HW-12
(Series 3)
Hand-Welding Torch

Instructions and Parts Data for the

HELIARC TRADE MARK

HW-12 (Series 3)
Hand-Welding Torch

Be sure this information reaches the operator. You can get extra copies through any Linde office.

Linde Instruction Literature
Introduction

The HELIARC HW-12 Torch

... is a heavy-duty, water-cooled hand-welding torch for use with straight-polarity direct current (DCSP), reverse-polarity direct current (DCRP), or high-frequency stabilized alternating current (ACHF).

... is primarily designed for heavy-duty welding of material requiring welding currents of 300 to 500 amperes. Lighter materials may also be welded using reduced currents, proper size collets and collet body assemblies, and smaller electrodes.

... has a rated current capacity of 500 amp. in continuous service. Higher currents may be used at reduced duty cycles.

... uses either metal nozzles for longer service life, or ceramic cups.

Design Features

... Efficient water-cooling system cools outer surface of collet body directly with flowing water. Metal nozzles are cooled by heat transfer to the torch body across a tapered seat and threaded connection.

... Enclosure of water flow passages within torch prevents flow constriction or leakage through accidental damage. Elimination of bulky external cooling tubes to nozzle improves operator's visibility, torch maneuverability, and access to confined spaces.

... Torch parts are readily disassembled for cleaning of water-cooling components. Straight internal flow passages are easily cleared with a cleaning rod.

... Quick-release collets require only a quarter turn of the torch cap to release the electrode for adjustment or replacement. No wrench is required, and adjustment of the electrode through the torch cap rather than through a hot gas cup prevents burning of the operator's fingers.

... Electrode stub loss is minimized by decreasing the distance between the end of the metal nozzle and the bottom of the electrode to the shortest length for which satisfactory water-cooling can be provided.

... Molded Fiberite torch body insulation has excellent heat resistance. The torch does not require additional asbestos shielding to protect it against reflected heat.

... Uniform shielding gas distribution pattern requires less argon for good shielding. In many cases, a smaller nozzle can be substituted for the nozzle ordinarily required at a given current, permitting better access to confined spaces.

... Small post-weld electrode cooling time is required, due to efficient water-cooling and minimized exposed electrode length. This reduces the argon volume required to prevent contamination of the electrode while cooling, and is especially important where the operation consists primarily of short welds.

... Either 3-in. or 7-in. electrodes may be used by mounting short or long interchangeable torch caps.
I. Setting Up the HW-12 Torch

The HELIARC HW-12 Torch is furnished with:

1. 12-1/2-ft. Power Cable
2. 12-1/2-ft. Argon and Water Hose
3. 1/8- and 1/4-In. Collet Bodies
4. A Collet Body Wrench
5. Power Cable Adaptor Assembly which connects to a standard 4/0 welding cable lug.
6. Nozzle Insulator Sleeve

A. Required Torch Accessories

The following accessories are required to place the torch in operation:

1. Either a metal nozzle or ceramic cup (see recommendations in Sec. II, Paragraph C). A Cup Adaptor (Part No. 19Z71) is required when standard ceramic cups are used.
2. Electrodes and Collets of corresponding size should be selected from the recommendations shown in Table I. For a complete listing of part numbers refer to the Replacement Parts section of this booklet.

B. Power, Argon, and Water Supply Equipment

Refer to F-8847, "How to Plan a HELIARC Manual Welding Installation" for detailed information. Figure 1 illustrates a typical installation.

C. Additional Equipment

(Not Supplied by Linde)

In addition to the items mentioned above, the customer must also have a supply of argon, welding transformer or generator, welding cable, cable lugs, and ground clamp.

D. Optional Accessories

The following optional accessories are offered for use with the HW-12 Torch:

1. Flow Switch, Torch Saver II (Part No. 40V51) to protect the torch and cables from overheating, where water supply pressure may fluctuate. (See Figure 1.)
2. An OXWELD V-30 Double Shutoff Valve (Part No. 16X21) automatically shuts off the argon and water when the torch is hung on the valve arm. (See Figure 1.)
3. A 1/4-In. Argon Hose Assembly either 12-1/2 ft. long (Part No. 533F42) or 25 ft. long (Part No. 533F43), for connecting the regulator to the V-30 valve. (See Figure 1.)
4. Two 1/4-In. Water Hose Assemblies, either 12-1/2 ft. long (Part No. 543F02) or 25 ft. long (Part No. 543F03), for connecting the V-30 valve to the water supply line and for connecting the water outlet of the power cable adaptor (or water outlet of flow switch, if used) to the drain. Lengths of 1/4-In. pipe may be used instead of hose, if desired.
5. For extension of the 12-1/2-ft. hose supplied with the HW-12, additional hose assemblies (like those listed in Paragraphs 3 and 4 above) will be required, as well as an Argon Hose Coupling (Part No. 6978) and a Water Hose Coupling (Part No. 11Z15).
6. A transparent Torch Cap (Part No. 56Y84). This cap, used with 7-in. electrodes, enables the welder to judge the length of the remaining electrode without removing the torch cap.
7. Short Torch Cap (Part No. 56Y45). This cap is required when the torch is used with 3-in. electrodes, especially where access to confined spaces is required.
FIG. 1 - Schematic Diagram of Water and Argon Connections for HELIARC HW-12 Torch
II. Installation

A. Hose Connections

Fig. 1 indicates the correct method of assembling the accessories used to supply argon and cooling water to the HW-12 Torch. Detailed instructions covering the mounting and use of each individual accessory are packed with the equipment.

B. 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 and water, 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, Control Circuits for HелиARC Welding) giving descriptions of the circuits and specifications for the equipment needed is available upon request.

3. Electrical Connections (see Fig. 2). 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.

C. Nozzles, Cups, Collet Bodies, and Collets

1. 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 cups may also be used. For the most effective argon protection, select the proper nozzle or cup size according to the recommendations in Table I. Metal nozzles provide longer service life than ceramic cups, and should be used wherever possible in preference to the ceramics. 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 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 3.

FIG. 2 - Schematic Diagram for HелиARC Welding

FIG. 3 - Inserting the Nozzle Insulating Sleeve
TABLE I
Electrode, Metal Nozzle, and Ceramic Cup Sizes for Various Welding Currents

<table>
<thead>
<tr>
<th>Electrode Size (in.)</th>
<th>Metal Nozzle No.</th>
<th>Ceramic Cup No.</th>
<th>ACHF* Pure Tungsten</th>
<th>ACHF* Thoriated Tungsten</th>
<th>DCSP** Pure or Thoriated Tungsten</th>
<th>DCSP** Thoriated Tungsten</th>
<th>DCRP Pure or Thoriated Tungsten</th>
<th>DCRP Thoriated Tungsten</th>
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<tbody>
<tr>
<td>0.040</td>
<td>6</td>
<td>4</td>
<td>10-60</td>
<td>15-80</td>
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<tr>
<td>1/16</td>
<td>6</td>
<td>4-5</td>
<td>50-100</td>
<td>70-150</td>
<td>100-200</td>
<td>10-20</td>
<td>15-20</td>
<td>10-20</td>
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<tr>
<td>3/32</td>
<td>6-8</td>
<td>4-7</td>
<td>100-150</td>
<td>140-235</td>
<td>150-250</td>
<td>15-30</td>
<td>10-30</td>
<td>15-30</td>
</tr>
<tr>
<td>1/8</td>
<td>8</td>
<td>6-7-8</td>
<td>150-210</td>
<td>225-325</td>
<td>250-400</td>
<td>15-40</td>
<td>10-50</td>
<td>10-50</td>
</tr>
<tr>
<td>5/32</td>
<td>8</td>
<td>-</td>
<td>200-275</td>
<td>300-425</td>
<td>400-500</td>
<td>15-60</td>
<td>10-60</td>
<td>15-60</td>
</tr>
<tr>
<td>3/16</td>
<td>8-10-12</td>
<td>-</td>
<td>250-350</td>
<td>400-525***</td>
<td>500-800***</td>
<td>15-70</td>
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</tr>
<tr>
<td>1/4</td>
<td>10-12</td>
<td>-</td>
<td>325-475</td>
<td>500-700***</td>
<td>****</td>
<td>15-80</td>
<td>10-80</td>
<td>15-80</td>
</tr>
</tbody>
</table>

*Cup Adaptor (119Z71) is required when ceramic cups are used.

**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.

***The HW-12 Torch has a maximum rated current capacity of 500 amperes in continuous service for 1 hour. Higher currents may be used at reduced duty cycles.

****Exceeds capacity of standard HELIARC torches.

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.

2. Electrodes: Table I indicates the correct electrodes for various welding ranges. Note that thoriated electrodes are required to obtain rated capacity with ACHF currents. The HW-12 can be used for applications above the 500 amp. range only at reduced duty cycles.

3. Collet Bodies: A collet body for 1/8-in. to 1/4-in. collets is supplied assembled in the torch. An accessory collet body for .040-in. to 1/8-in. collets is also supplied with the torch. To change or replace a collet body, see appropriate steps in Section IV.

4. Electrode Collets: Collets are available for seven standard electrode sizes (.040-in. to 1/4-in. diameter). To install a collet and an electrode, proceed as follows:
   (a) Remove the torch cap from the torch.
   (b) Insert a collet for the electrode size you intend to use into the top of the torch head.
   (c) 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.

D. Safety Precautions
1. Use a standard welder’s helmet with the proper shade of glass for the welding current to be used.
2. Wear suitable clothing to protect exposed skin from arc burns.
3. Be sure to shut off power before adjusting or replacing electrodes.
4. When welding copper indoors, provide good ventilation or use a respirator.
5. If you use chlorinated solvents for degreasing or cleaning the workpiece, do not weld near degreasing tanks.
6. 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.”

E. Final Steps Before Welding
1. If you are using an R-502 Regulator:
   (a) With the regulator flow-adjusting valve closed, slowly open the argon cylinder valve (to prevent a sudden rush of gas into the regulator); then fully open the argon cylinder valve.
   (b) Open the regulator flow-adjusting valve until the desired flow is obtained.

2. If you are using an R-64 Regulator and an L-23 Flowmeter:
   (a) Back off on the regulator pressure-adjusting screw.
   (b) Slowly open the argon cylinder valve: then open it fully.
   (c) Adjust the regulator to a 20-lb. delivery pressure.
   (d) Open the flowmeter valve to the desired flow.

3. Turn on the cooling water supply. Check to see that the water flows at recommended pressure, volume and temperature (see Sec. III-A).
4. Set the welding transformer or generator for the desired welding current.
5. Close the foot or hand switch, if one is used.
6. Draw a test arc on a heavy piece of scrap steel or copper.
III. General Notes on Torch Operation

A. Torch Cooling System
1. Use Clean Cooling Water
   (a) The cooling water which circulates through the torch body and power cable must be clean and free from dirt and other solid material. Otherwise the torch passages may become clogged, thereby cutting off or greatly reducing the flow of cooling water.
   (b) If torch water passages become clogged, first remove lower torch-end parts and collet body so that foreign particles may emerge freely. Then flush torch with water, or clean flow passages by inserting a 3/32-in. diameter wire through the hose connection fittings.
   (c) If you cannot avoid using dirty water, and a torch saver flow switch, Part No. 40V51, is not used, install a suitable strainer at the cooling water inlet to prevent clogging. A strainer is available from Linde under Part No. 96W69 or from Hays Manufacturing Co., Cat. No. 2400.

2. Cooling Water Volume, Inlet Pressure and Temperature Requirements
   (a) For adequate cooling of the torch body, nozzle, and torch power cable, a minimum of one quart of cooling water should pass through the cooling system in 35 seconds. (For purposes of calculating water consumption, this volume of cooling water amounts to about 25-1/2 gallons per hour.)
   (b) The inlet temperature of the cooling water must not be higher than 60 deg. F.
   (c) An inlet water pressure of about 25 psi will generally be sufficient to pass the necessary volume of cooling water.
   (d) If inlet water pressure is above 50 psi, a water regulator should be installed to prevent possible damage to the hose.
   (e) If less than one quart of cooling water passes through the cooling system in 35 seconds, or if the cooling water inlet temperature is more than 60 deg. F., do not operate the torch at its full capacity. All restrictions which reduce the flow must be removed and the water inlet temperature must be lowered to 60 degrees to utilize the full torch current rating.

3. Torch Saver II, Part No. 40V51. This accessory should be used to protect the torch from overheating in case of water supply fluctuation or failure. When water flow falls below a safe limit, the switch shuts off the welding current until the required flow is restored. Instructions for installation and operation (Form 9743) are packed with each assembly. Additional copies are available without charge from your nearest LINDE office.

B. Torch Hose
1. Make certain that all argon hose connections and the nozzle or 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, a dark gray deposit on or beside the weld, or a cloudy weld puddle, indicates air leakage.

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

C. Do Not Let the Nozzle Touch the Work
   If a nozzle touches the work, the arc may jump the gap from the electrode to the nozzle rather than to the work because of the conductivity of the hot gases. To avoid this "arc flash-over," which can ruin a metal nozzle, do not allow the nozzle to touch the work or any grounded metal surface.

D. Nozzle Compound
   HW-12 Metal Nozzles are dipped in LINDE 85 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 (Part No. 08N65) or a 1 qt. can (Part No. 08N75) should be obtained to maintain the protective coating on the nozzles.

E. Keep the Electrode Clean
1. If weld spatter sticks to the electrode, a black soot may appear when welding 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 heavy piece of scrap steel or copper (do not use a carbon block).

2. Should contamination of the electrode occur due to contact with the weld puddle, shut off the power and remove the electrode from the torch. Break off a small piece from the end, and then replace the electrode. Always remove the electrode before breaking it off, to minimize waste of electrodes. It is advisable to nick the electrode slightly with a grinding wheel at the point where the break is to be made. Then remove the contaminated end with pliers gripped close to the nick.
IV. Disassembly
(See HW-12 Assembly Drawing, Fig. 4)

1. 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.

2. Remove the electrode and electrode collet.

3. Unscrew the nozzle from the water jacket (85Z98).

4. Hold the water jacket adaptor (84Z92) with a strap wrench to keep it from turning, and unscrew the water jacket (85Z98). Inspect insulator gasket (86Z23), backup ring (11N60), and "O" ring (lower 85W55) which are removed with the jacket. Replace if defective.

5. 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.

6. 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.

7. 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 leak-proof connection.
V. Replacement Parts Data

FOR
"HELIARC" HW-12 HAND-WELDING TORCH
PART NO. 16X37

A. Replacement Parts

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>11N60</td>
<td>Back-Up Ring</td>
</tr>
<tr>
<td>85W07</td>
<td>Collet Body Gasket (one spare supplied)</td>
</tr>
<tr>
<td>85W55</td>
<td>&quot;O&quot; Ring (used) (two spare rings supplied)</td>
</tr>
<tr>
<td>54Y65</td>
<td>Power Cable and Hose Assembly</td>
</tr>
<tr>
<td>54Y94</td>
<td>Argon Inlet Hose Assembly (12-1/2 ft.)</td>
</tr>
<tr>
<td>54Y95</td>
<td>Water Inlet Hose Assembly (12-1/2 ft.)</td>
</tr>
<tr>
<td>*56Y44</td>
<td>Torch Cap (long)</td>
</tr>
<tr>
<td>56Y65</td>
<td>Torch Body Assembly</td>
</tr>
<tr>
<td></td>
<td>*Includes:</td>
</tr>
<tr>
<td>79Z40</td>
<td>Inlet Connection (2 used)</td>
</tr>
<tr>
<td>79Z63</td>
<td>Water Outlet Connection</td>
</tr>
<tr>
<td>57Y09</td>
<td>Sheathing (Zippered)</td>
</tr>
<tr>
<td>60Y04</td>
<td>Collet Body Wrench</td>
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<tr>
<td>84Z67</td>
<td>Power Cable Adaptor Assembly</td>
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<td>84Z82</td>
<td>Water Jacket Adaptor</td>
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<table>
<thead>
<tr>
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<td>85Z13</td>
<td>Handle</td>
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<tr>
<td>85Z98</td>
<td>Water Jacket</td>
</tr>
<tr>
<td>85Z99</td>
<td>Nozzle Insulator Sleeve (2 supplied)</td>
</tr>
<tr>
<td>88Z23</td>
<td>Insulator Gasket (one spare supplied)</td>
</tr>
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</table>

* Includes "O" Ring (5/8-in. I.D.), Part No. 85W50.

B. Accessories

(Not Supplied in HW-12 Torch package, Part No. 16X37)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>6978</td>
<td>Argon Hose Coupling</td>
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<tr>
<td>40V31</td>
<td>Torch Saver II, Flow Switch</td>
</tr>
<tr>
<td>533F42</td>
<td>Argon Inlet Hose Extension Assembly (12-1/2 ft.)</td>
</tr>
<tr>
<td>543F02</td>
<td>Water Inlet and Outlet Hose Extension Assembly (12-1/2 ft.)</td>
</tr>
<tr>
<td>*56Y45</td>
<td>Torch Cap (short)</td>
</tr>
<tr>
<td>*56Y94</td>
<td>Transparent Torch Cap (long)</td>
</tr>
<tr>
<td>11Z15</td>
<td>Water Hose Coupling</td>
</tr>
<tr>
<td>18Z71</td>
<td>Cup Adaptor (for Ceramic Cups)</td>
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### NOZZLES, CUPS, AND COLLETS

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<thead>
<tr>
<th>Metal Nozzles</th>
<th>Ceramic Cups</th>
<th>Torch Collets</th>
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<tbody>
<tr>
<td>86Z01</td>
<td>85Z07</td>
<td>84Z59 (0.040-in.)</td>
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<tr>
<td>86Z02</td>
<td>85Z08</td>
<td>84Z60 (1/16-in.)</td>
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<td>86Z03</td>
<td>85Z09</td>
<td>84Z61 (3/32-in.)</td>
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<td>86Z06</td>
<td>85Z10</td>
<td>84Z62 (1/8-in.)</td>
</tr>
<tr>
<td></td>
<td>85Z11</td>
<td>85Z16 (1/8-in.)</td>
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<tr>
<td></td>
<td></td>
<td>85Z17 (5/32-in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85Z18 (3/16-in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85Z19 (1/4-in.)</td>
</tr>
</tbody>
</table>

**Collet Body**
11N66
11N65

### C. 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 your nearest LINDE repair station for possible repair. **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 at the factory to obtain a strong and completely water-tight joint. A satisfactory repair job cannot be done without these tools.

#### ARGON AND WATER HOSE ASSEMBLIES

If the argon or water hose assemblies become damaged, we recommend that you purchase a new hose assembly or send the damaged hose assembly to the nearest LINDE repair station for possible repair. **DO NOT ATTEMPT PERMANENT REPAIRS YOURSELF.** As with the power cable-and-hose assembly, the connection fittings are crimped on at the factory by special crimping tools to assure a leakproof connection. A completely satisfactory job cannot be done without these tools. Improper repair of an argon hose connection, for example, could cause argon dilution, resulting in incomplete arc protection and consequent unsatisfactory welds.

### VI. Series Changes

This booklet covers the HW-12 (Series 3) torch. It may also be used with the earlier models listed below if the changes which have been made are taken into consideration. The Series 3 torch contains a plastic back-up ring 11N60 which eliminates any possibility of water leakage due to warping of the insulator gasket. Modified collet bodies 11N65 and 11N66 are used with the back-up ring.

Series 2 torches are similar to Series 3 torches except that the Series 2 torch does not contain a back-up ring 11N60 and uses collet bodies 85Z14 and 85Z15.

Series 1 torches are similar to Series 2 torches except that the Series 1 torch uses nozzles 84Z96, 84Z97, and 84Z98 and water jacket 56Y62. The Series 1 torch does not contain an insulating sleeve 85Z99.
LINDE Supplies These Quality Products to the Nation's Industries

INDUSTRIAL GASES
LINDE Oxygen, Nitrogen, Argon, Neon, Helium, Krypton, Xenon, Hydrogen, and mixtures
PREST-O-LITE Acetylene

CALCIUM CARBIDE
UNION CARBIDE Calcium Carbide
CARBIC Processed Carbide

OXY-ACETYLENE EQUIPMENT
OXWELD Apparatus for Cutting, Joining, Treating, and Forming Metals
Acetylene Generators
Manifolds, Regulators and Valves
Welding Rods and Supplies
PUROX Welding and Cutting Apparatus
PREST-O-LITE Welding and Cutting Apparatus
PREST-O-LITE Air-Acetylene Apparatus and Small Tanks
CARBIC Acetylene Generators

ELECTRIC WELDING AND CUTTING EQUIPMENT
HELIARC Welding and Cutting Equipment
SIGMA Welding Equipment
UNIONARC Welding Apparatus and Supplies
UNIONMELT Automatic Welding Apparatus and Supplies

SPECIAL EQUIPMENT
LINDE Jet-Piercing Equipment
Plate-Edge Preparation Equipment
Steel-Conditioning Machines
Sub-Zero Cold Treatment Equipment
Liquid Oxygen Converters
Liquid Nitrogen Refrigerators
Liquefied Gas Containers
Storage and Transfer Equipment
For Cryogenic Fluids
OXWELD Oxy-Acetylene Cutting Machines
Pressure-Welding Machines
PREST-O-LITE Cylinders, Shells, and Shapes

OXYGEN THERAPY SUPPLIES
LINDE Oxygen U.S.P.
Oxygen Regulators
OXWELD Oxygen Manifolds and Valves

SPECIAL PRODUCTS
LINDE Synthetic Sapphire, Ruby, Spinel, and Titania
Fine Alumina Abrasive
Molecular Sieves


LINDE COMPANY
DIVISION OF UNION CARBIDE CORPORATION

General Office: 30 East 42nd Street, New York 17, N. Y.
Sales Offices in Principal Cities—See Adjoining Column

LINDE OFFICES

General Office
30 East 42nd Street, New York 17, N. Y.

Eastern States
Baltimore 4, MD., 200 East Joppa Road
Boston (Needham Hts.) 94, Mass., 300 First Avenue
Buffalo 2, N. Y., 250 Delaware Ave.
Charleston 4, W. Va., P. O. Box 4078, Kanawha City Station
New York, 2065 Route 22, Union, N. J.
Philadelphia, Pleasant Valley Rd. & Route 38, Moorestown, N. J.
Pittsburgh 22, Pa., 644 The Oliver Building
Washington, D. C., 777 14th Street, N.W.

Central States
Chicago 1, Ill., 230 North Michigan Avenue
Cincinnati 25, Ohio, 709 Melish Avenue
Cleveland 14, Ohio, 1300 Lakeside Avenue
Detroit 21, Mich., 10421 West Seven Mile Road
Indianapolis 4, Ind., 729 North Pennsylvania Street
Milwaukee 46, Wis., 1623 South 38th Street *
Minneapolis 2, Minn., 827 Second Avenue, South
St. Louis, 111 So. Meramec Ave., Clayton 5, Mo.

Southern States
Atlanta 8, Ga., 22 Seventh St., N. E.
Birmingham 5, Ala., 2900 Mobile Road
Jacksonville 3, Fla., 2410 Dennis Street
Memphis 5, Tenn., 48 West McLemore Avenue
New Orleans 19, La., 4833 Conti Street

Southwestern States
Dallas 26, Texas, 2626 Commerce Street
Denver 23, Co., 666 So. Santa Fe Drive
Houston 27, Tex., 3639 W. Alabama
Kansas City 5, Mo., 910 Baltimore Avenue
Tulsa 24, Okla., 2901 So. Harvard Avenue

Western States
Los Angeles (Vernon) 58, Calif., 2770 Leonis Blvd.
Portland 9, Ore., 1205 Northwest Marshall Street
Salt Lake City 1, Utah, 436 W. Ninth South Street
San Diego 10, Calif., 1004 Morena Blvd.
San Francisco 6, Calif., 22 Battery Street
Seattle 4, Wash., 3404 Fourth Avenue, South

In Canada
LINDE COMPANY
Division of Union Carbide Canada Limited
General Office: 40 St. Clair Ave., E., Toronto 7, Canada
Edmonton, Alta., Highway 16 and Government Road
Toronto 4, Ontario, 805 Davenport Road
Montreal 9, Quebec, 8311 Royden Road
Vancouver 8, B. C., 1173 Grant Street
St. Boniface, Manitoba, 733 Tache Avenue

Outside United States and Canada
Linde Department
Union Carbide International Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y., U. S. A.
Cable Address: UNICARBIDE, New York
Geneva, Switzerland, Union Carbide Europa, S. A., 40, Rue du Rhône
Mexico 15, D. F., Mexico, National Carbon-Eveready S. A., Calzada Mariana Escobedo No. 543

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F-9312-P  JMD J-8243-59