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The word HELIARC is a trade-mark of Union Carbide and Carbon Corporation or its Units
INSTRUCTIONS AND PARTS LIST
"HELIARC" SPOT-WELDING CONTROL BOX
TYPE DM-1289

THE "HELIARC" SPOT-WELDING PROCESS

DESCRIPTION

A "HELIARC spot weld" is a localized, argon-shielded arc weld, which is comparable to a resistance spot weld for joining two metal pieces.

The HELIARC spot weld is produced during the timed interval that an electric arc is established between a tungsten electrode and a weldment joint. The arc time interval is set by adjustment of the Type DM-1289 Control Box described in this booklet.

Booklet F-7015, "Instructions and Parts List, HELIARC Spot-Welding Torch, Type HW-8", enumerates the special advantages of HELIARC spot-welding. It also contains a list of all apparatus required for the process, and information on process applications.

OPERATING INSTRUCTIONS

CONTROL BOX CONNECTIONS

The schematic diagram in Fig. 3 shows the connection of the Type DM-1289 Control Box in relation to other equipment used for HELIARC spot-welding.

The control box should be mounted in a convenient location so that the tube of the flowmeter inside it is absolutely vertical. In this position the torch connection panel is at the bottom of the box, and the hinged cover swings open to the right.

One power cord with a service plug attached provides control box power supply from 115 V, 60 cycle lines. A line switch for power supply is located on the right side of the box, where this cord is secured with a strain-relief grommet (see Fig. 1).

A second, two-wire cord (no service plug attached, as shown in Fig. 1) leading into the control box must be connected to the welding-current interrupting contactor. One leg of this "contactor cord" connects to a terminal on the contactor coil. The other leg connects to one lead of the contactor power line, which should be 115 V, 60 cycle supply. The second lead of the contactor power supply is attached to the second terminal of the contactor coil.

It should be understood that the contactor cord is not supplied with power from the Type DM-1289 Control Box, but is energized by current from the contactor power supply, which comes from another source.

The welding cable which serves as the "electrode lead" runs from the high-frequency current generator to the control box, where it passes through a porcelain grommet on the right side of the box, for attachment to a terminal on the welding-current relay. A solder-type welding cable lug is furnished for connecting the cable at this point.

- 3 -
Fig. 1 -- Right End View of HELIARC Spot-Welding Control Box, Type DM-1289

- 4 -
An argon supply hose, furnished with the control box, runs from an argon regulator to connect to the control box panel on the fitting marked "Argon In" (see Fig. 2). The spot-welding torch hose for argon connects to the panel fitting marked "Argon Out". The argon regulator should be set for a delivery pressure of 25 psi.

A cooling water supply hose, furnished with the control box, runs from the water supply system to the panel fitting marked "Water In". The torch inlet water hose connects to the panel fitting marked "Water Out".

The torch power cable lead connects to the panel fitting marked "Cable".

The torch switch cord plugs into the panel receptacle marked "Control Switch".

A cooling water discharge hose, furnished with the control box, connects to the panel fitting marked "Water to Drain".

It should be noted in Fig. 3 that an "earth ground" is recommended for safety on the control box, as well as the other equipment required for HELIARC spot-welding. The control box ground terminal is located to the right of the panel fittings, on the bottom of the box (see Fig. 2).
A minimum water pressure of 25 psi at the control box connection will supply adequate cooling water flow of one and one-half pints per minute. Water pressure should not exceed 50 psi to avoid rupturing torch hose. If the feed water line varies in pressure outside the 25-psi to 50-psi range, it is advisable to install a suitable water pressure regulator, such as the Kleeney and Mueller, Inc., Type 463, 1/4-in. size, for water service.

Restrictions from foreign matter in water passages may throttle cooling water flow, even though proper water pressures are maintained. If it is necessary to use a water supply that is not clean, install a standard 1/4-in. or 3/8-in. pipe-size basket or Y-type strainer, with screen mesh size of 40 or finer, ahead of the water inlet hose connection on the control box.

CONTROL BOX SETTINGS

Table I shows nominal settings of apparatus components to HELIARC spot weld several metal thicknesses. The adjustment of settings for arc time interval and argon flow are made inside the control box.

TABLE I

"HELIARC" SPOT WELDING FACTORS FOR STAINLESS STEEL, LOW ALLOY STEEL AND MILD STEEL

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<td>155</td>
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<td>0.064</td>
<td>240</td>
<td>2</td>
<td>4</td>
<td>1/8</td>
</tr>
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</table>

Arc time interval settings are made by regulation of the pointer on the arc interval timer, which is located on the upper right corner or the electrical panel, inside the control box. The timer is calibrated between zero and 15 seconds of arc interval time. Do not change timer settings while the timer is running, that is, while a HELIARC spot weld is being made, because the mechanical parts of the timer may be damaged by adjustment during this interval. Typical settings of the timer are given in Table I.

Argon flow settings are made by regulation of the needle valve located on the downstream side of the flowmeter, which is mounted in the lower left corner inside the control box.

Argon shutoff delay: Tungsten electrodes used in HELIARC spot welding become white-hot during the period of arc time required to produce each spot weld. The electrode cools rapidly after the arc is extinguished, but it should cool in an argon atmosphere to prevent oxidation of the tungsten. For that reason the solenoid valve in the argon line is not shut off simultaneously with the welding arc, but is closed a few seconds later after the electrode has cooled down to present a "silvery" appearance.
The time interval of argon shutoff delay varies with the amount of welding current used, but averages from 15 to 18 seconds for the current range of a 1/8-in. diameter electrode. Adjustment of argon shutoff delay is made on the argon shutoff timer, located on the front of the electrical control panel to the left of the arc interval timer. The argon delay timer is calibrated in tenths of minutes up to one minute delay. A setting of "$3" on the calibrated dial assures shutoff delay for 18 seconds. If it appears that an electrode cools to a "silvery" color in less than 18 seconds for a given welding current, the duration of argon shutoff delay may be reduced accordingly to conserve argon.

OPERATING CYCLE

Assuming that all power, argon and water service connections have been made to the apparatus necessary to make a HELIARC spot-weld, the process operating cycle for one spot weld occurs as described in the following. The functions of control components is outlined in the order of occurrence. The physical shapes of control components are shown in Fig. 5 and Fig. 6, and they are identified by their electrical symbols, as shown on the control box wiring diagram in Fig. 4, for assistance in tracing the electrical circuits.

1. The cycle is started by depressing the torch trigger momentarily, to close a 6 V pilot circuit (leads A and B). This circuit operates through a step-down transformer (D-207215) and a 6 V relay (CR1). The torch trigger need not be depressed throughout the spot-welding cycle, but may be released immediately.

2. The 6 V pilot circuit energizes a control relay (CR), which locks in electrically (with a clearly audible sound) to close the main contactor in the welding transformer primary circuit. The argon solenoid valve (AV) is opened at the same time, to start argon flowing through the spot-welding torch. The torch electrode and the welding "ground" cable become "alive" with welding current and high-frequency starting current.

3. Establishment of an arc starts flow of welding current from the welding transformer, causing welding current relay (WC) to close.

4. A holding relay (HR) is energized when current relay (WC) closes, to start the motor of the arc interval timer (TDW).

5. Control relay (CR) is de-energized at the end of arc time interval by the opening of contacts (1 and 3) on the arc timer (TDW). The arc timer (TDW) resets automatically for the next spot-welding cycle.

6. The welding transformer primary contactor is opened when control relay (CR) is de-energized, to shut off transformer and high-frequency current generator power supply, and therefore extinguish the welding arc. At the same time, an argon delay timer (TDA) is started when (CR) is de-energized.

7. The argon solenoid valve (AV) is closed by argon delay timer (TDA) at the expiration of the delay interval, and the timer resets automatically for the next spot-welding cycle.
NOTE: It is not necessary to wait for the electrode to cool between each spot-welding cycle. For example, if spot welds are made in rapid succession, say every five seconds, the argon delay timer (TDA) will reset automatically each time the torch trigger is depressed, and argon will flow continuously through the torch. The argon solenoid valve will close only when the argon delay timer "runs out", some 15 or 18 seconds (or other timer setting) after an arc is extinguished.

**PRECAUTIONS AND SAFE PRACTICES**

The main switch on the welding machine power lines should be opened before the Type DM-1289 Control Box is opened for inspection. The welding cable "electrode lead" is connected to one terminal of the welding current relay (WC), and could be a source of electrical shock if the welding transformer and high-frequency current generator were turned on accidentally.

Operating power supply (115 V, 60 cycle) to the control box usually will be required to check functional disorders. All control circuits, with the exception of the 6 V pilot circuit (wires A and B), are 115 V lines. The usual precautions should be observed for handling these voltages.

The control box line switch should be turned to the "off" position once, and turned back to the "on" position, before a test spot weld is made.

---

*Fig. 3 -- Schematic Diagram of Electrical Connections for HELIARC HW-8 Torch and Control Box*
following a check of control circuits. After all electrical connections have been remade, the torch electrode is energized with welding current when the trigger is depressed; and an arc will be established at any time that the electrode is placed near enough to an electrical ground, unless the control box line switch has been turned off to de-energize the control system. Premature establishment of an arc, especially when the torch is not in the proper position to make a spot weld, may damage the torch, or may cause injury to the operator.

**MAINTENANCE INSTRUCTIONS**

The apparatus required for HELIARC spot-welding is subject to the disorders that may be anticipated for any electrical system. General maintenance instructions apply for determining obvious causes of operation failure, such as checking all power supply lines for correct voltage, switches for "on" position, blown fuses, short circuits and electrical grounds.

If it is clear that operation failure is not caused by malfunctioning of the welding transformer, high-frequency current generator or transformer primary contactor, the Type DM-1289 Control Box should be inspected by a competent electrician for operating difficulties. The welding cable "electrode lead" should be removed from the control box connection before testing control components. The welding current relay may be operated by hand pressure to actuate holding relay (HR). A check list of possible sources of trouble in the control box assembly is given below.

Defective line switch: Bridge wires L3 and L4 ahead of the fuses but past the switch with a voltmeter or test lamp. If no voltage is indicated when the switch is in the "on" position, the switch should be repaired or replaced.

Dead fuses: Bridge wires L3 and L4 past the fuses. No voltage indicates that fuse elements are dead and must be replaced. If fuses blow again immediately after replacement, check all circuits for shorts, caused by worn or broken insulation on wiring. Shorts may occur also in the step-down transformer, relays or timers.

Shorted condensers between wires L4, 1, 6 and 8 may cause fuses to blow. Reverse the control box power cord in its receptacle, and replace dead fuse elements. If fuses continue to blow, check each condenser separately. In unusual circumstances one or more condensers may burn out, to cause insulation breakdown on other components.

Welding current relay (WC): If the arc interval timer does not start, especially when using welding currents from 60 to 125 amperes, the welding current relay may be too stiff. Reduce the spring tension on the end of the relay armature.

A snap-action switch operated by the relay armature may not reset if it does not receive the full movement of the armature. The toggle arm on this switch should be bent slightly to receive the full displacement stroke of the relay armature.

Insufficient spring tension on the armature, or friction in the moving parts may cause the relay to stick. Adjust for free movement.
Relays (CR and CRI): Inspect these relays for mechanical operation, to determine if movable parts are locked by friction.

Arc interval timer (TDW): A toggle switch, marked "Timer", located at the lower left corner of the front electrical panel, should be in the "on" position. If the timer sticks or fails to reset automatically, disconnect the timer motor leads on terminals 1 and 2, and check operation with a separate 115 V supply. The timer should be removed for repair or replacement if it does not function on the separate power supply.

If the timer does function with the separate power supply, check welding current relay (WC) or holding relay (HR) for faulty mechanical operation or for shorts. Relay (HR) should operate to start the arc timer (TDW). If (HR) appears to be in good working order, bridge wires 1 and 6 with a jumper (insulated wire with bare ends) to determine if contacts are closing on the coil of current relay (WC), to complete the circuit to relay (HR).

Argon delay timer (TDA): This timer will not operate if control relay (CR) does not function properly. The timer itself may be checked for a defective drive motor, snap-action switch or broken wiring. If the timer is not defective, it should run when a jumper is placed between wires L3 and 7.

Argon solenoid valve (AV): This valve should function, if it is not defective, when a jumper bridges wires L3 and 8. Broken or frozen contacts on argon delay timer (TDA) may make valve (AV) inoperative. The "float" or "spinner" in the argon flowmeter should drop to zero when the argon valve is closed. The valve plunger is not seating properly in the closed position if a reading is indicated on the flowmeter.

Torch trigger switch: The HELIARC spot-welding torch actually is not part of the Type DM-1289 Control Box, but it is connected thereto electrically by the torch switch cord, which carries the 6 V pilot circuit. This initiating circuit may be broken by parted wires in the switch cord, or by damaged elements in the torch trigger switch. The spot-welding cycle described previously should begin instantly after the trigger switch is closed, or after wires A and B are shorted by contact.
Fig. 5 -- Inside Front View of HELIARC Spot-Welding Control Box Type DM-1289
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<td>D-204550</td>
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<td>Water and Argon Inlet Block Assembly</td>
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# ACCESSORIES SUPPLIED

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LINDE Oxygen, Nitrogen, Argon, Hydrogen
PREST-O-LITE Acetylene
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PUROX Welding and Cutting Apparatus
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Acetylene Generators

SPECIAL MACHINES
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Sub-Zero Cold Treatment Equipment

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Pressure-Welding Machines

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P.O. Box 124
East Park Drive
Tonawanda, N. Y.
CHARLESTON 1, W. VA.
2 Virginia Street
NEW YORK 17, N. Y.
205 East 42nd Street
PHILADELPHIA 22, PA.
1421 North Broad Street
PITTSBURGH 19, PA.
312 Ross Street

Central States
CHICAGO 1, I. L.
230 North Michigan Avenue
CINCINNATI 6, OHIO
2506 Fifth Street
CLEVELAND 14, OHIO
1513-15 Superior Avenue
DETROIT 2, Mich.
6240 General Motors Building
3044 West Grand Boulevard
INDIANAPOLIS 4, IND.
729 North Pennsylvania Street
MILWAUKEE 4, Wis.
1623 South 38th Street
MINNEAPOLIS 2, MINN.
827 Second Avenue
ST. LOUIS 8, MO.
4228 Forest Park Boulevard

Southern States
ATLANTA 3, GA.
310 Peachtree Street, N. E.
BIRMINGHAM 5, ALA.
100-13 South 22nd Street
JACKSONVILLE 3, FLA.
2410 Dennis Street
MEMPHIS 5, TENN.
48 West McLemore Avenue
NEW ORLEANS 13, LA.
828-32 Howard Avenue

Southwestern States
DALLAS 1, TEXAS
2606 Commerce Street
DENVER 2, COLO.
2101 Blake Street
HOUSTON 11, TEXAS
6119 Harrisburg Boulevard
KANSAS CITY 6, MO.
910 Baltimore Avenue
TULSA 3, OKLA.
614 National Bank of Tulsa Bldg.
320 South Boston Avenue

Western States
EL PASO, TEXAS
810 Texas Street
LOS ANGELES 14, CALIF.
416 West Biltmore Street
PACIFIC, ARIZ.
341 West Buchanan Street
PORTLAND 9, ORE.
1205 Northeast Marshall Street
SALT LAKE CITY 1, UTAH
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SEATTLE 4, WASH.
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