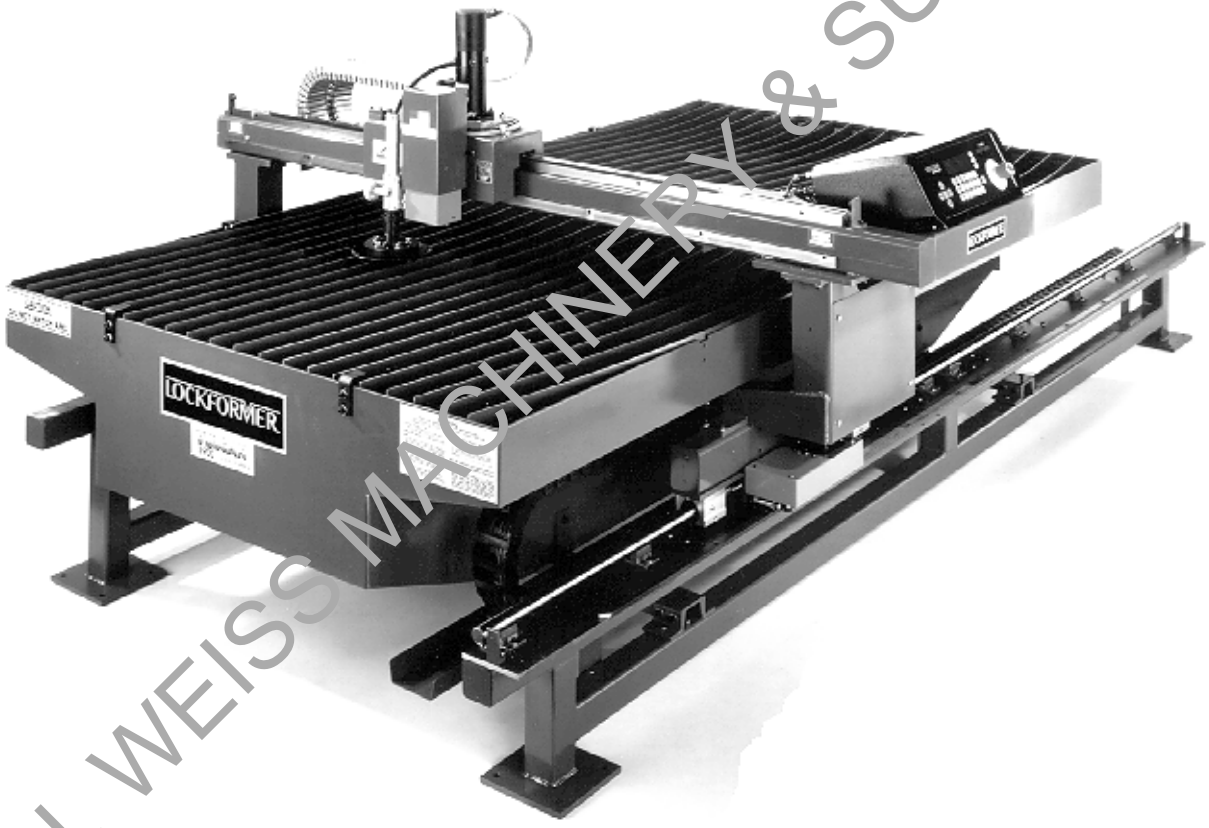
Vulcan
CUTTING SYSTEMS

OPERATORS MANUAL

MODEL 2900



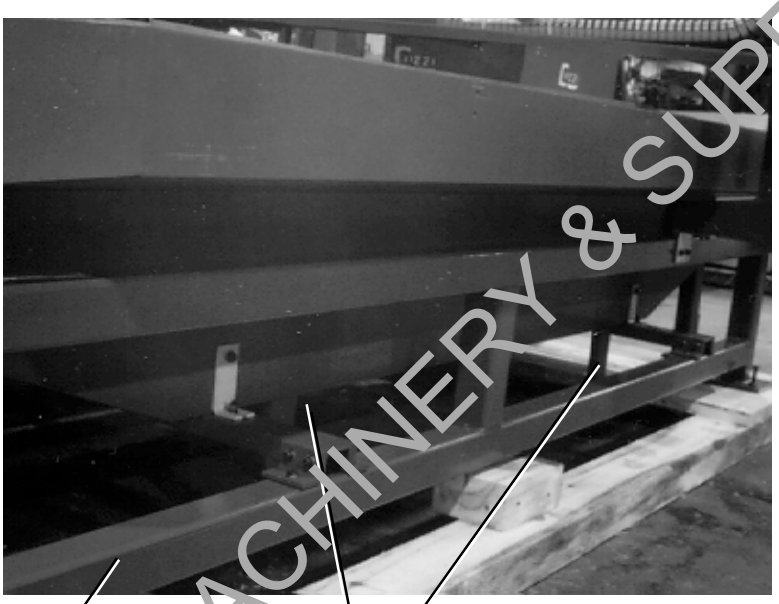
LOCKFORMER
711 OGDEN AVE. LISLE IL. 60535-1399 PHONE 630-964-8000 FAX 630-964-5685

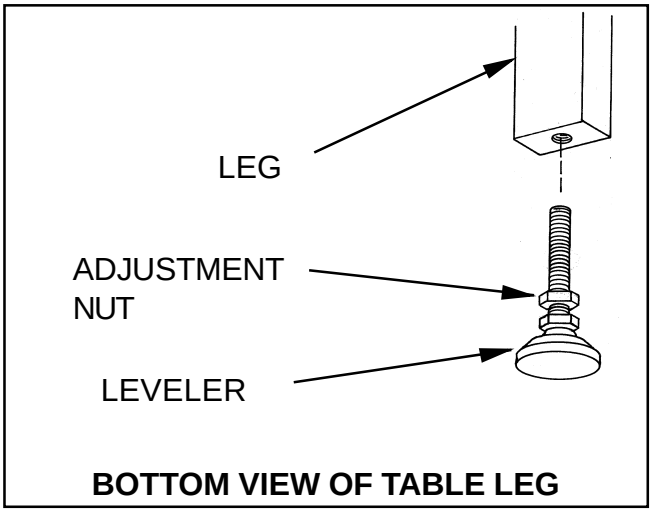
REV 08-98

INSTALLING THE TABLE LEVELERS

The underside of each of the inner legs of the Vulcan table has a 1/2-13 tapped hole. Four leveler pads have been furnished with the table. BEFORE REMOVING THE TABLE FROM THE SHIPPING SKIDS completely thread the adjustment nut as shown in the illustration, then fully thread a leveler into each leg.

DO NOT ANCHOR THE TABLE TO THE FLOOR. A Lockformer installation technician will level the equipment and secure it to the floor.





BOTTOM VIEW OF TABLE LEG

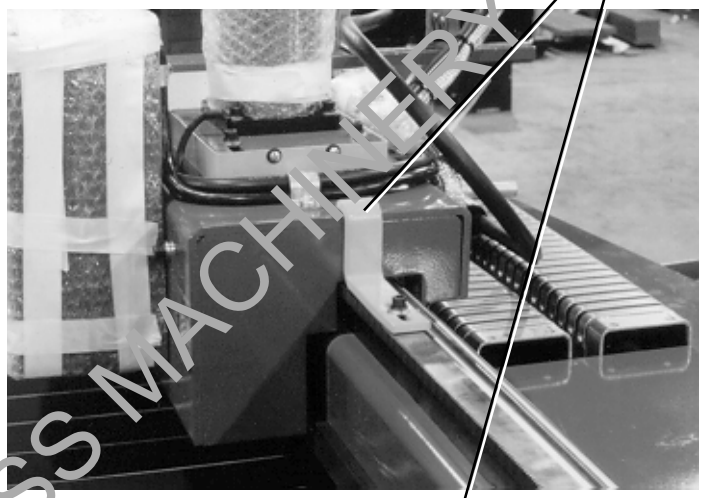
SHIPPING BRACKET REMOVAL

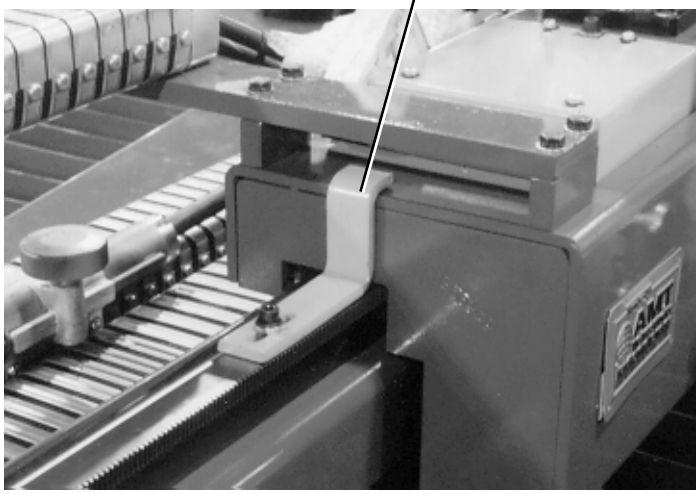
IMPORTANT!

REMOVE THE STEEL ANGLE BRACKETS (YELLOW) SHOWN IN THE PHOTOS BELOW BEFORE ATTEMPTING TO OPERATE YOUR VULCAN MACHINE. THESE ITEMS WERE USED TO SECURE THE MACHINE DURING SHIPPING.

REPLACE THE TWO SOCKET HEAD CAP SCREWS SECURING THE BRACKETS ON THE CARRIAGE WITH THE SHCS IN THE BAG ATTACHED TO THE TORCH HEAD (ALLEN WRENCH INCLUDED).

REMOVE THESE BRACKETS



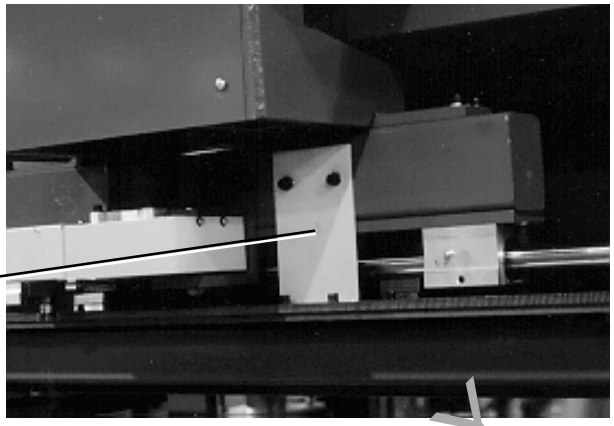


BRACKET REMOVAL CONT.

REMOVE THESE YELLOW BRACKETS BEFORE REMOVING TABLE.

THESE BRACKETS ARE FOUND ON BOTH SIDES OF THE VULCAN MACHINE.

BRACKET REMOVAL CONT.



REMOVE THIS BRACKET
BEFORE OPERATING THIS
MACHINE

WHEEL SIDE OF CARRIAGE
SHIPPING BRACKET REMOVAL

1. Position an appropriate, safe jacking device and carefully lift the carriage enough to take the weight off of the yellow shipping bracket.
2. Remove the bracket by removing the four mounting screws (B).
3. Lower the carriage.

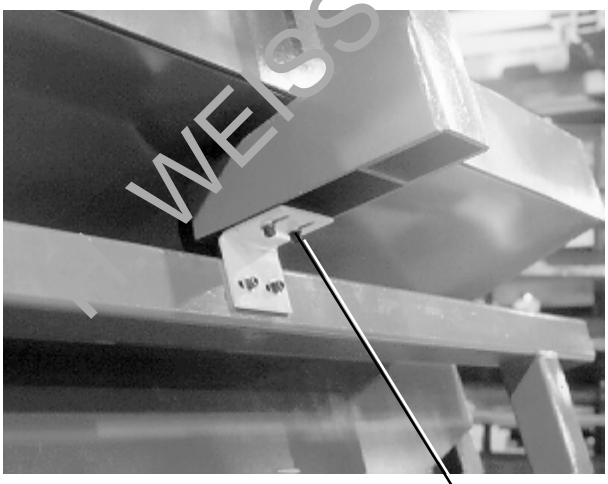


PHOTO 1

(B)

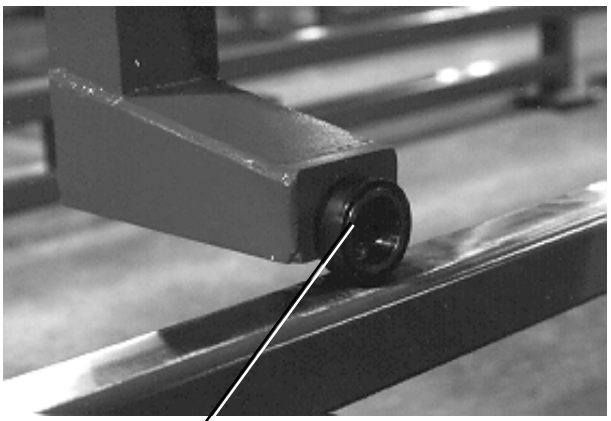


PHOTO 2

WHEEL

SAFETY INFORMATION

YOU ARE NOT READY TO OPERATE THIS EQUIPMENT IF YOU HAVE NOT READ AND UNDERSTOOD THE SAFETY INFORMATION IN THIS MANUAL.

SAFETY FIRST! All Personnel working with or near the Vulcan must read this section!

In addition to the following guidelines, refer to Sections 1, 2, and 3 of this manual for additional safety information.

The Vulcan Plasma Arc Cutting System can be used with complete safety by its operator and any persons in the immediate area, but personnel must take precautions against light, heat, radiation, fumes, and noise produced by the Vulcan while performing plasma cutting operations. Everyone who works with or near this machine must familiarize themselves with possible hazards and the simple, effective means explained below to avoid them! Pay close attention to the following Guidelines and the Vulcan will provide cost efficient service with minimal risk to personnel:

TERM DESCRIPTION

CAUTION: Hazards or unsafe practices which could result in minor personal injury, and product or property damage.

WARNING: Hazards or unsafe practices which could result in severe personal injury or death.

DANGER: Immediate hazards which will result in severe personal injury or death.

The words "should" and "must" as used in this manual shall have the following meaning; the use of should means we strongly suggest that the instruction be followed. The use of must means that the instruction is mandatory for the safety of equipment and personnel.

INSTANT-ON TORCHES - The machine torch is an instant-on torch. These torches fire (produce a plasma arc) immediately after torch switch closure or remote switch closure for a machine torch. Always stand away from the torch as a precaution against accidental torch firing. Be aware of this hazardous potential; failure to do so can result in serious bodily injury.

EMERGENCY STOP switch shuts off power to all parts of machine except plasma unit. The torch will stop cutting, but its power will still be active, so throw the main DISCONNECT switch to cut all power!

CARRIAGE MOVEMENT - The carriage on which the Plasma Cutting Torch is mounted moves with firm, steady force and can injure anyone in its path. It can travel the entire length of the table (this is the Y axis). The torch unit also travels across the carriage when cutting (X axis). Keep this path clear. Stand back from the moveable parts of the machine when it is in operation, or about to be started. NOTE: When used in this manual, the term "machine" will refer to the carriage only. Other sections of the Vulcan will be described by their specific name and listed separately.

BURN SAFETY - Intense ultraviolet light, sparks, and hot metal produced by plasma arc cutting will harm either exposed skin or eyes. Operators and nearby personnel must wear protective clothing and equipment to avoid hazards.

Eyes Safety - Wear tinted safety goggles, goggles with side shields, or a welding helmet to protect eyes. Refer to the chart for recommended lens or shield shade;

Arc Current	Lens/Shield Shade
Up to 100 Amps	Shade No. 8
100-200 Amps	Shade No. 10
200-300 Amps	Shade No. 12
Over 400 Amps	Shade No. 14

Do not use eyewear with broken or pitted lenses or covers. Replace at once.

Post warnings and inform other people in the area not to look directly at the arc unless wearing glasses, goggles, or a helmet.

The Vulcan Operating Area should be adapted to reduce reflection and transmission of ultraviolet light. Install protective screens or curtains to reduce ultraviolet transmissions. Paint walls and other surfaces with dark colors to reduce reflection.

Skin Safety - Always wear protective clothing including, but not exclusive to, gauntlet gloves, safety shoes, and head covering.

Flame retardant clothing with cuffless trousers to shield body from sparks and slag is strongly suggested.

After cutting, sheet edges and the cutting table are dangerously sharp and hot. To avoid cuts and burns, use heavy gloves to handle pieces during removal.

Do not touch the front of the torch when starting it. After cutting, allow time for the front of the torch to cool.

Qualified first-aid personnel and facilities should be available at or near any Vulcan site to treat accidental eye and skin burns at once.

FUME HAZARDS AND PRECAUTIONS - Plasma Arc Cutting vaporizes metals <u>into toxic gases</u>, so constant ventilation and precautions regarding exposure to the operator or any persons near the Vulcan <u>are absolutely necessary</u>! <u>An appropriate ventilation system</u>, designed to safely withdraw toxic fumes from the area, <u>must</u> be installed and used whenever the Vulcan is operated. <u>Do not</u> use the Vulcan in a confined space unless a safe ventilation system and an operators fresh air supply is present and working properly! Refer to Section 1, Preliminary Installation for details about necessary initial ventilation setups.

Be sure to activate the ventilation system <u>before</u> starting the Torch. Periodically check to see that the vent system continues to remove air efficiently! To ensure that it pulls with its greatest force during cutting, always cover the table top(s) completely, so air can only flow through a small area to force gases into the 12" vent hole. If sheets smaller than 5 x 10' are used, cover excess space on table top(s) with scrap metal.

Do not cut containers with toxic materials inside or containers that have held toxic materials. Clean such containers thoroughly before cutting.

Stock containing or coated with significant percentages of beryllium, cadmium, lead, mercury, or zinc can all give off poison fumes when burned by plasma arc cutting. Do not cut this stock unless the operator, or anyone else subjected to the fumes, wears respiratory equipment or an air supplied helmet, or the table ventilation system is working efficiently.

Wear a proper breathing mask and use proper ventilation when cutting galvanized metal.

EXTREME CAUTION! Various chlorinated solvents decompose and can turn to lethal phosgene gas when exposed to ultraviolet radiation caused by plasma cutting. Do not use such solvents on stock to be cut by the Vulcan. Ask your vendor about suspect solvent formulas. Do not keep these or any degreasing agents near the Plasma Arc Cutting System.

FIRE HAZARDS AND PRECAUTIONS - Heat, sparks and slag produced by plasma cutting of metal can cause explosions or fire. Keep fire extinguishers within the immediate Vulcan area. Do not leave any combustible matter within 35 ft. (10 meters) of the Vulcan site!

It is strongly recommended that containers used for poisonous or explosive substances never be plasma cut.

Be sure the Vulcan area ventilation system works properly. Never start the Vulcan as long as air around it is laden with flammable/explosive agents such as dust, gasoline or other flammable gas, or combustible liquid vapors. Let the vent system remove such substances first!

Quench freshly cut metal in water or allow metal to cool after cutting, before handling it, or letting any combustible substances nearby that might be ignited by its heat.

ELECTRICAL HAZARDS AND PRECAUTIONS

Primary Safety Directive - To perform any maintenance or do any work with the machine's electrical components, always disconnect the main switch to cut power entirely from all parts or the Vulcan, to avoid the dangers of electrocution.

Because plasma cutting requires greater (open circuit) voltage than ordinary welding, up to 300 VDC, greater precautions against electrocution must be used while cutting.

Input Connections (Refer also to Section 1, Preliminary Machine Installation)

Install a wall-mounted line disconnect switch as close to the plasma unit power supply as possible and fuse it according to local electrical codes. This switch allows the operator to turn the power supply off quickly in an emergency situation.

Conform to all national, state, and local electrical codes for primary wiring sizes and types.

Be sure that input conductors are of proper size to carry Plasma Unit's rated current.

Primary power cable must have a minimum 600 v. rating.

Do not use the system with a damaged power cord. Inspect the primary power cord frequently for damage or cracking of the cover. **EXPOSED WIRING CAN KILL!!** If a power cord is damaged, replace it immediately.

Inspect the torch leads. Replace if frayed or damaged.

Never operate the plasma system unless the power supply unit covers are in place. Exposed power supply connections present a severe electrical hazard.

Do not touch the workpiece, including the waste cutoff, while you cut. Leave the workpiece in place or on the workbench with the work cable attached while cutting.

Before changing the torch parts, disconnect the main power or unplug the power supply. After changing the torch parts and returning the retaining cap to its operating position, plug the power supply in again.

Never bypass or shortcut the safety interlocks.

Before removing a power supply cover for maintenance, disconnect the main power at the wall disconnect switch or unplug the power supply. To avoid exposure to severe electrical hazard, wait five minutes after disconnecting the main power to allow capacitors to discharge.

Wear insulated gloves and boots to maintain proper insulation against electrical shock. If you must work in or near a damp area, use extreme caution.

Check cable often for any cracking or peeling of covers and replace defective wiring IMMEDIATELY!

NOTE! To avoid a tripping hazard, it is suggested that bright Safety Tape be put around the ground rod and any cable that must lay in a space where people walk.

NOTE! Personal Protection - Keep your body and clothing dry. Do not operate the Vulcan in a wet or damp environment without proper insulation against ELECTROCUTION! Do not stand, sit, or otherwise be in any contact with water while operating machine or ELECTROCUTION may result!

Do not operate the Vulcan if any of its electrical cables, torch leads, or the torch itself is damaged. Do not attempt any maintenance to the Vulcan, including service to torch, plasma unit, or power supply, without first disconnecting power from machine entirely by shutting off the main disconnect!

EXPLOSION PREVENTION - WARNING: The plasma system uses compressed gas. Observe proper precautions when handling and using compressed gas equipment and cylinders. Refer to the Index at the end of this section.

When cutting with the plasma system, do not cut in atmospheres containing explosive dust or vapors. Do not cut pressurized cylinders or any closed container.

Compressed Gas Cylinders - Be certain to take correct precautions when handling and operating compressed gas equipment and cylinders.

Handle and use any compressed gas cylinder in strict accordance with safety standards such as published by the Compressed Gas Association in Arlington, VA. (CGA), American Welding Society in Miami, Fla. (AWS), and the Canadian Standards Association in Ontario, Canada (CSA).

Do not move a cylinder unless its protective valve cover is in place. Do not use a cylinder unless it is secured in place, upright.

Do not use a cylinder that leaks or is otherwise physically damaged. Do not use hammers or any other implement to force a stuck valve open. Return cylinders with any such defects to supplier.

Do not lubricate cylinder valve(s) with oil or grease.

Never move or transport a cylinder without the protective valve cover in place.

Do not use a cylinder or its contents for any other purpose than that for which it was designed.

Do not allow a cylinder near electrical hazards such as welding arcs, or expose cylinder to an open flame or excessive heat, sparks, or slag of any kind, which can cause rupture or explosion.

Hose - Label and color-code all gas hoses in order to clearly identify the type of gas in each hose. Consult applicable national, state, or local codes.

Never use an oxygen hose for any gas other than oxygen.

Use the shortest possible lengths of hose to avoid damage, reduce pressure drop, and prevent possible volume flow restriction. Let the hose lie as straight as possible to prevent kinks when interconnecting system components. Coil excess hose and place it out of the way to prevent damage and to eliminate tripping danger.

Check hose regularly for wear, leaks, loose connections, or any damage from heat, flame or sparks. Immediately replace damaged or unreliable hose!

Pressure Regulators - Maintain all pressure regulators used on the Plasma Unit of the Vulcan in proper working order to avoid failure and danger to operating personnel. Do not use any regulator that leaks, creeps excessively or is otherwise damaged. It is strongly recommended that any malfunctioning equipment be serviced only by trained technicians, at it's manufacturer's designated facility.

Do not lubricate regulator(s) with oil or grease and do not use a regulator for any gas other than that for which it was designed.

NOISE PREVENTION - The plasma cutting process can generate high levels of noise. Depending on the arc current, material being cut, acoustics, and size of the cutting room, distance from the torch and other factors, acceptable noise levels as defined by national, state, or local codes may be exceeded by your plasma system.

GROUNDING - Before operating the plasma system:
Input Power - Be sure the power cord is plugged into a properly grounded outlet or that the power cord ground wire is properly connected to the ground in the disconnect box. If installation of the plasma system involves connecting a power cord to the power supply, ensure that the power cord ground wire is properly connected. Conform to national, state, and local standard when fastening the power ground wire to the power supply chassis. CSA standards recommends placing the power cord ground wire on the stud first; then place the other wires on top of the power cord ground. Fasten the retaining nut tightly.

Make sure that all electrical connections are tight to avoid excessive heating.

Input Power - Connect Ground Lead of power input cable to both electrical system ground in disconnect box, and to ground stud in Plasma Unit power supply. Be certain all ground lugs are large enough to carry rated current load and make all connections tight to prevent resistance heating.

Output Power - Connect all positive output ground leads to cutting table Star Ground (referred to, and illustrated in Section 1). Connect Star Ground to reliable Earth Ground. Refer to National Electrical Code Grounding Electrode System or other appropriate source for suitable Ground specifications.

Work Table - Clamp the work cable with good metal-to-metal contact to the workpiece (not the portion that will fall away) or to the work table.

Connect the work table to a good earth ground. Consult the U.S. National Electrical Code, Article 250, Section H *Grounding Electrode System*, or other appropriate national, state, or local codes.

For additional information, refer to the Index at the end of this section.

ELECTRIC AND MAGNETIC FIELDS (EMF)
Plasma arc cutting and gouging systems create electric and magnetic fields that may interfere with the correct operation of electronic health support equipment, such as pacemakers or hearing aids. Any person who wears a pacemaker or hearing aid should consult a doctor before operating or being near any plasma system when it is in use. To minimize exposure to EMF: (1) Keep both the work

cable and the torch lead on one side of your body. Keep your body from coming in between the torch lead and the work cable. (2) Keep distance of work cable to workpiece as short as possible to eliminate loop areas. (3) Route torch leads as close as possible to work cable. (4) Do not wrap the torch lead or work cable around your body. (5) Stay as far away from power source as possible.

SAFETY DEVICES - The Plasma Units used on Vulcan have safety interlocks to prevent danger to personnel and damage to machine. Do not try to short out or override these interlocks! Check interlocks and all safety related parts of Plasma Unit frequently and replace them IMMEDIATELY if they are not working!

The interlocks turn off the power supply when the retaining cap is loosened.

Never bypass or shortcut the safety interlocks on any of the plasma system units.

Do not use the Plasma Unit unless all of its power supply covers are in place; failure to do so will ENDANGER the operator and other persons near the machine and it will interfere with cooling of vital parts of Unit, which can be damaged as a result.

Be certain that all electrical connections are covered with appropriate insulation material. Cracked insulation must be replaced!

Each plasma unit is designed to be used only with specific Vulcan torches. Do not substitute other torches which could overheat and present a potentially dangerous situation to the operator and any personnel in the area.

PUBLICATION INDEX

The Publication Index contains a list of publications dealing with plasma arc cutting equipment safety practices.

1. American National Standards Institute, 1430 Broadway, New York, NY 10018 (212) 354-3300.

ANSI Standard Z41.1, *Standard for Men's Safety-Toe Footwear*
ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*
ANSI Standard Z88.2, *Practices for Respiratory Protections*
ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection*

2. American Welding Society, 550 LeJeune Road, P.O. Box 351020, Miami, FL 33135 (305) 443-9353.

ANSI Standard Z49.1, *Safety in Welding and Cutting*
AWS Standard A6.0, *Welding and Cutting Containers Which Have Held Combustibles*
AWS Standard F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping that Have Held Hazardous Substances*

3. National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210 (617) 770-3000.

NFPA Standard 51, *Oxygen - Fuel Gas Systems for Welding and Cutting*
NFPA Standard 70-1978, *National Electrical Code*
NFPA Standard 51B, *Cutting and Welding Processes*

4. Superintendent of Documents, U.S. Government Printing Office, North Capitol Street, Washington, D.C. 20402 (202) 783-3238.

NIOSH, *Safety and Health in Arc Welding and Gas Welding and Cutting*
OSHA, *Safety and Health Standards*, 29FR 1910

5. Canadian Standards Association Standard Sales, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada (416) 747-4000.

CSA Standard W117.2, *Code for Safety in Welding and Cutting*
Canadian Electrical Code Part 1, *Safety Standards for Electrical Installations*

6. Compressed Gas Association, 1235 Jefferson Highway, Arlington, VA 22202 (703) 979-0900.

CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders*

7. National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103 (215) 564-3484.

NWSA booklet, *Welding Safety Bibliography*

THIS SAFETY ALERT SYMBOL INDICATED IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

WARNING

BEFORE ANY MACHINE IS USED BY AN EMPLOYEE OR IS LOANED OR RENTED, MAKE ABSOLUTELY CERTAIN THAT THE OPERATOR(S) PRIOR TO OPERATING:

1. IS INSTRUCTED IN SAFE AND PROPER USE.
2. REVIEWS AND UNDERSTANDS THE MANUAL(S) PERTAINING TO THE MACHINE.

IT IS THE USER'S RESPONSIBILITY TO UNDERSTAND AND FOLLOW THE MANUFACTURER'S INSTRUCTIONS ON MACHINE OPERATION AND MAINTENANCE, AND TO OBSERVE ALL PERTINENT LAWS AND REGULATIONS.

YOU ARE NOT READY TO OPERATE THIS EQUIPMENT UNTIL YOU HAVE READ AND UNDERSTOOD THE SAFETY INFORMATION IN THIS MANUAL.

REMEMBER, A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT. GIVE COMPLETE AND UNDIVIDED ATTENTION TO THE JOB AT HAND.

WARNING, DO NOT WEAR LOOSE CLOTHING, JEWELRY, OR UNRESTRAINED HAIR OR BEARD STYLES WHICH MAY CATCH IN MOVING PARTS.

WARNING, THE OPERATOR MUST HAVE AUXILIARY OPERATING PERSONNEL CLEARLY WITHIN HIS FIELD OF VISION AT ALL TIMES!

WARNING, DO NOT HANDLE MATERIAL (COIL, SHEET OR BLANK) WITHOUT WEARING PROTECTIVE GLOVES.

WARNING, NARROW OR UNSTABLE COILS MUST NOT BE TRANSPORTED WITHOUT THE AID OF BLOCKING AND/OR SIDE SUPPORTS

DANGER, COILS MUST NEVER BE CARRIED OVER THE HEADS OF OTHER EMPLOYEES.

WARNING, KEEP LIQUIDS (SOLVENTS, LUBRICANTS, ETC.) AWAY FROM ELECTRICAL EQUIPMENT.

WARNING, YOU MUST NEVER DISCONNECT OR REMOVE ANY SAFETY DEVICE OR OPERATE ANY MACHINE WHO'S SAFETY DEVICES HAVE BEEN DISCONNECTED OR REMOVED.

DANGER, DISCONNECT AND LOCK OUT ALL POWER SOURCES BEFORE INITIATING ANY REPAIRS.

WARNING, IMPROPER OPERATION OF THIS MACHINE MAY CAUSE DAMAGE TO THE MACHINE AND/OR PERSONAL INJURY TO THE OPERATOR AND NEARBY PERSONNEL.

WARNING, HYDRAULIC SYSTEMS ARE HIGHLY PRESSURIZED. ESCAPING HYDRAULIC OIL, EVEN AN INVISIBLE PINHOLE LEAK, CAN PENETRATE BODY TISSUES CAUSING SERIOUS INJURY. WHEN LOOKING FOR LEAKS, USE A PIECE OF WOOD OR CARDBOARD. (NEVER USE THE HANDS OR ANY OTHER PART OF THE BODY)

WARNING, IF ANY PART OF THIS MACHINE SHOULD BECOME OVER LUBRICATED AND LUBRICANT SPILLS OVER OR BUILDS UP, IT SHOULD BE CLEANED UP IMMEDIATELY, SO AS NOT TO HINDER THE PROPER OPERATION OF THE MACHINE OR ENDANGER OTHER PERSONNEL.

WARNING, DO NOT OPERATE ANY EQUIPMENT WITHOUT GUARDS AND COVERS INSTALLED IN PLACE.

WARNING, KEEP THE WORK AREA CLEAR OF OBSTRUCTIONS AND THE FLOOR CLEAN AND DRY.

WARNING, NEVER USE STOOLS, BOXES, CRATES OR SIMILAR ITEMS AS SUBSTITUTES FOR WORK PLATFORMS, SCAFFOLDING OR LADDERS.

WARNING, DO NOT OPERATE ANY EQUIPMENT WHICH HAS LOOSE, WORN, OR BROKEN PARTS.

WARNING, BEFORE PERFORMING ANY MAINTENANCE ON THIS MACHINE, BE SURE THAT THE MAIN DISCONNECT SWITCH IS SHUT OFF AND LOCKED IN PLACE.

WARNING, DO NOT OVERLOAD EQUIPMENT BEYOND IT'S STATED OR IMPLIED CAPACITIES.

DANGER, YOU MUST NEVER CHECK DIMENSIONS OF WORKPIECE WHILE EQUIPMENT IS OPERATING.

The Lockformer Company,
711 Ogden Ave., Lisle, Ill. 60532 (630) 964-8000

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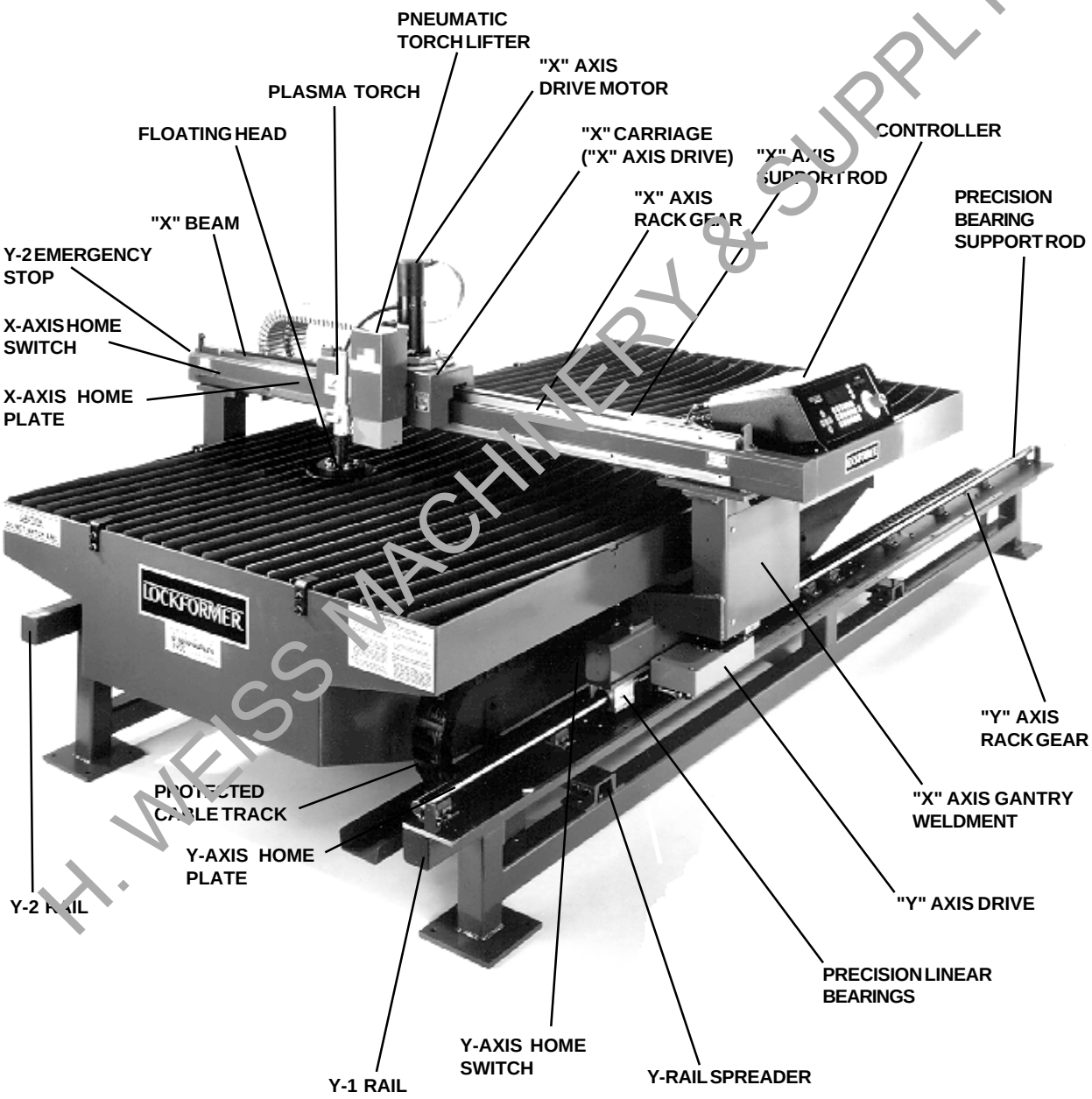


SECTION 1

PRELIMINARY MACHINE INSTALLATION

1. Safety
2. Uncrating
3. Location of Machine
4. Checklist for Rail System
5. Drive Rack
6. Grounding Procedure / Power Supply
7. Ventilation
8. Fiber Optic Cable Reference

The following information outlines the factory procedures for preliminary installation of the Lockformer Vulcan Cutting Machine. Appropriate Lockformer reference and assembly drawings accompany this manual as section 4.

1. SAFETY - Voltages used on this machine are potentially hazardous. Therefore, all equipment must be installed and maintained in accordance with local requirements and National Electrical Codes. Also see the SAFETY FIRST section of this manual.

2. UNCRATING - The machine's crating should ensure that all components arrive in good order, but as the assemblies are uncrated, check all contents with the packing list for possible damage from shipping. If anything shows up missing, or damaged, notify the carrier in writing at once. It is the responsibility of the receiver to file any claims for damage against the carrier. As each assembly or detail is unpacked, it should be placed in a suitable dry area and have its preservative removed by use of a nontoxic fluid. Avoid the use of trichlorethylene or perchloroethylene, and ensure that the cleaning area is well ventilated.

3. LOCATION OF MACHINE - The Vulcan needs a floor space where vibration is at an absolute minimum. Precision operation is necessary for accurate cutting, thus avoid areas where the transmission of any heavy vibration, (from trucks, factory equipment, etc.) may occur nearby.

Choose a site for the Vulcan near gas and electrical outlets, and if possible, near any related production lines, for manufacturing efficiency. Material handling is also important, so be sure to provide space for stockpiling material and moving it by hoist, truck, or other means. Adequate lighting and ventilation must be available for safety reasons, as noted in the safety material.

Machine Grounding - Connect and maintain good electrical grounds to supply ground wire and machine rail. Do not ground to electrical conduit or pipes carrying gases or flammable liquids. Use only recommended sizes of electrical cable. See page 3 for details.

4. CHECKLIST FOR RAIL SYSTEM RAILS - The Machine is factory shipped with all Rails aligned correctly, but it is recommended that such alignments be rechecked after arrival and initial placement of machine at its permanent operating site.

To Check the Rails, perform the following steps:

1. Use the jacking screws on the pedestals to level table over each pedestal to within 1/32".

2. Level outboard table Guide Rail to within 1/32".

3. Use the leveling screws to level Guide Rail and Outboard Rail (crossways).

4. Straighten Guide Rail to within .005".

5. NOTE! This Step is for DUAL TABLE SETUPS Only: Check Rail joints; Rail ends must be in tight, positive contact and flush across top and sides of Guide Rail and top of outboard Rail.

6. Check Rail Spacing on X Axis, across carriage; if not 73" +/- 1/32", loosen outboard Rail and reposition it as required to set this dimension.

7. Recheck Steps 1 through 6.

8. Anchor the table(s) to floor securely with lag bolts. NOTE: Such fastening can only be performed after all alignments of machine are verified; then, customer must use any procedures desired to secure table, ensuring that Machine and its Rails remain stationary, which is vital.

5. DRIVE RACK - To ensure correct alignment of Machine's Drive Rack after shipment, perform the following:

1. Clamp a short piece of rack across the rack joint in order to check the correct tooth to tooth distance.

2. If the short piece you've used to set across the rack joints does not mesh smoothly, then, loosen the rack screws and reset the rack sections until the teeth of the short piece mesh across the joint.

3. Recheck the joint for proper alignment: it must be correct.

4. Be certain to retighten all screws on racks if adjustment was necessary.

Cable Set-Up (Also See SAFETY FIRST):

The cables for the Vulcan must be correctly installed and positioned for it to operate safely and efficiently.

The proper cable setup procedures are as follows:

1. Locate the Plasma Unit (consult Lockformer Service Department).

2. Use as short a power cord as is practical to connect the machine to its power supply. Do not use a cable that is too short - use one that leaves some slack so it cannot stretch or break during use. Do not coil the cables. Follow all applicable local, state, and national codes.

3. Route AC power wires to keep them away from any auxiliary power; this includes solenoids, control boxes, etc.

4. Route all Drive controls, tape/DNC/Remote and Encoder cables as far from Power leads as possible. If Plasma mode/fuel is being used, also route cables as far from Torch leads as possible.

5. Connect the Vulcan to an AC power source for its use exclusively. Do not operate any other machinery from the same power line as the Vulcan!

6. Be certain that no wire is placed where it can be affected by high frequency noise, or it may malfunction. Do not locate wires at random.

6. GROUNDING PROCEDURE / POWER SUPPLY - A Vulcan and its peripheral equipment must be properly grounded for safe, efficient operation of this system, which requires careful routing and connection of ground wires. Star Ground is the term used here to describe the method of focusing all of the System's ground wires by directing them all to same central tie point to an earth ground. Refer to accompanying Lockformer Assembly Drawings to assist in the correct arrangement of electrical connections for grounding. Figure # 1, which appears at the end of this section, is a Star Ground Assembly Drawing, showing suggested positioning for grounding wires.

Set up the grounding as follows:

a. Use the System's work table as the Star Ground tie point. Position the Star Ground lug as shown in Figure # 1, near Plasma supply and in close proximity to location of ground rod. NOTE! This ground rod must be installed according to the National Electrical Code Standards. See Safety First.

b. Install a copper ground rod (at least 8 ft. long and 1/2" in diameter) in close proximity to the STAR Ground, directly beneath it if possible.

NOTE! To avoid tripping on cable, it is suggested that bright Safety Tape be put around Ground Rod

and any cable that must be the space where people walk.

c. Connect the Star Ground to the ground rod with a stranded wire (minimum 2 AWG) This wire cannot be more than 4' long. Be sure each end of the wire is tightly secured to Ground and rod, respectively.

d. Connect the Green Wire; shipped secured to machine gusset, to the Star Ground point.

e. Attach a Ground wire (minimum 8 AWG) to each rail of cutting table, then bring these wires to the Star Ground point.

f. Clean any surfaces; to which either end of a ground wire will be connected, of any rust or grease, to ensure that all ground connections make the necessary intimate contact with the component; then connect all grounding wires, making sure all connections are tight. Use wire (minimum of 8 AWG) for grounding straps.

g. When using Plasma Mode, Torch leads should have a braided shield (included with shipment) with the braid connected to the earth ground at the Plasma Unit.

h. Shield the DNC/REMOTE (Fiber Optics) cables. Connect the shields to the chassis ground of the control and to the chassis ground of the reader.

i. For machine setups requiring rail extensions, connect a short ground wire between the 2 rails, where they butt together. Then move ground wires described in item (e) to the end of each extended Rail that is closest to Ground Rod.

NOTE: Supply power to machine through a shielded main power line. Do not use any sort of extension Cord.

The Controller and Drive System must both operate on the same 110 v. current line. The Vulcan Plasma Unit has been pre-wired for voltage ordered. Connect it to reliable sources of ordered voltage power.

7. VENTILATION - (see SAFETY, FIRST Foreword for additional information!) - To remove the toxic gases that are generated when metal is vaporized, a suction system with minimum. 3000-3500 cfm. exhaust draw must be installed on the cutting table through the 12" opening at the bottom of table.

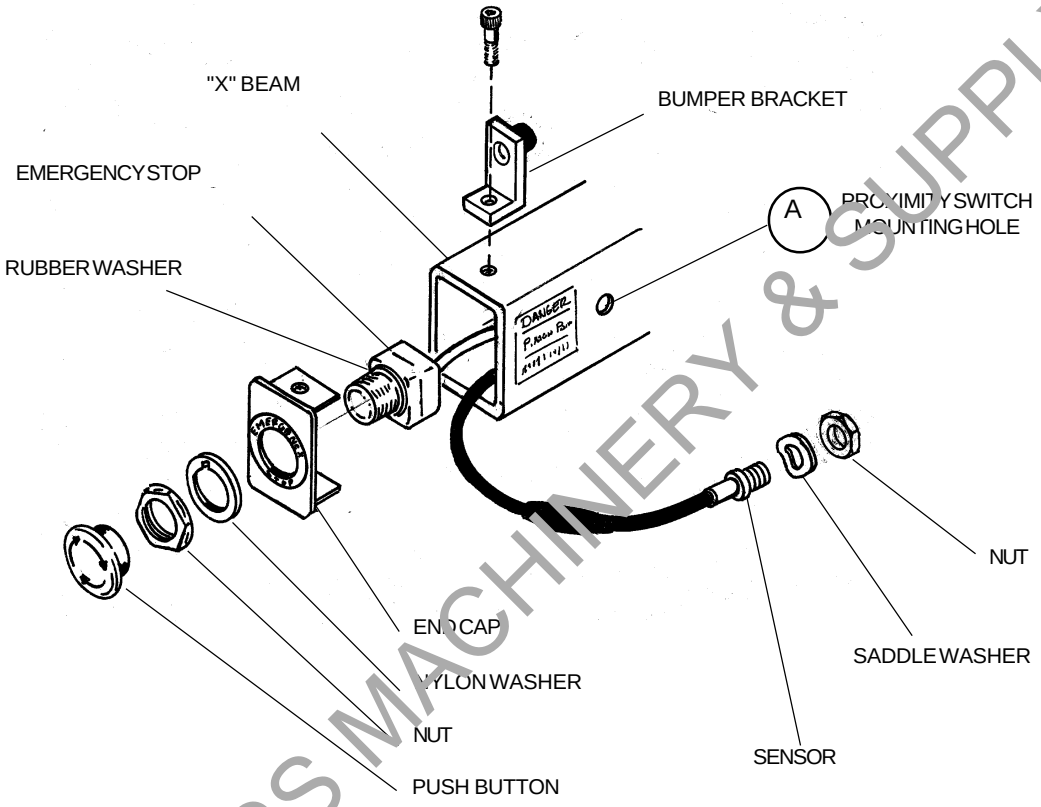
On 2 Table systems, install a switchable damper, so exhaust is drawn from the table in use (cutting will take place on only one table at a time). Limit switches may be used to activate appropriate table damper when needed.

8. FIBER OPTIC CABLE REFERENCE - For additional information on the setup and use of the Fiber Optic Cables over which the host Computer and Vulcan Controller communicate, please refer to Section number 5.

INSTALLATION OF THE PROXIMITY SWITCH AND EMERGENCY PUSHBUTTON.

Remove the bumper bracket and end cap from the carriage tubing. Remove the bag of components. Open the bag and remove its contents. Install the proximity switch back into the tubing and out through the mounting hole (A). Add the saddle washer and nut. The end of the sensor should be set to allow .062" clearance between it and its pickup block located on the carriage.
CAUTION ... APPROPRIATE CLEARANCE MUST BE PROVIDED OR DAMAGE WILL RESULT.

To install the emergency stop, refer to the accompanying illustration.



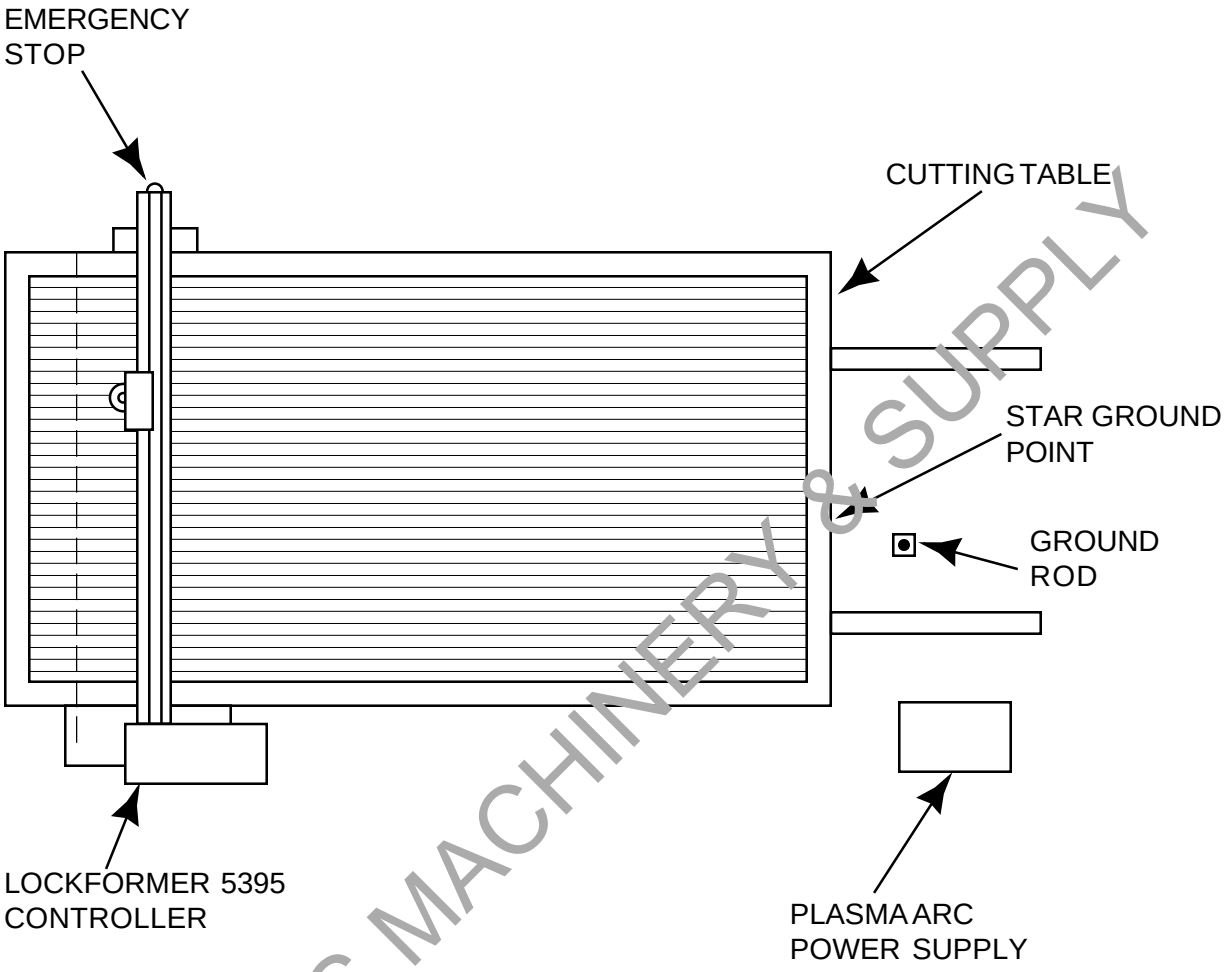


Figure 1

SECTION 2

OPERATION AND PROCEDURES

1. Loading the table with material
2. Control Power-On Procedure
3. Initial Torch/Head Set-Up Procedure
4. Emergency Stop
5. Plasma Unit Set-Up
6. Job Download
7. Exhaust Activation
8. Dry Run
9. Operation of Control During Cutting
10. Releasing a Job to Start a New Job
11. Lost Cut Recovery
12. Vulcan Download Quick Chart
13. Manual Data Input
14. Shape Library
15. Vulcan Operation Flow Chart

1. LOADING THE TABLE WITH MATERIAL

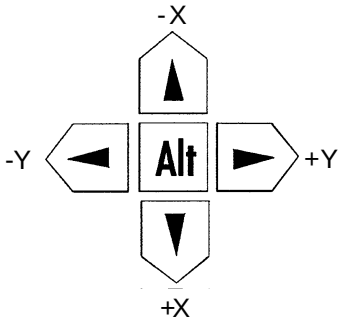
The material sheet size, gauge and type for the job will be shown on the *SHEET CUT LISTING*. This is the first page of the sheet report.

Position the first sheet to be cut against the metal stops which are located along the edge and at the end of the table. The metal stops should be level to or just below the height of the metal sheet. SEE ILLUSTRATION #1

2. CONTROL POWER-UP PROCEDURE

Turn the power on to the Lockformer 5395 controller using the main ON/OFF switch located at the rear. After the unit has completed the Power On Self Test (POST), release the Emergency stops; one emergency stop is located on the controller front panel and the other is mounted on the outboard side of the bridge. After the Emergency Stops have been released, press the DRIVES ON key to apply power to the drives. Then press AUTO ZERO to Home the machine to the coordinates (0,0) on the table. SEE ILLUSTRATION #1

Machine Jog: The machine jog keys are split off from the other keys and are positioned on the left side of the panel. Unlike the other panel keys, the jog keys (with exception to the ALT key) are pressure sensitive; the greater the force exerted on a key the faster the axis being jogged will move. When in jog mode, the screen display shows the current axis positions relative to (0,0). To return to the main menu press the ESC key.



JOG KEYS

Fast Jog Mode: If the operator needs to move the machine from one spot on the table to another, double clicking on the ALT key will activate the Fast Jog Mode. Pressing one of the jog keys will move the machine until it reaches one of the ends or F3 - Stop is pressed. The left direction jog key will move the machine to (0) along the Y-axis. The right direction jog key will move it to (120) along the Y-axis. The up direction key will move it to (0) on the X-axis. The down direction jog key will move it to (60) on the X-axis.

3. INITIAL TORCH/HEAD SET-UP PROCEDURE

The distance of the torch to the material is critical and must be checked prior to cutting the job and adjusted if necessary. The exact distance may vary according to material type and thickness. The Hypertherm operations manual provides the correct setting.

a. Jog the torch head to the set-up location. SEE ILLUSTRATION #1.

b. Lower the torch using the HEAD UP/DOWN key.

c. Loosen the two set screws located on the shield collar.

d. Loosen the two screws located on the Height Adjustment Knob assembly. The shield will now set flat on the work piece.

e. To lower or raise the torch in relation to the material, turn the height adjustment knob until the correct height is achieved, then tighten the two set screws.

f. Set "Gap B" to about 1/2" using the height adjustment knob, then tighten the two screws. SEE ILLUSTRATION #2

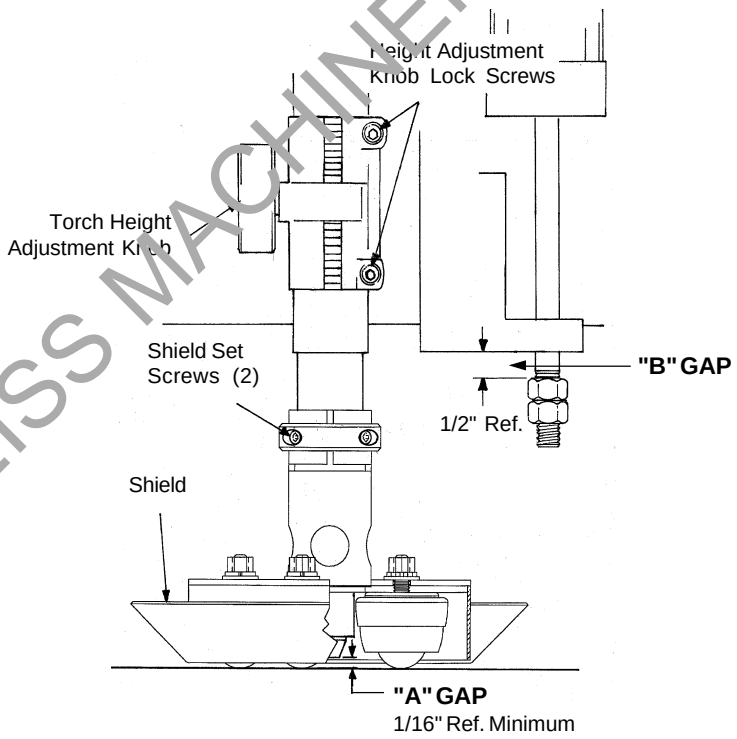


ILLUSTRATION 2

NOTE: Torch to work distance should never be less than 1/16"
Torch body should be square and plumb to workpiece.

After the torch height setup is complete, raise the torch by pressing HEAD UP/DOWN key. To relocate at (0,0) press the GO HOME key.

4. EMERGENCY STOP

The Emergency Stop circuit used on the Lockformer 5395 Controller meets Category 3 of International Safety Standards.

Press an Emergency Stop push button if any problems or irregularities occur. These buttons (one located on the controller, and one located on the far side of the bridge) will disable all operations of the Vulcan Cutting Machine.

Pressing the Emergency Stop push buttons will cause the following:

all power to be removed from the drives immediately
all outputs to be disabled (plasma torch will be turned off)

To restart the machine after an Emergency Stop shutdown:

release the Emergency Stop push button
press the DRIVES ON key
press the AUTO ZERO key to home the machine to (0,0)

5. PLASMA UNIT SET-UP

NOTE: The gas (air) supply should be clean, dry, and free of oil to ensure maximum consumable life.

A three stage filter assembly is recommended to filter the gas (air). CONTACT LOCKFORMER SERVICE DEPARTMENT FOR DETAILS.

Before applying power to the Plasma unit, verify that the input gas (air) pressure is set according to the figure as shown in the Hypertherm operations manual.

After connecting power to the unit, set the main switch to the ON position.

Set switch on plasma unit to TEST to allow gas to flow through the torch.

Adjust the gas pressure regulator on the Hypertherm unit for the setting specified in the Hypertherm manual.

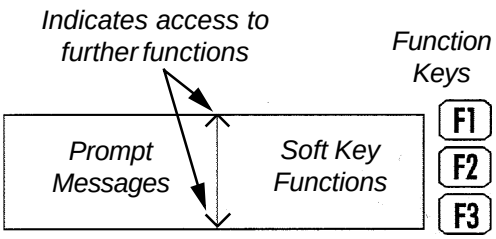
NOTE: For systems using 50 ft long lead sets add 5 psi to the figure specified in the manual.

Adjust the amperage knob on the plasma unit to the setting specified in the Hypertherm manual.

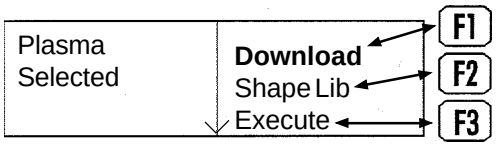
6. JOB DOWNLOAD

Lockformer 5395 Control Overview

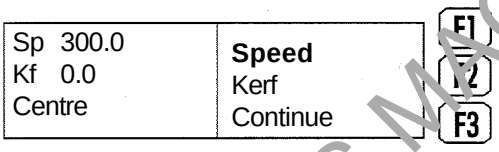
The display screen on the Lockformer 5395 control is a four line backlit graphics display and is used to present status and prompt information to the operator and at the same time provide soft key functionality with the keypad.



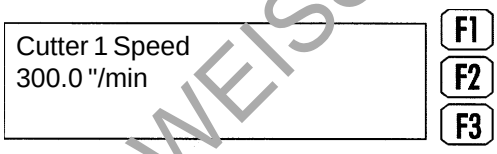
A system of three function keys has been implemented. The function of each key changes depending upon the menu displayed at the time. The display is divided into two sections; the left section shows prompt messages and the right shows the three soft key functions. If a function required is not displayed on the screen it may be accessed by using either the up or the down arrow keys so long as that function is on that same menu level.



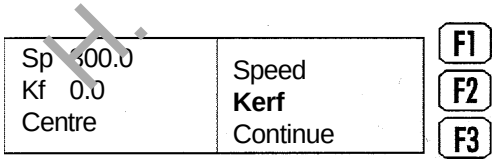
TO DOWNLOAD a job, press the DOWNLOAD (F1) key.



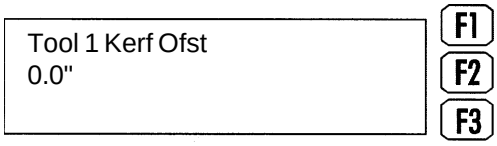
The display will then show the next three functions; SPEED, KERF, and CONTINUE. To set the cutting speed, press the SPEED key.



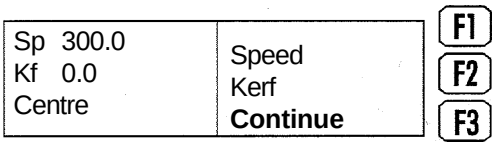
If this is the correct speed, press the ESC key. If not, enter the desired speed using the numbered keys, and press the ENTER key.



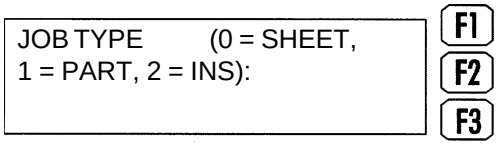
If a kerf setting is required or needs to be reset, press the KERF key.



When cutting a fitting job, a kerf setting is not required. If a kerf setting is needed, or if the kerf setting needs to be reset to 0, use the numbered keys and press the ENTER key. Otherwise, press the ESC key.



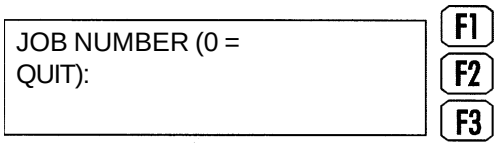
To begin the dialog between the controller and the office computer, press the CONTINUE key.



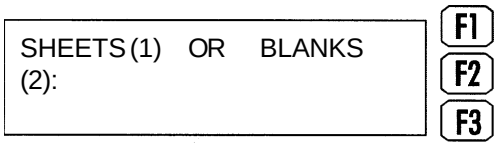
The computer will respond by sending a request to the controller:

0 To select a sheet from the Vulcan fittings program.
1 To select a part from the Vulcan parts program.
2 To select an insulation job from the Vulcan program.

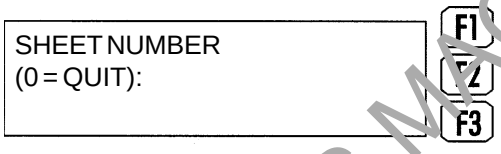
Input your choice and press the ENTER key.



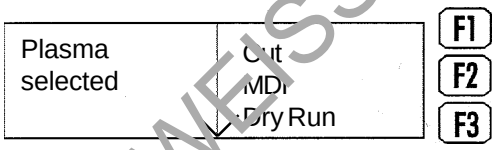
The office computer will then request the operator to input the job number. The job number can be found at the top of the *SHEET CUT LISTING*. Use the numbered keys and press ENTER.



If one piece of a sheet needs to be cut, press BLANKS (2) rather than SHEETS. This allows for an individual piece being cut from a single sheet without cutting any other pieces.



After entering the job number, the office computer will ask you to enter the sheet number you wish to cut. When starting a new job, this will be sheet number 1. When downloading of the first sheet is complete, the secondary menu will appear and you will be ready to begin cutting.

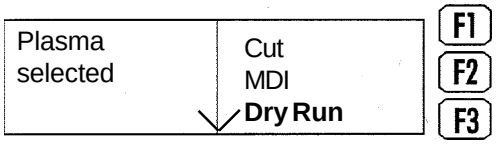


Secondary Menu

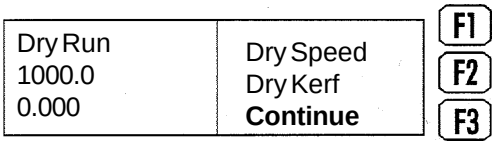
7. EXHAUST ACTIVATION

Do not run the Vulcan Plasma Cutter without the appropriate ventilation system turned on.

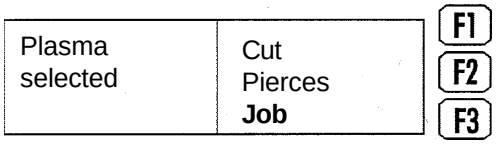
8. DRY RUN



Before cutting the first sheet, the operator may wish to perform a dry run of the sheet to check the torch cut path. To execute a dry run, press the DRY RUN key.



Next enter the desired speed. The kerf should be equal to the value set when the job was downloaded.



Next press the continue key.

CUT will cause the machine to move to the first piece and begin cutting.

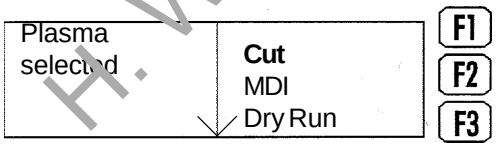
PIERCES allows to skip to a specific part on the sheet. To skip forward, enter the piece number.

JOB will cause the machine to start the dry run of the sheet.

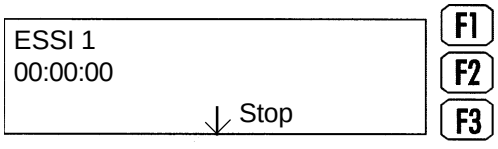
9. OPERATION OF CONTROLLER DURING CUTTING

CAUTION, HAVE ALL PERSONNEL STAND CLEAR OF THE PATH OF THE CUTTING TORCH WHICH CAN TRAVERSE THE ENTIRE LENGTH OF THE TABLE(S).

NOTE: Pieces of the fittings will be cut in the same order that their identification labels are printed by the office computer. Place the labels on the corresponding pieces as they are being cut.

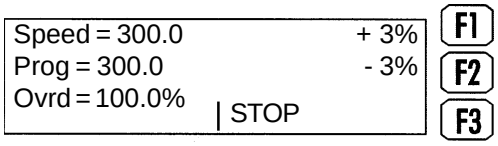


BEGIN CUTTING by pressing the CUT key. The torch will then move to the start point, drop automatically and start cutting the pieces.



If the job must be interrupted for **any reason** press the STOP key. This shuts off the torch and halts the machine on the cut path. To restart cutting, press the RESUME key.

After the first sheet is cut, the torch will park at the (0, 120) position. SEE ILLUSTRATION #1. If the *Autoloading* option is engaged in the **Companel2** program, the next sheet of the job will be downloaded automatically when the bridge has reached the park position. If not, the bridge will remain at the (0, 120) position and wait for the operator to manually download the next sheet. The **Companel2** program also offers the option of Manual Stop. This option allows for continued cutting after the Autodownload is completed *or* to wait for the operator to release the hold. If Manual Stop is active, press the RESUME key to continue cutting.



Speed during the cutting cycle may need to be increased or decreased to improve cut quality. This can be achieved by pressing the SPEED key on the front panel. When pressed, the display will indicate the preset speed, the override speed, and the percentage speed change. Pressing the F1 or F2 speed keys causes the feed rate to increase or decrease by 3%, respectively. If a large speed change is required, the operator may use the numbered keys to enter the new speed as a percentage of the initial speed.

10. RELEASING A JOB TO START A NEW JOB

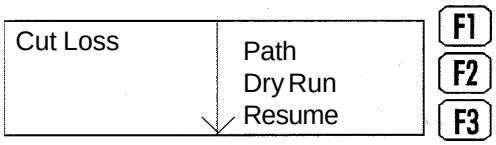
From time to time it may be necessary to quit a job before completion. Should this happen, finish cutting the current sheet. If Autoloading is on, press the STOP key before the machine reaches the park position, then select ABORT. This will position the machine at the park position, but not begin the AutoDownload of the next sheet. Next press the DOWNLOAD key on the control panel. The display will show;

NEXT SHEET, 0=Y, 1=N, 2=QUIT JOB

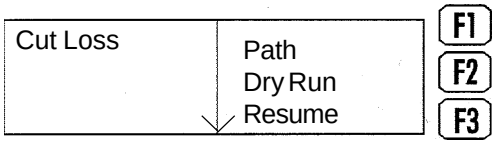
Select 2 to quit the job. This will prompt the **Companel2** program to release the current job from the schedule and allow a new job to be downloaded.

11. LOST CUT RECOVERY

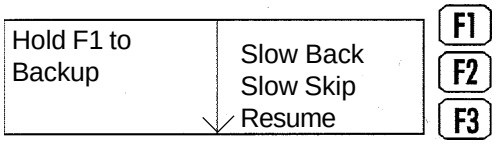
If the transferred arc loses contact with the workpiece, the plasma Unit will shut off the DC-power to the torch and remove the machine motion input to the Lockformer control, stopping machine motion.



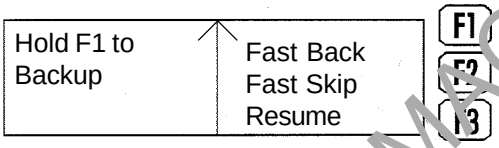
When this happens, a prompt message is displayed; "Lost Cut Machine Stopped." To recover, press the RESUME key.



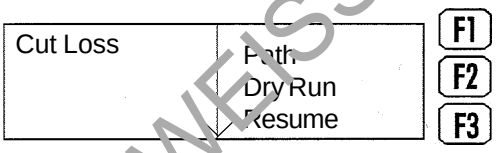
If it is necessary to backup on the cut path, press the PATH key.



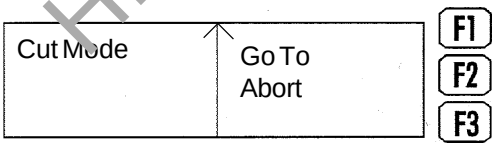
Press the SLOW BACK key. Make sure to keep the key pressed until the torch reaches the cut loss point on the workpiece.



If you need to reverse direction over the cut path at a faster speed, use the down arrow key to access the FAST BACK function.



When ready to restart the torch, press the RESUME key.



If you wish to abort the job, press the down arrow to access the ABORT key. This will cause the machine to move to the (0,0) point when cutting the first sheet of the job. Otherwise it will go to (0, 120).

12. VULCAN DOWNLOAD QUICK CHART

EXECUTE A SHEET METAL JOB

1. Turn on all power
2. Press the DRIVES ON key
3. Press the AUTO ZERO key
4. Press F1 - Download
   - Press F1 - Speed (to change speed)
   - Press F2 - Kerf (to change kerf)
5. Press F3 - Continue
6. Enter the Job Type
   - **0 = Sheet**
   - 1 = Part
   - 2 = Insulation
7. Enter the Job number (type 0 to quit)
8. Enter **1=Sheet**, 2=Blank
9. Enter the Sheet number (type 0 to quit)
10. Press F1 - Cut when ready

EXECUTE A BLANK

1. Turn on all power
2. Press the DRIVES ON key
3. Press the AUTO ZERO key
4. Press F1 - Download
   - Press F1 - Speed (to change speed)
   - Press F2 - Kerf (to change kerf)
5. Press F3 - Continue
6. Enter the Job Type
   - **0 = Sheet**
   - 1 = Part
   - 2 = Insulation
7. Enter the Job number (type 0 to quit)
8. Enter 1=Sheet, **2=Blank**
9. Enter the Blank number (type 0 to quit)
10. Press F1 - Cut when ready

EXECUTE A PART

1. Turn on all power
2. Press the DRIVES ON key
3. Press the AUTO ZERO key
4. Press F1 - Download
   - Press F1 - Speed (to change speed)
   - Press F2 - Kerf (to change kerf)
5. Press F3 - Continue
6. Enter the Job Type
   - 0 = Sheet
   - **1 = Part**
   - 2 = Insulation
7. Enter Job number (type 0 to quit)
8. Press F1 - Cut when ready

EXECUTE AN INSULATION JOB

1. Turn on all power
2. Press the DRIVES ON key
3. Press the AUTO ZERO key
4. Press F1 - Download
   - Press F1 - Speed (to change speed)
   - Press F2 - Kerf (to change kerf)
5. Press F3 - Continue
6. Enter the Job Type
   - 0 = Sheet
   - 1 = Part
   - **2 = Insulation**
7. Enter the Job number (type 0 to quit)
8. Enter **1=Sheet**, 2=Blank
9. Enter the Sheet number (type 0 to quit)
10. Press F1 - Cut when ready

13. MANUAL DATA INPUT (MDI)

MDI - "GO TO" INSTRUCTIONS

1. Press the ESC key to reach primary screen
2. Press F3 - Execute
3. Press F2 - MDI
4. Press F1 - Go To
5. Press F1 - to set the X-axis coordinate, then press the ENTER key
6. Press F2 - to set the Y-axis coordinate, then press the ENTER key
7. Press F3 - to set the speed of the machine, then press the ENTER key
   If necessary, press the DOWN ARROW once to VIEW BLK. Press F1 to review the coordinates and speed.
8. Press the EOB/DRY RUN key on the controller and the machine will move to desired position

MDI - "RIP TO" INSTRUCTIONS

Move the machine to starting point of cut

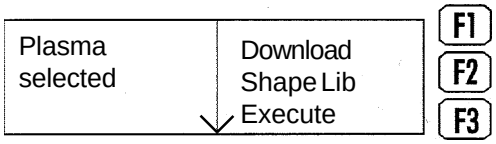
1. Press the ESC key to reach primary screen
2. Press F3 - Execute
3. Press F2 - MDI
4. Press F2 - Rip To
5. Press F1 - to set the X-axis coordinate, then press the ENTER key
6. Press F2 - to set the Y-axis coordinate, then press the ENTER key
7. Press F3 - to set the speed of the machine, then press the ENTER key
   If necessary, press the DOWN ARROW once to VIEW BLK. Press F1 to review the coordinates and speed.
8. Press the EOB/DRY RUN key on the controller and the machine will cut a straight line from resting position to the set coordinates

MDI - "RIP CUT" INSTRUCTIONS

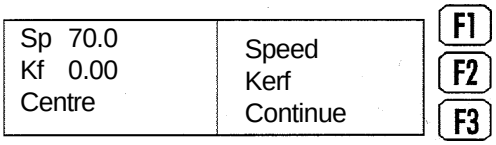
Move the machine to starting point of cut

1. Press the ESC key to reach primary screen
2. Press F3 - Execute
3. Press F2 - MDI
4. Press F3 - Rip Cut
5. Press F1 - to set the speed of the machine, then press the ENTER key
6. When ready to cut, press F2 - Pierce On
7. When torch fires, press, and hold down, the jog key in the direction of the cut you want.
   The jog keys are not pressure sensitive during Rip Cut. The torch will only move at the designated speed.

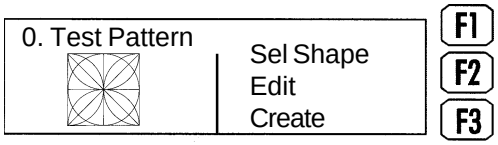
14. SHAPE LIBRARY



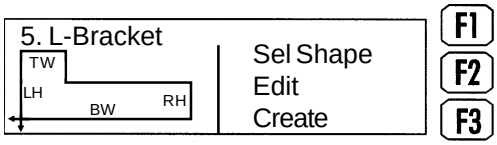
Press the ESC key to reach the primary screen. Press F2 - Shape Lib



Press F3 - Continue



Use the ARROW keys to find the shape desired OR press F1 - Sel Shape and enter the shape number.

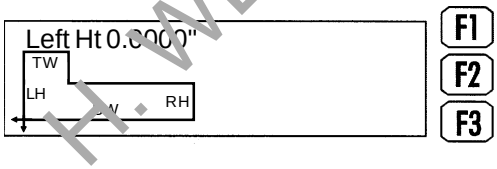


EXAMPLE: If shape number 5 was needed, the operator could use the ARROW keys, or enter shape number 5.

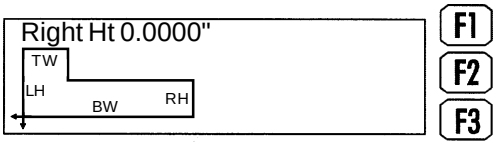
Press F2 - Edit to enter the piece dimensions. Since each piece is different, dimension requirements may differ from one another. When editing, type the necessary dimensions for that particular piece. Once finished, press F3 - Create. The operator will then be able to begin cutting.

EXAMPLE: The following is an example of how to use the Shape Library. For this example, shape number five, the L-Bracket, will be used. For each step, use the numbered keys on the control panel, then press ENTER. When the last step is finished, the program will revert back to the Sel Shape screen.

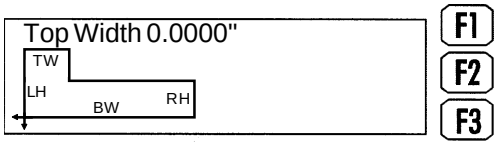
Step 1



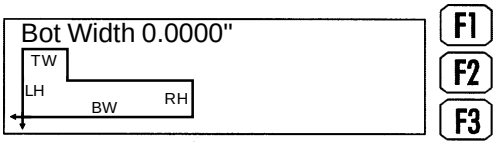
Step 2



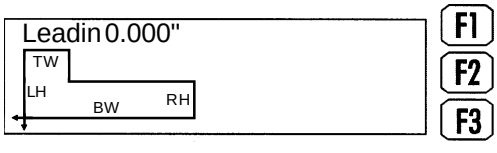
Step 3



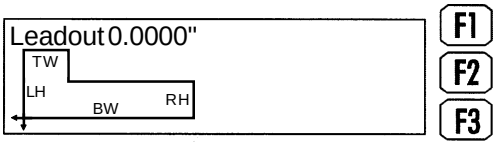
Step 4



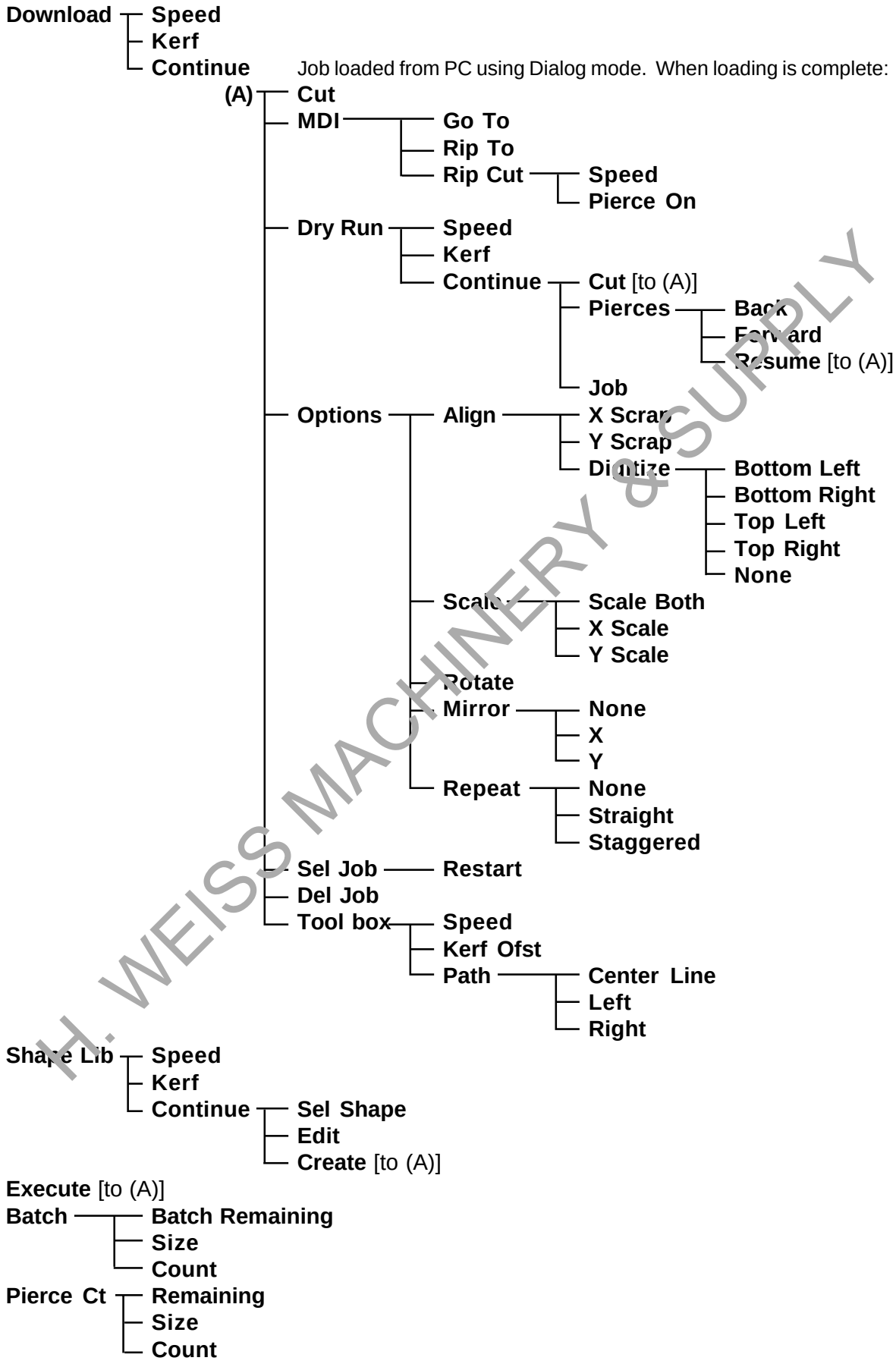
Step 5

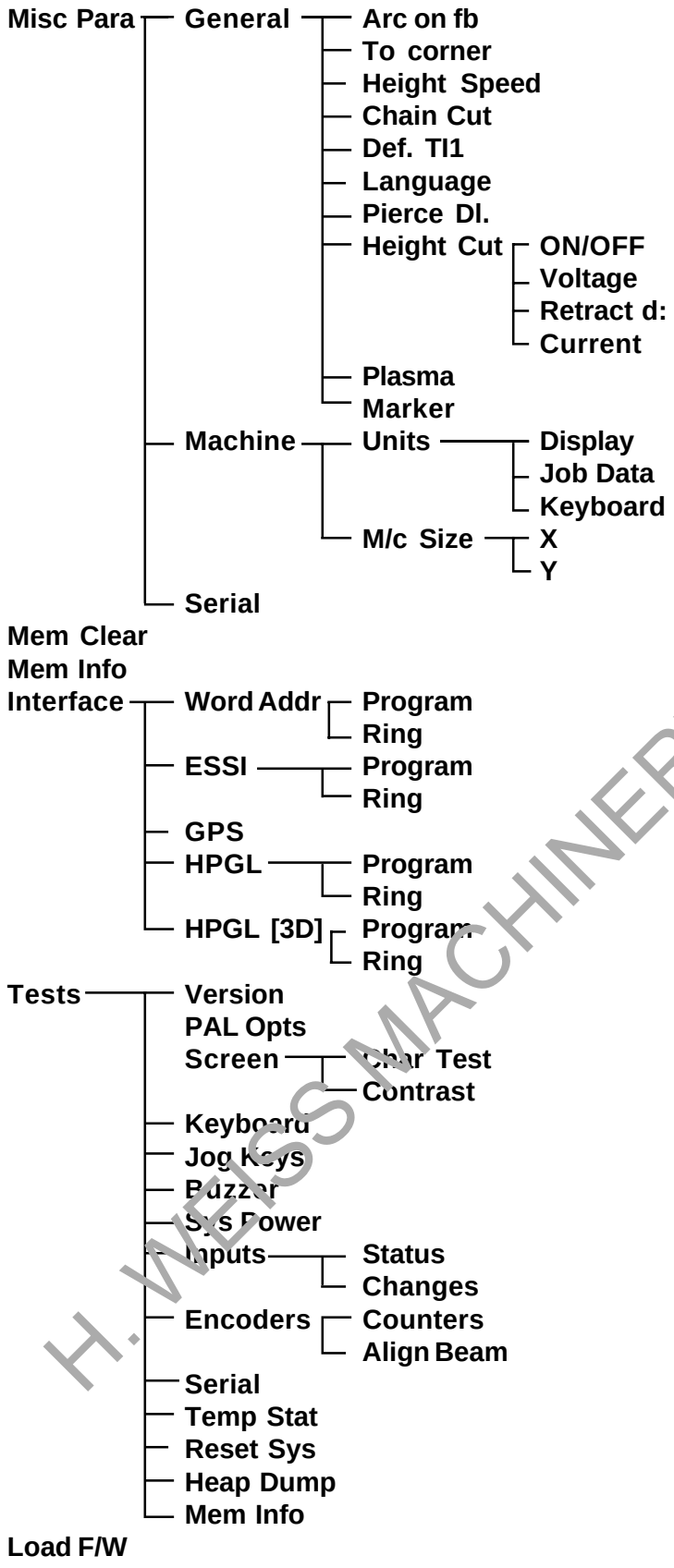


Step 6



15. VULCAN OPERATION FLOW CHART





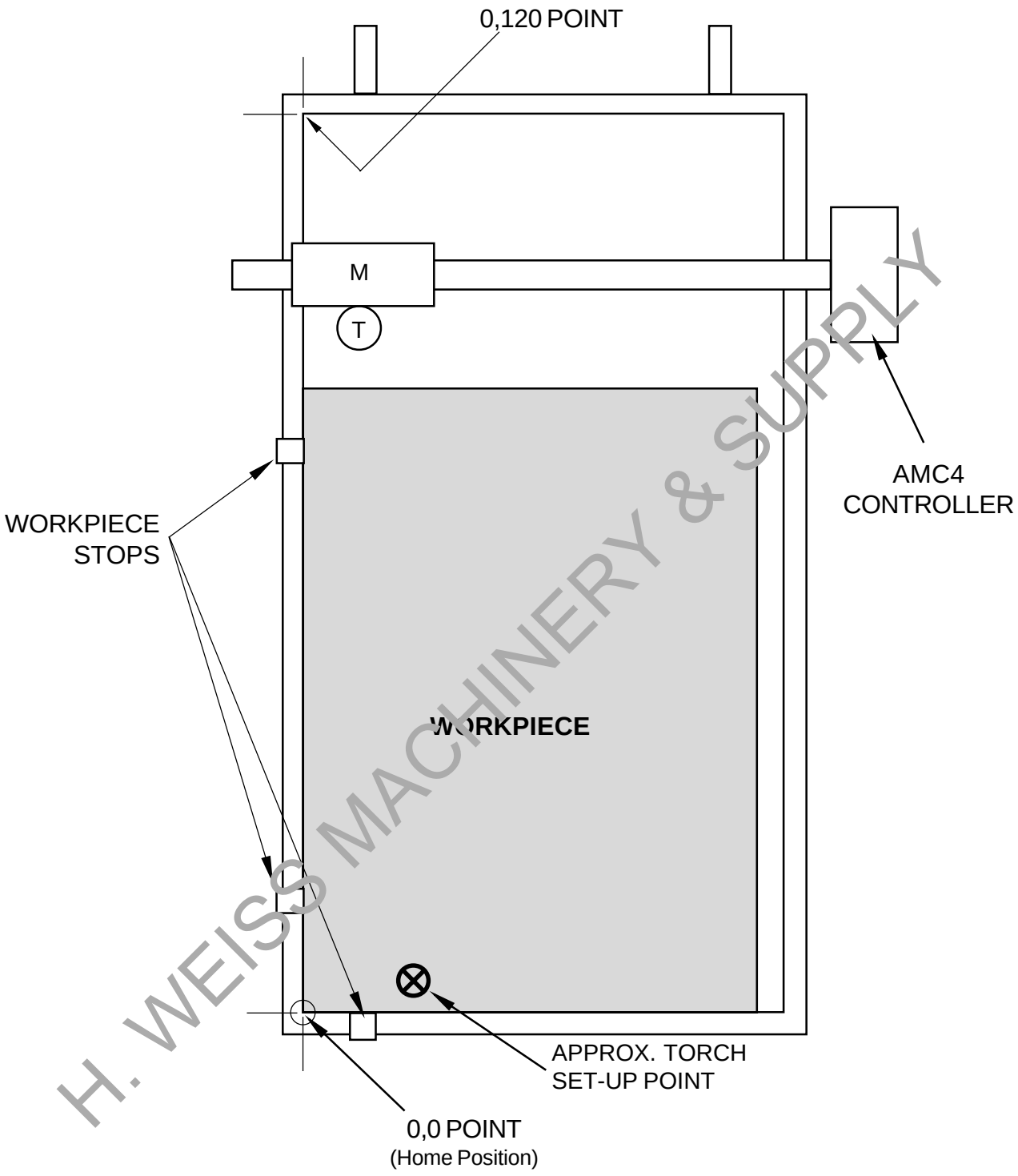


ILLUSTRATION 1

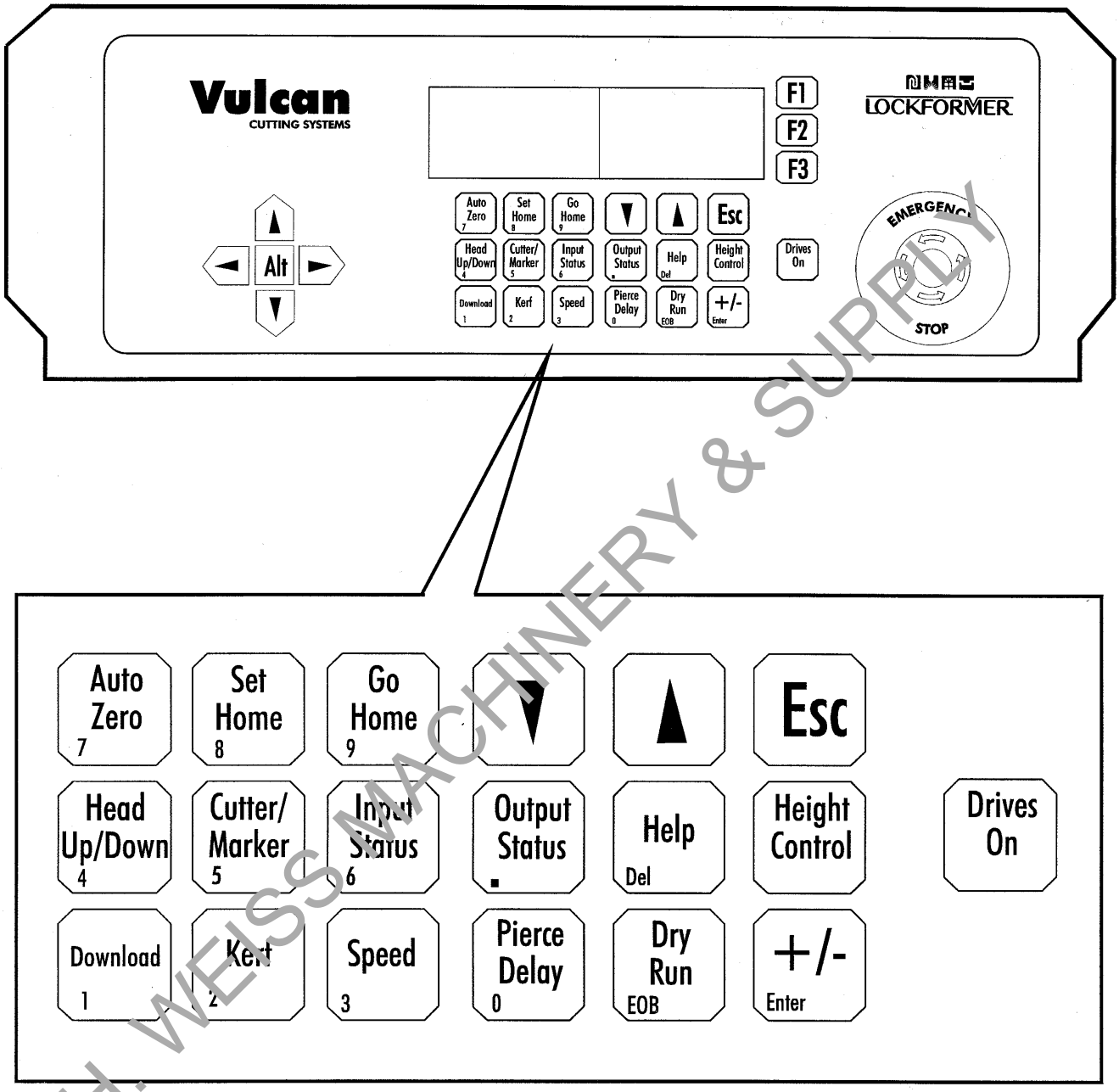


ILLUSTRATION 3

SECTION 3

MAINTENANCE

1. Safety
2. Inspection and Upkeep
3. Lubrication
4. Reinstallation and Assembly of the Vulcan Torch Head
5. Torch Height Adjustment

1. SAFETY - Shut Off main power disconnect to cut off power from Vulcan (including Plasma Unit) before attempting to work on electrical circuits or performing any cleaning of machine that involves reaching in between parts that can move!

Do not touch electrically hot parts! Keep cables dry, free of oil and grease, and protected at all times from damage by hot metal and sparks. Do not use cable with worn or damaged insulation; repair or replace it immediately. Keep equipment clean, in good condition, and free of oil, grease and other combustibles.

DO NOT use equipment which is not functioning properly. Perform all required repairs and test the machine to ensure that it is in proper operating condition before resuming production.

2. INSPECTION AND UPKEEP - Proper lubrication (see Table below), along with a clean machine and work area are the 2 most important factors for trouble-free operation. Remove any accumulation of debris before the start of an 8 hour workday. Inspect and maintain the Vulcan as often as required. Past experience has shown these to be the best guidelines and procedures to follow:

a) Clean accumulated dirt from all areas.

b) Tighten loose hardware, including all gas and electrical connections; loose power connections can overheat during use of machine.

c) Replace any power cables and connectors that get worn or damaged at once! Check for frayed, cracked insulation, particularly in areas where conductors enter equipment.

d) Clean all components, particularly electrical parts where metallic particles can cause short circuits; blow out Torch Ball casters as explained later.

Keep all rails, racks, rollers, pinions clean to allow smooth motion of moving parts, WHICH IS ESSENTIAL FOR THIS MACHINE! Use a wire brush to remove dirt and debris from such areas.

3. LUBRICATION - Lubrication and the time periods when required are presented in the Lubrication Table below. Where TRIBOL 878 is designated as a lubricant, use only a thin film, then let it dry to prevent dust pickup.

Lubrication Table:

Item	Time Interval:	Operation;	Lubricant
Rails	Every 8 Hours	Clean with Galv-Off	TRIBOL 878
Thompson Shaft & Bearings	Every 40 Hours	Clean with Galv-Off	TRIBOL 878
Carriage Wheels	Every 8 Hours	Clean with Galv-Off	TRIBOL 878
Pinion Gears	Every 8 Hours	Clean with Galv-Off	TRIBOL 878
Motorized Torch Extension	Every 8 Hours	Clean with Galv-Off	TRIBOL 878

The next subsection explains complete resetting of Torch head if it has been disturbed or installation of new head if needed; it is not routine maintenance.

Please be advised that the "Thompson Shaft" bearings should be lubricated every 40 hours of operation. (TRIBOL 878 Machinery oil, ODC free (aerosol can) or equivalent.) This should also be done in conjunction with the daily cleaning of the rails.

We have found that dirt and other material becomes lodged inside the bearing, causing it to "drag" on the shaft. This causes erratic cuts on the material. Should you have any questions, please give us a call.

4. REINSTALLATION AND ASSEMBLY OF THE VULCAN TORCH HEAD

Regular maintenance of the torch head includes resetting the torch height for the stock being cut, and cleaning; as described at the end of this section.

If a torch head is ever to be removed and a new one installed, or if a torch head has to be reset, use the following procedures:

Disconnect primary power leads and gas tanks before beginning actual removal of torch head from main machine.

PHOTO 1

1. Complete head assembly in place on bracket.

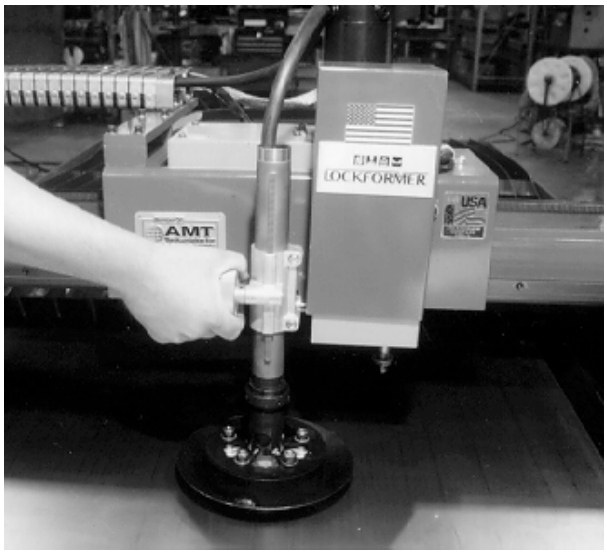


PHOTO 2

PHOTO 3

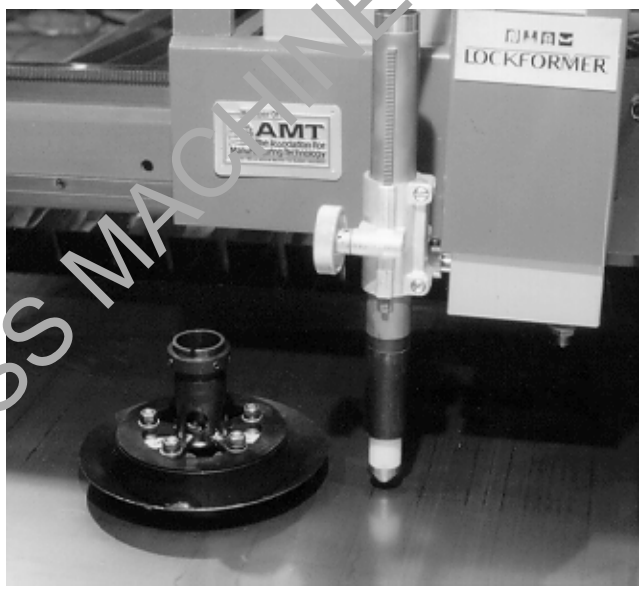
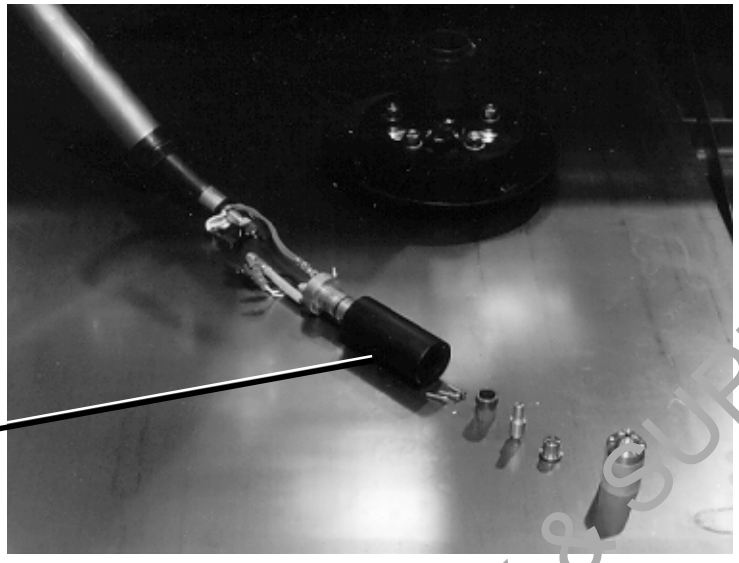


PHOTO 4

2. Loosen the Head fastening screws as shown in Photos 2 and 3, and remove the lower Assembly from the Head as shown in Photo 4.

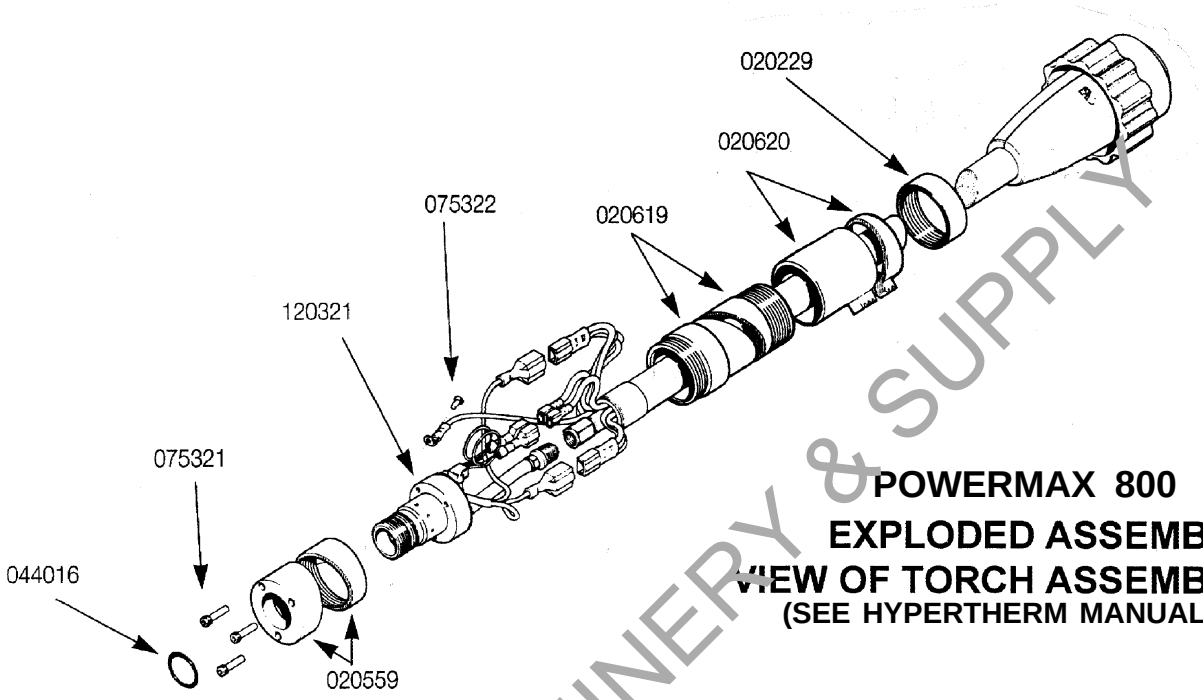


3. Remove the torch assembly from the holder casting. Now remove the torch body by loosening the threaded collar. Unscrew housing to expose wires.

4. Use a 3/32" hex key to remove 3 socket head screws and carefully disconnect the two fittings as follows:

a. Remove black shrink wrap tubing.
b. Remove screw (phillips head) holding terminal.
c. Using two line wrenches (5/16" and 7/16") disconnect the tubing fittings.

5. Perform the steps above in reverse to install a new Torch head.



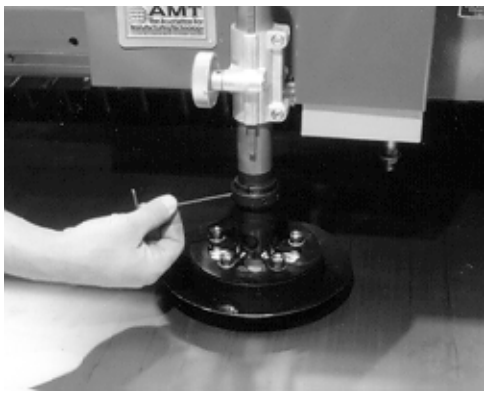
POWERMAX 800
EXPLODED ASSEMBLY
VIEW OF TORCH ASSEMBLY
(SEE HYPERTHERM MANUAL)

5. Torch Height Adjustment - In case a Torch Assembly's setting is ever disturbed and needs resetting, or if a new Torch Head must be installed, The Torch Head's ball casters and Torch Nozzle must be set correctly in relation to each other and to the sheets the Torch will cut.

To adjust the Torch to the correct settings, place a test sheet on the table beneath the Torch Head, loosen the two brass Torch Holder Screws (at right of Torch), loosen the two set screws (near bottom of Torch Assembly, just above the top of the black Head Shield) and let the Head Assembly slip down all the way, so it rests on the sheet.

Looking under the Torch, use the torch height adjustment knob to set the bottom of the Torch Nozzle to 1/16" minimum above the sheet, and retighten the set screws. The Ball Casters and Torch Nozzle are now in correct relation to each other, approximately 1/16" apart.

To set the entire Torch Assembly at the correct height, use the Knob to raise the Assembly up so all 5 ball casters just barely touch the sheet (previously they had rested all the way down on it). After this, retighten brass Torch Holder Screws. NOTE: Head must be square and perpendicular to panel, with all 5 casters touching it after resetting. If it is not square, reset the Torch by using the vertically pivoting adjusting screws behind it.



Torch height setting of Casters resting on sheet is only a starting setting; see Section 2 for more information on setting Torch properly for different thicknesses of stock.

Whenever drastically changing thickness of stock to be cut (by 1/8" or more), the height setting of the bottom of the Torch must be reset. Raise the Torch Assembly, if necessary to allow for thicker stock. It is unnecessary to change the Torch height for thinner stock; then slide a test sheet of the new thickness under Torch. Use Knob to raise or lower Torch as needed, so ball casters barely rest on new sheet, as explained above; then retighten its fastening screws.

IMPORTANT!

Beside the normal service required for the Plasma Cutting Torch in its Instructions, the ball casters of the Lockformer Torch Head must be cleaned after every three or four panels, to prevent dust buildup and resultant clogging.

To clean the ball casters, raise the Torch to its maximum height and shut off machine power supply. Then manually push each ball up into its caster housing, at the same time blowing the dust out with compressed air. Check for cleanliness by spinning each ball. If it does not spin freely, repeat the above operation until it does. Be certain to reset Torch to its proper height.

CAUTION

Use safety glasses and a #M# 08500 nontoxic particle mask or its equivalent when blowing the dust out of the ball caster.

SECTION 4

ASSEMBLY DRAWINGS AND PARTS LIST

1. Assembly Drawings

   51489 Y - Drive Motor Assembly
   51491 Y - Two-Drive Motor Assembly
   51494 X - Drive Motor Assembly
   51495 X - Drive Motor Assembly
   51648 Rail Assembly
   51526 Rail Assembly - 20 ft. Single Park
   51659 Rail Assembly - 20 ft. Double Park
   52637 Torch Lifter Assembly
   58470 Floating Head Assembly

2. Parts List

SECTION 5

FIBER OPTICS INFORMATION

1. Specifications
2. Input / Output Interface
3. System Malfunction Isolation
4. Normal Fiber Optic Operation
5. Quick Test - Will Not Download
6. Checking the Fiber Optic System
7. Checking the Fiber Optic Cable
8. Bit-Driver Sensitivity Adjustment
9. Bypassing the Fiber Optic System
10. Office Cable Pin Configuration

The S.I. Tech Model 2005 Asynchronous Optical Bit-Driver is a short haul limited distance "modem." At the transmission end, the Unit accepts digital information via an RS-232 connector. It converts this data for transmission over a Duplex optical fiber transmission line. At the other end, another Bit-Driver converts information back to a form that is RS-232 compatible.

1. SPECIFICATIONS

Operating Mode:	Asynchronous, Simplex or Full Duplex
Transmission Line Interface:	Two ST fiber optic connector receptacles for interfacing with Duplex optical cable. 12 dB power budget at 880 nm for 10-9 Bit Error Rate, using 62.5 micron core fiber.
Operating Temperatures:	0^{o} Celsius to + 50^{o} Celsius.
Input Power:	105 to 130 VAC, 60 hz, 10 watts. Power transformer secondary fused. Standard 3 wire cord for wall outlet, unless 220 VAC supply is required
Input/Output Interface:	RS-232-C Type D Asynchronous (at 110 Bits/sec to 115 kbits/sec.)

2. INPUT/OUTPUT INTERFACE

Input/output interface conforms to EIA standard RS-232-C, having a type D full Duplex configuration. A female 25 pin D connector carries the following signals:

Pin	Description	EIA
1	Protective Ground	AA
2	Transmitted Data	BA to Bit-Driver
3	Received Data	BB to Bit-Driver
4*	Request to Send	CA to Bit-Driver
5	Clear to Send	CB From Bit Driver
6	Data Set Ready	CC From Bit Driver
7	Signal Ground	AB
8	Data Carrier Defect	CF From Bit Driver

*Optional Signals not needed for normal operation.

The functions of these signals are:

Protective Ground is a lead tied to the ground wire of the power cord. This is not a signal ground, but is intended to connect to the RS-232 cable assembly shield, when used, to reduce radiated noise and possible IC damage due to static discharge to the cable.

Transmitted Data is the data being sent from the local terminal to the remote Bit-Driver and terminal.

Received Data is the data being received over the transmission line from the remote Bit-Driver.

Request to Send is a control function from the local terminal. The signal is normally used on half Duplex operation and is not required in the model 2005 Bit-Driver.

Clear to Send is a control function used by the local terminal. In the model 2005 Bit-Driver, the Request to Send is connected to the Clear to Send with a 10 millisecond delay for equipment

requiring Clear to Send.

Data Set Ready is a D.C. level indicator to the terminal that the local Bit-Driver has power applied.

Signal Ground is the level to which all voltages for the RS-232 interface are referenced.

Data Carrier Detect is a control signal from the Bit-Driver which indicates a signal is being received from the remote Bit-Driver.

3. SYSTEM MALFUNCTION ISOLATION - Listed below is a step-by-step test procedure which can be used to isolate a system malfunction. Steps 1 and 2 are used primarily at the time of installation and may be skipped if the system has been in operation prior to failure. Once the cause of failure is determined, further testing is unnecessary. The Bit-Driver test described below requires the standard RS-232 interface connection. Prior to starting the test, verify that the DIP switch is set with both NORM and RTS1 switch only in the ON position.

1. Verify that the terminal generates an RTS command on pin 4 by touching the probe to the pad numbered 4. The - LED should be on. If not, an RTS signal may be generated internal to the Bit-Driver by turning RTS2 ON and RTS 1 OFF at the DIP switch.

2. Verify that the terminal generates its transmitted data on pin 2 by touching the probe to the pad numbered 2. The - LED should be ON. If data is being transmitted the + LED will flash. If not, the terminal is defective or not configured properly. Refer to the nonstandard input/output interface section on how to identify whether a Null Modem configuration is required.

3. Check the DCD status LED on the front panel. If it is ON, then proceed to step 4. Otherwise disconnect the two fibers from the rear of the Bit-Driver. In a room with subdued light, place a paper or foam cup over both the R and T receptacles. The transmitted signal will be reflected off the bottom of the cup back into the optical receiver to accomplish analog loopback. The DCD status LED should be ON. If not, check for RTS signal as described in step 1. If RTS is present and RTS1 switch is ON, then return the Bit-Driver to the factory.

4. Connect the probe tip to the pad labeled 8. The + LED should be ON. If not, return the Bit-Driver to factory.

5. Connect the probe tip to the pad labeled 5. The + LED should be ON. If not, check the RTS1 and RTS2 switches. One or the other must be on as determined in Step 1. If + LED is not ON, then return the Bit-Driver to factory.

6. If not done previously, disconnect the two fibers from the rear of the Bit-Driver. In a room with subdued light, place a paper or foam cup over both the R and T receptacles. The transmitted signal will be reflected off the bottom of the cup back into the optical receiver to accomplish analog loopback. Cause the terminal to generate characters. Both the TD and RD LED's on the front sheet should flash. If they do, proceed to step 7. Otherwise connect the probe tip to the pad marked 2. Both the - LED should be ON and the + LED should flash as data is transmitted. If not, the terminal is not transmitting data.

7. While generating characters connect the probe tip to pin 3. The - LED should be ON and the + LED should flash. If not, return the Bit-Driver to the factory.

8. While the terminal is generating characters it should also be displaying the characters. If it is, then the local Bit-Driver is OK. Proceed with step 9. Otherwise, switch the DP switch so that switches 1 and 3 are ON. The Bit-Driver is now set into a digital loopback mode so that data is not processed by the Bit-Driver. As the terminal transmits data it should also receive the data. If not, the terminal or RS232 cable is defective.

9. Reconnect the optical fibers to the Bit-Driver.

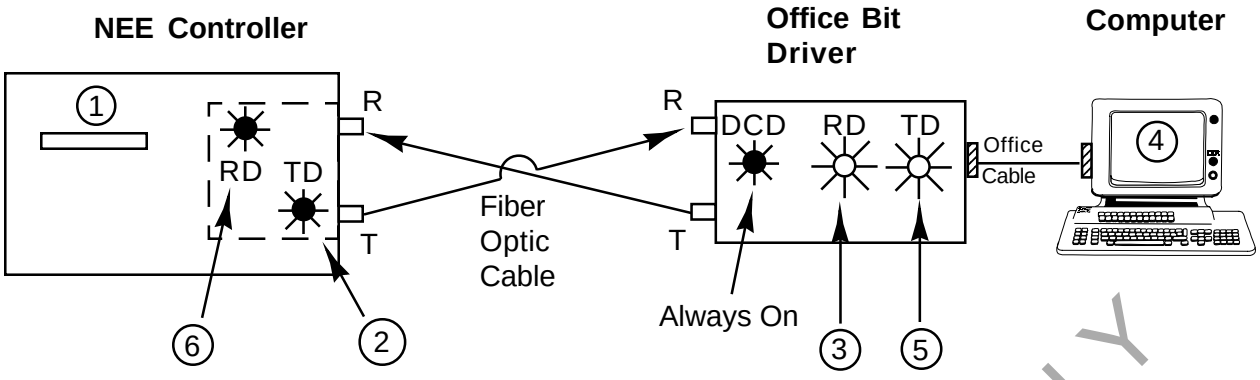
10. Repeat tests 1 to 9, as necessary, for the remote Bit-Driver.

11. If a defect is still not isolated, the F/O cable may be defective. Its continuity can be roughly checked by placing connector at one end near a 60 watt or larger light. (CAUTION: excessive heat may damage connector) At the other end light should be visible coming from the fiber. If not, the fiber is defective.

IMPORTANT! IF, AFTER PERFORMING TROUBLESHOOTING YOU FIND UNITS STILL NOT WORKING, CHECK WITH A S.I. TECH SALES APPLICATION ENGINEER FOR OPTICAL UNIT SERVICE CALL OR WRITE S.I. TECH, P.O. BOX 609, GENEVA, IL., 60134,; PHONE (630) 232-8640.

WARNING: This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

4. Normal Fiber Optic Operation



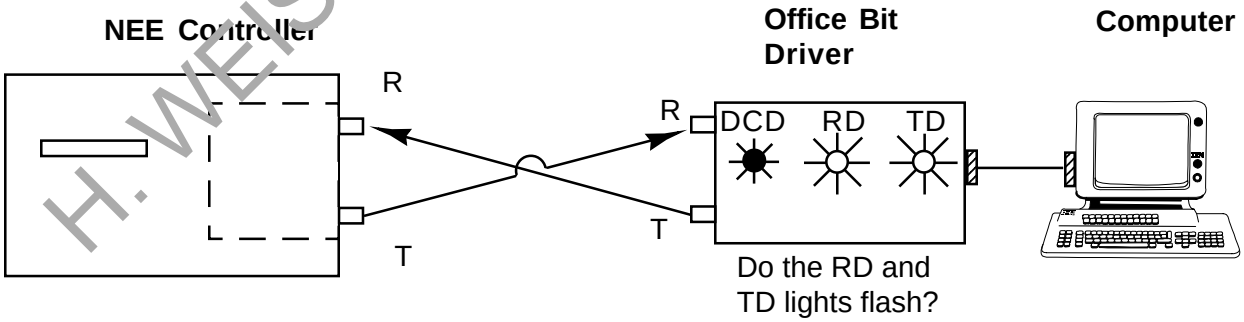
Normal Operation

1) Press DOWNLOAD on Controller.
2) TD light on internal bit-driver flashes (transmits data to office bit-driver).
3) RD light on Office bit-driver flashes (receives data from internal bit-driver).
4) Computer Communication Panel 2 screen will change to "WAITING FOR JOB TYPE".
5) TD light on office bit-driver (transmits data back to internal bit-driver).
6) RD light on internal bit-driver flashes.
7) Controller displays: 0=Job, 1=Part, 2=Ins.

5. QUICK TEST

Will Not Download

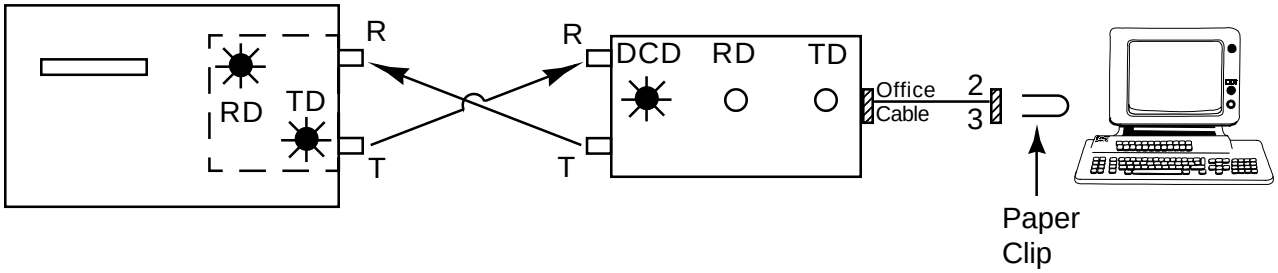
1) Turn Controller and Computer completely OFF following shut down procedure.
2) Turn Controller and Computer ON.
3) Try DOWNLOAD again.
4) Does it work?



* If DOWNLOAD does not work, check the following on office bit driver:

a) DCD and RD light always on - Remove optic cable. Point back of bit-driver toward a room light. Does RD light go out. Check optic cable and/or adjust the bit-driver.
b) RD flashes, TD light does not - Check office cable for continuity. Check connection to computer. Check Communication Panel 2 Program in the computer.
c) RD and TD flashes - Check fiber optic cable. Check internal bit-driver.

6. CHECKING THE FIBER OPTIC SYSTEM



NOTE: Following directions exactly is necessary to ensure accurate results.

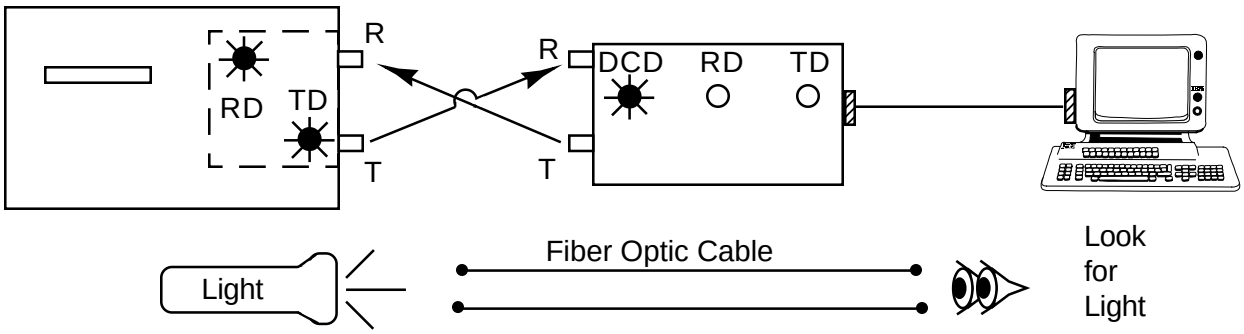
1) Turn Controller OFF.
2) Remove cover from Controller by removing the 6 phillips and 4 Allen screws. It may be necessary to remove the bolts that hold the controller down. Then slide cover forward to expose internal bit-driver.
3) Unfold a small paper clip so that both ends are parallel, then place those ends into the office cable or bit-driver across pins 2 and 3 for both 9 and 25 pin female plugs.
4) Turn Controller ON.
5) Arrow down to TEST and press the correct [F] key.
6) Arrow down to SERIAL and press the correct [F] key.
7) All of the bit-driver RD and TD lights should be flashing. The screen on the Controller will display: "FIFO FITTED"
   "SERIAL HOST PORT"
   "FAILED"
   This is normal.

* If NOT, check the following:

a) No Lights Flash - Could be a problem in testing. Recheck testing procedure.
b) Still No Lights Flash - Indicates a faulty internal bit-driver or Controller.
c) TD Internal Flashes Only - Check optic cable, external bit-driver, and office cable.
d) TD Internal and RD External Flashes Only - Check office cable or bit-driver. Paper clip may not be in pins 2 and 3.
d) TD Internal, RD and TD External Flashes Only - Check fiber optic cable and internal bit-driver.

8) To exit Serial Test press ESC

7. TO CHECK FIBER OPTIC CABLE

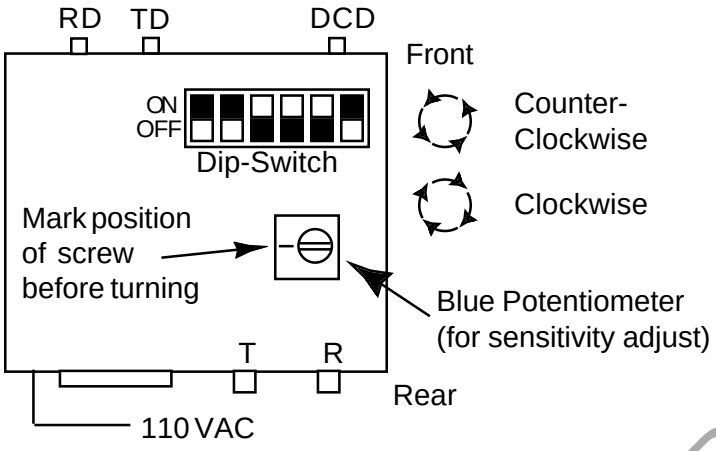


8. BIT-DRIVER SENSITIVITY ADJUSTMENT

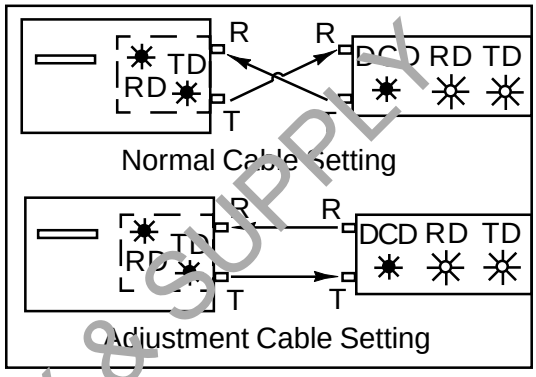
In order to adjust the bit-driver, you must remove the black metal cover, then connect the fiber optic cable in reverse of normal operations at one end only. ("Cable Setting" Illustration below)

1) Turn the blue sensitivity potentiometer counterclockwise until the RD diode on the front panel lights up. (see diagram below) If RD is already on, go to step 2.
2) Turn the same potentiometer clockwise until the RD diode turns off.

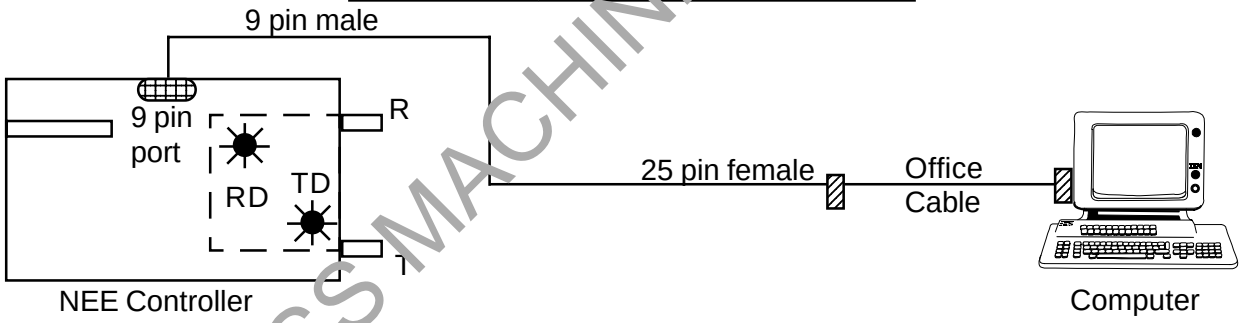
TOP VIEW



CABLE SETTING



9. TO BYPASS OPTIC SYSTEM



NOTE: Adding a 9 to 25 pin cable to connect computer to controller eliminates the bit-driver system entirely. Furthermore, this will verify that the computer and Controller function properly.

10. OFFICE CABLE PIN CONFIGURATION

#7096
9 pin to 25 pin cable

Computer (9 pin)	Bit-Driver (25 pin)
1	1
2	2
3	3
4	
6	
7	
8	
5	7

#7091
25 pin to 25 pin cable

Computer (25 pin)	Bit-Driver (25 pin)
1	1
2	2
3	3
7	7
4	
5	
6	
20	

SECTION 6

TROUBLESHOOTING

1. X and Y Axis Movement
2. Cutting Errors
3. Torch Movement
4. Computer Block
5. Flash Program

Instructions to Install New Table Set-Up Software
Computer Set-Up
Controller Configuration

SECTION 6

TROUBLESHOOTING GUIDE:

Most minor difficulties that users have with the Vulcan have very simple explanations and solutions. This Section was prepared to make it easier for operating personnel to solve such problems quickly, so it is not necessary to consult Lockformer in many cases.

Caution Shut Off All Incoming Power To Check Any Electrical Components Before Servicing!

X and Y Axis Movement

PROBLEM	SOLUTION
Drives will not power-up. Display says: "Press Drives On"	1. Check the two Emergency-Stop switches. The one on the controller and the other at the end of the bridge. 2. Check Safety Control Cable from E-stop to Controller. 3. Controller
Controller displays "Axis Following Error" after pressing AUTO ZERO	1. Motor - Switch X and Y motor. If problem goes to other drive motor, then bad motor. 2. Cable - Make sure cables are connected. 3. Controller
Machine will not stop when Auto Zeroing in X or Y axis.	1. Inspect Home Switch for visible damage. (X-Home is at the end of the bridge, Y-Home is on the Y-1 rail) 2. Check the gap between Home Switch and the Homing Plate for both the X and Y Home. Give an allowance of 0.018". (Use a feeler gauge or piece of 26 ga. metal) 3. Wave a Quarter over the Home Switch while the machine is moving. If it stops, adjust the Homing Plate. If not, replace the switch. 4. Bad input/output cable on the controller.
Following error for X or Y axis	1. Check bearings. 2. Bad motor (switch motor to check).

Cutting Errors

Torch cutting off the sheet	1. Check the sheet size. 2. Check for correct placement. Sheet must be against the stops. 3. Check and adjust the Zero Home plates.
Parts are being cut 1/8 to 1/4" too large, or the machine overshoots	1. Loose or worn pinion gears. 2. Loose belt. 3. Check encoder. To check, zero the machine. Use the MDI to move the machine to (0,120), then physically measure the distance to see if it moved 120 inches. 4. Switch motors.

Torch Movement

Machine moves rapidly when Auto Zeroing X-axis, followed by screen message: Axes: X Following Error Exceeded	Check encoder cable.
Torch will not raise or lower	1. Check for any binding at torch lifter with power off. 2. Check air pressure. Minimum air pressure must be 40 psi. 3. Check for 24 VDC at lifter assembly. If "yes", replace the 4-way valve. If "no" check cable and fuses on back of controller.
Torch head goes up and down too fast or too slow.	Adjust the screw on the two brass muffler on the four-way valve. NOTE: The top screw is for moving up, and the bottom screw is for moving down.

Computer Block

Block Not Found on computer	Protection Block must be plugged in properly.

FLASH PROGRAM

Instructions to Install New Table Set-Up Software

1. Double click on the left mouse button, OS/2 full screen, insert the disk labelled "Table Set-Up Diskette #1" into drive A and type A:INSTALL and press Enter. Wait for 60 seconds and the screen will change and follow instructions.

2. Turn the power off then back on as requested after INSTALL is complete.

Computer Set-Up

To flash the controller with the new operating system, both the office computer and the controller at the machine must be configured as follows:

1. Before flashing the controller shut down either VDOWNLOAD or COMMUNICATIONS PANEL 2 Icon.

   A. Close VDOWNLOAD by double clicking the left mouse button on the VDOWNLOAD icon. Make sure caps lock is on and press "Q".

   B. Close COMMUNICATIONS PANEL 2 by clicking the left mouse button once on the COMMUNICATIONS PANEL 2 Icon and choose CLOSE. When asked if it is OK to shut down all communication programs, click on OK.

2. Double click the left mouse button on the TABLE SETUP S icon to start the Flash Programmer.

3. Set the Baud Rates to 38400 by using the arrow keys.

4. Use the tab key to change to Com Port.

5. Configure to Com 1, or select Com 2 if using the Austin computer. Place an X in the Use CTS box by pressing the spacebar.

6. Press the tab key to change to Download Event Symbols and place an X in the small box by using the spacebar.

7. Press the tab key to change to Download WorkFiles and place an X in the small box by using the spacebar.

8. Press the "F" key:
   Select the **amc_____.hex** file using the arrow key and press Enter.
   Select the **lf29_____.ini** using the arrow key and press Enter.
   Select the **eventsub.gpl** using the arrow key and press Enter.
   Select the **workfiles** by using the space bar and down arrow key to tag each one. After tagging all the workfiles press Enter.

After selecting the five files configure the control at the machine.

Controller Configuration

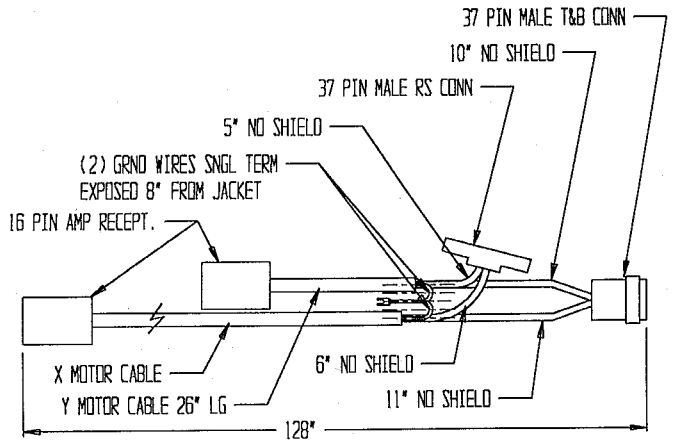
1. Power up the controller.

2. Use the down arrow key and press F2 to select Interface. Press F3 to select GPS and press the ESC key.

3. Press the down arrow key until Load F/W. Press F1. If Baud Rate 38400 appears, press the ESC key and return to the office computer. Otherwise, press the GO HOME key then the up arrow key and select 38400. Press ESC.

Now the controller is configured. Return to the office computer and press the Enter key to start the Flash. After the flash has been completed press ESC. To exit the Flash program do a normal computer shut down and re-boot the computer.

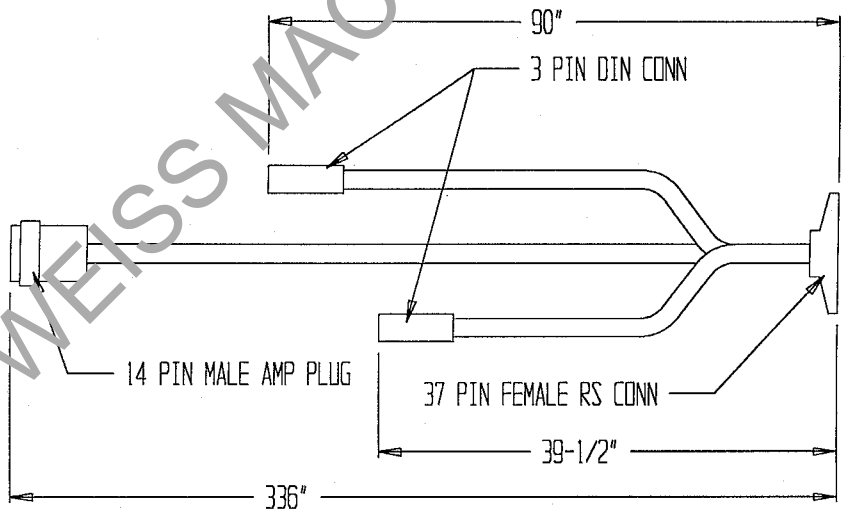
AA85652



FOR NEE CONTROLLER SINGLE X,SINGLE Y DRIVE

THE LOCKFORMER CO. 711 OGDEN AVE. LISLE, ILLINOIS 60532			B
MACHINE: VULCAN NEE		PART NUMBER: AA85652	5
PART NAME: X/Y MOTOR/ENCODER CABLE			4
			3
MATERIAL	HEAT TREAT	SCALE	2
FRAC. TOL ±1/2" / DEC. TOL / ANG. TOL	DRAWN BY JJB / CHECKED BY	DATE 04-11-96	REVISIONS

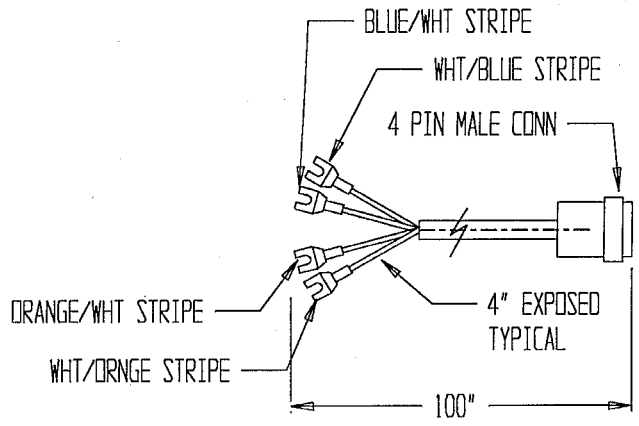
AA85653



INPUT -OUTPUT CABLE ASSY NEE CONTROLLER

THE LOCKFORMER CO. 711 OGDEN AVE. LISLE, ILLINOIS 60532			B
MACHINE: VULCAN NEE		PART NUMBER: AA85653	5
PART NAME: I-O CABLE NEE CONTROLLER			4
			3
MATERIAL	HEAT TREAT	SCALE	2
FRAC. TOL ±1/2" / DEC. TOL / ANG. TOL	DRAWN BY JJB / CHECKED BY	DATE 04-11-96	REVISIONS

AA85654

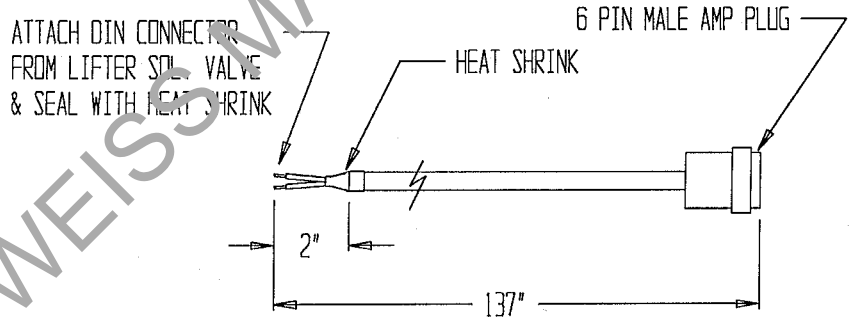


2

FOR REMOTE E-STOP NEE CONTROLLER

THE LOCKFORMER CO. 711 OGDEN AVE. LISLE, ILLINOIS 60532			6
MACHINE: VULCAN NEE		PART NUMBER: AA85654	5
PART NAME: SAFETY CIRCUIT CABLE 100'			4
			3
MATERIAL	HEAT TREAT	SCALE	2 4" WAS 2" ECO 064/104276 W.P. 5-20-97
FRAC. TOL. ±1/2" / DEC. TOL. / ANG. TOL.	DRAWN BY JJB / CHECKED BY	DATE 04-11-96	REVISIONS

AA85655

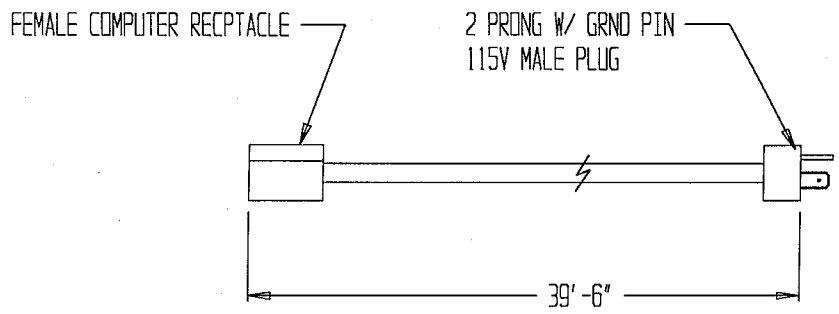


2

TORCH LLIFTER CABLE FOR NEE CONTROLLER

THE LOCKFORMER CO. 711 OGDEN AVE. LISLE, ILLINOIS 60532			6
MACHINE: VULCAN NEE		PART NUMBER: AA85655	5
PART NAME: CABLE TORCH LIFTER			4
			3
MATERIAL	HEAT TREAT	SCALE	2 137"/2" WAS 135"/4" ECO 064/104276 W.P. 5-20-97
FRAC. TOL. ±1/2" / DEC. TOL. / ANG. TOL.	DRAWN BY JJB / CHECKED BY	DATE 04-11-96	REVISIONS

AA85656

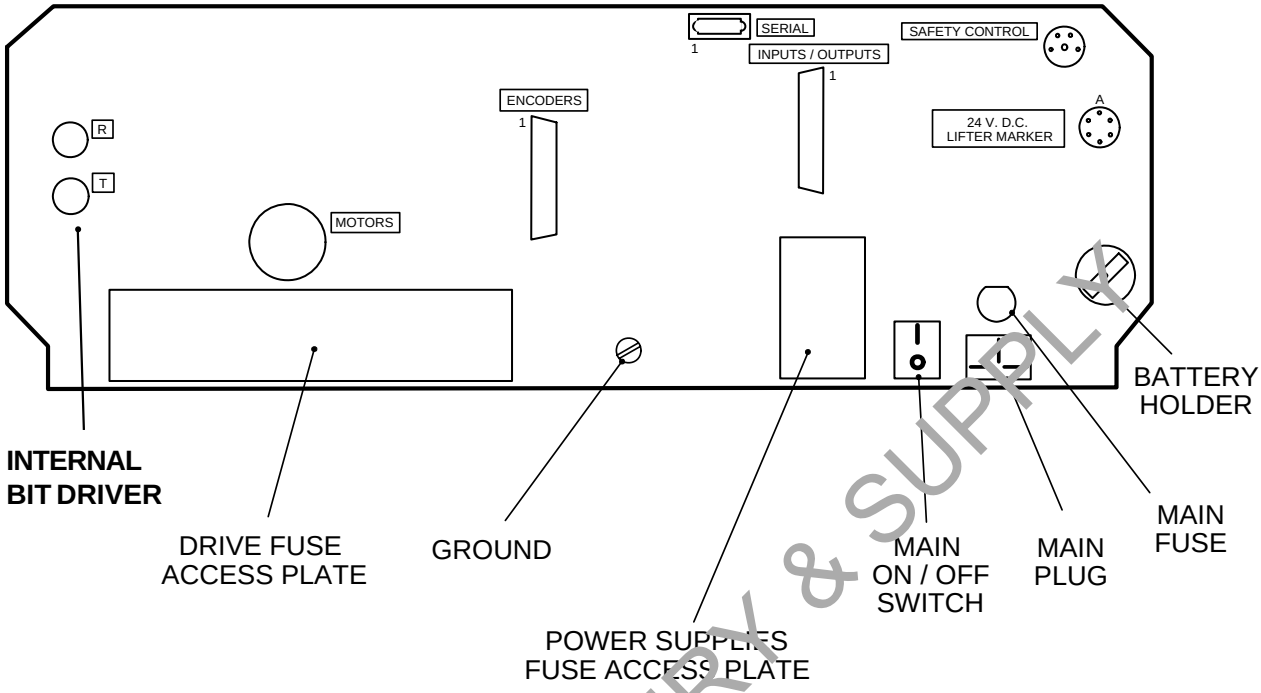


MAIN CONTROLLER POWER CABLE
THREE CONDUCTOR WITH SHIELD
FOR NEE CONTROLLER

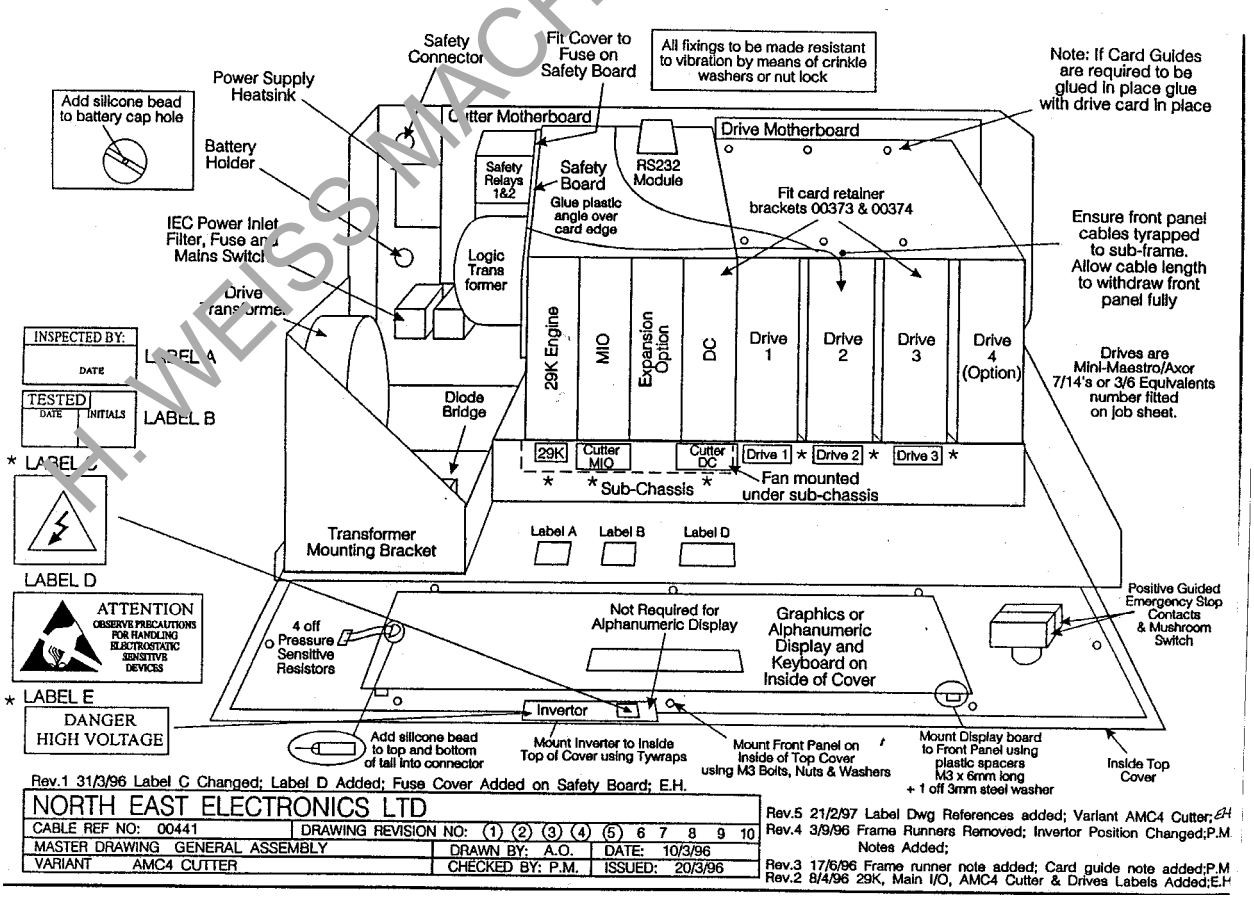
I

THE LOCKFORMER CO. 711 OGDEN AVE. LISLE, ILLINOIS 60532					6
MACHINE VULCAN NEE			PART NUMBER AA85656		5
PART NAME CABLE MAIN POWER 39'-6" LG					4
MATERIAL	HEAT TREAT		SCALE		3
FRAC. TOL. ±1/2"	DEC. TOL.	ANG. TOL.	DRAWN BY JJB	CHECKED	DATE 04-11-96
					2
					REVISIONS

NEE CONTROLLER
BACK PANEL LAYOUT



INTERIOR OF NEE CONTROLLER
GENERAL ASSEMBLY



SECTION 7

ADDITIONAL INFORMATION