INSTRUCTIONS and PARTS LIST
for
HELIARC
Trade-Mark

HW-9
HAND-WELDING TORCH

CONTENTS

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>2</td>
</tr>
<tr>
<td>I. SETTING UP THE HW-9 TORCH TO WELD</td>
<td></td>
</tr>
<tr>
<td>A. Equipment Needed</td>
<td>2</td>
</tr>
<tr>
<td>B. Hose Connections</td>
<td>2</td>
</tr>
<tr>
<td>C. Electrical Connections</td>
<td>2</td>
</tr>
<tr>
<td>D. Installing Gas Cups,</td>
<td></td>
</tr>
<tr>
<td>Electrodes and Electrode Holders</td>
<td>4</td>
</tr>
<tr>
<td>E. Final Steps Before Welding</td>
<td>5</td>
</tr>
<tr>
<td>II. GENERAL NOTES ON TORCH OPERATION</td>
<td>5</td>
</tr>
<tr>
<td>A. Electric Power Requirements</td>
<td></td>
</tr>
<tr>
<td>B. Torch Hose</td>
<td>5</td>
</tr>
<tr>
<td>C. Keep the Electrode Clean</td>
<td>6</td>
</tr>
<tr>
<td>III. SAFETY PRECAUTIONS</td>
<td>6</td>
</tr>
<tr>
<td>IV. HOSE REPAIR AND REPLACEMENT</td>
<td>6</td>
</tr>
<tr>
<td>REPLACEMENT PARTS LIST</td>
<td>7</td>
</tr>
</tbody>
</table>

ALL PREVIOUS EDITIONS SHOULD BE DESTROYED

Be Sure this Booklet Reaches the Operator. You Can Get Extra Copies Through Any LINDE Office.

Linde Instruction Literature

A. F.
SEP 3 0 1952
INTRODUCTION

The HELIARC HW-9 Torch is designed for hand welding thin-gauge materials. It can be used for welding with high-frequency stabilized a.c. or straight-polarity d.c. depending on the job requirements. It can be used at currents up to 75 amperes (a.c. or d.c.s.p.) for continuous duty.

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 welding current you intend to use.

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. 21X62) and a standard oxygen regulator.

5. An OXWELD V-26 Shutoff Valve. (Optional)

6. 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. (Use of the V-26 Shutoff Valve between the cable fitting and the argon hose is optional.) The following standard OXWELD hose assemblies are available:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>10Y72</td>
<td>12-1/2-ft.</td>
</tr>
<tr>
<td>10Y68</td>
<td>25-ft.</td>
</tr>
</tbody>
</table>

7. 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.

8. Suitable lengths of 2/0 welding cable.

9. A clamp to ground the welding cable to the work.

10. 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>
</tbody>
</table>

B. Hose Connections

1. Connect the R-502 Regulator to the argon cylinder. (See F-6968, "Instructions and Parts List for the OXWELDR-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 9333 "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.

3. The use of a V-26 Shutoff Valve between the regulator and the power cable assembly is optional. Two argon hose assemblies are necessary to make the connection in this case.

C. Electrical Connections

Before making any connections, refer to the schematic wiring diagrams in Figures 1 and 2 for a.c. and d.c. welding setups. Note that a foot switch is connected in an external circuit to interrupt welding current. Its use is recommended because it provides a convenient method of control. It also enables you to protect the weld puddle at the end of a seam with an atmosphere of argon and thus control crater cracking -- especially with high-temperature alloys. If you have an a.c. setup, radio interference caused by high-frequency current will be greatly reduced, since no high-frequency current will flow when the welding current is shut off. If no foot switch is used, the arc must be broken by lifting the torch from the work.

A number of special electrical circuits have been designed and developed to control the various phases of the welding process automatically. By their use, you can conserve argon, provide greater convenience of operation, minimize radio interference, and give added protection to the equipment and operator. For specific details, write or call

(Continued on Page 4.)

The terms "Heliarc," "Linde," and "Oxweld" are registered trade-marks of Union Carbide and Carbon Corporation.
FIG. 1 - SCHEMATIC DIAGRAM FOR "HELIARC" A.C. WELDING

FIG. 2 - SCHEMATIC DIAGRAM FOR "HELIARC" D.C. WELDING

NOTE 1: HEAVY LINES INDICATE CHANGES TO BE MADE IN GENERATOR CIRCUIT
NOTE 2: × INDICATES "BREAK CONNECTION HERE"
your nearest LINDE office. A booklet which gives descriptions and electrical diagrams of these control circuits (F-9067) can be obtained free of charge.

1. Connections for A.C. Welding

(a) Connect the torch power cable to the torch terminal of the high-frequency generator with a suitable length of 2/0 welding cable.

(b) Connect the work to the "work" terminal of the high-frequency generator with a suitable length of 2/0 welding cable. Secure the cable with a clamp to a clean surface of the work so that you have a good contact.

(c) Connect the high-frequency generator to the terminals of the transformer secondary with suitable lengths of 2/0 cable.

(d) Connect the transformer primary to one set of terminals of the main contactor. Then connect the other terminals of the main contactor to the 220- or 440-volt main power supply. Be sure to select a conductor which will carry the maximum current you will use.

(e) Connect the high-frequency generator to the lines leading from the main contactor to the transformer primary. Make this connection so that power to the high-frequency generator is shut off when the main contactor is open.

(f) Connect one terminal of the main contactor coil to one terminal of the foot switch. Connect the remaining terminals of the contactor coil and the foot switch to opposite sides of the control circuit a.c. supply. (24 volts a.c. maximum.)

(g) Make a ground connection from 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 to the "work" terminal of the high-frequency generator.

2. Connections for D.C. Welding

(a) For straight-polarity d.c. welding, connect the torch power cable to the generator terminal marked "electrode" or "negative." Connect the workpiece to the generator terminal marked "work" or "positive." Use suitable lengths of 2/0 welding cable to make these connections. If the generator has a polarity switch, be sure that it is set in the straight-polarity position.

(b) Connect the 2/0 welding cable leading to the work to a ground clamp. Secure the clamp to clean, bright metal of the workpiece so that good contact is established.

(c) Make separate ground connections to the work and to the generator case.

(d) If your generator is separately excited type such as that shown in Figure 2, welding current can be shut off remotely without lifting the torch from the work. This is done by means of a foot or hand switch which actuates a field relay. The field relay is paralleled with a 0.25 MFD, 600-volt discharge condenser. For all other types of generators, obtain the manufacturer's recommendations on installing a remote current shutoff.

Connect one terminal of the foot switch to the relay. Connect the remaining terminals of the switch and of the relay to opposite sides of the separate control circuit a.c. supply. (24 volts a.c. maximum.)

(e) Connect the motor side of the generator to the 3-phase, 220- or 440-volt a.c. main power supply.

D. Installing Gas Cups, Electrodes and Electrode Holders (SEE FIGURE 3)

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

1. From Table I on page 5, 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 nut from the torch head. Insert the electrode and collet into the collet nut. 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.

KEEP TORCH HOSE OFF HOT METAL
3. Screw the cup onto the collet nut. 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.

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 loosening the collet nut about one-quarter turn, adjusting the electrode, and tightening the collet nut again with the fingers.

**TABLE I**

| Electrode Diameter (inches) | Welding Current Amperes
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACHF</td>
</tr>
<tr>
<td>.020</td>
<td>2-15</td>
</tr>
<tr>
<td>.040</td>
<td>20-60</td>
</tr>
<tr>
<td>1/16</td>
<td>40-75</td>
</tr>
</tbody>
</table>

**NOTE 1:** Current values in this table are metered readings and do not correspond to transformer or generator settings unless the transformer or generator has been specifically calibrated for HELIARC welding.

**NOTE 2:** Because of the electrical characteristics of HELIARC welding, transformers not specifically designed for HELIARC welding should not be operated at more than 70% of their rated capacity. The manufacturer's recommendations should be obtained regarding the use of such transformers for HELIARC welding.

**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. (If a V-26 or other valve is used in the argon line, be sure that it is open. Otherwise you will get no reading on the flowmeter.)

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 220- or 440-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 220- or 440-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>Av. Current Per</td>
<td>No. 2</td>
</tr>
<tr>
<td>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 Mullenbach Elec. Mfg. Co.,

**ALWAYS SHUT OFF THE CURRENT BEFORE YOU ADJUST OR REPLACE ELECTRODES**
Los Angeles, Cal., 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. SAFETY PRECAUTIONS

A. IF YOU USE A CHLORINATED SOLVENT — SUCH AS CARBON TETRACHLORIDE, TETRACHLOROETHYLENE, OR TRICHLOROETHYLENE — TO REMOVE GREASE OR OIL FROM THE WORK, BE SURE THAT THE WORK HAS DRIED THOROUGHLY BEFORE YOU BEGIN TO WELD. ALSO, DO NOT WELD NEAR DEGREASING TANKS CONTAINING THESE SOLVENTS. FUMES FROM A CHLORINATED SOLVENT MAY REACH THE WELDING ARC AND BREAK DOWN CHEMICALLY TO FORM A TOXIC GAS.

THIS CONDITION MAY EXIST WITH ANY WELDING PROCESS.

B. USE A STANDARD ARC WELDING HELMET WITH THE PROPER SHADE OF GLASS FOR THE WELDING CURRENT YOU INTEND TO USE. SEE TABLE ON PAGE 2.

C. WEAR SUITABLE CLOTHING TO PROTECT EXPOSED SKIN FROM ARC BURNING.

D. BE SURE TO SHUT OFF POWER BEFORE YOU ADJUST OR REPLACE ELECTRODES.

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.

KEEP ELECTRODES CLEAN AND FREE OF SPLATTER
Replacement Parts List

FOR
LIGHT-DUTY AIR-COOLED "HELIARC"
WELDING TORCH HW-9
PART NO. 16X28

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>85W49</td>
<td>&quot;O&quot; Ring (3 used)</td>
<td>85W49</td>
<td>&quot;O&quot; Ring</td>
</tr>
<tr>
<td>56Y35</td>
<td>Torch Body</td>
<td>56Y40</td>
<td>Torch Cap (long)</td>
</tr>
<tr>
<td>56Y38</td>
<td>Cable and Hose Assembly (12 ft.)</td>
<td>85W49</td>
<td>&quot;O&quot; Ring</td>
</tr>
<tr>
<td>84Z28</td>
<td>Torch Handle</td>
<td></td>
<td>SUPPLIED AS ORDERED (These parts must be purchased separately.)</td>
</tr>
<tr>
<td>84Z29</td>
<td>Collet Nut</td>
<td>21X62</td>
<td>Argon Flow Control Adaptor</td>
</tr>
<tr>
<td>84Z30</td>
<td>Insulator Sleeve</td>
<td>86Y42</td>
<td>Cable and Hose Assembly (24 ft.)</td>
</tr>
<tr>
<td>84Z31</td>
<td>Torch Cap (short)</td>
<td>84Z33</td>
<td>1/16-in. Collet</td>
</tr>
<tr>
<td>84Z85</td>
<td>Cable Adaptor</td>
<td>84Z34</td>
<td>.020-in. Collet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>84Z35</td>
<td>.040-in. Collet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>84Z36</td>
<td>No. 4 Ceramic Cup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>84Z37</td>
<td>No. 5 Ceramic Cup</td>
</tr>
</tbody>
</table>

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A DIVISION OF UNION CARBIDE AND CARBON CORPORATION

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