INSTRUCTIONS

for

HW-9
TIG WELDING TORCH

The HW-9 Torch is an air-cooled hand-welding torch designed for 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 Torch

A. Required Torch Accessories

In addition to the HW-9 torch (16X28 for 12-1/2 ft. cable or 16X44 for 25 ft. cable), you will need the following:

1. An electrode and collet of proper size for the current you intend to use. See Table 1 for selection of proper electrode size. For collet part numbers see the Replacement Parts section.

2. A high-impact or ceramic cup of proper size for the particular welding application. The No. 5 cup is suitable for most applications. Where space is limited, the No. 4 cup is preferred. When a wide gas shielding pattern is required a No. 6 cup is preferred. Nos. 7 and 8 ceramic cups may also be used on the HW-9 torch. In such cases, an adaptor, Part No. 322117, is required. For cup part numbers see the Replacement Parts section.

B. Power and Argon Supply Equipment

1. A suitable welding transformer, motor-generator, or rectifier plus welding cable, cable lugs, and a ground clamp.

2. A supply of argon and either an R-502 Argon Regulator and Flowmeter (04X34) OR an R-509 Argon Regulator (05X50) OR an Argon Flow Control Adaptor (21X62) and a standard oxygen regulator.

3. A 12-1/2 ft. argon hose, Part No. 40V77, for connecting the torch cable to the regulator outlet.

C. Gas Lens

Collet bodies containing gas lenses consisting of a permeable barrier of concentric, fine-mesh, stain-

less steel screens may be obtained as optional accessories. The gas lens focuses the gas stream and thereby improves performance in drafty locations. This feature also enables the operator to extend the electrode approximately 3/4-in. beyond the cup to weld inside corners and other hard-to-reach places. To add a gas lens, order a collet body and gas cup as directed in Section IV, plus a collet body insulator, Part No. 53N85, and adaptor, Part No. 45V52.

D. Hose Connections

1. Connect the regulator to the argon cylinder. Refer to the regulator instruction booklet for information on attaching and adjusting the regulator.

If the Argon Flow Control Adaptor is to be used, installation instructions may be found in F-9333. The adaptor may be quickly and easily installed inside the torch handle. Once in place, any argon flow can be obtained by setting the argon regulator to a particular pressure and referring to a chart supplied which lists pressure 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 12-1/2 ft. argon hose.

E. 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 terminals 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 TIG Welding](image)

**FIG. 1 - Schematic Diagram for TIG Welding**

**F. Installing Torch Accessories**

Collets are available for each electrode size (.020, .040, and 1/16-in. diameter). Select the correct size electrode for the welding current you intend to use from Table 1.

To install the collet, electrode and cup (see Fig. 2), do the following:

1. Remove the insulator sleeve and collet body from the torch.

![Fig. 2 - Exploded View of HW-9](image)

**FIG. 2 - Exploded View of HW-9**

2. 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.

3. Screw the collet body into the front end of the torch body.

4. 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.

5. Screw the proper size ceramic cup onto the collet body.

6. 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. A transparent torch cap, available as an accessory, will aid in determining when a new electrode is needed.

**TABLE 1 - ELECTRODE SIZES FOR DIFFERENT WELDING CURRENTS**

<table>
<thead>
<tr>
<th>Electrode Size (in.)</th>
<th>ACHF *</th>
<th>DCS *</th>
<th>DCR *</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.040</td>
<td>5-15</td>
<td>5-20</td>
<td>5-20</td>
</tr>
<tr>
<td>0.040</td>
<td>10-30</td>
<td>15-80</td>
<td>15-80</td>
</tr>
<tr>
<td>1/16</td>
<td>50-100</td>
<td>70-110</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 to the thoriated tungsten electrodes.

Maximal 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.
G. Gas Lens Accessories

To install the gas lens accessories, refer to the insert in (Fig. 3) and do the following:

1. Remove the cup, insulator sleeve (105Z26), and collet body (105Z27) from the torch.

2. Before assembling any parts into the torch:
   a) Install the insulator sleeve (105Z26) so that it fits in the center section of the adaptor (45V52).
   b) Place the insulator (53N85) over the top end of the gas lens collet body as shown in Fig. 3.
   c) Screw the collet body with insulator into the adaptor (45V52) and tighten with a wrench. A special collet body wrench, Part No. 59K07, is available.

3. Place the correct size electrode and collet into the top end of the adaptor, making sure the bottom end of the collet mates with the tapered seat in the collet body.

4. Screw the entire assembly into the front end of the torch. A clockwise rotation of the insulator sleeve will tighten the collet on the electrode.

5. Screw the proper size gas lens cup onto the collet body.

H. 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 power supply for the desired welding conditions.

4. Close the foot or hand switch, if one is used.

5. Draw a test arc on a piece of scrap steel or copper.


II. General Notes on Torch Operation

A. Using Low Current Range

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.

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

B. Torch Hose

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 authorized 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.

C. Factors Affecting High-Frequency Starting in TIG 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. 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.

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

5. Some high-frequency units including the early model of high frequency generator, 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.

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

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

8. 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.

III. Safety Precautions

A. Use a standard welder's helmet with the proper shade of glass for the welding current to be used.

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-52-529, "Precautions and Safe Practices for Electric Welding and Cutting," which is available without charge from any Linde office.

IV. Replacement Parts Data

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FIG. 3 - LINDE HW-9 (Series 3) Torch

* Series 1 and 2 torches differ from the series 3 in that they do not have I.A.A. inert gas fittings (i.e., the power cable adaptor on the series 3 accepts an argon hose having a male fitting, whereas the series 1 and 2 models accept an argon hose having a female fitting).

Accesories

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>59K07</td>
<td>Wrench, Gas Lens Collet Body</td>
</tr>
<tr>
<td>21X82</td>
<td>Argon Flow Control Adaptor</td>
</tr>
<tr>
<td>56Y83</td>
<td>Transparent Torch Cap (long)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collets and Collet Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size, in.</td>
</tr>
<tr>
<td>Collet</td>
</tr>
<tr>
<td>Gas Lens Collet Body(1)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Cups</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic Cup</td>
<td>84Z36</td>
<td>84Z37</td>
<td>84Z86</td>
<td>85Z10*</td>
<td>85Z11*</td>
</tr>
<tr>
<td>High-Impact Cup</td>
<td>14N65</td>
<td>14N66</td>
<td>14N67</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Long High-Impact Cup</td>
<td>14N73</td>
<td>14N74</td>
<td>14N75</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Gas Lens High-Impact Cup</td>
<td>53N58</td>
<td>53N59</td>
<td>53N60</td>
<td>53N61</td>
<td>---</td>
</tr>
</tbody>
</table>

* An adaptor (322117) is required when using these cups.

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