

AMI
ARC MACHINES, INC.



M9 SERIES WELD HEADS
OPERATION MANUAL

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

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MODEL 9 SERIES WELD HEAD OPERATION MANUAL

Table of Contents

<u>Chapter</u>	<u>Description</u>	<u>Page</u>
1.0	Introduction.....	3
2.0	Unpacking.....	3
3.0	Cable hook up.....	3
4.0	Water Cooling.....	5
5.0	Rotation (speed) Auto-Calibration.....	5
5.2	Rotation (speed) Manual Calibration.....	6
6.0	Clamp Insert Installation.....	7
7.0	Electrode Geometry & Installation.....	9
8.0	Shielding Gas.....	14
9.0	Return-to-home (rotor) position adjustment.....	15
10.0	Cleaning & maintenance.....	17
11.0	Storage.....	18

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

1.0 INTRODUCTION

This manual covers basic set up and maintenance of the following model 9 and model 9E series weld heads: 9-750, 9-1500, 9E-1500, 9-2500, 9E-2500, 9-3500, 9E-3500, 9-4500, 9E-4500, 9ER-4500, 9-7500 and 9E-7500. The operator should have a working understanding of the power supply being used and should understand this manual before operating the weld head.

2.0 UNPACKING

When unpacking the weld head use extreme caution in removing the plastic bag covering the cable connectors. Tools such a knife or other sharp object can cut the cables.

3.0 CABLE HOOK UP

CAUTION

Always turn the power supply off before making any cable connections.

The Model 9 series weld heads come supplied with an integral 10ft (3 m) cable. This cable is NOT connected directly to the power supply. It must be mated to the power supply via an adapter pig-tail or adapter cable. Extension cables may also be used. The use of an extension cable does not eliminate the requirement for an adapter. If an extension cable is used, it is connected between the power supply and the adapter. After making connections, slide the rubber boots together. See figures 1 - 4



Fig. 1

Connect the power and ground fittings by pulling the brass ring back and inserting the male fitting into the female fitting, until it is fully seated. If it is not fully seated, it will leak water or potentially come apart.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

3.0 CABLE HOOK UP (contd.)

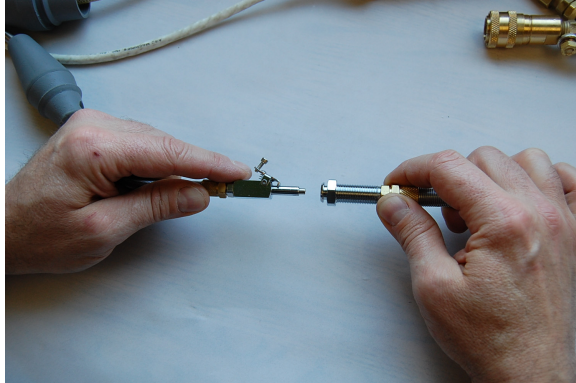


Fig. 2

To connect the male to female (chrome) gas fittings, unscrew the (4-40) socket head screw to allow the latch to open far enough to fully seat the two fittings. Lightly tighten this screw to prevent accidental disconnection of this fitting.

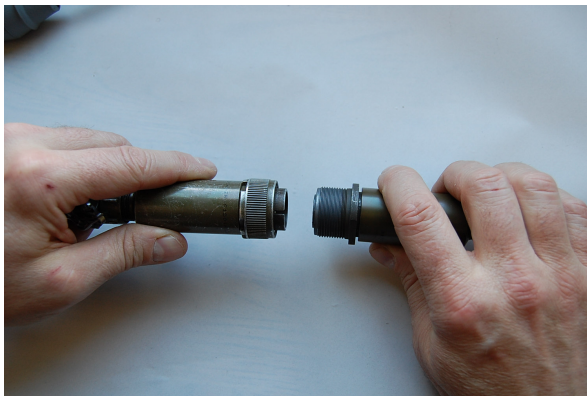


Fig. 3

Connect the motor control connector by aligning the key to the slot, and lightly tightening the outer ring. Be careful not to cross-thread this ring.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

3.0 CABLE HOOK UP (contd.)

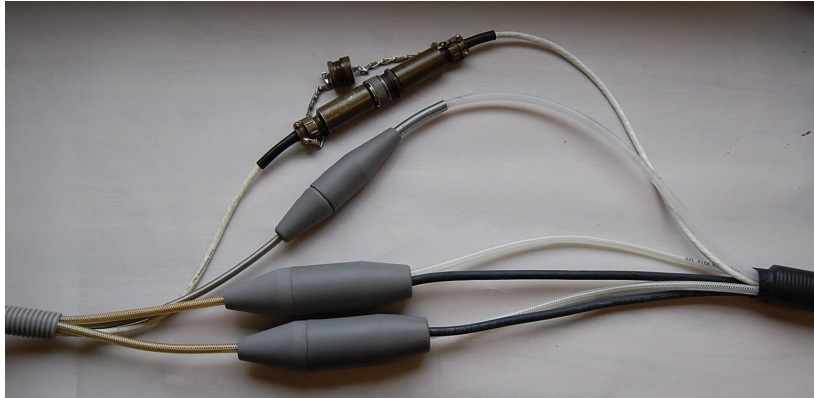


Fig. 4

Slide the boots together securely to protect the connectors and fittings from dirt, and to prevent the power and ground connectors from coming in contact with each other.

4.0 WATER COOLING

Most Model 9 series heads are plumbed for water cooling, and are cooled via the power supply's (optional) cooling unit. Although water cooling is not required for all applications, it should always be used when welding tube or pipe wall thicknesses of 0.065" (1.6mm) or heavier in the Model 9-500C or 0.083" (2.1mm) or heavier in all the other water-cooled models 9 series heads. In addition, water-cooling should always be used when doing high-duty-cycle work, regardless of the tube wall thickness. Consult the factory for recommendations.

5.0 ROTATION (SPEED) AUTO-CALIBRATION

Before welding, the electrode rotation motor in the weld head must be calibrated to the power supply. Most power supplies include an auto calibration function in the software. Refer to the power supply operation manual for specifics on auto calibration.

- 5.1 Should the power supply indicate that the weld head requires calibration adjustment, the calibration potentiometer can be accessed through the screw driver slot on the side of the return-to-home switch housing. See fig. 5. Follow the instructions on your power supply in making adjustments to the potentiometer.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

5.0 ROTATION (SPEED) AUTO-CALIBRATION (Contd.)

Note: Some larger Model 9 series weld heads provide access to the calibration potentiometer through an access hole in the side of the housing, adjacent to the potentiometer. A nylon screw is used to plug this access hole. Removed it to gain access to the calibration potentiometer. Replace this screw when calibration is complete.



Fig. 5
Model 9-1500

5.2 ROTATION (SPEED) MANUAL CALIBRATION

Some power supplies do not have auto calibration software. In this case, the weld head motor is manually calibrated by creating a weld program that should rotate the electrode 360 degrees. ie: 1 RPM for a total of 60 seconds, 2 RPM for a total of 30 seconds, 3 RPM for a total of 20 seconds, etc. Select a speed (RPM) and corresponding time close to or equal to the speed that you intend on welding at to achieve the most accurate calibration.

5.3 Calibration must be run in the “TEST” mode. Create a one level weld schedule at your selected RPM. Amperage and pulse rate settings may be set to any value, as during rotation calibration no arc will be established. Set the rotation mode to “CONT” (continuous rotation). Set rotation delay and downslope times to 0.0.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

5.0 ROTATION (SPEED) MANUAL CALIBRATION (Contd.)

- 5.4 Add one additional level with a duration of 5 or more seconds, with the rotation mode set to "OFF". This additional level (with rotation off) will hold the electrode at its stopped position allowing the operator to see if it traveled too far (traveling too fast) or not far enough (traveling too slow).
- 5.5 Be sure the power supply is in the "TEST" mode, and run the program. Should the electrode rotate too fast (traveling more than 360 degrees), stopping beyond the home position, slow it down by turning the potentiometer counter clockwise (CCW). Should the rotation be too slow (traveling less than 360 degrees) stopping before it reaches a full 360 degrees, turn the potentiometer clockwise (CW). Continue this procedure until the electrode stops after 360 degrees of travel.

6.0 CLAMP INSERT & GAS SEAL INSTALLATION

Clamp inserts are designed for a specific tube or pipe size. Select the appropriate clamp for the specific tube or pipe to be welded. A set of clamps fits one side of the weld head. Except for some special applications, or when using a model 9E or 9ER type weld head, two sets of clamps are required. One set fits on each side of the head.

Note: A set of clamp inserts is made from one piece, and then split into two halves. Each half is marked with matching alphanumeric characters. Keeping matched sets together (on the same side of the weld head) will result in the highest level of weld joint concentricity.

- 6.1 Before mounting the clamp insert into the head be sure both the clamp and weld head clamp mounting groove are clean and free of dirt, oil or other contaminants. The clamp mounting screw need only be lightly snug. See fig. 6.

CAUTION

Use of the wrong size clamp, or clamping the head on the curved section of an elbow or other irregular surface can result in damage to the clamp insert, weld head clamp latch and/or hinge.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

6.0 CLAMP INSERT & GAS SEAL INSTALLATION (cont'd.)

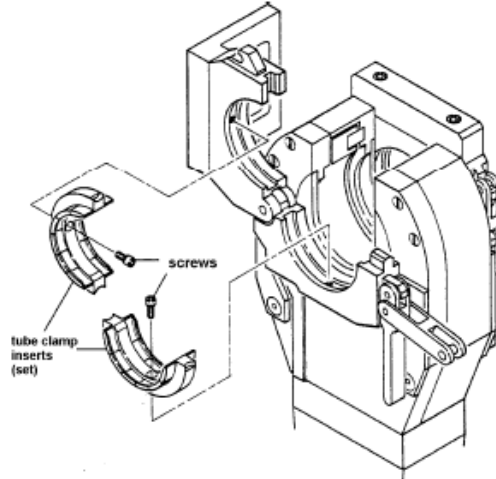


Fig. 6

6.2 Model 9E and 9ER type heads use a clamp insert on one side, and a gas seal on the other side of the head. The hole in the gas seal is approximately 1/8" (3mm) larger than the diameter of the part to be welded. Components such as elbows or other non-straight or odd-shaped parts will sometimes require repositioning of the gas seal to facilitate approximately a 1/16" (1.6mm) gap all around the part being welded. This gap is used to allow arc gas to exit the weld head and to minimize gas seal burning. The four mounting holes in the gas seal are large enough to allow the gas seal to be positioned as required. Blank gas seals (without a hole in the center) are available for custom applications. See fig. 7.



Fig. 7
Model 9ER-4500

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

7.0 ELECTRODE GEOMETRY & INSTALLATION

CAUTION

To prevent the possibility of electrical shock, the power supply must be in the "TEST" mode before proceeding with electrode installation or removal. Take extreme care that fingers or foreign objects are clear of the rotor when jogging.

The recommended electrode type is 2% Ceriated. (AWS Spec. A5.12/A5.12M, Orange tip). This type of electrode provides superior arc starting and longer life than 2% Thoriated electrodes. Other types can also be used. Consult factory for recommendations.

Most Model 9 series heads accommodate two electrode sizes. Either 0.040" (1.0mm) and 1/16" (1.6mm) or 1/16" (1.6mm) and 3/32" (2.3mm) diameter. The mounting holes in the rotor are approximately 180 degrees apart.

CAUTION

Do not install an 0.040" electrode into the 1/16" electrode mounting hole, or a 1/16" electrode into a 3/32" electrode mounting hole, and never install more than one electrode.

- 7.1 The electrode length ultimately determines the arc gap, and the arc gap determines the arc voltage which affects the heat input into the weld. Thus a consistent arc gap from weld to weld is essential for weld repeatability.

In order to determine the correct electrode diameter, length and tip diameter for a specific application, use the charts and formula below.

See figures 8, 9, 10, 11, and 12.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

7.0 ELECTRODE GEOMETRY & INSTALLATION (cont'd.)

Use this chart to determine the weld head Rotor O.D.

Model	Rotor O.D.
9-750	2.00" (50.8mm)
9-1500	3.187" (80.9mm)
9E-1500	2.687" (68.25mm)
9-1500 w/elect. extender	2.031" (51.6mm)
9-2500	4.380" (111.25mm)
9E-2500	4.280" (108.71mm)
9-2500 w/elect. extender	3.156" (80.16mm)
9-3500	5.380" (136.65mm)
9E-3500	5.310" (134.87mm)
9-3500 w/elect. extender	4.031" (102.38mm)
9-4500	6.875" (174.62mm)
9E-4500	6.280" (159.51mm)
9ER-4500	5.776" (146.71mm)
9-4500 w/elect. extender	4.920" (124.97mm)
9-7500	10.440" (265.18mm)
9E-7500	9.375" (238.12mm)
9-7500 w/elect. extender	8.280" (210.31mm)

Fig. 8

Use this chart to establish an appropriate Arc Gap and Electrode Tip diameter

Tube/Pipe Wall Thickness	Recommended Arc Gap	Recommended Tip Diameter
0.020"-0.035" (.5 - 1.0mm)	0.020"-0.030" (0.5-0.8mm)	0.010"-0.20" (.25-.50mm)
0.035"-0.085" (1.0-2.1mm)	0.050"-0.070" (1.3-1.8mm)	0.030" (0.8mm)
0.091"-0.154" (2.3-3.9mm)	0.070"-0.090" (1.8-2.3mm)	0.040" (1.0mm)

Fig. 9

Use this chart to determine the electrode diameter.

Tube/Pipe Wall thickness	Electrode Diameter
0.020" - 0.035" (.50 - 1.0mm)	0.040" or 1/16" (1.0 or 1.6mm)
0.049" - 0.083" (1.2 - 2.1mm)	1/16" (1.6mm)
0.091" - 0.154" (2.3 - 3.9mm)	3/32" (2.3mm)

Fig. 10

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

7.0 ELECTRODE GEOMETRY & INSTALLATION (cont'd.)

Use the formula below, along with your Rotor O.D. and Arc Gap to establish the electrode length.

$$\frac{\text{ROTOR O.D.} - \text{TUBE O.D.}}{2} - \text{ARC GAP} = \text{ELECTRODE LENGTH}$$

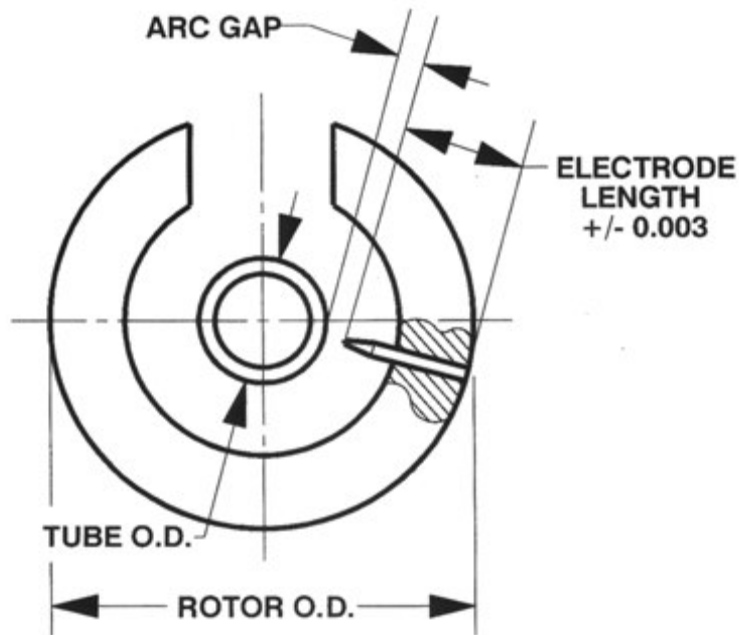


Fig. 11

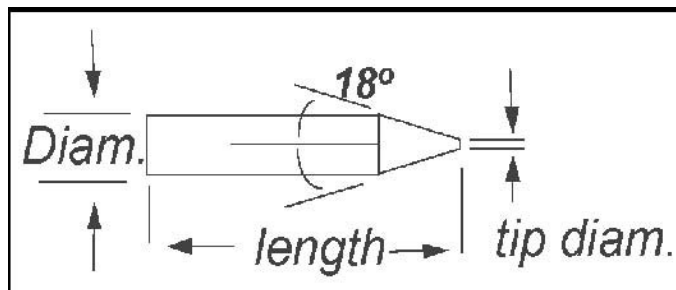


Fig. 12

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

7.0 ELECTRODE GEOMETRY & INSTALLATION (cont'd.)

- 7.3 To change electrodes, using the "JOG" button on the power supply or remote operators pendant, jog the rotor around until the electrode is in the 12 O'clock position. See fig. 13.
- 7.4 Lay the weld head on its side to prevent accidental dropping of the electrode into the weld head. Loosen the electrode set screw. See fig. 13

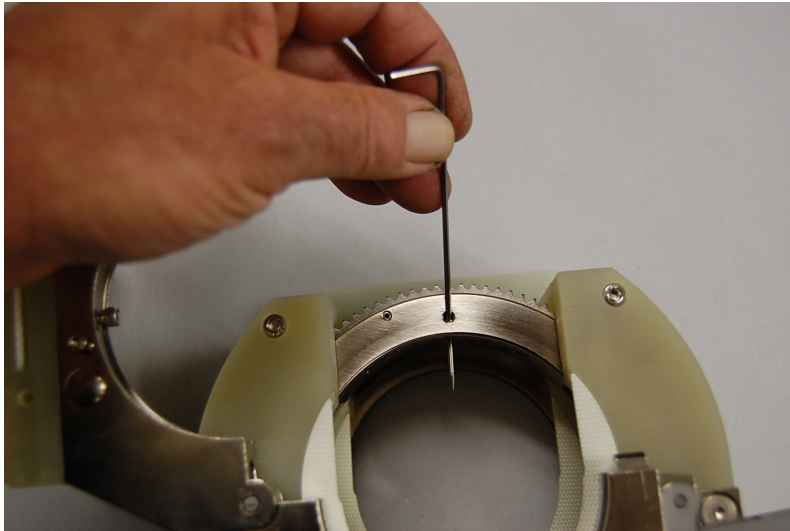


Fig. 13

Note: Insure that the electrode mounting hole is free of foreign matter. If required, use isopropyl alcohol to clean the rotor. Catch rinsate with a lint-free cloth.

- 7.5 Install the electrode from the rotor O.D., being sure to position the electrode flush with the rotor O.D. (outside diameter). Using the correct electrode length, and installing it correctly will assure a correct and repeatable arc gap. See fig. 14.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

7.0 ELECTRODE GEOMETRY & INSTALLATION (cont'd.)



Fig. 14

Install the electrode so the back end is flush with the rotor outside diameter.

Caution

Do not leave any part of the electrode protruding past the rotor O.D.

7.6 Two spare electrode set screws may be found in the weld head cover. See Fig. 15.

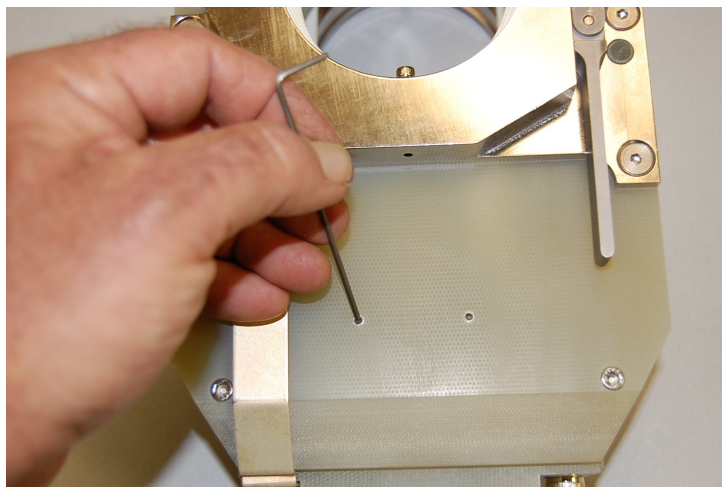


Fig. 15
Model 9-2500

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

8.0 SHIELDING GAS

The type of shielding gas used has a profound effect on the character of the arc and the depth of weld penetration. The most commonly used shielding gas and backup (I.D. purge) gas used is Argon. Gas mixtures of 95% Argon/5% hydrogen or 75% helium/25% argon are sometimes used to achieve deeper penetration. Consult the factory for recommendations.

8.1 The Model 9 series weld heads work best when the arc gas is set to the proper flow rate. Excessive flow rates can blow the arc, and flow rates set too low can cause excessive weld oxidation (discoloration) and electrode contamination. Use the Manual Purge button on the power supply to open the solenoid, and set the flow rate on your flow meter at your gas source.

8.2 Prepurge time and post purge time are also factors in minimizing weld oxidation and extending electrode life. Refer to chart below for recommended arc gas flow rates and minimum recommended pre & post purge times.

Note: The chart below (Fig.16) indicates the minimum recommended purge times. Using longer purge times will extend the life of the electrode and produce cleaner welds.

Model	Recommended Arc Gas Flow Rate (CFH)	Recommended Minimum Pre/Post purge times (seconds)
9-750	10-14 (21-29 LPM)	20
9-1500	15-25 (31-52 LPM)	20
9E-1500	25-35 (52-73 LPM)	20
9-2500	25-30 (52-63 LPM)	30
9E-2500	25-40 (52-84 LPM)	30
9-3500	25-30 (52-63 LPM)	30
9E-3500	30-45 (63-94 LPM)	30
9-4500	30-40 (63-84 LPM)	45
9E-4500	30-50 (63-105LPM)	45
9ER-4500	30-50 (63-105 LPM)	45
9-7500	30-40 (63-84 LPM)	60
9E-7500	40-60 (84-126 LPM)	60

Fig. 16

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

8.0 SHIELDING GAS (cont'd.)

Note: If the system is being hooked up for the first time, or if it has been a number of hours since it was last used, it's a good idea to initiate the Manual Purge button on the power supply to clear the lines of oxygen for a few minutes before initiating a weld sequence.

9.0 RETURN-TO-HOME (ROTOR) POSITION ADJUSTMENT

The Model 9 series weld heads will return the rotor to the "home" (open) position at the end of the weld program, after the post purge time has timed-out. A properly adjusted rotor will stop with both ends of the rotor flush or slightly recessed in the housing. A rotor that needs adjustment will either stop with one side of the rotor protruding out from the housing, or in a worst case, the rotor does not stop at all after it returns to home, in which case, the power supply would have to be shut down before attempting any adjustment. See fig. 17.

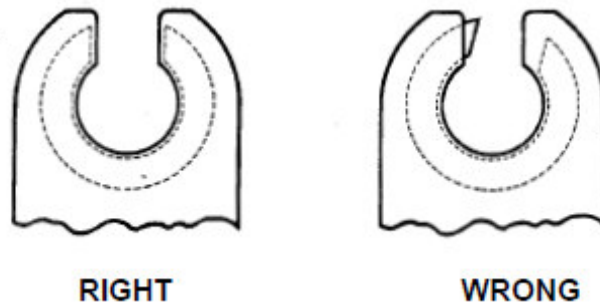


Fig. 17

Should your Model 9 require return-to-home adjustment, follow these steps:

- 9.1 Be sure the power supply is either turned off or in the "TEST" mode.
- 9.2 Remove the screws holding the lower of the two access covers over the return-to-home limit switch.
- 9.3 For Models 9-750 series and 9-1500 series heads, loosen the screw on the left that holds the return-to-home limit switch bracket. See fig. 18.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

9.0 RETURN-TO-HOME (ROTOR) POSITION ADJUSTMENT (cont'd.)

- 9.3.1 For Models 9-2500, 9-3500, 9-4500, 9-7500 and other heads in this series, loosen both screws that hold the return-to-home limit switch bracket. See fig.19.

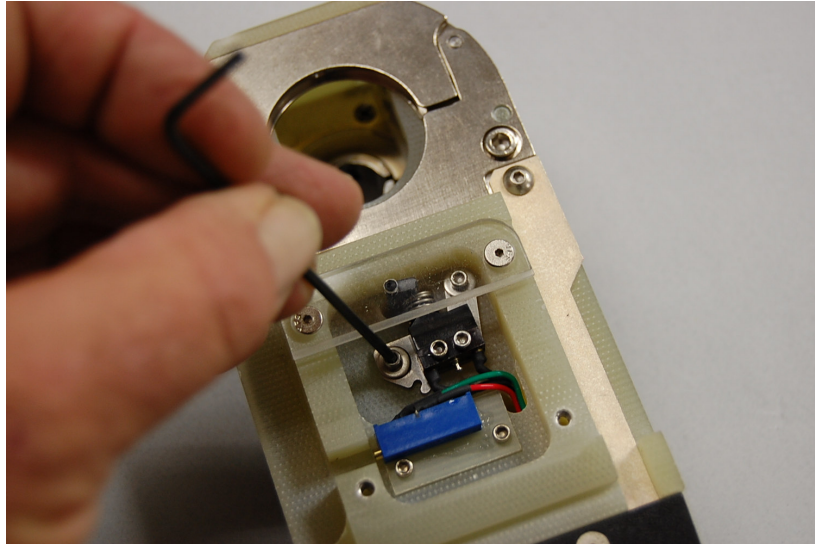


Fig. 18
(Models 9-750 & 9-1500 series weld heads.)

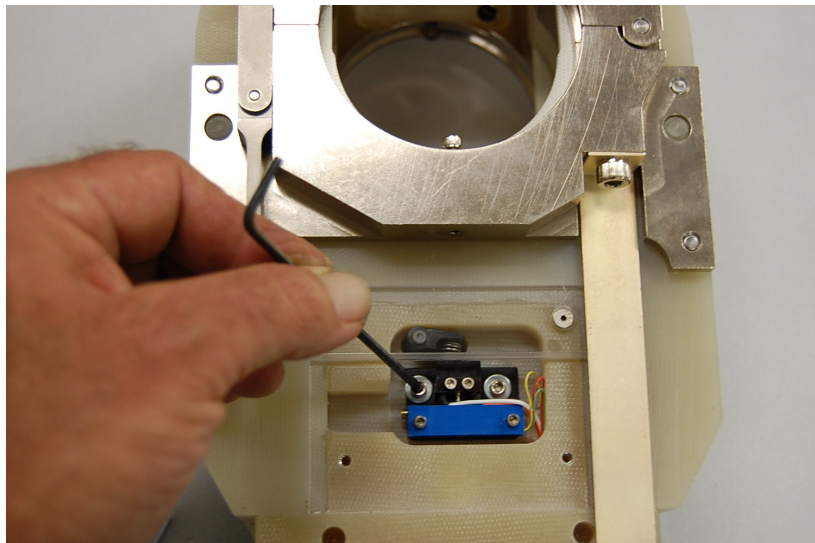


Fig. 19
(Models 9-2500, 9-3500, 9-4500 & 9-7500
series weld heads.)

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

9.0 RETURN-TO-HOME (ROTOR) POSITION ADJUSTMENT (cont'd.)

- 9.4 Slide the limit switch bracket very slightly toward the rotor, (to stop the rotor sooner) or very slightly away from the rotor (to stop the rotor later) and re-tighten the limit switch mounting bracket screw(s).
- 9.5 Turn on the unit, and open a weld schedule.
- 9.6 Be sure the machine is in the "TEST" mode, and be sure the rotor is safe to rotate. No tools or fingers in the way. Touch "START", then immediately touch "STOP". The rotor should return to the "HOME" position. Should the rotor not stop in the correct "HOME" position, repeat steps 9.3 – 9.6.
- 9.7 Replace the access cover(s).

10.0 CLEANING AND MAINTENANCE

All of the connectors at the end of the cable must be kept clean and free of grease, oil, dirt or other contaminants. Keep the cap on the electrical multi-pin connector when not in use.

From time to time, depending on the cleanliness of the tube/pipe being welded, the type and quality of the arc gas and the number of welds done, the rotor and weld head housing will build up soot, which should be cleaned on a regular basis.

- 10.1 Use isopropyl alcohol and Scotch Brite or steel wool to clean both brass (male and female) power and ground connectors. Rinse off all debris and dry before reconnecting.
- 10.2 After cleaning, use a small amount of o-ring lube, oil or grease on the female (brass) connector o-ring to facilitate easier connecting.
- 10.3. Use a clean lint-free cloth and isopropyl alcohol to clean the rotor, (black) rotor guide ring, weld head housing and view window.

MODEL 9 SERIES WELD HEAD OPERATION MANUAL

11.0 STORAGE

If the weld head has been used with water-cooling, and is to be stored for more than 1 month, the residual water or water/coolant mix should be purged from the hoses and weld head to minimize internal corrosion.

This is also important if the weld head is to be stored where the temperature might fall below freezing, as trapped water can freeze and damage weld head and/or hose internals.

Although you may not be storing the adapter and /or extension cables, leave them hooked up to the weld head when purging out the water.

- 11.1 To drain the coolant from the weld head and cables, use Arc Machines, Inc. fitting part number 294-PB-06. Unplug the water “supply” line from the cooling unit, (leaving the water “return” line connected to the cooling unit) and attach the (female) fitting (294-PB-06) to the disconnected “supply” line. See Fig. 20.



Fig. 20

- 11.2 Using a pressurized air source of maximum 20 PSI, (139 Kp) (1.38 Bar) blow air into the fitting to force the water out of the cables and weld head, and back into the cooling unit. See fig. 20.

**MODEL 9 SERIES WELD HEAD
OPERATION MANUAL**

11.0 STORAGE (Cont'd.)

**CAUTION, DO NOT USE AIR PRESSURE
ABOVE 20 PSI (139 Kp) (1.38 Bar)**

- 11.2 Attach the dust cap to the electrical connector, and store the weld head in a clean, dust-free area.
- 11.3 Store the head with the clamp housing latches un-latched.