INSTRUCTIONS for

GENUINE HELIARC®

HW-90 & HW-90 PENCIL
TIG WELDING TORCHES

HW-90 Torch, 60/120-deg. head with 12-1/2-ft cable ................. Part No 16X28
HW-90 Torch, 60/120-deg. head with 25-ft cable ..................... Part No 16X44
HW-90 Pencil Torch, 180-deg. head, 12-1/2-ft cable ................. Part No 16X47

CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc equipment, we urge you to read our booklet, Precautions and Safe Practices for Arc Welding, Cutting and Gouging, 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 pages 3 and 4 before installing or operating this equipment.

RATING: With standard or gas lens collet bodies: 110 amps. (ACHF or DCSP) Continuous duty 120 amps. at 50% duty cycle. (Using standard collet bodies.)

COOLING: Air-cooled design.

ELECTRODES: Uses .020, .040, and 1/16-in. diameter electrodes, 3-in. or 7-in. long. Both the short torch cap (designed for 3-in. electrodes) and the long cap are supplied with the HW-90 torch. See Table 1 for electrode diameter vs. current recommendations.

COLLETS: Available for each electrode size. See Table 2. One collet body (supplied with torch) is used with each collet.

CUPS: For use with standard collet bodies: Standard, high impact, and long high-impact in ceramic sizes 4, 5, and 6. See Table 3.

For use with gas lens collet bodies: High-impact ceramic in sizes 4, 5, 6, and 7. See Table 3.

TORCH DIMENSIONS:

<table>
<thead>
<tr>
<th></th>
<th>HW-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, approx</td>
<td>8-3/4-in.</td>
</tr>
<tr>
<td>Handle diameter</td>
<td>3/4-in.</td>
</tr>
<tr>
<td>Height of torch head w/short cap</td>
<td>3-1/8-in.</td>
</tr>
<tr>
<td>w/long cap</td>
<td>7-1/8-in.</td>
</tr>
<tr>
<td>Diameter of Head</td>
<td>19/32-in.</td>
</tr>
<tr>
<td>Head Angle</td>
<td>60° or 120°</td>
</tr>
<tr>
<td>Weight (less cable)</td>
<td>3 oz</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>HW-90 Pencil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, approx</td>
<td>7-1/8-in.</td>
</tr>
<tr>
<td>Handle diameter</td>
<td>3/4-in.</td>
</tr>
<tr>
<td>Head Angle</td>
<td>180°</td>
</tr>
<tr>
<td>Weight (less cable)</td>
<td>5 oz</td>
</tr>
</tbody>
</table>

REQUIRED ACCESSORIES OR SERVICES:
- Collet, collet body, electrode, cup.
- Shielding gas regulator-flowmeter (if cylinder gas is used) OR flowmeter (if gas is piped).
- Gas Hose, 12-1/2-ft. long (40V77) or 25-ft. long (34V38) connects between regulator-flowmeter and torch cable and hose assembly.
- Welding power and shielding gas supplies.
- Power Cable Adaptor (53N43) for connecting torch power cable to power and gas supplies.
USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained, and repaired in accordance with the instructions provided. This equipment must be checked periodically. Malfunctioning or poorly maintained equipment should not be used. Parts that are broken, missing, worn, distorted, or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair, or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.
SAFETY PRECAUTIONS

WARNING: These Safety Precautions are for your protection. They summarize precautionary information from the references listed in Additional Safety Information section. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below as well as all other manuals, material safety data sheets, labels, etc. Failure to observe Safety Precautions can result in injury or death.

1. Always wear safety glasses with side shields in any work area, even if welding helmets, face shields, and goggles are also required.
2. 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 to expose themselves to the rays of the electric-arc or hot metal.
3. Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high-topped 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.
4. Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned, and open pockets eliminated from the front of clothing.
5. Protect other personnel from arc rays and hot sparks with a suitable non-flammable partition or curtains.
6. Use goggles over safety glasses when chipping slag or grinding. Chipped slag may be hot and can fly far. Bystanders should also wear goggles over safety glasses.

FIRES AND EXPLOSIONS -- Heat from flames and arcs can start fires. Hot slag or sparks can also cause fires and explosions. Therefore:

1. Remove all combustible materials well away from the work area or cover the materials with a protective non-flammable covering. Combustible materials include wood, cloth, sawdust, liquid and gas fuels, solvents, paints and coatings, paper, etc.
2. Hot sparks or hot metal can fall through cracks or crevices in floors or wall openings and cause a hidden smoldering fire or fires on the floor below. Make certain that such openings are protected from hot sparks and metal.
3. 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. Do not do hot work on closed containers. They may explode.
4. Have fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket, or portable fire extinguisher. Be sure you are trained in its use.
5. Do not use equipment beyond its ratings. For example, overloaded welding cable can overheat and create a fire hazard.
6. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire. Use fire watchers when necessary.
7. For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

ELECTRICAL SHOCK -- Contact with live electrical parts and ground can cause severe injury or death. DO NOT use AC welding current in damp areas, if movement is confined, or if there is danger of failing.

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.
2. Connect the workpiece to a good electrical ground.
3. Connect the work cable to the workpiece. A poor or missing connection can expose you or others to a fatal shock.
4. Use well-maintained equipment. Replace worn or damaged cables.
5. Keep everything dry, including clothing, work area, cables, torch/electrode holder, and power source.
6. Make sure that all parts of your body are insulated from work and from ground.
7. Do not stand directly on metal or the earth while working in tight quarters or a damp area; stand on dry boards or an insulating platform and wear rubber-soled shoes.
8. Put on dry, hole-free gloves before turning on the power.
9. Turn off the power before removing your gloves.
10. Refer to ANSI/ASC Standard Z49.1 (listed on next page) for specific grounding recommendations. Do not mistake the work lead for a ground cable.

ELECTRIC AND MAGNETIC FIELDS — May be dangerous. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and cutting current creates EMF around welding cables and welding machines. Therefore:

1. Welders having pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.
2. Exposure to EMF may have other health effects which are unknown.
3. Welders should use the following procedures to minimize exposure to EMF:
   A. Route the electrode and work cables together. Secure them with tape when possible.
   B. Never coil the torch or work cable around your body.
   C. Do not place your body between the torch and work cables. Route cables on the same side of your body.
   D. Connect the work cable to the workpiece as close as possible to the area being welded.
   E. Keep welding power source and cables as far away from your body as possible.

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FUMES AND GASES -- Fumes and gases, can cause discomfort or harm, particularly in confined spaces. Do not breathe fumes and gases. Shielding gases can cause asphyxiation. Therefore:

1. Always provide adequate ventilation in the work area by natural or mechanical means. Do not weld, cut, or gouge on materials such as galvanized steel, stainless steel, copper, zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
2. Do not operate near degreasing and spraying operations. The heat or arc rays can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gases.
3. 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.
4. Refer to ANSI/ASC Standard Z49.1 (see listing below) for specific ventilation recommendations.

5. WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code §25249.5 et seq.)

CYLINDER HANDLING -- Cylinders, if mishandled, can rupture and violently release gas. Sudden rupture of cylinder, valve, or relief device can injure or kill. Therefore:

1. Use the proper gas for the process and use the proper pressure reducing regulator designed to operate from the compressed gas cylinder. Do not use adaptors. Maintain hoses and fittings in good condition. Follow manufacturer's operating instructions for mounting regulator to a compressed gas cylinder.
2. Always secure cylinders in an upright position by chain or strap to suitable hand trucks, undercarriages, benches, walls, post, or racks. Never secure cylinders to work tables or fixtures where they may become part of an electrical circuit.
3. When not in use, keep cylinder valves closed. Have valve protection cap in place if regulator is not connected. Secure and move cylinders by using suitable hand trucks. Avoid rough handling of cylinders.
4. Locate cylinders away from heat, sparks, and flames. Never strike an arc on a cylinder.
5. For additional information, refer to CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", which is available from Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

EQUIPMENT MAINTENANCE -- Faulty or improperly maintained equipment can cause injury or death. Therefore:

1. 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.
2. Before performing any maintenance work inside a power source, disconnect the power source from the incoming electrical power.
3. Maintain cables, grounding wire, connections, power cord, and power supply in safe working order. Do not operate any equipment in faulty condition.
4. 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.
5. Keep all safety devices and cabinet covers in position and in good repair.
6. Use equipment only for its intended purpose. Do not modify it in any manner.

ADDITIONAL SAFETY INFORMATION -- For more information on safe practices for electric arc welding and cutting equipment, ask your supplier for a copy of "Precautions and Safe Practices for Arc Welding, Cutting and Gouging", Form 52-529.

The following publications, which are available from the American Welding Society, 550 N.W. LeJeuene Road, Miami, FL 33126, are recommended to you:
1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting"
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding"
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting"
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting"
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding"
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding"
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."

MEANING OF SYMBOLS - As used throughout this manual: Means Attention! Be Alert! Your safety is involved.

DANGER Means immediate hazards which, if not avoided, will result in immediate, serious personal injury or loss of life.
WARNING Means potential hazards which could result in personal injury or loss of life.
CAUTION Means hazards which could result in minor personal injury.
PRÉCAUTIONS DE SÉCURITÉ


1. PROTECTION INDIVIDUELLE— Les brûlures de la peau et des yeux dues au rayonnement de l’arc électrique ou du métal incandescent, lors du soudage au plasma ou à l’électrode ou lors du gouageage à l’arc, peuvent s’avérer plus graves que celles résultant d’une exposition prolongée au soleil. Aussi convient-il d’observer les précautions suivantes:

a. Portez un écran facial adéquat muni des plaques protectrices et des verres filtrants appropriés afin de vous protéger les yeux, le visage, le cou et les oreilles des étincelles et du rayonnement de l’arc électrique lorsque vous effectuez des soudures ou des coupes ou lorsque vous en observez l’exécution.

b. Portez des gants ignifugés à crins, une tunique épaisse à manches longues, des pantalons sans rebord, des chaussures à embout d’acier et un casque de soudage ou une calotte de protection, afin d’éviter d’exposer la peau au rayonnement de l’arc électrique ou du métal incandescent. Il est également souhaitable d’utiliser un tablier ininflammable de façon à se protéger des étincelles et du rayonnement thermique.

c. Les étincelles ou les projections de métal incandescent risquent de se loger dans des manches retroussées, des bords relevés de pantalons ou dans des poches. Aussi convient-il de garder boutonnés le col et les manches et de porter des vêtements sans poches à l’avant.

d. Protégez des étincelles et du rayonnement de l’arc électrique les autres personnes travaillant à proximité à l’aide d’un écran ininflammable adéquat.

e. Ne jamais omettre de porter des lunettes de sécurité lorsque vous vous trouvez dans un secteur où l’on effectue des opérations de soudage ou de coupage à l’arc. Utilisez des lunettes de sécurité à écrans ou verres latéraux pour piquer ou mêler le laitier. Les piquetures incandescentes de laitier peuvent être projetées à des distances considérables. Les personnes se trouvant à proximité doivent également porter des lunettes de protection.

f. Le gouageage à l’arc et le soudage à l’arc au plasma produisent un niveau de bruit extrêmement élevé (de 100 à 114 dB) et exigent par conséquent l’emploi de dispositifs appropriés de protection auditive.

2. PRÉVENTION DES INCENDIES— Les projections de laitier incandescent ou d’étincelles peuvent provoquer de graves incendies au contact de matériaux combustibles solides, liquides ou gazeux. Aussi faut-il observer les précautions suivantes:

a. Éloigner suffisamment tous les matériaux combus-
levage, des câbles de grue ou divers chemins électriques.

g. Empêchez l’apparition de toute humidité, notamment sur vos vêtements, à la surface de l’emplacement de travail, des câbles, du porte-électrode et du poste de soudage/coupage. Réparez immédiatement toute fuite d’eau.

4. VENTILATION— La respiration prolongée des fumées résultant des opérations de soudage/coupage, à l’intérieur, d’un local clos, peut provoquer des malaises et des dommages corporels. Aussi convient-il d’observer les précautions suivantes:

a. Assurez en permanence une aération adéquate de l’emplacement de travail en maintenant une ventilation naturelle ou à l’aide de moyens mécaniques. N’effectuez jamais de travaux de soudage ou de coupage sur des matériaux de zinc, de plomb, de beryllium ou de cadmium en l’absence de moyens mécaniques de ventilation capables d’empêcher l’inhalation des fumées dégagées par ces matériaux.

b. N’effectuez jamais de travaux de soudage ou de coupage à proximité de vapeurs d’hydrocarbure chloré résultant d’opérations voisines de dégraissage ou de pulvérisation. La chaleur dégagée ou le rayonnement de l’arc peut déclencher la formation de phosgène -- gaz particulièrement toxique -- et d’autres gaz irritants, à partir des vapeurs de solvant.

c. Une irritation momentanée des yeux, du nez ou de la gorge constatée au cours de l’utilisation de l’équipement dénote un défaut de ventilation. Arrêtez-vous de travailler afin de prendre les mesures nécessaires à l’amélioration de la ventilation. Ne poursuivez pas l’opération entreprise si le malaise persiste.

d. Certaines commandes comportent des canalisations où circule de l’hydrogène. L’armoire de commande est munie d’un ventilateur destiné à empêcher la formation de poches d’hydrogène, lesquelles présentent un danger d’explosion; ce ventilateur ne fonctionne que si l’interrupteur correspondant du panneau avant se trouve placé en position ON (Marche). Veillez à manœuvrer cette commande en vérifiant si le couvercle est bien en place, de façon à assurer l’efficacité de la ventilation ainsi réalisée. Ne jamais débrancher le ventilateur.

e. Les fumées produites par l’opération de soudage ou de coupage peuvent s’avérer toxiques. Aussi est-il nécessaire de disposer en permanence d’un dispositif adéquat de ventilation de type aspirant, afin d’éliminer du voisinage de l’opérateur tout dégagement de fumée visible.

f. Consultez les recommandations particulières en matière de ventilation indiquées à l’alinéa 6 de la norme Z49.1 de l’AWS.

5. ENTRETIEN DE L’ÉQUIPEMENT— Un équipement entretenu de façon défectueuse ou inadéquate risque non seulement de réaliser un travail de mauvaise qualité mais, chose plus grave encore, d’entraîner des dommages corporels graves, voire mortels en déclenchant des incendies ou des chocs électriques. Observez par conséquent les précautions suivantes:


b. Ne procédez jamais à une tâche d’entretien quelconque à l’intérieur du poste de soudage/coupage, avant d’avoir débranché l’alimentation électrique.

c. Maintenez en bon état de fonctionnement les câbles, le câble de masse, les branchements, le cordon d’alimentation et le poste de soudage/coupage. N’utilisez jamais le poste ou l’équipement s’il présente une défectuosité quelconque.


e. Laissez en place tous les dispositifs de sécurité et tous les panneaux de l’armoire de commande en veillant à les garder en bon état.

f. Utilisez le poste de soudage/coupage conformément à son usage prévu et n’effectuez aucune modification.

6. INFORMATIONS COMPLÉMENTAIRES RELATIVES À LA SÉCURITÉ—

Pour obtenir des informations complémentaires sur les règles de sécurité à observer pour le montage et l’utilisation d’équipements de soudage et de coupage électriques et sur les méthodes de travail recommandées, demandez un exemplaire du livret N° 52529 "Precautions and Safe Practices for Arc Welding, Cutting and Gouging" publié par ESAB. Nous conseillons également de consulter les publications suivantes, tenues à votre disposition par l’American Welding Society, 550 N.W. LeJuene Road, Miami, FL 32126:

a. “Safety in Welding and Cutting” AWS Z49.1


d. “Recommended Safe Practises for Plasma Arc Cutting” AWS-A6. 3.


f. “Recommended Safe Practices for Air Carbon Arc Gouging and Cutting” AWS-C5. 3.

OPTIONAL ACCESSORIES:

- Gas Lens Collet Bodies (see Table 2) for extending the shielding gas stream so that an electrode can be extended 3/4-in. beyond the cup. Improves performance in drafty locations and enables operator to weld inside corners and other hard to reach places. To use the gas lens, a collet body insulator (53N85), adaptor (45V52) and special gas cups (see Table 3) are also required.
- Wrench (59K07) for use with the above gas lens collet bodies.
- Braided Nylon Sheath, 9-ft. (2075198) and 20-ft. (2075200) for protecting service lines.
- Tig Accessory Kit (999124) includes long torch cap, 1 each 0.040" and 1/16" collets, collet body, 1 each No. 4, 5, and high impact cups, and 1 each 7" long x 0.040" and 1/16" dia. 2% thoriated electrodes.
- Torch Cable Adaptor (19636) connects to torch body permitting to use HW-17's high performance cable P/N 997022 (12-1/2-ft.) or 997023 (25-ft.) with the HW-90 torch. The cable is designed for low temperature flexibility and greater heat resistance. (Do not use adaptor and HW-17 cable with the pencil torch.)

SET-UP AND INSTALLATION

1. Connect the regulator/flowmeter to a gas cylinder. Refer to the instructions supplied with the regulator/flowmeter for details on attaching and adjusting the regulator.
2. Connect one end of the gas hose (40V77 or 34V38) to the regulator outlet; and the other end to the torch cable adaptor (53N43).
3. Connect the power cable adaptor to the welding power source, either directly or through a suitable length of welding cable fitted with lugs.
4. If using the standard torch accessories, refer to Fig. 1 and install collet, electrode, and cup as follows:
   a. Remove the insulator sleeve and collet body from the torch.
   b. 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.
   c. Screw the collet body into the front end of the torch body.
   d. 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.
   e. Screw the proper size ceramic cup onto the collet body.
   f. 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.
5. If using the optional gas lens accessories, install the parts as follows:
   a. Remove the sleeve and the standard collet body from the torch (the standard collet body is not required for this installation).
   b. Referring to the inset of Fig. 1, install the sleeve onto the adaptor (45V52); place the insulator (53N85) over the small diameter end of the gas lens collet body; and then screw the collet body into the adaptor. Tighten with a wrench (special collet body wrench (59K07) is available).
   c. Insert the selected electrode and collet (tapered end first) into the adaptor end.
   d. Screw the entire assembly (adaptor end first) into the front end of the torch. Rotating the sleeve clockwise will tighten the collet on the electrode.
   e. Install the selected gas lens cup onto the collet body.
   f. Electrode may be adjusted to extend from 1/8-in. to 3/4-in. beyond the cup depending on the nature of the work. Turn the sleeve about 1/4 turn or less to loosen the electrode.

OPERATING INSTRUCTIONS

1. Make sure that all gas connections in the system have been securely tightened, and that the torch cap (on the HW-90 with 600/1200 head) has been well-tightened.
2. With the regulator flow-adjusting valve closed, open the gas cylinder or station valve.
3. Set the power supply for the desired welding current.
4. Open all shielding gas valves downstream from the flowmeter or flowmeter/regulator (e.g., lever-operated shutoff valve, or solenoid-operated valve in power supply).
5. 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 five minutes thereafter). This will help prevent weld contamination.
6. Close control switch at work station or power supply.
7. 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.)**
8. If the test arc is satisfactory, commence welding.

**OPERATION AND MAINTENANCE HINTS**

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 1250 F. (52° C).
3. Do not try to repair a damaged power cable. Replace it.
4. 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.
5. Keep an eye on the sealing "O" rings on the collet body and torch cap. If it shows sign of wear or distortion, cut it off. Then install a new ring (85W49). Apply a little silicone grease to the new ring before attempting to slide it over the cap threads.

**Table 1 - Electrode Sizes for Different Welding Currents**

<table>
<thead>
<tr>
<th>Electrode Size (in.)</th>
<th>ACHF*</th>
<th>DCSP†</th>
<th>DCRP†</th>
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<tbody>
<tr>
<td>Pure Tungsten</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Thoriated Tungsten</td>
<td>5-15</td>
<td>5-20</td>
<td>5-20</td>
</tr>
<tr>
<td>Thoriated</td>
<td>10-60</td>
<td>15-80</td>
<td>15-80</td>
</tr>
<tr>
<td>0.020</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0.040</td>
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<td></td>
<td></td>
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<tr>
<td>0.060</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/16</td>
<td>50-100</td>
<td>70-110</td>
<td>70-110</td>
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- In general, for DCSP, the lower end of the specified current range applies to the pure tungsten electrodes and the upper end of 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 than shown on their scale readings.
- Thoriated tungsten electrodes are recommended when gas lens and high frequency starting are used.

**Table 2 - Collets and Collet Bodies**

<table>
<thead>
<tr>
<th>Size, in.</th>
<th>.020</th>
<th>.040</th>
<th>1/16</th>
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<tbody>
<tr>
<td>Collet</td>
<td>64Z34</td>
<td>84Z35</td>
<td>84Z33</td>
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<tr>
<td>Gas Lens Collet Body*</td>
<td>45V41</td>
<td>45V42</td>
<td>45V43</td>
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- An adaptor (45V52) and insulator (53N85) are also required when using a gas lens.

**Table 3 - Cups**

<table>
<thead>
<tr>
<th>Cup No.</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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Fig. 2 - HW-90 Torch - (60°/120° Head, 12-1/2-ft. cable) - Part No. 16X28
(60°/120° Head, 25-ft. cable) - Part No. 16X44

Fig. 3 - HW-90 Pencil Torch (12-1/2-ft. cable) - Part No. 16X47