IM609-B

May, 2001

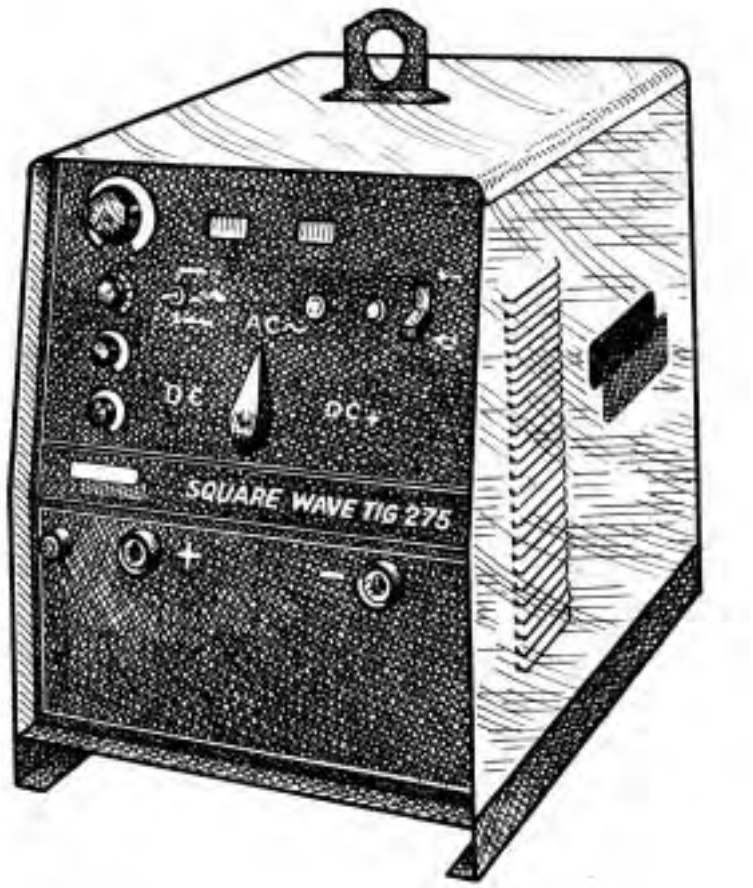
Square Wave TIG 275

For use with machines having Code Numbers: **10523, 10524, 10525, 10605, 10738**

This manual covers equipment which is no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT**. And, most importantly, think before you act and be careful.



Date of Purchase:_____
Serial Number:_____
Code Number:_____
Model:_____
Where Purchased:_____

OPERATOR'S MANUAL

ISO 9001

Designed and Manufactured Under a Quality Program Certified by ABS Quality Evaluations, Inc. to ISO 9001 Requirements.
CERTIFICATE NUMBER: 30273

LINCOLN® ELECTRIC

• World's Leader in Welding and Cutting Products •
• Sales and Service through Subsidiaries and Distributors Worldwide •
Cleveland, Ohio 44117-1199 U.S.A. TEL: 216.481.8100 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

For Diesel Engines: Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

For Gasoline Engines: The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

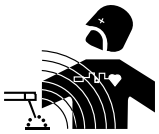
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

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ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.c. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.d. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.e. Also see item 1.b.

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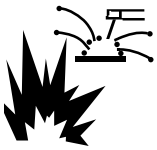


WELDING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

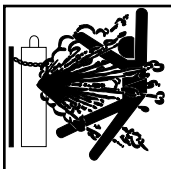
6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.



CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-l, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer’s recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

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PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

Mar. '93

Thank You —— for selecting a **QUALITY** product by Lincoln Electric. We want you to take pride in operating this Lincoln Electric Company product ••• as much pride as we have in bringing this product to you!

Please Examine Carton and Equipment For Damage Immediately

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, Claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Model Name & Number _____

Code & Serial Number _____

Date of Purchase _____

Whenever you request replacement parts for or information on this equipment always supply the information you have recorded above.

Read this Operators Manual completely before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. The level of seriousness to be applied to each is explained below:

⚠ WARNING

This statement appears where the information **must** be followed **exactly** to avoid **serious personal injury** or **loss of life**.

⚠ CAUTION

This statement appears where the information **must** be followed to avoid **minor personal injury** or **damage to this equipment**.

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TECHNICAL SPECIFICATIONS - Square Wave TIG 275 (K1617-1, and -2)

INPUT - SINGLE PHASE ONLY

Standard Voltage	Input Current at 40% Duty Cycle		Input Current at 60% Duty Cycle		Input Current at 100% Duty Cycle		Idle Current	Idle Power Power	Code Number
	DC STICK, DC TIG, BALANCED AC TIG	UNBALANCED AC TIG	DC STICK, DC TIG, BALANCED AC TIG	UNBALANCED AC TIG	DC STICK, DC TIG, BALANCED AC TIG	UNBALANCED AC TIG			
208/230/460/1/60 (K1617-1)									
460/575/1/60 (K1617-2)	95/86/43	130/120/61	76/69/34	106/97/50	57/52/26	82/75/38	5/4/2	900 WMax.	10523
208/230/460/1/60 (K1617-1)	43/35	61/49	34/28	50/41	26/21	38/31	2/1.5	900 WMax.	10525
	95/86/43	130/120/61	76/69/34	106/97/50	57/52/26	82/75/38	5/4/2	900 WMax.	10605

RATED OUTPUT & ADDITIONAL OUTPUT CAPACITY

Duty Cycle		Amps	Volts at Rated Amperes	Current Range	Auxiliary Power
40% Duty Cycle	AC/DC Stick	275 A	31.0 V	5-315 Amps	115 Volts AC, 10 Amps Grounded NEMA-5-15R Receptacle and 10 Amp Circuit Breaker
NEMA Class II (40)	AC/DC TIG	255 A	16.1 V		
60% Duty Cycle	AC/DC Stick	225 A	29.0 V	MAX O.C.V. AC & DC 80V	
	AC/DC TIG	200 A	15.4 V		
100% Duty Cycle	AC/DC Stick	175 A	27.0 V	Normal O.C.V. 72 V (AC) 59 V (DC)	
	AC/DC TIG	150 A	14.8 V		

RECOMMENDED INPUT WIRE AND FUSE SIZES

	For AC/DC Stick, DC TIG and Balanced AC TIG Welding at 275A 40% Duty Cycle w/o Optional K1620-1 Power Factor Capacitors Based on the 1996 U.S. National Electrical Code				For Unbalanced AC TIG Welding above 180A, 255A 40% Duty Cycle, Maximum Penetration w/o Optional K1620-1 Power Factor Capacitors Based on the 1996 U.S. National Electrical Code			
Input Voltage / phase/ Frequency	Fuse (Super Lag) or Breaker Size[1]	Input Amperes	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes 40°C (104°F) Ambient	Type 75°C Copper Ground Wire in Conduit AWG (IEC) Sizes	Fuse (Super Lag) or Breaker Size[1]	Input Amperes	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes 40°C (104°F) Ambient	Type 75°C Copper Ground Wire in Conduit AWG (IEC) Sizes
208/1/60	125	111	4 (21.2 mm^2)	6 (13.3 mm^2)	150	130	3 (25.0 mm^2)	6 (13.3 mm^2)
230/1/60	125	100	4 (21.2 mm^2)	6 (13.3 mm^2)	150	120	3 (25.0 mm^2)	6 (13.3 mm^2)
460/1/60	60	50	8 (8.4 mm^2)	10 (5.3 mm^2)	70	61	8 (8.4 mm^2)	8 (8.4 mm^2)
575/1/60	50	40	10 (5.3 mm^2)	10 (5.3 mm^2)	60	49	8 (8.4 mm^2)	10 (5.3 mm^2)

[1] Also called “inverse time” or “thermal/magnetic” circuit breakers; circuit breakers which have a delay in tripping action that decreases as the magnitude of current increases.

PHYSICAL DIMENSIONS

	Height	Width	Depth	Weight
Power Source	24.06 in. 611 mm Lift Hook add 3.57” (91 mm)	19.15 in. 486 mm	28.00 in. 711 mm	Approx. 330 lbs. 150 kg.
Power Source on Undercarriage	33.40 in. 848 mm	27.65 in. 702 mm	40.65 in. 1033 mm	Approx. 375 lbs. 170 kg.

TECHNICAL SPECIFICATIONS - Square Wave TIG 275 (K1618-1)

INPUT - SINGLE PHASE ONLY

Standard Voltage	Input Current at 40% Duty Cycle		Input Current at 60% Duty Cycle		Input Current at 100% Duty Cycle		Idle Current	Idle Power	Code Number
	DC STICK, DC TIG, BALANCED AC TIG	UNBALANCED AC TIG	DC STICK, DC TIG, BALANCED AC TIG	UNBALANCED AC TIG	DC STICK, DC TIG, BALANCED AC TIG	UNBALANCED AC TIG			
220/380/415/1/50/60	99/57/52	139/79/72	83/45/421	12/64/59	63/36/33	86/49/45	8/6/5	900 WMax.	10524

RATED OUTPUT & ADDITIONAL OUTPUT CAPACITY

Duty Cycle		Amps	Volts at Rated Amperes	Current Range	Auxiliary Power
40% Duty Cycle	AC/DC Stick	275 A	31.0 V	5-315 Amps	220 Volts AC, 2 Amps Schuko Receptacle and 2 Amp Circuit Breaker
NEMA Class II (40)	AC/DC TIG	255 A	20.2 V		
60% Duty Cycle	AC/DC Stick	225 A	29.0 V	MAX O.C.V. AC & DC 80V	
	AC/DC TIG	200 A	18.0 V		
100% Duty Cycle	AC/DC Stick	175 A	27.0 V	Normal O.C.V. 72 V (AC) 59 V (DC)	
	AC/DC TIG	150 A	16.0 V		

RECOMMENDED INPUT WIRE AND FUSE SIZES

	For AC/DC Stick, DC TIG and Balanced AC TIG Welding at 275A 40% Duty Cycle w/o Optional K1620-1 Power Factor Capacitors Based on the 1996 U.S. National Electrical Code				For Unbalanced AC TIG Welding above 180A, 255A 40% Duty Cycle, Maximum Penetration w/o Optional K1620-1 Power Factor Capacitors Based on the 1996 U.S. National Electrical Code			
Input Voltage / phase/ Frequency	Fuse (Super Lag) or Breaker Size[1]	Input Amperes	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes 40°C (104°F) Ambient	Type 75°C Copper Ground Wire in Conduit AWG (IEC) Sizes	Fuse (Super Lag) or Breaker Size[1]	Input Amperes	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes 40°C (104°F) Ambient	Type 75°C Copper Ground Wire in Conduit AWG (IEC) Sizes
220/1/50/60	125	106	4 (21.2 mm^2)	6 (13.3 mm^2)	175	139	3 (25.0 mm^2)	6 (13.3 mm^2)
380/1/50/60	70	60	8 (8.4 mm^2)	8 (8.4 mm^2)	90	79	6 (13.3 mm^2)	8 (8.4 mm^2)
415/1/50/60	70	55	8 (8.4 mm^2)	8 (8.4 mm^2)	90	72	6 (13.3 mm^2)	8 (8.4 mm^2)

[1] Also called “inverse time” or “thermal/magnetic” circuit breakers; circuit breakers which have a delay in tripping action that decreases as the magnitude of current increases.

PHYSICAL DIMENSIONS

	Height	Width	Depth	Weight
Power Source	24.06 in. 611 mm Lift Hook add 3.57” (91 mm)	19.15 in. 486 mm	28.00 in. 711 mm	Approx. 340 lbs. 154 kg.
Power Source on Undercarriage	33.40 in. 848 mm	27.65 in. 702 mm	40.65 in. 1033 mm	Approx. 385 lbs. 175 kg.

Read entire installation section before starting installation.

Safety Precautions

⚠ WARNING

ELECTRIC SHOCK can kill.
- **Only qualified personnel should perform this installation.**
- **Turn the input power OFF at the disconnect switch or fuse box before working on this equipment.**

- **Do not touch electrically hot parts.**
- **Always connect the Square Wave TIG 275 grounding screw (located on the right rear corner of the base) to a good electrical earth ground.**
- **Always connect the Square Wave TIG 275 to a power supply grounded per the National Electrical Code and any local codes.**

SELECT SUITABLE LOCATION

Place the welder where clean cooling air can freely circulate in through the rear louvers and out through the side louvers. Dirt, dust or any foreign material that can be drawn into the welder should be kept at a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance trips.

STACKING

Square Wave TIG 275's cannot be stacked.

LIFTING AND MOVING

The Square Wave TIG 275 should be lifted with a hoist. (It weighs approximately 330 lbs./150 kg.) An optional undercarriage is available to easily move the unit. Refer to the Accessories section of this manual. The Square Wave TIG 275 is designed to be used with a K932-1 Undercarriage. Complete installation instructions are included with the K932-1 Undercarriage. When the undercarriage is properly installed, the Square Wave TIG 275 lift bale is nonfunctional. **Do not attempt to lift the power source with the undercarriage attached.** The undercarriage is designed for hand moving only; mechanized towing can lead to personal injury and/or damage to the Square Wave TIG 275.

TILTING

Each machine must be placed on a secure, level surface, either directly or on a recommended undercarriage. The machine may topple over if this procedure is not followed.

ENVIRONMENTAL RATING

The Square Wave TIG 275 power source carries an IP21 environmental rating. It may be used in normal industrial and commercial environments. It is rated for use in damp, dirty rain-sheltered environments.

MACHINE GROUNDING AND HIGH FREQUENCY INTERFERENCE PROTECTION

The frame of the welder must be grounded. A ground screw marked with the symbol ⏚ is located at the right rear corner of the base for this purpose. See your local and national electrical codes for proper grounding methods.

The spark gap oscillator in the high frequency generator, being similar to a radio transmitter, can be blamed for many radio, TV and electronic equipment interference problems. These problems may be the result of radiated interference. Proper grounding methods can reduce or eliminate radiated interference.

The Square Wave TIG 275 has been field tested under recommended installation conditions and has been found to comply with F.C.C. allowable radiation limits. A certificate (S14929) is being sent with each welder for customer convenience. If he desires or is required to obtain certification of compliance with F.C.C. RF Energy Radiation Limits, this certificate can be used. It is the customer's responsibility to obtain this certification. This welder has also been found to comply with NEMA standards for high frequency stabilized power sources.

Radiated interference can develop in the following four ways:

1. Direct interference radiated from the welder.
2. Direct interference radiated from the welding leads.
3. Direct interference radiated from feedback into the power lines.
4. Interference from re-radiation of "pickup" by ungrounded metallic objects.

Keeping these contributing factors in mind, installing equipment per the following instructions should minimize problems.

1. Keep the welder power supply lines as short as possible and enclose as much of them as possible in rigid metallic conduit or equivalent shielding for a distance of 50 feet (15.2m). There should be good electrical contact between this conduit and the welder case ground. Both ends of the conduit should be connected to a driven ground and the entire length should be continuous.

2. Keep the work and electrode leads as short as possible and as close together as possible. Lengths should not exceed 25 ft (7.6m). Tape the leads together when practical.

3. Be sure the torch and work cable rubber coverings are free of cuts and cracks that allow high frequency leakage. Cables with high natural rubber content, such as Lincoln Stable-Arc® better resist high frequency leakage than neoprene and other synthetic rubber insulated cables.

4. Keep the torch in good repair and all connections tight to reduce high frequency leakage.

5. The work piece must be connected to an earth ground close to the work clamp, using one of the following methods:

   a) A metal underground water pipe in direct contact with the earth for ten feet or more.

   b) A 3/4" (19mm) galvanized pipe or a 5/8" (16mm) solid galvanized iron, steel or copper rod driven at least eight feet into the ground.

The ground should be securely made and the grounding cable should be as short as possible using cable of the same size as the work cable, or larger. Grounding to the building frame electrical conduit or a long pipe system can result in re-radiation, effectively making these members radiating antennas. (This is not recommended).

6. Keep all access panels and covers securely in place.

7. All electrical conductors within 50 ft (15.2m) of the welder should be enclosed in grounded rigid metallic conduit or equivalent shielding. Flexible helically-wrapped metallic conduit is generally not suitable.

8. When the welder is enclosed in a metal building, the metal building should be connected to several good earth driven electrical grounds (as in 5 (b) above) around the periphery of the building.

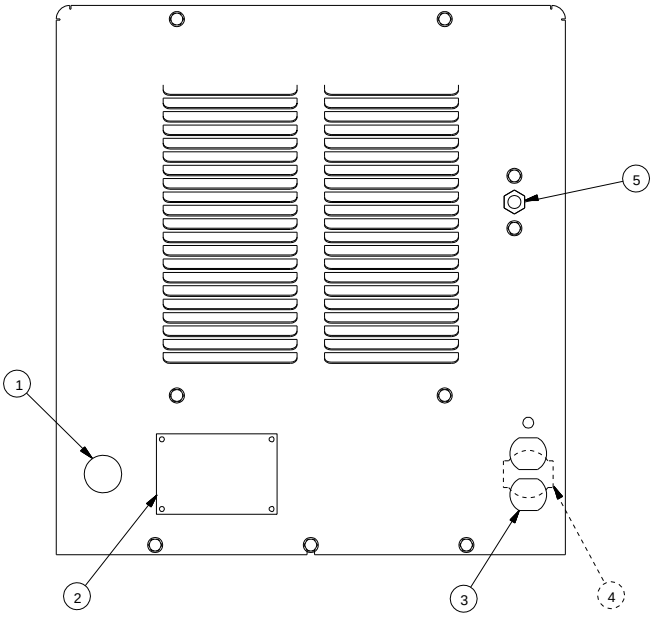
Failure to observe these recommended installation procedures can cause radio or TV and electronic equipment interference problems and result in unsatisfactory welding performance resulting from lost high frequency power.

SUPPLY CONNECTIONS

Be sure the voltage, phase, and frequency of the input power is as specified on the rating plate, located on the rear of the machine.

See Figure A.1 for the location of the rating plate, the entry hole, and the reconnect panel.

FIGURE A.1



1. Input Entry
2. Rating Plate
3. 115V Receptacle & Breaker (60 HZ. Machines only)
4. 220V Receptacle & Breaker (50/60 HZ. Machines Only.)
5. Gas Input Fitting

Remove the right case side to reveal the reconnect panel. Welder supply line entry provision is in the case rear panel. Entry is through a 1.4 inch (36 mm) diameter hole in the case back.[1]

All connections should be made in accordance with all local codes and national electrical codes. Installation by a qualified electrician is recommended.

1. Connect the terminal marked ⏚ (at the base of the welder below the reconnect panel) to an earth ground.

2. Connect the input leads to terminals marked L1 (U) and L2 (V) on the reconnect panel. Use a single phase line or one phase of a two or three phase line.

[1]On European, 50/60 Hz. models, entry is through a 1.75 inch (46mm) diameter hole. A reducing washer and plastic strain relief good for 18.0 to 25.4 mm (.709 to 1.00 inch) cords is provided. For larger input conductors a customer supplied plastic strain relief should be used.

Fuse the input circuit with the recommended super lag fuses or delay type[1] circuit breakers. Choose an input and grounding wire size according to local or national codes or refer to the **Technical Specifications** page at the beginning of this section. Using fuses or circuit breakers smaller than recommended may result in "nuisance" tripping from welder inrush currents even if not welding at high currents.

Unbalanced AC TIG welding draws higher input currents than those for Stick, DC TIG, or Balanced AC TIG welding. The welder is designed for these higher input currents. However, where unbalanced AC TIG welding above 180 amps is planned, the higher input currents require larger input wire sizes and fuses per the **Technical Specifications** page at the beginning of this section.

INPUT RECONNECT PROCEDURE

On multiple input voltage welders, be sure the reconnect panel is connected per the following instructions for the voltage being supplied to the welder.

[1] Also called "inverse time" or "thermal/magnetic" circuit breakers; circuit breakers which have a delay in tripping action that decreases as the magnitude of the current increases.

⚠ CAUTION

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN CAUSE IMMEDIATE FAILURE OF COMPONENTS WITHIN THE WELDER.

Welders are shipped connected for the highest input voltage as listed on the rating plate. To change this connection, refer to the following instructions:

1. Remove the right case side to reveal the reconnect panel.

2. Reconnect the lead marked A to the terminal stud corresponding to the input voltage used. Refer to the figure representing the model being reconnected:

Figure A.2 208/230/460/1/60 Domestic Model
Figure A.3 460/575/1/60 Domestic/Canadian Model
Figure A.4 220/380/415/1/50/60 European Model
(Con't)

Figure A.2
Reconnect Panel Instructions for 208/230/460 Domestic Model

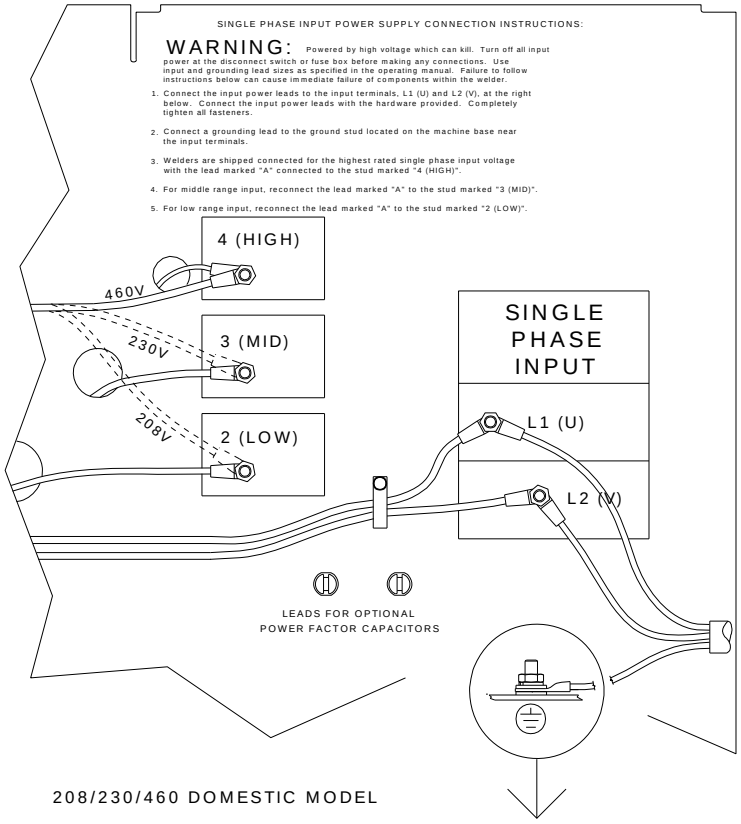


Figure A.3
Reconnect Panel Instructions for 460/575 Canadian Model

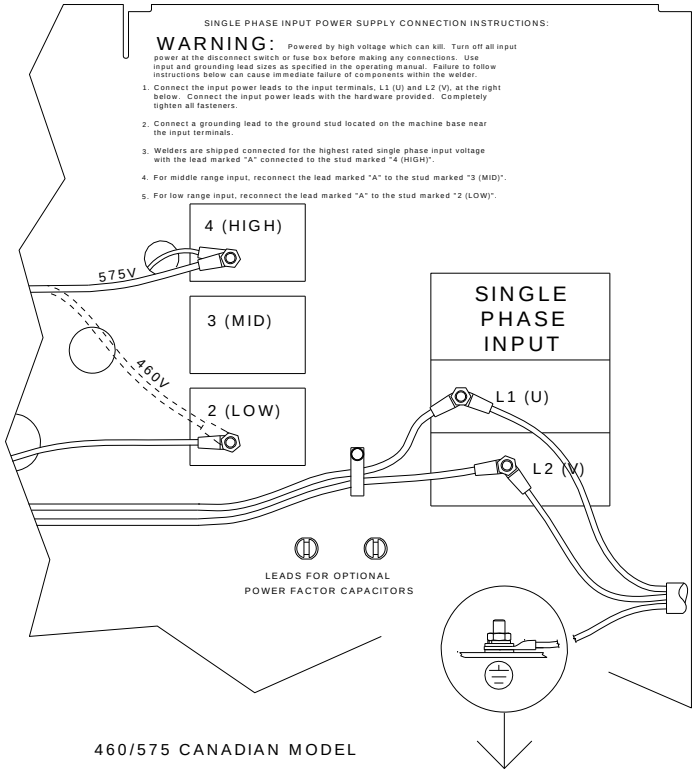
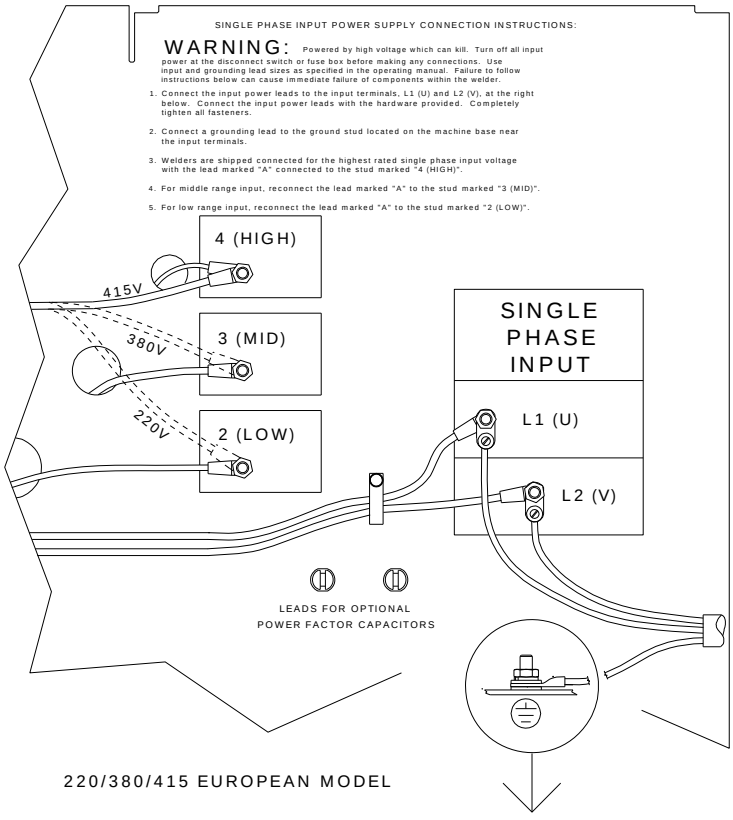


Figure A.4
Reconnect Panel Instructions for 220/380/415 European Model



Designations on the reconnect panel LOW, MID, and HIGH correspond to the nameplated input voltages of a triple voltage welder. Dual voltage welders use only LOW and HIGH.

EXAMPLE: On a 208/230/460 volt welder, LOW is 208V, MID is 230V, and HIGH is 460V.

3. Make sure all connections are tight. Replace the case side and all screws.

OUTPUT CONNECTIONS

⚠ WARNING

To avoid being startled by a high frequency shock, keep the TIG torch and cables in good condition.

ELECTRIC SHOCK can kill.

- Turn the power switch of the power source “OFF” before installing adapters on cable or when connecting or disconnecting adapter plugs to power source.

See Figure B.1 for the location of the work and electrode terminals, the gas and optional water solenoids, and the Remote Receptacle.The Square Wave TIG 275 is equipped with Twist-Mate connectors for the electrode and work connection.

WORK CABLE CONNECTION

The Twist-Mate connection allows fast and reliable work cable attachment to the work terminal of the Square Wave TIG 275 welding power supply.

Assemble the work cable by attaching the correct Twist-Mate adapter and work clamp to an adequately-sized welding cable. The Twist-Mate cable plug included with the machine is designed to accept a welding cable size of of #2 to #1. See Table A.1 and A.2 for recommended sizes and corresponding hardware.

TABLE A.1
Cable Sizes for Combined Lengths of Copper Electrode and Work Cable

Machine Size	Lengths up to 100 ft	100 to 200 ft	200 to 250 ft
275 Amp 40% Duty Cycle	#1 (42.4mm^2)	1/0 (53.5mm^2)	2/0 (67.4mm^2)

TABLE A.2
Recommended Work and Stick Electrode Components

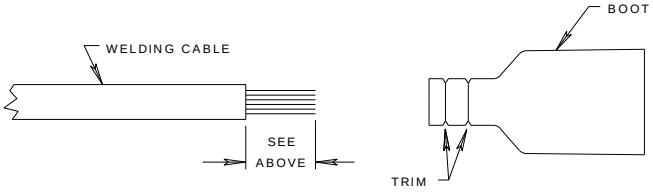
Twist Mate Cable Plug for Work Lead (#2 to #1)	Twist Mate Cable Plug for Work Lead (1/0 to 2/0)	Twist Mate Cable Plug for Work Lead (2/0 to 3/0)	Work Clamp	Electrode Holder
K852-50	K852-70	K852-95	K910-1	K909-4

Assemble the correct Twist-Mate-adapter plug to the work cable as follows:

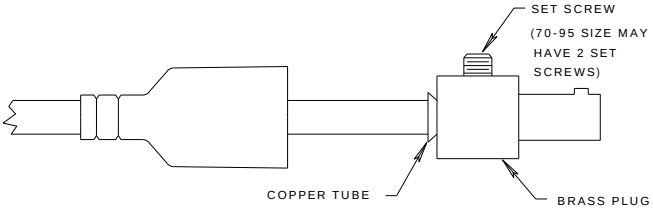
1. Skin the cable jacket to 1.00 in (25.4 mm) for a #2 thru 2/0 (35 thru 70 mm2) cable. Skin the cable jacket to 1.50 in (38.1 mm) for a 2/0 thru 3/0 (70 thru 95 mm2) cable.

2. If necessary, trim the cable end of the rubber boot to match the diameter of the cable.

3. Slide the rubber boot onto the skinned cable end. Use soap for lubricant if required.



4. Slide the copper tube into the brass plug. Insert skinned cable into the copper tube.



5. Tighten set screw(s) to collapse copper tube. Screw(s) must apply firm pressure against welding cable.

6. Slide the rubber boot over the brass plug. The rubber boot must be positioned to completely cover all electrical surfaces after the plug is locked into the receptacle. For more details see S18737PRINT or instructions included with the adapter kit.

TIG TORCH CONNECTION

The Twist-Mate connection allows fast and reliable TIG torch attachment to the electrode terminal of the Square Wave TIG 275 welding power supply. Twist-Mate TIG adapters are made of brass, combining high electrical conductivity with mechanical strength. They are available in several sizes and styles to accommodate a wide selection of gas and water-cooled TIG torches.

- Air-Cooled TIG Torch connections refer to TWIST-MATE ADAPTER for LA-9 and LA-17 TIG TORCH Section.

- Water-Cooled TIG Torch connections refer to TWIST-MATE ADAPTER for LW-18 and LW-20 TIG TORCH Section.

Any torch having hoses and cables equipped with Compressed Gas Association (CGA) style fittings can be connected to an appropriate Twist-Mate adapter (see **ACCESSORIES** section). **The power source must be switched off while making any of these connections.**

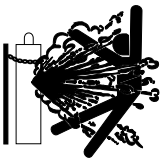
Do not operate a water-cooled torch without an adequate coolant supply. Set-ups using recirculated coolant require that the cooler be switched on and running. If the water solenoid valve option is used with a cooler, the coolant does not flow until the solenoid is actuated.

For set-ups using water as a single-pass through coolant, install a strainer into the system upstream of the Square Wave TIG 275 to reduce the concentration of particles that could contaminate the system. Otherwise, flow passages could become obstructed or clogged, causing torch overheating or failure. The optional water solenoid valve may also malfunction.

When the water solenoid valve option is installed into the Square Wave TIG 275, connect the coolant supply line from either cooler outlet or single-pass supply to the “Water Inlet” fitting located on the machine’s case front. Connect the TIG torch’s smaller water fitting to the “Water Out” fitting also located on the case front. A non-metallic coolant line is required between the electrode connection and the drain or cooler inlet. This reduces the possibility of an electrical hazard.

TIG welding torches are available with 12.5 and 25 foot (3.8 and 7.6 m, respectively) long cables. Use the shorter length whenever possible to reduce radio interference problems.

⚠ WARNING



CYLINDER could explode if damaged.

- Keep cylinder upright and chained to a support.
- Keep cylinder away from areas where it could be damaged.
- Never allow the torch to touch the cylinder.
- Keep cylinder away from live electrical circuits.
- Maximum inlet pressure 150 psi.

The high-pressure cylinder of inert shielding gas must be equipped with a flow regulator that limits the gas pressure to 150 psi maximum at the machine’s gas inlet. This brass inlet fitting is located on the rear panel of the Square Wave TIG 275. Install a hose between the gas flow meter and the inlet fitting.

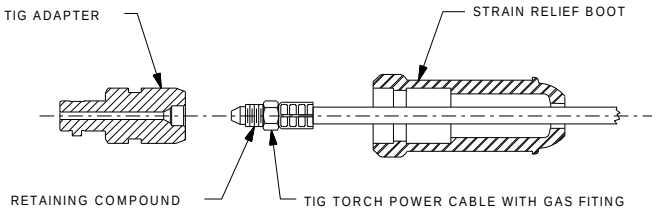
For other conditions, consult the manufacturer’s instructions for the water cooler or TIG torch being used.

TWIST-MATE ADAPTER FOR LA-9 and LA-17 TIG TORCH

The Twist-Mate connection allows fast and reliable TIG torch connections to the electrode terminal of the Square Wave TIG 275. The Twist-Mate adapter, strain relief boot and retaining compound needed to connect an LA-9 or LA-17 torch (or any equivalent air-cooled TIG torch with a right-hand male 3/8-24 fitting) are included with the Square Wave TIG 275.

Assemble the the LA-9 or LA-17 TIG torch to the Twist-Mate adapter as follows:

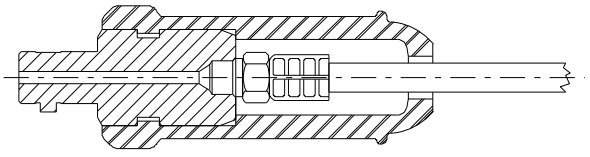
1. Slide the strain relief boot over the TIG torch's power cable with gas fitting.



2. Apply a small amount of retaining compound to the fitting threads as shown. Thread the fitting to the TIG adapter and tighten to ensure a sealed gas connection and a good electrical connection. (35-45 in-lbs)

3. Hold the TIG adapter, with cable installed, firmly in place by securing it into the Twist- Mate receptacle on the power source or into a padded vise. Align the hex in the boot with the hex on the adapter. Firmly push the boot onto the adapter, rocking the boot to assist installation. Use soap for lubricant if required.

COMPLETED ASSEMBLY



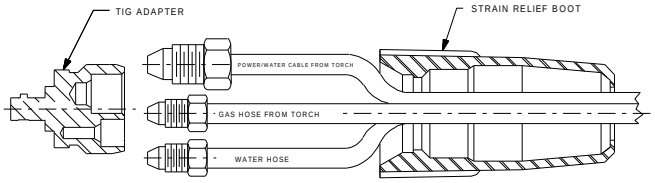
4. Examine the strain relief boot and TIG adapter for correct assembly. The boot should nest into the Twist-Mate receptacle on the power source. All electrical surfaces should be completely covered when in the Twist-Mate receptacle on the power source. For more details see M19115PRINT included with the machine.

TWIST-MATE ADAPTER FOR LW-18 and LW-20 TIG TORCH

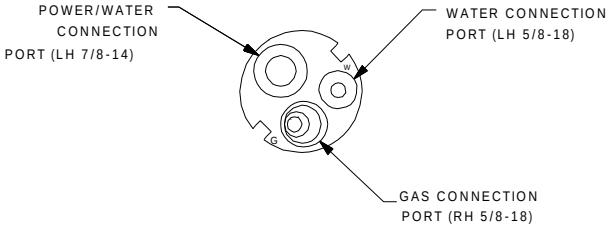
The Twist-Mate connection allows fast and reliable TIG torch connections to the electrode terminal of the Square Wave TIG 275. The Twist-Mate adapter and strain relief boot needed to connect an LW-18 or LW-20 torch (or any equivalent water-cooled TIG torch with the fittings shown in the diagrams under step 2 and 3.) are included with the Square Wave TIG 275.

Assemble the the LW-18 or LW-20 TIG torch to the Twist-Mate adapter as follows:

1. Slide the strain relief boot over the TIG torch's power/water cable (large fitting) and gas hose (small fitting without notches on hex). Also slide a water hose into the strain relief boot as shown.

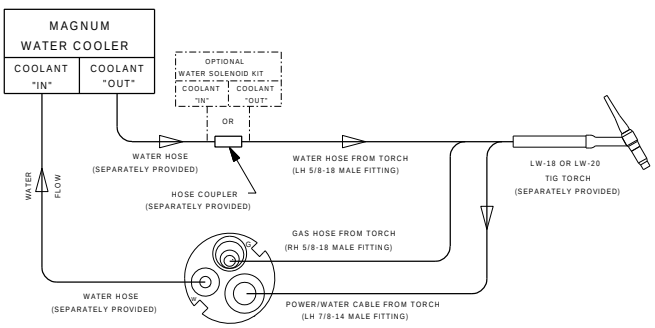


2. Thread the power/water cable (large fitting) from the torch to the large port on the TIG adapter and tigten to ensure a water tight connection. Next, thread the gas hose (small fitting without notches on hex) to the port marked "G" on the TIG adapter and tighten to ensure a sealed gas connection. Next, thread the water hose to cooler (or to water drain) to the port marked "W" on the TIG adapter.



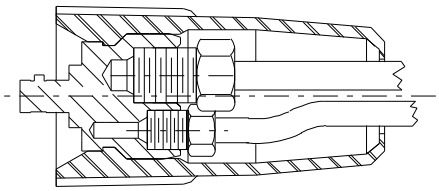
3. Check all connections made in step 2 for gas and water leaks before proceding.

CONNECTION DIAGRAM



4. Hold the TIG adapter, with cables and hoses installed, firmly in place by securing it into the Twist-Mate receptacle on the power source or into a padded vise. Apply a thin film of lubricant to the boot's lead in chamfer area. Also apply lubricant to the lead in chamfer and 2" diameter on the TIG adapter. Next align the strain relief boot keys with the TIG adapter slots. Now firmly push the boot onto the adapter, rocking the boot to assist installation.

COMPLETED ASSEMBLY



5. Examine the strain relief boot and TIG adapter for correct assembly. The boot should nest into the Twist-Mate receptacle on the power source. The boot face will be 1/8 inch away from the machine front. All electrical surfaces should be completely covered when in the Twist-Mate receptacle on the power source. For more details see M19116PRINT included with the machine.

STICK ELECTRODE CABLE CONNECTION

The Twist-Mate connection allows fast and reliable stick electrode attachment to the electrode terminal of the Square Wave TIG 275 welding power supply.

Assemble the stick electrode cable by attaching the correct Twist-Mate adapter and electrode holder to an adequately-sized welding cable. The Twist-Mate cable plug is NOT provided with the machine for the stick electrode connection. See Table A.1 and A.2 for recommended sizes and corresponding hardware.

Assemble the correct Twist-Mate adapter plug to the stick electrode cable as detailed in "Work Cable Connection".

⚠ WARNING

DO NOT CONNECT A TIG TORCH AND STICK ELECTRODE CABLE AT THE SAME TIME. THEY WILL BOTH BE ELECTRICALLY HOT WHENEVER THE OUTPUT CONTACTOR IS ENERGIZED.

INSTALLATION OF FIELD INSTALLED OPTIONS

Installation instructions are included with the following accessories:

K559-2 Magnum Cooler Mounting Bracket

K932-1 Undercarriage When the undercarriage is properly installed, the Square Wave TIG 275 lift bale is nonfunctional. Do not attempt to lift the power source with the undercarriage attached. The undercarriage is designed for hand moving only; mechanized towing can lead to personal injury and/or damage to the Square Wave TIG 275.

K1619-1 TIG Pulser Kit

K1620-1 Power Factor Capacitor Kit

K1621-1 Water Solenoid Kit

K1622-1 Twist Mate Adapter Kit for LA9 & LA17 Torches (Included with Machine)

K1622-2 Twist Mate Adapter Kit for LW18 & LW20 Torches (Included with Machine)

K1622-3 Twist Mate Adapter Kit for LA26 Torch

K852-50 Twist Mate Cable Plug for #2 to #1 Work Lead (Included with Machine)

K852-70 Twist Mate Cable Plug for 1/0 to 2/0 Work Lead

K852-95 Twist Mate Cable Plug for 2/0 to 3/0 Work Lead

Installation of the K963-1 or K963-2 Hand Amptrol, the K814 Arc Start Switch and the K870 Foot Amptrol are as follows:

Connect the 6-pin MS-type (Amphenol) connector to the Remote Receptacle (See Figure 3). Secure with the threaded collar.

SAFETY PRECAUTIONS

Read and understand this entire section before operating the machine.

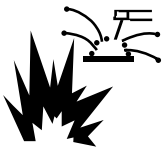
⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Always wear dry insulating gloves.
- Read and follow "Electric Shock Warnings" in the Safety section if welding must be performed under electrically hazardous conditions such as welding in wet areas or on or in the workpiece.

FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.



WELDING SPARKS can cause fire or explosion

- Keep flammable material away.
- Do not weld on containers that have held combustibles.

ARC RAYS can burn.

- Wear eye, ear and body protection.

Observe additional Safety Guidelines detailed in the beginning of this manual.

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

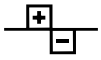
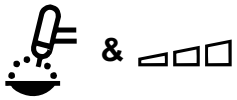
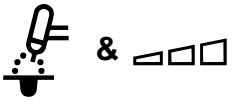
POWER SWITCH

SYMBOL	MEANING
	ON
	OFF

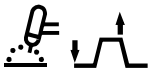
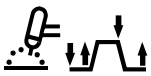
OUTPUT CONTROL

SYMBOL	MEANING
	CURRENT CONTROL (OUTPUT)

AC WAVE BALANCE CONTROL

SYMBOL	MEANING
	AC WAVE BALANCE
	CLEAN (INCREASING POSITIVE POLARITY)
	PENETRATE (INCREASING NEGATIVE POLARITY)

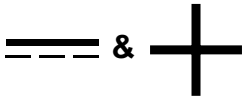
MODE SWITCH

SYMBOL	MEANING
	TIG 2-STEP
	TIG 4-STEP
	STICK

POST FLOW CONTROL AND DOWN SLOPE TIME CONTROL

SYMBOL	MEANING
	POST FLOW TIME
	DOWN SLOPE TIME

POLARITY SWITCH

SYMBOL	MEANING
	DC- POLARITY
	DC+ POLARITY
	AC POLARITY

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

OPTIONAL WATER SOLENOID CONNECTIONS

SYMBOL	MEANING
	WATER (COOLANT) INPUT
	WATER (COOLANT) OUTPUT

OUTPUT CONNECTIONS

SYMBOL	MEANING
	WORK CONNECTION
	ELECTRODE CONNECTION

ADDITIONAL SYMBOLS

SYMBOL	MEANING
	REMOTE CONTROL
	DO NOT SWITCH WHILE WELDING
	WARNING
	PROTECTIVE GROUND
	TIG (GTAW)
	SINGLE PHASE
	SINGLE PHASE TRANSFORMER AC & DC RECTIFIER POWER SOURCE

GENERAL DESCRIPTION

The Square Wave TIG 275 is a constant current, single range square wave AC/DC TIG (GTAW) arc welding power source with built-in high frequency stabilization. It also has stick (SMAW) capability. A TIG Pulser Kit, Power Factor Capacitor Kit, and a Water Solenoid Kit are available as field installed options.

The Square Wave TIG 275 includes advanced features such as Presettable Digital Meters, Auto Balance™, 2-Step/4-Step operation, adjustable Down slope Time control and Fan as Needed. It also features Twist Mate connections for the electrode and work leads. In addition, fixed preflow and variable post flow timers are included to control the shielding gas, as well as the water flow when using the optional water solenoid.

RECOMMENDED PROCESSES AND EQUIPMENT

The Square Wave TIG 275 is recommended for the TIG (GTAW) and stick (SMAW) welding processes within its output capacity of 5 to 315 amps, on both AC and DC polarity. It is compatible with all Magnum TIG accessories, as well as many industry standard items, such as TIG torches, hoses, and water coolers.

DESIGN FEATURES AND ADVANTAGES

- Meets NEMA CLASS II (40) and IP21 environmental certification. CSA NRTL/C certified (Domestic and Canadian Models Only).

- Meets IEC-974-1 and IP21 environmental certification. CE certified (European Model Only).

- Built in Digital Ammeter and Voltmeter for precise process control. When not welding, the digital ammeter displays the peak current set with the output control knob. This allows the user to easily preset the peak current within the full output range of the machine. This includes a persistence feature which captures and continues to display the peak welding current and it's corresponding voltage for five seconds after the weld is completed.

- AC Wave Balance control knob provides flexibility to the customer. Set it to the Auto Balance position and the circuitry automatically provides the proper amount of cleaning and penetration for normal AC TIG welding. For special applications simply dial in the amount of cleaning and penetration needed.

- Fan As Needed (FAN) circuit turns 'ON' the fan only when cooling is needed. FAN minimizes the amount of dust, dirt, and other foreign material drawn into the machine. A build up of these materials can cause excessive operating temperatures and nuisance shut downs.

- 2-STEP/4-STEP TIG/STICK mode control switch. 4-STEP mode requires the use of an optional Arc Start Switch. This welding mode reduces fatigue by eliminating the need to manually control the weld current during the weld.

- Down Slope Time control is active in 4-STEP TIG mode. It controls the amount of time (approximately 1 to 10 seconds) it takes the weld current to ramp down from the Preset level to 25% ±10% of that level.

- Post Flow Time control is active in the 2 and 4-STEP TIG modes. It controls the amount of time (approximately 5 to 50 seconds) the shielding gas flows after the weld is completed.

- Robotic Interface connection on the PC board can be connected to the machines Remote Receptacle for automated welding procedures. This interface allows remote control of the trigger and output current of the machine as well as providing a signal when the weld is established. (For details contact the Lincoln Automation Center)

- Built in High Frequency Generator automatically performs in the correct mode. If the machine is in STICK mode, the HF stays 'OFF'. IF the machine is in DC TIG mode, the HF comes 'ON' and stays on until the arc is established. IF the machine is in AC TIG mode, the HF comes 'ON' and stays on continuously to stabilize the arc.

- Automatic Local/Remote current selection. The machine automatically senses if an Amptrol, Arc Start Switch or TIG Pulser is plugged in and transfers current control from local to remote.

- Built in preflow time of 0.5 seconds. Preflow time is eliminated if welding restarts during the pervious weld's post flow. This avoids unnecessary delays when making repeated welds.

- Simple dial and switch design provides the customer with flexible control of the welding process without unnecessary complication. Controls which are not needed in the weld mode selected are automatically locked out.

- Twist Mate connectors are provided for the electrode and work connections. This style connector makes the gas and current connections for the TIG torch at the same time. (Adapter plugs are provided)

- DC+/AC/DC- Polarity Switch allows the welder to change polarity without reconnecting leads.
- Provides excellent arc starting and stability throughout the machines wide current range (5 to 315 Amps) to handle the vast majority of TIG welding applications.
- Simple output current dial allows the user to preset the peak current within the full output range of the machine.
- Highly resistant to AC arc rectification.
- Thermostatically protected to prevent equipment damage.
- No tungsten spitting within current range of electrode.
- Designed to make maintenance and servicing easy.
- 115 Volt Receptacle with 10 Amp Circuit Breaker. Domestic and Canadian Models Only.
- 220 Volt European (Schuko) type Receptacle with 2 Amp Circuit Breaker. European Model Only.
- Low Voltage Trigger Circuit (18 VAC) for maximum operator safety.
- Remote Receptacle for Amptrol or Arc Start Switch connection.
- Gas Valve Inlet fitting conforms to Compressed Gas Association (CGA) standards.

LIMITATIONS

The Square Wave TIG 275 is not recommended for AC TIG welding when high concentrations of helium gas are used for shielding. This causes starting and arc rectification problems. Also the Square Wave 275 is not recommended for arc gouging due to it's limited output capacity. The Square Wave TIG 275 is also not recommended for pipe thawing.

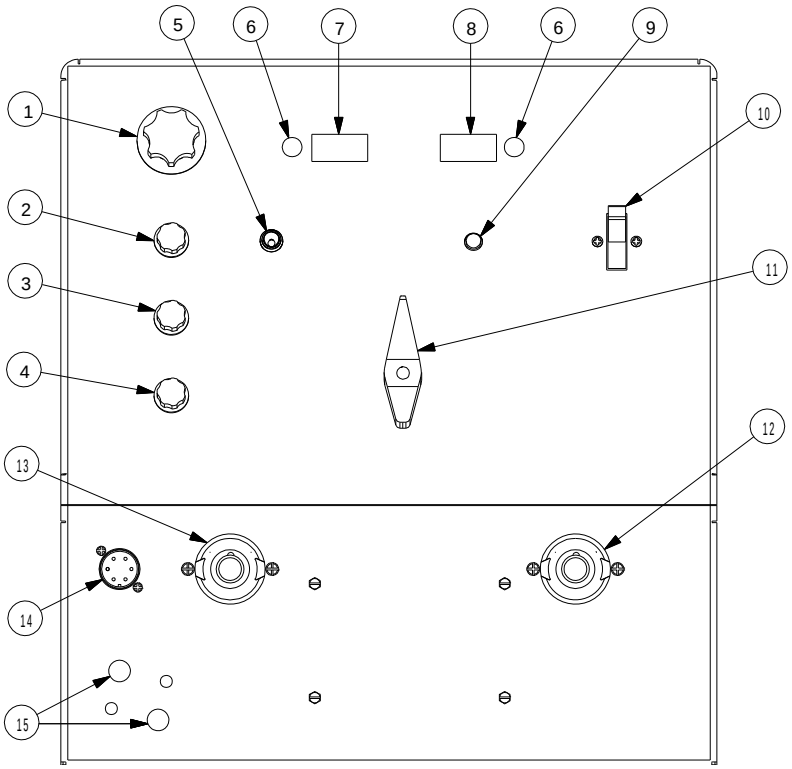
DUTY CYCLE AND TIME PERIOD

The duty cycle is based upon a 10 minute time period; i.e., for 40% duty cycle, it is 4 minutes welding and 6 minutes idling. If the duty cycle(s) are significantly exceeded, the thermostatic protection will shut off the output until the machine cools to a normal operating temperature. (Refer to **Technical Specifications** page)

CONTROLS AND SETTINGS

All operator controls and adjustments are located on the case front of the Square Wave TIG 275. Refer to Figure B.1 and corresponding explanations following.

FIGURE B.1 - CONTROL PANEL



1. Output Control Knob
2. AC Wave Balance Knob
3. Post Flow Knob
4. Down Slope Time Knob
5. Mode Switch
6. Trimmer Potentiometer
7. Digital Ammeter
8. Digital Voltmeter
9. Thermal Protection Light
10. Power Switch
11. Polarity Switch
12. Electrode Connection (Twist-Mate Connector)
13. Work Connection (Twist-Mate Connector)
14. Remote Control Amphenol
15. Water Solenoid (Optional)

1. **Current Control -** This knob is used to set the welding current from 5 to 315 amps. Read the complete Operating Instructions section for more information on Local and Remote setting of current.

2. **AC Wave Balance Control -** This knob is active in the AC TIG mode only. It is used to set the amount of cleaning and/or penetration produced during an AC TIG weld. Auto Balance™ automatically sets the AC Wave balance according to the welding current. If manual adjustment is desired, the balance can be adjusted from +0 (maximum cleaning) to +10 (maximum penetration).

   Read the Advanced Features section for a complete explanation of the AC Wave Balance.

3. **Post Flow Time Control -** This knob is active in the TIG mode only. It adjusts the post flow time from 5 to 50 seconds for shielding gas. It also adjusts cooling water flow when the optional K1621-1 Water Solenoid Kit is used.

4. **Down Slope Time Control -** This knob is active in 4-Step TIG mode only. It adjusts the time (from 0.5 to 10 seconds) the welding output takes to ramp down from the preset level to 25% ±10% of that level.

5. **Mode Switch** - A three position toggle switch used to select the welding mode. Refer to the WELDING OPERATION section for more information on how the machine functions in each of the following modes:

Stick: This mode is used for the stick electrode (SMAW) welding process. In this position the only active control is the output current control. The output terminals are continuously energized.

2-Step TIG: This mode is used for the TIG (GTAW) welding process. An Arc Start switch must be used to weld. The Down Slope Time has no effect in this mode.

4-Step TIG: This mode is used for the TIG (GTAW) welding process. An Arc Start switch must be used to weld. All controls are active in this mode.

6. **Trimmer Potentiometers -** Allows the meters to be calibrated in the field.

7. **Digital Ammeter -** The ammeter displays actual welding current during a weld cycle and displays the peak current for approximately 5 seconds after welding is complete. Otherwise the machine's set current is displayed. Read the complete Operating Instructions section for more information on the Ammeter.

8. **Digital Voltmeter -** This meter displays welding voltage, as measured on the output studs of the Square Wave TIG 275. After welding is complete, the meter displays the welding voltage corresponding to the peak welding current and displays this value for approximately 5 seconds

9. **Thermal Protection Light -** A yellow light which only lights when an over temperature situation occurs. See the Maintenance Section for more information on thermostatic protection.

10. **Power Switch -** Turns power "ON" or "OFF" to the welder. When switched "ON" the digital meters will illuminate, indicating that the power is on.

11. **Polarity Switch -** Selects DC+, AC or DC- welding polarity without reconnecting leads. DO NOT SWITCH WHILE WELDING.

12. **Twist Mate Electrode and**

13. **Work Connections -** Easy to connect electrode and work connections. This style Electrode Connection makes the gas and current connections for the TIG torch at the same time. (Adapter plugs are provided with the machine.)

14. **Remote Receptacle -** For Amptrol, Arc Start Switch or Robotic Interface connection.

15. **Optional Water Solenoid Connections -**

Easy to install this optional feature which allows for water flow control for water cooled torches.

WELDING OPERATION

TIG WELDING

Familiarize yourself with the Controls and Settings Section before attempting operation of the Square Wave TIG 275.

TIG WELDING GUIDELINES

TIG welding can be done in either the TIG 2-Step or the TIG 4-Step Weld Mode. TIG 2-Step is typically used with Hand or Foot Amptrols, with Remote Current control. TIG 4-Step typically uses an Arc Start switch and Local Current Control, because it provides a very brief current upslope, and a .5 to 10 second adjustable current downslope. TIG 4-Step also functions like a trigger interlock, making it unnecessary to hold down the Arc Start switch during a weld. If remote current control is desired in this mode, a device which provides separate arc start and current control must be used. Read the TIG Welding Sequence of Operation sections for more details on 2-Step and 4-Step operation.

Recommended tungsten electrode sizes, stickouts, currents, cup or nozzle sizes are shown in Table B.1. SINCE WELDING APPLICATIONS CAN VARY, THIS CHART IS INTENDED AS A GUIDE ONLY.

TABLE B.1 TYPICAL CURRENT RANGES FOR TUNGSTEN ELECTRODES [2]

Tungsten Electrode Diameter in. (mm)	DCEN (-)	DCEP (+)	AC				Approximate Argon Gas Flow Rate C.F.H. (1/min.)		TIG Torch Nozzle Size [4], [5]
			Unbalanced Wave		Balanced Wave				
	1%, 2% Thoriated Tungsten	1%, 2% Thoriated Tungsten	Pure Tungsten	1%, 2% Thoriated Tungsten Zirconiated	Pure Tungsten	1%, 2% Thoriated Tungsten Zirconiated	Aluminum	Stainless Steel	
.010 (.25)	2-15	[3]	2-15	2-15	2-15	---	3-8 (2-4)	3-8 (2-4)	#4, #5, #6
0.020 (.50)	5-20	[3]	5-15	5-20	10-20	5-20	5-10 (3-5)	5-10 (3-5)	
0.040 (1.0)	15-80	[3]	10-60	15-80	20-30	20-60	5-10 (3-5)	5-10 (3-5)	
1/16 (1.6)	70-150	10-20	50-100	70-150	30-80	60-120	5-10 (3-5)	9-13 (4-6)	#5, #6
3/32 (2.4)	150-250	15-30	100-160	140-235	60-130	100-180	13-17 (6-8)	11-15 (5-7)	#6, #7, #8
1/8 (3.2)	250-400	25-40	150-210	225-325	100-180	160-250	15-23 (7-11)	11-15 (5-7)	
5/32 (4.0)	400-500	40-55	200-275	300-400	100-240	200-320	21-25 (10-12)	13-17 (6-8)	#8, #10
3/16 (4.8)	500-750	55-80	250-350	400-500	190-300	290-390	23-27 (11-13)	18-22 (8-10)	
1/4 (6.4)	750-1000	80-125	325-450	500-630	250-400	340-525	28-32 (13-15)	23-27(11-13)	

(1) When used with argon gas. The current ranges shown must be reduced when using argon/helium or pure helium shielding gasses.

(2) Tungsten electrodes are classified as follows by the American Welding Society (AWS):
Pure . . . . . EWP
1% Thoriated EWTh-1
2% Thoriated EWTh-2
Though not yet recognized by the AWS, Ceriated Tungsten is now widely accepted as a substitute for 2% Thoriated Tungsten in AC and DC applications.

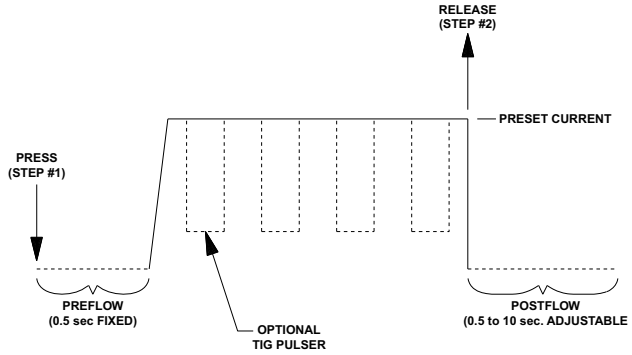
(3) DCEP is not commonly used in these sizes.

(4) TIG torch nozzle "sizes" are in multiples of 1/16ths of an inch:
#4 = 1/4 in. (6 mm)
#5 = 5/16 in. (8 mm)
#6 = 3/8 in. (10 mm)
#7 = 7/16 in. (11 mm)
#8 = 1/2 in. (12.5 mm)
#10 = 5/8 in. (16 mm)

(5) TIG torch nozzles are typically made from alumina ceramic. Special applications may require lava nozzles, which are less prone to breakage, but cannot withstand high temperatures and high duty cycles.

TIG WELDING SEQUENCE OF OPERATION

WELDING IN TIG MODE (2-STEP)



In 2-STEP mode an Arc Start switch or Amptrol must be used. The switch or Amptrol is pressed to start the weld. (Step 1) Output continues until the switch or Amptrol is released. (Step 2)

1. Connect the Twist Mate plug to the receptacle located on the front of the machine. The connection locks into place with a quarter turn making both the power and gas connections. See the TIG TORCH CONNECTION section to install the Twist Mate plug on your torch.

2. Connect an Arc Start Switch or an Amptrol to the Remote Amphenol.

3. Turn the welder, gas supply and water supply (if equipped), on. The digital ammeter/voltmeter displays will illuminate when the power is on. NOTE: Cooling fan may not be "ON" when not welding. (See MAINTENANCE Section)

4. Set the MODE switch to "2-STEP TIG".

5. Set the peak current displayed on the digital ammeter with the output control knob.

6. Select AC or DC- electrode polarity. See Table B.2.

TABLE B.2
RECOMMENDED POLARITY SETTINGS FOR TIG WELDING

Type of Welding	Electrode Polarity
Stainless Steel	DC-
Aluminum & Magnesium	AC
Other Metals	DC-

7. If welding with AC polarity, set the AC Wave Balance Knob to Auto Balance™. This gives the optimum ratio between cleaning and penetration, automatically adjusted for the output current. If manual adjustment of the AC Wave Balance is desired, adjust the wave balance to the desired settings. See the Advanced Features section for more information on setting and using the AC Wave Balance.

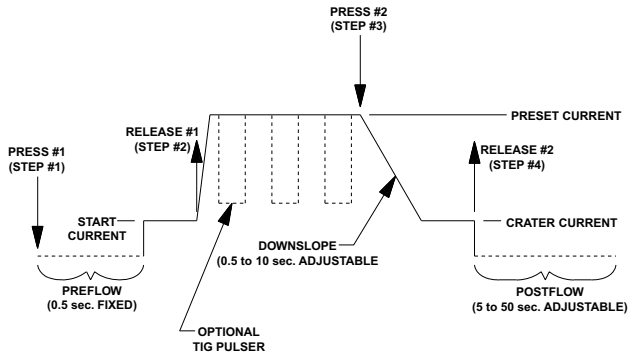
8. Set the Post Flow Time with the post flow knob. Post flow control knob adjusts the time that the shielding gas flows (and cooling water flow, if the optional water solenoid is used) after the weld cycle. Use short post flow times with low currents and small tungstens, use long post flow times at high output currents with large tungstens.

9. With the torch held safely away from everything, press the Arc Start Switch or Amptrol and set the gas flow meter. Release the switch or Amptrol. The welder is now ready for welding.

10. Position the tungsten electrode at the start of the weld at a 65˚ to 75˚ angle with the horizontal so that the electrode is approximately 1/8" (4 mm) above the work piece. Press the Arc Start Switch. This opens the gas (and optional water solenoid) valves to automatically purge air from the hose and torch. After a 0.5 second preflow time, the high frequency becomes available to strike the arc.

11. Hold the Arc Start Switch or Amptrol down until an arc is established. If using an Amptrol, read the Section on Hand and Foot Amptrol Operation. Release the Arc Start Switch or Amptrol to stop the arc and start the Post Flow timer. After the Post Flow time has expired, the gas and (optional water solenoid) valves will close. To make another weld, repeat steps 10 and 11.

WELDING IN TIG MODE (4-STEP)



In 4-STEP mode an Arc Start switch must be used. The switch is pressed and then released to start the weld cycle. Pressing and releasing the switch a second time ends the weld cycle. This eliminates the need to continuously hold down the switch during the weld. The process works as follows:

(STEP #1) First Press: Initiates a 0.5 second preflow of shielding gas then starts the weld at a current equal to 5 Amps or 25% +/- 10 % of preset current (whichever is greater).

(STEP #2) First Release: The output current ramps up to the preset level in 0.5 seconds.

(STEP #3) Second Press: The output current ramps down to 5 Amps or 25% +/- 10 % of the preset current (whichever is greater). The time it takes to ramp down can be adjusted from approximately 0.5 to 10 seconds with the Down Slope Time control knob.

(STEP #4) Second Release: Output is turned off stopping the weld and starting the 5 to 50 seconds post flow set with the Post Flow control knob.

1. Connect the Twist Mate plug to the receptacle located on the front of the machine. The connection locks into place with a quarter turn making both the power and gas connections. See the TIG TORCH CONNECTION section to install the Twist Mate plug on your torch.

2. Connect an Arc Start Switch to the Remote Amphenol.

3. Turn the welder, gas supply and water supply (if so equipped), on. The digital ammeter/voltmeter display will illuminate when the power is on. NOTE: Cooling fan may not be “ON” when not welding. (See MAINTENANCE section)

4. Set the MODE switch to “4-STEP TIG”.

5. Set the peak current displayed on the digital ammeter with the output control knob.

6. Select AC or DC- electrode polarity. See Table B.2.

7. If welding with AC polarity, set the AC Wave Balance Knob to Auto Balance™. This gives the optimum ratio between cleaning and penetration, automatically adjusted for the output current. If manual adjustment of the AC Wave Balance is desired, adjust the wave balance to the desired settings. See the Advanced Features section for more information on setting and using the AC Wave Balance.

8. Set the Post Flow time with the Post Flow knob. Post Flow time provides shielding gas flow (and cooling water, if used) after the weld. Use short Post Flow times with low currents and small tungstens and long Post flow times at high output currents and large tungstens.

9. Set the Downslope Time with the Downslope Time Knob. This will adjust the time of the crater fill period.

10. With the torch held safely away from everything, press the Arc Start Switch and set the gas flow meter. Release the switch. The welder is now ready for welding.

11. Position the tungsten electrode at the start of the weld at a 65˚ to 75˚ angle with the horizontal so that the electrode is approximately 1/8" (4 mm) above the work piece. Press the Arc Start Switch. This opens the gas and water valves to automatically purge air from the hose and torch. After a 0.5 second preflow time, the high frequency becomes available to strike the arc.

12. Hold the Arc Start Switch down until an arc is established. The arc will start at a low current value that is equal to 25% +/- 10 % of the preset current established in Step 5 or 5 Amps, whichever is greater.

13. Release the Arc Start Switch and the current will ramp up to the preset maximum current in 0.5 seconds and remain there indefinitely.

14. Press the Arc Start Switch a second time to initiate the Down Slope time. The current will ramp down to a crater fill level of 25% +/- 10 % of the preset current or 5 Amps whichever is greater within the time set with the Down Slope knob in Step 9.

15. Release the Arc Start Switch to stop the arc and start the Post Flow timer. After the post flow time has expired, the gas and optional water valves will close. The make another weld, repeat steps 11 through 15.

HAND AND FOOT AMPTROL OPERATION

Both the Hand and Foot Amptrol work in a similar manner. They are meant to be used for remote current control. The TIG 2-Step mode must be selected when using an Amptrol for remote current control.

For simplicity, the following explanation will refer only to "Amptrols", meaning both Foot and Hand models. The term "minimum" refers to a Foot pedal in the "up" position, as it would be with no foot pressure, or a Hand Amptrol in the relaxed position, with no thumb pressure. "Maximum" refers to a fully depressed Foot Amptrol, or a fully extended Hand Amptrol.

The Amptrol is capable of controlling the output current from 5 amps to the preset current on the output control knob. For example, if the preset is at 200 amps, the Amptrol, when depressed just past its minimum position, will cause the Square Wave TIG 275 to weld at 5 amps. At the Amptrol's maximum position, the output will be near 200 amps.

It is important to note that, for many applications, the tungsten will not start an arc at only 5 amps. (Refer to the TIG Welding Guidelines for recommended tungsten currents.) To start an arc reliably, it is important to depress the Amptrol far enough so that the machine output current is near the tungsten operating range. In the example above, a 3/32" tungsten may be used on DC- to weld near 200 amps. To start the weld, the operator may have to depress the Amptrol approximately 1/4 of the way down, or to nearly 50 amps, in order to start the arc. Merely depressing the Amptrol to its 5 amp minimum position will not start the arc.

ADVANCED TIG WELDING FEATURES

AC WAVE BALANCE AND AUTO BALANCE™

The AC Wave Balance feature is unique to the Square Wave TIG 275. It is active only in AC TIG mode. It controls the amount of positive and negative current in the AC output.

The Square Wave TIG 275 allows the operator to select Auto Balance™. This selection provides automatic adjustment of the AC Wave Balance; it is suitable for most welding conditions. Auto Balance™ gives the ideal amount of cleaning and penetration, based on the welding current output.

Manual adjustment of the AC Wave Balance is also possible. Manual Balance settings vary from 0 (maximum cleaning) to 10 (maximum penetration). A setting of 3 yields a balanced output (equal amounts of cleaning and penetration). Use the following as a guide when setting the Balance manually:

BALANCED (3): The amounts of positive and negative are the same.

CLEANING (0 to 2): Provides more positive current than negative current. Since the positive current produces the "cleaning" or oxide removal on aluminum, this setting is used for welding on heavily oxidized aluminum.

PENETRATION (4 to 10): Provides more negative current than positive. The arc plasma will be more concentrated and more easily directed to where the heat is needed. Higher penetration settings allow a given size of tungsten to carry more current.

CAUTION: Use only the amount of cleaning required because the greater amount of positive current will heat the tungsten more and possibly cause it to melt or "spit". Also, the arc is usually more flared and less stable with more cleaning current.
In general, use just enough "cleaning" to remove oxides and to give good wetting of the puddle.

STICK WELDING

1. Turn the welder “ON”. The digital ammeter/voltmeter will illuminate when the power is on.

2. Set the Mode Switch to “STICK”. Set the output current displayed on the digital ammeter with the Output Control Knob. No other functions or adjustments operate in the Stick Mode.

3. Select the desired DC+/AC/DC- electrode polarity.

4. Clamp the electrode in the electrode holder, start the weld by lightly touching the electrode to the work. Stop the weld by pulling the electrode away from the work piece.

AUXILIARY POWER

60 HERTZ DOMESTIC MACHINES

The Square Wave TIG 275 machines rated for 60 Hz operation provides 10 amps of 115 volt AC power at a standard NEMA 5-15R receptacle, located on the lower case back of the machine. This circuit is protected from shorts and overloading by a 10 amp circuit breaker, located next to the receptacle. The auxiliary circuit is intended for running water coolers and small power tools, whose current draw is within the 10 amp rating. Note that some types of equipment, especially pumps and large motors, have starting currents which are significantly higher than their running current. These higher starting currents may cause the circuit breaker to open. If this situation occurs, the user should refrain from using the Square Wave TIG 275 auxiliary for that equipment.

50/60 HERTZ EUROPEAN MACHINES

The Square Wave TIG 275 machines rated for 50/60Hz operation provides 2 amps of 220 volt AC power at a continental European (Schuko) type receptacle, located on the lower case back of the machine. This circuit is protected from shorts and overloading by a 2 amp circuit breaker, located above the receptacle. The auxiliary circuit is intended for running water coolers whose current draw is within the 2 amp rating of the receptacle. Note that some types of equipment, especially pumps and motors, have starting currents which are significantly higher than their running currents. These higher starting currents may cause the circuit breaker to open. If this situation occurs, the user should refrain from using the Square Wave TIG 275 auxiliary for that equipment.

ACCESSORIES INCLUDED WITH MACHINE

K852-50 - Twist Mate Cable Plug for #2 to #1 Work Lead.

K1622-1 - Twist Mate Adapter Kit for LA9 and LA17 Torches.

K1622-2 - Twist Mate Adapter Kit for LW18 and LW20 Torches.

OPTIONAL ACCESSORIES

K963-1, -2 - Hand Amptrol

K870 - Foot Amptrol

K814 - Arc Start Switch

K559-2 - Magnum® Cooler Mounting Bracket

K932-1 - Undercarriage When the undercarriage is properly installed, the Square Wave TIG 275 lift bale is nonfunctional. Do not attempt to lift the power source with the undercarriage attached. The undercarriage is designed for hand moving only; mechanized towing can lead to personal injury and/or damage to the Square Wave TIG 275.

K1619-1 - TIG Pulser Kit

K1620-1 - Power Factor Capacitor Kit

K1621-1 - Water Solenoid Kit

K1622-3 - Twist Mate Adapter Kit for LA26 Torch

K852-70 - Twist Mate Cable Plug for 1/0 to 2/0 Work Lead

K852-95 - Twist Mate Cable Plug for 2/0 to 3/0 Work Lead

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Only qualified personnel should perform this maintenance.**
- **Turn the input power OFF at the disconnect switch or fuse box before working on this equipment.**
- **Do not touch electrically hot parts.**

⚠ WARNING

To avoid receiving a high frequency shock, keep the TIG torch and cables in good condition.

ROUTINE AND PERIODIC MAINTENANCE

Very little routine maintenance is necessary to keep your Square Wave TIG 275 running in top condition. No specific schedule can be set for performing the following items; factors such as hours of usage and machine environment should be considered when establishing a maintenance schedule.

1. Periodically blow out dust and dirt which may accumulate within the welder using an air stream.
2. Inspect welder output and control cables for fraying, cuts, and bare spots.
3. Inspect the spark gap at regular intervals to maintain the recommended spacing. See the Service Procedures Section for complete information on spark gap settings.
4. The fan motor has sealed ball bearings which require no maintenance.

OVERLOAD PROTECTION

THERMOSTATIC PROTECTION

This welder has thermostatic protection from excessive duty cycles, overloads, loss of cooling, and high ambient temperatures. When the welder is subjected to an overload or loss of cooling, a thermostat will open. This condition will be indicated by the illumination of the yellow Thermostatic Protection Light on the case front (see Figure 3). The fan will continue to run to cool the power source. No welding is possible until the machine is allowed to cool and the Thermostatic Protection Light goes out.

FAN AS NEEDED (F.A.N.)

The Square Wave TIG 275 has the F.A.N. circuit feature, which means the cooling fan will operate only while welding; then for about 6 minutes after welding has stopped. The cooling fan will operate continuously if the yellow Thermostatic Protection Light in “ON”. (See Design Features and Advantages Section)

SERVICE PROCEDURES

⚠ WARNING

Use extreme caution when working with the secondary circuit of the high frequency transformer. Turn the input power off using the disconnect switch or fuse box before working inside the machine. This is particularly important when working on the secondary circuit of the high voltage transformer (T3) because the output voltage is dangerously high.

DO NOT APPLY POWER TO THE SQUARE WAVE TIG 275 WITH THE SIDES AND ROOF REMOVED. The case front and case back assemblies tend to lean in towards the center assembly; there is a danger of a short circuit when this occurs. If you must troubleshoot the machine with power applied, do so with the roof in place, and check for shorts before applying power.

Operation of the Square Wave TIG 275 should be trouble-free for the life of the machine. Should a malfunction occur, however, the following procedures will be useful to trained service personnel with experience in repairing arc welding equipment.

COMPONENT LOCATION AND ACCESS

Control PC Board:

Remove the left case side. Use a 3/8" Nut Driver or other suitable tool.

Note: The Case side can be removed while roof is in place, as long as the three screws which secure the roof to the case side are removed. The PC Board is mounted on left divider assembly and can be removed with a phillips head screwdriver.

Display PC Board, Arc Starter/Bypass PC Board:

Remove the roof and both case sides. Use a 3/8" Nut Driver or other suitable tool. These PC Boards are located on the inside case front of the machine.

Spark Gap Assembly, High Voltage Transformer:

Remove the right case side. Use a 3/8" Nut Driver or other suitable tool. The high voltage transformer is mounted to the base. The spark gap assembly is located on the inside case front.

Main Rectifier:

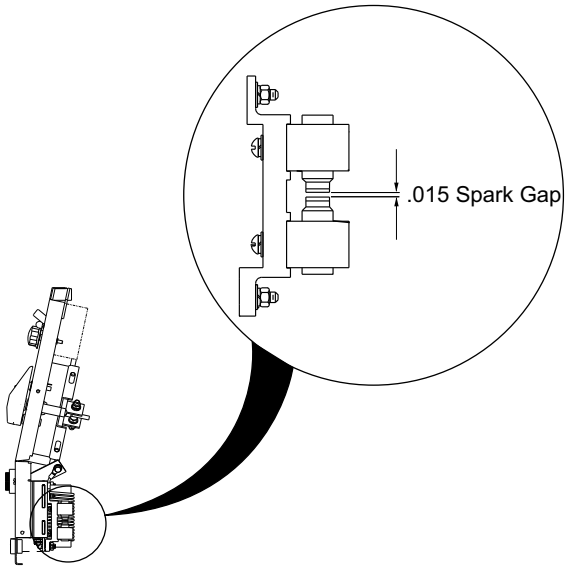
Remove the roof and both case sides. Next, remove the case back assembly. Use a 3/8" Nut Driver or other suitable tool. The main rectifier is mounted to the main transformer, in front of the cooling fan.

SPARK GAP ADJUSTMENT

The spark gap is set at the factory to a gap of 0.015 inches (0.4 mm). This setting is adequate for most applications. Where less high frequency is desired, the setting can be reduced to 0.008 inches (0.2 mm).

To adjust the spark, first be sure that the input power to the machine is 'OFF' AT THE DISCONNECT SWITCH OR FUSE BOX. The high voltages developed in the high frequency circuit can be lethal. Next, remove the right case side. Use a 3/8" Nut Driver or other suitable tool. Disconnect the two push on wires to the spark gap blocks and pull back the dust shield. Check the spark gap spacing with a feeler gauge. If adjustment is required, pull off one of the two leads going to the aluminum spark gap blocks. Adjust the gap by loosening the Allen head screw, reset the gap and tightening the screw in the new position. Replace the dust shield and the two leads removed earlier. Reinstall the case side.

FIGURE D.1 SPARK GAP



RIGHT SIDE VIEW OF MACHINE

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, TIG mode problems, TIG welding problems and Stick welding Problems.

Step 2. PERFORM EXTERNAL TESTS.
The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. RECOMMENDED COURSE OF ACTION

If you have exhausted all of the items in step 2. Contact your Local Lincoln Authorized Field Service Facility.

⚠ CAUTION

DO NOT use a volt-ohm meter to measure output voltages in TIG mode. The High Frequency Arc Starter voltage can damage the meter.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
GENERAL MACHINE TROUBLE		
Machine will not turn on.	1. Input supply not "hot". Check input supply line voltage and fuses. 2. Input power switch (S1) faulty. Check and replace.	Contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance.
No machine output.	1. Make sure the input Power Switch (S1) is in the “ON” position. 2. A protective thermostat may be open. An open thermostat disables machine output. Allow machine to cool and thermostat will close. The yellow thermal light (TL1) should be lit in this condition. 3. If the machine is not “hot” (i.e. you have not been welding) and the thermostat light is lit, the thermostat wiring or a thermostat may be faulty. Check for continuity between leads 313 and 314 at P3 on the Control PC Board. If not present, test each wire and thermostat individually. 4. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures 5. Main Transformer (T1) may be faulty.	
Control panel display does not function, but the output is normal.	1. Check for loose connections at the Control PC Board (P4) or at the Display Board (P20 & P21).. 2. The Display PC Board may be faulty. See PC Board Troubleshooting Procedures. 3. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	
The Voltmeter always reads "000", but the output is normal.	1. Check leads 252 and 253 and their connections to the Polarity Switch (S2) and to the Control PC Board connection (J6). 2. The Display PC Board may be faulty. See PC Board Troubleshooting Procedures.	

⚠ CAUTION

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Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
GENERAL MACHINE TROUBLE		
The Ammeter displays “000", but the machine has output with no control.	1. The shunt lead connections may be open. Check the red lead (222) and white lead (221) twisted pair all the way from the shunt back to the Control PC board connector (J2). 2. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	Contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance.
One of the meters is blank.	1. Check for loose connections at Control PC Board (P4) and at the Display PC Board (20 & 21)The Display. 2. The Display PC Board may be faulty. See PC Board Troubleshooting Procedures.	
Accessories plugged into the 115 volt receptacle do not work. (220 volt receptacle on European model only)	1. Is accessory defective? Plug it into a known "hot" receptacle to see if it works. 2. Circuit Breaker CB may be open. Before resetting the circuit breaker, find out why it opened. See the Auxiliary Power section for more information.	
Machine regularly overheats; thermostat (s) open.	1. Check for proper voltage at fan. If proper voltage is present, but fan is not rotating or is rotating slowly, replace fan motor. If proper voltage is not present, but fan is not rotating or is rotating slowly, the output fan circuit on the control PC Board may be faulty. 2. Dirt and dust have clogged the cooling channels inside the machine. Blow out the machine with clean, dry compressed air. 3. Are the duty cycles being exceeded? Read the Instruction Manual thoroughly for duty cycle information. 4. Is there adequate clearance around the side and back of the machine, especially near the intake and exhaust louvers? Do not block the flow of cooling air during operation.	

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
GENERAL MACHINE TROUBLE		
The machine makes a very loud buzzing noise in DC stick, or in DC TIG when the Arc Start Switch or Amptrol is pressed.	1. Diode D1 may be shorted. Check and replace. 2. One of the main SCR's may be shorted. Check and replace.	Contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance.
The machine has output and the meters are "ON" but there is no high frequency present and the gas solenoid does not function.	1. Check and replace 5 Amp Fuse (F1) located below the Control PC Board on the right. (Fuse is present on European models only)	
High frequency is present, but bad starting at low currents. (Approximately 15 Amps and below)	1. Check and replace 5 Amp Fuse (F2) located below the Control PC Board on the left. (Fuse is present on European models only)	
STICK WELDING TROUBLE		
Stick electrode "Blasts Off" when touched to the work piece.	1. Weld current is set too high for electrode size. Reduce the preset current. 2. One of the main SCR's may be shorted. 3. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	Contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance.
Cannot adjust AC Wave Balance.	1. AC Wave Balance Function is only operational in the AC TIG mode. 2. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	
Variable or sluggish welding arc.	1. Poor work or electrode connection. 2. Welding leads too small. Use larger work and electrode leads 3. Welding current set too low.	

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
TIG WELDING TROUBLE		
Machine does not respond (no gas flow, no high frequency, no open circuit voltage) when Arc Start Switch or Amptrol is pressed. Thermal light is not lit.	1. Defective Arc Start Switch or Amptrol. Check for continuity between pins D and E on cable connector when Arc Start Switch or Amptrol is pressed. 2. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	Contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance.
No gas or water flow (with optional water solenoid) when Arc Start Switch or Amptrol is pressed in the TIG Weld Mode.	1. Gas supply is empty or not turned on. 2. Pinched, disconnected, or leaking gas or water hose. 3. Gas and/or water lines or solenoids are blocked with dirt. Clean out and use filters to prevent reoccurrence. 4. Defective gas and/or water solenoid. Check and replace. 5. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	
No High Frequency.	1. Spark gap is too large. Reset gap per Periodic Maintenance Section instructions. 2. Check gas solenoid operation. If it is not working, check 115V circuit from Main Transformer (T1). Check Fuse (F1) on European models only. 3. Defective high voltage transformer (T2). Check and replace. 4. One or more of the following components may be open: R5 or C6. Check and replace. 5. The Control PC Board may be faulty. See PC Board Troubleshooting Procedures.	

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
TIG WELDING TROUBLE		
Weak High Frequency.	1. Spark gap is too close. Reset gap per Periodic Maintenance Section instructions. 2. Work and electrode cables in poor condition, allowing high frequency to "leak" to ground. Use good quality cables, preferably those with a high natural rubber content, and as short as possible. 3. No shielding gas. Adjust gas flow for a flow of 10 to 30 CFH (4.7 to 14.1 1/min) for most applications. (High frequency will not jump from the tungsten to work without shielding gas).	Contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance.
Output quits momentarily; gas flow and high frequency are also interrupted.	1. May be caused by high frequency interference. Is the machine grounded properly, according to the installation instructions? Are there other machines in the area which may be strong sources of high frequency? Make sure that they are also properly installed and grounded. 2. Some internal ground connections may have become loose. Check that the screws which mount the Control PC Board and the Bypass Stabilizer PC Board are tight. Also, all case parts should be in place, and the case screws should be tight.	

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

PC BOARD TROUBLESHOOTING PROCEDURE

Before replacing a PC Board which is suspected of being defective, visually inspect the PC Board in question for any electrical or mechanical damage to any of the components or conductors on the board, partially insulated molex pins or connectors.

a. If there is no visible damage to the PC Board, install a new one and see if this remedies the problem. If the problem is remedied, reinstall the old PC Board to see if the problem still exists. If the problem no longer exists with old PC Board:

    1. Check the PC Board harness connector pins for corrosion, contamination or looseness.

    2. Check leads in the plug harness for loose or intermittent connections.

b. If PC Board has visible electrical damage, before possibly subjecting the new PC Board to the same cause of failure, check for possible shorts, opens or grounds caused by:

    1. Frayed or pinched lead insulation.

    2. Poor lead termination, such as a poor contact or a short to adjacent connection or surface.

    3. Shorted or open control cable leads, or other external leads.

    4. Foreign matter or interference behind the PC Boards.

c. If PC Board has visible mechanical damage, inspect for cause, then remedy before installing a replacement PC Board.

    If there is damage to the PC Board or if replacing PC Board corrects problem, return it to the local Lincoln Electric Field Service Shop.

INPUT - BYPASS PC BOARD (EUROPEAN MODELS ONLY)

This board is mounted to the case front and connects to the input power at the line switch. It passes excess high frequency to ground, protecting the machine and power line. For proper operation it must be securely grounded, by means of its ground and mounting screws to the case front. The quick connect terminals from the line switch must be fully seated. Failures of this board should be very rare.

BYPASS / STABILIZER PC BOARD

The board is mounted between the output terminals. It passes excess high frequency to ground before it can reach the inside of the machine. For proper operation, it must be securely grounded, by means of its ground and mounting screws, to the case front. Failures of this board should be very rare.

DISPLAY PC BOARD

The board is mounted directly to the front panel. The Control P.C. Board supplies power and metering information to the board.

CONTROL PC BOARD

This board, located on the left divider assembly, is the heart of the machine. All welding output is controlled by this board. The Display board receives its information from the Control board as well. Very little external diagnostic work can be performed on this board. If one control or function of the machine does not appear to be working, it is best to trace out the wiring associated with that function all the way back to the Control board with an ohmmeter. If all checks out there, verify that the following voltages are present at the output of the auxiliary leads at the main transformer, T1.

CONTROL PC BOARD
AUXILIARY LEAD VOLTAGES

Main Transformer (T1) Auxiliary Lead Number	Plug P8 Locations	Approximate Voltage
209 to 210	1 to 9	18 VAC
201 to 204	4 to 6	18 VAC
231 to 232A	2 to 12	115 VAC
211A to 212	13 to 14	23 VAC

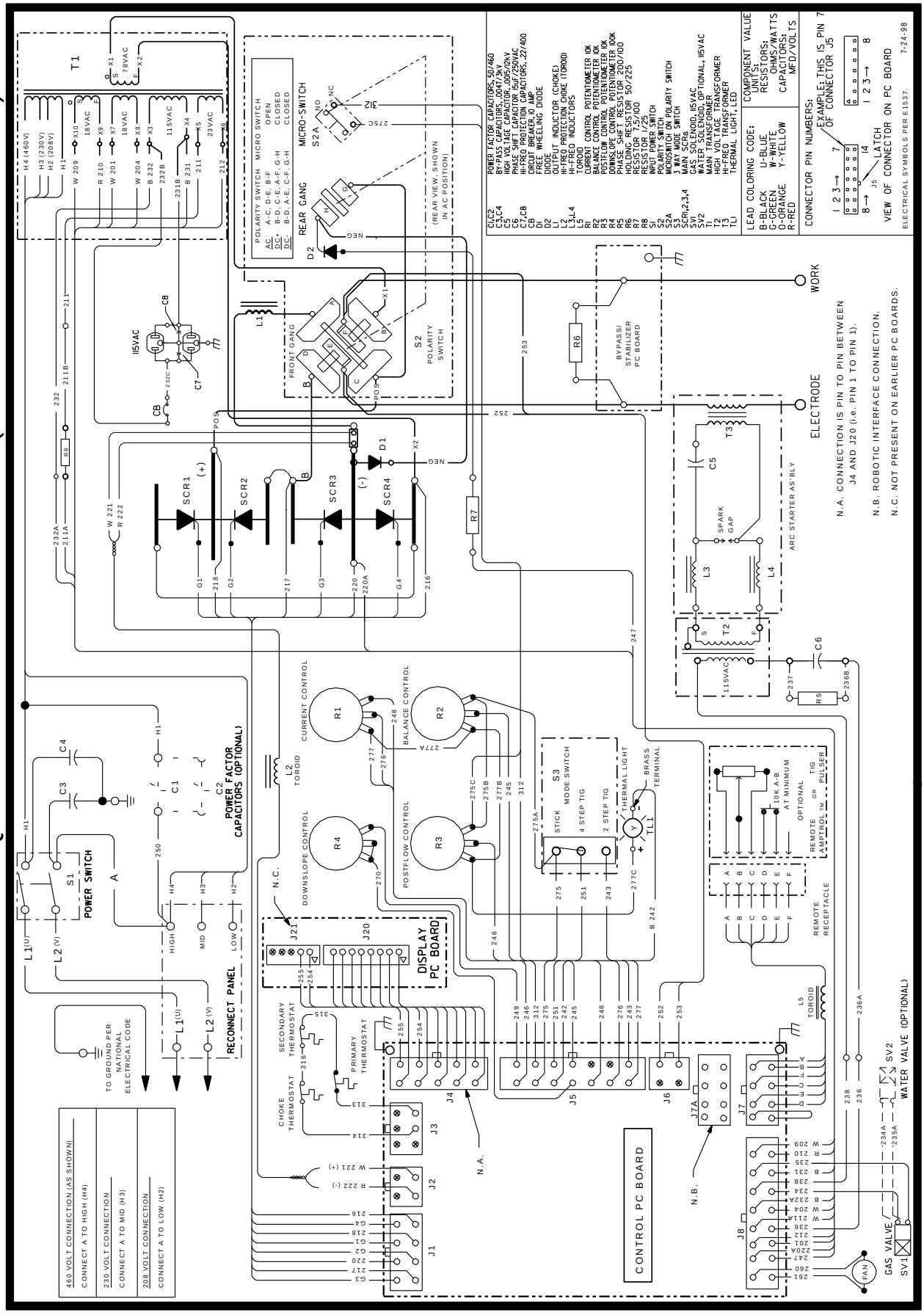
Often, replacement with a known good board is the best service method. Remove the board that is suspected to be defective. Carefully look over the board, checking for burnt traces or components. If none are found, install the known good board. If the trouble goes away, reinstall the suspected bad board to confirm that the board was indeed at fault. If the problem is now gone with the original board installed, the problem is probably with one of the leads or connectors going to the board.

Consult the Lincoln Service Department if further troubleshooting assistance is required.

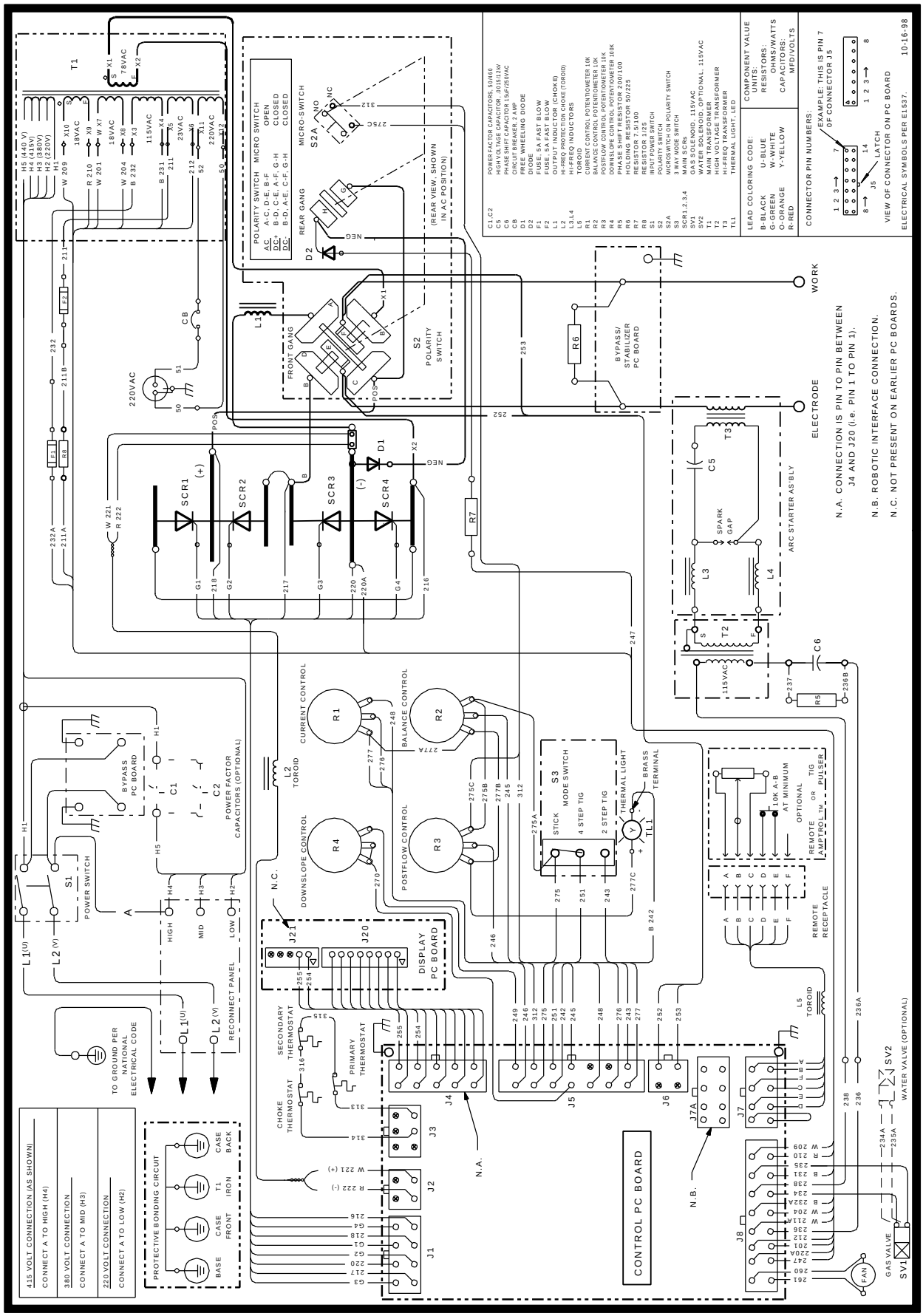
⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

WIRING DIAGRAM

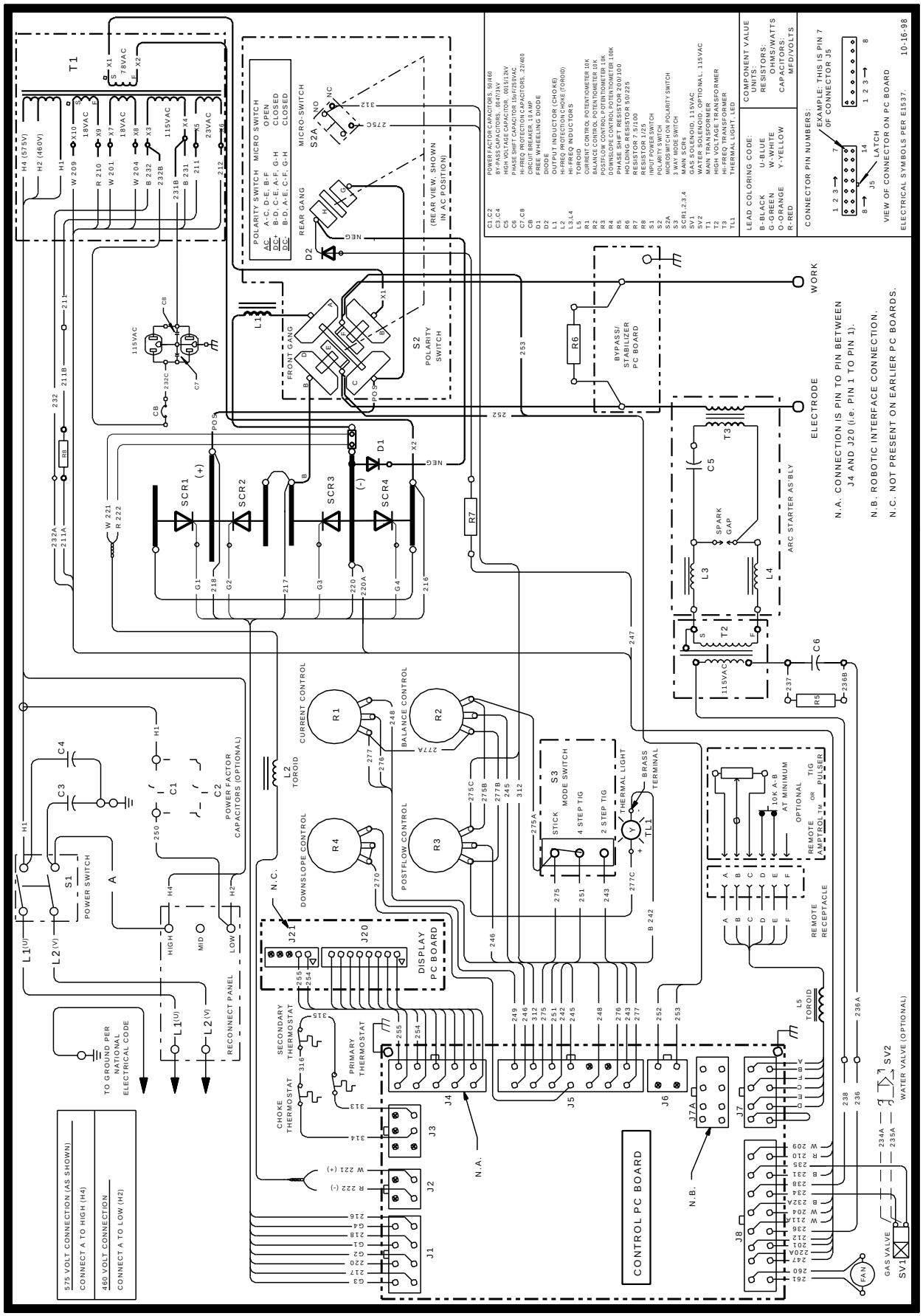


WIRING DIAGRAM



LINCOLN ELECTRIC

WIRING DIAGRAM



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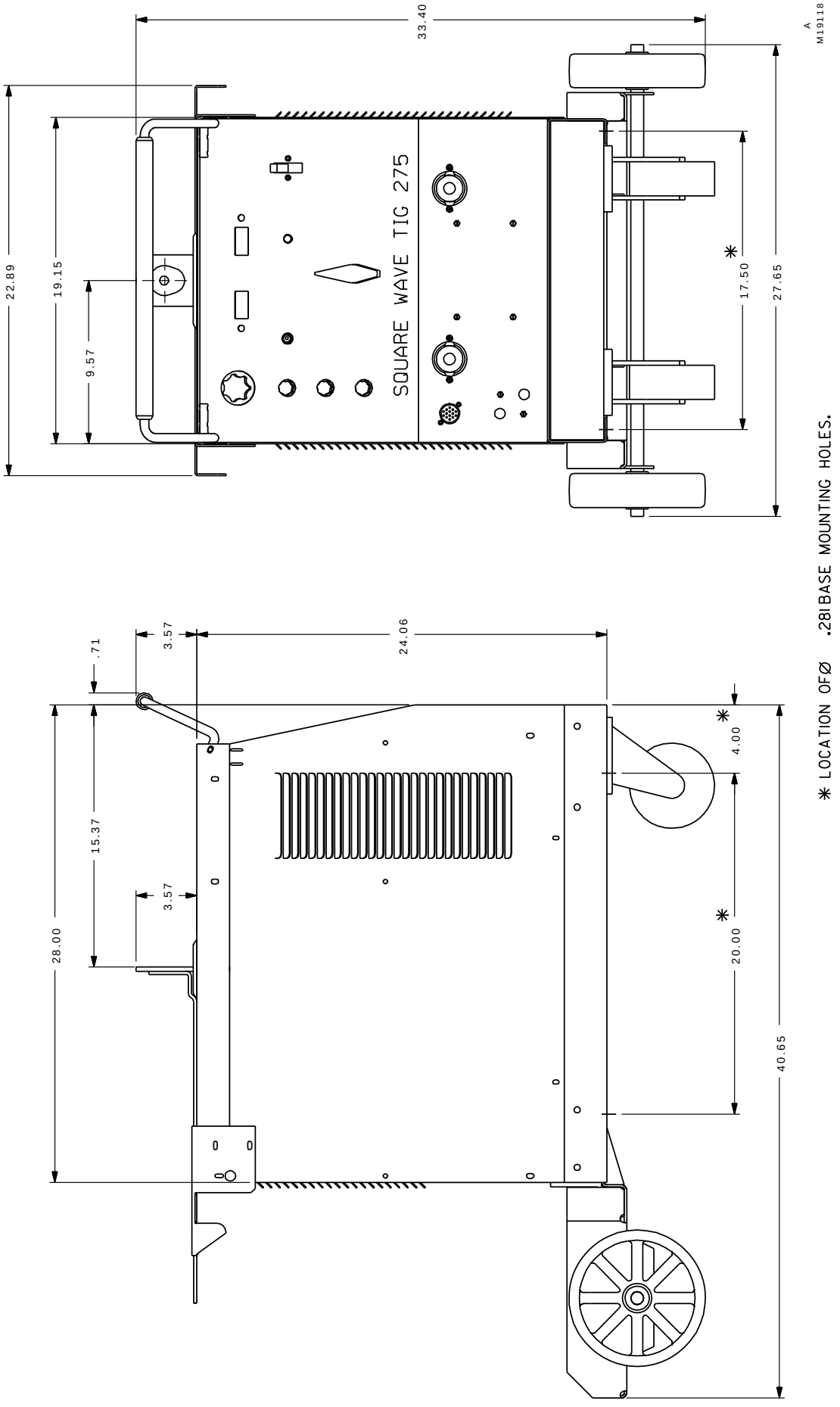

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		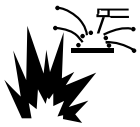	
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。	● 燃えやすいものの側での溶接作業は絶対にしてはなりません。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● パネルやカバーを取り外したままで機械操作をしないで下さい。	Japanese **注意事項**
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.	Arabic **تحذير**

LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的説明以及應該使用的銀捍材料，並請遵守貴方的有関勞動保護規定。

이 제폼에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

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