Nozzle PT-36 1.0mm (.040")
5	5	5	0558008010	Nozzle PT-36 1.0mm (.040") PR
5	5	5	0558006014	Nozzle PT-36 1.4mm (.055")
5	5	5	0558006018	Nozzle PT-36 1.8mm (.070")
5	5	5	0558006020	Nozzle PT-36 2.0mm (.080")
5	5	5	0558006023	Nozzle PT-36 2.3mm (.090")
5	5	-	0558006025	Nozzle PT-36 2.5mm (.099")
5	5	-	0558006030	Nozzle PT-36 3.0mm (.120")
5	5	-	0558006036	Nozzle PT-36 3.6mm (.141")
5	-	-	0558006041	Shield PT-36 4.1mm (.161")
5	5	5	0558007624	Shield PT-36 2.4mm (.095")
5	5	5	0558006130	Shield PT-36 3.0mm (.120")
5	5	5	0558006141	Shield PT-36 4.1mm (.160")
5	5	5	0558006166	Shield PT-36 6.6mm (.259")
5	-	-	0558006199	Shield PT-36 9.9mm (.390")

PT-36 H35 Heavy Plate Start-up Kit 0558005225

Part Number	Quantity	Description
0558003963	5	Electrode, Tungsten 3/16"D
0558003965	5	Nozzle H35 .198" Divergent
0558003964	2	Collet 3/16"D Electrode
0558005689	2	Electrode/Collet Holder PT-36
0558003967	2	Collet Body
0558002532	5	Baffle, 32 Hole x .023
0558006688	5	Shield High Current
0558003918	1	Electrode Holder Tool PT-36
0558003962	1	Tungsten Electrode Tool
0558008737	2	Nozzle Retaining Cup Assy High Current

APPENDIX

Recommended Regulators

Liquid Cylinder Service:
O_2: R-76-150-540LC ..... P/N 19777
N_2: R-76-150-580LC ..... P/N 19977

High Pressure Cylinder Service:
O_2: R-77-150-540 ..... P/N 998337
Ar & N_2: R-77-150-580 ..... P/N 998344
H_2 & CH_4: R-77-150-350 ..... P/N 998342
Industrial Air : R-77-150-590 ..... P/N 998348

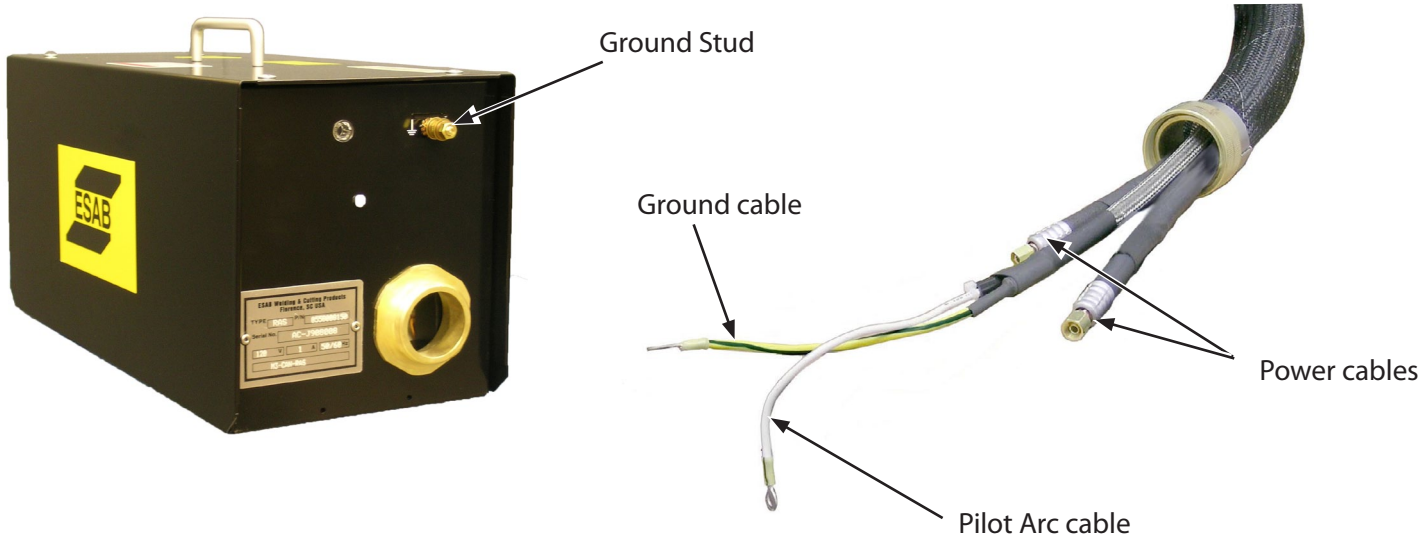
Station/Pipeline Service:
O_2: R-76-150-024 ..... P/N 19151
Ar & N_2: R-76-150-034 ..... P/N 19155
Air, H_2, & CH_4: R-6703 ..... P/N 22236

Connection of Torch to Plasma System

DANGER

Electric Shock Can Kill!

- **Disconnect primary power source before making any adjustments.**
- **Disconnect primary source before doing maintenance on system components.**
- **Do not touch front-end torch parts (nozzle, retaining cup, etc.) without turning primary power off.**



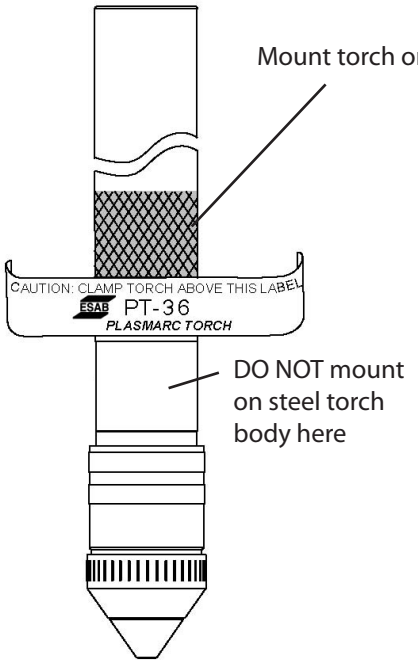
Connection to the Remote Arc Starter Box

The PT-36 has two water cooled power cables which must be connected to the negative output from the power supply. The right handed 7/16-20 fitting is on the cable supplying coolant to the torch. The left handed 7/16-20 fitting is on the cable returning coolant from the torch. Both of these cables have a green/yellow wire to be connected to the ground stud shown above.

The pilot arc cable is connected to the arc starter box (see Installation section). The pilot arc cable also has a green/yellow wire that is connected to a grounding stud.

Mounting Torch to Machine

DANGER **CLAMPING ON TORCH BODY MAY CAUSE DANGEROUS CURRENT TO FLOW THROUGH MACHINE CHASSIS.**



- Do not mount on stainless steel torch body.
- Torch body is electrically insulated, however high frequency start current may arc through to find a ground.
- Clamping near torch body may result in arcing between body and machine.
- When this arcing occurs, torch body may require non-warranty replacement.
- Damage to machine components may result.
- Clamp only on insulated torch sleeve (directly above label) not less than 1.25" (31.75mm) from the torch end of the sleeve.

APPENDIX

DANGER

Hydrogen explosion hazard! Read the following before attempting to cut with a water table.
A hazard exists whenever a water table is used for plasma arc cutting. Severe explosions have resulted from the accumulation of hydrogen beneath the plate being cut. Thousands of dollars in property damage has been caused by these explosions. Personal injury or death could result from such an explosion. The best available information indicates that three possible sources of hydrogen exists in water tables:

1. **Molten Metal Reaction**
   Most of the hydrogen is liberated by a fast reaction of molten metal from the kerf in the water to form metallic oxides. This reaction explains why reactive metals with greater affinity for oxygen, such as aluminum and magnesium, release greater volumes of hydrogen during the cut than does iron or steel. Most of this hydrogen will come to the surface immediately, but some will cling to small metallic particles. These particles will settle to the bottom of the water table and the hydrogen will gradually bubble to the surface.

2. **Slow Chemical Reaction**
   Hydrogen may also result from the slower chemical reactions of cold metal particles with the water, dissimilar metals, or chemicals in the water. The hydrogen gradually bubbles to the surface.

3. **Plasma Gas**
   Hydrogen may come from the plasma gas. At currents over 750 amps, H-35 is used as cut gas. This gas is 35% hydrogen by volume and a total of about 125 cfh of hydrogen will be released.
   Regardless of the source, the hydrogen gas can collect in pockets formed by the plate being cut and slats on the table, or pockets from warped plate. There can also be accumulation of hydrogen under the slag tray or even in the air reservoir, if these are part of the table design. The hydrogen, in the presence of oxygen or air, can then be ignited by the plasma arc or a spark from any source.

4. **Follow these practices to reduce hydrogen generation and accumulation:**
   A. Clean the slag (especially fine particles) from the bottom of the table frequently. Refill the table with clean water.
   B. Do not leave plates on the table overnight or a weekend.
   C. If a water table has been unused for several hours, vibrate it in some way before the first plate is laid in position. This will allow accumulated hydrogen in the refuse to break loose and dissipate before it is confined by a plate on the table. This might be accomplished by laying the first plate onto the table with a slight jolt, then raising the plate to permit hydrogen to escape before it is finally set down for cutting.
   D. If cutting above water, install fans to circulate air between the plate and the water surface.
   E. If cutting underwater, agitate the water under the plate to prevent accumulation of hydrogen. This can be done by aerating the water using compressed air.
   F. If possible, change the level of the water between cuts to dissipate accumulated hydrogen.
   G. Maintain pH level of the water near 7 (neutral). This reduces the rate of chemical reaction between water and metals.

APPENDIX

WARNING

Possible explosion hazard from plasma cutting aluminum-lithium alloys!

Aluminum-Lithium (Al-Li) alloys are used in the aerospace industry because of 10% weight savings over conventional aluminum alloys. It has been reported that molten Al-Li alloys can cause explosions when they come into contact with water. Therefore, plasma cutting of these alloys should not be attempted in the presence of water. These alloys should only be dry cut on a dry table. Alcoa has determined that "dry" cutting on a dry table is safe and gives good cutting results. DO NOT dry cut over water. DO NOT water injection cut.

The following are some of the Al-Li alloys currently available:

Alithlite (Alcoa)	X8192 (Alcoa)
Alithally (Alcoa)	Navalite (U. S. Navy)
2090 Alloy (Alcoa)	Lockalite (Lockheed)
X8090A (Alcoa)	Kalite (Kaiser)
X8092 (Alcoa)	8091 (Alcan)

For additional details and information on the safe use from the hazards associated with these alloys, contact your aluminum supplier.

WARNING

Oil And Grease Can Burn Violently!

- Never use oil or grease on this torch.
- Handle torch clean hands only on clean surface.
- Use silicone lubricant only where directed.
- Oil and grease are easily ignited and burn violently in the presence of oxygen under pressure.

WARNING

Hydrogen explosion hazard.

Do Not Cut Underwater With H-35! Dangerous buildup of hydrogen gas is possible in the water table. Hydrogen gas is extremely explosive. Reduce the water level to 4 inches minimum below the workpiece. Vibrate plate, stir air and water frequently to prevent hydrogen gas buildup.

Spark hazard.

WARNING

Heat, spatter, and sparks cause fire and burns.

- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles (e.g. butane lighter).
- Pilot arc can cause burns. Keep torch nozzle away from yourself and others when activating plasma process.
- Wear correct eye and body protection.
- Wear gauntlet gloves, safety shoes and hat.
- Wear flame-retardant clothing that covers all exposed areas.
- Wear cuffless trousers to prevent entry of sparks and slag.

APPENDIX

Preparing to Cut

- Select an appropriate condition from the Cut Data manual (SDP File) and install recommended torch front-end parts (nozzle, electrode, etc.) See Cut Data manual to identify parts and settings.
- Position torch over material at desired start location.
- See Power Source Manual for proper settings.
- See Description and Installation sections for gas control and startup procedures.

Mirror Cutting

When mirror cutting, a reverse swirl gas baffle and reverse diffuser are required. These reverse parts will "spin" the gas in the opposite direction, reversing the "good" side of the cut.

Reverse 4 x .032 Baffle	**P/N 0558002534**
Reverse 8 x .047 Baffle	**P/N 0558002530**
Reverse Diffuser	**P/N 0004470115**

Cut Quality

Causes affecting cut quality are interdependent. Changing one variable affects all others. Determining a solution may be difficult. The following guide offers possible solutions to different undesirable cutting results. To begin select the most prominent condition:

- Cut Angle, negative or positive
- Cut Flatness
- Surface Finish
- Dross
- Dimensional Accuracy

Usually the recommended cutting parameters will give optimal cut quality, occasionally conditions may vary enough that slight adjustments will be required. If so:

- Make small incremental adjustments when making corrections.
- Adjust Arc Voltage in 5 volt increments, up or down as required.
- Adjust cutting speed 5% or less as required until conditions improve.

APPENDIX

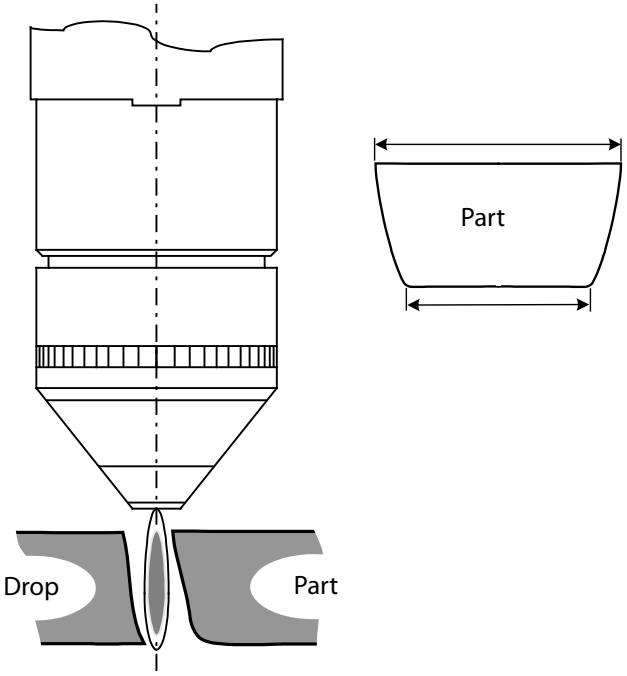
⚠ CAUTION **Before attempting ANY corrections, check cutting variables with the factory recommended settings/consumable part numbers listed in Cut Data manual.**

Cut Angle

Negative Cut Angle

Top dimension is greater than the bottom.

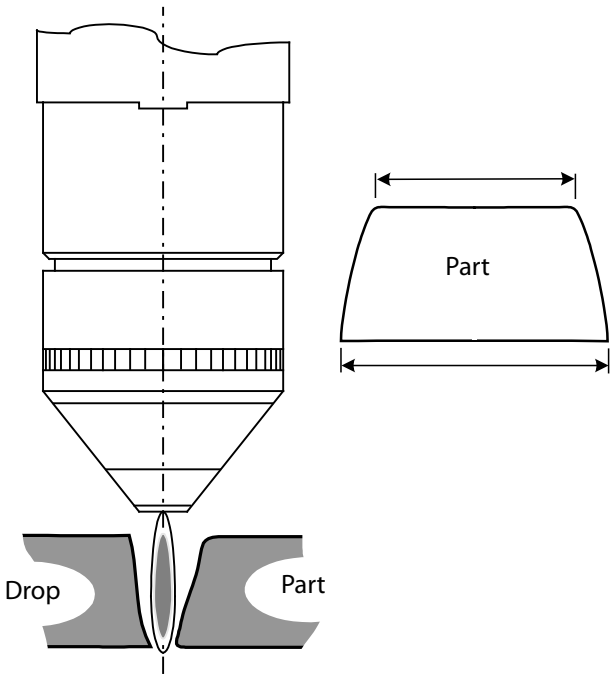
- Misaligned torch
- Bent or warped material
- Worn or damaged consumables
- Standoff low (arc voltage)
- Cutting speed slow (machine travel rate)



Positive Cut Angle

Top dimension is less than the bottom dimension.

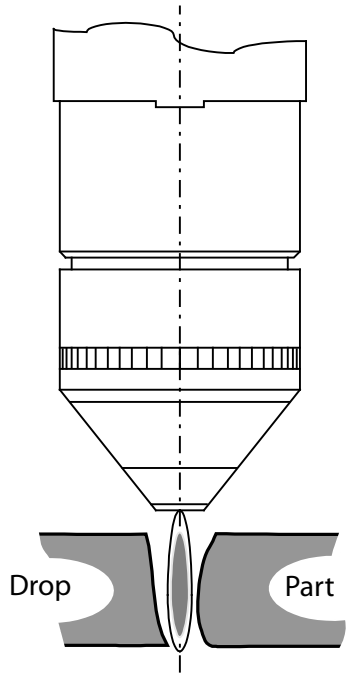
- Misaligned torch
- Bent or warped material
- Worn or damaged consumables
- High standoff High (arc voltage)
- Cutting speed fast
- Current high or low. (See Cut Data manual for recommended current level for specific nozzles).



Cut Flatness

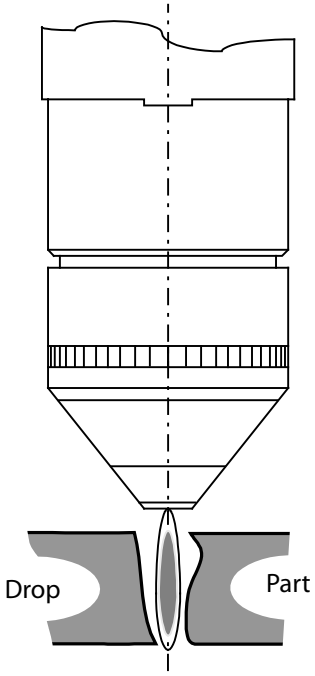
Top And Bottom Rounded. Condition usually occurs when material is .25" thick (6.4mm) or less.

- High current for given material thickness.
  (See Cut Data manual for proper settings).

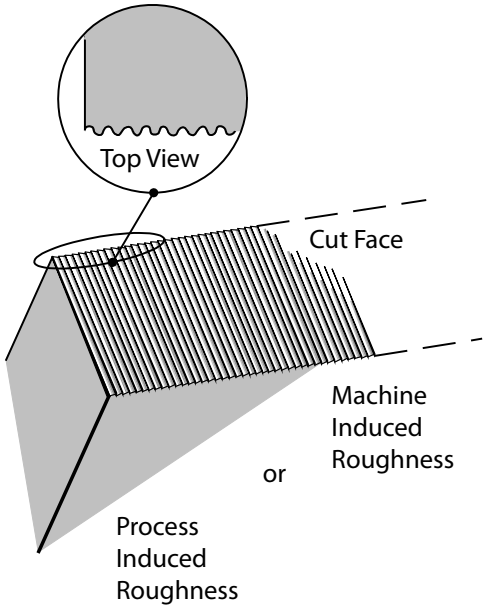


Top Edge Undercut

- Standoff low (Arc Voltage).



Surface Finish



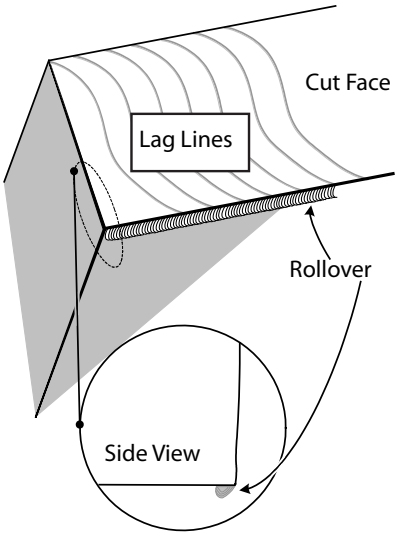
Process Induced Roughness
Cut face is consistently rough. May or may not be confined to one axis.

- Incorrect Shield Gas mixture (See Cut Data manual).
- Worn or damaged consumables.

Machine Induced Roughness
Can be difficult to distinguish from Process Induced Roughness. Often confined to only one axis. Roughness is inconsistent.

- Dirty rails, wheels and/or drive rack/pinion.
- Carriage wheel adjustment.

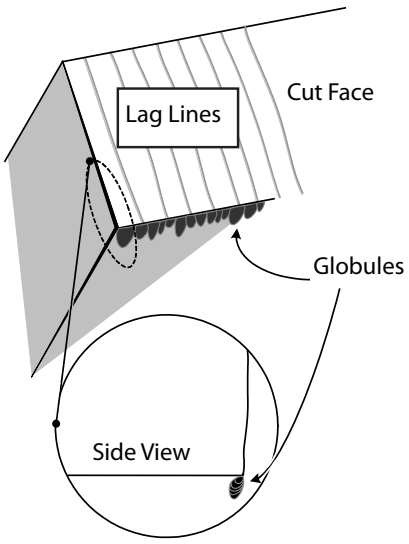
Dross



Dross is a by-product of the cutting process. It is the undesirable material that remains attached to the part. In most cases, dross can be reduced or eliminated with proper torch and cutting parameter setup. Refer to Cut Data manual.

High Speed Dross
Material weld or rollover on bottom surface along kerf. Difficult to remove. May require grinding or chipping. "S" shaped lag lines.

- Standoff high (arc voltage).
- Cutting speed fast.



Slow Speed Dross
Forms as globules on bottom along kerf. Removes easily.

- Cutting speed slow.

APPENDIX

⚠ CAUTION

Recommended cutting speed and arc voltage will give optimal cutting performance in most cases. Small incremental adjustments may be needed due to material quality, material temperature and specific alloy. The operator should remember that all cutting variables are interdependent. Changing one setting affects all others and cut quality could deteriorate. Always start at the recommended settings.

Top Dross
Appears as splatter on top of material. Usually removes easily.

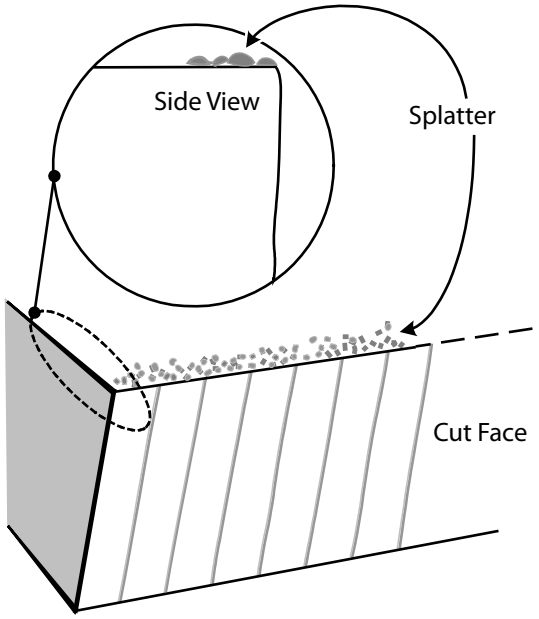
- Cutting speed fast
- Standoff high (arc voltage)

Intermittent Dross
Appears on top or bottom along kerf. Non-continuous. Can appear as any kind of dross.

- Possible worn consumables

Other Factors Affecting Dross;

- Material temperature
- Heavy mill scale or rust
- High carbon alloys



⚠ CAUTION

Before attempting ANY corrections, check cutting variables with the factory recommended settings/consumable part numbers listed in the Cut Data manual.

Dimensional Accuracy

Generally using the slowest possible speed (within approved levels) will optimize part accuracy. Select consumables to allow a lower arc voltage and slower cutting speed.

NOTICE

Recommended cutting speed and arc voltage will give optimal cutting performance.

Small incremental adjustments may be needed due to material quality, material temperature and specific alloy. The operator should remember that all cutting variables are interdependent. Changing one setting affects all others and cut quality could deteriorate. Always start at the recommended settings. Before attempting ANY corrections, check cutting variables with the factory recommended settings/consumable part numbers listed in the Cut Data manual.

Torch Flow Passages

Torch Front End Disassembly

Wear on torch parts is a normal occurrence to plasma cutting. Starting a plasma arc is an erosive process to both the electrode and nozzle. Regularly scheduled inspection and replacement of PT-36 parts must take place to maintain cut quality and consistent part size.

DANGER **HOT TORCH WILL BURN SKIN!**
ALLOW TORCH TO COOL BEFORE SERVICING.

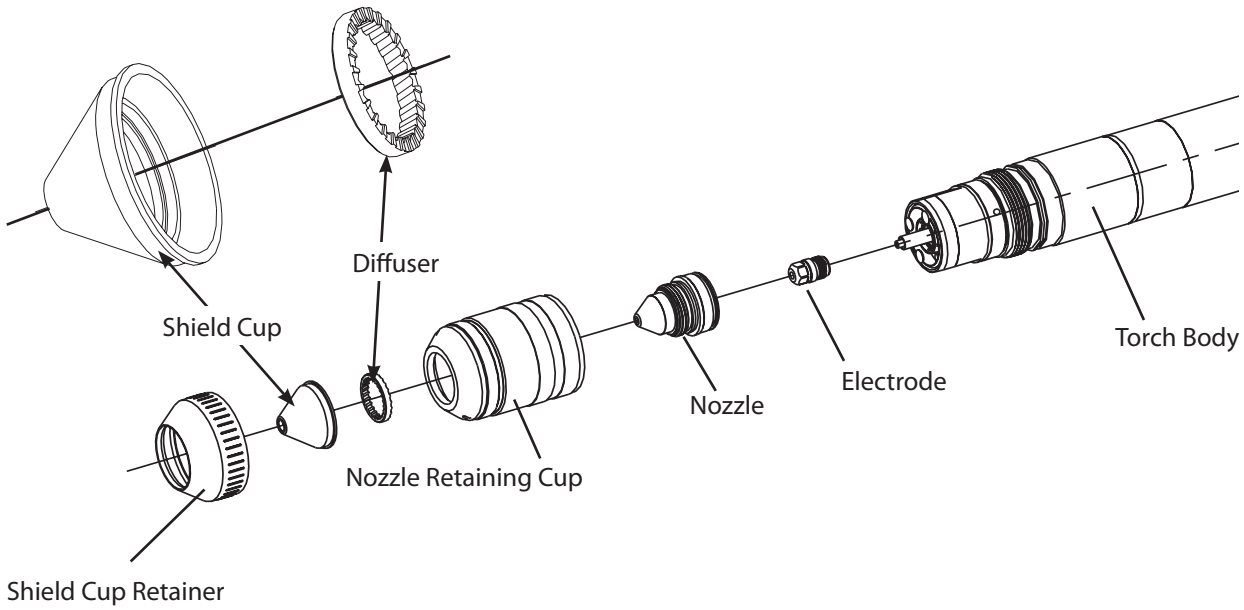
1. Remove the Shield Cup Retainer.

NOTE:
If the shield cup retainer is difficult to remove, try to screw the nozzle retaining cup tighter to relieve pressure on the shield cup retainer.

2. Inspect mating metal surface of shield cup and shield cup retainer for nicks or dirt that might prevent these two parts from forming a metal to metal seal. Look for pitting or signs of arcing inside the shield cup. Look for melting of the shield tip. Replace if damaged.

3. Inspect diffuser for debris and clean as necessary. Wear on the top notches does occur, effecting gas volume. Replace this part every other shield replacement. Heat from cutting many small parts in a concentrated area or when cutting material greater than 0.75" (19.1mm) may require more frequent replacement.

CAUTION **Incorrect assembly of the diffuser in the shield will prevent the torch from working properly. Diffuser notches must be mounted away from the shield as illustrated.**



4. Unscrew nozzle retainer and pull nozzle straight out of torch body. Inspect insulator portion of the nozzle retainer for cracks or chipping. Replace if damaged.

Inspect nozzle for:

- melting or excessive current transfer.
- gouges from internal arcing.
- nicks or deep scratches on the O-ring seating surfaces .
- O-ring cuts, nicks, or wear.
- Remove hafnium particles (from the nozzle) with steel wool.

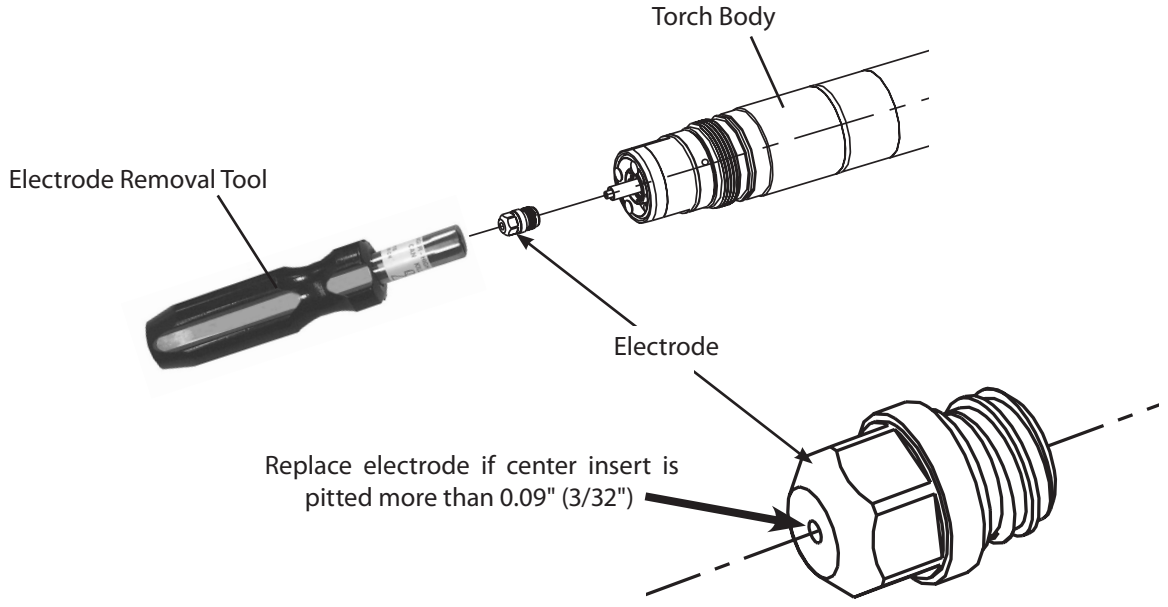
Replace if any damage is found.

NOTE:
Discoloration of internal surfaces and small black starting marks are normal and do not effect cutting performance.

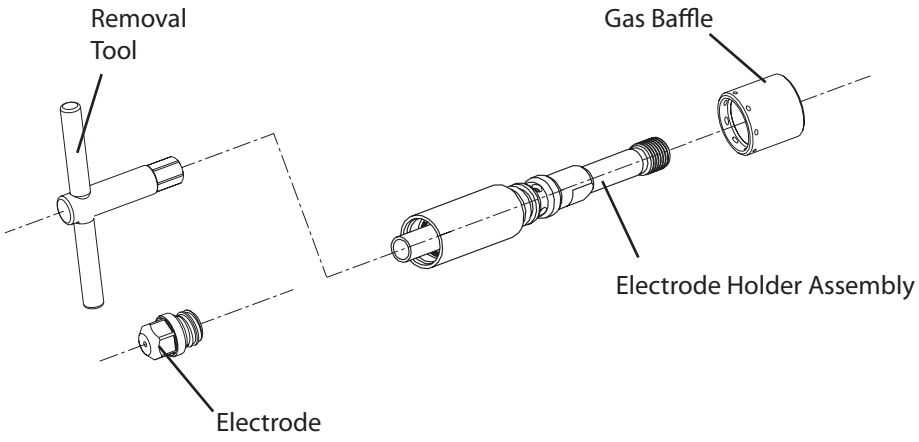
If the holder was tightened sufficiently, the electrode may unscrew without being attached to the electrode holder. When installing the electrode, use only sufficient force to adequately secure the electrode.

5. Remove electrode using electrode removal tool.

6. Disassemble electrode from electrode holder. Insert flats on the holder into a 5/16" wrench. Using the electrode tool, rotate electrode counter-clockwise to remove. Replace electrode if center insert is pitted more than 0.09" (3/32").



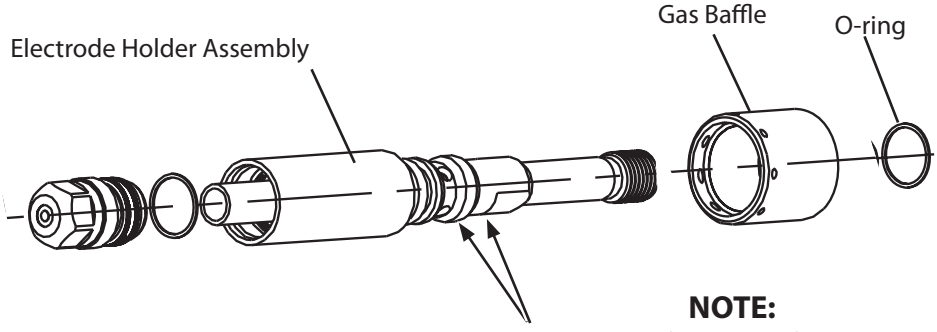
7. Remove electrode holder from torch body. Hex on the end of the electrode holder removal tool will engage in a hex in the holder.



NOTE:
The electrode holder is manufactured in two pieces. Do not disassemble. If the holder is damaged, replace the electrode holder assembly.

8. Disassemble electrode holder and gas baffle. Carefully remove O-ring from electrode holder and slide baffle from holder. Inspect nozzle seating surface (front edge) for chips. Look for cracks or plugged holes. Do not attempt to clear holes. Replace baffle if damaged.

NOTE:
Check all O-rings for nicks or other damage that might prevent O-ring from forming a gas/water tight seal.



NOTE:
Discoloration of these surfaces with use is normal. It is caused by galvanic corrosion.

Assembly of Torch Front End

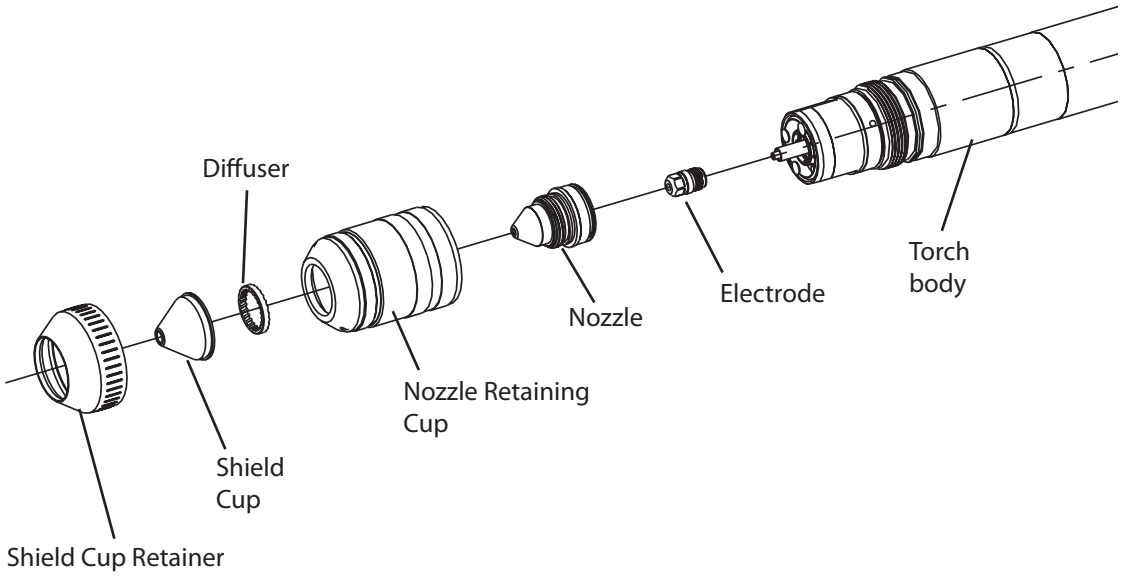
⚠ CAUTION

Over-tightened parts will be difficult to disassemble and may damage torch. Do not over tighten parts during reassembly. Threaded parts are designed to work properly when hand-tightened, approximately 40 to 60 inch/pounds.

- Reverse order of disassembly.
- Apply a very thin coat of silicone grease to O-rings before assembling mating parts. This facilitates easy future assembly and disassembly for service.
- Installing the electrode requires only moderate tightening. If the electrode holder is made tighter than the electrode, it is possible to change worn electrodes without removing the electrode holder.
- Turn on the coolant circulator and purge the gases through the torch.

NOTE:

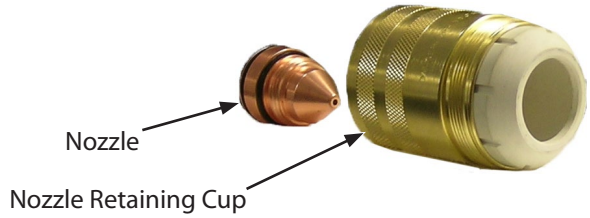
When assembling, place the nozzle inside the nozzle retaining cup and thread the nozzle retaining cup/nozzle combination on the torch body. This will help align the nozzle with the assembly. The shield cup and shield cup retainer should be installed only after installing the nozzle retaining cup and nozzle. Otherwise the parts will not seat properly and leaks may occur.



Assembly of Torch Front End using the Speedloader

Use of a speedloader, p/n 0558006164, will ease assembly of the torch front end parts.

step 1. To use the speedloader, first insert the nozzle into the nozzle retaining cup.

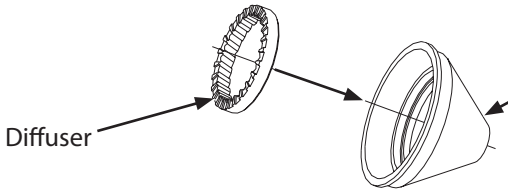


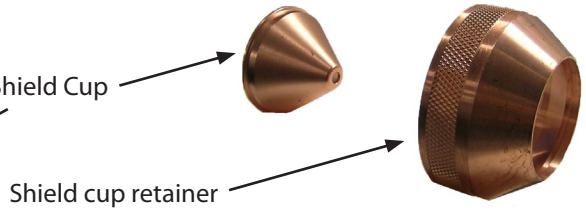
step 2. Screw the speedloader into the nozzle retaining cup to secure the nozzle.

step 3. Secure retaining nut on nozzle with preassembly tool, p/n 0558005917 included with the speedloader.

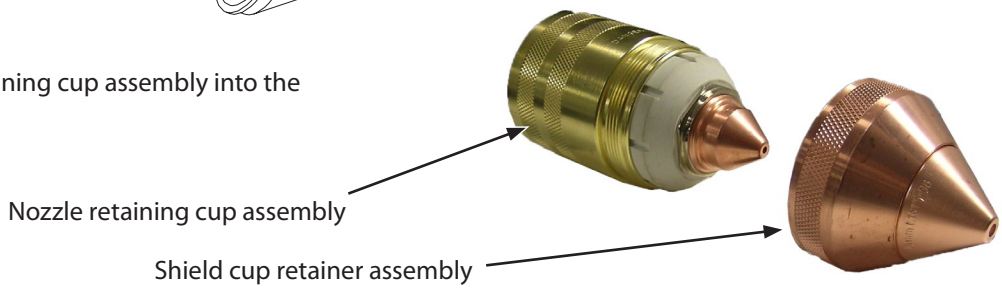
step 4. Remove the speedloader. It is very important to remove the speedloader to ensure proper seating of the remaining parts.

step 5. Insert the diffuser into the shield cup.





step 6. Insert the nozzle retaining cup assembly into the shield cup retainer.



step 7. Screw shield cup retainer assembly onto nozzle retaining cup assembly.

Torch Front End Disassembly (for Production Thick Plate)

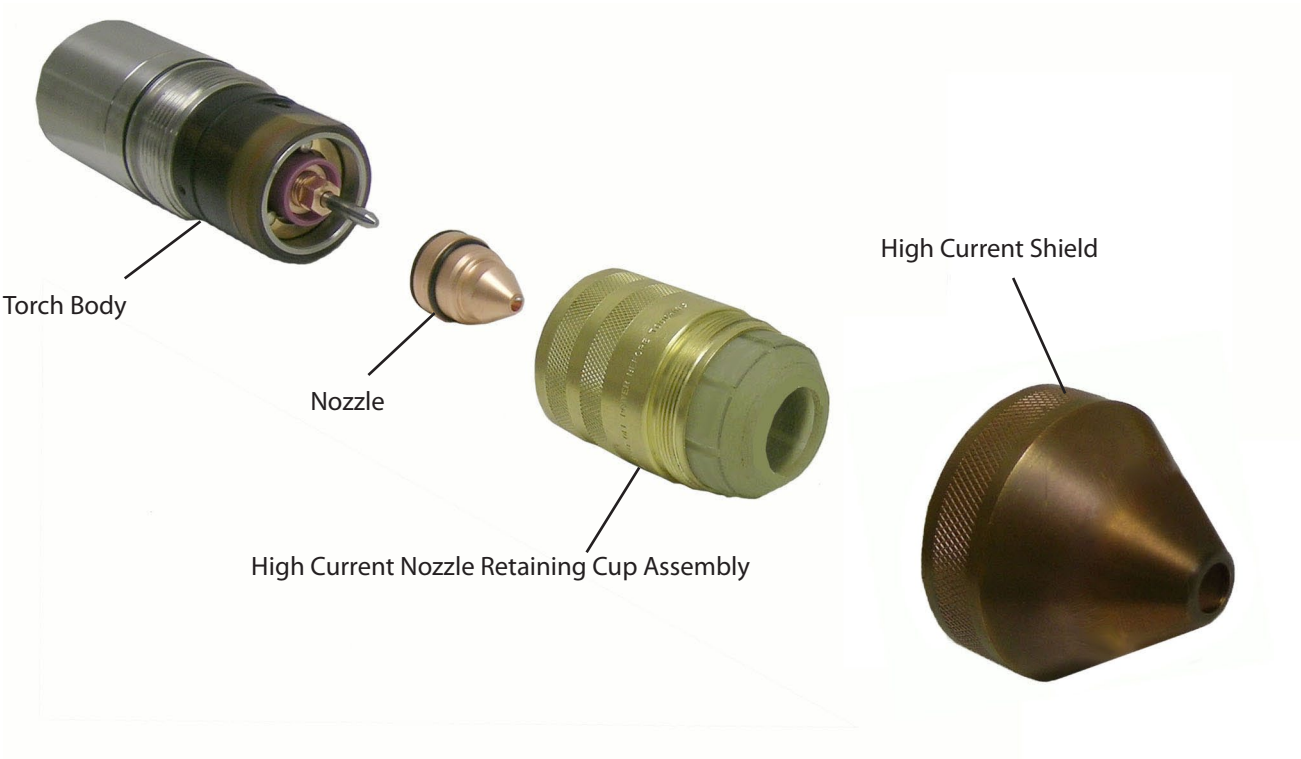
DANGER

HOT TORCH WILL BURN SKIN!
ALLOW TORCH TO COOL BEFORE SERVICING.

CAUTION

Incorrect assembly of the diffuser in the shield will prevent the torch from working properly. Diffuser notches must be mounted away from the shield as illustrated.

1. Remove the High Current Nozzle Retaining Cup assembly. Unless one of these components requires replacement, they can remain assembled to each other. Inspect for signs of melting on the shield cup and check the insulator portion of the nozzle retaining cup for wear or damage.

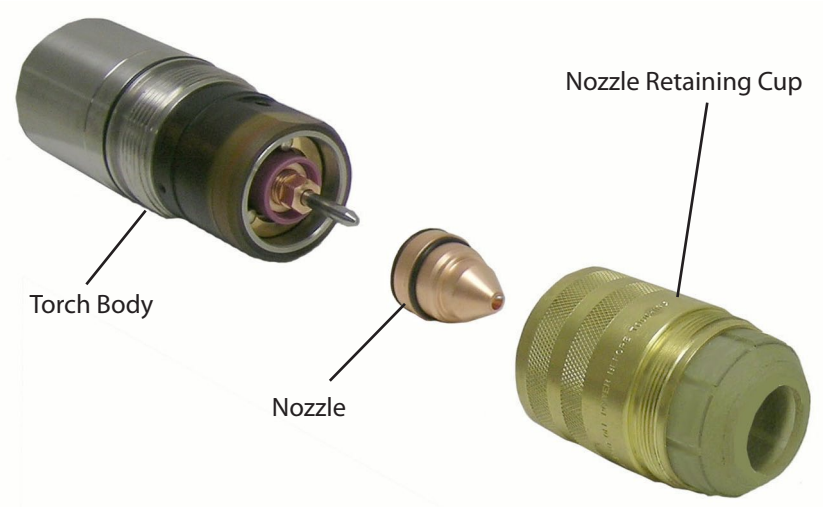


2. Pull nozzle straight out of torch body.

Inspect nozzle for:

- melting or excessive current transfer.
- gouges from internal arcing.
- nicks or deep scratches on the O-ring seating surfaces.
- O-ring cuts, nicks, or wear.
- Remove tungsten particles (from the nozzle) with steel wool.

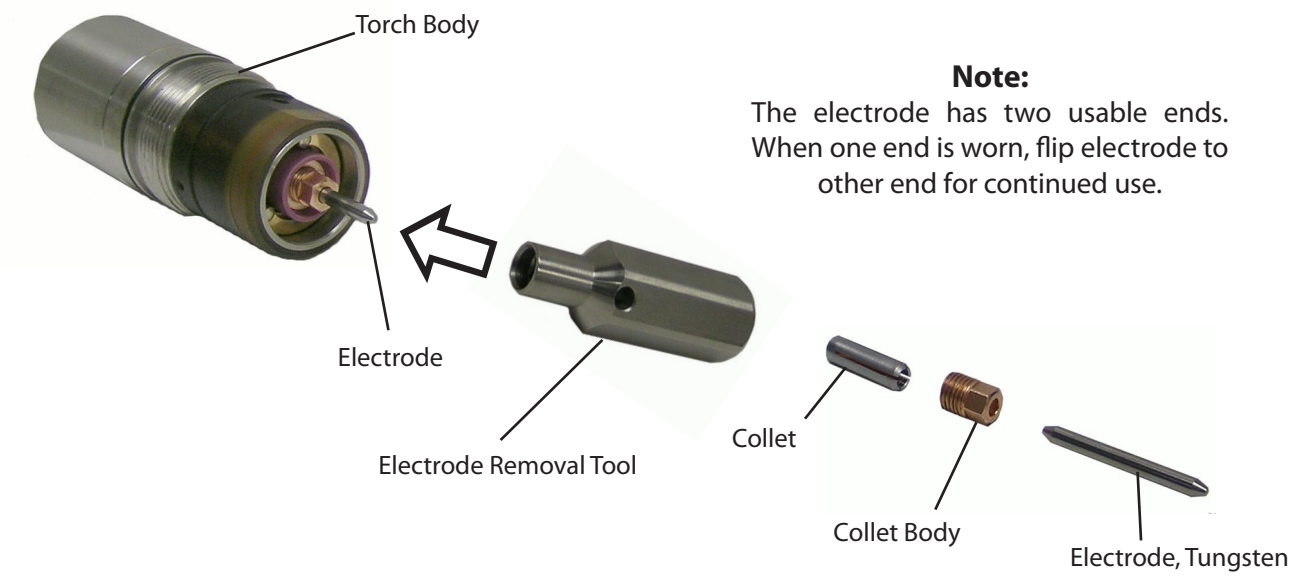
Replace if any damage is found.



NOTE:
Discoloration of internal surfaces and small black starting marks are normal and do not effect cutting performance.

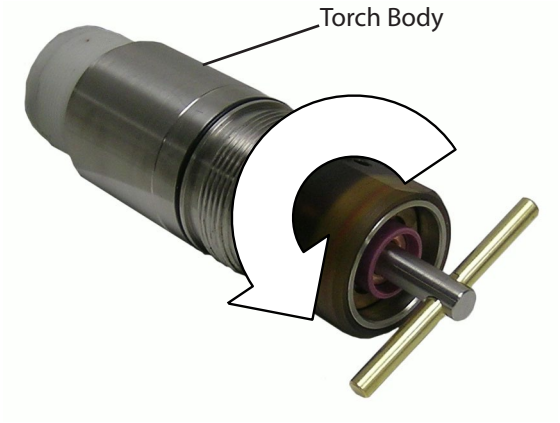
3. Remove electrode using electrode removal tool.

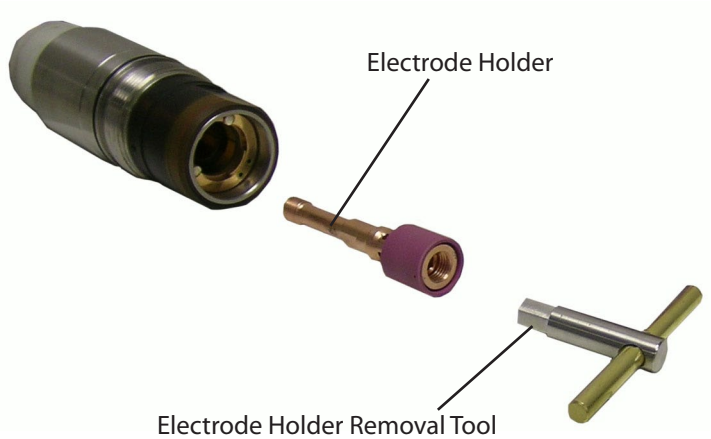
4. Disassemble electrode from electrode holder. Insert flats on the holder into a 5/16" wrench. Using the electrode tool, rotate the collet body counter-clockwise to remove. Replace electrode if center is pitted more than 0.06" (1/16") or if the flat has become irregular in shape or is worn to a larger diameter. Use only sufficient force to adequately secure the electrode.



Note:
The electrode has two usable ends. When one end is worn, flip electrode to other end for continued use.

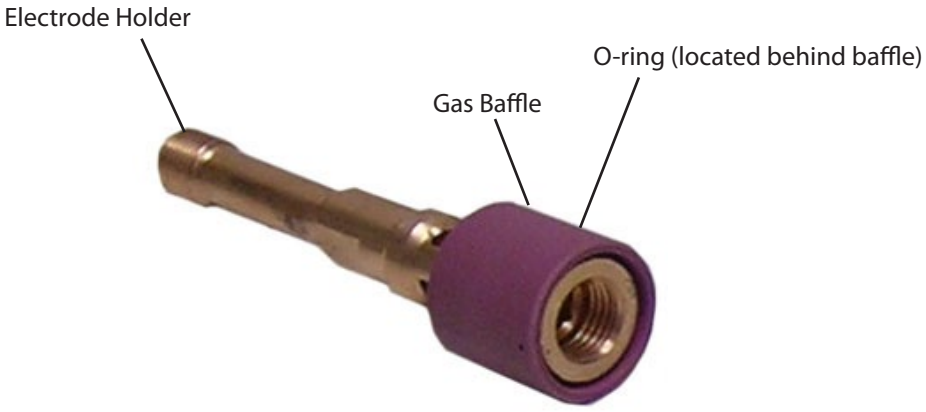
5. If the electrode holder did not come out in step 3, remove the electrode holder from torch body using the Electrode Holder Removal Tool. The hex on the end of the electrode holder removal tool will engage in a hex in the holder.





8. Disassemble electrode holder and gas baffle. Carefully remove O-ring from electrode holder and slide baffle from holder. Inspect nozzle seating surface (front edge) for chips. Look for cracks or plugged holes. Do not attempt to clear holes. Replace baffle if damaged.

NOTE:
Check all O-rings for nicks or other damage that might prevent O-ring from forming a gas/water tight seal.



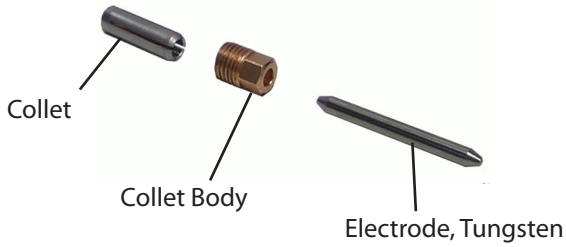
Assembly of Torch Front End (for Production Thick Plate)

⚠ CAUTION

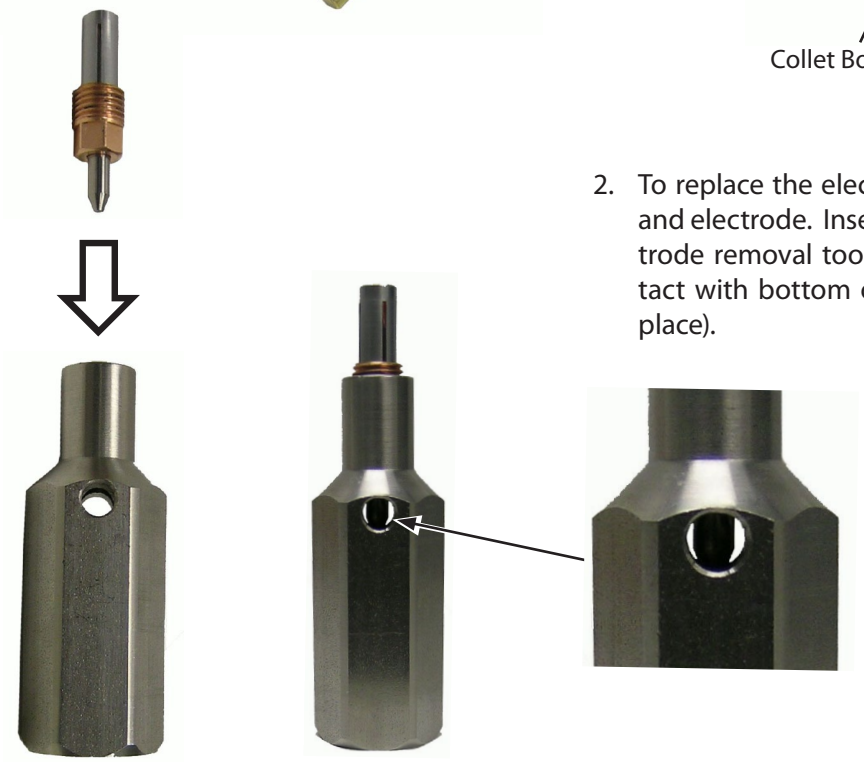
Over tightened parts will be difficult to disassemble and may damage torch. Do not over tighten parts during reassembly. Threaded parts are designed to work properly when hand tightened, approximately 40 to 60 inch/pounds.

- Reverse order of disassembly.
- Apply a very thin coat of silicone grease to O-rings before assembling mating parts. This facilitates easy future assembly and disassembly for service.
- Installing the electrode requires only moderate tightening.

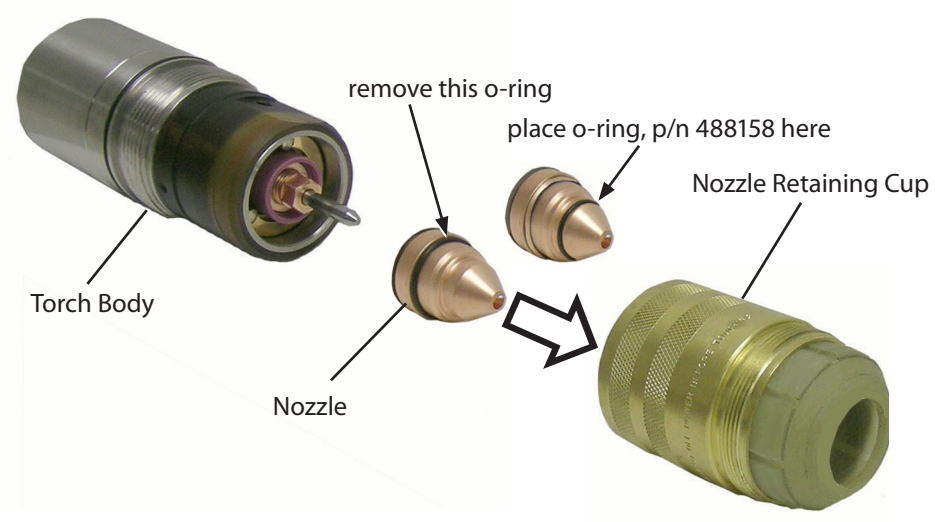
1. Replace electrode holder in torch body. Hex on the end of the electrode holder removal tool will engage in a hex in the holder.



2. To replace the electrode, assemble collet, collet body and electrode. Insert electrode assembly into the electrode removal tool and ensure electrode makes contact with bottom of tool hole (electrode will fall into place).

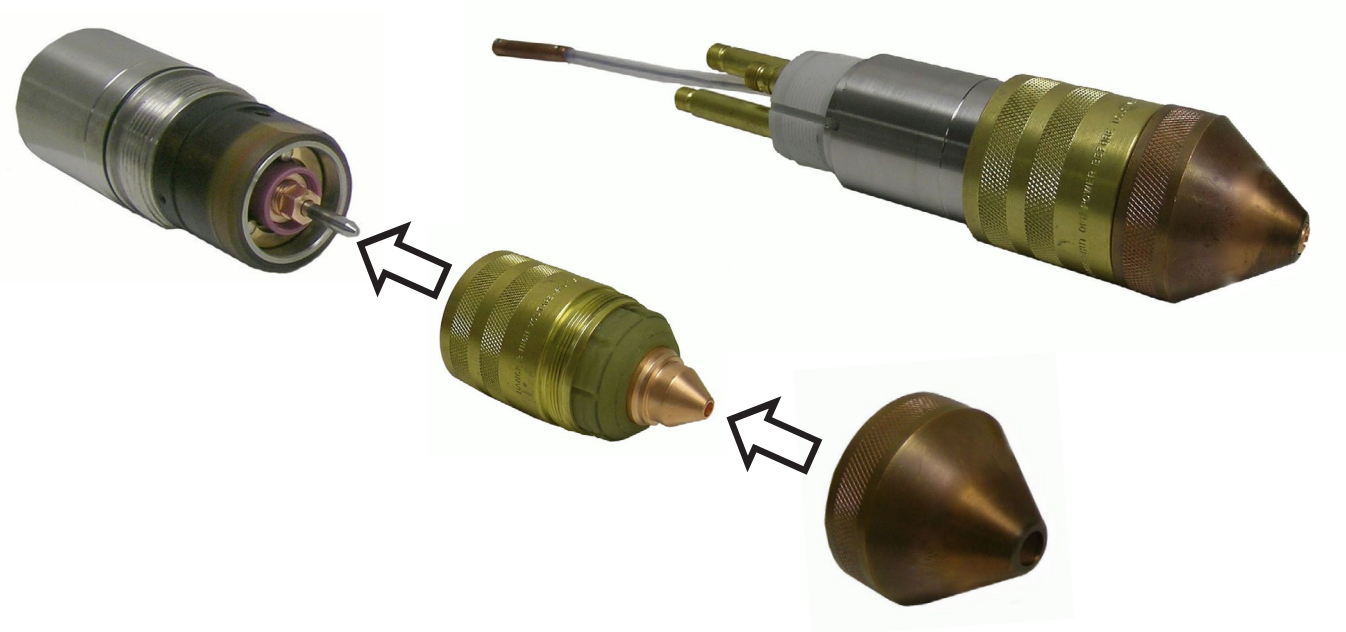


3. Screw electrode assembly in a clockwise direction to torch body. Electrode will tighten in the correct position when collet closes. When using the high current nozzle retaining cup remove o-ring indicated and replace it with o-ring, p/n 488158 as shown.



NOTE:

When assembling, place the nozzle inside the high current nozzle retaining cup and thread the high current nozzle retaining cup/nozzle combination on the torch body. This will help align the nozzle with the assembly. The high current shield cup can be assembled onto the high current nozzle retaining cup at any time.



Torch Body Maintenance

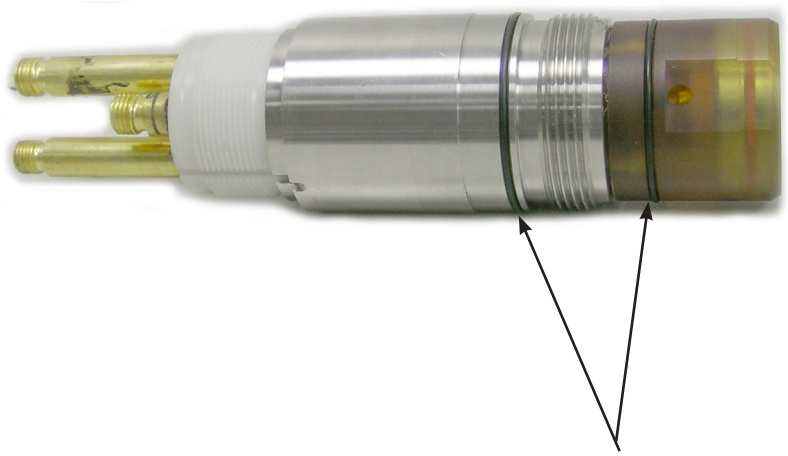
- Inspect O-rings daily and replace if damaged or worn.
- Apply a thin coat of silicone grease to O-rings before assembling torch. This facilitates easy future assembly and disassembly for service.
- O-ring (1.61" (41mm) I.D. x .07" (1.8mm) BUNA-70A) p/n 996528.

WARNING

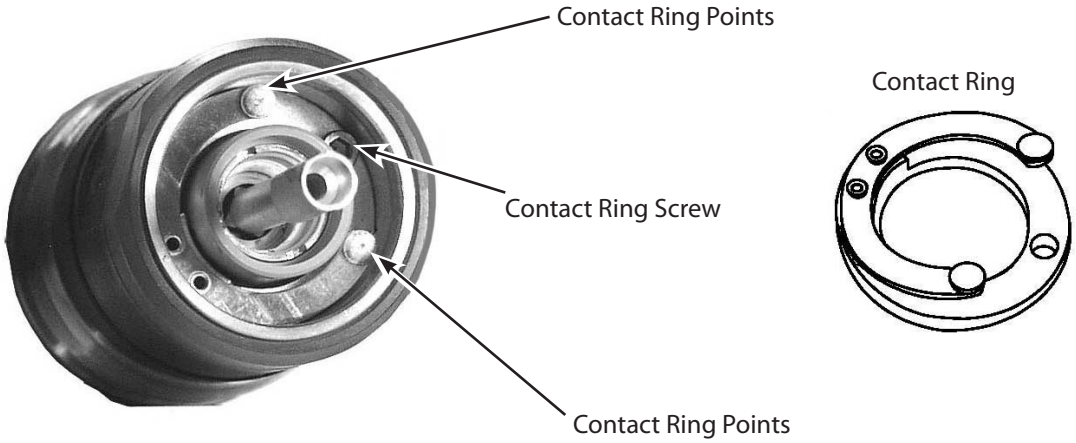
Electric Shock Can Kill!

Before performing torch maintenance:

- Turn power switch of the power source console to the OFF position
- Disconnect primary input power.



- Keep electrical contract ring contact points free of grease and dirt.
- Inspect ring when changing nozzle.
- Clean with cotton swab dipped in isopropyl alcohol.



Removal and Replacement of the Torch Body

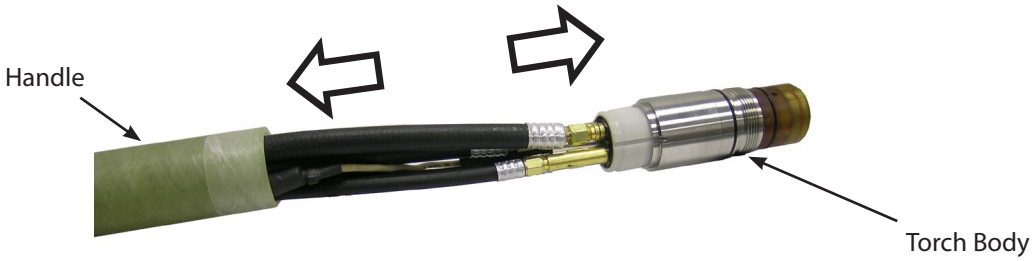
Electric Shock Can Kill!

WARNING

Before performing torch maintenance:

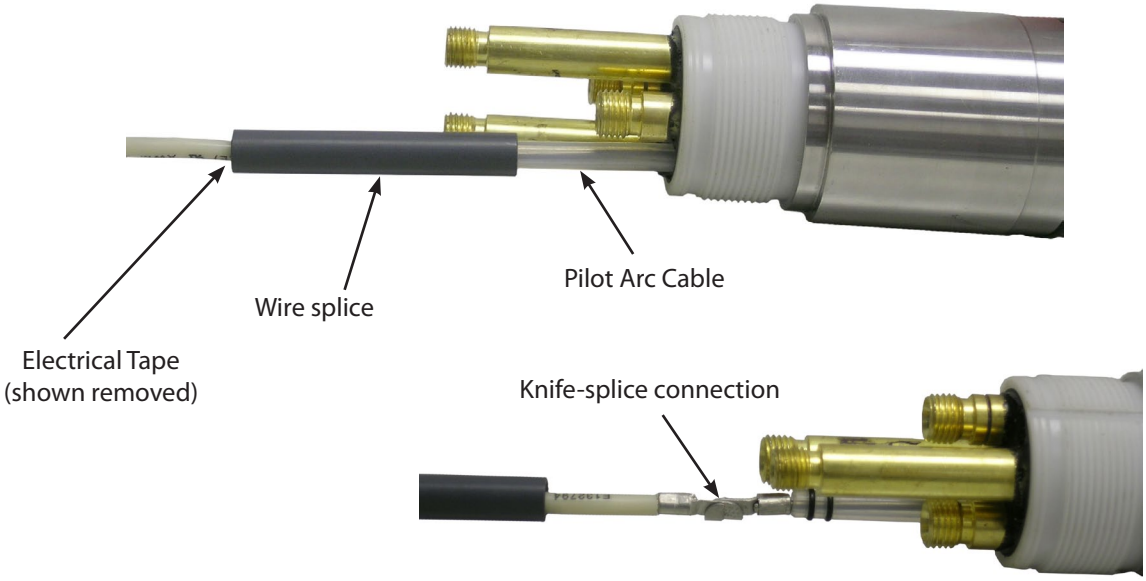
- Turn power switch of the power source console to the OFF position .
- Disconnect primary input power.

1. Loosen the worm gear hose clamp so that the torch sleeving can be freed and pulled back up the cable bundle. Approximately 7 inches should be far enough. Unscrew the torch sleeve and slide it back until the pilot arc connection is exposed.



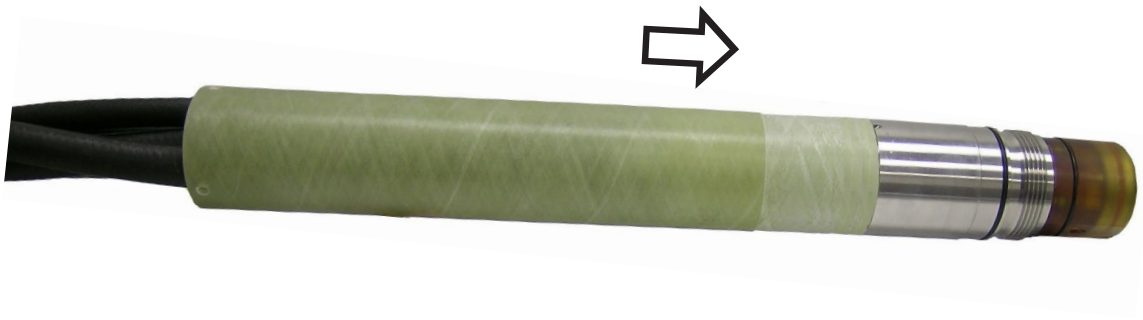
2. Disconnect the power cables which are threaded onto the shorter stems at the back of the torch. Note that one of these connections is left-handed. Unscrew the gas hoses from the torch head assembly by using a 7/16" (11.1mm) and a 1/2" (12.7mm) wrench. Removal of the gas hoses is easier if the power cables are removed first.

3. Unwrap the electrical tape at the back of the gray plastic insulator over the pilot arc connection. Slide the insulator back and undo the knife connectors.



4. To install the new torch head assembly - Connect the pilot arc cable and the main power cable by reversing the steps taken to disconnect them. Be sure the gas and water fittings are tight enough to prevent leaks, but do not use any kind of sealant on them. If the knife connection seems loose, tighten the connection by pressing on the parts with needle-nosed pliers after they are assembled. Secure the gray pilot arc insulator with 10 turns of electrical tape.

5. Slide the handle forward and thread it firmly onto the torch body.



Reduced Consumable Life

1. Cutting Up Skeletons

Cutting skeletons (discarded material left after all pieces have been removed from a plate). Their removal from the table can adversely affect electrode life by:

- Causing the torch to run off the work.
- Greatly increasing the start frequency. This is mainly a problem for O_2 cutting and can be alleviated by choosing a path with a minimum number of starts.
- Increasing likelihood that the plate will spring up against the nozzle causing a double arc. This can be mitigated by careful operator attention and by increasing standoff and reducing cutting speeds.

If possible, use an OXWELD torch for skeleton cutting or operate the PT-36 at a high standoff.

2. Height Control Problems

- Torch crashing is usually caused by a change in arc voltage when an automatic height control is used. The voltage change is usually the result of plate falling away from the arc. Disabling the height control and extinguishing the arc earlier when finishing the cut on a falling plate can effectively eliminate these problems.
- Torch crashing can also occur at the start if travel delay is excessive. This is more likely to occur with thin material. Reduce delay or disable the height control.
- Torch crashing can also be caused by a faulty height control.

3. Piercing Standoff Too Low	Increase pierce standoff
4. Starting on edges with continuous pilot arc	Position torch more carefully or start on adjacent scrap material.
5. Work Flipping	The nozzle may be damaged if the torch hits a flipped up part.
6. Catching on Pierce Spatter	Increase standoff or start with longer lead-in.
7. Pierce not complete before starting	Increase initial delay time.
8. Coolant flow rate low, Plasma gas flow rate high, Current set too high	Correct settings
9. Coolant leaks in torch	Repair leaks

Checking for Coolant Leaks

Coolant leaks can originate from seals on the electrode, electrode holder, nozzle, and torch body. Leaks could also originate from a crack in the insulating material of the torch or nozzle retaining cup or from a power cable.

To check for leaks from any source remove the shield cup, clean off the torch, purge it, and place it over a clean dry plate. With the gases off, run the water cooler for several minutes and watch for leaks. Turn on the plasma gas and watch for any mist from the nozzle exit. If there isn't any, turn off the plasma gas, turn on the shield gas, and watch for any mist from the shield gas passages in the nozzle retaining cup.

If a leak appears to be coming from the nozzle orifice, remove and inspect the o-rings on the nozzle, electrode, and electrode holder. Check the sealing surfaces on the electrode holder and stainless steel torch liner.

If you suspect that a leak is coming from the electrode itself, you can install a 100 to 200 amp 2-piece nozzle base without a nozzle tip. After purging, run the water cooler with the gas off and observe the end of the electrode. If water is seen to collect there, make sure it is not running down the side of the electrode from a leak at an o-ring seal.

⚠ WARNING **If it is necessary to supply power to the power source to run the water cooler, it is possible to have high voltages at the torch with no arc present. Never touch the torch with the power source energized.**

NOTES

NOTES

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