INSTRUCTIONS for

HW-12
HEAVY-DUTY
TIG WELDING TORCH
P/N 16X37

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 our 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.

RATING: 500 amps (ACHF or DCSP) continuous duty; 600 amps at 50% duty cycle.

COOLING: Closed-loop water cooling system; straight line water passages.

ELECTRODES: Uses .040-in. through 1/4-in. diameter electrodes (3-in., or 7-in.). Standard torch cap is designed for 7-in. electrodes. Short cap (for 3-in.) is available as an option. See Table 1 for electrode diam. vs. current recommendations.

COLLETS: Available for seven electrode sizes. See Table 2.

COLLET BODIES: Sizes to match collets. See Table 2.

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Capacity</th>
<th>500 amp continuous duty, ac or dc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>600 amp at 50% duty, ac or dc</td>
</tr>
<tr>
<td>Overall Length</td>
<td>12-in. (305 mm)</td>
</tr>
<tr>
<td>Handle Diameter</td>
<td>1-3/8-in. (35 mm)</td>
</tr>
<tr>
<td>Length of Head</td>
<td>5-in. (short cap) (127 mm)</td>
</tr>
<tr>
<td></td>
<td>8-3/8-in. (long cap) (217 mm)</td>
</tr>
<tr>
<td>Diameter of Head</td>
<td>1-1/2-in. (38 mm)</td>
</tr>
<tr>
<td>Head Angle</td>
<td>60-deg.</td>
</tr>
<tr>
<td>Weight (less cable and hose)</td>
<td>16 oz. (457 gm)</td>
</tr>
<tr>
<td>Cooling Requirements</td>
<td>1.7 qt/min (1.6 L/min)</td>
</tr>
</tbody>
</table>

NOZZLES AND CUPS: Metal nozzles for longer service life, or standard and high-impact ceramic cups, See Table 3 and 4.

REQUIRED ACCESSORIES OR SERVICES

— Nozzle, collet, collet body, electrode, cup.
— Fuse Assembly (45V34) or power cable adaptor (45V11).

NOTE: The fuse assembly contains a standard fuse link (54N26) which is rated for welding current up to 250 amps. If intending to use welding currents greater than 250 amps, replace fuse link with a heavy-duty fuse link (54N30 - supplied in a package of 5). Instructions for replacement (F-11-103) are packed with the fuse assembly.

— Water hose (to connect fuse assembly or adaptor to drain). Recommended: 40V76.
— Shielding gas regulator-flowmeter (if cylinder gas is used) or flowmeter (if shielding gas is piped).
— Adequate Water Supply - For adequate torch cooling at maximum rating, a water flow of 1.7 quart/min. with inlet temperature 60-deg. F or less, is needed. To secure this flow, pressure of the water supply must be at least 25 psi if torch has 12-1/2-ft. cable and hose, 35 psi if torch has 25-ft. cable and hose. (If flow switch is use in system, 5 psi more upstream of switch is needed). Pressure should not exceed 50 psi, measured at inlet of the torch hose, lest the plastic will be damaged.
— Welding power and shielding gas supplies.

OPTIONAL ACCESSORIES

— Short Cap (56Y45) for use with 3-in. electrodes.
— V-30 Double Shut-Off Valve (16X21): Shuts off both water and gas flow when torch is hung on valve arm.
— Flow Switch (Torch Saver) P/N 40V51: Water-metering switch which can be interconnected to the welding con-
SAFETY PRECAUTIONS

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-toppeled 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, Batterymarch Park, Quincy, MA 02269.

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 parts.
   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 mistake 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 steel, 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 your welding equipment supplier for a copy of "Precautions and Safe Practices for Electric Welding and Cutting", Form 52-529. The following publications, which are available from the American Welding Society, 550 N.W. Lejuene Rd., Miami, FL 33126, 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 Practices for Plasma Arc Cutting" - AWS C5.2
   e. "Recommended Safe Practices 'or Plasma Arc Welding" - AWS C5.1
   f. "Recommended Safe Practices for Air Carbon Arc Gouging and Cutting" - AWS C5.3

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tactor coil to cut off welding power if flow rate drops below 0.375 gal./min. Recommended for use when water pressure may fluctuate severely. Use in conjunction with, or instead of, fuse. (See Figure 2.)

— Braided Nylon Sheath to protect service lines: P/N 41V98 (8-ft. long).
— Service Line Extensions: Refer to Fig. 2 for water and argon hose extensions and couplings.
Power Cable, 12-1/2-ft. (4OV78, 300 amps maximum)
Power Cable Coupling (11N19)
Power Cable Insulator Sleeve (10N27)

SET-UP AND INSTALLATION (See Figure 2)

1. Set up the torch and accessories, following Figure 2 and observing all instructions supplied with regulator/flow-meter, fuse and flow switch. (In the simplest installation, the torch gas hose is attached directly to the flow-meter outlet, and the water hose is attached to a water line, utilizing adaptor 11N16, supplied with torch.)
2. Connect the fuse assembly or power cable adaptor to the welding power source, either directly or through a suitable length of welding cable fitted with lugs. Run a hose from the fuse or adaptor to a water drain.
3. Install electrode as follows:
   a. Remove torch cap.
   b. Insert an electrode of corresponding size into the top of the collet. Allow the electrode to protrude 1/8- to 3/16-in. beyond the end of the nozzle or cup for butt welding, and 1/4- to 3/8-in. for fillet welding. Then screw the torch cap onto the torch head and tighten it just enough to hold the electrode firmly. (To readjust electrode, loosen torch cap.)
4. Metal nozzles and ceramic cups: Four sizes of metal nozzles are used with the HW-12 Torch. The No. 12 Nozzle is used for welding thick sections, particularly where wide shielding gas coverage is desired, for example, in joints with large tolerance gaps. By ordering Cup Adaptor (19Z71) five sizes of ceramic or high impact cups may also be used. For the most effective argon protection, select the proper nozzle or cup size according to the recommendations in Table 1. Metal nozzles provide longer service life than ceramic or high impact cups, and should be used wherever possible. Despite their higher initial cost, they will almost always prove more economical over any appreciable service period.

In ACHF service, however, metal nozzles can be damaged by accidental grounding before the arc is established. Where occasional grounding cannot be avoided with reasonable care, ceramic or high impact cups should be used. Ceramic cups should not be used with welding currents over 250 amps, and should be used in d.c. service only where definitely preferred for a specific purpose.

IMPORTANT NOTE: A nozzle insulating sleeve (85Z99) is supplied with the Torch. This sleeve is inserted into the torch body as shown in Figure 1.

![Fig. 1 - Inserting the Nozzle Insulating Sleeve](image)

OPERATING INSTRUCTIONS

1. Make sure that all argon and water connections in the system have been securely tightened, and that the torch cap has been well-tightened.
2. Turn on the water. (See Required Accessories section above for pressure and flow requirements.)
3. With the regulator flow-adjusting valve closed slowly open the shielding gas cylinder or station valve.
4. Set the power supply for the desired welding current.
5. Open all shielding gas valves downstream from flow-meter or flowmeter/regulator, (lever-operated shut-off valve, or solenoid-operated valve in power supply).
6. 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 5 minutes thereafter) to drive out air and moisture. This will help prevent weld contamination.

7. Close control switch at work position or at power supply.
8. 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.)
9. If the test is satisfactory, commence welding.
Fig. 2 - Connection Diagram for the HW-12 Torch

Table 1 - Electrode, Metal Nozzle, and Cup Sizes for Various Welding Currents

<table>
<thead>
<tr>
<th>Electrode Diameter in.</th>
<th>Cup or Metal Nozzle No.</th>
<th>Welding Currents, Amps</th>
<th>ACHF*</th>
<th>DCSP</th>
<th>DCRP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Using pure tungsten electrodes</td>
<td>Using conventional thoriated electrodes†</td>
<td>Using pure or conventional thoriated tungsten electrodes</td>
<td></td>
</tr>
<tr>
<td>.040</td>
<td>6</td>
<td>10-60</td>
<td>15-80</td>
<td></td>
<td>15-80</td>
</tr>
<tr>
<td>1/16</td>
<td>6</td>
<td>50-100</td>
<td>70-150</td>
<td>70-150</td>
<td>10-20</td>
</tr>
<tr>
<td>3/32</td>
<td>6, 8</td>
<td>100-160</td>
<td>140-235</td>
<td>150-250</td>
<td>15-30</td>
</tr>
<tr>
<td>1/8</td>
<td>8</td>
<td>150-210</td>
<td>225-325</td>
<td>250-400</td>
<td>25-40</td>
</tr>
<tr>
<td>5/32</td>
<td>8</td>
<td>200-275</td>
<td>300-400</td>
<td>400-500</td>
<td>40-55</td>
</tr>
<tr>
<td>3/16</td>
<td>8, 10</td>
<td>250-350</td>
<td>400-500</td>
<td>500-750**</td>
<td>55-80</td>
</tr>
<tr>
<td>1/4</td>
<td>10, 12</td>
<td>325-475</td>
<td>500-630**</td>
<td>750-1100**</td>
<td>80-125</td>
</tr>
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</table>

* The maximum current values shown in the table for ACHF have been determined using an unbalanced wave transformer. If a balanced wave transformer is used, either reduce the maximum values in the table by about 30 per cent or use the next larger size electrode. This is necessary because of the higher heat input to the electrode in a balanced wave setup.

NOTE: All current values are metered readings. Most transformers deliver about 15 per cent more current than shown on their scale readings.

** Exceeds the rated capacity of the torch.
† Balled electrode tip ends can best be formed and maintained at these a.c. current levels.
Table 2 - Collets and Collet Bodies

<table>
<thead>
<tr>
<th>Electrode Diam. (in.)</th>
<th>0.040</th>
<th>1/16</th>
<th>3/32</th>
<th>1/8</th>
<th>5/32</th>
<th>3/16</th>
<th>1/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collet</td>
<td>84Z59</td>
<td>84Z60</td>
<td>84Z61</td>
<td>84Z62</td>
<td>85Z16</td>
<td>85Z18</td>
<td>85Z19</td>
</tr>
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</table>

Table 3 - Gas Cups*

<table>
<thead>
<tr>
<th>Cup No.</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic</td>
<td>85Z07</td>
<td>85Z08</td>
<td>85Z09</td>
<td>85Z10</td>
<td>85Z11</td>
</tr>
<tr>
<td>High Impact</td>
<td>14N57</td>
<td>14N58</td>
<td>14N59</td>
<td>14N60</td>
<td>14N61</td>
</tr>
</tbody>
</table>

* Adaptor P/N 19Z71 required, (see Fig. 1).

Table 4 - Metal Nozzles

<table>
<thead>
<tr>
<th>Nozzle No.</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal nozzle</td>
<td>86Z01</td>
<td>86Z02</td>
<td>86Z03</td>
<td>86Z06</td>
</tr>
</tbody>
</table>

OPERATION AND MAINTENANCE HINTS

If this equipment does not operate properly, stop work immediately and investigate the cause of the malfunction. Maintenance work must be performed by an experienced person, and electrical work by a trained electrician. Do not permit untrained persons to inspect, clean, or repair this equipment. Use only recommended replacement parts.

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-deg. F.

3. Do not try to repair a damaged power cable or gas or water hose. Replace it.

4. If the torch water passages become clogged, they can sometimes be cleared by reversing the direction of water flow (that is, sending water in through the power cable, out through the water hose). However, never weld with the flow reversed. A strainer in the water inlet line (such as P/N 96W69) is good insurance against clogging.

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

6. Keep an eye on the sealing “O” ring on the torch cap. If there are signs of wear or distortion, cut it off and install a new ring (85W50). Apply a little silicone grease before attempting to slide the new “O” ring into the cap groove.

7. HW-12 Metal Nozzles are dipped in No. 65 Nozzle Compound prior to packing. The silicone coating prevents the adherence of spatter to the nozzles and ensures the maintenance of a complete and uniform gas shielding pattern. A four ounce can of this compound (P/N 08N65) or a 1 qt. can (P/N 08N75) should be obtained to maintain the protective coating on the nozzles.

8. When disassembly is required:
   a. Unscrew the torch cap. Inspect “O” ring (85W50) for nicks, cracks, excessive distortion and flatness. Replace with a new part if defective. This “O” ring acts as a seal against argon leakage and air entrainment.
   b. Remove the electrode and electrode collet.
   c. Unscrew the nozzle from the water jacket (85Z98).
   d. Hold the water jacket adaptor (84Z92) with a strap wrench to keep it from turning, and unscrew the water jacket (85Z98). Inspect insulator gasket (86W23), backup ring (11N60), and “O” ring (lower 85W55) which are removed with the jacket. Replace if defective.
   e. Insert the drill rod collet body wrench (60Y04), supplied with the torch, through opposing argon drillings in the collet body. Unscrew collet body (11N65 or 11N66) from the torch body. Inspect “O” ring (85W07) without removing it from the torch body (use a beam of light). This “O” ring acts as an important seal between gas and water, but does not normally require replacement.
   f. Unscrew water jacket adaptor (84Z92) from the torch body. Inspect “O” ring (upper 85W55). Replace if defective. THIS STEP IS NOT NECESSARY TO CHANGE OR REPLACE A COLLET BODY.
   g. To reassemble, follow the preceding steps in reverse order. Moisten the upper end of collet body (11N65 or 11N66) before screwing into torch body (this assists passage through “O” ring 85W07). The shoulder on the collet body should fit tightly against the lower end of the torch body to assure good electrical contact. Be certain that the water jacket (85Z98) is sufficiently tightened for a leakproof connection.
Fig. 3 - HW-12 Heavy-Duty Tig Torch with 12-1/2-ft. Cable and Hose - P/N 16X37