INSTRUCTIONS and PARTS DATA
for the
HELIARC
Trade Mark

HW-9
(Series 2)
HAND-WELDING TORCH

Introduction

The HELIARC HW-9 Torch is designed for hand welding thin-gage materials. It can be used for welding with high-frequency stabilized a.c. or straight-polarity d.c. depending on the job requirements. The torch can be used at currents up to 110 amperes continuous duty a.c. or d.c.

I. Setting Up the HW-9 Torch to Weld

A. Equipment Needed

Check to be sure you have the following before setting up the equipment.

1. HELIARC HW-9 Torch, which includes:
   (a) Power cable-and-hose assembly.
   (b) Torch cap.

2. An electrode and collet of proper size for the current you intend to use.

3. A gas cup of proper size for the particular welding application.

4. To control argon flow, one of the following:
   (a) OXWELD R-502 Argon Regulator.
   (b) OXWELD L-23 Argon Flowmeter and a standard oxygen regulator.
   (c) Argon Flow Control Adaptor (Part No. 21X52) and a standard oxygen regulator.

Be sure this information reaches the operator. You can get extra copies through any Linde office.
5. Additional hose assemblies:

(a) A 1/4-in. argon hose assembly (equipped with standard oxygen "B" size hose connections) of suitable length for connecting the torch cable and hose assembly to the regulator or flowmeter outlet. The following standard OX-WELD hose assemblies are available:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>533F42</td>
<td>12-1/2-ft.</td>
</tr>
<tr>
<td>533F43</td>
<td>25-ft.</td>
</tr>
</tbody>
</table>

6. Welding transformer and a high-frequency generator, if welding is to be with a.c.; a welding generator, if welding is to be with d.c.

7. Suitable lengths of 2/0 welding cable.

8. A clamp to ground a length of welding cable to the work.

9. A welder's helmet with the proper shade of glass for the welding current you intend to use.

<table>
<thead>
<tr>
<th>Glass No.</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Up to 30 amps.</td>
</tr>
<tr>
<td>8</td>
<td>30 to 75 amps.</td>
</tr>
<tr>
<td>10</td>
<td>75-110 amps.</td>
</tr>
</tbody>
</table>

B. Hose Connections

1. Connect the R-502 Regulator to the argon cylinder. (See F-8066, "Instructions and Parts List for the OX-WELD R-502 Regulator," for instructions on attaching and adjusting the regulator.) If the Argon Flow Control Adaptor is to be used, installation instructions may be found in Form 8333, "HW-9 Flow Control Adaptor." The adaptor may be quickly and easily installed inside the handle of the torch. Once in place, any argon flow can be obtained by setting the argon pressure gauge to a particular pressure. A chart is supplied that lists gauge settings vs. shielding gas flows. The chart is in the form of a decal and can be attached to the torch handle for ready reference.

2. Connect the regulator outlet to the power cable adaptor inlet with a suitable length of 1/4-in. argon hose.

C. Electrical Setup

1. Power Requirements

(a) For a.c. welding, a single-phase transformer requiring a 230- or 460-volt, alternating current supply is generally used.

(b) For d.c. welding, a motor-generator or rectifier unit powered by a 230- or 460-volt, 3-phase alternating current supply is generally used.

NOTE: Be sure to obtain manufacturer's recommendations on power requirements for your transformer, rectifier or generator.

2. Special Control circuits: Several special control circuits have been developed to automatically control various phases of the welding process. By use of these circuits, you can conserve argon, reduce radio interference when using high-frequency current, and provide greater convenience of operation. For specific details, call or write your nearest LINDE office. A booklet (Form 9067) giving descriptions of the circuits and specifications for the equipment needed will be sent to you without charge upon request.

3. Electrical Connections (see Fig. 1). The torch power cable terminates in a power cable adaptor permitting you to connect the torch to the output terminal of a transformer, motor-generator, rectifier, or a high-frequency generator. When using high-frequency, be sure to ground the work terminal of the high-frequency generator; MAKE NO OTHER GROUND CONNECTION. Connect the case of the high-frequency generator and the case of the transformer, motor-generator, or rectifier to the work terminal of the high-frequency generator. Provision should be made for turning the high-frequency generator on and off as required.

![FIG. 1 - Schematic Diagram for HELIARC Welding](image)

The terms HELIARC, LINDE and OX-WELD are registered trade marks of Union Carbide Corporation.
D. Installing Gas Cups, Electrodes and Electrode Holders (See Figure 2)

CAUTION: BE SURE TO SHUT OFF POWER BEFORE INSTALLING OR ADJUSTING ELECTRODES.

1. From Table I, select the size of electrode for the welding current you intend to use. Then select a collet corresponding in size to the electrode.
2. Remove the collet body from the torch head. Insert the electrode and collet into the collet body. Then screw the collet nut into the torch head to tighten the collet on the electrode.

Ceramic cups can be used to the full capacity of the torch.

3. Screw the cup onto the collet body. The No. 5 ceramic cup is recommended for most work. Where it is necessary to use the HW-9 Torch in very confined spaces, the somewhat smaller No. 4 ceramic cup should be used. The No. 6 cup is preferred for fillet welding or when welding metals requiring wide gas shielding. Cups designed for the HELIARC HW-10 torch may also be used on the HW-9 torch. Adaptor No. 322117 must be obtained if HW-10 cups are to be used.

4. 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.

![Exploded View of HW-9](image)

**TABLE 1**

<table>
<thead>
<tr>
<th>Electrode Size (in.)</th>
<th>WELDING CURRENTS, AMPERES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACHF</td>
</tr>
<tr>
<td>Pure Tungsten</td>
<td>5-15</td>
</tr>
<tr>
<td>Thoriated Tungsten</td>
<td>10-60</td>
</tr>
<tr>
<td>Pure or Thoriated</td>
<td>50-100</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 to 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 current than shown on their scale readings.

E. Final Steps Before Welding

1. Open the argon cylinder valve slowly to prevent a sudden rush of gas into the regulator; then open fully.
2. Open the regulator or flowmeter flow-adjusting valve until the float shows the desired argon flow.
3. Set the welding transformer or generator for the desired welding conditions.
4. Close the foot or hand switch.
5. Draw a test arc on a piece of scrap steel or copper.

For Complete information on HELIARC welding, including argon flows, etc. see F-6190, "How to Weld with HELIARC Torches." This book is packed with each HW-9 Torch.
II. General Notes on Torch Operation

A. Electric Power Requirements

1. For a.c. welding, a single phase transformer is generally used. This will require a 230- or 460-volt a.c. power supply. For exact information on power supply requirements obtain the specifications supplied by the manufacturer of your transformer.

2. For d. c. welding, a motor-generator unit is generally used which requires a 230- or 480-volt, 3 phase a.c. power supply. For exact information on power requirements, obtain the specifications supplied by the manufacturer of your motor generator unit.

3. Many welding generators have poor arc stability characteristics when welding current is less than 25% of maximum generator rating. In such cases, a standard resistor in the ground line between generator and workpiece will give arc stability at currents as low as 10 amp.

   For very low currents (down to 2 amps.), an incandescent bulb resistor is recommended. Mount several bulb sockets on a board, and connect the sockets in parallel. Connect the socket bank in series in the ground welding lead. Current passed will depend on number and size of bulbs in the sockets. Current passed per bulb, given a 90-volt open-circuit, is shown below. For lower open-circuit voltages, current drops in proportion to the voltage reduction.

<table>
<thead>
<tr>
<th>Photoflood Lamps</th>
<th>Std. Lighting Lamps</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2</td>
<td>No. 4</td>
</tr>
<tr>
<td>Av. Current Per Bulb (amps)</td>
<td>3.3</td>
</tr>
</tbody>
</table>

With a ground line resistance, the generator current control is largely ineffective. When easily variable currents are needed (as in cases of uneven joint thickness or poor fit-up) a variable resistance should be placed in the generator exciter circuit to vary the generator voltage. The "Arctrol" welding controller, a foot-pedal control made by Worthington-Mullenbach, Plainfield, New Jersey, will be found very suitable for this purpose.

4. Special reactors are available from transformer manufacturers to provide very low current ranges when alternating current is used.

B. Torch Hose

1. Make certain that all argon hose connections and the gas-cup connections are gas-tight. If they are not, the argon may become diluted by air due to leakage, resulting in incomplete arc protection. The electrode should be silvery in color when it cools. A bluish color denotes air leakage. When welding aluminum, the presence of a dark gray deposit on or beside the weld, or a cloudy weld puddle, also indicates air leakage.

2. Keep hose off hot metal. Plastic hose softens and begins to lose strength when heated to about 125 deg. F.

3. For instructions on hose repair and replacement, see below.

C. Keep the Electrode Clean

When weld spatter sticks to the electrode, a black soot may appear when you weld aluminum; or a reddish deposit may appear when you weld stainless steel. To clean the electrode, simply draw an arc for a few seconds on a piece of scrap steel or copper.

III. Precautionary Information

A. Use a standard welder's helmet with the proper shade of glass for the welding current to be used (see Table in Sec. 1-A).

B. Wear suitable clothing to protect exposed skin from arc burns.

C. Be sure to shut off power before adjusting or replacing electrodes.

D. When welding copper indoors, provide good ventilation or use a respirator.

E. If you use chlorinated solvents for degreasing or cleaning the workpiece, do not weld near degreasing tanks.

F. Shield your welding station to protect neighboring workers from ultra-violet radiation.

   For further details on safety precautions, refer to F-8925, "Precautions and Safe Practices for Electric Welding."

IV. Hose Repair and Replacement

Power Cable-and-Hose Assembly

If the power cable-and-hose assembly becomes damaged, we recommend that you purchase a new assembly or send the damaged cable-and-hose assembly to the nearest LINDE apparatus repair station where it will be repaired for a nominal charge plus the cost of parts, if such repair is advisable. **DO NOT TRY TO REPAIR IT YOURSELF.** The connection fittings at each end of the assembly are crimped to the cable and insulator hose by special crimping tools to obtain a strong and completely gas-tight joint. A satisfactory repair job cannot be made without these tools.
**Parts List**

**FOR**

LIGHT-DUTY AIR-COOLED"HELIARC"

WELDING TORCH HW-9 (Series 2)

16X28 (12-1/2 ft.)

PART NO. 16X44 (25-ft.)

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### A. Replacement Parts

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>85W49</td>
<td>&quot;O&quot; Ring (2 used)</td>
</tr>
<tr>
<td>56Y35</td>
<td>Torch Body</td>
</tr>
<tr>
<td>56Y38</td>
<td>Cable and Hose Assembly (12-1/2 Ft.) (16X28)</td>
</tr>
<tr>
<td>56Y97</td>
<td>Cable and Hose Assembly (25 Ft.) (16X44)</td>
</tr>
<tr>
<td>84Z28</td>
<td>Torch Handle</td>
</tr>
<tr>
<td>84Z31</td>
<td>Torch Cap (short)</td>
</tr>
<tr>
<td>84Z85</td>
<td>Cable Adaptor</td>
</tr>
<tr>
<td>105Z26</td>
<td>Insulator Sleeve</td>
</tr>
<tr>
<td>105Z27</td>
<td>Collet Body</td>
</tr>
</tbody>
</table>

**SUPPLIED**

56Y40  Torch Cap (long)

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### B. Accessories

(These parts must be purchased separately.)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21X62</td>
<td>Argon Flow Control Adaptor</td>
</tr>
<tr>
<td>56Y83</td>
<td>Transparent Torch Cap (long)</td>
</tr>
<tr>
<td>84Z33</td>
<td>1/16-in. Collet</td>
</tr>
<tr>
<td>84Z34</td>
<td>.020-in. Collet</td>
</tr>
<tr>
<td>84Z35</td>
<td>.040-in. Collet</td>
</tr>
<tr>
<td>84Z36</td>
<td>No. 4 Ceramic Cup</td>
</tr>
<tr>
<td>84Z37</td>
<td>No. 5 Ceramic Cup</td>
</tr>
<tr>
<td>84Z86</td>
<td>No. 6 Ceramic Cup</td>
</tr>
<tr>
<td>322117</td>
<td>Adaptor for HW-10 Ceramic Cups</td>
</tr>
</tbody>
</table>
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FACTORs AFFECTING HIGH-FREQUENCY STARTING IN "HELIARC" WELDING

Properly applied, high-frequency starting should give quick, clean, positive starts. However, there are many factors which influence starting performance. Since most of these factors are relatively easy to control, there should be no difficulty in obtaining good starts. The following are some of the items which should be checked.

1. Thoriated tungsten electrodes will usually provide better starting than straight tungsten electrodes.

2. Use the proper size electrode. Grinding a point on the end of the electrode will usually improve the starting performance of an oversize electrode.

3. If the torch uses a metal cup, ground the cup to the torch mounting or to the work through a resistor. The value of this resistor is not critical and a resistor on the order of 10,000 ohms, 25 watts, will be entirely satisfactory. Do not use the small radio-type resistor since they will usually be damaged by the high voltage, high frequency. The use of this grounding method will sometimes double the electrode-to-work distance over which a start can be consistently made, and it usually eliminates failure to start.

4. Where a modern low-power high-frequency unit is used and where the torch is equipped with a shielded cable, remove the shield from the torch cable. If this can not be done easily, removing the ground connection from the shield will usually help.

5. Gas flow is an important factor. Too high or too low a gas flow will make high-frequency starting more difficult.

6. Some high-frequency units including the early model of Linde Part No. 22N36 use a small size bypass condenser. Increasing the size of this condenser to 10 or 20 mfd will usually improve the starting reliability because it permits more of the low frequencies generated by the high-frequency unit to pass through the spark. These low frequencies add considerable energy to the spark and help develop the cathode spot required for starting.

7. Check the spark gaps to make certain that they are clean and properly adjusted.

8. Periodically blow out the high-frequency unit to prevent accumulations of dust which might cause leakage.

9. Keep the length of cable between the high-frequency unit and the torch as short as possible. This cable should be suspended from insulated hangers and not run over the floor or over or near metal surfaces. Avoid loops in this cable. Also, keep this cable away from other cables to avoid high-frequency pick up by the other cables.

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