INSTRUCTIONS for

HW-9 & HW-9 PENCIL TIG WELDING TORCHES

HW-9 Torch, 60/120-deg. head with 12-1/2-ft. cable . . . Part No. 16X28
HW-9 Torch, 60/120-deg. head with 25-ft. cable . . . . . . Part No. 16X44
HW-9 Pencil Torch, 180-deg. head, 12-1/2-ft. cable . . . Part No. 16X47

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for electric welding equipment, we urge you to read Linde's free booklet, "Precautions and Safe Practices for Electric Welding and Cutting." Form 52-529. Do not permit untrained persons to install, operate, or maintain this equipment. Do not attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions on page 2 before installing or operating this equipment.

SUPPLEMENTARY LITERATURE (available through Linde Offices or Linde welding supply distributors).
F-9847 — How To Plan a Tig Welding Installation.
F 3499 — Safety Precautions for Argon, Helium, and other industrial gases.

RATING: With standard or gas lens collet bodies: 110 amps.
(ACHF or DCSP) continuous duty; 120 amps. at 50% duty cycle. (Using standard collet bodies.)

COOLING: Air-cooled design.

ELECTRODES: Uses .020, .040, and 1/16-in. diameter electrodes, 3-in. or 7-in. long. Both the short torch cap (designed for 3-in. electrodes) and the long cap are supplied with the HW-9 torch. See Table 1 for electrode diameter vs. current recommendations.

COLLETS: Available for each electrode size. See Table 2. One collet body (supplied with torch) is used with each collet.

CUPS: For use with standard collet bodies: Standard ceramic in sizes 4 through 8. High-impact and long high-impact in ceramic sizes 4, 5, and 6. See Table 3.

For use with gas lens collet bodies: High-impact ceramic in sizes 4, 5, 6, and 7. See Table 3.

TORCH DIMENSIONS:

<table>
<thead>
<tr>
<th>HW-9</th>
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<tbody>
<tr>
<td>Length, approx.</td>
<td>8-3/4-in. (222 mm)</td>
</tr>
<tr>
<td>Handle diameter</td>
<td>3/4-in. (19 mm)</td>
</tr>
<tr>
<td>Height of torch head w/short cap</td>
<td>3-1/8-in. (79 mm)</td>
</tr>
<tr>
<td>w/long cap.</td>
<td>7-1/8-in. (181 mm)</td>
</tr>
<tr>
<td>Diameter of Head</td>
<td>19/32-in. (15 mm)</td>
</tr>
<tr>
<td>Head Angle</td>
<td>60° or 120°</td>
</tr>
<tr>
<td>Weight (less cable)</td>
<td>3 oz. (85 g)</td>
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<table>
<thead>
<tr>
<th>HW-9 Pencil</th>
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<tbody>
<tr>
<td>Length, approx.</td>
<td>7-1/8-in. (181 mm)</td>
</tr>
<tr>
<td>Handle diameter</td>
<td>3/4-in. (19 mm)</td>
</tr>
<tr>
<td>Head Angle</td>
<td>180°</td>
</tr>
<tr>
<td>Weight (less cable)</td>
<td>5 oz. (142 g)</td>
</tr>
</tbody>
</table>

REQUIRED ACCESSORIES OR SERVICES:
- Collet, collet body, electrode, cup.
- Shielding gas regulator-flowmeter (if cylinder gas is used)
  OR flowmeter (if gas is piped).
- Gas Hose, 12-1/2-ft. long (40V77) or 25-ft. long (34V38) connects between regulator-flowmeter and torch cable and hose assembly.
- Welding power and shielding gas supplies.
- Power Cable Adaptor (53N43) for connecting torch power cable to power and gas supplies.
WARNING: These Safety Precautions are for your protection. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below. Failure to observe these Safety Precautions can result in personal injury or death.

1. PERSONAL PROTECTION - Skin and eye burns from exposure to rays from an electric-arc or hot metal can be more severe than sunburn. Therefore:
   a. Use a face shield fitted with the correct filter and cover plates to protect your eyes, face, neck, and ears from sparks and rays of the arc when operating or observing operations. WARN bystanders not to watch the arc and not expose themselves to the rays of the electric-arc or hot metal.
   b. Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high-topped shoes, and a welding helmet or cap for hair protection, to protect against arc rays and hot sparks or hot metal. A flameproof apron may also be desirable as protection against radiated heat and sparks.
   c. Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned, and pockets eliminated from the front of clothing.
   d. Protect other nearby personnel from arc rays and hot sparks with a suitable non-flammable partition.
   e. Always wear safety glasses or goggles when in a work area. Use safety glasses with side shields or goggles when chipping slag or grinding. Chipped slag may be hot and can travel considerable distances. Bystanders should also wear safety glasses or goggles.
   f. Some gouging and cutting processes produce excessively high noise levels and require ear protection.

2. FIRE PREVENTION - Hot slag or sparks can cause serious fires when in contact with combustible solids, liquids or gases. Therefore:
   a. Remove all combustible materials well away from the work area or completely cover the materials with a protective non-flammable covering. Such combustible materials include wood, clothing, sawdust, gasoline, kerosene, paints, solvents, natural gas, acetylene, propane, and similar combustible articles.
   b. Hot sparks or hot metal can fall into cracks in floors or wall openings and cause a hidden smoldering fire. Make certain that such openings are protected from hot sparks and metal.
   c. Do not weld, cut or perform other hot work until the workpiece has been completely cleaned so that there are no substances on the workpiece which might produce flammable or toxic vapors.
   d. For fire protection, have fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket, or portable fire extinguisher.
   e. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire.
   f. For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", which is available from the National Fire Protection Association, 470 Atlantic Ave., Boston, MA 02210.

3. ELECTRICAL SHOCK - Contact with live electrical parts can cause severe burns to the body or fatal shock. Severity of electrical shock is determined by the path and amount of current through the body. Therefore:
   a. Never allow live metal parts to touch bare skin or any wet clothing. Be sure gloves are dry.
   b. When standing on metal or operating in a damp area, make certain that you are well insulated. Wear dry gloves and rubber-soled shoes and stand on a dry board or platform.
   c. Always ground the power supply by connecting a ground wire between the power supply and an approved electrical ground.
   d. Do not use worn or damaged cables. Do not overload the cable. Use well maintained equipment.
   e. When not operating, turn off the equipment. Accidental grounding can cause overheating and create a fire hazard. Do not coil or loop cable around parts of the body.
   f. Be sure the proper size ground cable is connected to the workpiece as close to the work area as possible. Grounds connected to building framework or other remote locations from the work area increase the possibility of output current passing through lifting chains, crane cables, or various electrical paths.
   g. Keep everything dry, including clothing, work area, cables, electrode holder, and power supply. Fix water leaks immediately.
   h. Refer to AWS Standard Z49.1 in Item 6 below for specific grounding recommendations. Do not make the work lead for a ground cable.

4. VENTILATION - Fumes, particularly in confined spaces, can cause discomfort and physical harm. Do not breathe fumes. Therefore:
   a. At all times provide adequate ventilation in the work area by natural or mechanical ventilation means. Do not weld, cut, or gouge on materials such as galvanized zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
   b. Do not operate in locations close to chlorinated hydrocarbon vapors coming from degreasing or spraying operations. The heat or arc rays can react with solvent vapors to form phosgene, a highly toxic gas, and other irritant gases.
   c. If you develop momentary eye, nose, or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work area. Do not continue to operate if physical discomfort persists.
   d. Refer to AWS Standard Z49.1 in Item 6 below for specific ventilation recommendations.

5. EQUIPMENT MAINTENANCE - Faulty or improperly maintained equipment can result in poor work, but most importantly it can cause physical injury or death through fires or electrical shock. Therefore:
   a. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
   b. Before performing any maintenance work inside a power supply, disconnect the power supply from the electrical power source.
   c. Maintain cables, grounding wire, connections, power cord, and power supply in safe working order. Do not operate any equipment in faulty condition.
   d. Do not abuse any equipment or accessories. Keep equipment away from heat sources such as furnaces, wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.
   e. Keep all safety devices and cabinet covers in position and in good repair.
   f. Use equipment for its intended purpose. Do not modify it in any manner.

6. ADDITIONAL SAFETY INFORMATION - For more information on safe practices for setting up and operating electric welding and cutting equipment and on good working habits, ask for a free copy of Linde's "Precautions and Safe Practices for Electric Welding and Cutting", Form 52-625. The following publications which are available from the American Welding Society, 2501 N.W. 7th Street, Miami, FL 32125, are recommended to you:
   a. "Safety in Welding and Cutting" - AWS Z49.1 (ANSI)
   c. "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances" - AWS F4.1
   d. "Recommended Safe Practices for Plasma Arc Cutting" - AWS A6.3
   e. "Recommended Safe Practices for Plasma Arc Welding" - AWS C5.1
   f. "Recommended Safe Practices for Air Carbon Arc Gouging and Cutting" - AWS C5.3.
OPTIONAL ACCESSORIES:
- Gas Lens Collet Bodies (see Table 2) for extending the shielding gas stream so that an electrode can be extended 3/4-in. beyond the cup. Improves performance in drafty locations and enables operator to weld inside corners and other hard to reach places. To use the gas lens, a collet body insulator (53N85), adaptor (45V52) and special gas cups (see Table 3) are also required.
- Wrench (59K07) for use with the above gas lens collet bodies.
- Braided Nylon Sheath, 9-ft. (2075198) and 20-ft. (2075200) for protecting service lines.
- Transparent Torch Cap, long (56Y83) for HW-9 with 60°/120° head to aid in determining when new electrode is needed.

SET-UP AND INSTALLATION

1. Connect the regulator/flowmeter to a gas cylinder. Refer to the instructions supplied with the regulator/flowmeter for details on attaching and adjusting the regulator.
2. Connect one end of the gas hose (40V77 or 34V38) to the regulator outlet; and the other end to the torch cable adaptor (53N43).
3. Connect the power cable adaptor to the welding power source, either directly or through a suitable length of welding cable fitted with lugs.
4. If using the standard torch accessories, refer to Fig. 1 and install collet, electrode, and cup as follows:
   a. Remove the insulator sleeve and collet body from the torch.
   b. Place the correct size electrode and collet into the top end of the collet body, making sure the bottom end of the collet mates with the tapered seat in the collet body.
   c. Screw the collet body into the front end of the torch body.
   d. Install the insulator sleeve so that it fits between the groove on the collet body and the flange on the torch body. A clockwise rotation of the sleeve will then tighten the collet on the electrode.
   e. Screw the proper size ceramic cup onto the collet body.
   f. Adjust the electrode so that it extends 1/8-in. to 3/16-in. beyond the end of the cup. This is done by turning the collet insulator sleeve about one-quarter turn to the left, adjusting the electrode, and tightening the collet insulator sleeve again with the fingers.
5. If using the optional gas lens accessories, install the parts as follows:
   a. Remove the sleeve and the standard collet body from the torch (the standard collet body is not required for this installation).
   b. Referring to the inset of Fig. 1, install the sleeve onto the adaptor (45V52); place the insulator (53N85) over the small diameter end of the gas lens collet body; and then screw the collet body into the adaptor. Tighten with a wrench (special collet body wrench (59K07) is available).

Operating Instructions

1. Make sure that all gas connections in the system have been securely tightened, and that the torch cap (on the HW-9 with 60°/120° head) has been well-tightened.
2. With the regulator flow-adjusting valve closed, open the gas cylinder or station valve.
3. Set the power supply for the desired welding current.
4. Open all shielding gas valves downstream from the flowmeter or flowmeter/regulator (e.g., lever-operated shut-off valve, or solenoid-operated valve in power supply).
5. Set shielding gas flow to the desired level, as registered on flowmeter tube or gauge. **NOTE**: Purge the gas hose by allowing the gas to flow long enough (up to 15 minutes on new torch; less than five minutes thereafter). This will help prevent weld contamination.
6. Close control switch at work station or power supply.
7. Draw a test arc on a heavy piece of scrap steel or copper. (Do NOT use a carbon block, which will tend to contaminate the electrode.)
8. If the test arc is satisfactory, commence welding.
OPERATION AND MAINTENANCE HINTS

1. A poor shielding gas connection, or a leaky hose, will not only waste gas but permit the entry of minute amounts of air, sufficient to contaminate both the electrode and the weld. Trouble signs: a bluish cast on the electrode after it has cooled; in welding aluminum, a dark gray deposit on or beside the weld bead.

2. Keep the torch hose away from hot metal. The plastic hose begins to lose strength at 125°F (52°C).

3. Do not try to repair a damaged power cable. Replace it. Then send the damaged assembly, if it appears worth salvaging, to a Linde repair station, which has special tools for making up tight connections.

4. If an electrode becomes contaminated, shut off power, then remove electrode from torch. Break off the contaminated end (nickering with a grinding wheel first will help) and replace electrode.

5. Keep an eye on the sealing ‘O’ rings on the collet body and torch cap. If it shows sign of wear or distortion, cut it off. Then install a new ring (85W49). Apply a little silicone grease to the new ring before attempting to slide it over the cap threads.

<table>
<thead>
<tr>
<th>Electrode Size (in.)</th>
<th>Welding Currents, Amperes</th>
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<tbody>
<tr>
<td></td>
<td>ACHF*</td>
<td>DCSP†</td>
</tr>
<tr>
<td></td>
<td>Pure Tungsten</td>
<td>Thoriated Tungsten</td>
</tr>
<tr>
<td>0.020</td>
<td>5 - 15</td>
<td>5 - 20</td>
</tr>
<tr>
<td>0.040</td>
<td>10 - 60</td>
<td>15 - 80</td>
</tr>
<tr>
<td>1/16</td>
<td>50 - 100</td>
<td>70 - 110</td>
</tr>
</tbody>
</table>

*In general, for DCSP, the lower end of the specified current range applies to the pure tungsten electrodes and the upper end of the thoriated tungsten electrodes.

*Maximum values for unbalanced wave transformers. Balanced wave reduces maximum by about 30 per cent.

NOTE: All current values are metered readings. Transformers designed for metal-arc welding deliver about 15 per cent more than shown on their scale readings.

Thoriated tungsten electrodes are recommended when gas lens and high frequency starting are used.

<table>
<thead>
<tr>
<th>Table 2 - Collets and Collet Bodies</th>
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<tbody>
<tr>
<td>Size, in.</td>
</tr>
<tr>
<td>Collet</td>
</tr>
<tr>
<td>Gas Lens Collet Body*</td>
</tr>
</tbody>
</table>

*An adaptor (45V52) and insulator (53N85) are also required when using a gas lens.

<table>
<thead>
<tr>
<th>Table 3 - Cups</th>
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<tbody>
<tr>
<td>Cup No.</td>
</tr>
<tr>
<td>Ceramic Cup</td>
</tr>
<tr>
<td>High-Impact Cup</td>
</tr>
<tr>
<td>Long High-Impact Cup</td>
</tr>
<tr>
<td>Gas Lens High-Impact Cup</td>
</tr>
</tbody>
</table>

*An adaptor (322117) is required when using these cups.
For Gas Lens Accessories, see Fig. 1.

Fig. 2 - HW-9 Torch - (60°/120° Head, 12-1/2-ft. cable) - Part No. 16X28
(60°/120° Head, 25-ft. cable) - Part No. 16X44

Fig. 3 - HW-9 Pencil Torch (12-1/2-ft. cable) - Part No. 16X47
LITERATURE CHANGES

“Q” Edition (11/78) of this booklet supersedes F-9683 and covers the following changes:

1. Added HW-9 pencil torch which was formerly covered in F-9683.
2. Material for the optional cable sheath was changed from asbestos to braided nylon sheath.
3. Deleted the optional fixed orifice flow control adaptor (21X62) which is no longer available.
4. Cable adaptor (53N43) is no longer supplied with the torch; it is now a required accessory.

“R” Edition (8/81) of this booklet covers part number change on replacement torch handle.