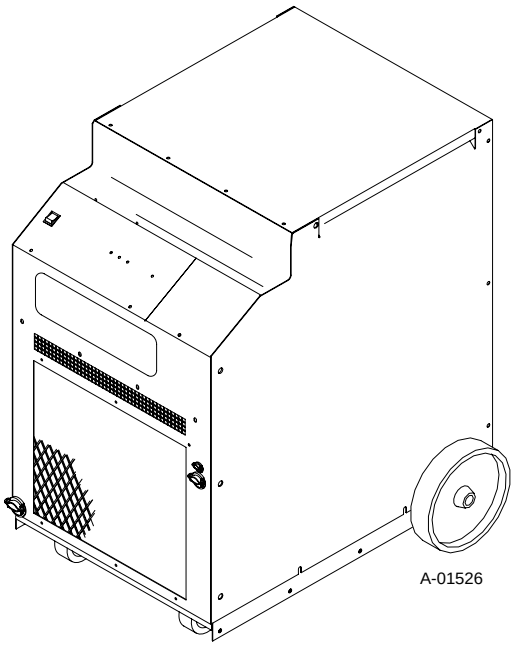
THERMAL DYNAMICS®

A THERMADYNE® Company

MERLIN® 6000

CE Plasma Cutting

Slave Power Supply



Service Manual

September 29, 2005 **Manual No. 0-2604**

CE

WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Merlin 6000 CE Plasma Cutting Slave Power Supply
Service Manual No. 0-2604

Published by:
Thermal Dynamics Corporation
82 Benning Street
West Lebanon, New Hampshire, USA 03784
(603) 298-5711

www.thermal-dynamics.com

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Printed in the United States of America

Publication Date: September 29, 2005

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Power Supply Serial #: _____

Torch Serial #: _____

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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.

WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions

WARNINGS

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.

GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.
- 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 Sec. 25249.5 et seq.)

ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”

- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.
- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.


FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.


NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and / or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.


PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI / ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018

6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3

13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103

14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

NOTE

Toute opération, procédure ou renseignement général sur lequel il importe d’insister davantage ou qui contribue à l’efficacité de fonctionnement du système.

ATTENTION

Toute procédure pouvant résulter l’endommagement du matériel en cas de non-respect de la procédure en question.

AVERTISSEMENT

Toute procédure pouvant provoquer des blessures de l’opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.

1.05 Precautions De Securite Importantes

AVERTISSEMENTS

L’OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L’ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.

Coupant à l’arc au jet de plasma produit de l’énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d’un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé electronique. Ceux qui travail près d’une application à l’arc au jet de plasma devrait consulter leur membre professionel de médication et le manufacturier de matériel de santé pour déterminer s’il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d’éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d’utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.

FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.
- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Eliminez toute source de telle fumée.
- Ce produit, dans le procéder de soudage et de coupe, produit de la fumée ou des gaz pouvant contenir des éléments reconnu dans L'état de la Californie, qui peuvent causer des défauts de naissance et le cancer. (La sécurité de santé en Californie et la code sécurité Sec. 25249.5 et seq.)

CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.

INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.

RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons

ultra-violets très forts. Ces rayons d'arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.
- Utilisez la nuance de lentille qui est suggèrée dans le recommendation qui suivent ANSI / ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggerée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** Ces valeurs s'appliquent ou l'arc actuel est observé clairement. L'experience a démontrer que les filtres moins foncés peuvent être utilisés quand l'arc est caché par moiceau de travail.*

BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous dú4ez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et / ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3

13. Livret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103

14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX , disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126

15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: 82 Benning Street
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73 / 23 / EEC as amended by Council Directive 93 / 68 / EEC) and to the National legislation for the enforcement of this Directive.

The equipment described in this manual conforms to all applicable aspects and regulations of the "EMC Directive" (European Council Directive 89 / 336 / EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements. Among them are:

* CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.

* UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.

* ISO / IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.

* CENELEC EN50199 EMC Product Standard for Arc Welding Equipment

* For environments with increased hazard of electrical shock, Power Supplies bearing the S mark conform to EN50192 when used in conjunction with hand torches with exposed tips, if equipped with properly installed stand-off guides.

* Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Operations Director
Thermadyne Europe
Europa Building
Chorley N Industrial Park
Chorley, Lancashire,
England PR6 7BX

CE

1.08 Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of XL Plus Series, CutMaster Series , Cougar and DRAG-GUN): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

The limited warranty period for XL Plus Series and CutMaster Series shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the further limitations on such three (3) year period (see chart below).

The limited warranty period for Cougar and DRAG-GUN shall be as follows: A maximum of two (2) years from date of sale to an authorized distributor and a maximum of one (1) year from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

	Parts			
PAK Units, Power Supplies	**XL Plus & CutMaster Series**	**Parts Cougar/Drag-Gun**	**Parts All Others**	**Labor**
Main Power Magnetics	3 Years	1 Year	2 Years	1 Year
Original Main Power Rectifier	3 Years	1 Year	2 Years	1 Year
Control PC Board	3 Years	1 Year	2 Years	1 Year
All Other Circuits And Components Including, But Not Limited To, Starting Circuit, Contactors, Relays, Solenoids, Pumps, Power Switching Semi-Conductors	1 Year	1 Year	1 Year	1 Year
Consoles, Control Equipment, Heat Exchanges, And Accessory Equipment	1 Year		1 Year	1 Year
Torch And Leads				
Maximizer 300 Torch			1 Year	1 Year
SureLok Torches	1 Year		1 Year	1 Year
All Other Torches	180 Days	180 Days	180 Days	180 Days
Repair/Replacement Parts	90 Days	90 Days	90 Days	None

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Effective: November 15, 2001

SECTION 2: INTRODUCTION

2.01 Scope Of Manual

This Manual provides Service Instructions for Thermal Dynamics Merlin 6000 CE Master Power Supply. Information in this manual is therefore particularly applicable to the Troubleshooting and Repair of the equipment, and is intended for use by properly-trained Service Technicians familiar with this equipment.

For setup of this equipment, individual operating procedures and basic troubleshooting, refer to Operating Manual (0-2603).

Read both the Operating and Service Manual thoroughly. A complete understanding of the capabilities and functions of the equipment will assure obtaining the performance for which it was designed.

2.02 General Service Philosophy

Several key points are essential to properly support the application and operation of this equipment.

A. Application

The equipment should satisfy the customer's requirements as supplied and as described in Section 3 of this manual. Be sure to confirm that the equipment is capable of the application desired.

B. Modifications

No physical or electrical modifications other than selection of standard options, Accessories, or Factory approved updates are to be made to this equipment.

C. Customer/Operator Responsibilities

It is the customer / operator's responsibility to maintain the provided equipment and peripheral Accessories in good operating order in accordance with the procedures outlined in the Operating Manual, and to protect the equipment from accidental or malicious damage.

D. Repair Restrictions

The electronics consists of Printed Circuit Board Assemblies which must be carefully handled, and must be replaced as units. No replacement of printed circuit solder-mounted components is allowed except as noted in this manual.

Printed Circuit Board Assemblies to be returned must be properly packaged in protective material and returned intact per normal procedures.

2.03 Service Responsibilities

The Service Technician should be familiar with the equipment and its capabilities. Technician should be prepared to recommend arrangements of components which will provide the most efficient layout, utilizing the equipment to its best possible advantage.

Maintenance work should be accomplished in a timely manner. If problems are encountered, or the equipment does not function as specified, contact Technical Services Department at West Lebanon, NH for assistance (1-603-298-5711).

This manual may include references to the Power Supplyor Printed Circuit Board (PCB) Assembly revision letter(s). Depending on when manufactured the revision letters may be single or double letters. Locate of the revision letter(s) are as follows:

- **Power Supply Revisions**

  There are old style and new style data tags. The old style data tag has the revision letter(s) at the end of the serial number. The new style data tag has the revision letter(s) in an area marked 'Rev'.

- **Printed Circuit Board Revisions**

  Revision letter(s) are located at the end of the PCB Assembly part number (##x####-AA).

SECTION 3: INTRODUCTION & DESCRIPTION

3.01 Introduction

The information in this Section is the same information contained in Section 2 of the Operating Manual. It is supplied here to familiarize the Service Technician with the capabilities and limitations of the equipment. This information will also provide the Service Technician with an overall understanding of the equipment which will, in turn, allow proper training of the customer's operating personnel.

3.02 General Description

The Slave Power Supply may be connected in parallel to double the cutting current of the Merlin 6000 or Merlin 6000GST Master Power Supply. All signal inputs/outputs, gas, and torch connections are still connected to the Master Power Supply when the Slave Power Supply is used. The Slave Power Supply has the same power circuits as the Master Power Supply. A second Master Power Supply can also be used as a Slave Unit when connected to the Master Power Supply. The equipment will automatically be configured when the parallel cable is installed.

NOTES

Refer to the Merlin 6000 Plasma Cutting CE Master Power Supply Operating Manual 0-2601 for more information on the Master Power Supply.

Refer to the Merlin 6000GST Plasma Cutting CE Master Power Supply Operating Manual 0-2653 for more information on the Master Power Supply.

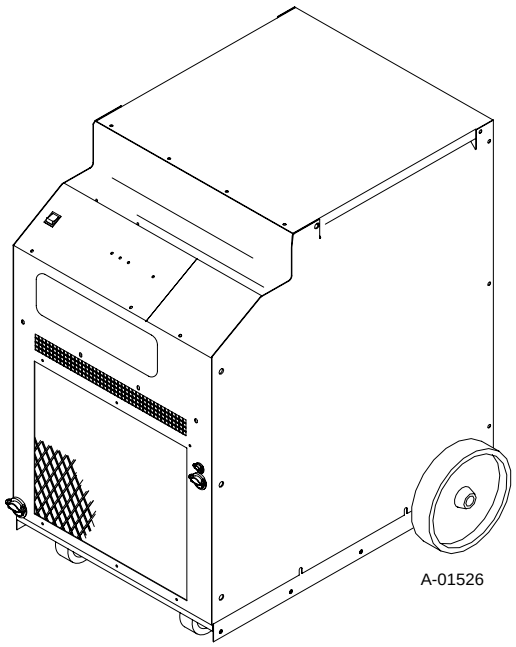


Figure 3-1 Slave Power Supply

A typical system configuration will contain the following:

- One CE Master Power Supply with Running Gear
- One CE Slave Power Supply with Running Gear
- Arc Starter Box
- Maximizer 300 Machine Torch with Leads and Mounting Assembly
- Torch Supply Leads Components
- Parallel Cable
- Maximizer 300 Spare Parts Kit
- 25 ft (7.6 m) Work Cable and Ring Lug
- Optional Air Line Filter Assembly (or) High Pressure Regulators for Master Power Supply

3.03 Specifications & Design Features

The following apply to the Slave Power Supply only:

1. **Controls**

   ON / OFF Switch

2. **Control Indicators**

   AC , TEMP, DC LED Indicators

3. **Input Power**

Voltage	Frequency	Phase	Amperage
380	50 or 60 Hz	3	51
415	50 or 60 Hz	3	47

NOTE

Refer to Appendix 1 for recommended input wiring size, current ratings, and circuit protection requirements.

Amperage depends on input voltage (Refer to Appendix 1).

4. **Output Power**

   Slave Power Supply:

   50 to 150 amps

   Total output of Master/Slave Power Supplies:

   Continuously adjustable by potentiometer from 100 to 300 amps (Minimum of 50 amps if Slave Power Supply is Turned OFF)

5. **Duty Cycle (see NOTE)**

NOTE

The duty cycle will be reduced if the primary input voltage (AC) is low or the DC voltage is higher than shown in the chart.

Power Supply Duty Cycle	
Ambient Temperature	104° F (40° C)
Duty Cycle	100%
Current	150 Amps
DC Voltage	140 vdc

6. **Power Supply Dimensions**

   Enclosure Only -

   Width: 24.12 in (0.61 m)

   Height: 38.38 in (0.98 m)

   Depth: 34.25 in (0.87 m)

   Fully Assembled -

   Width: 28.50 in (0.72 m)

   Height: 43.38 in (1.10 m)

   Depth: 43.75 in (1.11 m)

7. **Weight of Power Supply Only**

   575 lbs (260.8 kg)

3.04 Theory Of Operation

A. Input and Output Power

The Power Supply accepts input voltages of 380 / 415V, 50 or 60 Hz, three-phase. The unit converts AC input power to DC power for the main cutting arc. The negative output is connected to the torch electrode through the negative torch lead, and the positive output connects to the workpiece through the work cable.

B. Main Cutting Arc

The Power Supply accepts 50 or 60 Hz three-phase line input. The power supply converts AC input power to DC power for the main cutting arc. The negative output is connected to the torch electrode through the negative torch lead. The positive output is connected to the workpiece via the work cable and clamp connection.

C. Thermal Interlocks

The system has built-in thermal interlocks to provide safe and efficient operation. When an interlock shuts down the system, the torch switch (or control device) must be used to restart the system.

Thermal overload sensors are located in the transformer and main heatsink in the power supply. If one of these components is overheated the appropriate switch will open up, causing the temperature light to turn from green to red and shutting off power to the main contactor. When the overheated component cools down the switch will close again and allow operation of the system.

SECTION 4: TROUBLESHOOTING

4.01 Introduction

This Section provides service troubleshooting for the Power Supply, allowing the Technician to isolate any faulty Subassemblies. Refer to Section 5, Repairs & Replacement Procedures, for parts replacement instructions.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other Subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty.

NOTE

The troubleshooting contained in this manual is for the CE Merlin 6000 Slave Power Supply only. Troubleshooting other parts of the system is covered in the separate manuals for that product.

4.02 Periodic Inspection & Procedures

NOTE

Refer to Appendix 4 for a recommended maintenance schedule for non-liquid cooled plasma cutting systems.

This subsection describes inspection procedures which should be performed at periodic intervals as required.

The only routine maintenance required for the power supply is a thorough cleaning and inspection, with the frequency depending on the usage and the operating environment.

To clean the unit, first make sure that the power is disconnected. Remove the side panels and blow out any accumulated dirt and dust with compressed air. The unit should also be wiped clean. If necessary, solvents that are recommended for cleaning electrical apparatus may be used.

While the side panels are off, inspect the wiring in the unit. Look for any frayed wires or loose connections that should be corrected.

4.03 System Theory

The CE Merlin 6000 Slave Power Supply is used with either the CE Merlin 6000 or CE Merlin 6000GST Master Power Supply.

A. System Description

The system is designed for mechanized cutting only and consists of the following:

- CE Merlin 6000 or CE Merlin 6000GST Master Power Supply
- Maximizer 300 Torch
- Torch Supply Leads
- Arc Starter Box
- Optional CE Merlin 6000 Slave Power Supply
- Optional Gas Control (GC3000) for Merlin 6000 only
- Optional Remote Control (RC6010)
- Optional Standoff Control (SC10)

The output current of the basic system is 50-150 amperes (A). Systems with the Optional Merlin 6000 Slave Power Supply the output current of the system is 100 to 300 amperes (A). A second Master Power Supply may also be used as the Slave Power Supply. Outputs between 50 to 100A are still available by shutting off the Slave Power Supply.

All gas controls, including gas solenoids, gas pressure regulators and gauges, are in the Merlin 6000 Master Power Supply.

Optional Gas Control (GC3000) for Merlin 6000 only, Remote Control (RC6010) and Standoff Control (SC10), refer to note, may be used in various combinations.

NOTE

The Standoff Control SC10 must be used with the Remote Control RC6010.

The Optional Gas Control (GC3000) for Merlin 6000 only contains the gas select control switches and a switch for the set functions.

An Optional Remote Dual Meter with Hour Meter and Arc Starts Counter is available with all Merlin 6000 Systems. The meters are mounted to the front panel of the unit.

A Slave Power Supply has the same power circuits as the Master Power Supply, but the gas controls, heat exchanger (torch coolant) and pilot circuits have been removed. When a Master Power Supply is used as a Slave, those circuits are automatically disabled. The Merlin 6000 System uses the same Slave Power Supply as the Merlin 6000GST System. A switch on the Switching Control PC Board (PCB) configures the power supply for Merlin 6000 operation (refer to Switching Control PCB description for details).

B. Input Voltage Selection

The main transformer (T1) has busbar connections to select one of three input voltage ranges. Each main transformer secondary has two taps. One secondary tap is automatically selected by the Voltage Selection PC board when primary power is applied. If input voltage is within the lower half of the selected voltage range (for example, 380V or 415V in the 380/415/460V range), the higher voltage taps are selected. If input voltage is within the upper half of the selected voltage range (460V in the 380/415/460V range), the lower voltage taps are selected. This arrangement provides secondary voltages close to the optimum levels. When the lower voltage taps are selected a red indicator, D18, on the Voltage Selection PC Board will be ON.

The auxiliary voltage taps, 115 VAC and 28 VAC circuits, are selected directly by relays on the Voltage Selection PC Board. The fan and pump motors are supplied by the Motor Control Contactors (MC1 and MC2). MC1 is for the high voltage tap and MC2 is for the low voltage tap. Three-phase primary power is controlled by one of the Main Contactors (W1 for the high voltage tap or W2 for the low voltage tap).

C. Switch-Mode Power Supply Operation

Primary three-phase power from the Main Transformer secondary is rectified by the three-phase bridge diodes D1-D6. The resulting negative DC voltage (approximately -320 vdc) is applied to the switching transistor (Q1). The switching transistor controls the output current by pulse width modulation (PWM). PWM varies the duty cycle (or on-time versus off-time) of the switch. The greater the on-time, the higher the output current will be. Components D7-10, R2-3, C13-14, L1, and the Suppression PC Board are snubbers to limit voltage and current surges caused by switching Q1 on and off. D11-14 are free wheeling diodes. When Q1 is on, current flows through Q1 into the output network. When Q1 is off, D11-14 provide a path for current to continue flowing supported by energy that was stored in the output network during the time Q1 was on. The switching transistor output is a series of pulses which are filtered back into pure DC voltage by the output network. The output network consists primarily of the main inductor (L2A and L2B), resistor R13, and capacitor C23.

D. Switching Control PC Board (PCB)

The Switching Control PC Board compares the shunt amp output with the current control pot setting and generates logic level PWM signals. The shunt and Shunt Amp PC Board are located between the input bridge positive and work lead to measure the output cutting current. The PWM signals are sent to the Driver PC Board, where they are converted into the current and voltage levels needed to drive the switching transistor.

NOTE

The Switching Control PCB in the Merlin 6000 Master Power Supply may be used in the Merlin 6000 Slave Power Supply and the Merlin 6000GST Master Power Supply.

In the Master Power Supply, the Switching Control PCB does the following:

- Senses if the Remote Control (RC6010) is installed, then routes the current control signal from the remote instead of the Merlin Master Power Supply front panel control.
- Sends the Current Control Signal to the Slave Power Supply through the Isolation PCB and Parallel Cable connection. All signals to and from the Slave Power Supply pass through the Isolation PCB and Parallel Cable.
- Combines the Output Signal from the Slave Power Supply with the Shunt Amp signal. The result creates a Display Signal that is sent to the Remote Control current display.
- Configures the Remote Control for 300A, instead of 150A, when a Slave Power Supply is used.
- Sends a torch voltage signal to the Standoff Control, if used.
- Supplies POT HI and POT LOW signals for setting MIN and MAX output to both the Remote Control and Master Power Supply front panel current controls.
- Sends current sensing (CSR) signal, when output is greater than 12A, to Logic PCB.
- Sends over current shutdown signal, when current is greater than 175A, to Logic PCB.
- Turning OFF the ENABLE, from the Remote Control switch or a switch connected to TB2, will shut off coolant flow and DC power to allow changing torch parts. A relay on the Switching Control PCB removes power from one side of the motor contactor (MC) and main contactor (W) coils when the ENABLE switch is OFF.

A DIP-switch (SW1) configures the Switching Control PCB for no current ramping (Merlin 6000) or current ramping (Merlin 6000GST).

NOTE

For a Merlin 6000 System, both Master and Slave Power Supplies should have both sections of SW1 turned OFF.

E. Logic PC Board (PCB) Functions

The Logic PC Board used in the Slave Power Supply is the same part as used in the Master Power Supply. Some functions of the PC Board that are used in the Master Power Supply are not used in the Slave Power Supply. The functions of the Logic PC Board in the Slave Power Supply are as follows:

- Monitors the temperature interlocks.
- Drives the front panel Status LED's.
- Contains circuits to determine if a Slave Power Supply is connected and turned ON.
- If Slave Power Supply is turned ON, signals the Switching Control PCB and Remote Control to be configured for 300A operation.

The following is the sequence that the Logic PCB goes through:

- Receives the START signal from the CNC cutting machine controller from either the remote control, standoff control, direct from the controller via the remote connector or through TB2 the "simple" interface terminal strip.
- Energizes the main contactor, W1 or W2, as determined by the Voltage Selection PCB.
- When the Arc Starter Box senses OCV greater than 250V between the torch's plus and minus, it starts the capacitor discharge (CD) arc starting circuit to fire the spark gap producing the high voltage spark which starts the DC pilot arc.
- Once a constant DC pilot is established the torch voltage drops below 250V and shuts off the CD circuit.
- When the torch is close to the work the cutting arc "transfers" to the work. The resulting current in the work lead is sensed by the Shunt Amp, then the Switching Control PCB sends the CSR signal to the Logic PCB which opens the pilot contactor , shutting off the pilot and generating an OK-TO-MOVE signal.
- The OK-TO-MOVE signal can be either contact closure or 24 VAC through contacts selected by SW5 on the Logic PCB (set for contacts if RC6010 or SC11 is used). The OK-TO-MOVE signal is sent to the remote control, standoff control or direct to the cutting machine controller. It also controls the Arc Hour and Starts Counter Meters and the optional High Flow Water Shield.
- At the end of the cut, when the START signal is removed and the Logic PCB starts a 1/2 second delay. After the 1/2 second delay the Logic PCB removes the PWM enable signal. This 1/2 second delay allows time for the Switching Control PCB to ramp the output current down until the arc goes out.

  Units with Logic Control PCB 19x1247 or 19x1360 rev AE or earlier:

  The Main Contactor will also shut off at the end of the 1/2 second delay.

  Units with Logic Control PCB 19x1360 rev AF or later:

  The Main Contactor will stay ON until post-flow is complete.

- Post-flow timer, initiated at removal of the START signal, keeps the plasma and secondary gases flowing for a period of time. The post-flow time is selectable from 5 to 40 seconds using DIP-switch SW4, so gas is immediately available during the selected time to restart the arc without waiting for preflow. For more information on setting DIP-switch SW4, refer to the Operating Manual Section 4.07, Optional Power Supply Settings.

  Units with Logic Control PCB 19x1360 rev AF or later:

  The Main Contactor is kept ON during post-flow time. If the time between cuts is less than the post-flow time, the Main Contactor will not cycle ON and OFF. This will extend the life of the Main Contactor. It may be necessary to select a longer post-flow time to reduce Main Contactor cycling between cuts.

F. LED/Current Control PC Board

The LED/Current Control PC Board contains the sequence status LED indicators and the front panel current control pot.

4.04 Troubleshooting Guide

• Troubleshooting and Repair

Troubleshooting and repairing this unit is a process which should be undertaken only by those familiar with high voltage high power electronic equipment.

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

• Advanced Troubleshooting

NOTE

For basic troubleshooting and parts replacement procedures refer to Merlin 6000 Slave Power Supply Operating Manual 0-2603.

The advanced troubleshooting covered in this Service Manual requires Power Supply disassembly and live measurements. It is helpful for solving many of the common problems that can arise with the Merlin 6000 Slave Power Supply.

If major complex subassemblies are faulty, the unit must be returned to an authorized service center for repair.

Follow all instructions as listed and complete each in the order presented.

Specific test procedures and LED status identification tables have been grouped together, and are referenced by the troubleshooting guide.

• How to use this Guide

The following information is a guide to help the Service Technician determine the most likely causes for various symptoms. This guide is set up in the following manner:

1. Perform operational check(s) on the equipment to isolate problem to possible circuit(s).
2. Determine symptom and isolate to defective assembly using the following format:

   X. Symptom (Bold Type)

   Any Special Instructions (Text Type)

   1. *Cause (Italic Type)*

      a. Check / Remedy (Text Type)

3. Locate your **symptom** in the appropriate Sub-Section.
4. **C**heck the *causes* (easiest listed first) for the **symptom**.
5. Check the remedies listed for each cause.
6. Repair as needed being sure to verify that unit is fully operational after any repairs.

NOTE

Many signals are transferred between Printed Circuit Board Assemblies on Ribbon Cables. If these cables become faulty they can then cause various problems. ***Do not*** *forget about these cables when troubleshooting.*

A. No front panel LED indicators ON; Fan not operating

1. *No primary power. Refer to symptoms C and D also.*
   a. Check for proper three-phase power at input terminal board
2. *Faulty ON/OFF switch (SW1)*
   a. Disconnect primary power. Check each section for continuity. Replace switch if necessary
3. *Faulty voltage selection board*
   a. Refer to Section 4.05-A, Voltage Selection PC Board Check. Replace Voltage Selection PC Board if necessary

B. AC indicator ON; Fan not operating

1. *Parallel cable not connected (Slave Power Supply)*
   a. Install Parallel Cable
2. *No ENABLE to Slave Power Supply*
   a. Refer to Section 4.05-T, Isolation PCB and Parallel Cable Interface
3. *Blown fuse (F1 or F2)*
   a. Check and replace fuse if necessary. Refer to Section 4.05-C, Blown Fuse (F1 or F2).
4. *Faulty ON/OFF switch (SW1)*
   a. Disconnect primary power. Check each section for continuity. Replace switch if necessary
5. *Faulty Voltage Selection PC Board*
   a. Refer to 4.05-A, Voltage Selection PC Board Check. Replace Voltage Selection PC Board if necessary
6. *Faulty motor contactor (MC1 or MC2)*
   a. Refer to Section 4.05-D, Motor Control Contactor Check (MC1 or MC2). Replace contactor if necessary

C. Fuse blows at disconnect when primary power is turned ON

1. *Voltage selection busbars connected incorrectly*

   a. Check and correct if necessary.

2. *One leg of three-phase primary connected to chassis ground*

   a. Rewire input cable per Operating Manual.

3. *Main transformer shorted*

   a. Replace main transformer

D. Fuse blows at disconnect when main contactor (W1 or W2) closes

1. *Shorted input diode (D1-D6)*

   a. Refer to Section 4.05-E, Diode Check. Replace diode(s) as required.

2. *Switching transistor (Q1) shorted to heatsink*

   a. Replace Q1, check heatsink for possible damage. Refer to Section 4.05-H, Switching Control Check (Q1).

3. *Shorted input capacitor (C7-C12)*

   a. Replace capacitor if necessary

4. *Shorted diode (D11-D14)*

   a. Check for proper 3-phase power at input terminal board, check diodes. Refer to Section 4.05-E, Diode Check.

5. *Faulty Voltage Selection PC Board*

   a. If W1 and W2 come on simultaneously replace Voltage Selection PC Board.

6. *Faulty Main Contactor (W1 or W2)*

   a. Check both contactors for welded contacts and replace contactor(s) if necessary

E. TEMP indicator on (red)

1. *Faulty Fan power, Fan, Fan Capacitor, Fuse, or Contactor*

   a. Isolate the faulty component as follows and replace component(s) as necessary:

   Check for approximately 230 VAC between wire #13 (MC1 or MC2, J39-2) and wire #12 (F1 fuse, J39-5).

   - If not present check for blown F1 (refer to section 4.05-C) or defective MC contactor (refer to section 4.05-D).
   - If 230 VAC is present Fan or Fan capacitor (C32) is defective.

2. *Faulty thermal sensor (TS1 to TS5)*

   a. Refer to Section 4.05-F, Thermal Sensing Circuit Check. Replace sensor(s) if necessary

3. *Faulty Logic PC Board*

   a. Refer to Section 4.05-F, Thermal Sensing Circuit Check. Replace Logic PC Board if necessary

4. *Faulty LED/Current Control PC Board*

   a. Refer to Section 4.05-F, Thermal Sensing Circuit Check. Replace LED / Current Control PC Board if necessary.

F. *Depending on the Logic Control PCB installed refer to one of the following symptoms*

- ***For Logic Control PCB 19x1247 or 19x1360 rev AE or Earlier***

  After Pre-Flow, DC indicator OFF; Logic Control PCB START LED and Main Contactor do not come ON or only momentarily ON (less than 1/2 second); No Pilot Arc

- ***For Logic Control PCB 19x1360 rev AF or Later***

  After Pre-Flow, DC indicator OFF; Logic Control PCB LEDs PWM ON and START do not come ON not even momentarily; No Pilot Arc

1. *Master Power Supply not receiving START signal*

   a. Refer to Master Power Supply Service Manual

2. *Slave Power Supply not receiving START signal*

   a. Master Power Supply starts but Slave does not

   Verify that the Slave Power Supply Logic PCB READY and RUN LEDs are ON

   - If the LEDs are ON, refer to section 4.05-L, Isolation and Parallel Cable Interface
   - If the LEDs are OFF, refer to Section 4.05-G, Power Supply Start Circuit

G. ***Depending on the Logic Control PCB installed refer to one of the following symptoms***

- ***For Logic Control PCB 19x1247 or 19x1360 rev AE or Earlier***

  After Pre-Flow, DC indicator OFF; Logic Control PCB START LED is ON for preflow; W ON LED only ON momentarily (less than 1/2 second); START LED goes OFF same time as W ON LED; No Pilot Arc

- ***For Logic Control PCB 19x1360 rev AF or Later***

  After Pre-Flow, DC indicator OFF; Logic Control PCB START LED is ON for preflow; PWM ON LED only ON momentarily (less than 1/2 second); START LED goes OFF same time as PWM ON LED; No Pilot Arc

1. *Shorted Torch or Faulty Q1*

   a. Isolate problem between torch and Q1

   Remove wire #7 from W7 faston tab on Logic PCB. Insulate end of wire (may have 300 vdc on it) before applying power to unit.

   - If START LED now stays ON for 3 seconds after preflow, then fault is a short between torch tip and electrode circuits (torch head, leads, arc starter box). Repair as required.
   - If START LED does not stay ON for 3 seconds, then Q1 may be faulty. Refer to Section 4.05-H, Switching Control Check.

H. Weak or Sputtering Pilot

1. *Incorrect pilot resistor setting in Master Power Supply*

   a. Must be adjusted according to the input line voltage, Refer to Master Power Service Manual Section 4.05-M, Pilot Resistor Adjustment

2. *Low Open Circuit Voltage (OCV)*

   a. Improper connection of transformer voltage select buss bars, check for correct configuration

   b. Faulty Voltage Selection PCB

The Merlin has three input voltage ranges; 200-230, 380-460, 500-575 VAC. If the incoming voltage is in the lower half of any range an LED, D18, on the Voltage Selection PCB should be OFF, if it's ON, refer to 4.05-A, Voltage Selection PCB Check.

I. Main arc starts but current is 1/2 what is expected; Main contactor (W1 or W2) goes off

1. *Fault condition causes output greater than 175 amps*

   a. Current Control signal (DEMAND) greater than 10 vdc.

   Measure for 10 vdc on the Switching Control PC Board from TP1 (ground) to Front Panel CURRENT Control, J10-15, or to the Remote Current Control, J7-18 (see NOTE).

NOTE

Measure the voltage while attempting to cut as the voltage may be correct prior to cutting.

   If voltage exceeds 10 vdc, may be momentarily, perform checks at Section 4.05-K, Steps 2 and 3.

   b. Shorted Q1 or faulty Switching Control PC Board. Refer to Section 4.05-H, Switching Control Check (Q1).

J. Main arc transfers but does not pierce through the plate or pierce is too slow

1. *Current is correct from Master Power Supply*

   a. Make sure Slave Power Supply is turned ON, Parallel Cable is connected and the Slave Power Supply Work Lead is connected

   b. Current Control circuit is faulty; Refer to Section 4.05-K, Current Control, Display, and CSD Checks

K. Standoff Control Not Working Correctly

Refer to Troubleshooting in the Standoff Control Instruction Manual.

L. Remote Control Not Working Correctly

Refer to Troubleshooting in the Remote Control Instruction Manual.

4.05 Test Procedures

The following tests are suggested for specific problems listed in the troubleshooting guide.

WARNING

Several of these tests involve voltage measurements that must be made with power on. Use extreme care when making these tests. Tests requiring voltage measurements are marked with the warning symbol. Disconnect primary power to the system for all other tests.

A. Voltage Selection PC Board Check

The CE Merlin transformer uses the input voltage range (380-460 VAC) selected by buss bars. Within this range there are transformer taps for the upper and lower halves of the range. The dividing line between the upper and lower halves for this range is as follows:

- 380 - 460 VAC; approximately 409 VAC

The Voltage Selection PCB automatically selects the correct taps.

NOTE

The connector for the following tests on the Voltage Selection PC Board is labelled J1. The System Schematic and the other supplied data refers to this connector as J6.

A one second delay after wall power is turned ON, when the voltage at J6-20 to J6-22 is greater than 28 VAC (upper half of range), the Voltage Select PCB enables relays K1, K4 and K5 (labeled 'HV' on the system schematic) and the red LED, D18. The relays and LED will not turn ON unless switch SW1, front panel ON / OFF Switch is ON.

- If the voltage at J6-20 to J6-22 is less than 28 VAC, then relays K2 and K3 (labeled 'LV' on the system schematic) are enabled and LED, D18, will not come ON.
- If LED, D18, is ON and the voltage is less than 28 VAC replace the Voltage Selection PCB.

28 VAC Test

1. Check the AC input from J6-24 to both J6-20 and J6-22 for 12 - 18 VAC.
2. Check the AC voltage from J6-24 to both J6-17 and J6-18 for 16 - 22 VAC.
3. If input voltages are correct, check output from J6-24 to both J6-19 and J6-21 for 14 - 18 VAC.
4. If output is not present at J6-19 and J6-21, check between J6-24 (-) and both J6-16 and J6-23 (+) for 12 - 16 vdc. If voltage is present at both points or neither, replace the Voltage Selection PC Board. If voltage is found at J6-23 but not at J6-16, check SW1-B and all wiring and connections.

120 VAC Test

NOTE

Refer to Appendix 5 for 120 VAC Circuit Diagram.

1. Check the voltage input from F2 (wire #10) to J6-9 for 100 - 120 VAC. Check the input from F2 to J6-10 for 120 - 140 VAC.
2. If the voltage input is present, check the red LED indicator (D18) on the voltage selection board. If the indicator is lit, measure voltage output between F2 (wire #10) and J6-7. If the indicator is not lit, measure between F2 and J6-12. The voltage output at either point should measure 110 - 130 VAC.
3. If both or neither J6-7 or J6-12 have high voltage present, replace the voltage selection board. Check voltage between J6-14 and wire #10 on fuse F2 for 110 - 130 VAC. This supplies 120 VAC to the rest of the unit.

B. Enable Circuit Tests

Coil voltage of 120 VAC is supplied to the Motor Contactors (MC1 and MC2) and the Main Contactors (W1 and W2) through the Voltage Selection PCB (refer to Section 4.05-A and Appendix 5). The return path is through the Switching Control PCB Enable Relay (K1), the ON / OFF Switch (SW1-A) and the 5A fuse (F2).

Shutting off the Enable removes power from the contactors, fan motor and the DC output.

ENABLE signal to the Slave Power Supply also comes from TB2 in the Master Power Supply. The signal goes through the Isolation PCB to the Parallel Connector, J54. Signal then goes through the Parallel Cable to J15 on the Slave Power Supply. Refer to Section 4.05-L, Isolation PCB and Parallel Interface.

Check Enable Relay K1 circuit per the following:

NOTE

This procedure applies to both the Master and Slave Power Supplies:

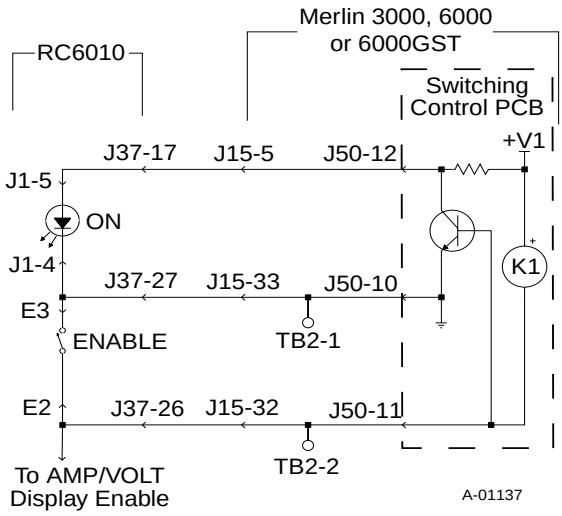


Figure 4-3 Enable Circuit Diagram

1. Check for zero AC volts from F2, wire #10, to J7-22 and from F2, wire #10, to J7-24.

   - If voltage is correct, the Enable Relay is closed. The fault is in the contactor (refer to Section 4.05-D, Motor Control Contactor Check) or the voltage supply (refer to Section 4.05-A, Voltage Selection PCB Checks).
   - If voltage, approximately 120 VAC, is present at J7-24 the circuit is open between J7-24 and F2. Check Fuse F2 or ON / OFF Switch for open condition.
   - If there is about 120 VAC at J7-22 then Enable Relay K1 is not closed, proceed to next step.

2. Check for the +15 vdc relay power supply, +V1, on the Switching Control PCB. Measure between TP1 and TP2 on the Switching Control PCB. Should be about +15 vdc at TP2.

   - If voltage is not correct, power may not be getting to the PCB or there may be a short either on or off the PCB.

3. Check for 14 to 18 VAC incoming power by measuring from TP1 to J7-12 and J7-15.

   - If voltage is not correct, refer to Section 4.05-A, 28 VAC tests.

   To check for shorts, remove J9, J10 and J50 from the Switching Control PCB. Also, remove J70 from the Signal Isolation PCB.

   Check for +15 vdc from TP1 to TP2.

   - If voltage is incorrect, then the PCB may be faulty, proceed to next step
   - If voltage is correct, then reinstall the connectors one at a time to isolate the problem. In the case of a ribbon cable the cable itself may be shorted.

C. Blown Fuse (F1 or F2)

1. A shorted or frozen motor will cause F1 to fail. A shorted or open fan motor starting capacitor (C32) may also cause F1 to fail.

2. Fuse F2 fuses the 120 VAC circuit. MC1 or MC2 and T2 are energized when power is first applied. If shorted, any one of these components would cause F2 to fail. W1 or W2, and PCR energize after the torch switch or remote start switch is activated. The resistance for each of these components is as follows:

Component	Resistance (ohms)
T2	9
MC1	7
MC2	7
W1	16
W2	16
PCR	58

Check the resistance of each component or disconnect all the components and reconnect one at a time to determine which component causes the fault.

D. Motor Control Contactor Check (MC1 or MC2)

NOTE

Refer to Appendix 5 for 120 VAC Circuit Diagram.

The 120 VAC is supplied to the Motor Control Contactor (MC1 and MC2) coils from the Voltage Selection PC Board, which selects the proper tap on the Main Transformer (T1). The return path travels from wire #110 through K1 on the Switching Control PC Board to wire #8, through the ON / OFF switch (SW1A) to wire #9, through fuse F2 to wire #10 and T1.

Only one of the two contactors should have voltage applied. If the red LED indicator (D18) on the voltage selection board is lit, MC2 should be energized. If D18 is not lit, MC1 should be energized.

a. Check the voltage across the coil on the contactor for approximately 120 VAC. If voltage is present, replace the contactor. If it is not, perform the 120 VAC test (refer to Section 4.05-A) to check for a proper voltage supply from the voltage selection board. If correct, continue to step 2 to isolate the problem in the return path.

b. With one meter lead on the supply side of the contactor coil (wire #3 for MC1 or wire #4 for MC2) measure to wires #8, 9, and 10 to determine where the return circuit is broken. On the return path, F2 and SW1-A can be measured for continuity. Enable Relay, K1, on the Switching Control PC Board will normally be open when power is OFF. Refer to Section 4.05-B for Enable Circuit Checks.

E. Diode Check

There are fourteen diodes in the main heatsink area, including six large 150 amp input rectifier diodes (D1-6) and eight small 70 amp diodes (snubbing diodes D7-10 and freewheeling diodes D11-14). To measure the resistance of each diode use one of the following:

- An ohmmeter set on the Rx1 or Rx10 scale
- Digital meter set to the diode function

Measure the resistance of each diode in both directions. The readings should differ by at least a factor of ten. If the readings do not differ (both high or both low), disconnect one end of the diode and recheck. If the diode reading is not correct with one end disconnected, then replace the diode. Check all diodes before turning on power to the system.

If a diode fails, check the potential causes of diode failure to make sure the replacement diode will not also fail when it is installed:

1. Isolate and check each diode separately to determine which individual diode has failed.

2. High frequency protection for the input rectifier diodes (D1-6) is provided by capacitors C1 - C6 and MOV 1-3, which are located between each side of the diode heatsink on the input filter PC board. Except for the shorts, these components can not be checked with a volt / ohm meter. To be safe, the complete input filter board should be replaced any time an input diode fails.

3. Diodes can overheat if air flow over the heatsink is not adequate or if the diode is not properly fastened to the heatsink. Check that all small diodes (D7-14) are torqued to 20-25 in-lbs (2.3-2.8 Nm) and all large diodes (D1-6) are torqued to 100-125 in-lbs (11.3-14.1 Nm). Apply a light film of electrically conductive heatsink compound between the diode and heatsink. Make sure air passages in and out of the unit are not obstructed.

4. Diodes that are faulty at the time of manufacture are difficult to diagnose. These diodes generally fail within the first few hours of operation. Before deciding that this was the case, be sure to check out other possibilities.

F. Thermal Sensing Circuit Check

1. Thermal sensors TS1, TS2, TS4, and TS5 are connected in series to J1-9 on the Logic PC Board. TS2 is a PTC resistor whose resistance varies with temperature from about 100 ohms at room temperature (68°F / 20°C) to 3.3K at 140°F (60°C) switch point. TS1, TS4 and TS5 are switches normally closed, 0 ohms, that open at over temperature. TS1, TS4 and TS5 are part of the Main Transformer Assembly. TS2 is on the Heatsink.

   Check the voltage from J1-9 to test point TP1 (or J1-8) on the Logic PC Board for less than 7.5 vdc.

   If the voltage is greater than 7.5 vdc, the unit is overheated or a temperature sensor is faulty.

2. If the unit still operates but the TEMP indicator is red, the problem may be on the LED PC board. If the voltage is less than 7.5 vdc, check the voltage from J3-4 to test point TP1 (ground). If the voltage is greater than +4 vdc (and the TEMP indicator is lit red), replace the LED PC board. If the voltage at J3-4 is less than 4V, replace the Logic PC Board.

G. Power Supply Start Circuit

The following describes the flow of the START signal through the system.

- The START signal enters the Master Power Supply at J15-24 (sig) and J15-25 (return). This is in parallel with TB2-3 and TB2-4 which can be used instead of J15.
- From J15 or TB2 the signal goes to the Logic PCB at J1-19 and J1-18. This turns ON the START LED (D8).

  Units with Logic Control PCB 19x1247 or 19x1360 rev AE or earlier:

  Logic Control PCB W ON LED (D9) and the Main Contactor (W1 or W2) turn ON at the end of preflow.

  Units with Logic Control PCB 19x1360 rev AF or later:

  Logic Control PCB START LED and the Main Contactor (W1 or W2) turn ON at the beginning of preflow. At the end of preflow the PWM ON LED (D9) comes ON.

- After preflow and at the same time that the Master Power Supply Main Contactor (W) comes ON, the START TO SLAVE signal leaves the Master Power Supply Logic PCB at J4-6 and J4-5.
- The signal then goes through the Isolation PCB and Parallel Cable to the Slave Power Supply J15-24 and J15-25.
- Inside the Slave Power Supply the signal continues to the Logic Control PCB. The signal then goes to J1-19 and J1-18 on the Logic Control PCB, turning ON the START LED (D18).
- If the Master Power Supply starts but the Slave Power Supply does not get a START signal (START LED is OFF) refer to Section 4.05-L, Isolation PCB and Parallel Cable Checks.
- If the START LED is ON, even momentarily, go to Section 4.05-I, PWM Enable Signal Circuit.

If Slave Power Supply does not start do the following:

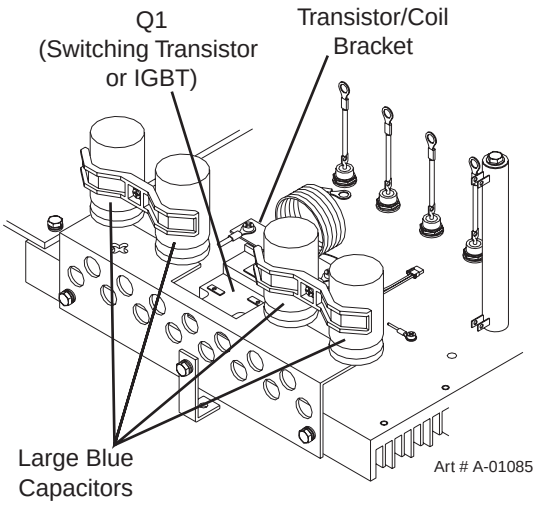
The Slave Power Supply has no coolant and requires the THIS IS SLAVE signal to disable the coolant input. A jumper in the Parallel Cable from J15-35 to J15-36 provides the THIS IS SLAVE signal. The signal goes to the Slave Power Supply Logic PCB. Check for 0 vdc from TP1 (ground) to J4-9 on the Logic PCB.

- If the voltage is correct and the TEMP LED is green the Slave Power Supply Logic PCB is faulty.

H. Switching Control Check (Q1)

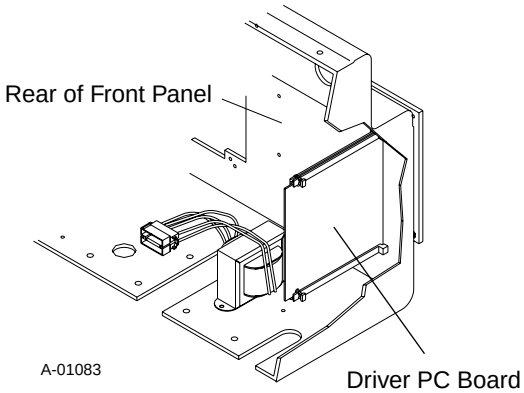
To produce DC output, the main switch (Q1) must be turned on and off rapidly. Power Supply output is controlled by the on-time. At the same time the Main Contactor (W1 or W2) closes, the Logic PC Board grounds pins 9 and 23 of the 34-pin ribbon cable (J3-9) on the Logic PC Board, J10-9 on the Switching Control PC Board). This enables the pulse width modulator (PWM) on the Switching Control PC Board.

The Logic PCB has protection circuits to remove PWM Enable signal if certain conditions are detected. The circuits can be disabled for troubleshooting purposes only, but first verify that Q1 is not faulty.



Q1 Location

To check for a defective Q1, remove power from the unit and disconnect J27 from the Driver PC Board.



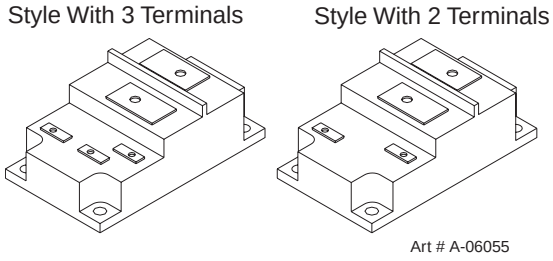
Driver PC Board Location

CAUTION

There are two types of J27 wiring harness connected to Q1. For units with a 3-wire J27 harness, refer to section H-1. For units with a 2-wire J27 harness, refer to section H-2.

H-1. Switching Transistor

There are two types of Switching Transistor / IBGT. The types can be identified by the top of the casing.



On a X1 or X10 scale or with a digital meter set for diode, measure between "C" (collector) terminal, wire #83, and "E" (emitter) terminal, wire #84). Reverse the meter leads and measure again. It is normal to measure an open (high reading) one way and a lower reading the other. A low or zero measurement both ways means the Q1 is shorted and must be replaced.

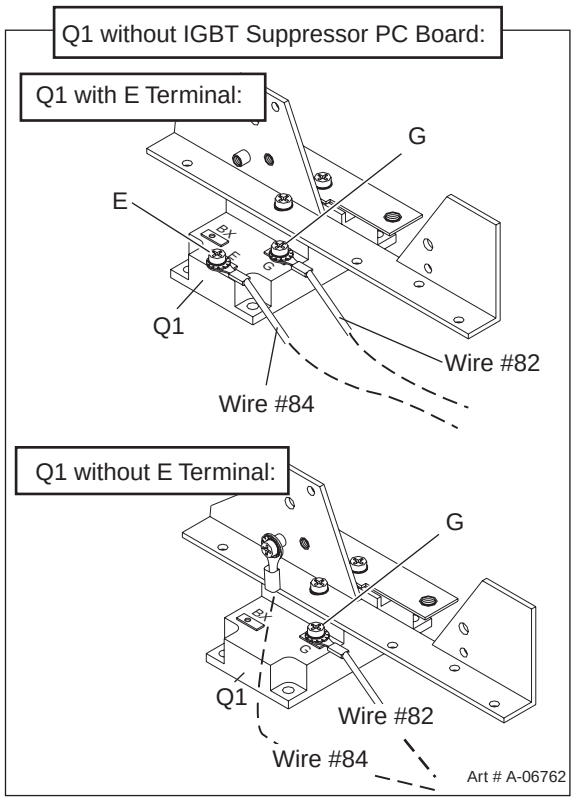
If correct, measure from the "B" (base) terminal, wire #82, to "E" (emitter) terminal, wire #84. Normal reading is from about 50 to 150 ohms (digital meter on ohms not diode scale) a short (zero ohms) or an open indicates a defective Q1.

NOTE

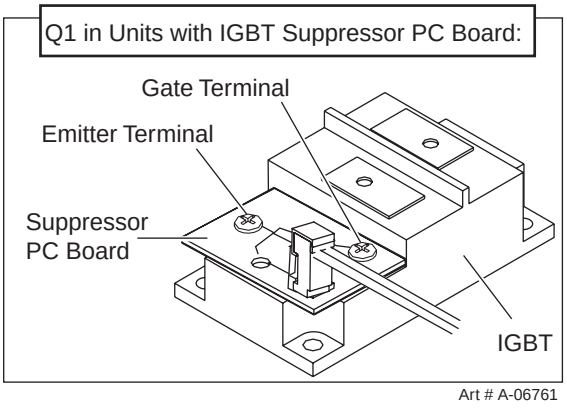
If the Switching Control Q1 has failed, the Driver PC Board must also be replaced. Refer to Section 6 for replacement parts.

H-2. IGBT

On units with Q1 without Suppressor PC Board:



On units with Q1 with Suppressor PC Board:



On a X1 or X10 scale or with a digital meter set for diode, measure between gate (G) terminal and emitter (E) terminal. Reverse the meter leads and measure again. It is normal to measure an open (high reading) one way and a lower reading the other. A low or zero measurement both ways means the Q1 is shorted and must be replaced.

If correct, measure from the gate terminal to emitter terminal. Normal reading is 2.2 ohms (digital meter on ohms not diode scale) a short (zero ohms) or an open indicates a defective Q1.

NOTE

If the Switching Control Q1 has failed, the Driver PC Board must also be replaced. Refer to Section 6 for replacement parts.

On all units:

- *Units with Logic Control PCB 19x1247 or 19x1360 rev AE or earlier:*

  If DC voltage is not detected within 75 ms at J1-24 on the Logic PC Board, the PWM Enable signal on J10-9 is removed, the START and W ON LEDs turn OFF and the Main Contactor opens.

- *Units with Logic Control PCB 19x1360 rev AF or later:*

  If DC voltage is not detected within 75 ms at J1-24 on the Logic PC Board, the PWM Enable signal on J10-9 is removed and the START and PWM ON LEDs are turned OFF.

Disabling protection circuits for troubleshooting

Connecting TP4 to TP1 (ground) on the Logic PC Board allows the PWM Enable signal to stay ON for 3 seconds. For Logic PCBs with TP7 (rev AD or later) connecting both TP7 and TP4 to TP1 (ground) allows the PWM Enable signal to stay on indefinitely.

The PWM compares shunt amp output on J9-5 with the current control signal (3.3 - 10 vdc) from the remote (J7-18) or the panel control (J10-15). A faulty shunt amp could cause the output, normally 0 vdc with no cutting arc, to go higher, shutting off the PWM and thus producing no DC. If the shunt amp ribbon connector is disconnected or pin 1 is open, approximately 12 vdc is applied to J9-5, shutting down the PWM in the same manner as a shunt amp failure.

The Switching Control PC Board sends pulses (+15 V) to the Driver PC Board on J8-1 and J8-3. The width of these pulses controls the on-time of Q1. The pulses are best observed with an oscilloscope, but an AC voltmeter should read about 6 to 7 VAC from J8-2 to both J8-1 and J8-3. If 0 VAC is measured at both J8-1 and J8-3, with the enables (J10-9 and J10-23) and shunt amp (J9-5) input low, replace the Switching Control PC Board.

WARNING

Both base and emitter are at -320 vdc potential. Use extreme caution when testing Driver PC Board output.

If switching pulses are present at J8-1 and J8-3, check the Driver PC Board output between J27-3 and J27-2.

The Driver PC Board output, J27-3 to J27-20, should measure about 1 VAC. If voltage measures 0 to -4 vdc (+ lead on J27-3) replace Driver PC Board. If switching pulses are not present (start signal OFF), -4 vdc is normal.

I. PWM Enable Signal Circuit

When the complaint is "No DC or no output from the Slave Power Supply" what to do?

There are a number fault sensors in the Power Supply which can prevent the Power Supply output from coming ON or cause it to shut OFF once it is ON. The output section is turned ON by the PWM Enable signal from the Logic PC Board. An LED on the Logic PC Board will be ON when the enable signal is present. Depending on the Logic PCB in the unit, the PWM Enable signal LED (D9) is labeled as follows:

- *Units with Logic Control PCB 19x1247 or 19x1360 rev AE or earlier:*

  LED (D9) is labeled W-ON

- *Units with Logic Control PCB 19x1360 rev AF or later:*

  LED (D9) is labeled PWM-ON

The possible symptoms in this subsection are:

- **Main Contactor (W1 or W2) do not come ON**
- **PWM enable LED (D9) indicator is ON momentarily, less then 1/2 second, then OFF**
- **PWM enable LED (D9) is on for 3 seconds then OFF; No pilot**
- **Pilot starts but Main Contactor (W1 or W2) and PWM enable signal LED (D9) shuts off immediately upon arc transfer**

The symptom must be carefully considered to determine where to look for the fault. Listed under each symptom are a number of tests that need to be performed to isolate the problem. Locate the symptom and proceed to that symptom area.

Main Contactor (W1 or W2) do not come ON

1. **READY or RUN LED on Logic PC Board is OFF.**

   a. Unit over temperature, TEMP LED red, input J1-9 will be greater than 7 volts.

   b. Logic PCB is Faulty.

2. **START LED on Logic PC Board is never ON, not even momentarily.**

   a. START signal (active low) not getting to J1-19. Check wiring between Logic PCB or J15 remote connector. Check Isolation PC Board and Parallel Cable, refer to Section 4.05-L.

   b. Logic PCB faulty.

PWM enable LED (D9) indicator is ON momentarily, less then 1/2 second, then OFF

1. **START LED is ON for preflow time then PWM Enable signal LED (D9) comes ON for less than 1/2 second, then both LEDs are OFF.**

   a. No DC or DC less than -60 vdc. Front Panel DC LED does not come ON. Check for shorted Q1 per Section 4.05-H.

   If Q1 checks okay, then install a jumper from TP4 to TP1 on the Logic PC Board to bypass the DC sensing circuit. If the problem is no DC then the PWM enable signal LED (D9) should now stay ON for 3 seconds then go OFF. If PWM enable signal LED (D9) still drops out in less than 1/2 second, problem is not a loss of DC but may be a shorted torch.

   b. Shorted torch (head, leads, consumables, etc.). Remove and insulate wire #7 from W7 faston on Logic PCB.

CAUTION

300 volts may be present on the wire.

If contactor stays on for about 3 seconds after remove wire #7, the problem is a shorted torch, tip to electrode, with voltage on the tip exceeding 220 volts.

PWM enable LED (D9) is on for 3 seconds then OFF; No pilot

1. **START LED is ON for preflow time, then PWM Enable signal LED (D9) comes ON for 3 seconds. Both LEDs then go OFF.**

   a. Pilot must start in 3 seconds after DC comes ON. Both pilot enable (U15-2) and tip voltage (U27-14) signals must be high within 3 seconds. If the spark gap (in Arc Starter Box) is firing during the 3 seconds, check for wrong pilot resistor setting (refer to Master Power Supply Service Manual Section 4.05-S, Pilot Resistor Adjustment), bad torch parts, or open connection in the torch leads.

   b. If spark gap is not firing, check for 24 VAC (Arc Starter Box PC Board LED is ON) and DC greater than 250V at E1 & E2 fastons on Arc Starter PC Board (DC will only be on for 3 seconds - see note). If both voltages are present, the Arc Starter PC Board is faulty.

NOTE

Logic PC Boards with Rev 'D' or later on the PC Board have a test point, TP7, connected to the anodes of D67 and D72. Installing a jumper from TP7 to TP1 will defeat the pilot sensor allowing more than three seconds for troubleshooting.

Pilot starts but Main Contactor (W1 or W2) and PWM enable signal LED (D9) shuts off immediately upon arc transfer

1. **PWM Enable signal LED (D9) shuts OFF at arc transfer.**

   a. Current Control signal (DEMAND) greater than 10 vdc.

   Measure for 10 vdc on the Switching Control PC Board from TP1 (ground) to Front Panel CURRENT Control, J10-15, or to the Remote Current Control, J7-18 (see NOTE).

NOTE

Measure the voltage while attempting to cut as the voltage may be correct prior to cutting.

   If voltage exceeds 10 vdc, may be momentarily, perform checks at Section 4.05-K, Steps 2 and 3.

   b. Shorted Q1 allows no current control, output exceeds 175A over current shutdown. Signal at J3-21 goes low, turning the START signal OFF. This happens very fast and is difficult to see. Best way is to check Q1 with an ohmmeter. Refer to Section 4.05-H, Switching Control Check.

   c. Faulty Shunt or Switching PCB will prevent current control, same results as with shorted Q1, may also cause Q1 to fail. Refer to Section 4.05-I, Switching Control Checks.

   d. No Current Sensing Signal (CSR) getting to the Logic PC Board. Loss of CSR will remove the START signal. The cause could be a faulty Switching PC Board current sensing circuit or a faulty Logic PC Board. Installing a jumper from TP8 (see Note) to TP1 on the Logic PC Board should prevent the shutdown.

NOTE

Logic PC Boards with Rev 'D' or later have a test point, TP8, connected to the anode of D62.

- If shutdown continues, the Logic PC Board is faulty.

If output current is set for over 250A and the PILOT contactor stays ON, check for a logic low (near zero volts) at J3-11, the CSR input.

- If low, the Logic PC Board is faulty.
- If not low then the Switching PC Board, Shunt PC Board, or ribbon cables are faulty.

J. Pilot Circuit Check

The pilot is ignited by a high voltage spark generated in the Arc Starter Box. The Arc Starter Box requires a 24 VAC supply which should always be present and a torch tip to electrode voltage greater than 250 vdc. When the PCR contactor closes, power supply open circuit voltage (280-350 volts) is connected across the torch plus (tip) and minus (electrode). Once the pilot starts the voltage drops to under 250 vdc shutting off the arc starter.

If the front panel PILOT led is ON, indicating drive to the PCR contactor, but there are no sparks at the spark gap in the arc starter box, first confirm that there is open circuit voltage (OCV) of 280-350 vdc between work lead and torch negative power lead. Then measure from the negative power lead to the red pilot wire #7. If it is low, zero to 50v, the torch is probably shorted (pilot resistors will get very hot). If it is between 100 and 200v PCR contactor is probably not closing. If it measures the same as the OCV the arc starter box may be defective.

For a shorted torch remove the consumable parts and check for damage, remove the head from the mounting tube and check for arcing. The short may also be internal to the head and it may or may not be measurable with an ohmmeter. Sometimes the only way to be sure is replace the head.

If the front panel PILOT indicator is OFF check the CSR indicator, D5, on the Logic PC Board. It should be OFF. If it is ON the Switching Control PC Board may be falsely indicating main arc transfer. Check for zero volts on the Switching Control PC Board at J9-5. If it does not measure zero the Shunt Amp which should have no output is defective. Otherwise the Switching Control PC Board is faulty. If the Logic PC Board CSR indicator is OFF and PILOT indicator is OFF, the Logic PC Board is faulty.

If PILOT indicator is ON and PCR is not closing, check for 120 VAC between wire #110 and J2-1 on the Logic PC Board.

NOTE

Refer to Appendix 5 for 120 VAC Circuit Diagram.

If not present, replace the Logic PC Board. If 120 VAC is present, check to see if it is at the PCR coil. If voltage is present, the contactor is faulty.

WARNING

High Voltage is present.

For the Arc Starter Box confirm that the OCV measured at the torch bulkhead is also present at E1 and E2 on the Arc Starter PC Board. If not, the torch leads extension may be open. Check for 24 VAC from J1-1 to J1-3 on the Arc Starter PC Board (see NOTE).

NOTE

There is a red LED indicator on the Arc Starter Box PC Board that will be ON when the 24 VAC is present.

If both OCV and 24 VAC are present, and no sparks are being generated, the Arc Starter PC Board is faulty.

The 24 VAC comes from Transformer T3, through Fuse F3, passes through Filter FL1 and out connector J14-5 and J14-8. If the 24 VAC is not present at J14, Fuse F3 is the most likely cause. Transformer T3 and Filter FL1 are other possibilities.

If the Fuse is blown, remove power, disconnect J14, replace the Fuse, 1A 250V, and turn ON power. If the fuse blows again, Filter FL1 may be shorted. If the Fuse does not blow, then reconnect J14. If the fuse blows again, the Arc Starter PCB is faulty or there is a short in the wiring between the Master Power Supply and the Arc Starter Box.

K. Current Control, Display and CSD Checks

NOTE

Refer to Appendix 11 for Current Control and Display Circuit Diagram

1. Tip Drag Circuit

The Power Supply unit has a circuit to monitor the torch tip voltage. The tip voltage is normally between -50 to -200 vdc (piloting or cutting) . Less than -20 vdc indicates the tip may be double arcing or touching the work. If that occurs, the tip drag circuit reduces the current to 40 to 50A to reduce torch part wear. Each power supply, Master and Slave, monitors this voltage independently via the pilot lead to the Arc Starter Box. Symptoms of a problem are:

- Only 40A to 50A output in a single Power Supply system.
- Only 190A to 200A output in a dual Power Supply system. One power supply output is correct and the other power supply in drag cut.
- Only 80A to 100A in a dual Power Supply system. Both Power Supplies in drag cut.

There are other problems that can cause similar symptoms. To check for drag cut do the following:

a. Check for -20 to -200 vdc on the Logic PCB in each Power Supply from TP1 (ground) to wire #7 faston (W7). Wire #7 at W7 goes to the red pilot lead, under where the gas and coolant hoses attach. The wire then goes to the Arc Starter Box and on to the torch tip

- If voltage is incorrect, then check for an open from that Power Supply to the Arc Starter Box and then to the torch tip.
- If voltage is correct, then check for less than 2 vdc from TP1 to TP5. If voltage is correct, then that Power Supply is in drag mode and the Logic PCB is faulty.

2. Current Control

The Slave power supply receives its current control signal from the master supply via. It's Isolation PCB and The Parallel cable and the Slave's J15 connector.

Refer to Section 4.05-L, Isolation PCB and Parallel Interface.

The Current Control signal from the Master Unit comes in on J15-1 and goes to J7-18 on the Switching Control PCB. It should vary between 3.3 to 10 vdc as the Master unit's control is moved from min to max. If it does not problem is in the Master unit or Parallel cable. If the voltage is correct, problem is with Switching PCB.

3. Remote AMPS Display

NOTE

Refer to Appendix 11 for Current Control and Display Circuit Diagram.

The Remote Control (RC 6010) AMPS displays the following:

- Indicates the current control setting before cutting (preview). Indicated by the right hand decimal point being ON.
- Indicates the actual current while cutting.
- All three decimals on indicates the remote is receiving the Corner Slowdown signal (CSD).
- Before cutting (preview) and with the three decimals ON, the display indicates the CSD potentiometer setting instead of the main current control.

The Remote Control display full scale is 150A if one Power Supply is used or 300A if two (Master and Slave) are used.

The following describes the flow of the SLAVE IS ON signal through the system:

- When the Slave Power Supply is present and turned ON, the SLAVE IS ON signal is present.
- Signal is active low (less than 2 vdc) from the Slave Power Supply Logic PCB J1-20 to J15-17.
- The signal then goes through the Parallel cable to the Master Power Supply Isolation PCB. Refer to Section 4.05-L Isolation and Parallel cable.
- The Master Power Supply Logic PCB receives the low SLAVE IS ON signal at J4-4.
- Master Power Supply Logic PCB then sends out an active high (5 vdc) on J1-20 (Remote Control uses 5 vdc logic).
- The active high 5 vdc signal is then sent to the Master Power Supply connector J15-17 and out the remote interface cable. If there is no Slave Power Supply or it is not turned ON, J15-17 should be low.
- Signal then goes to the Remote Control connector J37-14 which sets the Remote Control display to 300A full scale. If there is no Slave Power Supply or it is not turned ON the Remote Control display is set to 150A full scale.

The Current Control potentiometer voltage of 3.3 to 10 vdc gives a display of 50 to 150A or 100 to 300A, if the Slave supply is ON. The voltage comes from the Master Power Supply Switching Control PCB at J7-2. It then is routed out through the Master Power Supply connector J15-3. The voltage then goes through the remote interface cable and on to the Remote Control connector J37-1. This causes the current to be displayed from 50 to 150A or 100 to 300A, if the Slave supply is ON. In the preview mode (not cutting) the display signal at J7-2 should equal the control potentiometer wiper voltage at J7-18 checked in step 3 above.

- If voltage is incorrect, then the Switching Control PCB is faulty.

When cutting, each Power Supply (Master and Slave) monitors the actual output amps with their own Shunt Amp PCB. Each Power Supply Shunt Amp PCB output is 5.45 vdc for 150A and is sent to the Switching Control PCB at J9-5 in each Power Supply. Each Switching Control PCB converts the voltage to 10 vdc for 150A.

The resulting signal is set through the system as follows:

- In the Slave Power Supply the voltage is sent out the Switching Control PCB at J7-2 as OUTPUT SIGNAL TO MASTER.
- This signal is then sent to the J15-3 connector and out through the Parallel Cable to the Master Power Supply connector J15-3. Refer to Section 4.05-L, Isolation PCB and Parallel Cable.
- Master Power Supply Switching Control PCB receives the OUTPUT SIGNAL TO MASTER signal at J7-11.

Signal is then averaged with the Master Power Supply output signal.

- The average signal is then sent out to remote display on J7-2 as DISPLAY SIGNAL TO REMOTE.
- This signal is then sent out the Master Power Supply connector J15-3 to the Remote Control.

The following is an example of how the averaging circuit functions:

Master Power Supply outputs 10 vdc (150A) and the Slave Power Supply outputs 6.67 vdc (100A). The average is (10 + 6.67) / 2=8.33 vdc. With the display set for 300A full scale, 10 vdc equals 300A, then 8.33 vdc will equal approximately 250A. Normally, both the Master and Slave Power Supplies should have the same output, except if there is a fault both supplies.

L. Isolation PCB and Parallel Cable Checks

The Slave Power Supply is controlled from the Master Power Supply. There are three digital, ON or OFF, signals and two analog, voltages of varying levels, signals that must be passed between the two units. These signals have to be electrically isolated between the two units. The Isolation PCB in the Master Power Supply accomplishes this using both digital and analog optoisolator integrated circuits (IC).

NOTE

For a simplified diagram, refer to Appendix 12, Parallel Interface Diagram.

The circuits on each side of the isolation barrier require their own power supply. On the Master Power Supply side, unregulated, approximately 20 vdc, from J7-14 of the Master Power Supply Switching Control PCB goes to J70-3 of the Isolation PCB to power a regulator for +V1, +15 vdc. On the Slave Power Supply side, voltage from a 20 ma current source on the Slave Power Supply Switching Control PCB is applied through the Parallel Cable (J15-30 to J54-5) to a zener diode for +V2, +15 vdc. The two supplies, as well as the circuits they operate, are completely isolated from each other.

Two digital signals, ENABLE and START TO SLAVE and one analog signal, DEMAND TO SLAVE, 3.3 to 10 vdc, go from the Master Power Supply to the Slave Power Supply. One digital signal, SLAVE IS ON and one analog signal, OUTPUT SIGNAL TO MASTER, 0 to 10 vdc, go from the Slave Power Supply to the Master Power Supply.

Both the inputs and outputs of the digital signals are low when the signal is ON and high when signal is OFF. The diagram at Appendix 12, Parallel Interface Diagram, shows the expected voltages. A 14 vdc / 1 vdc indicates when the signal is OFF (high) it should be 14 vdc and when ON (low) it should be 1 vdc. If an input is correct and the output is not, the Isolation PCB is probably faulty, although the circuit that the signal goes to could be loading it down.

The ENABLE signal should be ON whenever the Master Power Supply ENABLE is ON. The START signal comes ON when the Master Power Supply contactor comes ON, at the end of the Master Power Supply preflow. The SLAVE IS ON signal should be ON when the Slave Power Supply is powered ON even if it's not enabled.

The analog outputs should be the same as the analog inputs. If the output is low and power supply (+V1 or +V2) is correct the Isolation PCB is faulty.

M. Pilot Resistor Adjustment

WARNING

Disconnect primary power at the source before assembling or disassembling power supply, torch parts, or torch and leads assemblies.

This Sub-Section applies only to the following Slave Power Supplies:

- Slave Power Supplies with the revision letter 'F' or later on the data tag
- Slave Power Supplies that have been retrofitted with Pilot Resistors

Slave Power Supplies, as noted above, and all Master Power Supplies contain adjustable pilot resistor circuits. For output current below 250A, only the pilot circuit in the Master Power Supply is activated. For output current above 250A the Master and Slave Power Supply pilot circuits are activated.

Slave and Master Supply pilot resistors are initially set at the factory and may need to be adjusted to the customer's input power (see Notes).

NOTES

The instructions in this Sub-Section apply to the Slave Power Supply only.

To adjust the Master Power Supply pilot resistors, refer to the Manual supplied with the Master Power Supply.

The pilot current has to be high enough that the pilot will not sputter or go out, but not too high to cause excessive wear of the torch consumables. The amount of pilot current is determined by the value of the pilot resistors and the open circuit voltage which varies with the input line voltage. Both the Slave and Master Power Supplies should be adjusted the same. Wire #99 tap sets the pilot current level. To set the pilot current level use the following procedure:

1. Remove the left and right side panels of the Master Power Supply.

NOTE

The switches located on the Logic PC Board and the Switching PC Board must be set the same as in the Master Power Supply.

2. Locate and identify the pilot resistors (R16, R21 and R22) which are on a bracket in front of the fan.

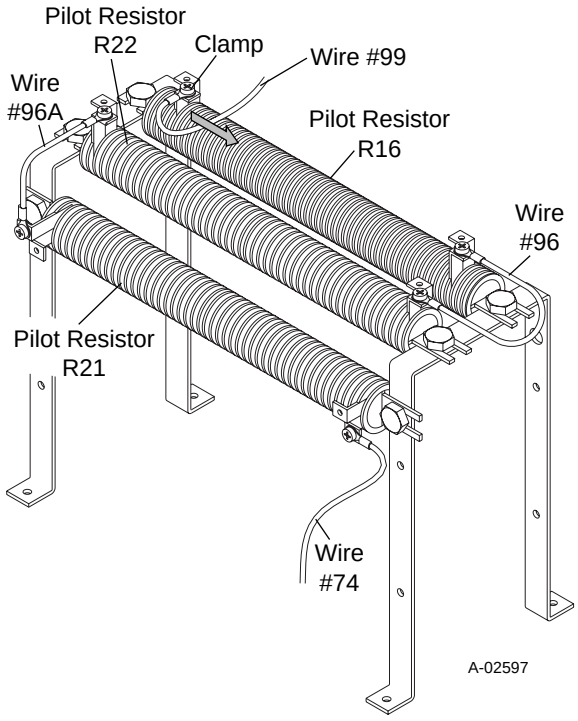


Figure 4-4 Location Of Pilot Resistors (Viewed From The Front Of Power Supply)

3. Check the busbar configuration on the input terminal board to determine which range the power transformer is set for.
4. Measure the level of the AC line voltage being supplied to the Power Supply.
5. To determine the recommended pilot resistor setting use the following table as follows:
   a. Find the voltage that is nearest what was measured above.
   b. Note the ohms value for the voltage. Example: If the measured voltage is 360, then the pilot resistor value is 6 ohms.

NOTE

Voltages that are from 410 to 420V required values from 8.5 or 9 to 4.5 ohms. If the voltage is near one of these points it is best to set for the lower ohms value.

The reason is because within each range the Power Supply will automatically select a high or low tap on the transformer secondary. This is based on the input AC line voltage at the time the Power Supply is turned ON. If the line voltage is near one of these points the voltage might measure, for example, 410 VAC and the pilot resistor setting should be 9 ohms to have a good pilot. The next time the system is turned ON, the input AC line voltage may have gone up to 420 VAC causing the pilot to sputter because 420 VAC requires setting of 4.5 ohms.

Pilot Resistor Setting vs. Input Line Voltage	
Input (VAC)	**Ohms**
340	5
350	5.5
360	6
370	6.75
380	7.25
390	8
400	8.5
410	9
420	4.5
430	5
440	5.5
450	6
460	6.5
470	7
480	7.5
490	8
500	8.5
510	9

6. Wires are attached to the pilot resistors with metal clamps or taps. Locate and loosen the screw that secures the wire #99 tap on resistor R16. Determine, from the Figure below, the correct position for the tap on R16 and tighten the screw.

   Example:

   To set for 6 ohms measure 5" from the right side of R16, where wire # 96 attaches, and secure the #99 tap at that position.

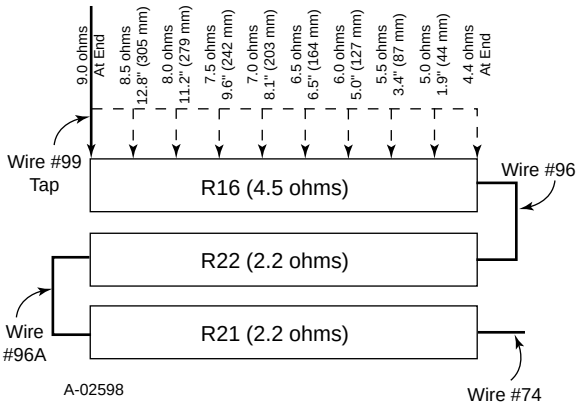


Figure 4-5 Resistance Value Diagram

7. Test the pilot at 300A output current. If it still sputters move the wire #99 tap to the right, toward wire #96, 1 inch (25.4 mm) at a time until the pilot no longer sputters.

SECTION 5: REPLACEMENT PROCEDURES

5.01 Introduction

This Section describes parts replacement procedures and all repairs which may be performed on the Power Supply.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other Subassemblies of this unit. Evidence of unauthorized repairs may void the factory warranty.

5.02 Anti-Static Handling Procedures

A. General

CAUTION

PC boards can be irreparably damaged by improper handling due to electrostatic discharge (ESD).

Replacement PC boards are shipped in a protective enclosure to prevent damage from electrostatic discharge (ESD) during shipping. Included with each replacement board is a ground strap to prevent static damage during installation.

WARNINGS

Read and understand these instructions and the instructions on the grounding wrist strap package before opening the equipment enclosure or removing the replacement PC board from its protective enclosure.

Disconnect primary power to the system before disassembling the torch, torch leads, or power supply enclosure.

Do not operate the equipment or test equipment under power while wearing the grounding wrist strap.

B. Procedure

1. Open the wrist strap and unwrap the first two folds of the band. Wrap the adhesive side firmly around your wrist.
2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.
4. Connect the equipment primary cable ground to the same electrical ground as the wrist strap.
5. Open the equipment enclosure (see instruction manual for the appropriate equipment) and remove the failed PC board.
6. Carefully open the ESD protective bag and remove the replacement PC board.
7. Install the replacement PC board in the equipment and make all necessary connections.
8. Place the failed PC board in the ESD protective bag and seal for return shipping.
9. Reassemble the equipment enclosure (see instruction manual for the appropriate equipment).
10. Remove the grounding wrist strap from your wrist and from the electrical ground connection before reconnecting primary power to the equipment.

5.03 Parts Replacement - General Information

The parts replacement procedures described in this manual, except for external Fuse(s) replacement, require that the Power Supply be disassembled. Depending on the part to be replaced will determine to what extent the Power Supply must be disassembled.

NOTES

Before removing any electrical connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

Each Subsection is referenced to Section 6 for parts lists and overall detailed drawing.

WARNING

Disconnect primary power from the source before opening or disassembling the power supply. Make sure AC indicator on the Power Supply front panel is OFF.

Before disassembling any part of the Power Supply first read the procedure for the part to be replaced, then proceed with the disassembly.

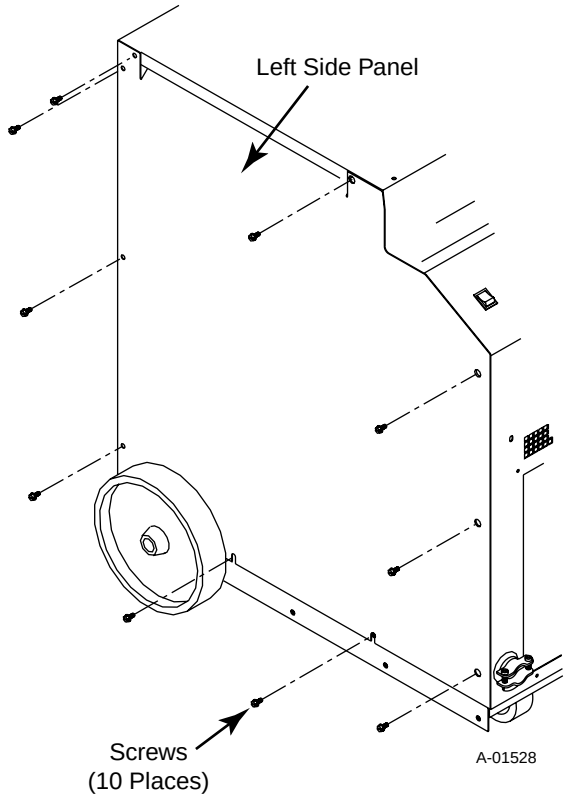
5.04 External Parts Replacement

NOTE

Refer to Section 6.03, External Power Supply Replacement Parts, for parts list and overall detail drawing.

A. Left/Right Side Panel Replacement

The Left and Right Side Panels are replaced in the same manner. The Left Side Panel of the Supply is the panel on the left side of the unit as viewed from the front of the unit.



1. Remove the four screws that secure the rear of the Side Panel to the Power Supply.
2. Loosen the two screws securing the bottom of the Side Panel to the base of the Power Supply. These two screws are in slotted holes in the Side Panel.
3. To remove the Side Panel from the Power Supply pull up and out on the Side Panel.
4. Reinstall the replacement Side Panel by reversing the above procedure.

B. Top Panel Replacement

1. Remove the Left and Right Side Panels per paragraph 'B' above.
2. On the top of the unit remove the Coolant Tank Cap from the Coolant Tank.
3. Remove the four screws securing the Top Panel to the front of the unit.
4. Remove the two screws securing the Top Panel to the rear of the unit.
5. Install the replacement Top Panel by reversing the above procedure.

C. Work Cable Replacement

1. Remove the Left Side Panel per Section 5.04-A.
2. Loosen the two screws of the Work Cable strain relief securing the Work Cable at the Front Panel.
3. Remove the nut (under the Horizontal Chassis Panel) securing the Work Cable connection to the Shunt Assembly.
4. Pull the Work Cable from the unit.
5. Install the replacement Work Cable by reversing the above procedure.

5.05 Access Panel Parts Replacement

NOTE

Refer to Section 6.04, Access Panel Replacement Parts, for parts list and overall detail drawing.

A. ON/OFF Switch Replacement

1. Unlatch the Access Panel to gain access to the rear of the ON / OFF Switch.
2. Disconnect all the wiring to the ON / OFF Switch.
3. Squeeze the top and bottom of the switch while pulling it out of the Access Panel
4. Install the replacement ON / OFF Switch by reversing the above procedure.

B. LED PC Board Assembly Replacement

1. Unlatch the Access Panel to gain access to the LED PC Board.
2. Remove the four screws and washers securing the LED PC Board to the Access Panel.
3. Disconnect the connector at J5 of the LED PC Board.
4. Install the replacement LED PC Board by reversing the above procedure.

C. Access Panel Replacement

1. Remove the Right Side Panel per Section 5.04-A.
2. Remove the following components from the Access Panel:
   - ON / OFF Switch per paragraph 'A' above.
   - LED PC Board per paragraph 'B' above.
3. Remove the four screws securing the Access Panel to the LED PC Board standoffs.
4. Install the replacement Access Panel by reversing the above procedure.

5.06 Front Panel/Chassis Parts Replacement

NOTE

Refer to Section 6.05, Front Panel/Chassis Replacement Parts, for parts list and overall detail drawing.

A. Bias PC Board Replacement

1. Remove the Right Side Panel per Section 5.04-A.
2. Disconnect all the wiring connections to the Bias PC Board Assembly.
3. Remove the Bias PC Board Assembly from four PC Board Standoffs.
4. Install the replacement Bias PC Board Assembly by reversing the above procedure.

B. Transformer (T2) Assembly Replacement

The Transformer (T2) Assembly is mounted to the rear of the Horizontal Chassis Panel and has 25.2 VCT (Center Tap) output.

1. Remove the Left Side Panel per Section 5.04-A.
2. Disconnect all the wiring connections to the Transformer Assembly.
3. Remove the four screws which secure the Transformer Assembly to the Horizontal Chassis Panel.
4. Carefully remove the Transformer Assembly from the unit.
5. Install the replacement Transformer Assembly by reversing the above procedure.

C. Internal Fuse (F3) Replacement

The Fuse (F3) is located inside the Power Supply behind the Right Side Panel. The Fuse is mounted next to the Bias PC Board on the rear of the Horizontal Chassis Panel.

1. Remove the Right Side Panel per Section 5.04-A.
2. Locate the Fuse mounted next to the Bias PC Board on the Horizontal Chassis Panel.
3. Remove the damaged Fuse from the snap type fuse holder.
4. Reinstall the replacement Fuse (1A, 250V) by reversing the above procedure.

D. Fuse Holder (Internal) Replacement

1. Remove the Left Side Panel per Section 5.04-A.
2. Remove the Fuse from the holder.
3. Disconnect the two wires connected to the Fuse Holder.
4. Remove the two small screws securing the Fuse Holder to the chassis.
5. Install the replacement Fuse Holder by reversing the above procedure.

5.07 Rear Panel Parts Replacement

NOTE

Refer to Section 6.06, Rear Panel Parts Replacement, for parts list and overall detail drawing.

A. Fan Replacement

1. Remove the Left Side Panel per Section 5.04-A.
2. Locate the Fan Assembly wiring connector inside the Rear Panel.
3. Carefully disconnect the wiring connector from the wiring harness.
4. Note the pin location of each wire to the connector.
5. Using a pin extraction tool remove the wiring from the connector.
6. On the Rear Panel remove the strain relief securing the Fan Assembly wiring to the Rear Panel.
7. Locate and remove the four bolts and lock nuts securing the Fan Assembly to the Rear Panel Assembly.
8. Carefully pull the Fan Assembly from the Rear Panel Assembly feeding the wiring through the hole.
9. Install the replacement Fan Assembly by reversing the above procedure.

B. PCR Contactor Replacement

1. Remove the Right Side Panel per Section 5.04-A.
2. Note the orientation of all the wires and then disconnect the input and output wiring from the Three-Phase Contactor Assembly.
3. Remove the two locking nuts securing the Three-Phase Contactor to the Rear Panel of the unit.
4. Install the replacement Three-Phase Contactor Assembly by reversing the above procedure.

C. Voltage Selection PC Board Replacement

1. Remove the Right Side Panel per Section 5.04-A.
2. Disconnect all the wiring connections to the Voltage Selection PC Board Assembly.
3. Remove the Voltage Selection PC Board from the four PC Board Standoffs.
4. Install the replacement Voltage Selection PC Board Assembly by reversing the above procedure.

5.08 Base Assembly Parts Replacement

NOTE

Refer to Section 6.07, Base Assembly Replacement Parts, for parts list and overall detail drawing.

A. DC Inductor (L2) Assembly Replacement

WARNING

The removal of this Assembly requires the use of a mechanical lift.

1. Remove the Left and Right Side Panels per Section 5.04-A.
2. Disconnect all the wiring at the DC Inductor Assembly.
3. Remove the six mounting bolts securing the DC Inductor Assembly to the Base.
4. Place a mechanical lift next to the left side of the Power Supply.
5. Carefully slide the DC Inductor Assembly out the left side of the unit and onto the mechanical lift.
6. Install the replacement DC Inductor Assembly by reversing the above procedure

B. 29KVA Transformer (T1) Assembly Replacement

WARNING

The removal of this Assembly requires the use of a mechanical lift.

1. Remove the Left and Right Panels per Section 5.04-A.
2. Disconnect all the wiring at the Transformer Assembly.
3. Remove the six bolts, star washers and flat washers securing the Transformer Assembly to the Base.
4. Place a mechanical lift next to the left side of the Power Supply.
5. Carefully slide the Transformer Assembly out the left side of the unit and onto the mechanical lift.
6. Install the replacement Transformer Assembly by reversing the above procedure.

C. Main Contactor (W1 or W2) Replacement

NOTE

The Main Contactors, W1 and W2, are replaced in the same manner.

1. Depending on which Main Contactor Assembly is to be replaced, remove the Left or Right Side Panel per Section 5.04-A.
2. Label all the wiring connected to the Main Contactor Assembly.
3. Disconnect the wires from the Main Contactor Assembly terminals.
4. Remove the two screws and star washers securing the Main Contactor Assembly to the Base.
5. Install the replacement Main Contactor Assembly by reversing the above procedure.

D. Thermostat Assembly Replacement

There are three Thermostat Assemblies mounted to the 29KVA Transformer. The Thermostat Assemblies are all replaced in the same way. To replace a Thermostat Assembly use the following procedure:

1. Remove the Left and Right Panels per Section 5.04-A.
2. Locate the Thermostat Assembly to be replaced and place a clean rag under the copper support. This will prevent debris from getting into the transformer coil.
3. Remove the tie-wrap securing the glass sleeving over the Thermostat Assembly.
4. Slide the glass sleeving back over the wiring harness (see NOTE) to expose the Thermostat Assembly connections.

NOTE

To make it easier to slide the glass sleeving back far enough, it may be necessary to remove a second tie-wrap on the wiring harness.

5. Disconnect the wiring connections at the Thermostat Assembly.
6. The Thermostat Assembly has Loctite on the threads and requires heat to break the seal. At the copper support carefully use a propane torch to heat the base and exposed threads of the Thermostat Assembly for 30 to 60 seconds.

7. Carefully use a wrench to remove the Thermostat Assembly. If resistance is felt, apply more heat (see NOTE).

NOTE

Using excessive force will cause the Thermostat Assembly mounting stud to shear off.

8. Clean the Thermostat Assembly contact surface area of the copper support.

9. Install the replacement Thermostat Assembly by reversing the above procedure and noting the following:

   - Carefully bend the tabs on the replacement Thermostat Assembly 90° the same as the removed part.
   - Apply Loctite 290 or equivalent to the Thermostat Assembly stud threads.
   - Using a torch wrench torque the Thermostat Assembly to 7 in-lbs (0.791 Nm).
   - Replace any removed tie-wrap(s).

5.09 Upper Chassis Parts Replacement

NOTE

Refer to Section 6.08, Upper Chassis Replacement Parts, for parts list and overall detail drawing.

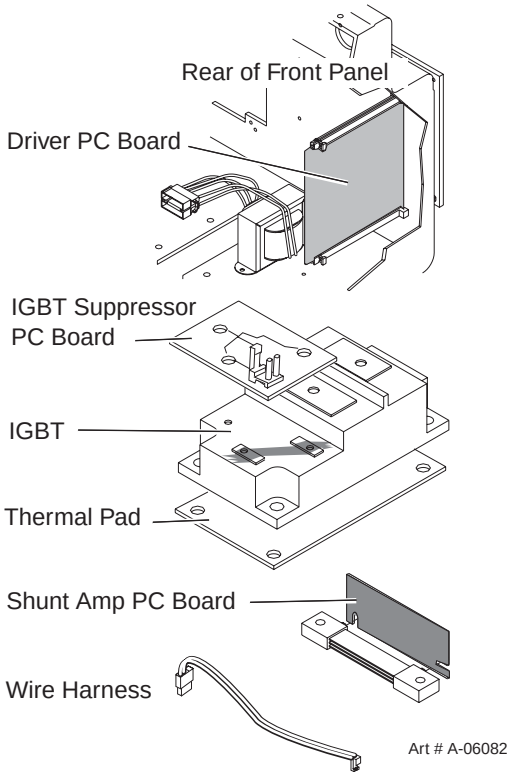
A. Power Driver PC Board Kit Replacement

CAUTION

All parts in replacement kit No. 7-3360 must be replaced at the same time. This kit includes the Power Driver PC Board, Shunt Amp PC Board, IGBT, and a wire harness. If any of these parts fail, all must be replaced at the same time. Failure to replace all parts together may lead to parts failure.

The Kit replaces the Driver PC Board, Shunt Amp PC Board, Switching Transistor / IGBT Assembly, and IGBT wire harness in the Merlin Series Power Supplies. The kit includes an IGBT Suppressor PC Board.

Kit Contents



The kit also includes:

- Installation Instructions
- Static Dissipative Bag
- Grounding Wrist Strap
- Static Handling Instructions

Installation Procedure

WARNING

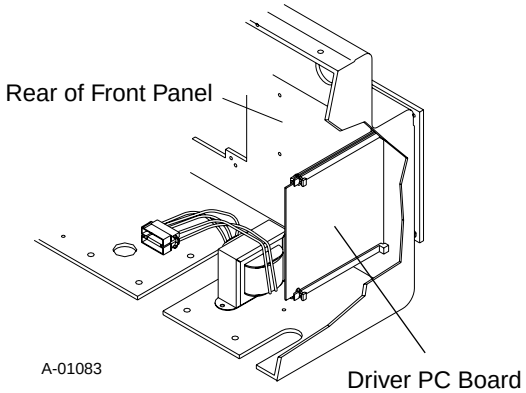
Disconnect primary power at the source before assembling or disassembling power supply, torch parts, or torch and leads assemblies.

1. Opening Enclosure

1. Turn OFF main input power to the Power Supply both at the Power Supply ON / OFF switch and at the main power disconnect.
2. Wait at least two minutes to allow the input capacitors to discharge.
3. Remove the top and side panels of the Power Supply. To remove the top panel of the Power Supply requires the removal of several screws. Carefully remove all the screws before attempting to remove the panels.

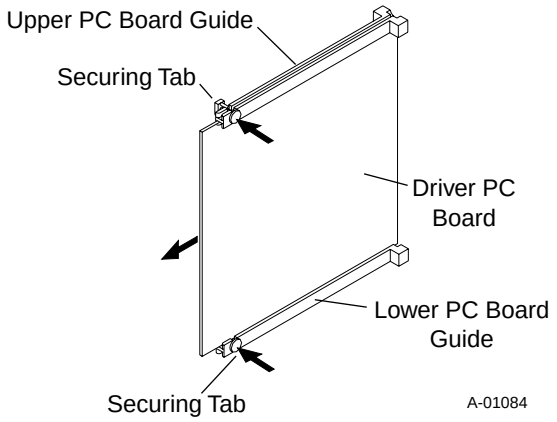
2. Driver PC Board Assembly Installation

1. Locate the old Driver PC Board Assembly on the inside left side, behind the front panel, as viewed from the front of the unit.



Driver PC Board Location

2. Note and label the two wiring connectors that connect to the Driver PC Board.
3. Disconnect the two wiring connectors from the Driver PC Board.
4. Press in the securing tab knob on the PC Board Guide to release the PC Board from the PC Board Guides. There is a securing tab on both the upper and lower PC Board Guides.

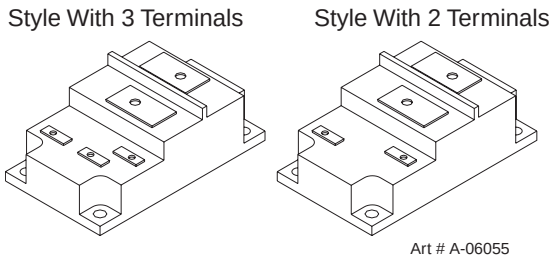


PC Board Guide Securing Tab

5. Carefully pull the PC Board from the guides and remove from the unit.
6. Install the replacement Driver PC Board Assembly reversing the above steps.

3. IGBT (Q1) Installation

1. Locate the old Switching Transistor / IGBT Assembly on the inside center-left, between the four large blue capacitors, as viewed from the front of the unit.
2. There are two different types of Switching Transistor / IGBT. The types can be identified by the top of the transistor casing. This kit replaces both types.

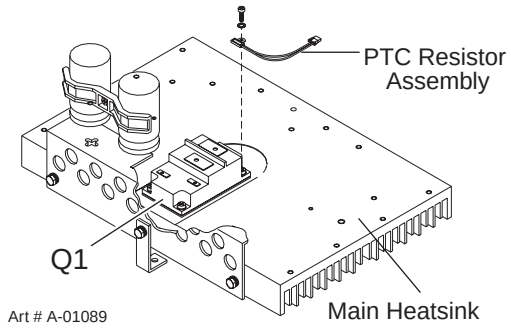


Switching Transistor / IGBT Styles

3. Remove the two screws securing the wires to the Switching Transistor / IGBT Assembly terminals. Remove and discard the wire harness.
4. Remove the screw that secures the Capacitor Mounting Bracket to the Switching Transistor / IGBT Assembly.

5. Remove the screw that secures the Transistor / Coil Bracket to the Switching Transistor / IGBT Assembly.

6. Remove the screw and washer securing the PTC Resistor Assembly to the Main Heatsink. Move the PTC Resistor Assembly out of the way to prevent it from becoming damaged.



PTC Resistor Assembly Location

7. Remove the four screws securing the Switching Transistor / IGBT module to the Main Heatsink. Be careful not to damage the surface of the heatsink.

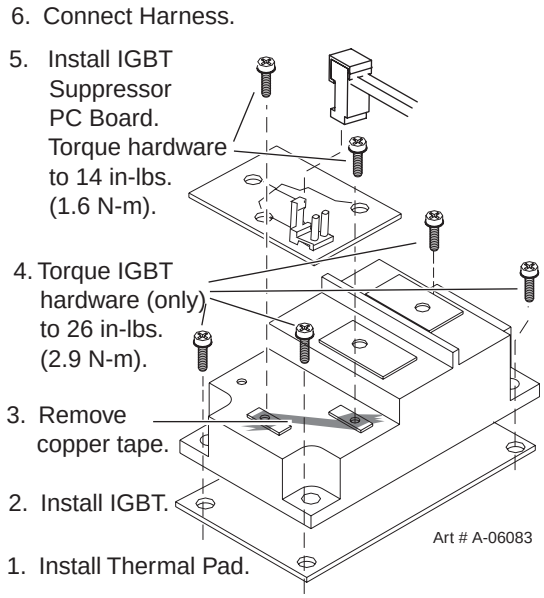
8. Pry between the Main Heatsink and the faulty Switching Transistor / IGBT Assembly until it slides easily.

9. Remove the faulty Switching Transistor / IGBT Assembly from the unit by sliding it towards the center of the Main Heatsink.

10. If the transistor thermal pad was not removed with the transistor, remove it now.

11. Use isoproply alcohol to clean the residue of the old transistor thermal pad from the transistor mounting area.

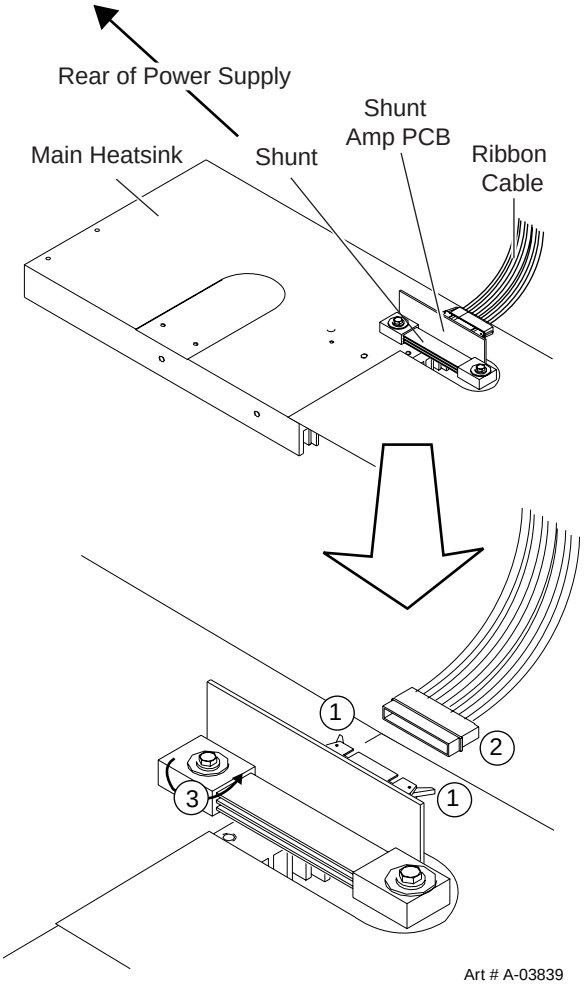
12. Install the replacement Thermal pad, the IGBT Assembly, IGBT Suppressor PC Board, and the replacement wire harness included in this kit in the sequence shown. Note the torque requirements. Connect the other end of the harness to the terminal from which the previous harness was disconnected, on the driver PC board.



IGBT Installation Sequence

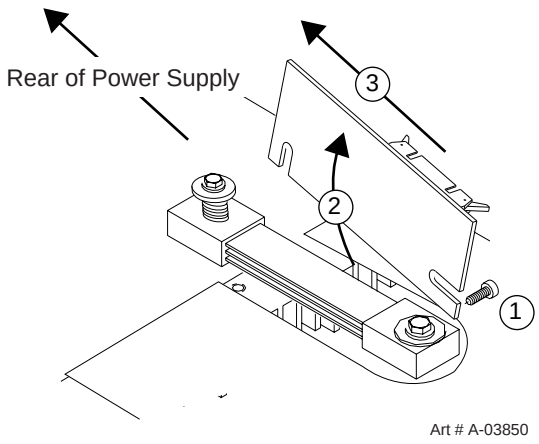
4. Shunt Amp PCB Replacement

1. Locate the Shunt Amp PCB, mounted to the Shunt on the main heatsink.
2. Use the grounding wrist strap provided separately in this kit. Follow all static handing instructions on the separate instruction sheet.
3. Open two locking tabs securing the ribbon cable connector to the Shunt Amp PCB. Carefully remove the cable connector from the Shunt Amp PCB.
4. Loosen, but do not remove, the bolt securing the Shunt to the main heatsink, to allow access to screws securing the Shunt Amp PCB to the Shunt.



Shunt Amp PCB Disconnection

5. Loosen, but do not remove, the screws securing the Shunt Amp PCB to the Shunt.
6. Refer to the illustration. Remove the Shunt Amp PCB from the power supply. Lift the end of the PCB closer to the rear of the Power Supply, and slide the PCB rearward to release it from the forward screw.



Shunt Amp PCB Removal

7. If necessary, carefully clean the PCB mounting surfaces on the shunt. Wipe the surfaces clean with a lint-free rag.

CAUTION

Do not use conductive material such as steel wool to clean the mounting surfaces.

8. Position the replacement Shunt Amp PCB on the Shunt. Secure with the hardware loosened previously. Tighten securely. Do not overtighten.
9. Fasten the Shunt to the main heatsink by tightening the bolt loosened previously. Tighten securely. Do not overtighten.
10. Align the ribbon cable connector with the receptacle on the Shunt Amp PCB. Press the connector fully into the receptacle. Close the two locking tabs on the receptacle. Check for a secure connection.
11. Reinstall the power supply outer panels.

B. Auxiliary Transformer (T2) Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-A.
2. Disconnect the wiring connector from the wiring harness at the Auxiliary Transformer Assembly.
3. Remove the two mounting screws securing the Auxiliary Transformer Assembly to the Upper Chassis / Gauge Assembly.
4. Remove the Auxiliary Transformer Assembly from the unit.
5. Install the replacement Auxiliary Transformer Assembly by reversing the above procedure.

C. Fuse (F1 and F2) Replacement

1. Open the hinged cover at the Front Panel torch leads connection area.
2. Locate and remove the cap from the fuse holder.
3. Pull the faulty Fuse from the fuse holder.
4. Install the replacement Fuse by reversing the above procedure.

D. Control Logic PC Board Assembly Replacement

1. Open the front panel access panel cover at the front of the Power Supply.
2. Fasten the access cover open with string or rubber band.
3. Note where each connector is located on the old Control Logic PC Board.
4. Disconnect the three connectors from the old Control Logic PC Board.
5. Note the orientation of the old Control Logic PC Board.
6. Remove the old Control Logic PC Board.
7. On the new Control Logic PC Board set the switches, SW1 through SW5, the same as the old Control Logic PC Board.
8. Install the replacement Control Logic PC Board by reversing the above procedure.

E. Switching Control PC Board Assembly Replacement

1. Remove the Top and Right Side Panels per Section 5.04-B.
2. Note the orientation of the old Switching Control PC Board.
3. Remove the Switching Control PC Board from the rear of the Upper Chassis / Gauge Panel far enough to disconnect the wiring connections.
4. Note where each connector is located on the Switching Control PC Board.
5. Disconnect the connectors from the Switching Control PC Board.
6. Reconnect the original wiring connectors to the replacement Switching Control PC Board before installing the replacement Switching Control PC Board.
7. Install the replacement Switching Control PC Board by reversing the above procedure.

5.10 Main Heatsink Assembly Parts Replacement

NOTE

Refer to Section 6.09, Main Heatsink Assembly Replacement Parts, for parts list and overall detail drawing.

A. 70 Amp STR. Diode Replacement

The Diode Replacement Kit (Cat # 8-1168) is a direct parts replacement for the failed Diode Assembly in the Power Supply.

The following parts are supplied with each replacement assembly:

- 70 Amp, 600V Str Diode Assembly (1 each)
- 0.75 inch diameter Thermal Interface Pad (1 each)
- Tube of RTV (1 each)

1. Turn OFF main input power to the Power Supply both at the Power Supply ON / OFF switch and at the main power disconnect.
2. Wait at least two minutes to allow the input capacitors to discharge.
3. Open the Power Supply to gain access to the faulty Diode Assembly.

4. Locate the old Diode Assembly inside the Power Supply.
5. Unsolder the wire lead from the old Diode Assembly.
6. Remove the old Diode Assembly from the unit. Make sure the replacement diode is a direct replacement for the old one.

NOTE

To avoid damage to a replacement diode from overheating during installation, a proper heatsink (example: alligator clip) must be used to disperse heat when soldering the wire lead to the diode.

7. Install the replacement diode by reversing the above procedure and noting the following:
   a. Wipe the surface clean where the replacement diode is to be installed.

NOTE

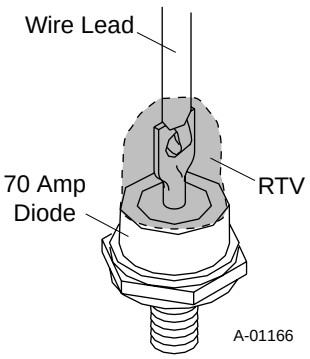
The thermal interface pads must be properly aligned when replacing the diode.

   b. Position the thermal interface pad between the diode and contact surface where the diode will be installed.

CAUTION

Diodes can overheat if not properly installed.

   c. Install the replacement diode and torque the diode to 20 - 25 in-lbs (2.3 - 2.8 Nm).
   d. Re-solder the wire lead to the replacement diode.
   e. Apply a layer of RTV over the top of the Diode Assembly to encapsulate the lead and top of the diode.



   f. Close up the Power Supply.

B. Relay Replacement (PSR and O_2)

The two Relay Assemblies are replaced in the same manner. The PSR Relay is 110 vdc and the O_2 Relay is 120VAC Relay.

1. Remove the Right Side Panel per Section 5.04-A.
2. Move the Relay Hold-Down Spring to the side of the Relay Assembly.
3. Pull the Relay Assembly from the Relay Socket.
4. Install the replacement Relay Assembly by reversing the above procedure.

C. 150 Amp REV Diode Replacement

The Diode Replacement Kit (Cat # 8-6152) is a direct parts replacement for the failed Diode Assembly in the Power Supply.

The following parts are supplied with each replacement assembly:

- 150 Amp, 800V Rev Diode Assembly (1 each)
- 1.06 inch diameter Thermal Interface Pad (1 each)

1. Turn OFF main input power to the Power Supply both at the Power Supply ON / OFF switch and at the main power disconnect.
2. Wait at least two minutes to allow the input capacitors to discharge.
3. Open the Power Supply to gain access to the faulty Diode Assembly.
4. Locate the old Diode Assembly inside the Power Supply.
5. Remove the nut and washer securing the old diode assembly to the mounting surface.
6. Remove the nut securing the diode wire lead to the PC Board.
7. Make sure the replacement diode is a direct replacement for the old one.
8. Install the replacement diode by reversing the above procedure and noting the following:
   a. Wipe the surface clean where the replacement diode is to be installed.

NOTE

The thermal interface pads must be properly aligned when replacing the diode.

b. Position the thermal interface pad between the diode and contact surface where the diode will be installed.

CAUTION

Diodes can overheat if not properly installed.

c. Install the diode. Torque the nut securing the diode to 100-125 in-lbs (11.3-14.1 Nm).

d. Reinstall the nut and washer securing the replacement diode wire lead to the PC Board.

D. 150 Amp STR Diode Replacement

The Diode Replacement Kit (Cat # 8-6153) is a direct parts replacement for the failed Diode Assembly in the Power Supply.

The following parts are supplied with each replacement assembly:

- 150 Amp, 800V Str. Diode Assembly (1 each)
- 1.06 inch diameter Thermal Interface Pad (1 each)

1. Turn OFF main input power to the Power Supply both at the Power Supply ON / OFF switch and at the main power disconnect.
2. Wait at least two minutes to allow the input capacitors to discharge.
3. Open the Power Supply to gain access to the faulty Diode Assembly.
4. Locate the old Diode Assembly inside the Power Supply.
5. Remove the nut and washer securing the old diode assembly to the mounting surface.
6. Remove the nut securing the diode wire lead to the PC Board.
7. Make sure the replacement diode is a direct replacement for the old one.
8. Install the replacement diode by reversing the above procedure and noting the following:

   a. Wipe the surface clean where the replacement diode is to be installed.

NOTE

The thermal interface pads must be properly aligned when replacing the diode.

   b. Position the thermal interface pad between the diode and contact surface where the diode will be installed.

CAUTION

Diodes can overheat if not properly installed.

   c. Install the diode. Torque the nut securing the diode to 100-125 in-lbs (11.3-14.1 Nm).

   d. Reinstall the nut and washer securing the replacement diode wire lead to the PC Board.

SECTION 6:
PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts list provides a breakdown of all basic replaceable parts. The parts lists are arranged as follows:

Section 6.03 External Power Supply Replacement Parts List

Section 6.04 Access Panel Replacement Parts

Section 6.05 Front Panel / Chassis Replacement Parts

Section 6.06 Rear Panel Replacement Parts

Section 6.07 Base Assembly Replacement Parts

Section 6.08 Upper Chassis Replacement Parts

Section 6.09 Main Heatsink Assembly Replacement Parts

NOTE

Parts listed without item numbers are not illustrated, but may be ordered by the catalog numbers shown.

B. Returns

If a product must be returned for service, contact your authorized distributor. Materials returned without proper authorization will not be accepted.

C. Product Improvements

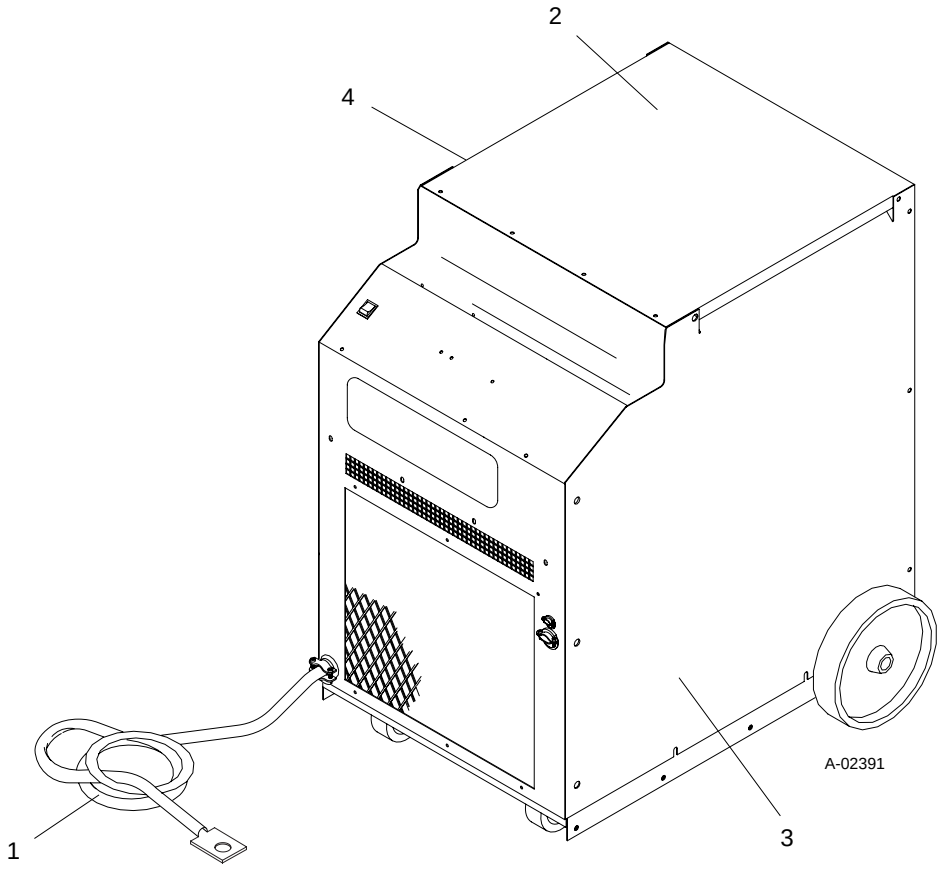
Improvements to the product since release is denoted by a revision letter(s) located on the data tag of the unit. There are old style and new style data tags that may be encounted. The old style data tag has the revision letter(s) at the end of the serial number. The new style data tag has the revision letter(s) in an area marked 'Rev'. The parts lists may include references to the revision letter(s) for parts that are different between revisions.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the description column of the Parts List. Also include the model and serial number of the machine as shown on the data tag attached to the unit. Address all inquiries to your authorized distributor.

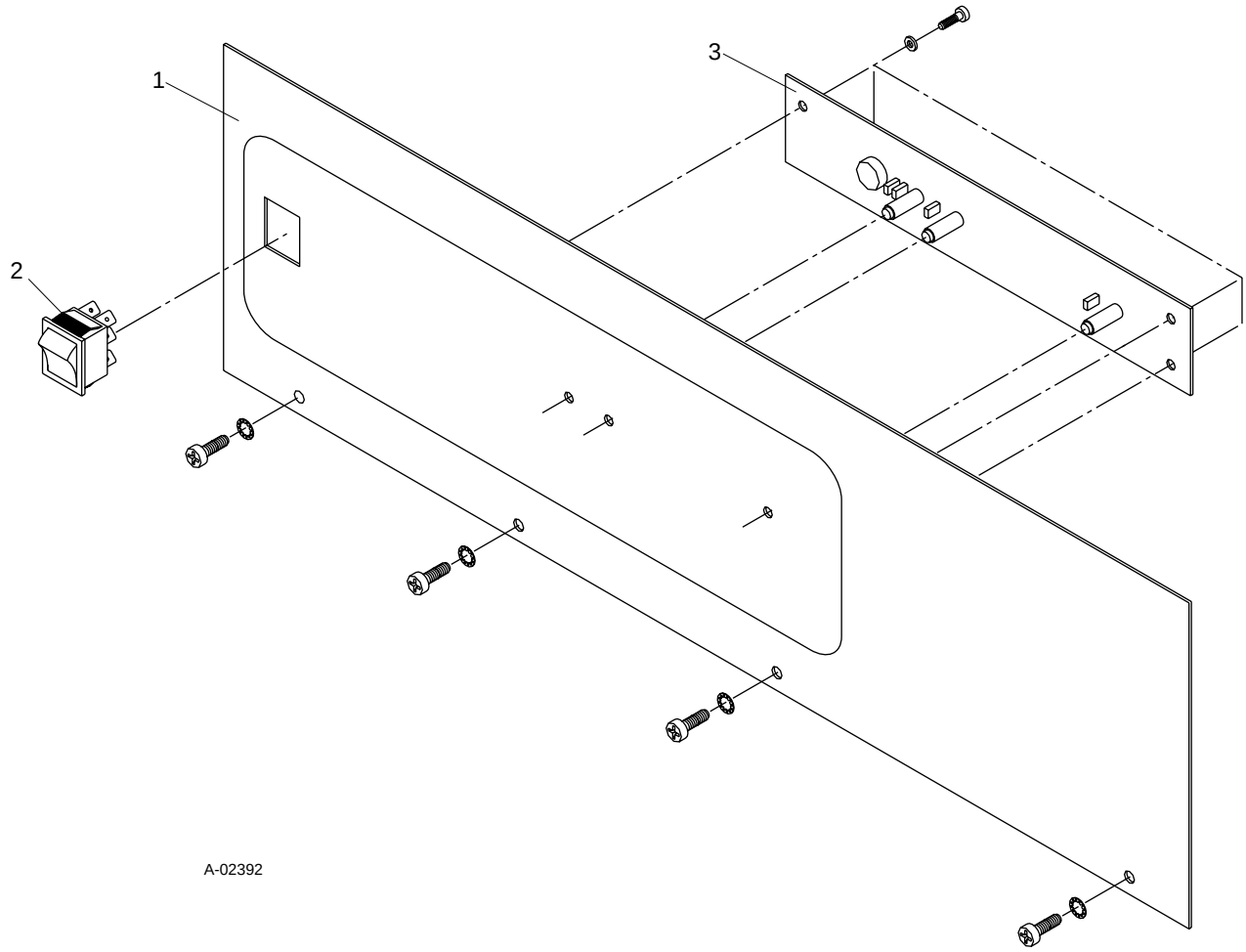
6.03 External Power Supply Replacement Parts List

Item #	Qty.	Description	Catalog #
	1	Complete CE Merlin 6000 Slave Power Supply w/Running Gear & Work Cable	3-6801-E
1	1	Work Cable with Ring Lug - 25 ft (7.6 m)	9-6892
2	1	Panel, Top	9-7752
3	1	Panel, R.H. Side With Overlay	9-6651
4	1	Panel, L.H. Side With Overlay	9-6652



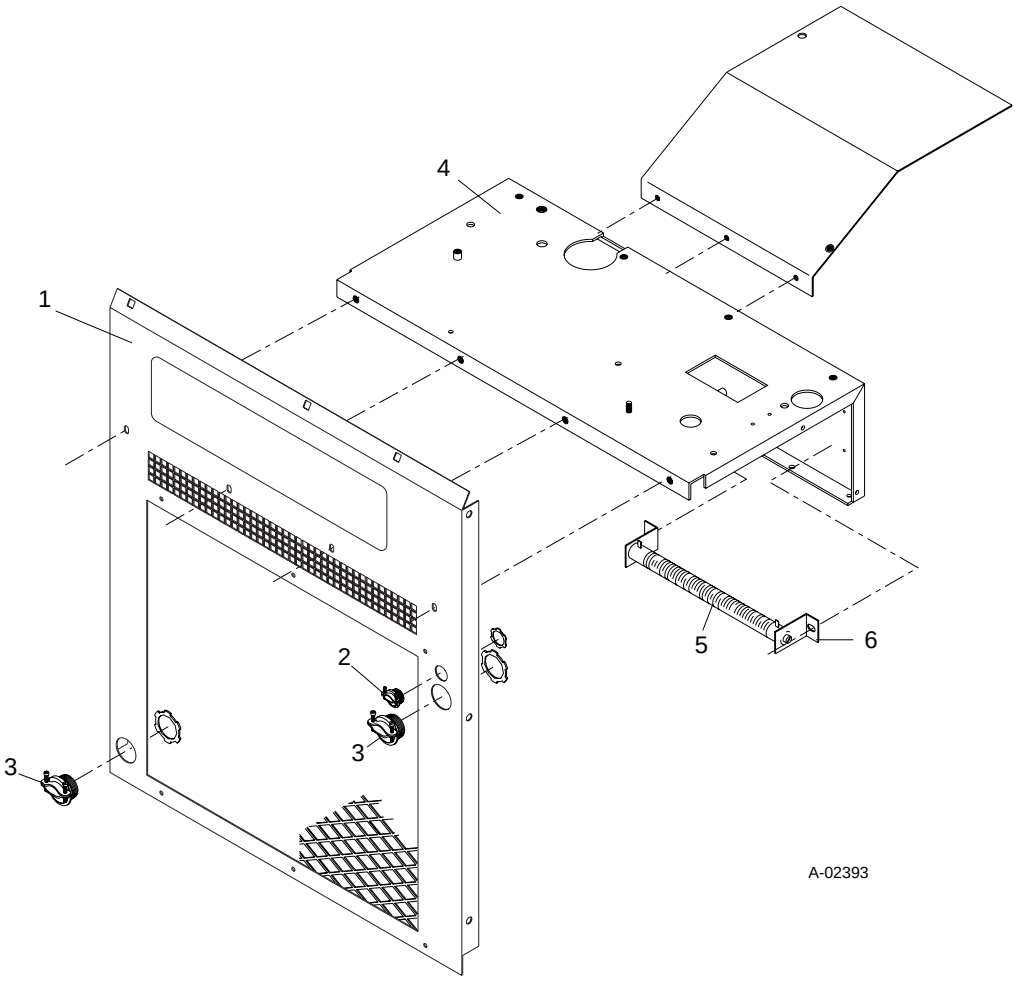
6.04 Access Panel Replacement Parts

Item #	Qty.	Description	Reference	Catalog #
	1	Access Panel Assembly Includes:		
1	1	Access Panel With Overlay		9-9027
2	1	ON / OFF Rocker Switch, DPST	SW1	8-3258
3	1	LED PC Board Assembly		9-9028



6.05 Front Panel/Chassis Replacement Parts

Item #	Qty.	Description	Reference	Catalog #
1	1	Front Panel With Overlay		9-9029
2	1	Strain Relief		9-2179
3	1	Strain Relief		8-6307
4	1	Horizontal Chassis Panel		9-6655
5	1	Resistor, 8 ohm		9-3431
6	1	Resistor Mounting Bracket Kit		8-4234

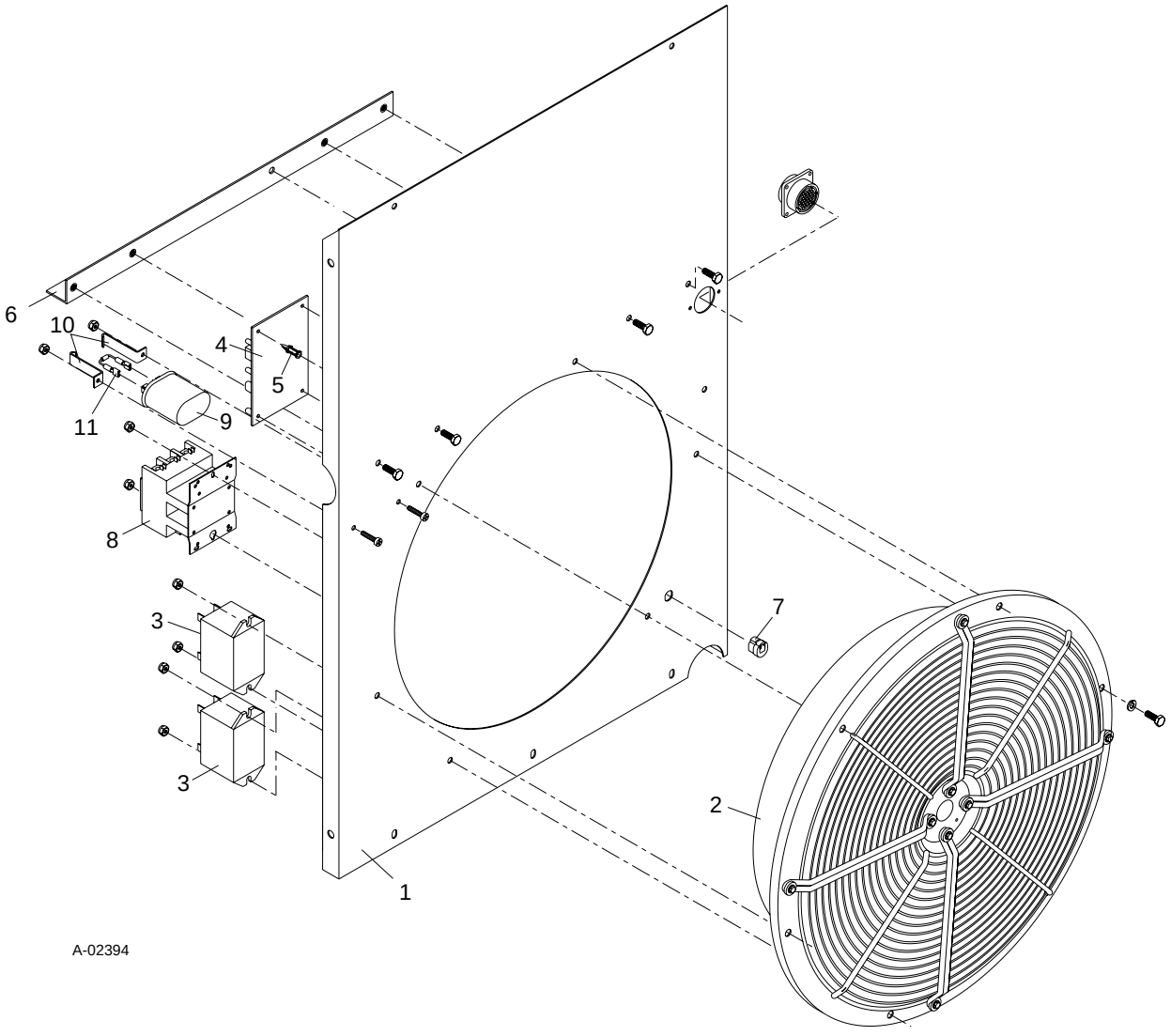


6.06 Rear Panel Replacement Parts

Item #	Qty.	Description	Reference	Catalog #
1	1	Rear Panel		9-9030
2	1	Fan, 16" Axial		8-6312
3	1	Relay, 25 amp, 120 AC	MC1, MC2	8-3390
4	1	Voltage Selection PC Board		8-5144
5	1	P.C. Board Supoort		9-5333
6	1	Bracket, Heatsink Support		8-5576
7	1	Strain Relief, For #10 Stranded Wire		8-4249
8	1	3 PH Contactor (Rev 'F' units or later) - See Note	PCR	9-7554
9	1	4 mfd, Capacitor (Rev 'F' units or later) - See Note	C28	9-3210
10	1	Capacitor Mounting Bracket (Rev 'F' units or later) - See Note		8-3391
11	1	330k Ohms Resistor Assembly (Rev 'F' units or later) - See Note	R17	9-5545

NOTE

Location shown is for current product offering. Refer to Section 6.07 for units retrofitted with Pilot Resistor Circuit.

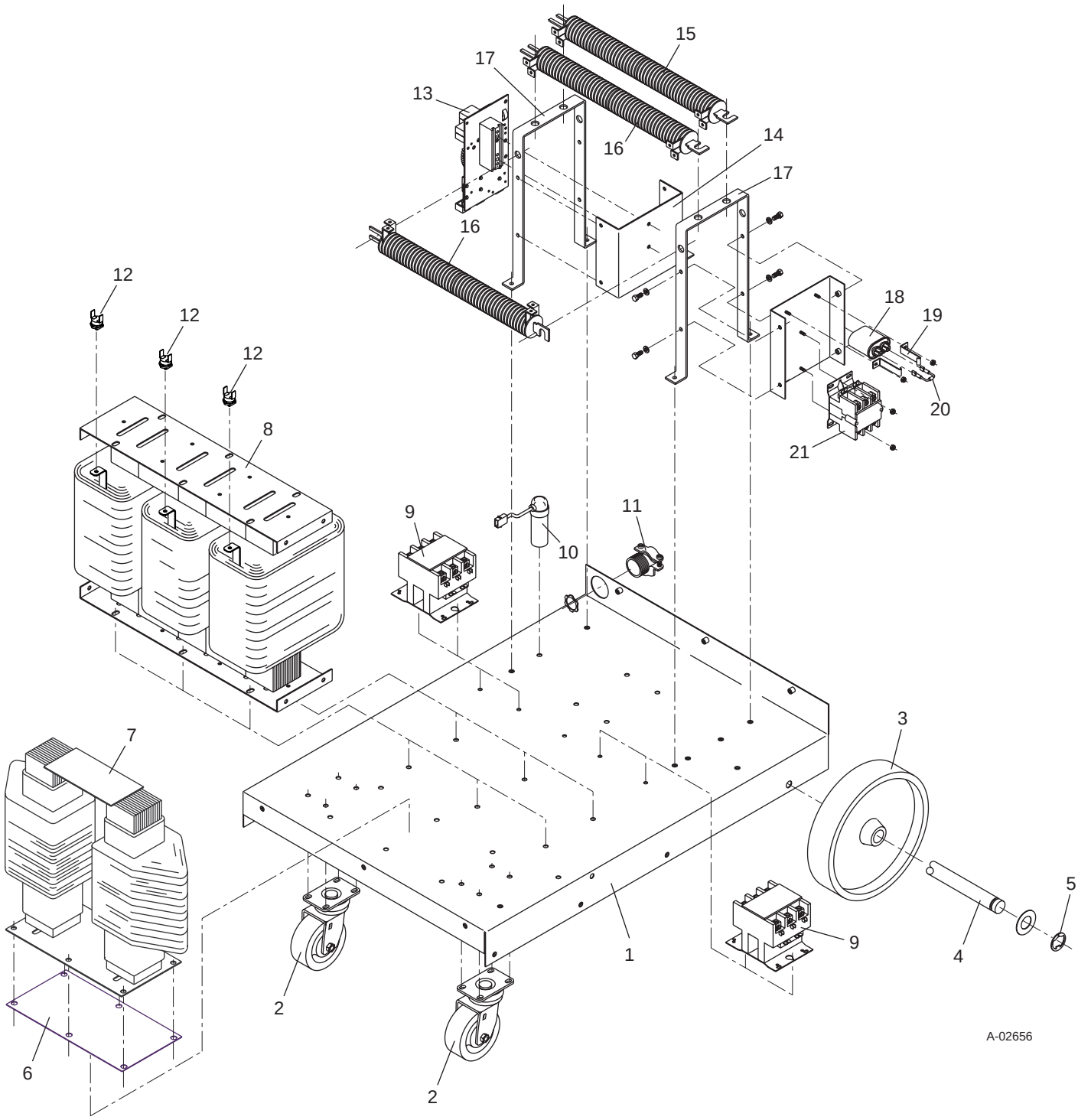


6.07 Base Assembly Replacement Parts

Item #	Qty.	Description	Reference	Catalog #
1	1	Base		9-6657
2	1	Caster, 5" Diameter		8-5578
3	1	Wheel, 8" Diameter		8-5579
4	1	Axle		9-1243
5	1	Retaining E-Ring, 1/2 Diameter Shaft		9-5539
6	1	Mat, Inductor Base		9-6662
7	1	DC Inductor Assembly		8-6145
8	1	29 KVA Transformer	T1	8-6670
9	1	Main Contactor	W1, W2	9-1244
10	1	Assembly, Capacitor Connection	C32	8-3263
11	1	1-1/4 Strain Relief		9-3164
12	1	Thermostat, Assembly Replacement Kit Includes:	TS1, TS4, TS5	9-7013
		Thermostat, Normally Closed, Opens at 115° C		
		Tie-Wraps		
13	1	EMC Filter PC Board Assembly		9-4541
14	1	Bracket, Mounting, Filter PCB		9-4553
	1	Pilot Resistor Retrofit Kit - Includes:		7-8912
15	1	Resistor-Air Cooled 4.5 Ohm-Power Rib (Rev 'F' units or later)	R16	9-3959
16	1	Resistor, 2.2 Ohm Adjustable (Rev 'F' units or later)	R21, R22	8-1361
17	1	Support, Pilot Resistor Mounting (Rev 'F' units or later)		9-4554
See NOTE below for the following:				
18	1	4 mfd, Capacitor (For Rev 'E' units or earlier)	C28	9-3210
19	1	Capacitor Mounting Bracket (For Rev 'E' units or earlier)		8-3391
20	1	330k Ohms Resistor Assembly (For Rev 'E' units or earlier)	R17	9-5545
21	1	3 PH Contactor (For Rev 'E' units or earlier)	PCR	9-7554

NOTE

Location shown is for Power Supplies retrofitted with Pilot Resistor Circuit. Refer to Section 6.06 for location of parts in current product.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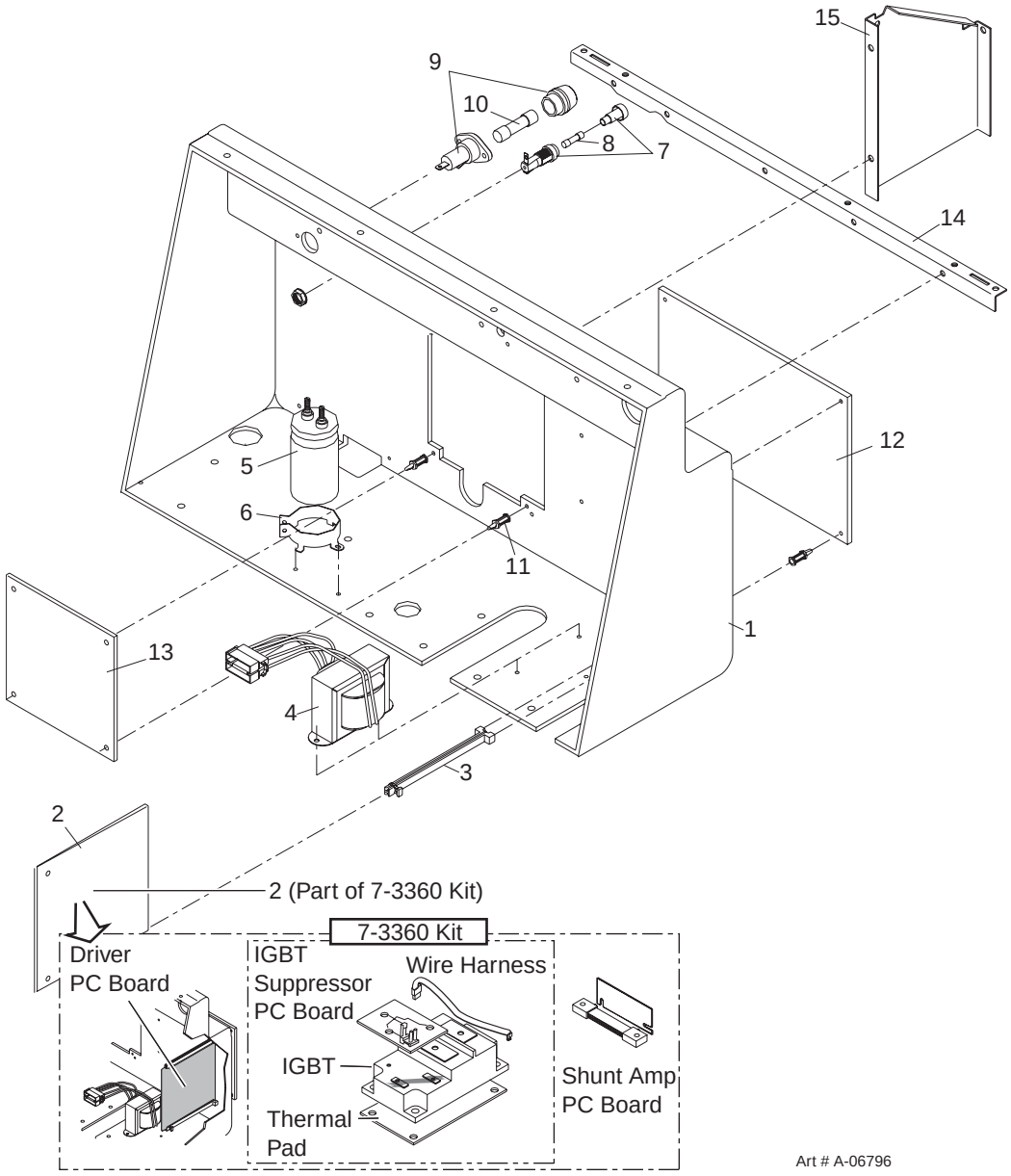
6.08 Upper Chassis Replacement Parts

Item #	Qty.	Description	Reference	Catalog #
1	1	Panel, Upper Chassis / Gauge		9-6658
2	1	Power Driver PC Board Assembly Includes:		7-3360
	1	Thermstrate, Transistor* (Refer to Section 6.09 Item # 7)		9-1406
	1	Switching Transistor, / IGBT* (Refer to Section 6.09 Item # 8)		
	1	Power Driver PC Board Assembly*	Not Available Separately	
3	1	PC Board Guide With 16mm Screw		9-1054
4	1	Auxiliary Transformer Assembly		9-4383
5	1	Capacitor, 300mfd, 400VDC		9-1300
6	1	Capacitor Mounting Clamp - 1 3 / 4" Diameter		8-3260
7	1	Fuse Holder For 1 / 4 x 1" Fuse		9-2936
8	1	Fuse, 5A, 250V	F2	8-1025
9	1	Fuse Holder, Buss.HPS		9-2937
10	1	Fuse, 10A, 250V	F1	8-1324
11	1	PC Board Support		9-5333
12	1	Assembly, Logic PC Board		9-6798
13	1	Assembly, Switching Control PC Board		9-6797
14	1	Bracket, Access Mounting		9-6659
15	1	Panel Divider		9-6660

* All parts in kit #7-3360 must be replaced at the same time.



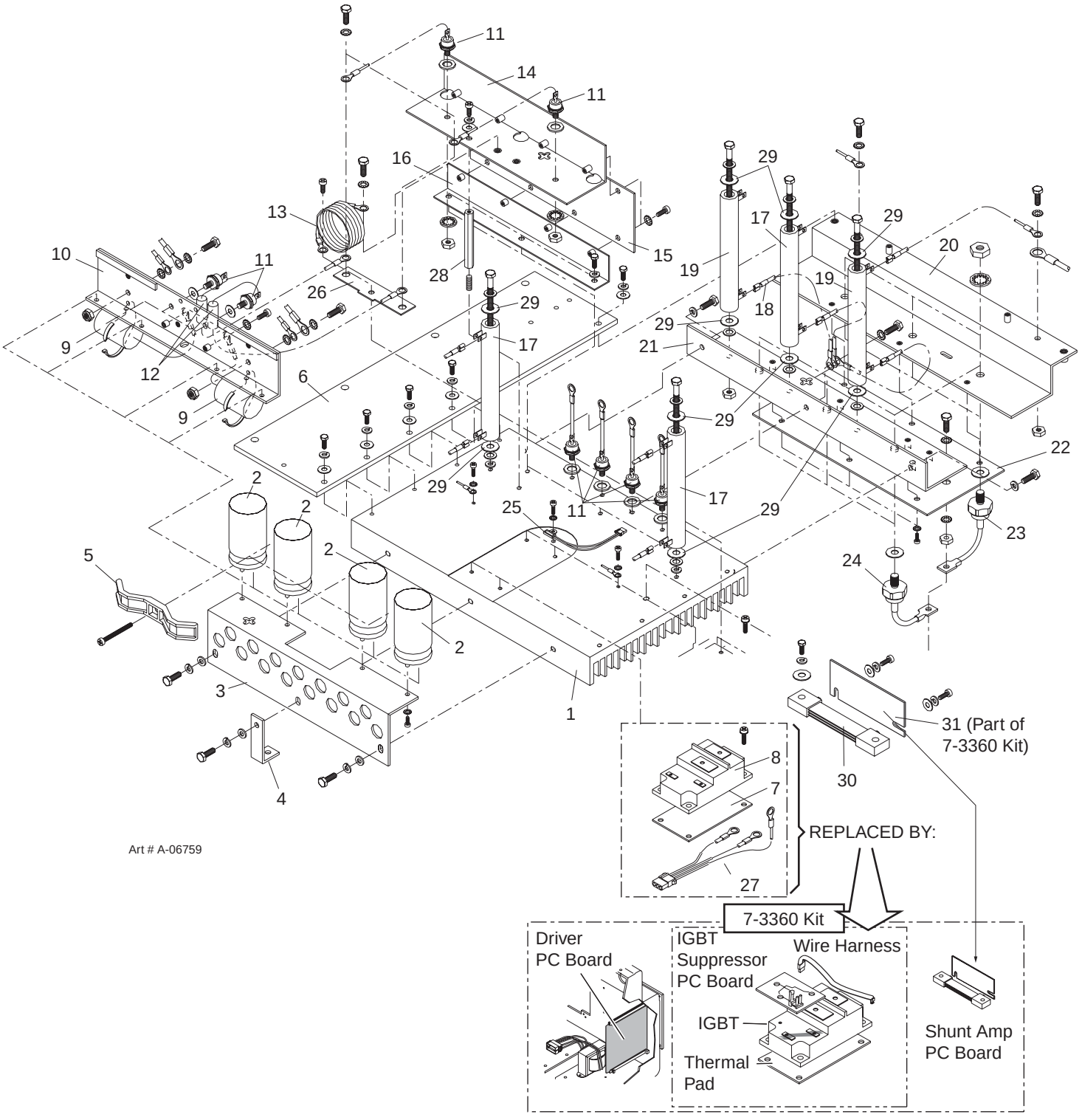
NOTE

Kit # 7-3360 includes several parts. If any of these parts fail, all must be replaced at the same time (along with additional parts in the kit). Failure to replace all parts together may lead to parts failure.

6.09 Main Heatsink Assembly Replacement Parts

Item #	Qty.	Description	Reference	Catalog #
1	1	Main Heatsink		9-1404
2	1	Capacitor, 550 mfd, 400VDC		9-1303
3	1	Bracket, Capacitor / Heatsink		8-4521
4	1	Support, Air Foil		8-2176
5	1	Capacitor Clamp		9-4212
6	1	Support, Heatsink Assembly		9-6663
7	1	Thermstrate, Transistor*		9-1406
8	1	Transistor / IGBT* (Refer to Section 6.08 Item #2)		
9	1	Capacitor, 10 mfd, 400V Poly., Hi-Current		9-1305
10	1	Bracket, Capacitor Mounting		8-6314
11	1	70 Amp STR. Diode Replacement Kit Includes: Diode, 70A, 600V STR Fast Thermal Interface Pad .75 Dia		8-1168
12	1	Capacitor, 0.15 µf, 630V Poly., Hi-Current		9-1408
13	1	Suppression Coil Assembly		9-1409
14	1	Bracket, Diode Lead		8-6316
15	1	Assembly, Heatsink Suppression PC Board		9-1410
16	1	Support, Capacitor Bracket / PC Board		8-6315
17	1	Resistor, 100 Ohm, 100W Style J		9-1405
18	1	Internal Wire Assembly Package		9-6661
19	1	Resistor, 3k Ohm, 100W Style J		8-6677
20	1	Plate, Negative Diode		8-6675
21	1	Plate, Positive Diode		8-6674
22	1	Diode Suppression PC Board Assembly		8-6155
23	1	150 Amp REV Diode Replacement Kit Includes: Diode, 150 Amp, 800V, REV. Thermal, Interface Pad 1.06 Dia.		8-6153
24	1	150 Amp STR Diode Replacement Kit Includes: Diode, 150 Amp, 800V, STR. Thermal, Interface Pad 1.06 Dia.		8-6152
25	1	Assembly, PTC Resistor	TS2	8-4523
26	1	Bracket, Transistor / Coil		8-6676
27	1	Harness Assembly, Transistor		8-6313
28	1	Standoff, 3 / 8 Hex Nylon		8-5147
29	1	Washer, Fiber Shoulder		8-6678
30	1	Shunt, 250A, 100 mV		9-4392
31	1	Shunt Amp PC Board Assembly*	Not Available Separately	

* Included in Kit # 7-3360. All parts in this kit must be replaced at the same time.



NOTE

Kit # 7-3360 includes several parts. If any of these parts fail, all must be replaced at the same time (along with additional parts in the kit). Failure to replace all parts together may lead to parts failure.

APPENDIX 1: INPUT WIRING REQUIREMENTS

Input		Power Input	Current	Suggested Sizes (See Note)			
Voltage (Volts)	Freq. (Hz)	3-Ph (kVA)	3-Ph (Amps)	Fuse (Amps) 3-Ph	Wire (AWG) 3-Ph	Wire (Canada) 3-Ph	Wire (mm2) 3-Ph
380	50/60	34	51	60	6	6	14
415	50/60	34	47	60	8	6	9

Line Voltages with Suggested Circuit Protection and Wire Sizes
Based on National Electric Code and Canadian Electrical Code

NOTES

Refer to Local and National Codes or local authority having jurisdiction for proper wiring requirements.

Cable size is de-rated based on the Duty Cycle of the equipment.

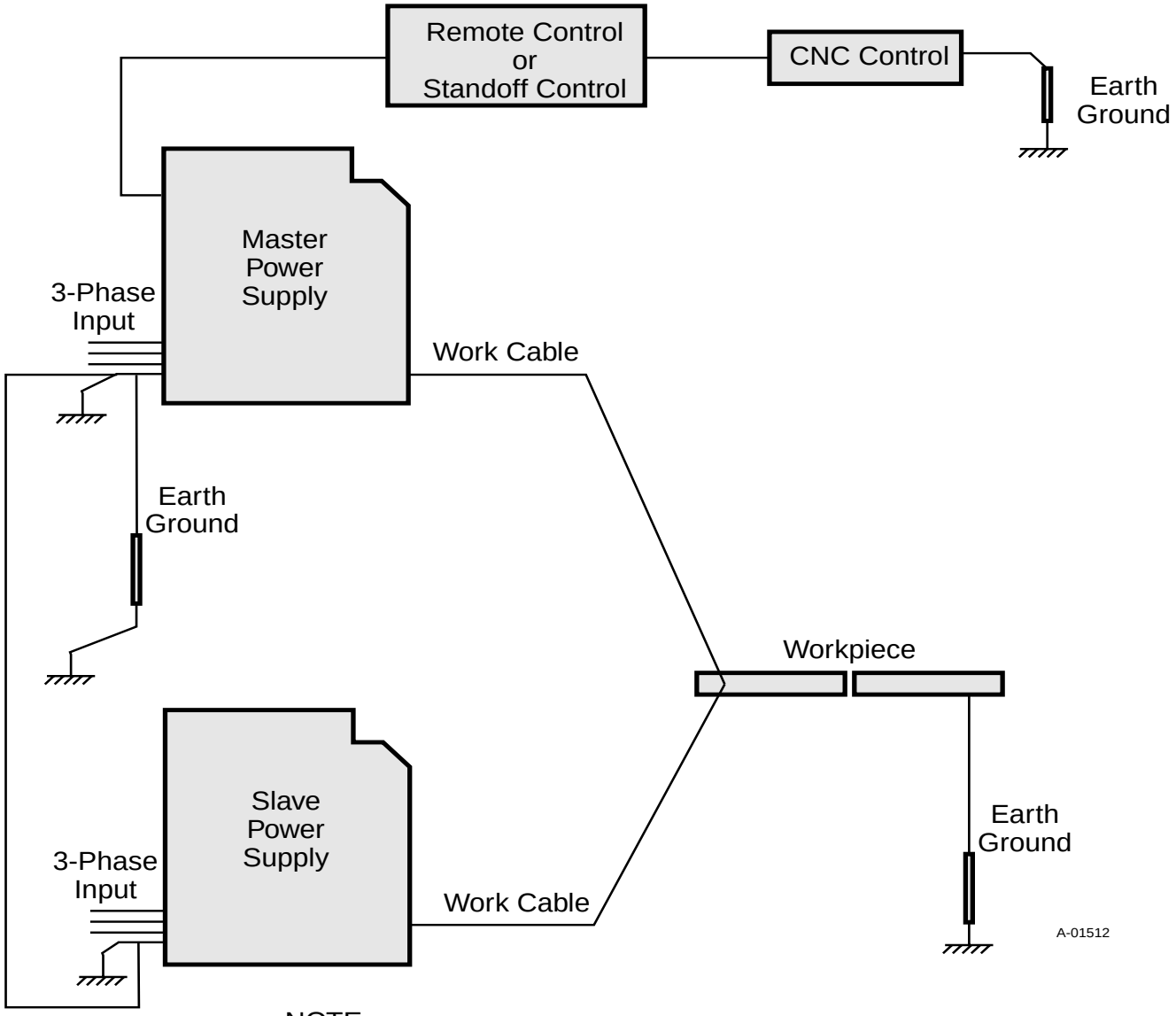
The suggested sizes are based on flexible power cable with power plug installations. For hard-wired installations refer to local or national codes.

Cable conductor temperature used is 167° F (75° C).

An energy limiting fuse UL Class RK-1 (examples: BUSS LPS/LPN-RK or Gould-Shawmut AZK-A6K) should be used to minimize damage to Plasma Cutting, Welding or power distribution equipment.

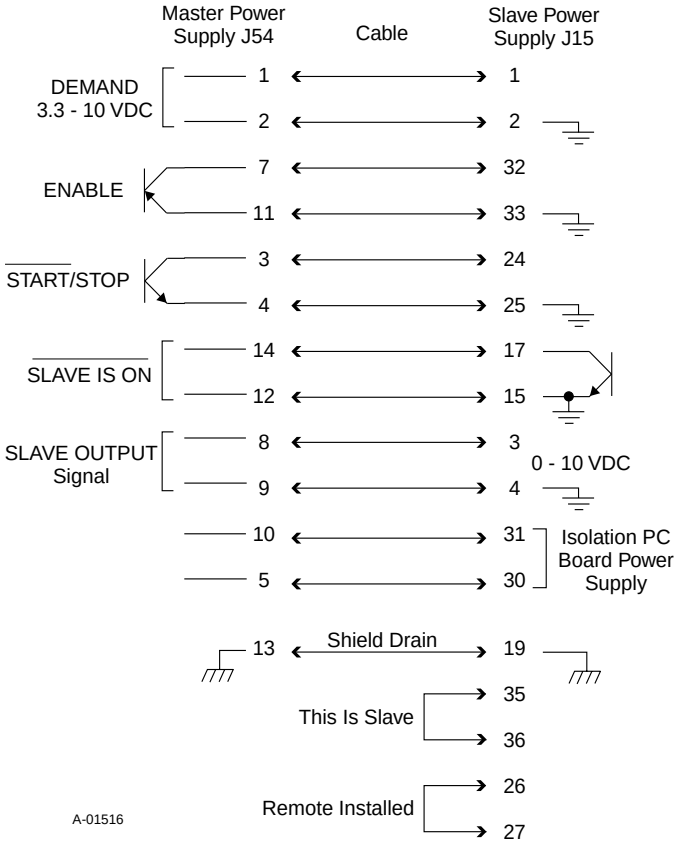
***NEVER** use replaceable element fuses like UL Class H, or "one-time" fuses like UL Class K5.*

APPENDIX 2: TYPICAL MECHANIZED SYSTEM WORK AND GROUND CABLE CONNECTIONS



NOTE
Work Cable(s) must connect direct to workpiece.
DO NOT connect Work Cable(s) to earth ground and then to workpiece.

APPENDIX 3: PARALLEL CABLE



APPENDIX 4: ROUTINE MAINTENANCE SCHEDULE

This recommended schedule applies to all types of ***non-liquid cooled*** plasma cutting systems. Some systems will not have all the parts listed and those checks need not be performed.

NOTE

The actual frequency of maintenance may need to be adjusted according to the operating environment.

Daily Operational Checks or Every Six Cutting Hours:

1. Check torch consumable parts, replace if damaged or worn.
2. Inspect torch for any cracks or exposed wires, replace if necessary.
3. Check plasma and secondary supply and pressure / flow.
4. Purge plasma gas line to remove any moisture build-up.
5. Inspect input power cable for damage or exposed wires, replace if necessary.

Weekly or Every 30 Cutting Hours:

1. Check fan for proper operation and adequate air flow.
2. Blow or vacuum dust and dirt out of the entire machine.

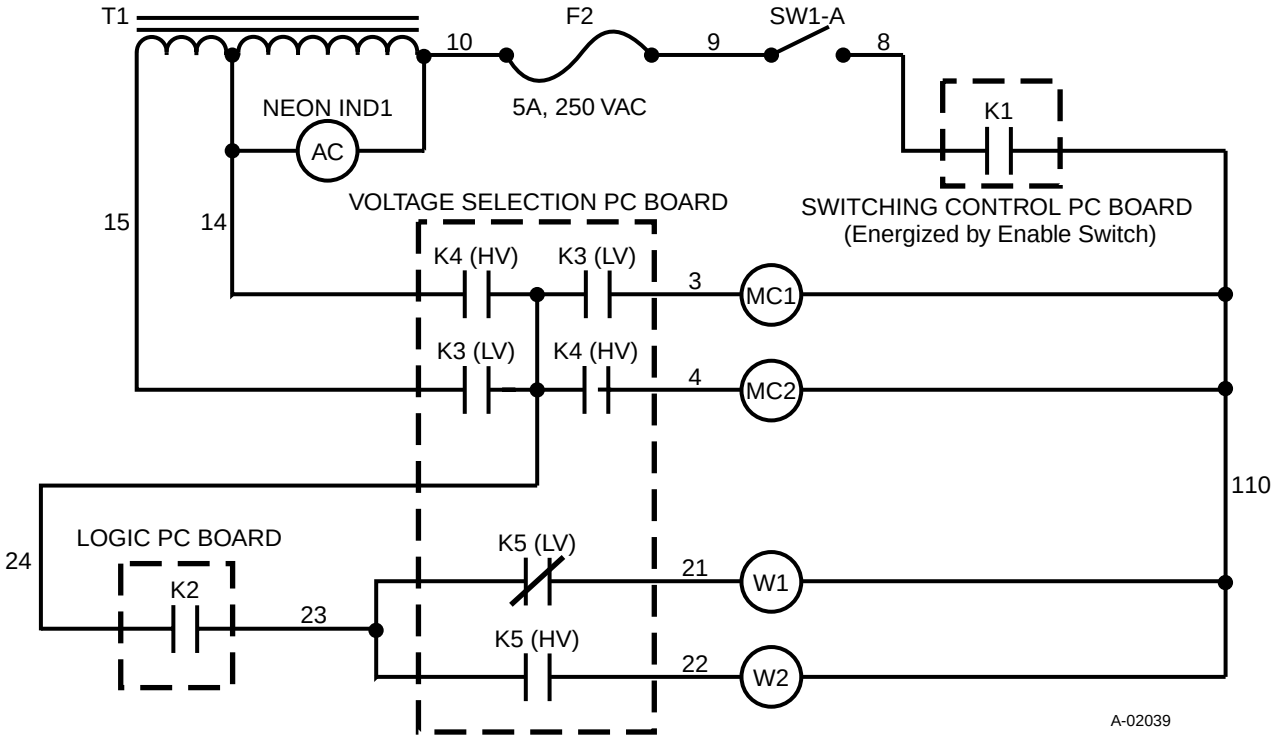
CAUTION

Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.

Six Months or Every 720 Cutting Hours:

1. Check the in-line air filter(s), clean or replace as required
2. Check cables and hoses for leaks or cracks, replace if necessary.
3. Check all contactor points for severe arcing or pits, replace if necessary.

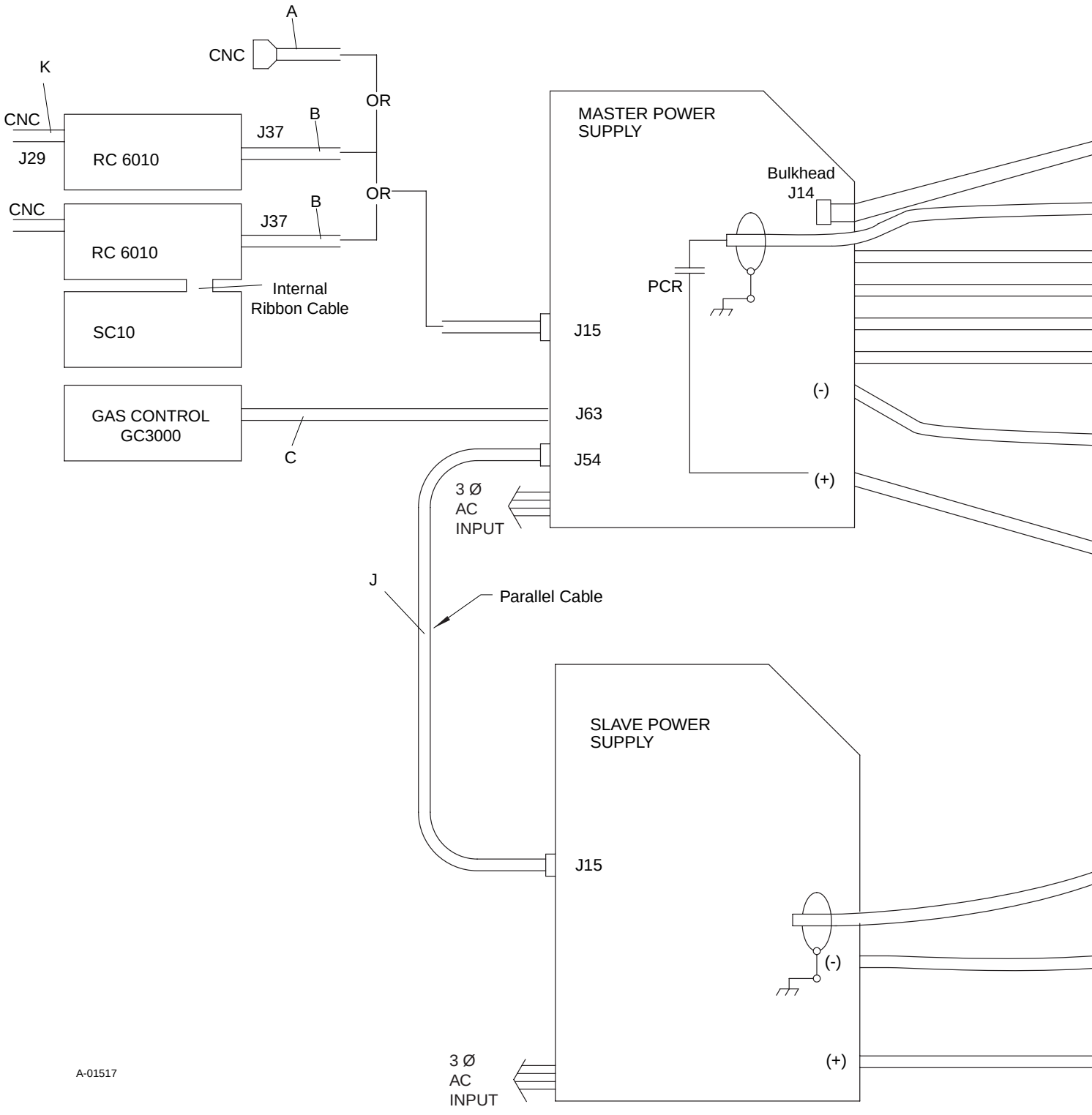
APPENDIX 5: MERLIN 6000 SLAVE POWER SUPPLY - 120 VAC CIRCUIT DIAGRAM

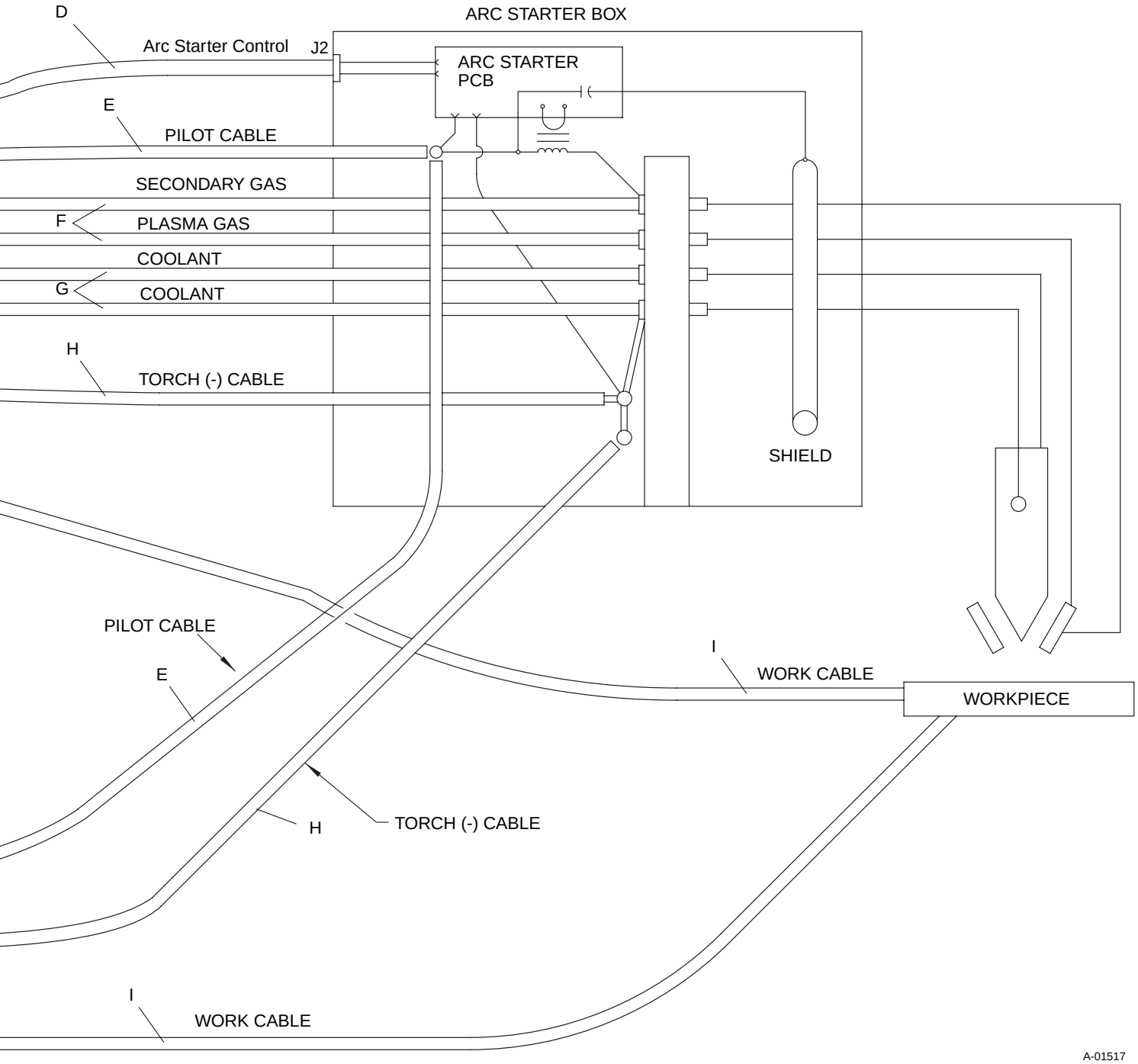


APPENDIX 6: TYPICAL MECHANIZED SYSTEM CABLE INTERCONNECTION DIAGRAM - For Merlin 6000 System

NOTE

Refer to Appendix 7 for complete data on the Cables and Hoses.

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ARC STARTER BOX
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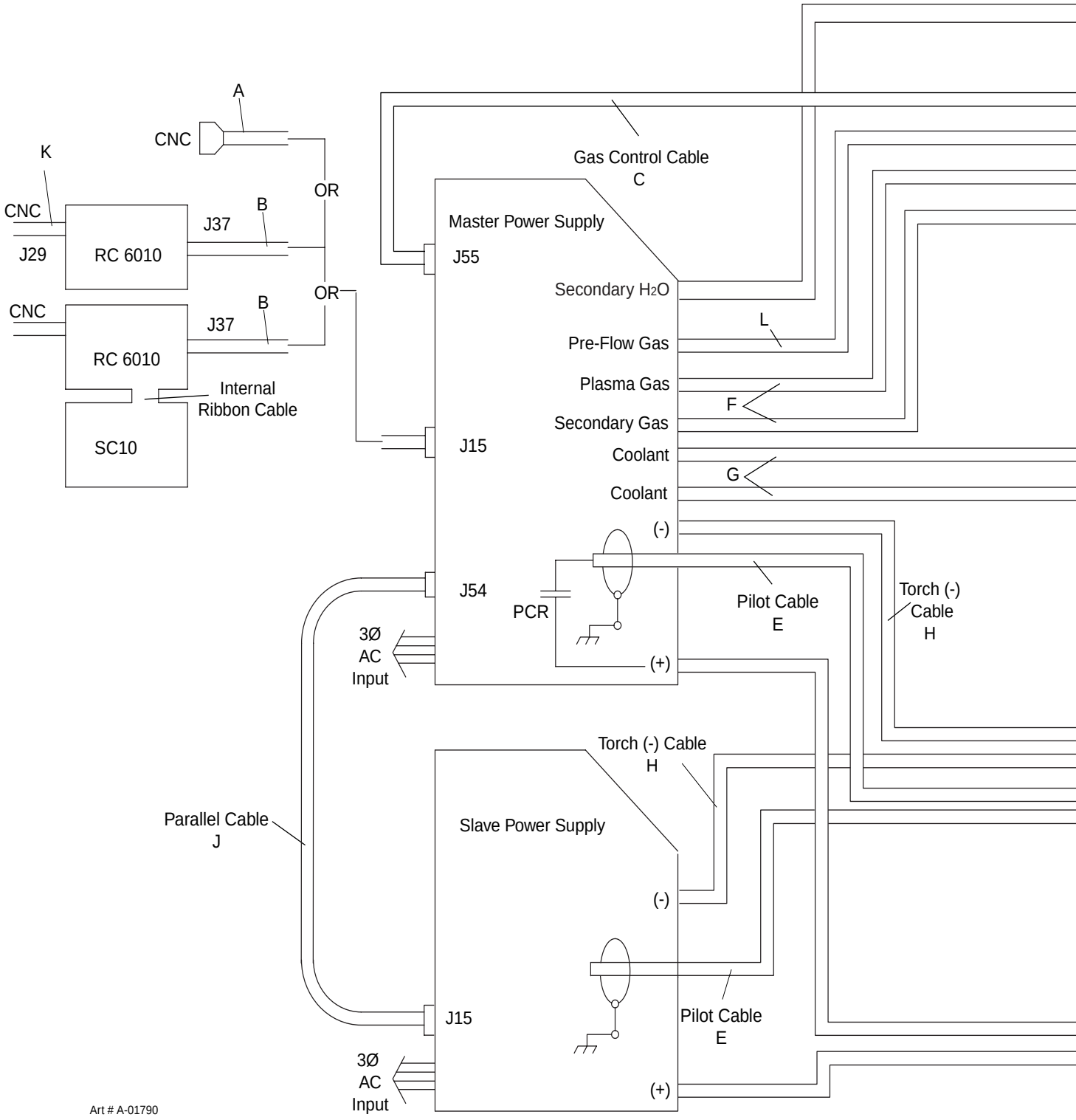
APPENDIX 7: QUICK REFERENCE TO INTERCONNECTING CABLES AND HOSES - For Merlin 6000 System

Cable	Description	Catalog #	Cable/Hose Diameter	
			Inches	mm
A	Power Supply CNC Cable			
	25 ft (7.6 m)	8-3380	3/8	9.5
	50 ft (15.2 m)	8-3381	3/8	9.5
	75 ft (22.9 m)	8-3382	3/8	9.5
	100 ft (30.5 m)	8-3383	3/8	9.5
B	Remote Control Cable			
	25 ft (7.6 m)	9-5961	1/2	13
	50 ft (15.2 m)	9-5962	1/2	13
	75 ft (22.9 m)	9-5963	1/2	13
	100 ft (30.5 m)	9-5964	1/2	13
C	Remote Gas Select Cable			
	25 ft (7.6 m)	9-4579	1/2	13
	50 ft (15.2 m)	9-4580	1/2	13
	75 ft (22.9 m)	9-4581	1/2	13
	100 ft (30.5 m)	9-4582	1/2	13
D	Arc Starter Control Cable			
	35 ft (10.7 m)	9-6901	1/4	6
	50 ft (15.2 m)	9-6902	1/4	6
	75 ft (22.9 m)	9-6903	1/4	6
	100 ft (30.5 m)	9-6904	1/4	6
	125 ft (38.1 m)	9-6905	1/4	6
E	Positive Pilot Supply Cable			
	35 ft (10.7 m)	9-6906	1/4	6
	50 ft (15.2 m)	9-6907	1/4	6
	75 ft (22.9 m)	9-6908	1/4	6
	100 ft (30.5 m)	9-6886	1/4	6
	115 ft (35.1 m)	9-6857	1/4	6
	125 ft (38.1 m)	9-6909	1/4	6
F	Plasma or Secondary Gas Hose #4			
	10 ft (3.0 m)	9-6910	1/2	13
	15 ft (4.6 m)	9-6911	1/2	13
	20 ft (6.1 m)	9-6912	1/2	13
	25 ft (7.6 m)	9-6913	1/2	13
	30 ft (9.1 m)	9-6914	1/2	13
	35 ft (10.7 m)	9-6915	1/2	13
	40 ft (12.2 m)	9-6916	1/2	13
	50 ft (15.2 m)	9-6917	1/2	13
	75 ft (22.9 m)	9-6918	1/2	13
	100 ft (30.5 m)	9-6919	1/2	13
	125 ft (38.1 m)	9-6920	1/2	13
G	Coolant Hose #8			
	35 ft (10.7 m)	9-6921	7/8	22
	50 ft (15.2 m)	9-6922	7/8	22
	75 ft (22.9 m)	9-6923	7/8	22
	100 ft (30.5 m)	9-6924	7/8	22
	115 ft (35.1 m)	9-6858	7/8	22
	125 ft (38.1 m)	9-6925	7/8	22
H	Torch (-) Cable			
	25 ft (7.6 m)	9-6892	3/4	19
	35 ft (10.7 m)	9-6926	3/4	19
	50 ft (15.2 m)	9-6927	3/4	19
	75 ft (22.9 m)	9-6928	3/4	19
	100 ft (30.5 m)	9-6896	3/4	19
	115 ft (35.1 m)	9-6856	3/4	19
	125 ft (38.1 m)	9-6929	3/4	19
I	Work Cable			
	25 ft (7.6 m)	9-6892	3/4	19
	35 ft (10.7 m)	9-6926	3/4	19
	50 ft (15.2 m)	9-6927	3/4	19
	75 ft (22.9 m)	9-6928	3/4	19
	100 ft (30.5 m)	9-6896	3/4	19
	115 ft (35.1 m)	9-6856	3/4	19
	125 ft (38.1 m)	9-6929	3/4	19
J	Parallel Cable - 8 ft (2.4 m)	9-6800	0.5	12.7
	Parallel Cable - 30 ft (9.1 m)	9-6997	0.5	12.7
K	CNC Cable			
	5 ft (1.5 m)	9-4483	5/8	16
	10 ft (3.0 m)	9-4484	5/8	16
	15 ft (4.6 m)	9-4485	5/8	16
	20 ft (6.1 m)	9-4486	5/8	16
	25 ft (7.6 m)	9-4486-25	5/8	16
	30 ft (9.1 m)	9-4486-30	5/8	16
	50 ft (15.2 m)	9-4486-50	5/8	16

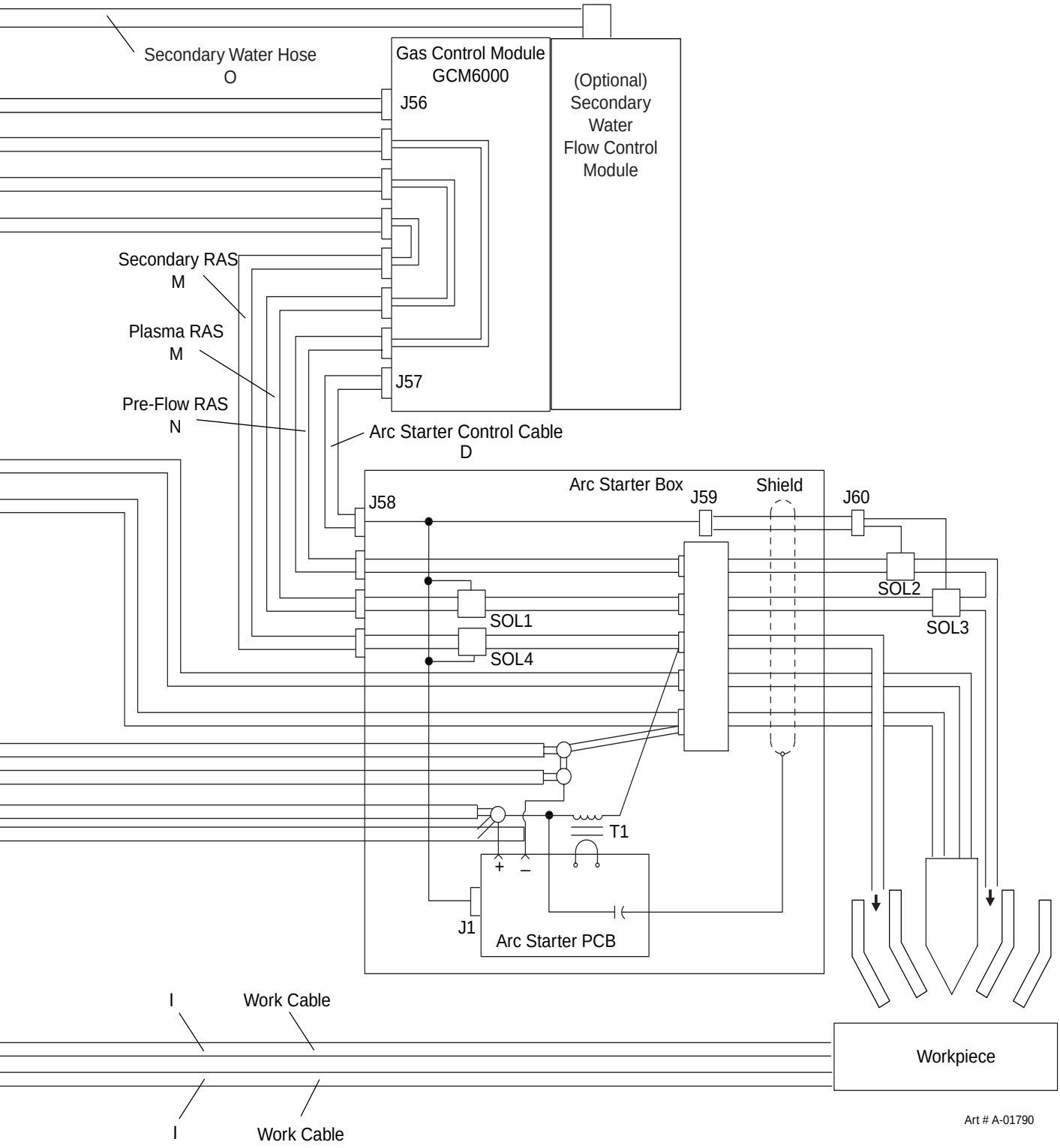
APPENDIX 8: TYPICAL MECHANIZED SYSTEM CABLE INTERCONNECTION DIAGRAM - For Merlin 6000GST System

NOTE

Refer to Appendix 9 for complete data on the Cables and Hoses.



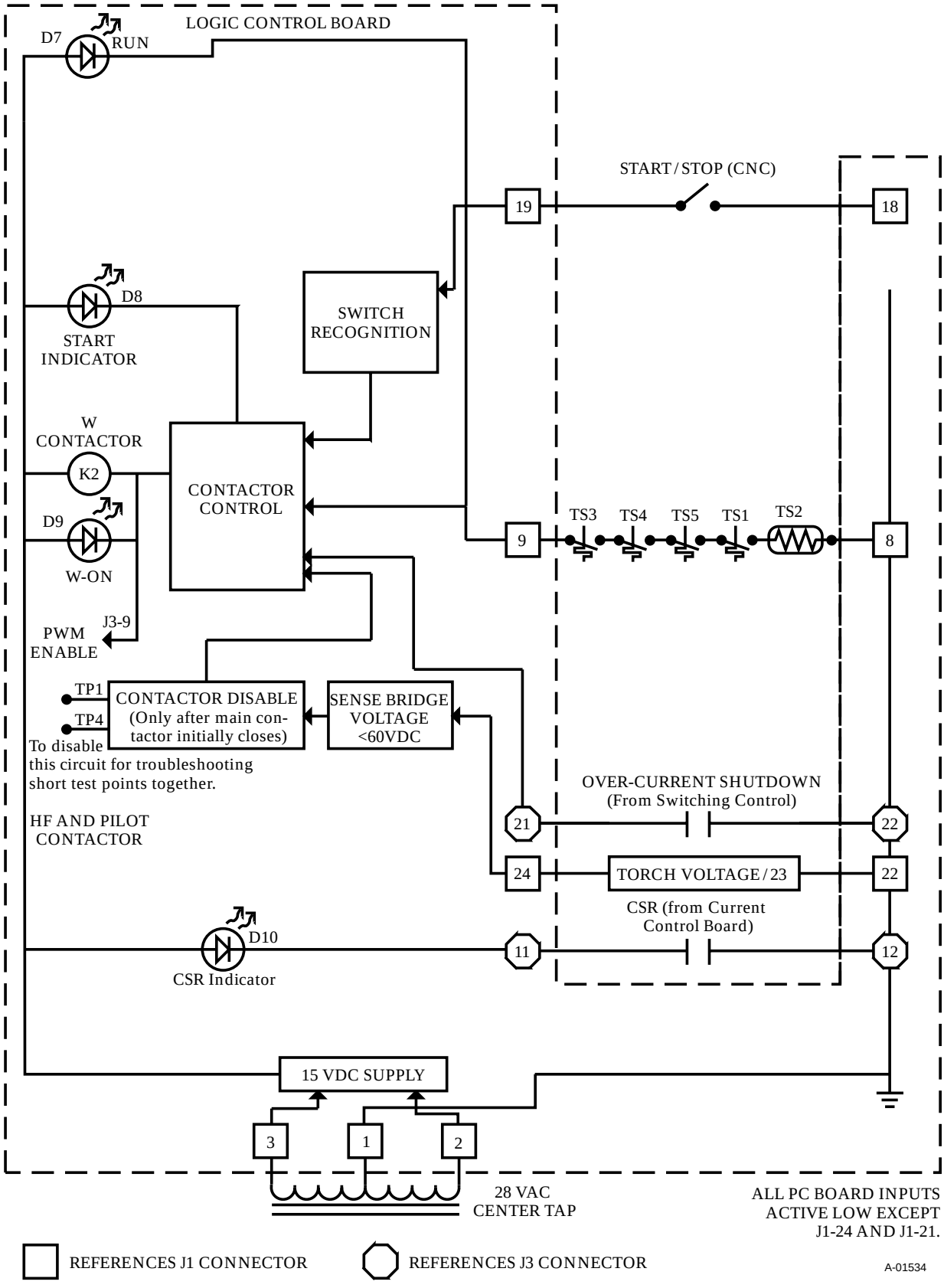
Art # A-01790


Secondary Water Hose
O
Gas Control Module
GCM6000
J56
(Optional)
Secondary
Water
Flow Control
Module
Secondary RAS
M
Plasma RAS
M
J57
Pre-Flow RAS
N
Arc Starter Control Cable
D
Arc Starter Box
J58
J59
Shield
J60
SOL1
SOL2
SOL3
SOL4
T1
+
–
J1
Arc Starter PCB
I
Work Cable
Workpiece
I
Work Cable
Art # A-01790

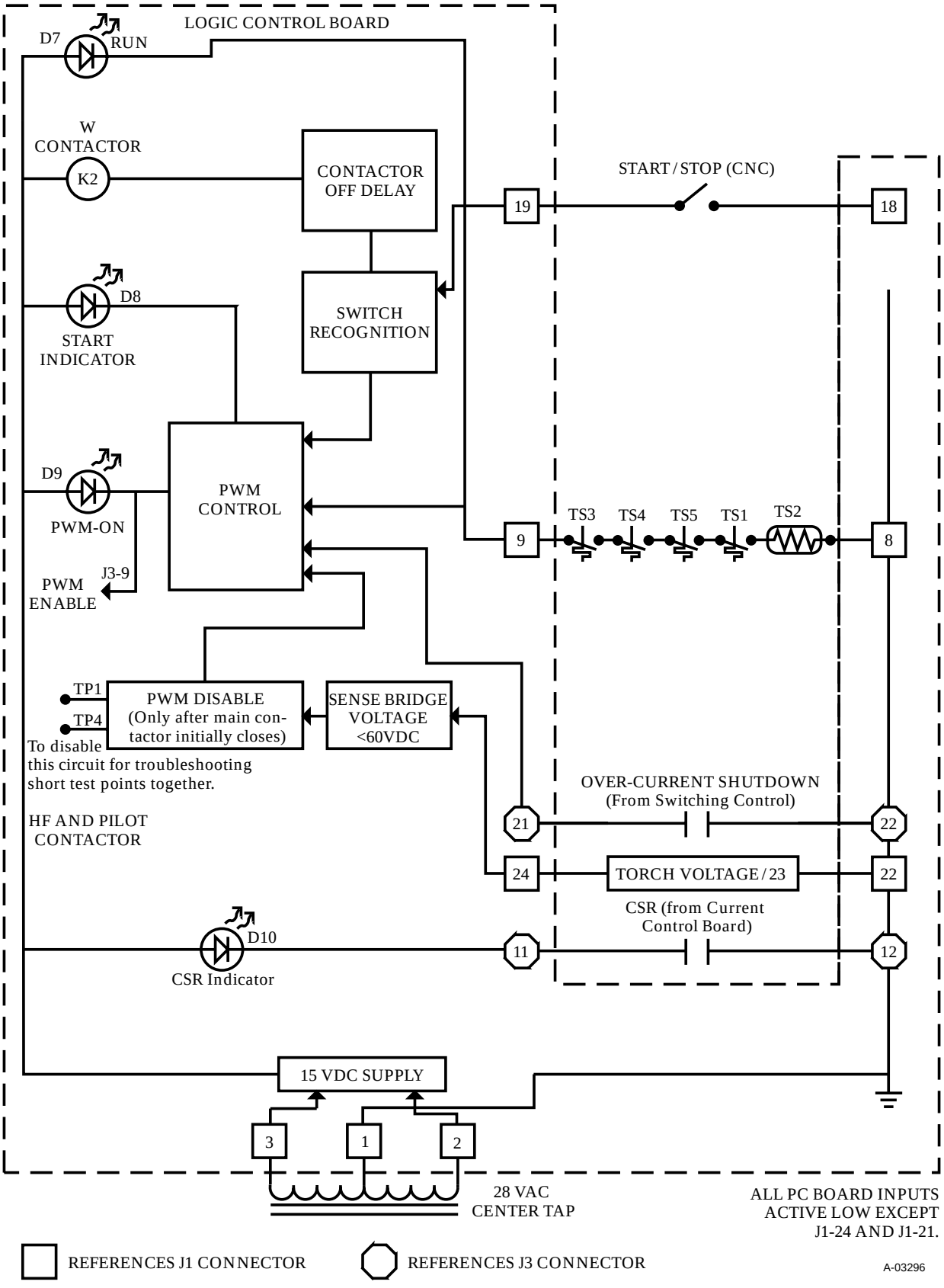
APPENDIX 9: QUICK REFERENCE TO INTERCONNECTING CABLES AND HOSES - For Merlin 6000GST System

Cable	Description	Catalog #	Cable/Hose Diameter Inches	mm
A	Power Supply CNC Cable			
	25 ft (7.6 m)	8-3380	3/8	9.5
	50 ft (15.2 m)	8-3381	3/8	9.5
	75 ft (22.9 m)	8-3382	3/8	9.5
	100 ft (30.5 m)	8-3383	3/8	9.5
B	Remote Control Cable			
	25 ft (7.6 m)	9-5961	1/2	13
	50 ft (15.2 m)	9-5962	1/2	13
	75 ft (22.9 m)	9-5963	1/2	13
	100 ft (30.5 m)	9-5964	1/2	13
C	Gas Control Cable			
	10 ft (3.0 m)	9-6934	1/2	13
	15 ft (4.6 m)	9-6935	1/2	13
	20 ft (6.1 m)	9-6936	1/2	13
	25 ft (7.6 m)	9-6937	1/2	13
	30 ft (9.1 m)	9-6938	1/2	13
	35 ft (10.7 m)	9-6939	1/2	13
	40 ft (12.2 m)	9-6940	1/2	13
	50 ft (15.2 m)	9-6941	1/2	13
	75 ft (22.9 m)	9-6942	1/2	13
	100 ft (30.5 m)	9-6943	1/2	13
	125 ft (38.1 m)	9-6944	1/2	13
D	Arc Starter Control Cable			
	10 ft (3.0 m)	9-6945	1/4	6
	15 ft (4.6 m)	9-6946	1/4	6
	20 ft (6.1 m)	9-6947	1/4	6
	25 ft (7.6 m)	9-6948	1/4	6
	30 ft (9.1 m)	9-6949	1/4	6
	35 ft (10.7 m)	9-6950	1/4	6
	40 ft (12.2 m)	9-6951	1/4	6
	50 ft (15.2 m)	9-6952	1/4	6
	75 ft (22.9 m)	9-6953	1/4	6
	100 ft (30.5 m)	9-6954	1/4	6
	125 ft (38.1 m)	9-6955	1/4	6
E	Positive Pilot Supply Cable			
	35 ft (10.7 m)	9-6906	1/4	6
	50 ft (15.2 m)	9-6907	1/4	6
	75 ft (22.9 m)	9-6908	1/4	6
	100 ft (30.5 m)	9-6886	1/4	6
	115 ft (35.1 m)	9-6857	1/4	6
	125 ft (38.1 m)	9-6909	1/4	6
F	Plasma or Secondary Gas Hose #4			
	10 ft (3.0 m)	9-6910	1/2	13
	15 ft (4.6 m)	9-6911	1/2	13
	20 ft (6.1 m)	9-6912	1/2	13
	25 ft (7.6 m)	9-6913	1/2	13
	30 ft (9.1 m)	9-6914	1/2	13
	35 ft (10.7 m)	9-6915	1/2	13
	40 ft (12.2 m)	9-6916	1/2	13
	50 ft (15.2 m)	9-6917	1/2	13
	75 ft (22.9 m)	9-6918	1/2	13
	100 ft (30.5 m)	9-6919	1/2	13
	125 ft (38.1 m)	9-6920	1/2	13
G	Coolant Hose #8			
	35 ft (10.7 m)	9-6921	7/8	22
	50 ft (15.2 m)	9-6922	7/8	22
	75 ft (22.9 m)	9-6923	7/8	22
	100 ft (30.5 m)	9-6924	7/8	22
	115 ft (35.1 m)	9-6858	7/8	22
	125 ft (38.1 m)	9-6925	7/8	22
H	Torch (-) Cable			
	25 ft (7.6 m)	9-6892	3/4	19
	35 ft (10.7 m)	9-6926	3/4	19
	50 ft (15.2 m)	9-6927	3/4	19
	75 ft (22.9 m)	9-6928	3/4	19
	100 ft (30.5 m)	9-6896	3/4	19
	115 ft (35.1 m)	9-6856	3/4	19
	125 ft (38.1 m)	9-6929	3/4	19
I	Work Cable			
	25 ft (7.6 m)	9-6892	3/4	19
	35 ft (10.7 m)	9-6926	3/4	19
	50 ft (15.2 m)	9-6927	3/4	19
	75 ft (22.9 m)	9-6928	3/4	19
	100 ft (30.5 m)	9-6896	3/4	19
	115 ft (35.1 m)	9-6856	3/4	19
	125 ft (38.1 m)	9-6929	3/4	19
J	Parallel Cable - 8 ft (2.4 m)	9-6800	0.5	12.7
	Parallel Cable - 30 ft (9.1 m)	9-6997	0.5	12.7
K	CNC Cable			
	5 ft (1.5 m)	9-4483	5/8	16
	10 ft (3.0 m)	9-4484	5/8	16
	15 ft (4.6 m)	9-4485	5/8	16
	20 ft (6.1 m)	9-4486	5/8	16
	25 ft (7.6 m)	9-4486-25	5/8	16
	30 ft (9.1 m)	9-4486-30	5/8	16
	50 ft (15.2 m)	9-4486-50	5/8	16
L	Pre-Flow Gas Hose #4			
	10 ft (3.0 m)	9-6956	1/2	13
	15 ft (4.6 m)	9-6957	1/2	13
	20 ft (6.1 m)	9-6958	1/2	13
	25 ft (7.6 m)	9-6959	1/2	13
	30 ft (9.1 m)	9-6960	1/2	13
	35 ft (10.7 m)	9-6961	1/2	13
	40 ft (12.2 m)	9-6962	1/2	13
	50 ft (15.2 m)	9-6963	1/2	13
	75 ft (22.9 m)	9-6964	1/2	13
	100 ft (30.5 m)	9-6965	1/2	13
	125 ft (38.1 m)	9-6966	1/2	13
M	Secondary RAS & Plasma RAS Hoses			
	5 ft (1.5 m)	9-6967	1/2	13
	10 ft (3.0 m)	9-6968	1/2	13
	15 ft (4.6 m)	9-6969	1/2	13
	20 ft (6.1 m)	9-6970	1/2	13
	25 ft (7.6 m)	9-6971	1/2	13
	30 ft (9.1 m)	9-6972	1/2	13
	35 ft (10.7 m)	9-6973	1/2	13
	40 ft (12.2 m)	9-6974	1/2	13
	50 ft (15.2 m)	9-6975	1/2	13
N	Pre-Flow RAS Hose			
	5 ft (1.5 m)	9-6976	1/2	13
	10 ft (3.0 m)	9-6977	1/2	13
	15 ft (4.6 m)	9-6978	1/2	13
	20 ft (6.1 m)	9-6979	1/2	13
	25 ft (7.6 m)	9-6980	1/2	13
	30 ft (9.1 m)	9-6981	1/2	13
	35 ft (10.7 m)	9-6982	1/2	13
	40 ft (12.2 m)	9-6983	1/2	13
	50 ft (15.2 m)	9-6984	1/2	13

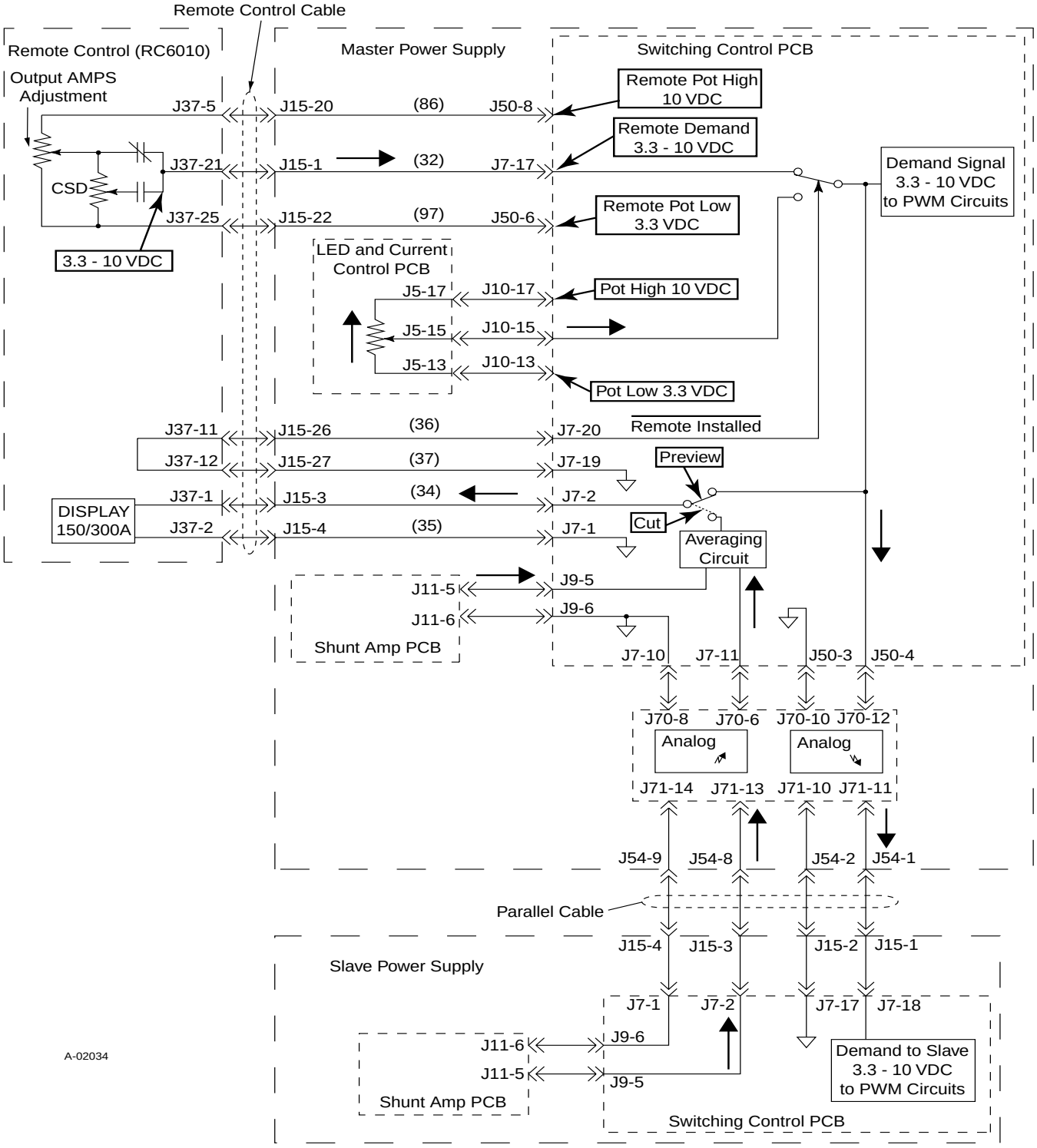
APPENDIX 10-A: LADDER DIAGRAM - 15 vdc (Rev AE or Earlier Logic Control PC Board)



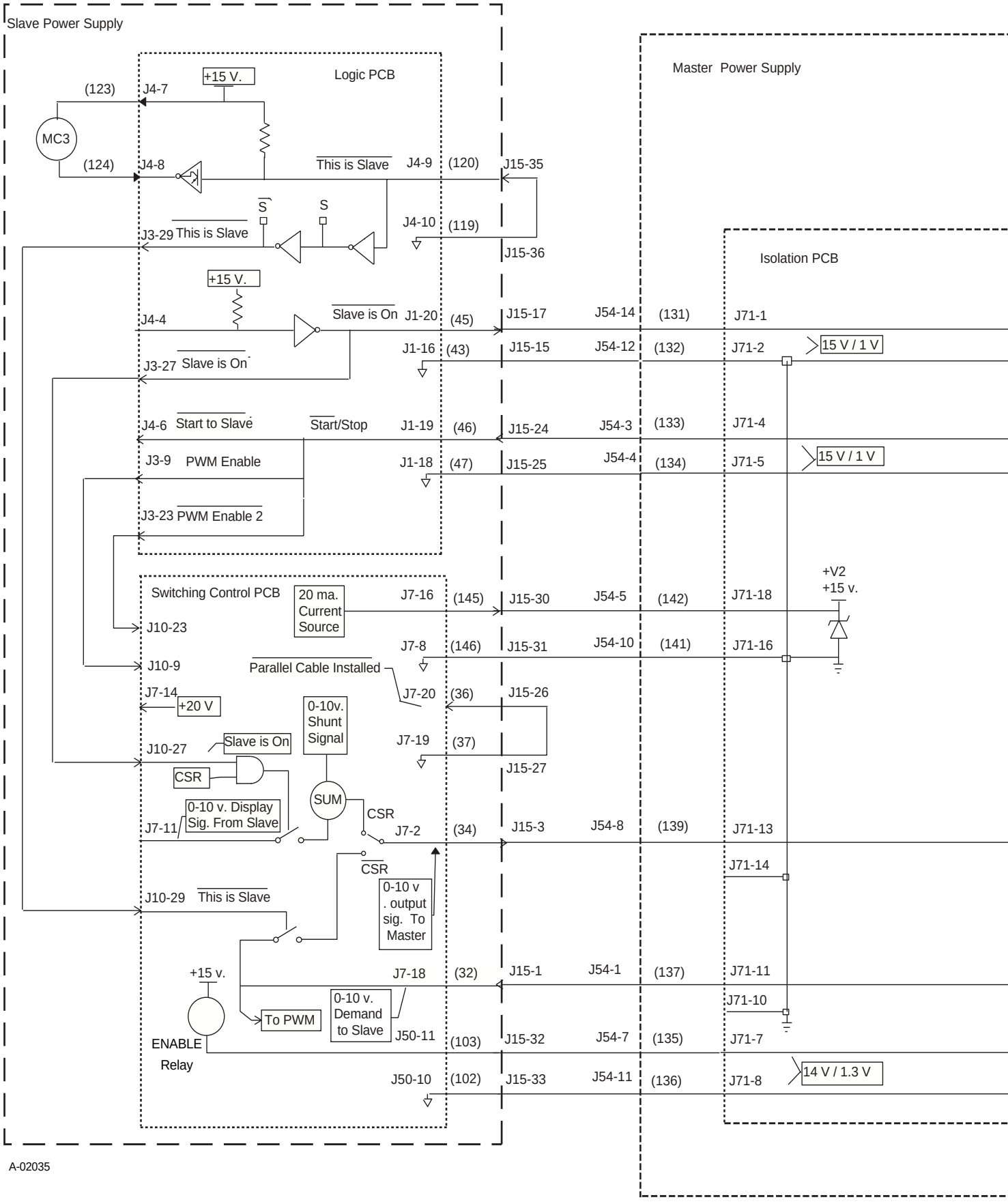
APPENDIX 10-B: LADDER DIAGRAM - 15 vdc (Rev AF or Later Logic Control PC Board)

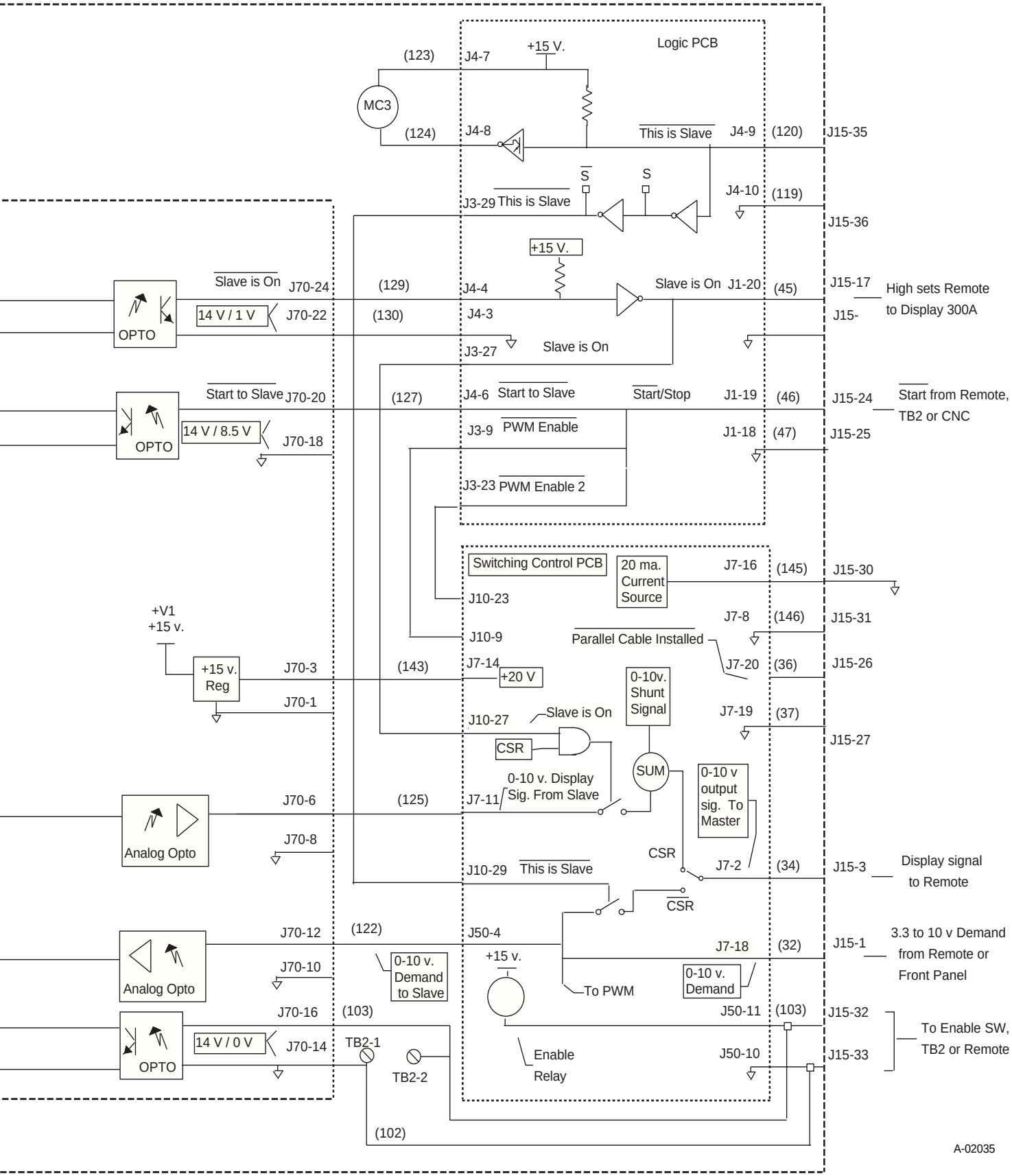


APPENDIX 11: CURRENT CONTROL AND DISPLAY DIAGRAM

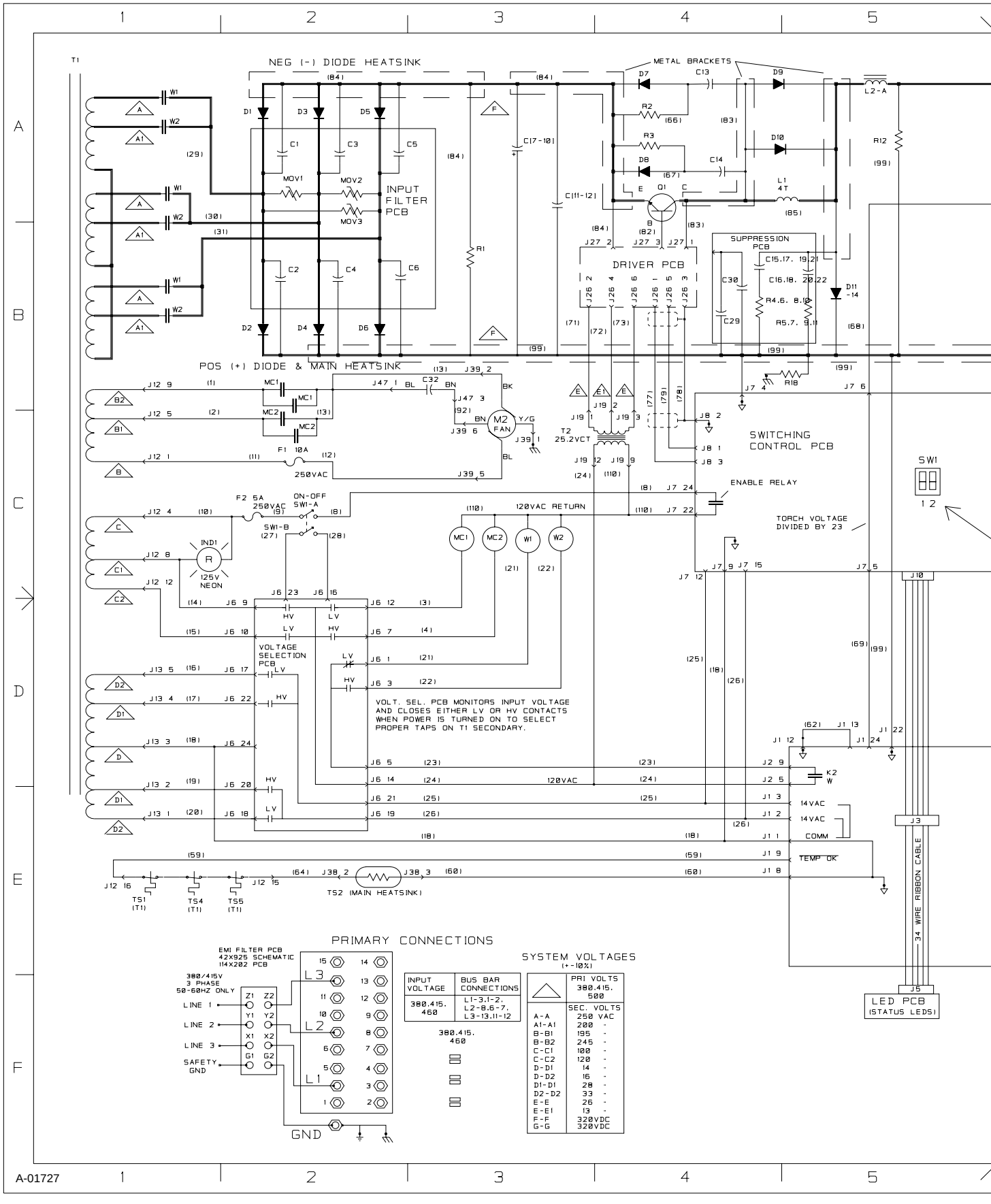


APPENDIX 12: PARALLEL INTERFACE DIAGRAM




Logic PCB
(123)
J4-7
+15 V.
MC3
(124)
J4-8
This is Slave
J4-9
(120)
J15-35
S
S
J3-29 This is Slave
J4-10
(119)
J15-36
+15 V.
Slave is On
J70-24
(129)
J4-4
Slave is On
J1-20
(45)
J15-17
High sets Remote to Display 300A
OPTO
14 V / 1 V
J70-22
(130)
J4-3
J15-
J3-27
Slave is On
Start to Slave
J70-20
(127)
J4-6
Start to Slave
Start/Stop
J1-19
(46)
J15-24
Start from Remote, TB2 or CNC
OPTO
14 V / 8.5 V
J70-18
J3-9 PWM Enable
J1-18
(47)
J15-25
J3-23 PWM Enable 2
Switching Control PCB
20 ma. Current Source
J7-16
(145)
J15-30
J10-23
+V1
+15 v.
J7-8
(146)
J15-31
J10-9
Parallel Cable Installed
+15 v. Reg
J70-3
(143)
J7-14
+20 V
J7-20
(36)
J15-26
J70-1
0-10v. Shunt Signal
J7-19
(37)
J10-27
Slave is On
J15-27
CSR
SUM
0-10 v. Display Sig. From Slave
0-10 v output sig. To Master
Analog Opto
J70-6
(125)
J7-11
J70-8
CSR
J10-29 This is Slave
J7-2
(34)
J15-3
Display signal to Remote
CSR
Analog Opto
J70-12
(122)
J50-4
J7-18
(32)
J15-1
3.3 to 10 v Demand from Remote or Front Panel
J70-10
0-10 v. Demand to Slave
+15 v.
To PWM
0-10 v. Demand
OPTO
14 V / 0 V
J70-16
(103)
J70-14
TB2-1
TB2-2
Enable Relay
J50-11
(103)
J15-32
J50-10
J15-33
To Enable SW, TB2 or Remote
(102)
A-02035

APPENDIX 13: SYSTEM SCHEMATIC - Rev 'E' or Earlier



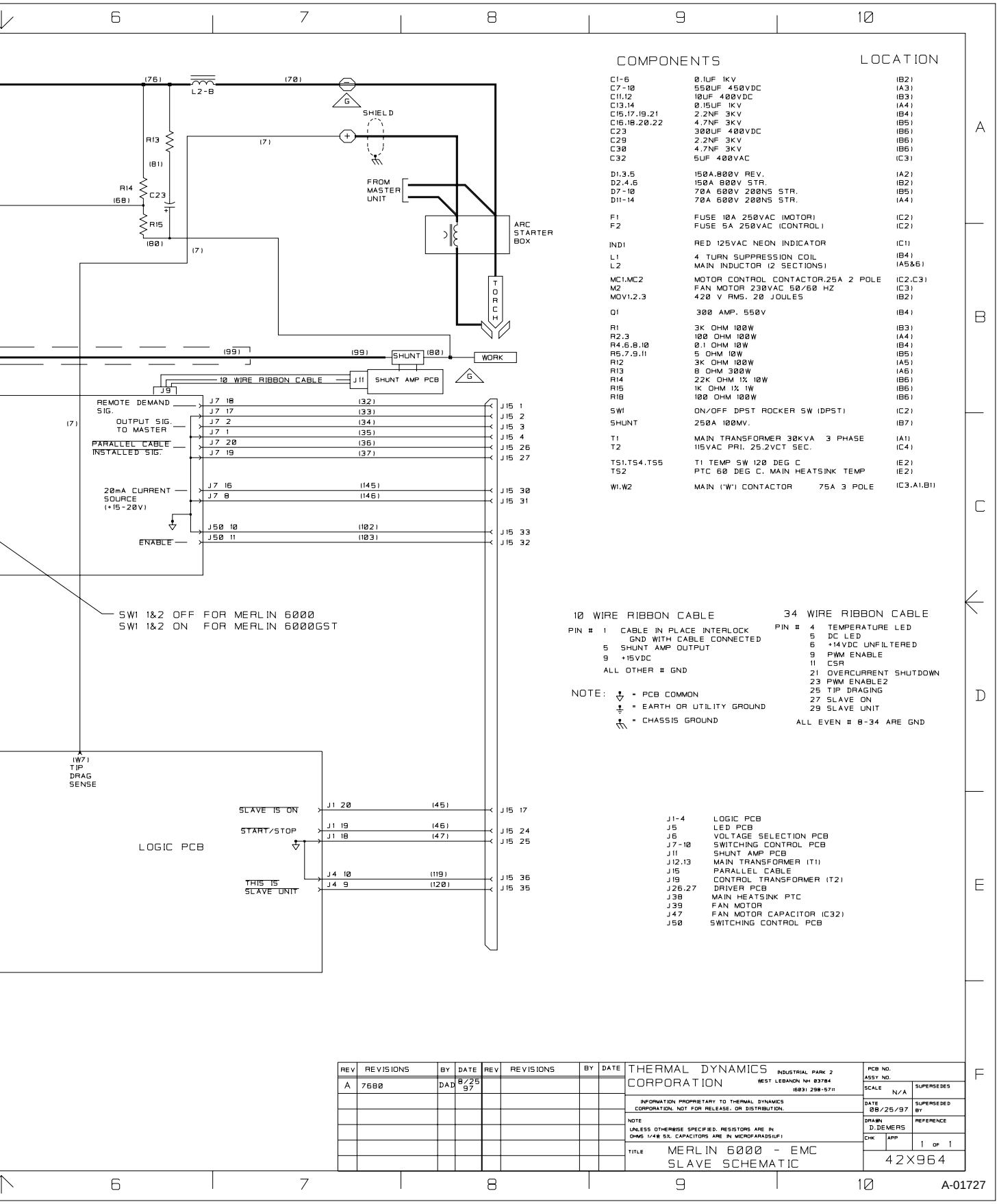
INPUT VOLTAGE	BUS BAR CONNECTIONS
380.415. 460	L1-3,1-2, L2-8,6-7, L3-13,11-12

380.415.
460

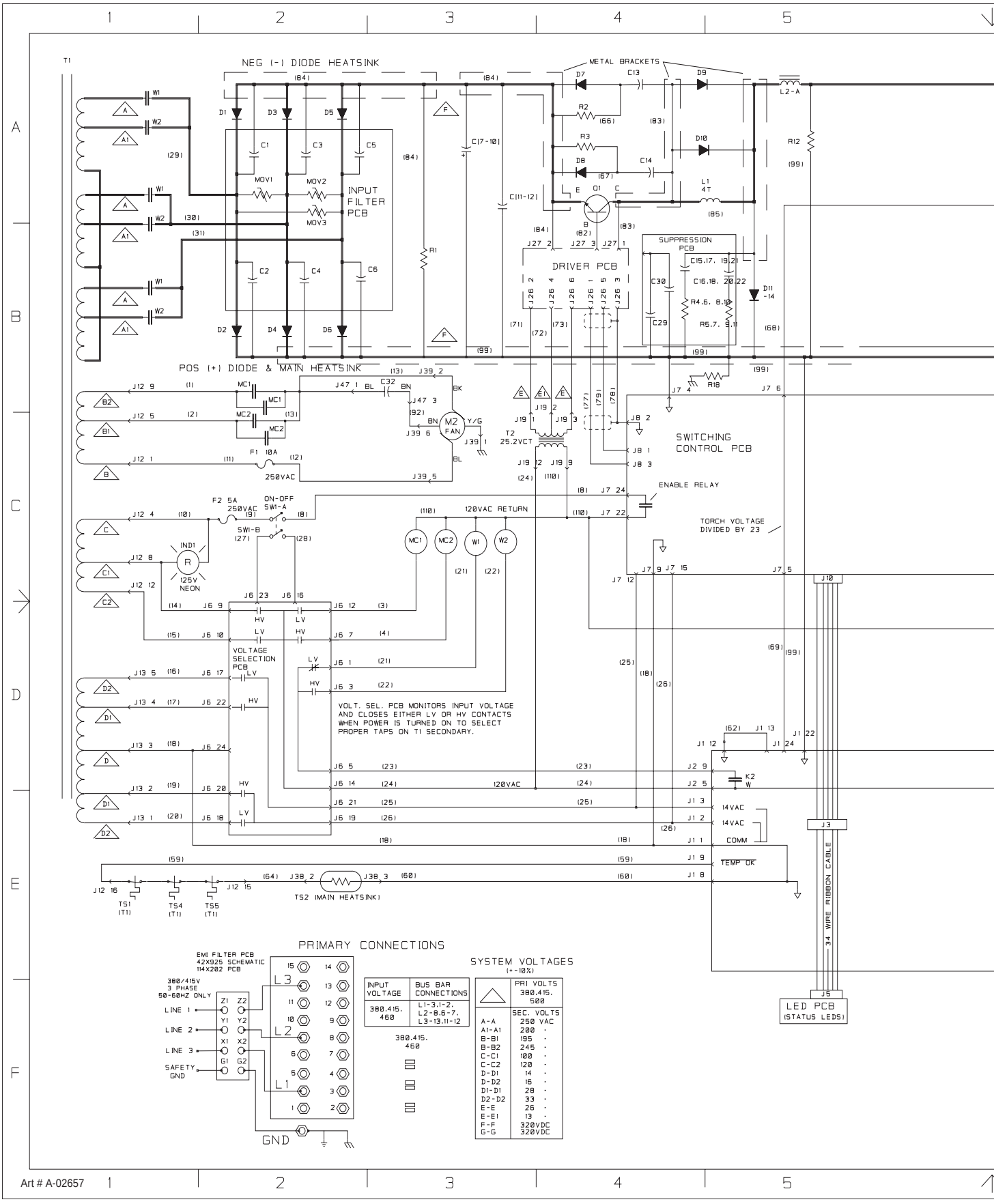
	PRI VOLTS 380.415. 500
	SEC. VOLTS
A-A	250 VAC
A1-A1	200 -
B-B1	195 -
B-B2	245 -
C-C1	100 -
C-C2	120 -
D-D1	14 -
D-D2	16 -
D1-D1	28 -
D2-D2	33 -
E-E	26 -
E-E1	13 -
F-F	320VDC
G-G	320VDC

NOTE

System Schematic for units with the letter 'E' or earlier on the data tag.

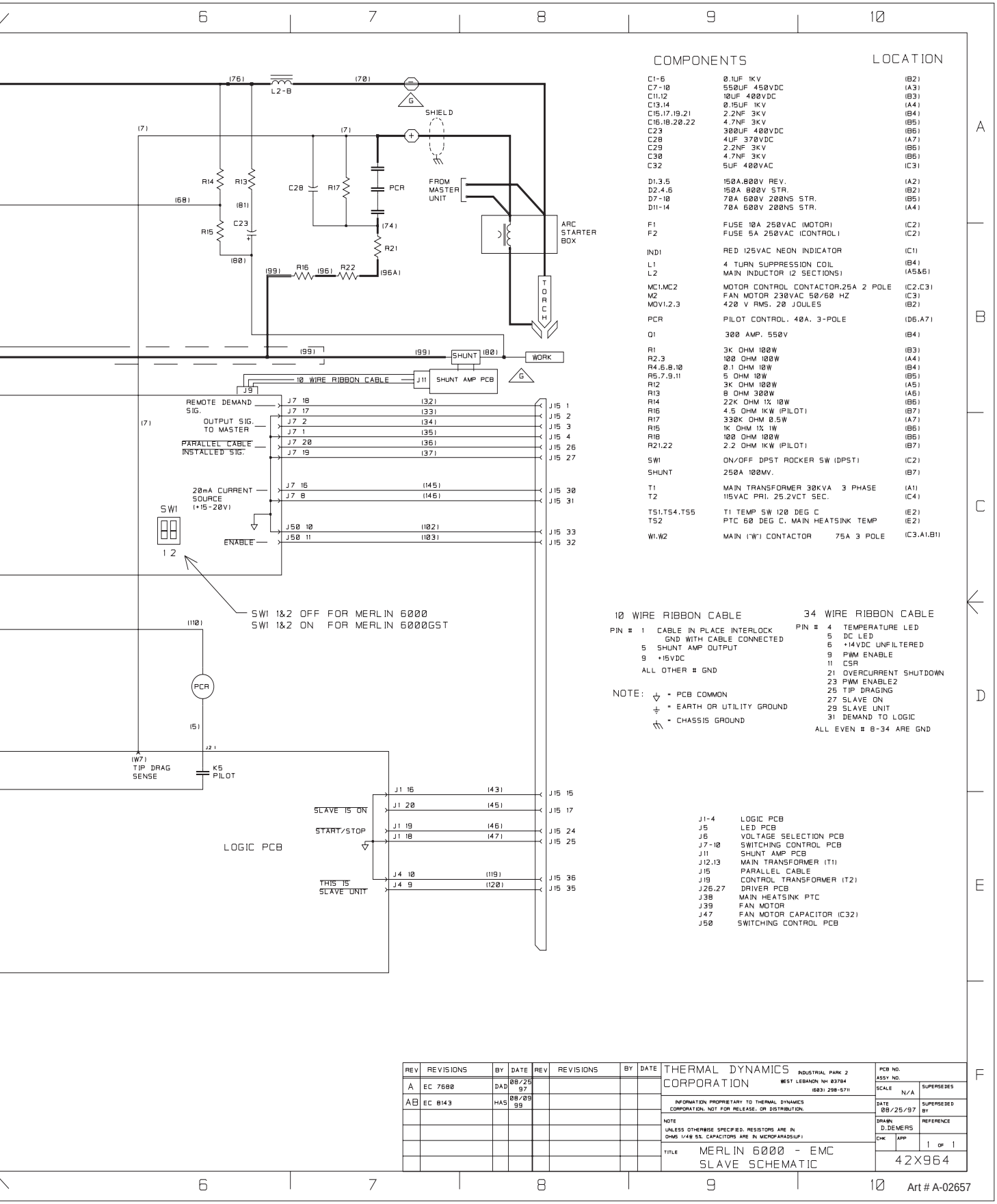


APPENDIX 14: SYSTEM SCHEMATIC - Rev 'F'

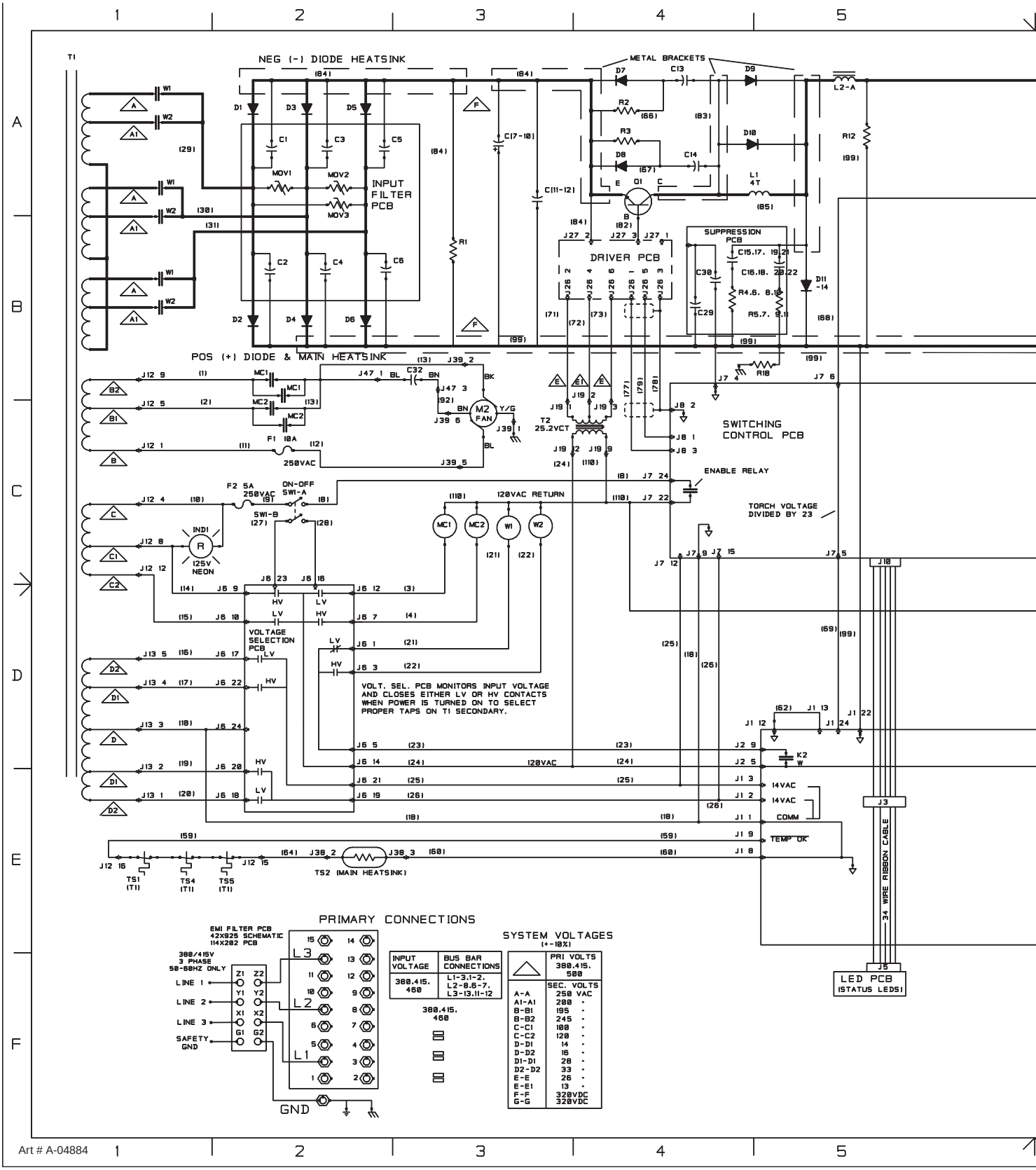


NOTE

System Schematic for units with the letter 'F' on the data tag.



APPENDIX 15: SYSTEM SCHEMATIC - Unit Rev 'AG'



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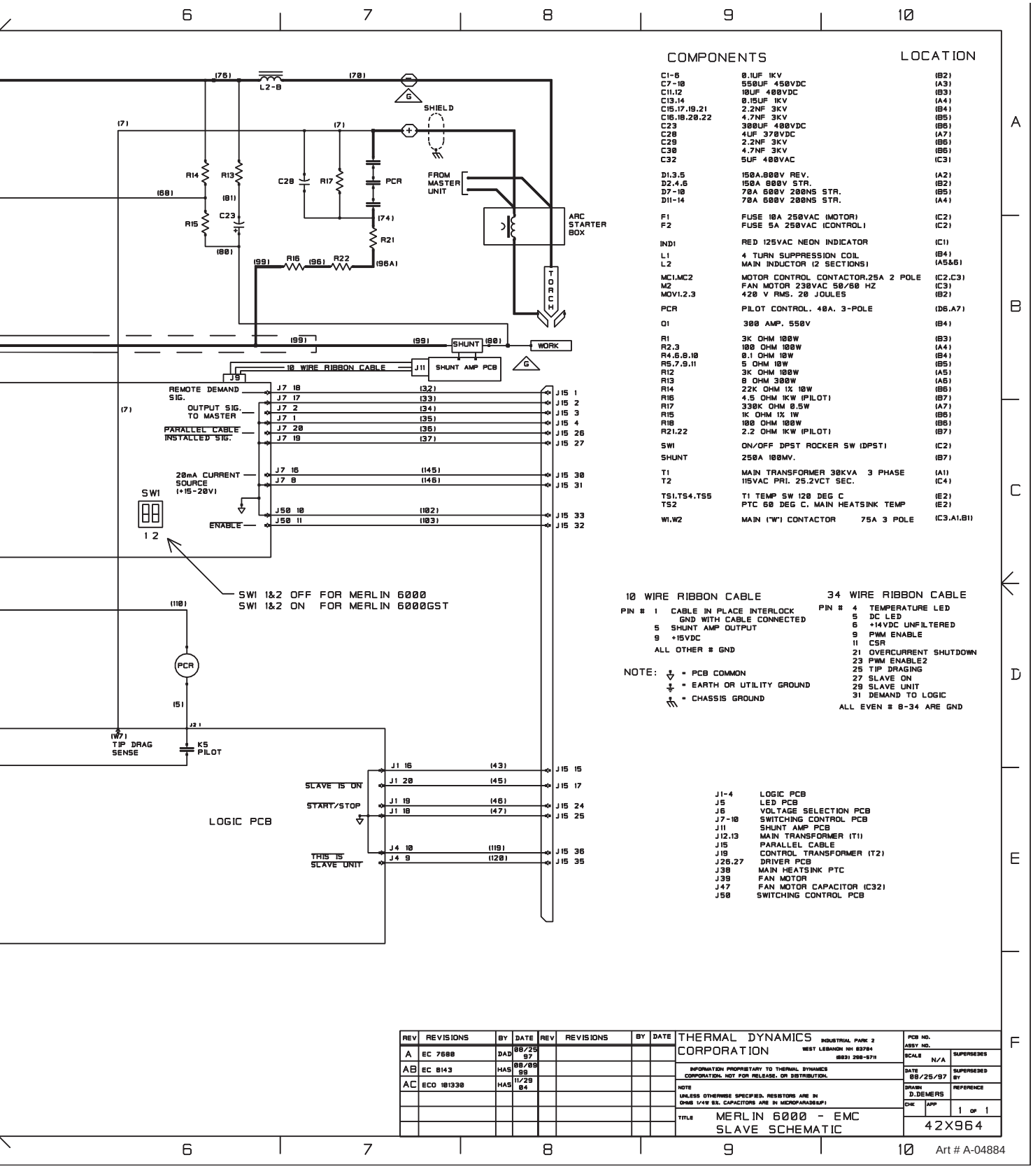
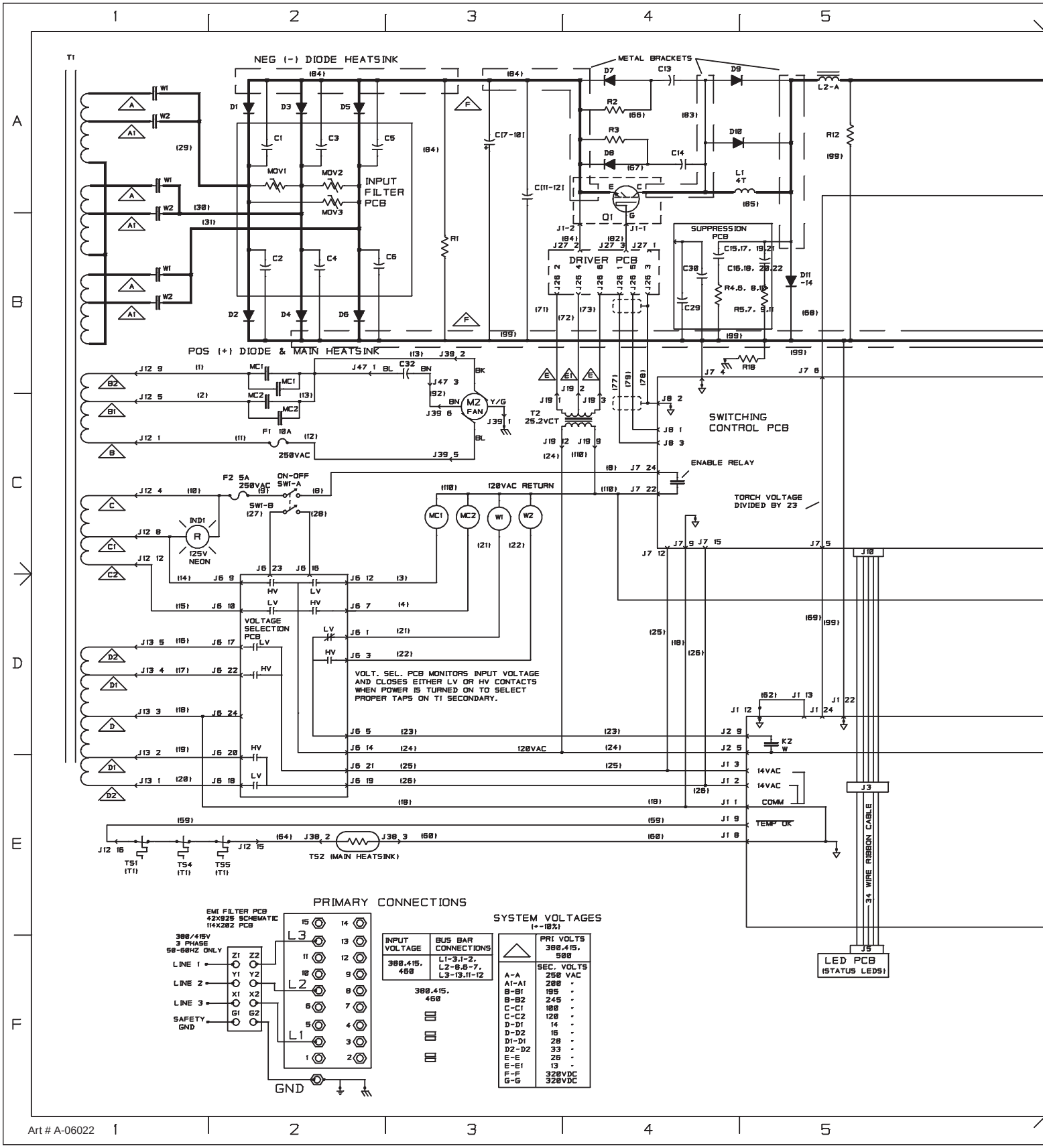
NOTE

System Schematic for units with 'AG' on the data tag.



APPENDIX 16: SYSTEM SCHEMATIC - Unit Rev 'AH' or later



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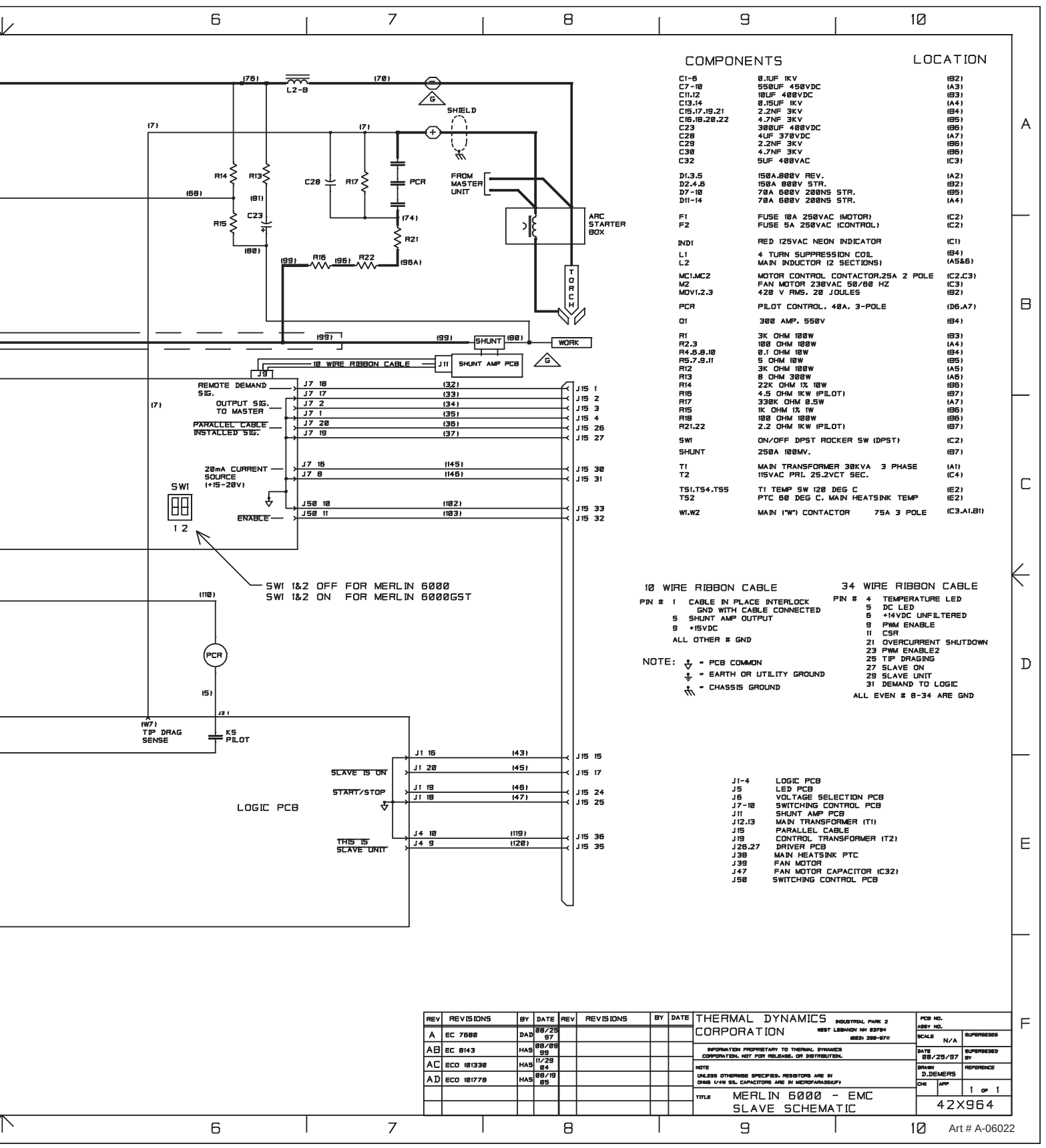

COMPONENTS / LOCATION

C1-6	0.1UF 1KV	(B2)
C7-10	550UF 450VDC	(A3)
C11.12	10UF 400VDC	(B3)
C13.14	0.15UF 1KV	(A4)
C15.17.19.21	2.2NF 3KV	(B4)
C16.18.20.22	4.7NF 3KV	(B5)
C23	300UF 400VDC	(B6)
C28	4UF 370VDC	(A7)
C29	2.2NF 3KV	(B6)
C30	4.7NF 3KV	(B6)
C32	5UF 400VAC	(C3)
D1.3.5	150A.800V REV.	(A2)
D2.4.6	150A 800V STR.	(B2)
D7-10	70A 600V 200NS STR.	(B5)
D11-14	70A 600V 200NS STR.	(A4)
F1	FUSE 10A 250VAC (MOTOR)	(C2)
F2	FUSE 5A 250VAC (CONTROL)	(C2)
IND1	RED 125VAC NEON INDICATOR	(C1)
L1	4 TURN SUPPRESSION COIL	(B4)
L2	MAIN INDUCTOR (2 SECTIONS)	(A5&6)
MC1.MC2	MOTOR CONTROL CONTACTOR.25A 2 POLE	(C2.C3)
M2	FAN MOTOR 230VAC 50/60 HZ	(C3)
MOV1.2.3	420 V RMS. 20 JOULES	(B2)
PCR	PILOT CONTROL. 40A. 3-POLE	(D6.A7)
Q1	300 AMP. 550V	(B4)
R1	3K OHM 100W	(B3)
R2.3	100 OHM 100W	(A4)
R4.5.8.10	0.1 OHM 10W	(B4)
R5.7.9.11	5 OHM 10W	(B5)
R12	3K OHM 100W	(A5)
R13	8 OHM 300W	(A6)
R14	22K OHM 1% 10W	(B6)
R16	4.5 OHM 1KW (PILOT)	(B7)
R17	330K OHM 0.5W	(A7)
R15	1K OHM 1% 1W	(B6)
R18	100 OHM 100W	(B6)
R21.22	2.2 OHM 1KW (PILOT)	(B7)
SW1	ON/OFF DPST ROCKER SW (DPST)	(C2)
SHUNT	250A 100MV.	(B7)
T1	MAIN TRANSFORMER 30KVA 3 PHASE	(A1)
T2	115VAC PRI. 25.2VCT SEC.	(C4)
TS1.TS4.TS5	T1 TEMP SW 120 DEG C	(E2)
TS2	PTC 60 DEG C. MAIN HEATSINK TEMP	(E2)
W1.W2	MAIN ("W") CONTACTOR 75A 3 POLE	(C3.A1.B1)

10 WIRE RIBBON CABLE

PIN # 1 CABLE IN PLACE INTERLOCK GND WITH CABLE CONNECTED
5 SHUNT AMP OUTPUT
9 +15VDC
ALL OTHER # GND

NOTE: = PCB COMMON
= EARTH OR UTILITY GROUND
= CHASSIS GROUND

34 WIRE RIBBON CABLE

PIN # 4 TEMPERATURE LED
5 DC LED
8 +14VDC UNFILTERED
9 PWM ENABLE
11 CSR
21 OVERCURRENT SHUTDOWN
23 PWM ENABLE2
25 TIP DRAGING
27 SLAVE ON
29 SLAVE UNIT
31 DEMAND TO LOGIC
ALL EVEN # 8-34 ARE GND

J1-4	LOGIC PCB
J5	LED PCB
J6	VOLTAGE SELECTION PCB
J7-10	SWITCHING CONTROL PCB
J11	SHUNT AMP PCB
J12.13	MAIN TRANSFORMER (T1)
J15	PARALLEL CABLE
J19	CONTROL TRANSFORMER (T2)
J26.27	DRIVER PCB
J38	MAIN HEATSINK PTC
J39	FAN MOTOR
J47	FAN MOTOR CAPACITOR (C32)
J50	SWITCHING CONTROL PCB

REV	REVISIONS	BY	DATE
A	EC 7888	DAD	08/25 97
AB	EC 8143	HAS	08/05 98
AC	ECO 181338	HAS	11/29 04
AD	ECO 181778	HAS	08/19 05

THERMAL DYNAMICS CORPORATION
INDUSTRIAL PARK 2 WEST LEBANON NH 03784 (603) 298-5711

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NOTE: UNLESS OTHERWISE SPECIFIED, RESISTORS ARE IN OHMS 1/4W 5%. CAPACITORS ARE IN MICROFARADS(UF)

TITLE: MERLIN 6000 - EMC SLAVE SCHEMATIC

PCB NO.
ASSY NO.
SCALE N/A
SUPERSEDES
DATE 08/25/97
SUPERSEDED BY
DRAWN D.DEMERS
CHK
APP
REFERENCE
1 OF 1

42X964

Art # A-06022