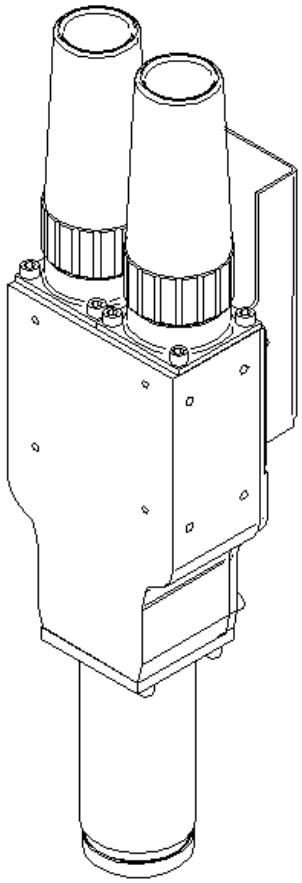
IM666-A

February, 2005

Tandem MIG Torch

G3494-2, 3, 4, 5, 6
G3494-2A, 3A, 4A, 5A, 6A



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.

OPERATOR'S MANUAL

ISO 9002
Accredited by the Dutch Council for Certification
REGISTRAR ACCREDITATION BOARD
Manufactured Under a Quality Program Certified by ABS Quality Evaluations, Inc. to ISO 9002 Requirements.
CERTIFICATE NUMBER: 30273

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• World's Leader in Welding and Cutting Products •
• Sales and Service through Subsidiaries and Distributors Worldwide •
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⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

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

The Above For Diesel Engines

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

The Above For Gasoline Engines

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.

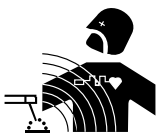
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

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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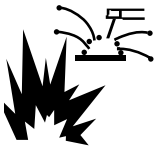


WELDING SPARKS can cause fire or explosion.

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.

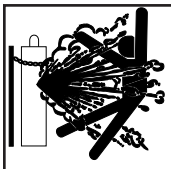
6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe 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.

Product _____

Model Number _____

Code Number or Date Code_____

Serial Number_____

Date Purchased_____

Where Purchased_____

Whenever you request replacement parts or information on this equipment, always supply the information you have recorded above. The code number is especially important when identifying the correct replacement parts.

On-Line Product Registration

- Register your machine with Lincoln Electric either via fax or over the Internet.

• For faxing: Complete the form on the back of the warranty statement included in the literature packet accompanying this machine and fax the form per the instructions printed on it.

• For On-Line Registration: Go to our **WEB SITE at www.lincolnelectric.com.** Choose "Quick Links" and then "Product Registration". Please complete the form and submit your registration.

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**.

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS - Tandem MIG Torch

Tandem MIG Torch Cable Length Availability	
Product Number	Gun Cable Length
G3494-2, 2A	4 ft (1.2 m)
G3494-3, 3A	6 ft (1.8 m)
G3494-4, 4A	8 ft (2.4 m)
G3494-5, 5A	10 ft (3.0 m)
G3494-6, 6A	12 ft (3.6m)

Shielding Gas Flow Rate
65 scfh (31 liters/min) minimum

Water Cooling Flow Rate for each Power Cable
.45 gal/min at 40 psi (1700 ml/min at 2.7 bar)

Water cooling flow rate for nozzle/gas cable
.45 gal/min at 40 psi (1700 ml/min at 2.7 bar)

Lead Electrode size
0.035" to 5/64" (0.9 mm to 1.9 mm)

Trail Electrode size
0.035" to 5/64" (0.9 mm to 1.9 mm)

Duty Cycle
100% at 450 amps per side / 900 amps Total
Maximum current draw per electrode 650 amp / 60% duty cycle

PHYSICAL DIMENSIONS			
HEIGHT	WIDTH	DEPTH	WEIGHT
17.54 in. 445.5 mm	3.75 in. 95.3 mm	4.5 in. (w/o bracket) 114.3 mm (w/o bracket)	14.0 lbs (w/ 4 ft. cable) 6.4 kg. (w/ 4 ft. cable)

GENERAL DESCRIPTION

The Tandem MIG torch delivers two wire electrodes to the weld pool. The wires are insulated from each other for the purpose of independent arc regulation. When welding, the wires or arcs are oriented one behind the other. The torch provides a small but rugged housing for delivering the two wires and it provides secure delivery of the shielding gas. Each side of the torch is rated for 450 Amps, 100% duty cycle with argon mix shielding gases.

The 900 amp Tandem MIG torches are supplied in two different configurations, the G3494-2 thru -6, (single gas delivery configuration) and the G3494-2A thru -6A (dual gas delivery configuration). The G3494-2 thru -6 is configured to be used with .035"-.052" diameter electrodes. Shielding gas delivery is by a single gas hose that delivers gas to the torch body. Internal to the torch body the gas is split and delivered to the two gas diffusers.

The G3494-2A thru -6A model is configured for .035"-5/64" diameter wires. The G3494-2A thru -6A design provides larger volumes of gas for gas shielding of the welding arcs and weld pool. Gas is delivered through the two welding power cable assemblies of the G3494-2A thru -6A; each assembly receives separate shielding gas from the two separate wire feeder solenoids. The dual source of gas provides additional gas volume needed for proper gas shielding of larger weld pools.

The torch can be operated bi-directionally, or even as a single wire torch as the need arises.

The Tandem MIG torch is not factory equipped with a feeder end connector. Use a K489-7 Fast-Mate adapter kit (see ACCESSORIES section) to attach the torch to the feeders. A K1500-1 gun connector must be installed in addition to the K489-7 Fast-Mate adapter, when using a Power Feed 10R Wire Feeder.

Liners are not included with the torch and must be ordered separately (see ACCESSORIES section).

The torch is suitable for welding with Lincoln solid wire steel MIG wires and metal core electrodes, from .035" to 5/64" (0.9 mm to 1.9 mm) diameter.

Argon based shielding gases are recommended. 100% CO^2 is not recommend because of the higher spatter levels associated with the gas.

DESIGN SUMMARY

The case, internal components and cables are the main sub-assemblies of the torch.

TORCH CASE

The case is made from several pieces fabricated from aluminum. The aluminum parts offer rigidity, strength and resistance to heat and spatter. The main housing is drilled and tapped for easy mounting to fixturing equipment. For automation and robotic applications, the barrel of the torch is removable and replaceable without having an effect upon the existing tool center point.

INTERNAL ASSEMBLY

Figure 1 Internal Assembly

All of the internal components are over molded with a high temperature epoxy material. The over molding rigidly holds all the parts in place while simultaneously insulating the sub-assemblies. Each "subgun" in the torch is electrically isolated from all other components and individually water cooled. Separate water cooling circuits minimize corrosion from electrical or galvanic action.

Each face on the subguns where the diffuser engages the torch is milled at a precise angle. The angle helps to keep the ends of the wires close together while allowing the use of standard contact tips. The slight bend also creates good electrical contact between the wire electrode and the tip.

CABLE ASSEMBLY

Three cable assemblies deliver the necessary power and cooling fluids to the torch.

a) G3494-X Series:
Two of the cable assemblies supply power, wire and water cooling to each side of the torch. The third bundle is made up of the nozzle water cooling hoses, the air blast line and the shielding gas line.

b) G3494-XA Series:
Two of the cable assemblies supply power, wire, shielding gas and water cooling to each side of the torch. The third bundle is made up of the nozzle water cooling hoses and the air blast line.

Torch liners must be ordered separately (see ACCESSORIES section). Customers who choose to run with different size wires in the lead and trail must use the correct liner for each wire.

CONSUMABLES

Heavy duty contact tips (KP2020 and KP2021 series) are recommended for all welding applications (see ACCESSORIES section). Standard or tapered contact tips should only be considered in special applications operating at low power.

Use only Tandem MIG diffusers with the Tandem MIG torch (see ACCESSORIES section). The Tandem MIG diffusers feature a narrow profile that prevents internal short circuits.

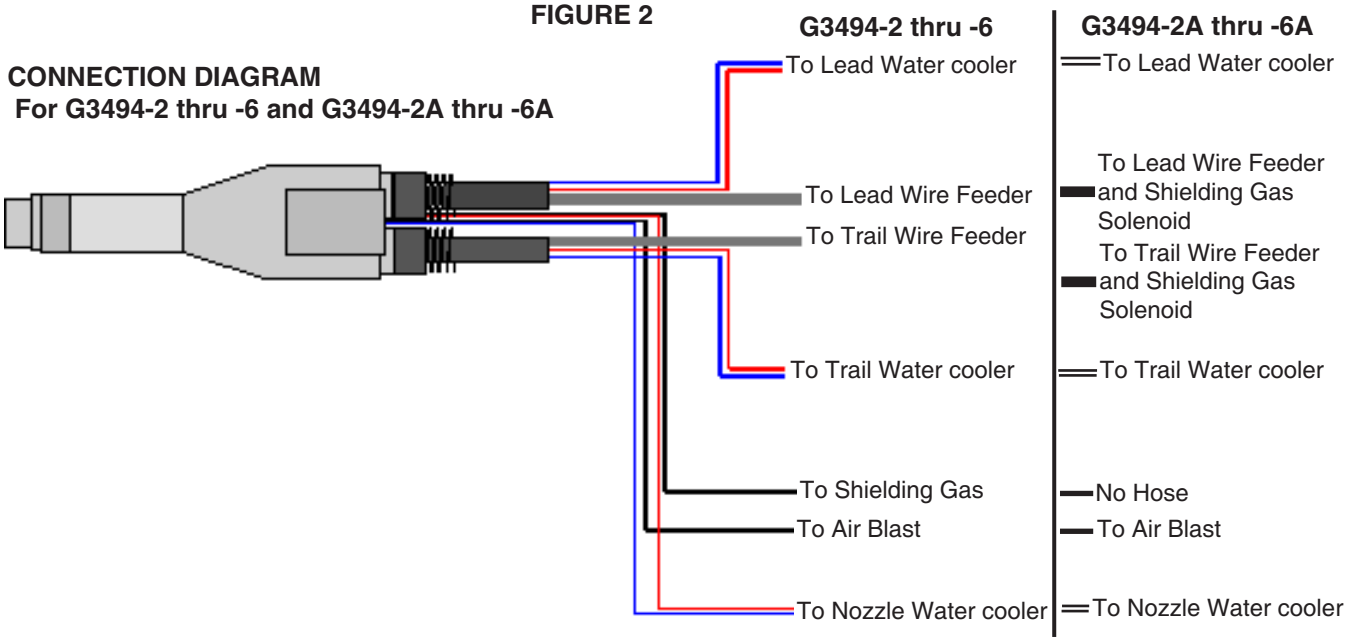
All of the gas nozzles (see ACCESSORIES section) also feature internal water cooling to assure a long life of the torch and nozzle. Water cooling of the nozzle reduces spatter accumulation. Nozzles are available for welding in locations where space is restricted while other nozzles are suitable for high deposition welding. Inside each nozzle is a shield to prevent spatter from bridging from the diffusers to the nozzle wall. The shield is made from a high temperature, glass-epoxy composite, or ceramic high temperature glass.

MOUNTING BRACKETS

A bracket for mounting the torch to a robot is available (see ACCESSORIES section). The bracket features an insulating plate to electrically isolate the torch from other equipment. The insulating plate also serves as a breakaway piece in the event of a severe collision.

FIGURE 2

CONNECTION DIAGRAM
For G3494-2 thru -6 and G3494-2A thru -6A



LINER INSTALLATION AND TRIMMING INSTRUCTIONS

a) Lay the torch and cable on a flat surface and straighten the cables.

b) With a 12 mm open-end wrench, unscrew the nut on the cable connector that restrains the liner. Remove the nozzle, and then remove both diffusers.

c) Remove the old liners.

d) Insert the new untrimmed liners into the connector end of the cable. Be sure the liner is of the correct size and type as stenciled on the liner bushing.

e) Screw the nut on to the cable connector. Snug, but do not overtighten.

f) Be sure the cable is still straight, and then trim the liner so that 0.3 inch (6.5mm) of the liner extends past the end of the torch. Remove any burrs from the end of the liner.

g) Screw the gas diffusers onto the torch and tighten.

CONTACT TIP AND GAS NOZZLE INSTALLATION

a) Choose the correct size contact tip for the electrode being used (wire size is stenciled on the side of the contact tip) and screw it snugly into the gas diffuser.

b) Select the gas nozzle that best suits the welding application. Inspect the o-rings on the nozzle for cuts or tears, and replace if necessary. Examine the nozzle shield and make sure it is free of spatter and welding debris. Slide the nozzle onto the torch and secure it into position with the threaded collar.

CONNECTING THE TORCH TO THE WELDING EQUIPMENT

(See Figure 2)
There are three cable bundles for the Tandem MIG torch.

a) G3494-X Series:
Two of the cable assemblies supply power, wire and water cooling to each side of the torch. The third bundle is made up of the nozzle water cooling hoses, the air blast line and the shielding gas line.

b) G3494-XA Series:
Two of the cable assemblies supply power, wire, shielding gas and water cooling to each side of the torch. The third bundle is made up of the nozzle water cooling hoses and the air blast line.

Both the G3494-X and the G3494-XA series torches require a K489-7 Fast-Mate adapter to connect the torch to wire feeder. When connecting to a Power Feed 10R wire feeder a K1500-1 gun connector must be installed at feeder before installing K489-7 Fast-Mate adapter.

a) Check that the drive rolls and feeder guide tubes are appropriate for the electrode size and type being used.

b) Push the end connector from torch into K489-7 Fast-Mate adapter on the wire feeder, and then tighten the locking nut. Do this for both of the torch power cables.

c) Attach the water lines from the torch power cables to a supply of cooling water.

d) Connect the water lines from the nozzle bundle to the Tandem MIG interface. If a Tandem MIG interface is not used, connect the water lines directly to the water cooler or other type of controller.

e) For G3494-X Series:
Connect the shielding gas line from the nozzle bundle to the Tandem MIG interface. Alternatively, connect the shielding gas line to the lead wire feeder. Do not connect the shielding gas line to trail wire feeder, because there would be no shielding gas in the event of a delayed trail arc start .

For G3494-XA Series:
Shielding gas connection was completed in step b, when torch cables were connected to Fast-Mate connector. Check gas hose connection from wire feeder solenoid to Fast-Mate connector for both the lead and trail wire feeders.

f) Attach the air blast line to the high pressure dry air supply (50-100 psi).

WATER COOLING EQUIPMENT

(See Figure 3)
The Tandem MIG torch requires three separate water coolers for proper cooling of the torch. The lead and trail part of the torch each require a water cooler as well as a third cooler for the nozzle. The three coolers maintain proper temperatures in the torch even at maximum rated output and duty cycle, leading to long parts life and consistent welds. The separate coolers eliminate the risk of any current leakage through the water.

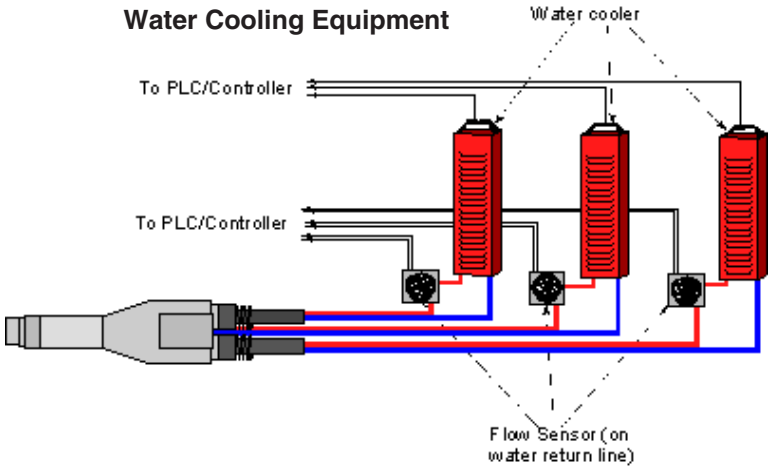
The water cooler for the nozzle should be programmed to turn on only during welding and remain on for twenty seconds after the weld is complete. Automatic control of the cooler minimizes the risk of an operator removing the nozzle and getting sprayed by the cooling fluid.

To maximize the life of the water coolers, the coolers for the lead and the trail part of the torch should turn on during welding and remain on for 60 seconds after the weld is complete.

Water cooler manufacturers often specify additives such as fungicides or alkalides. Follow manufacturers recommendations to achieve proper operation and long lifetimes without clogging.

K1536-1 Flow sensors should be placed in the return line of each water circuit. Use a KP1529-1 connector kit to attach the flow sensors as needed.

FIGURE 3
Water Cooling Equipment



MOUNTING THE TORCH

Always insulate the torch from any equipment or fixturing. Use M19190 Bracket Arm to Torch Body Insulator if necessary. (See Figure 4, Torch mounting dimensions)

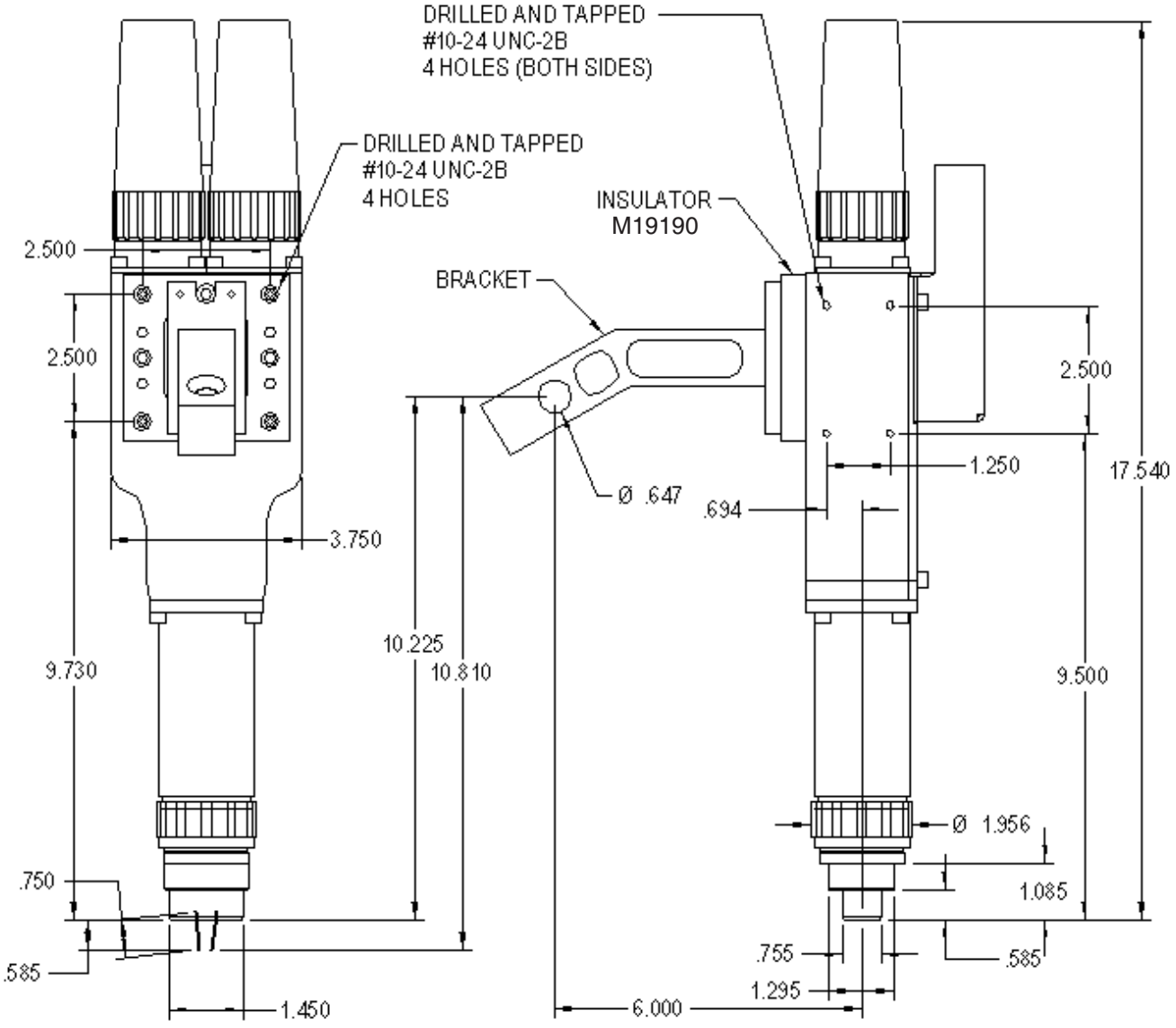
Check to make sure the cables are free to flex and do not get tangled or caught on other equipment. Do not let the cables drag on moving or hot parts.

Use a collision sensor if there is a risk that the torch may impact an object when the torch or work piece moves.

The case of the torch has holes drilled on the back, left and right sides for mounting the insulator on either the back or side of the torch. All of the holes are drilled and tapped for #10-24x.50 screws.

FIGURE 4

Torch Mounting Dimensions



WORK LEAD

Minimize the length of the electrode and work lead cables. Do not exceed 50 ft (15m) of combined electrode and work lead length.

To make the work lead connection, run a properly sized lead from the work connection on the power source directly to the fixture. The ground connection should be as close to the part to be welded as possible. **Do not combine work leads from the lead and trail power source.** Each machine requires an individual work lead to the welding fixture.

Do not tightly bundle the electrode leads or the work leads together. Welding performance may deteriorate.

SEAM TRACKING

Seam tracking is required if the joint position wanders or varies from part to part. Most optical and mechanical trackers are compatible with Tandem MIG. Check the manufacturer's specifications for the seam tracking equipment. Do not exceed the rated power limit for the seam tracking unit.

Through-the-arc-seam-tracking (TAST) works with Tandem MIG in the same manner as single wire TAST. Perform the current sensing for TAST on the lead electrode.

WELDING WITH MULTIPLE TANDEM MIG SYSTEMS

Special care must be taken when more than one Tandem MIG torch is welding simultaneously on a single part. Arc blow and arc interference may occur or be magnified.

Every torch requires a separate shielding gas regulator for proper flow rate and shielding gas coverage. **Do not attempt to supply shielding gas for two or more torches from only one regulator.**

Use one work lead per power source to connect the work stud to the welding fixture. **Do not combine all of the work leads into one lead.** Performing welding in the direction away from the work leads. For example, if there are two Tandem MIG systems welding on the same part, there should be four work leads (two lead and two trail power sources.)

WIRE STRAIGHTENERS

Use a wire straightener with each wire drive. **Failure to use a wire straightener may result in inconsistent welds and weld bead placement.**

TAIL GAS COVERAGE

The Tandem Mig process is capable of establishing wide weld bead profiles at higher than usual travel speeds. When performing large weldments at these high travel speeds the weld pool may become unprotected while cooling as the welding torch providing the shielding gas travels faster than the pool cools. To provide weld pool protection during these applications it is recommended to use the trailing gas assembly (M18408-5) to provide additional shielding.

ELECTRODES AND EQUIPMENT

TheTandem MIG torch has been designed for use with 0.035" through 5/64" (0.9 mm to 1.9 mm) Lincoln solid steel MIG wires and metal core wires. Refer to the appropriate Lincoln Process and Procedure Guidelines for further information on welding settings.

MAKING A WELD

⚠ WARNING

• When using an open arc process, it is necessary to use correct eye, head and body protection.

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a) Check to make sure the welding power sources are turned on and set to the correct parameters and programs.

b) Verify that the shielding gas supply is on and set for the correct flow rate.

c) Set the preflow and postflow times the same on both wire feeders. Make sure the post flow is long enough to provide shielding during any crater fill operation.

d) Check that all of the water coolers are operating properly.

e) If applicable, make sure the Air-Blast spray system is on.

f) Position the torch over the joint.

⚠ WARNING

• Automatic equipment may start unexpectedly.

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g) Make a weld by sending a trigger signal to the welding power sources.

AVOIDING WIRE FEEDING PROBLEMS

Wire feeding problems can be avoided by observing the following procedures:

a) Do not use a torch with cables longer than necessary.
b) Do not kink or pull the cable around sharp corners.
c) Keep the cable as straight as possible when welding or loading electrode through the cable.
d) Do not allow dolly wheels or trucks to run over cables.
e) Use only clean, rust-free electrodes. Electrodes manufactured by Lincoln Electric have proper surface lubrication.
f) Replace the contact tips when the arcs start to become unstable or the contact tip ends are fused or deformed.

SHIELDING GAS DELIVERY

Adjust flow regulators for prescribed gas flow. Inspect hoses regularly for worn or torn hoses. Perform a soapy water test on hoses if a leak is suspected. Avoid kinking or collapsing hoses with cable clamps. Insure that diffuser is properly seated and tight. **For G3494-XA series torch, two gas sources are required. Do not attempt to "Y" or Tee gas from one flow meter or regulator.**

AIR BLAST CLEANING

The welding torch is equipped with a separate gas hose for the purpose of providing a high pressure air blast through the nozzle area to clear loose spatter that may have accumulated between the two diffusers.

The high-pressure air is routed through the torch over molded assembly and exits into the nozzle through an opening in the nozzle shield. Air should be dry and free of oil or anti- spatter compound. Pressure should be adequate to free loose spatter (50-100 psi).

NOZZLE REAMING STATIONS

During robotic applications a reamer should be employed to keep the nozzle clean. Reaming the nozzle between welds will reduce the down time associated with manual torch cleaning. The M18426-1 reaming station is an option that is recommended for nozzle cleaning.

ANTI- SPATTER SPRAY

Anti-spatter compound may be used to keep weld spatter from accumulating in the nozzle. Anti-spatter should not be applied through the air blast line. Only dry air should be used for air blast functions.

Anti-spatter may be applied to the interior of the nozzle from an external sprayer. The M18426-1 reaming station comes equipped with an external anti-spatter spraying station.

Care should be taken to apply the right amount of anti-spatter to the internal area of the nozzle. Too much anti - spatter will cause diffuser clogging and weld porosity.

Only a very light covering of anti-spatter is required to keep the spatter from cling to the nozzle.

GENERAL OPTIONS / ACCESSORIES

The following options/accessories are available for your Tandem MIG Torch from your local Lincoln Distributor.

K489-7 Connector Kit - Magnum Fast-Mate Adapter

Liners

Steel, Stainless and Metal Cored Electrodes

S24198-10	.035-.045" / 0.9-1.2mm, 9 ft.(2.7m)
S24198-12	.035-.045" / 0.9-1.2mm, 15 ft.(4.6m)
S24198-11	.052-.078" / 1.3-2.0mm, 9 ft.(2.7m)
S24198-13	.052-.078" / 1.3-2.0mm, 15 ft.(4.6m)

Diffusers

M19186	Diffuser

Contact Tip

Steel, Stainless and Metal Cored Electrodes

KP2020-7B1	.030” / 0.8mm

Contact Tips (Heavy Duty)

Steel, Stainless and Metal Cored Electrodes

KP2021-1B1	.035" / 0.9mm
KP2021-6B1	.040" / 1.0mm
KP2021-2B1	.045" / 1.2mm
KP2021-3B1	.052" / 1.3mm
KP2021-4B1	1/16" / 1.6mm
KP2021-5B1	5/64" / 2.0mm

Gas Nozzles

S24198-1	1 1/2” x 3/4” (37mm x 19mm) contact tips recessed 1/8" (3mm)
S24198-2	1 1/2” x 3/4” (37mm x 19mm) contact tips extended 1/8” (3mm)
S24198-3	1 1/2” x 7/8 (37mm x 22mm) contact tips recessed 1/8" (3mm)
S24198-4	1 1/2” x 3/4” (37mm x 19mm) 15° bevel
S24198-5	1-5/8” x 1” (42mm x 24mm) for reamers
S24198-6	1-5/8” x 1” (42mm x 24mm) heavy duty

Nozzle Shields

M19267	Nozzle Shield (Fiber)
or	
M19558	Nozzle Shield (Ceramic)

Torch Shields

S24432	Torch Shield(for G3494-X Torch, with Air Blast)
S24432-1	Torch Shield(for G3494-X Torch, Solid Shield)
S24432-A	Torch Shield(for G3494-XA Torch, with Air Blast)
S24432-A1	Torch Shield(for G3494-XA Torch, Solid Shield)

Mounting Brackets

M19277	Bracket Arm
M19190	Bracket Arm to Torch Body Insulator

SAFETY PRECAUTIONS

⚠ WARNING

Have qualified personnel do the maintenance work. If a problem cannot be corrected by following the instructions, take the equipment to the nearest Lincoln Field Service Shop for repair.

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.**

See additional warning information throughout this operator's manual.

MAINTENANCE

a) Replace worn contact tips as required.

b) Remove spatter from inside of the gas nozzle and from the tips after every 20 minutes of arc time, or as required.

c) Replace the nozzle shield when it exhibits signs of deterioration.

d) For steel or metal cored electrodes, clean the cable liners after using approximately 2000 lbs of electrode. Remove the cables from the wire feeders and extend them so they are straight. Lay the cables out on the floor, if possible. Remove the contact tips from the torch. Using an air hose and only partial pressure, gently blow out the cable liners from the gas diffuser end. Flex the cables over its entire length and again blow out the cable. Repeat this procedure until no further dirt comes out.

⚠ CAUTION

EXCESSIVE PRESSURE MAY CAUSE THE DIRT TO FORM A PLUG.

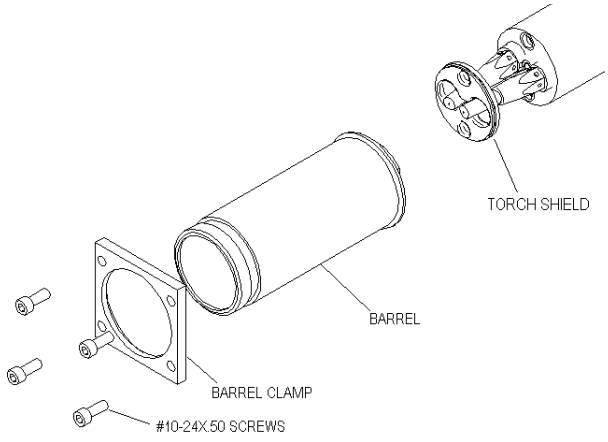
TORCH SHIELD REPLACEMENT

It is important that the torch shield be inspected and replaced on a routine basis. The torch shields (S24432, -1, -A, -1A) are designed to protect the more expensive overmolded assembly of the Tandem torch from arc and heat induced erosion. The shields must be inspected and replaced on a routine basis. It is important to replace burnt, eroded or other wise damaged shields during a routine inspection process. Care must be taken not to introduce moisture or fluid between shield and the over molded assembly. Retained moisture between the two components will induce erosion of the overmolded assembly. When replacing or inspecting the torch shield, clean components free of oil, dirt and moisture before welding.

(See Figure 5)

a) Turn off power to the welding equipment.
b) Remove the nozzle from the torch.
c) Unscrew and remove the contact tips and diffusers.
d) Using a 5/32" allen wrench, remove the four screws holding the barrel clamp and then remove the barrel clamp.
e) Slide the barrel off of the torch.
g) Remove the old torch shield from inside the barrel. Place a new torch shield in the barrel, being sure the orientation of the torch shield is correct. There is a small step in the torch shield that seats in the barrel. When assembled correctly, the face of the torch shield will be flush with the end of the barrel.
h) Assembly of the remainder of the torch is the reverse of the earlier steps.

FIGURE 5
Torch Shield Replacement



CONTACT TIP REPLACEMENT

Each application will dictate the frequency of contact tip replacement. Higher amperage higher duty cycle operations will require more frequent contact tip replacement. The condition of the contact tip greatly effects the welding performance. A routine tip replacement schedule should be established and adhered to. For general operations contact tips should be changed at the beginning of every shift.

LINER REPLACEMENT

Wire condition and plant environment as well as wire consumption rate dictate how often a liner should be changed. Smaller wire diameter will require a more frequent change interval than large diameter operations. For general operations using .045" dia. wire liners should be changed after approximately 2000 lbs of wire use.

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.

Step 2. POSSIBLE CAUSE.
The second column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

Step 3. RECOMMENDED COURSE OF ACTION
This column provides a course of action for the Possible Cause, generally it states to contact your local Lincoln Authorized Field Service Facility.

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Lincoln Authorized Field Service Facility.

⚠ 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.

TROUBLESHOOTING

E-2

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
The drive rolls turn, but wire will not feed or wire feeding is rough.	a. Gun cable is kinked and/or twisted.	a. Keep as straight as possible. Inspect cable and replace if necessary.
	b. Wire jammed in gun or cable.	b. Remove wire from gun and cable, then feed in new wire. Check for any obstructions. Replace the liner if necessary.
	c. Incorrect drive rolls and guide tubes.	c. Be sure the wire diameter being used matches the sizes of the drive rolls and guide tubes.
	d. Gun cable liner dirty.	d. Clean or replace liner.
	e. Conduit clogged or dirty.	e. Blow the conduit out with compressed air. Check for obstructions. Replace conduit if necessary.
	f. Worn drive rolls.	f. Replace or reverse split drive rolls.
	g. Electrode rusty or dirty.	g. Replace the electrode.
	h. Worn or improperly sized cable liner.	h. Replace cable liner.
	i. Partially flashed, melted or improper contact tip.	i. Replace the contact tip.
The arc starts, but during the weld the arc goes out and wire keeps feeding.	a. Loose electrode or work lead connection.	a. Verify that all the connections are tight and are not overheating.
	b. The output of the Power Wave is being exceeded, and the machine is "phasing back".	b. Change the welding procedure to reduce the output current.
	c. The wrong weld program has been selected.	c. Make sure the welding program on the power source matches the wire size and gas actually being run.
Water leaks from the torch.	a. Misassembled torch shield.	a. Assemble the torch shield properly. It should be flush with the bottom of the barrel.
	b. O-rings on the nozzle are cut, worn or torn.	b. Replace the o-rings.
	c. Loose connections where the cables enter the torch.	c. Properly connect the cables to the torch.
Porosity in the weld.	a. The parts to be welded are dirty.	a. Remove dirt, oil, lubricants and scale from the part to be welded.
	b. The parts to be welded have a surface coating.	b. Do not weld painted, plated or insulation-coated parts.
	c. The arc length is excessively long.	c. Properly set the weld procedure. Generally arc lengths do not exceed approximately 1/4".
	d. Insufficient shielding gas flow.	d. Verify that the torch is being supplied with 65 scfh.
	e. Gas solenoid not turning on.	e. Check that the gas solenoid fully turns on during welding.
	f. Loose shielding gas connections.	f. Check that all the connections are sealed and that there are no cuts or kinks in the shielding gas line.

⚠ 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.

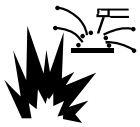
Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	PPOSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Porosity in the weld. (Continued)	g. Wrong shielding gas composition.	g. Make sure the shielding gas is appropriate for the weld procedure.
	h. Lead arc length too short.	h. The lead arc should be in the spray or pulse mode and not in globular or short arc transfer.
	i. Water is leaking into the arc.	i. Verify that nozzle to torch o-rings are sealing properly.
	j. Air is being drafted through the barrel.	j. Check that the o-rings to seal the barrel to the over molded assembly are sealing properly.
	k. Weld is too large.	k. Use a trailing gas shield or a nozzle that supplies a wider coverage of gas shielding.
	l. Excessive anti-spatter fluid.	l. Use only a minimal amount of anti-spatter fluid.
	m. For installations with an anti-spatter system, the anti-spatter solenoid may not be closing completely.	m. Verify that the solenoid closes completely.
	n. For installations without an anti-spatter system, the line may not be plugged.	n. Make sure the anti-spatter line is plugged and sealed.
The arc length is inconsistent.	a. The contact tip is worn.	a. The wire should slide freely through the contact tip. Replace if necessary.
	b. The liner and/or conduit are dirty or worn.	b. Clean the liners and conduit. Replace if necessary.
	c. The drive rolls and guide tubes on the wire feeder are not properly assembled.	c. Make sure the correct size drive rolls and guide tubes are in the feeder the wire feeds through without distortion.
	d. The variation in the joint is too large.	d. Improve fixturing and part forming if necessary, or add seam tracking.
	e. The electrode or work lead connections are loose.	e. Verify that all the connections are tight and are not overheating.
	f. Only one ground lead is being used.	f. Use an individual ground lead from the work stud of each power source to the fixture.
	g. The wrong weld program has been selected.	g. Make sure the welding program on the power source matches the wire size and gas actually being run.
There is arcing to the nozzle.	a. Spatter build-up is bridging between the nozzle and contact tips or diffusers	a. Remove spatter build-up on a regular basis. Adjust weld procedure to reduce spatter.
	b. The nozzle is too narrow for the application.	b. Switch to a wider nozzle.
	c. The torch is not insulated from the fixture.	c. Make sure the torch is on an insulated mount. Use M19190 insulator if necessary.
There is arcing between the contact tips or arc flaring.	a. Spatter build-up is creating a bridge between the contact tips.	a. Remove spatter build-up on a regular basis. Adjust procedure to reduce spatter.
	b. The wire size selection is wrong.	b. Switch to a larger diameter lead and trail wire.

⚠ 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.

NOTES

			
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。

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이 제품에 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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