WELD HEAD

THINLINE 80 SERIES

OPERATION MANUAL

990-121 REV L

REVISION RECORD

Revision	EO	Date	Basis of Revision
A	None	02/96	None. Original edition.
B	*Not Recorded*		Upgrade and add new equipment information.
C	17809	03/99	Change Hall Effect switch wire colors.
D	17791	02/99	Add 84SA/24 and 87SA/24.
E	19339	10/01	Major revision/reformat.
F	21776	05/08	Update to Miyachi America logo, and added new CAUTION information.
G	21853	08/08	Updated reflow information, specifications, & accessories.
H	42860	10/13	Updated to Miyachi America name and logo.
J	43207	03/15	Updated technical information. Updated to Amada Miyachi America name and logo.
K	43866	08/15	Updated to Amada Miyachi America format.
L	44244	05/16	Updated technical information

CONTENTS

CONTENTS (Continued)

CONTACT US

Thank you for purchasing a Amada Miyachi America™ Thin-Line® Series 80 Weld Head.

Upon receipt of your equipment, please thoroughly inspect it for shipping damage before its installation. Should there be any damage, please immediately contact the shipping company to file a claim, and notify us at:

Amada Miyachi America
1820 South Myrtle Avenue
Monrovia, California 91016
Phone: (626) 303-5676
FAX: (626) 358-8048
E-mail: info@amadamiyachi.com

The purpose of this manual is to supply operating, maintenance and service personnel with the information needed to properly and safely operate and service the Thin-Line® Series 80 Weld Heads.

We have made every effort to ensure that the information in this manual is accurate and adequate. Should questions arise, or if you have suggestions for improvement of this manual, please contact us at the above location/numbers.

Amada Miyachi America is not responsible for any loss due to improper use of this product.

SAFETY WARNINGS

DANGER

DEATH ON CONTACT may result if you fail to observe the safety precautions labeled on the equipment and noted on this page.

WARNING

HIGH VOLTAGE is used in the operation of this equipment.

CAUTION

Do ***not*** modify the electrode holders or attach additional mechanisms to the moving parts of the head. Doing so may hurt welding performance, damage the head, and ***void the warranty***.

- ***Never*** work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment, and who is competent in administering first aid. The technician who is aided by operators must warn them about the hazards.
- Whenever possible, turn the power supply to the equipment **OFF** before beginning work on it.
- Do ***not*** touch high-voltage connections, including input power connections, when installing or operating the equipment.
- Do ***not*** be misled by the term "low voltage." Potentials as low as 50 volts can be lethal under certain conditions.

LIMITED WARRANTY

1. (a) Subject to the exceptions and upon the conditions set forth herein, Seller warrants to Buyer that for a period of one (1) year from the date of shipment ("**Warranty Period**"), that such Goods will be free from material defects in material and workmanship.

(b) Notwithstanding the foregoing and anything herein to the contrary, the warranty set forth in this Section 1 shall be superseded and replaced in its entirety with the warranty set forth on **Exhibit A** hereto if the Goods being purchased are specialty products, which include, without limitation, laser products, fiber markers, custom systems, workstations, Seller-installed products, non-catalogue products and other custom-made items (each a "**Specialty Products."**

(c) EXCEPT FOR THE WARRANTY SET FORTH IN SECTION 1(A), SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

(d) Products manufactured by a third party and third party software ("**Third Party Product**") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in Section 1(a). For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer's sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party's warranty.

(e) Seller shall not be liable for a breach of the warranty set forth in Section 1(a) unless: (i) Buyer gives written notice of the defect, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods; (iii) Buyer (if requested to do so by Seller) returns such Goods (prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016or to such other location as designated in writing by Seller) to Seller pursuant to Seller's RMA procedures and Buyer obtains a RMA number from Seller prior to returning such Goods for the examination to take place; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective and that the defect developed under normal and proper use.

(f) Seller shall not be liable for a breach of the warranty set forth in Section 1(a) if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller's own service personnel, or an authorized representative's personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

(g) All expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

(h) Subject to Section 1(e) and Section 1(f) above, with respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: (i) repair or replace such Goods (or the defective part) or (ii) credit or refund the price of such Goods at the pro rata contract rate, provided that, if Seller so requests, Buyer shall, at Buyer's expense, return such Goods to Seller.

(i) THE REMEDIES SET FORTH IN SECTION 1(H) SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN SECTION 1(A). Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

Exhibit A
Warranty for "Specialty Products"

Limited Warranty

EXCEPT FOR THE WARRANTY SET FORTH BELOW IN THIS EXHIBIT A, SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

Warranty Period: The Warranty Period for Specialty Products is for one (1) year, and the Warranty Period for laser welders and laser markers is two (2) years (unlimited hours), and the Warranty Period for the laser pump diodes or modules is two (2) years or 10,000 clock hours, whichever occurs first (as applicable, the "**Warranty Period**"). The Warranty Period begins as follows: (i) on orders for Goods purchased directly by Buyer, upon installation at Buyer's site or thirty (30) days after the date of shipment, whichever occurs first; or (ii) on equipment purchased by a Buyer that is an OEM or systems integrators, upon installation at the end user's site or six (6) months after the date of shipment, whichever occurs first.

Acceptance Tests: Acceptance Tests (when required) shall be conducted at Amada Miyachi America, Inc., Monrovia, CA, USA (the "**Testing Site**") unless otherwise mutually agreed in writing prior to issuance or acceptance of the Acknowledgement. Acceptance Tests shall consist of a final visual inspection and a functional test of all laser, workstation, enclosure, motion and accessory hardware. Acceptance Tests shall include electrical, mechanical, optical, beam delivery, and software items deliverable under the terms of the Acknowledgement. Terms and conditions for Additional Acceptance Tests either at Seller's or Buyer's facility shall be mutually agreed in writing prior to issuance or acceptance of the Acknowledgement.

Performance Warranty: The system is warranted to pass the identical performance criteria at Buyer's site as demonstrated during final Acceptance Testing at the Testing Site during the Warranty Period, as provided in the Acknowledgement. Seller explicitly disclaims any responsibility for the process results of the laser processing (welding, marking, drilling, cutting, etc.) operations.

Exclusions: Seller makes no warranty, express or implied, with respect to the design or operation of any system in which any Seller's product sold hereunder is a component.

Limitations: The limited warranty set forth on this Exhibit A does not cover loss, damage, or defects resulting from transportation to Buyer's facility, improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the equipment, or improper site preparation and maintenance. This warranty also does not cover damage from misuse, accident, fire or other casualties of failures caused by modifications to any part of the equipment or unauthorized entry to those portions of the laser which are stated. Furthermore, Seller shall not be liable for a breach of the warranty set forth in this Exhibit A if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller's own service personnel, or an authorized representative's personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

Seller further warrants that all Services performed by Seller's employees will be performed in a good and workmanlike manner. Seller's sole liability under the foregoing warranty is limited to the obligation to re-perform, at Seller's cost, any such Services not so performed, within a reasonable amount of time following receipt of written notice from Buyer of such breach, provided that Buyer must inform Seller of any such breach within ten (10) days of the date of performance of such Services.

Seller shall not be liable for a breach of the warranty set forth in this Exhibit A unless: (i) Buyer gives written notice of the defect or non-compliance covered by the warranty, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect or non-compliance and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods and (a) Buyer returns such Goods to Seller's place of business at Buyer's cost (prepaid and insured); or (b) in the case of custom systems, Seller dispatches a field service provider to Buyer's location at Buyer's expense, for the examination to take place there; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective or non-compliant and the defect or non-compliance developed under normal and proper use.

All consumable, optical fibers, and expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

No warranty made hereunder shall extend to any product whose serial number is altered, defaced, or removed.

Remedies: With respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: repair such Goods (or the defective part). **THE REMEDIES SET FORTH IN THE FOREGOING SENTENCE SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN THIS EXHIBIT A.** Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

Products manufactured by a third party and third party software ("**Third Party Product**") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in this Exhibit A. For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer's sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party's warranty.

CHAPTER 1:
SYSTEM DESCRIPTION

Section I. Features

Overview

This manual is organized to assist you in getting productive quickly with your THIN-LINE® Series 80 Weld Head. *Chapter 1* describes the equipment, *Chapter 2* describes installation, *Chapter 3* describes operating procedures so you can run the weld head safely and efficiently, and *Chapter 4* describes maintenance and troubleshooting procedures.

Series 80 Weld heads come in different sizes and configurations and may be installed on Miyachi Unitek mounting hardware, custom mounting posts, or installed directly on your equipment using the two tapped holes on the rear of the weld head. Some heads are manually-actuated, others are air-actuated. Mounting templates and all necessary installation hardware are shipped with each weld head.

Miyachi Unitek THIN-LINE Series 80 are precision, low inertia, force-fired Weld Heads with a narrow vertical profile. The 1-3/4 inch (4.5 cm) width, 1 in. (2.5 cm) stroke, 20-40 pound (89-178 N) maximum force range, and throat depth allow their use in a wide variety of precision resistance welding applications. Both in-line and offset electrode holders are available. The dimensions of the mounting post and the main shaft have been selected to ensure that the electrodes do not "wipe" more than 0.003 in. (0.076 mm) on the 20 lb. (89 N) heads and 0.004 in. (0.102 mm) on the 40 lb. (178 N) heads. This is an important consideration in critical welding applications such as hermetic seals and pressure transducers.

The Series 80 is a "production line" head with a bearing life designed for a minimum of 20 million operations. Miyachi Unitek Weld Heads excel at precisely placing consistent, high quality welds. Their low inertia, lightweight design assures fast dynamic response, allowing the electrodes to follow the minute expansion and contraction of the weld joint as it heats and cools during the welding cycle. A differential motion Force-Firing System initiates the power source at the precise moment the Preset Firing Force is applied to the workpieces. Linear ball bearing bushings and an oversized, anti-rotational bearing system provide true, vertical in-line electrode motion, assuring smooth vertical travel of the upper electrode arm. This system minimizes the wiping action of the electrodes, even at maximum force settings.

Preset Firing Force

Firing force is continuously adjustable from 8 ounces (0.22 kg), 4 ounces (0.11 kg), 20 lbs. (89 N), or 40 lbs. (178 N) depending on the model. An adjustable Tare Spring on 20 lb. (89 N) models compensates for the weight of the electrode holders. The Firing Force Adjustment Cam easily adjusts the sensitivity of the Firing Force Switch.

Up And Down Stops

Series 80 Heads have adjustable Upstops and Downstops. The Downstop can be used to limit excessive downward travel. The Upstop controls the stroke, and consequently, the travel time of the head. In automated machine applications, using a stroke of less than 1/8 in. (3.2 mm) may significantly reduce bearing life. On air-actuated heads, *EZ-Air* prevents overforce.

Electrodes

Series 80 Weld Heads accept a wide variety of standard and special purpose electrodes. There are models available, which accept 1/8 in. (3.2 mm) or 1/4 in. (6.4 mm) diameter electrodes, 0.245 in. (6.3 mm) diameter eccentric electrodes, Unibond7, and Unitip7 Electrodes. The electrode holder on the Model 87 accepts Unitip electrodes and reflow soldering thermodes. The optional Model ETB4 Table Electrode fits Models 80, 84, 86, and 87.

Insulation

The Terminal Block, Flexible Copper Strap, and Upper Electrode Assembly are electrically insulated from the frame of the Weld Head. The Frame, Support Post, and Support Base are grounded to the bench top.

Welding Cables

Depending upon model, either #2 or #2/0 Welding Cables are provided to connect Series 80 Heads to the power source. Miyachi Unitek Heads deliver maximum performance when used with the appropriate Miyachi Unitek power sources.

Footpedal Actuation

The Series 80 Weld Heads, model number suffix "F," are footpedal (manually) actuated. Miyachi Unitek offers two different footpedal styles:

1 The Model CP Cable Pedal is a treadle-type cable actuator providing an approximate 3 to 1 mechanical advantage. This pedal is used with Models 80F, 86F, and 87F.

2 The Model MSP, Swing Action Footpedal, provides an approximate 5 to 1 mechanical advantage and is used with the Model 83F, 84F, 88F and 89F.

Air Actuation

Series 80 Weld Heads are equipped with two different types of air-actuation:

- **Standard Air-Actuation**
- **EZ-AIR®**

Standard Air-Actuation

Model 80A/115, 80A/24, 82A/115, 82A/24, 83A/24, 84A/24, 84A/115, 86A/115, 86A/24, 86ARE/24, 87A/115, 87A/24, 88A/115, 88A/24, and 89A/24 are equipped with a top mounted Air Cylinder with two Flow Controls, one or two Air Pressure Regulators, and a four-way Solenoid, making it easy to incorporate these weld heads into automated welding systems. The Air Solenoid Valve is available with either 24 volt, which is standard, or 115 volt AC ratings. Two Flow Controls are used to adjust the up and down speed of the upper electrode. The Air Solenoid Valve can be energized by most of the Miyachi Unitek power sources, or by a Model FSAC Footswitch. The Footswitch can be a single or two level type, dependent upon the power supply and the user's preference. Amada Miyachi America suggests that lubricators not be used in "clean" environments. However, the user will then be required to periodically put a few drops of oil in the cylinder. Some users use lubricators, some do not.

EZ-AIR™

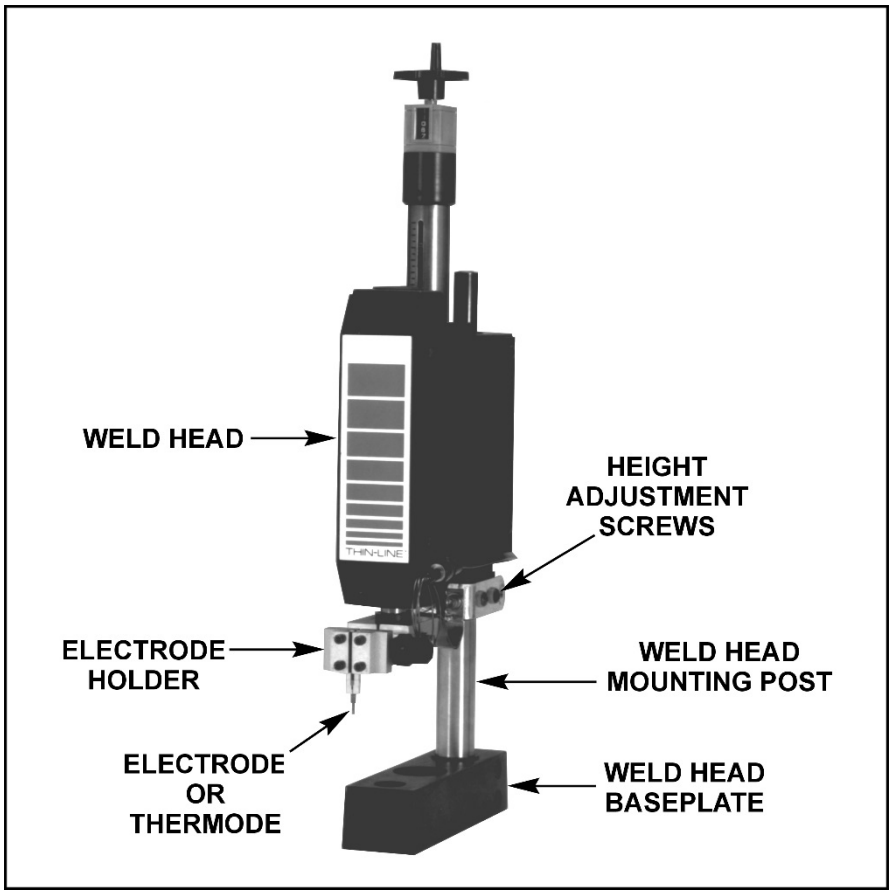
Model 80A/EZ, 86A/EZ, and 89A/EZ weld heads are equipped with factory-installed EZ-AIR, a Miyachi Unitek pneumatic control that actuates the electrodes and maintains a preset firing force. At a predetermined firing force, EZ-AIR closes the inlet and outlet valves to the weld head actuation cylinder and eliminates over-force. Series 80 air-actuated heads are easy to incorporate into automated welding systems. EZ-AIR can be energized by most of the Miyachi Unitek power sources, or by a Model FSAC Footswitch. The Footswitch can be a single or two-level type, dependent upon the power supply and the user's preference. For EZ-AIR instructions, see the separate EZ-AIR Operator Manual supplied with the weld head.

Reflow Soldering

Models 87SA and 84SA are designed specifically for Reflow Soldering.

If you have questions about reflow soldering contact your Amada Miyachi America representative, or visit the Amada Miyachi America website listed in the front of this manual for assistance.

Section II. System Components



Typical Series 80 Weld Head

Model 80A and 80F

These are conventional, 20 lb. (89 N) capacity welding heads with offset, opposed electrodes. Both the pedestal mounting (post) and lower electrode assembly can be removed and replaced by custom fixtures. All air actuated heads in the 80 Series are available with either 24 volt, 50/60 Hz. (Model 80A/24) or 115 volt, 50/60 Hz. (Model 80A/115) solenoids. The 24 volt solenoid is the standard option. The 115 volt solenoid does not comply with safety standards in some countries. Model 80 is supplied with one pair ES0450, 1/8 in. (3.2 mm) diameter Glidcop7 Straight electrodes. Glidcop is a registered trademark of Glidden Metals Company.

Model 80FLF

This model has a force range which can be set between 4 ounces (1.1 N) and 10 lbs. (45 N). It is assembled so that it can be used in applications which require very low, precise welding forces.

Model 82A

This model is designed for automated and special applications requiring custom mounting configurations and custom lower electrode fixtures. Rugged in-line electrode design eliminates upper electrode deflection, the cause of wiping action, and permits a maximum welding force of 40 lbs. (178 N). The Model 82 is supplied with one ES0850, Glidcop, 1/4 in. (6.4 mm) diameter Straight Electrode.

Model 83A and 83F

These are 40 lb. (178 N) welding heads with in-line, opposed electrodes. The lower electrode assembly can be removed and replaced by a custom fixture. Model 83 is supplied with one pair ES0850, 1/4 in. (6.4 mm) diameter Glidcop Straight electrodes.

Model 84A and 84F

These are 40 lb. (178 N) welding heads with offset, opposed electrodes. The lower electrode assembly can be removed and replaced by a table electrode or a custom fixture. Model 84 is supplied with one pair ES0850, 1/4 in. (6.4 mm) diameter Glidcop Straight electrodes.

Model 86A and 86F

These models feature Parallel Gap Weld Heads which are used for fine wire or ribbon bonding and parallel gap reflow soldering applications. They feature an easily read, high-resolution, digital force indicator that permits accurate resetting of force values. The Model 86 includes a voltage sensing and thermocouple adapter cable.

Compliant electrode holders allow the electrodes to conform to uneven workpiece surfaces. The Model 86 is supplied with Model EU1000, RWMA 2 Unibond Electrodes. Unitip Electrodes should ***not*** be used with the air actuated Model 86A, since any misadjustment of the Down Speed Flow Control would probably damage the delicate tip of the electrode. The Model 86FRE's Electrode Holders hold 1/8 in. (3.2 mm) diameter EO0400 Series Offset Electrodes. It is supplied with one pair of EO0402 RWMA 2 Offset Electrodes.

Model 87A and 87F

Reflow Soldering Heads use a variety of pulse heated elements, called thermodes, to reflow solder electronic components to pre-tinned printed circuit boards. The Model 87F can also be used with Unitips. As previously stated, Unitips are not recommended for use with air actuated heads. Solid electrode holders provide dimensional stability and high current carrying capacity. The 87F features an easily read, high resolution, digital force indicator that permits the accurate resetting of force values. The Model 87A and 87F include a voltage sensing and thermocouple adapter cable, which allows them to be used with both Unibond and Uniflow Controls. Model 87 Heads are not supplied with electrodes or thermodes.

Model 88A and 88F

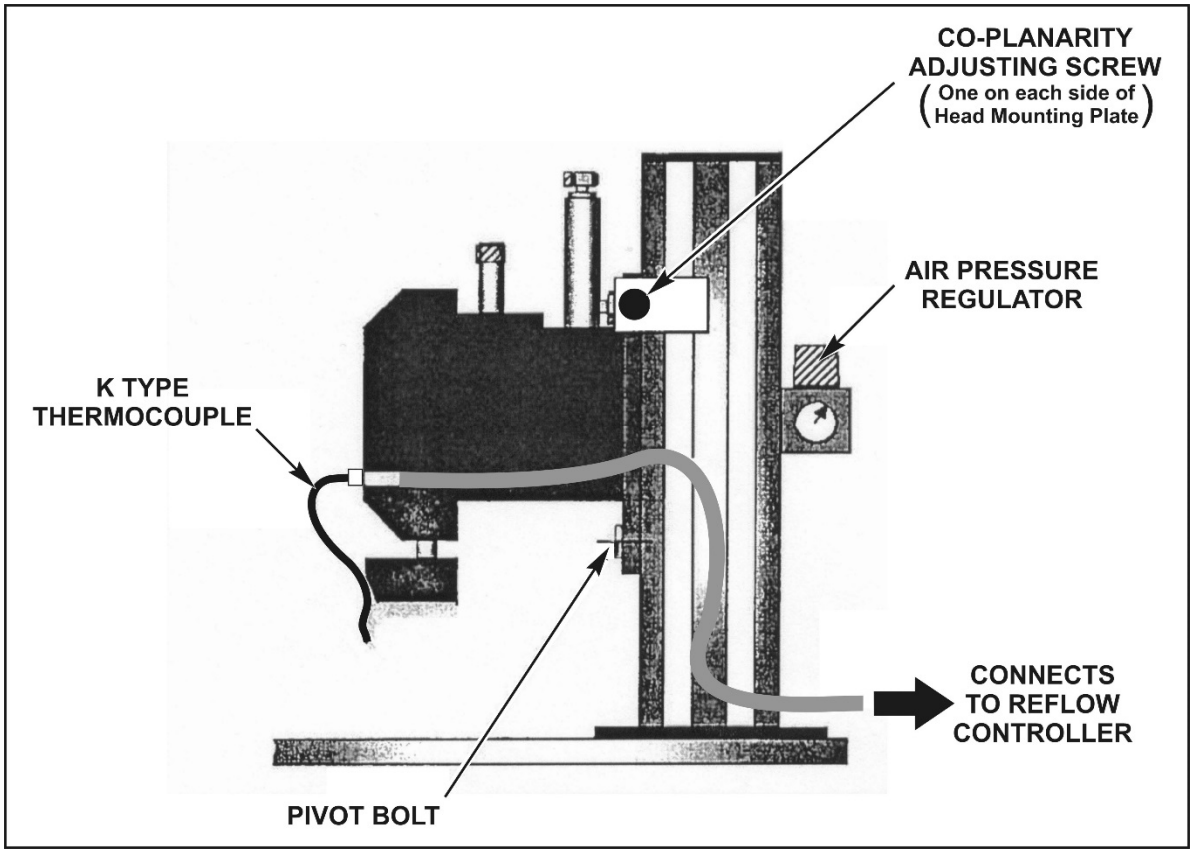
These are designed to function as either a series or a parallel weld head. The Electrode Holders are designed to hold eccentric electrodes which can be rotated, parallel to their length and adjusted with the electrode holders, so that the separation between the electrode faces is from 0.00-0.330 in. (0.0-8.4 mm). The welding force on each electrode can be independently set between 0.5-20 lbs. (2.2-89 N). The 88A is supplied with two regulators and four flow controls that allow the force and the speed of each electrode to be controlled independently. Model 88 Heads are supplied with one pair of ES0850E, Glidcop Eccentric Electrodes.

Model 89A and 89F

These are designed to function in the same manner as the Model 88 Heads. The force range of the Model 89A and 89F are adjustable from 6-40 lbs. (27-178 N), and 4-40 lbs. (18-178 N), respectively. Model 89 Heads are supplied with one pair of ES0850E, Glidcop Eccentric Electrodes.

Models 87SA and 84SA

Models 87SA and 84SA are designed specifically for high-precision reflow soldering. It contains a Model 17TDLB413 mounting block which can hold any of the TD series of thermodes. It also contains two co-planarity adjustments for consistent distribution of thermode pressure on the bonding surface.



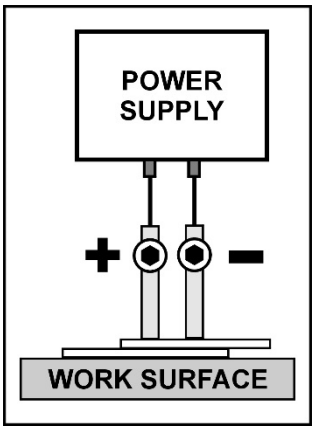
Models 87SA/84SA with Co-Planarity Adjustments and # 17TDLB413 Mounting Block

Models 87SA and 84SA are similar to the Models 87A and 84A, respectively, except they are designed specifically for high-precision reflow soldering. The 87SA includes a Model I7TDSB 177 mounting block and the 84SA includes a Model 17TDMB256 mounting block. The former can hold any thermode up to 1.5 in./38.lmm in length; the latter can hold any thermode up to 2.5 in./63.5mm in length. Both models also contain two co-planarity head adjustments, for consistent distribution of thermode pressure on the bonding surface, and an air cooling valve assembly, to accelerate cooling of the bonded pieces.

Both head modules incorporate a standard air cooling valve to accelerate cooling of the bonded pieces. The air cooling valve assembly plugs directly into the Uniflow controller. To actuate the solder cool valve, the user ***must*** turn the solder cool valve on during set up. The solder cool valve will then actuate the solenoid assembly at the end of the reflow period until the thermode temperature reaches the previous or cooling temperature, whichever is the lowest.

Section III. Welding Capabilities

Series Welding

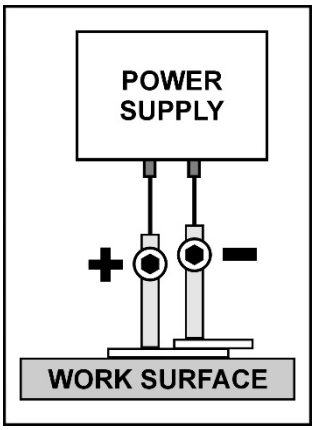


In series welding applications, both electrodes contact the *same* surface of each workpiece. The weld current flows from one electrode through the workpiece to the other electrode. This technique is used to weld workpieces which have only one surface accessible.

The work surface, or a user supplied fixture, acts as a support for the workpieces in series welding. If the Table is insulated from the workpieces, there is no possibility of shunting current away from the (-) electrode.

To use the Model 88 or 89 Weld Heads in the series welding mode, you ***must*** use the **Model DFS/88** Series Firing Switch Junction Box which is supplied with the head.

Step welding



In step welding, the size of the weld and the surface marking is frequently controlled by the diameter of the face of each electrode. If the (+) Electrode is significantly larger than the (-) Electrode the lower workpiece will not have any marking and the weld will be under the (-) Electrode.

The Table Electrode, or a user supplied fixture, acts as a support for the workpieces in step welding.

If the Table is insulated from the workpieces, there is no possibility of shunting current away from the (-) electrode.

Section IV. Operating Controls

Series 80 Air Actuation Specifications

PARAMETER / MODEL	80A, 86A, 87A, 88A	82A, 83A, 84A, 89A
Input Air Pressure - Nominal / Maximum	65/100 psi (448/690 kPa)	65/100 psi (448/690 kPa)
Regulator Output - Maximum	65 psi (448 kPa)	65 psi (448 kPa)
Cycle Rate (full strokes/sec) at Min. Force at greater than 20% of Rated Force	1.0 2.5	1.0 2.5
Solenoid Valve Voltage (AC volts)	24V Standard 115V Optional	24V Standard 115V Optional
Air Cylinder Inside Diameter	0.75 in. (1.9 cm)	1.0625 in. (2.7 cm)

Air Cylinders

The Model 88A and 89A use two air cylinders, two air pressure gauges, two air pressure regulators, and four flow controls. All other models are supplied with a one air cylinder, one air pressure gauge, one air pressure regulator, and two flow controls. The Air Solenoid, which controls the direction of air flow to the Air Cylinder, is available with either 24 volt (standard) or 115 volt 50/60 Hz. ratings. The Flow Controls allow independent adjustment of the up and downspeed of the upper electrode. The Solenoid and Regulator Assembly mounts on the spine of the Weld Head.

Hall Effect Limit Switch Option

Air actuated Heads which are equipped with magnetic pistons and a Hall Effect Limit Switch contain an "HS" in their model number, for example: 80A**HS**/24. The Hall Effect Switch only operates with stainless steel pneumatic cylinders equipped with internal magnets on the pistons. By accurately sensing the magnetic field of the piston when it passes beneath the Sensor, the position of the rod piston is determined, and a feedback signal is created which can be used by the user to detect when the Head is in the ***up*** position.

The magnetic piston surrounds the rod at the top of the piston. The Hall Effect Sensor, which uses solid state circuitry, mounts at any position around the exterior of the cylinder. It requires the user to supply 5 to 28 VDC as illustrated. The parts required to retrofit an existing Head to include this feature are described in *Chapter 2, Section IV, Install Optional Equipment*.

ELECTRICAL SPECIFICATIONS HALL EFFECT LIMIT SWITCH	
Output Type	Open Collector - current sink
Input Voltage (V_{in})	5 to 28 VDC
Input Current	25 Ma maximum
Output Voltage Drop	0.4 VDC maximum
Output Current	0.3 $V_{IN,}$ m00 mA maximum
Power Dissipation	300 mW maximum
Circuit Protection	Reverse polarity, transient voltage and false pulse protected

Footswitches

A one-level Footswitch actuates the head, and the Firing Switch in the head initiates the welding sequence. The first level of a two-level Footswitch actuates the head. The second level and the Force Firing Switch initiate the welding sequence. A two-level Footswitch is recommended when the operator is required to position the workpieces. It also allows the operator to actuate an air head without initiating the weld cycle since both the Firing Switch ***and*** the second level of the Footswitch must close before the weld portion of the sequence can begin.

CHAPTER 2
INSTALLATION

Section I. Introduction

Overview

Before you start installation, become familiar with the specific model you are using. As shown below, Series 80 Weld heads come in different sizes and configurations which require different mounting baseplates, mounting posts, and installation hardware.

Installation procedures depend on the size and configuration of a specific model, and whether the weld head, mounting post, and baseplate were shipped as separate pieces requiring assembly or shipped from the factory fully assembled. Some manually-actuated heads are shipped with foot pedals attached, others are not. Some air-actuated heads are shipped with the air head attached, others are not.

Despite differences from model-to-model, the installation principle is the ***same*** for each head:

- If not already attached, the weld head mounting post is attached to the baseplate.
- The weld head mounting baseplate is bolted securely to a workbench.
- The weld head is attached to the mounting post.
- If necessary, the air head (if used), foot pedal (if used), and optics (if used) are installed.
- Electrodes and weld cables are installed on the weld head.

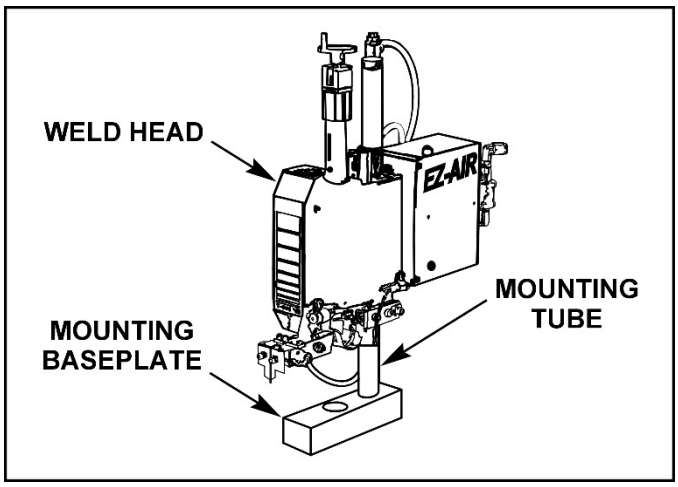
Mounting Posts

Series 80 weld heads may be purchased with or without mounting hardware. Amada Miyachi America provides three types of mounting posts (and corresponding installation hardware) designed for different models:

Mounting Tube

Smaller Series 80 Weld Heads are installed on short mounting tubes. These are factory-installed and do not require any assembly by the user.

Mounting tubes come in fixed lengths, the height of the weld head is not adjustable.



Dual-Post

This consists of two parallel posts connected at the top and bottom, leaving an open slot for the full length of the post. The mounting screws are installed from the back of the post and screwed directly into the weld head. The mounting screws can be loosened from the back of the post for adjusting the height of the weld head.

Channeled Post

This is an extruded aluminum post with channels on the front and back. By inserting T–Nuts into the channels, mounting plates can be screwed onto the front (for weld head), back (for air head), or both sides of the post (only the weld head is shown). This installation allows you to adjust the height of the weld head and air head separately.

Section II. Weld Head Installation

Overview

First, this section will give "Typical Installation" instructions that are common to ***all*** Series 80 weld heads. Then, additional instructions for installing ***specific*** weld head models are listed by model number. ***Before you start installation***:

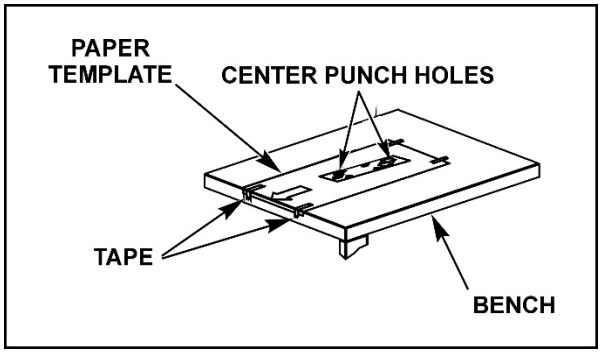
- Make sure you are familiar with the mounting configurations and installation hardware described and illustrated in this section.
- Read the *Typical Installation* instructions **and** the instructions for the *specific* weld head you want to install.
- Make sure you have all necessary parts and mounting hardware. Use the shipping list as a reference. Verify that the paper mounting template corresponds to the model number of the weld head. If you do ***not*** have the correct template, contact Amada Miyachi America at the address shown in the front of the manual.

Typical Installation

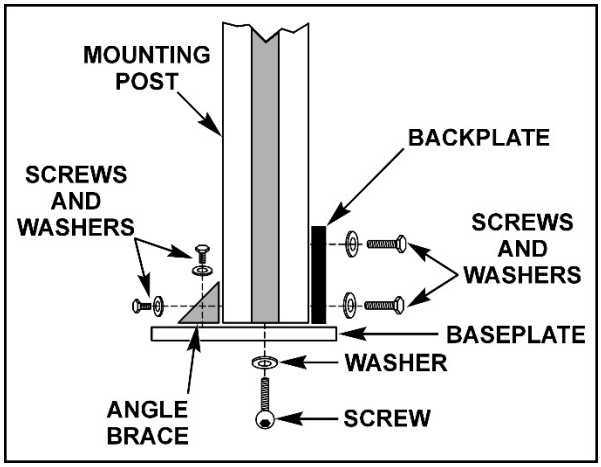
NOTE: Allow sufficient working space, usually 8-10 in. (20.32-25.4 cm), between the front edge of the bench and the mounting base. This allows the operator to use the bench as a support when positioning the workpiece.

1 Place the mounting template in the desired location on the workbench and tape it in place.

2 Drill the mounting holes as shown on the template.

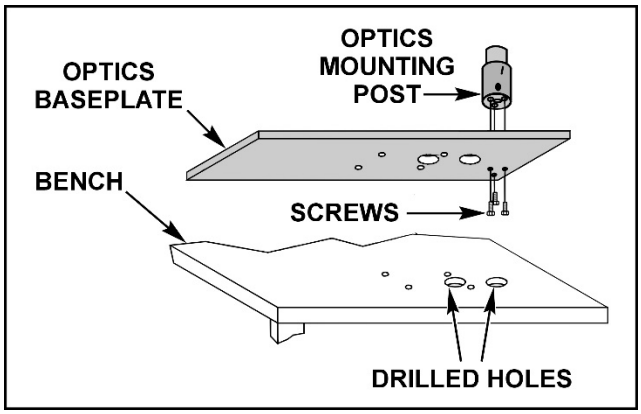


3 If necessary, install the weld head mounting post to the baseplate.

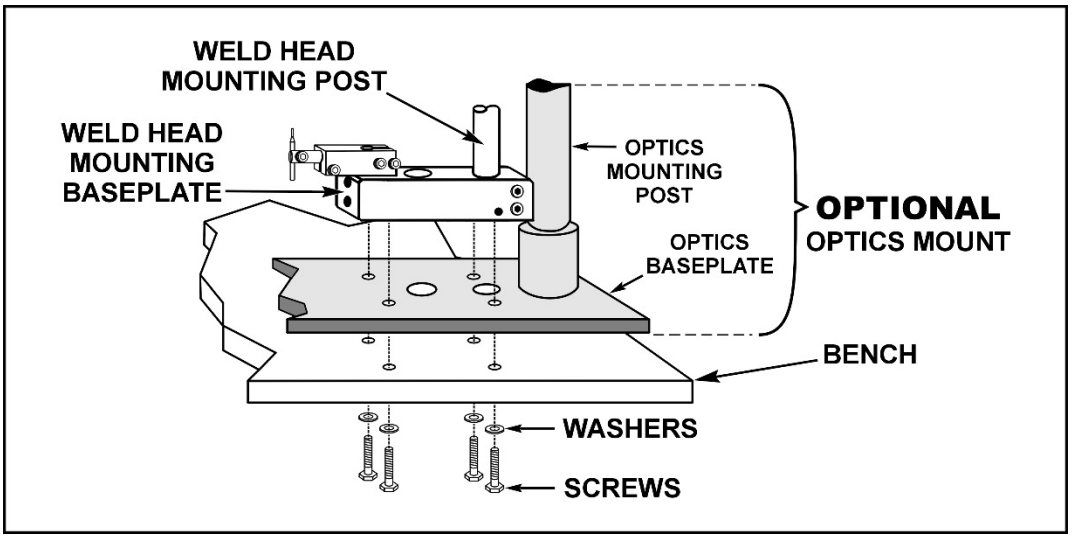


4 If you are using optics (microscope and/or illuminator), screw the optics mounting post to the optics baseplate (if not already installed).

NOTE: Follow the assembly instructions provided with the Optics. If necessary, drill holes in the Optics baseplate in order to accommodate the screws used to mount the weld head.



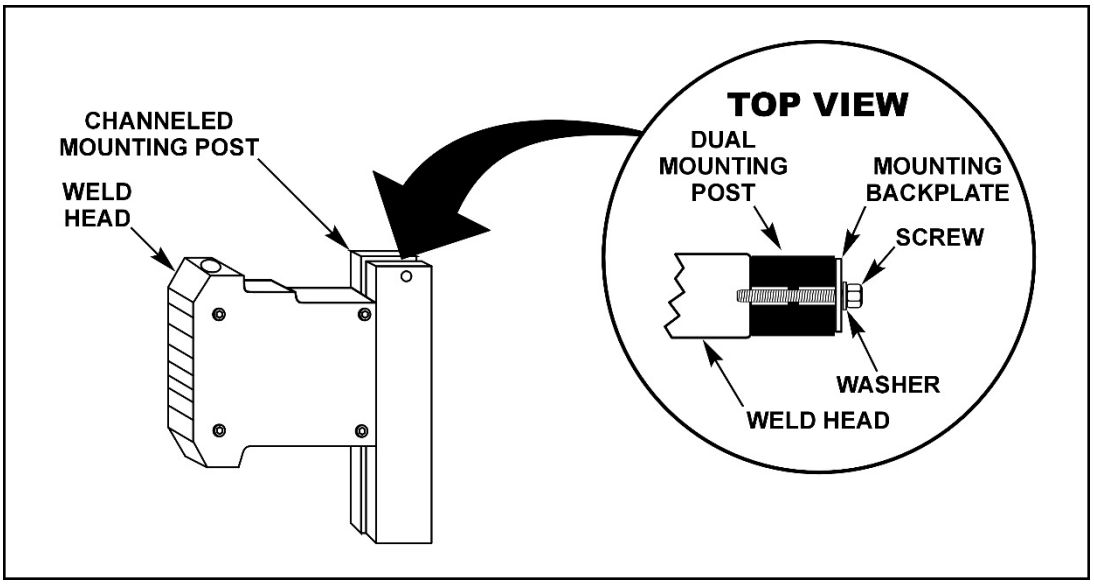
5 If not already attached, install the weld head mounting post to the weld head baseplate.



6 Screw the weld head mounting baseplate (and optics baseplate if used) to the workbench.

NOTE: If you are using optional optics (microscope/illuminator), install the optics baseplate between the workbench and the weld head mounting baseplate.

7-A Install the weld head on the **Dual-Post**.

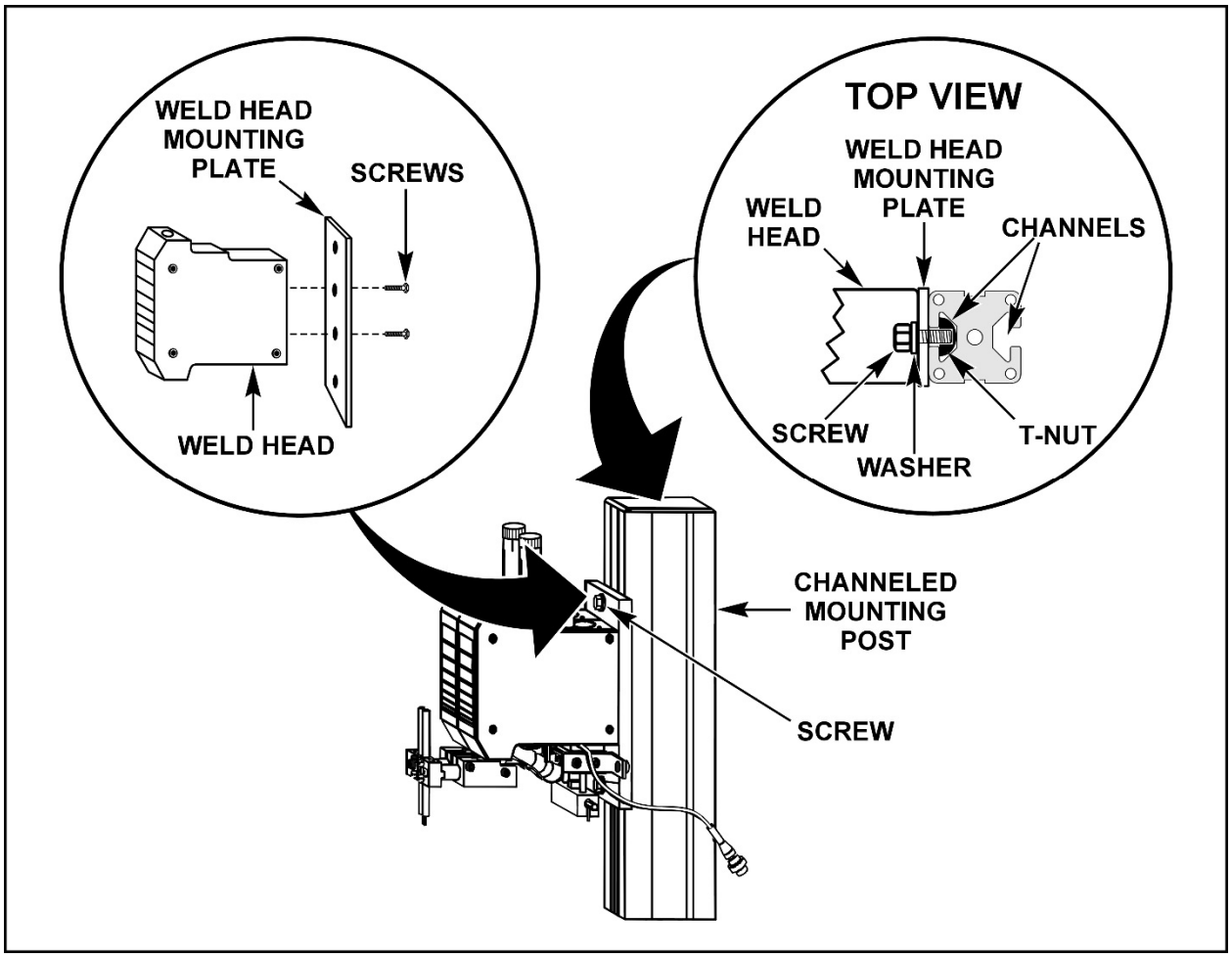


A) Install the mounting screws and washers onto the mounting backplate.

B) Place the weld head on the front of the mounting post, then insert the mounting screws through the slot in the back of the mounting post and screw them into the weld head.

C) Adjust the weld head to the desired height, then tighten the mounting screws.

7-B Install the weld head on the **Channeled-Post**.



A) Install the weld head mounting plate onto the weld head using the screws as shown.

B) Install the screws, washers, and T-nuts into the weld head mounting plate as shown.

C) If necessary, remove the end cap from the mounting post to expose the channels in the mounting post.

D) Raise the weld head and mounting plate above the mounting post, insert the bottom T-nut into the front channel of the mounting post, and slowly lower the weld head until you can insert the top T-nut into the channel. Slide the weld head to the desired height, then tighten the mounting screws.

E) If you are using an air head, install it on the rear of the mounting post following the procedures in Steps A through D.

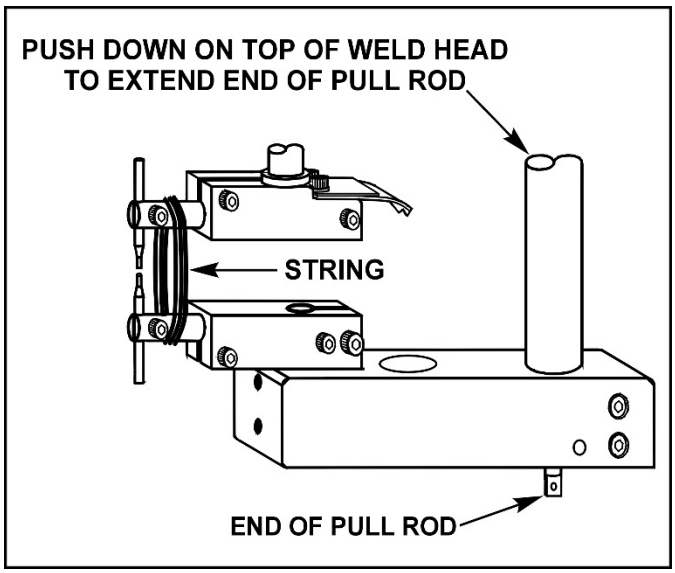
Model 80F, 86F, and 87F Model CP Footpedal Installation

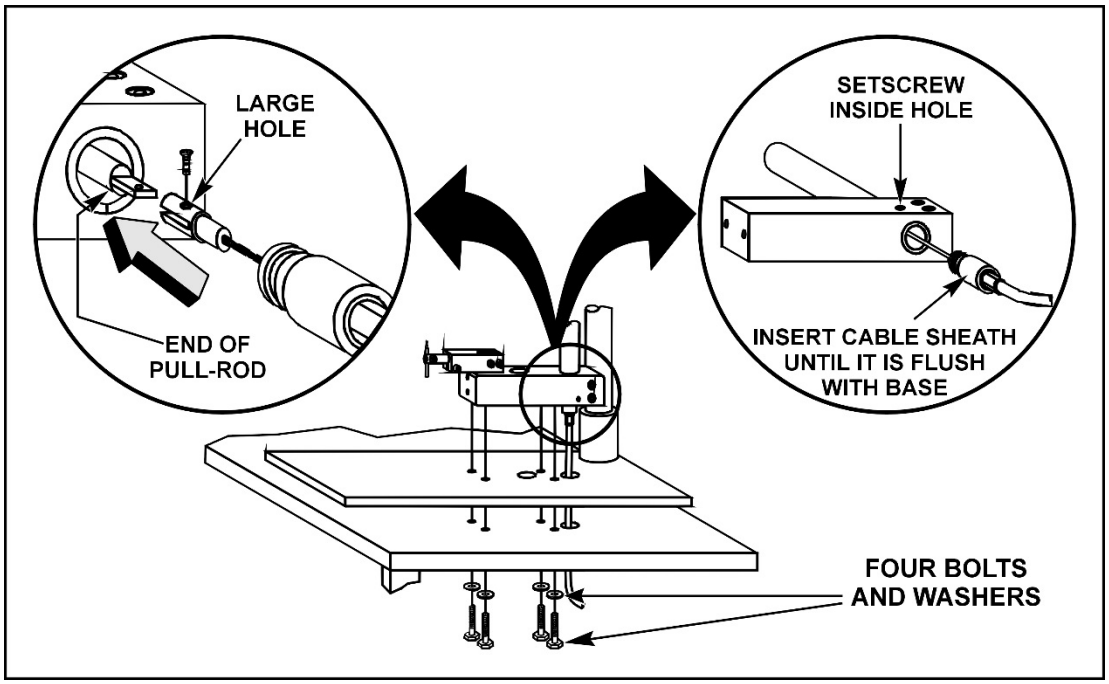
1 Push down on top of weld head to extend end of pullrod.

2 Secure Electrode Holders with string to hold in place.

3 Position head (and optional baseplate) on bench as shown.

4 Route footpedal cable up through bench (and baseplate).



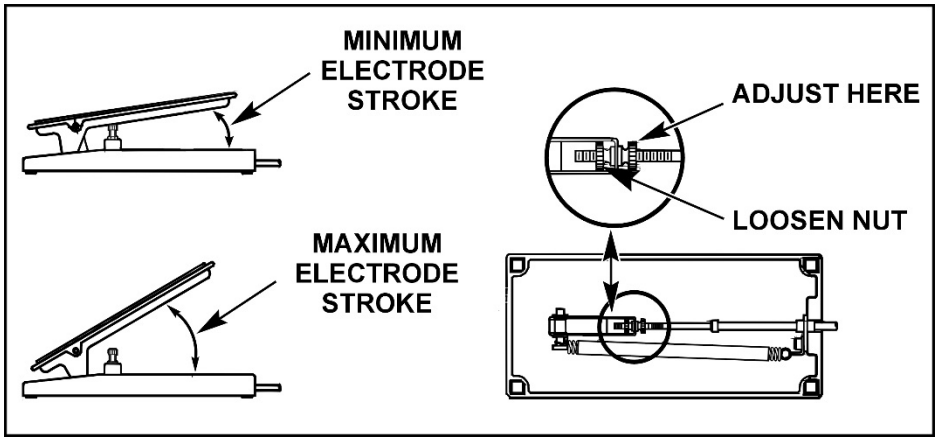


5 Attach cable from footpedal to pullrod (larger hole up) using small screw, which is supplied.

6 Untie string and release the electrode holders.

7 Depress pedal, and push cable sheath into pullrod hole until it is flush with base.

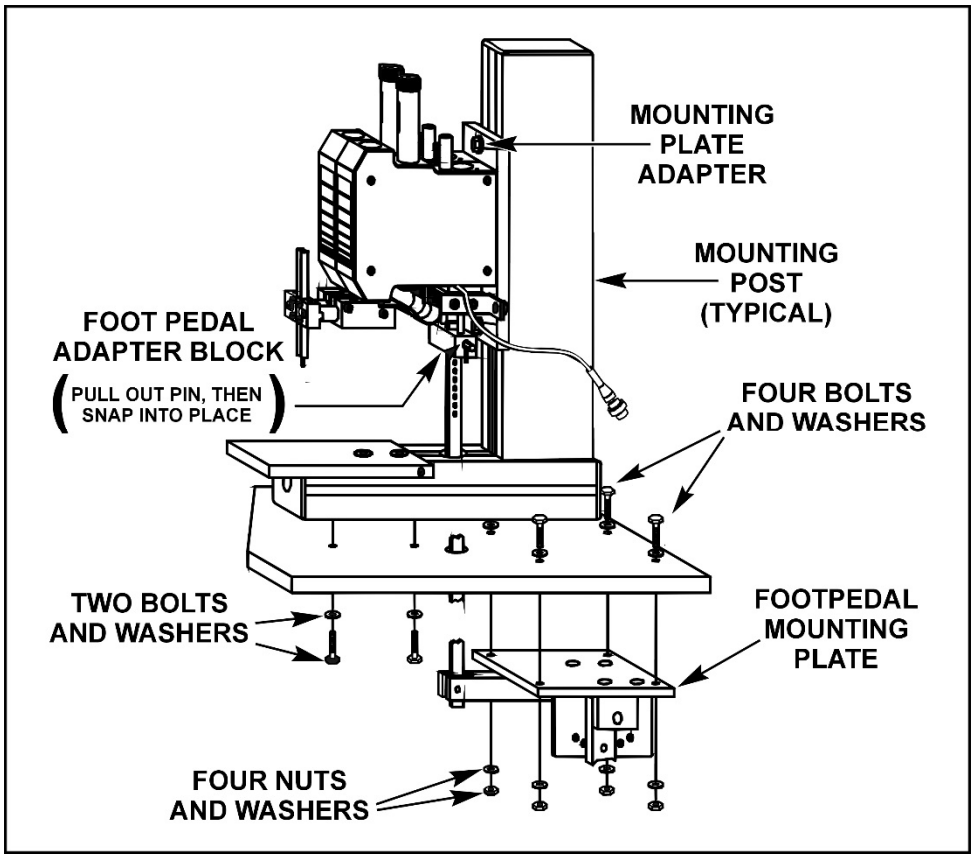
8 Secure sheath with set-screw as illustrated.



9 Adjust footpedal so that the electrode holders move the distance required by the application.

10 Adjust the angle of the treadle so that it provides the electrode stroke necessary for the application and is comfortable for the operator.

Model 83F, 84F, 88F, and 89F MSP Footpedal Installation



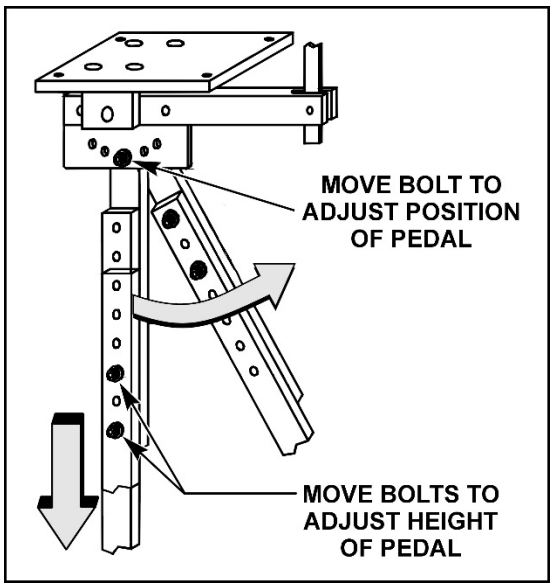
1 Screw the head to the bench and Model MSP Footpedal using four (4) screws, washers and nuts supplied with the shipping kit.

2 To adjust the height of the head, loosen two hex head cap screws on the mounting plate adapter, as illustrated, and slide Head up or down the mounting stand.

3 Pull out the pin on footpedal adapter block, as illustrated. Insert the pullrod and allow the pin to snap back into place.

5 Attach the pullrod to footpedal.Adjust the height of head, loosen two Allen head cap screws on the mounting plate adapter as shown, and slide Head up or down the mounting stand.

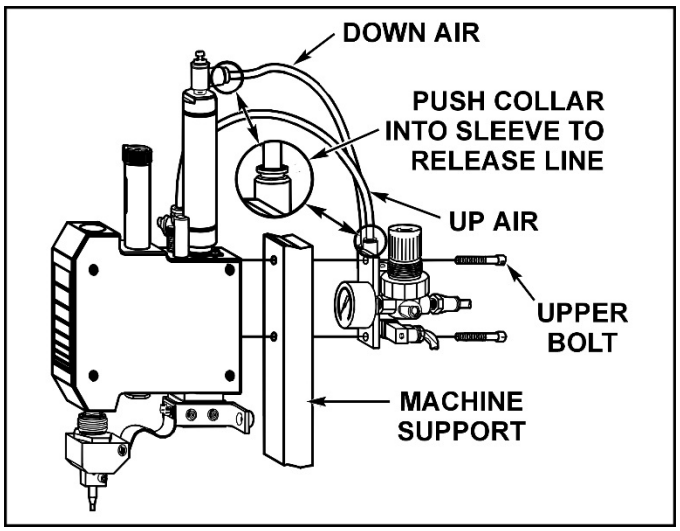
6 Attach the pullrod to footpedal. Adjust the angle and length of the footpedal so that it is comfortable for the operator.



Model 82A Air Head Installation

1 Screw the head to a user supplied mounting post using two 1/4" - 20 screws.

NOTE: The cross-section of the mounting plate should be such that the horizontal movement of the upper mounting screw should be less than 0.009 in. (0.229 mm) when the electrode applies 40 lbs. (178 N) to the workpiece. This should limit the electrode wiping to 0.004 in. (0.102 mm) at 40 lbs. (178 N), using offset electrode holders. In order to minimize deflection, and electrode skidding, the spine must be fully supported if weld forces exceed 20 lbs. (89 N).



2 Screw the air gauge assembly to the mounting plate, as illustrated, or in a location, which is as close as practical to the head. Use 0.25 in. (6.35 mm) outside diameter plastic hose, with a rated burst pressure of 250 psi (1,724 kPa), to connect the air pressure regulator to the fitting on the top of the air cylinder, as illustrated.

3 Connect the remaining fitting to the bottom of the air cylinder. Since the cylinder and air solenoid assembly use "quick release" fittings, special tools are not needed. Simply push the hose into the "quick release" fitting as far as it will go.

4 Verify that the air lines are inserted all the way into the sleeve on the fittings to prevent inadvertent blow-outs. The shorter the air lines, the faster the mechanical response of the Head.

5 Install a user supplied in-line filter lubricator on the air supply line to ensure the maximum life of the air cylinder, flow controls and regulator.

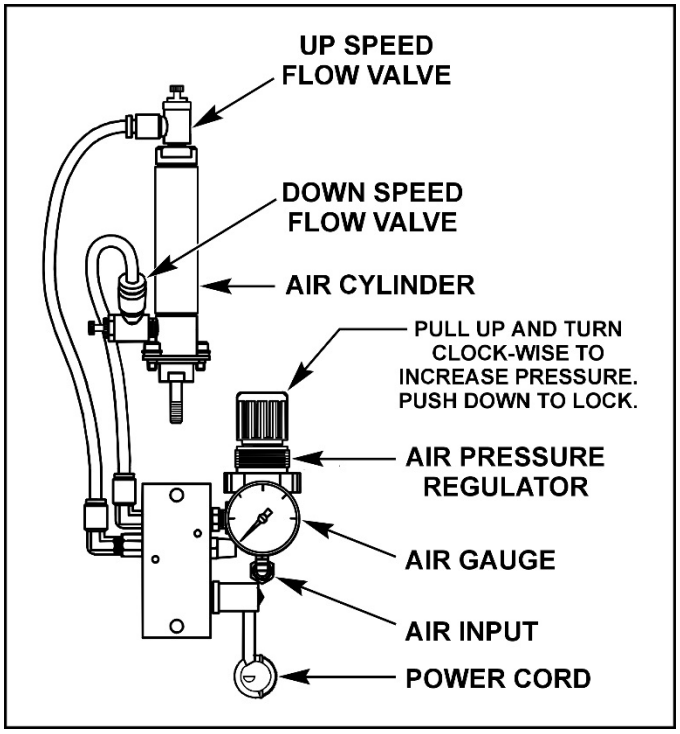
6 Connect the inlet port of the regulator valve assembly, as illustrated, to a properly filtered air supply (100 psi/690 kPa maximum). Use the shortest air lines possible to obtain the fastest mechanical response.

NOTE: The inside diameter of the main air supply line must be at least 0.5 in. (13 mm) to allow sufficient air flow. Connect the air line to the input air fitting.

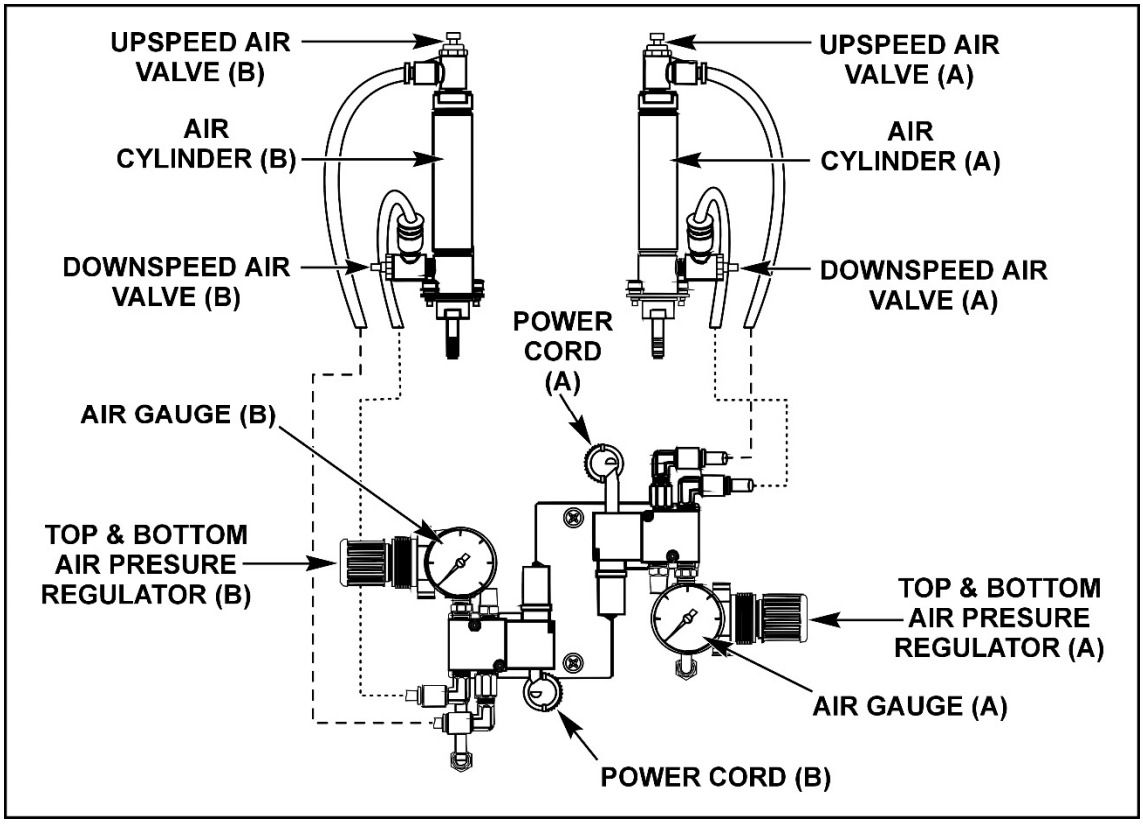
Models 80A, 83A, 84A, 86A, 87A, 88A, and 89A Air Head Installation

1 Insert a 0.25 in. (6.35 mm) outside diameter plastic hose, with a rated burst pressure of 250 psi (1,724 kPa), into the Air Input of the air solenoid valve assembly, as illustrated. The air input line uses a "quick release" fitting so special tools are not needed. Simply push the hose into the "quick release" fitting as far as it will go.

2 Connect the other end to a *properly filtered air supply* (100 psi/690 kPa maximum). Use the *shortest* air lines possible to obtain the fastest mechanical response. The inside diameter of the main air supply line must be at least 0.5 in. (13 mm) to allow sufficient air flow. The air supply should be filtered to ensure the maximum life of the air cylinder, flow controls, and regulator.



Single-Air Installation



Dual-Air Installation

NOTES:

- Amada Miyachi America suggests that in-line lubricators ***only*** be used in automated applications, since excess oil can blow-by worn seals in the Air Cylinder and be deposited on the workpieces.
- If an in-line lubricator is ***not*** used, then the air line should be removed from the top of the cylinder(s) once every 1 million cycles, and several drops of a light machine oil should be squirted into the top of the cylinder(s).
- To facilitate dressing the electrodes, reduce the air pressure to the top of the cylinder. As an alternative to changing the setting of the Top Air Pressure Regulator, a customer supplied bleeder valve connected to the output of the Top Air Pressure Regulator can be used to reduce the air pressure.

3 Connect the power cord from the solenoid air valve as specified in the Users' Manual for the appropriate power supply or control.

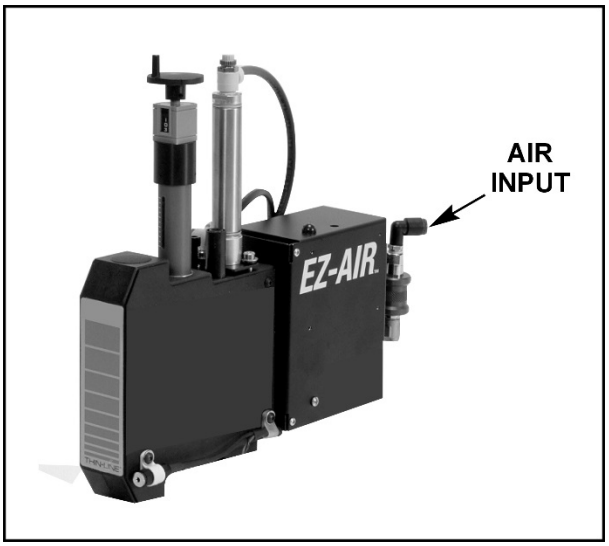
4 Install the system in accordance with established safety practices and standards. Anti-Tiedown Palm Buttons are not usually required if the electrode spacing will not allow the operator's fingers to fit between them.

Models 80A/EZ, 86A/EZ, and 89A/EZ EZ-AIR Installation

These weld heads come equipped with EZ-AIR factory-installed. Installation consists of bolting the weld head to the work bench and connection to an air supply. To connect an air supply to the EZ-AIR input, follow the instructions in the separate EZ-Air manual.

NOTES:

- You must use a *properly filtered air supply*, 100 psi (690 kPa) maximum. Use the *shortest* air lines possible to obtain the fastest mechanical response.
- Install the system in accordance with established safety practices and standards. Anti-Tiedown Palm Buttons are not usually required if the electrode spacing will not allow the operator's fingers to fit between them.



Air Connection

Optics

If you are using any of the optional optics (microscope or illuminator):

1 Verify that the optics mounting post is securely attached to the optics baseplate.

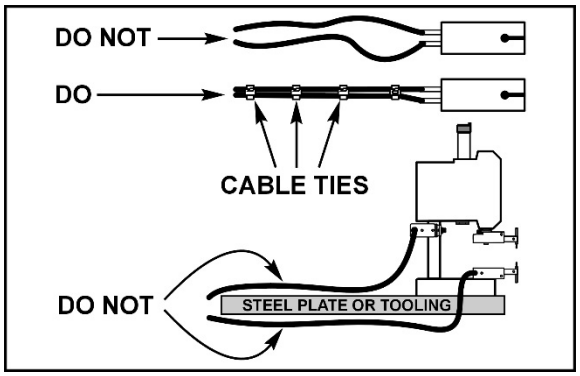
2 Install the optics following the instructions provided with the optics.

Section III. Connect Weld Cables

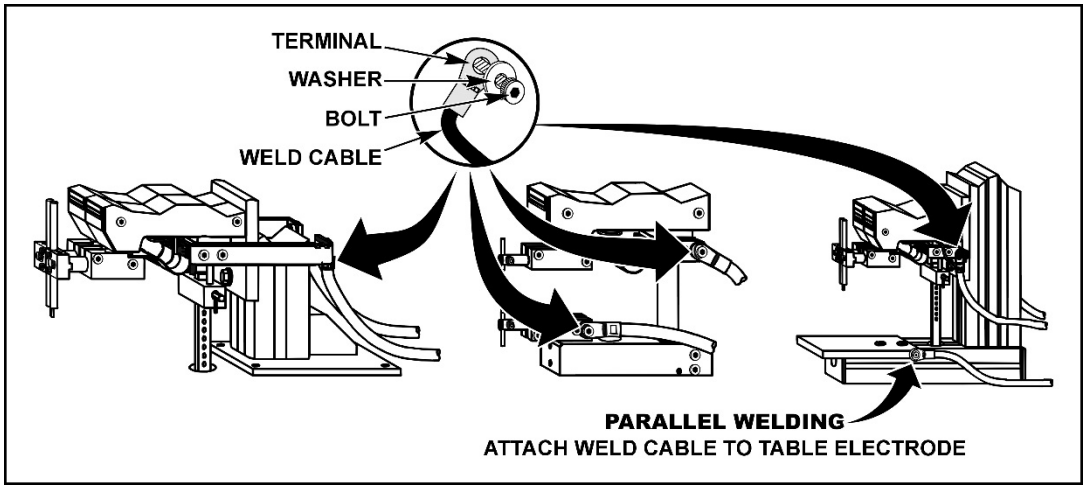
Weld Cables and Energy Losses

All Miyachi Unitek weld heads are supplied with the correct weld cables to provide maximum weld energy. If you need to install longer cables, or replace damaged cables,

- ***Use #2 AWG for lengths under 12 in. (30.5 cm) and #2/0 AWG for longer lengths***. Tie or tape cables together to minimize inductive losses. A separation of weld cables surrounding an area of one square foot could result in losses of up to 65%.
- ***Use the shortest possible Welding Cables***. It is common to have losses of up to 50% per foot for #6 cables and 20% for #2 cables.
- ***Both cables must always be on the same side of the head***. Route cables so that they do ***not*** surround magnetic materials such as air solenoids, tooling, or steel weld heads. The cable routing and weld head design should be such that the secondary loop does not encompass magnetic materials (steel) and/or is not encompassed by any magnetic material.



Connect Cables to Head



1 **Model 80, 83, and 84**: Connect one of the two cables supplied to the Power Bar.

Model 82A: Only one cable is supplied, connect it to the Power Bar.

Model 86, 87, 88, and 89: Connect one cable to each Power Bar.

2 Place the washer, which is supplied, between the head of the Socket Head Screw and the Terminal on the Cable. ***Do NOT place the washer between the Cable and the Power Bar.*** Tighten connections securely; they must be free from oxidation, dirt, and/or grease.

3 Connect the other end of the cables to the power supply or output transformer, in accordance with the instructions in its Users' Manual.

Section IV. Install Electrodes for Welding

CAUTION

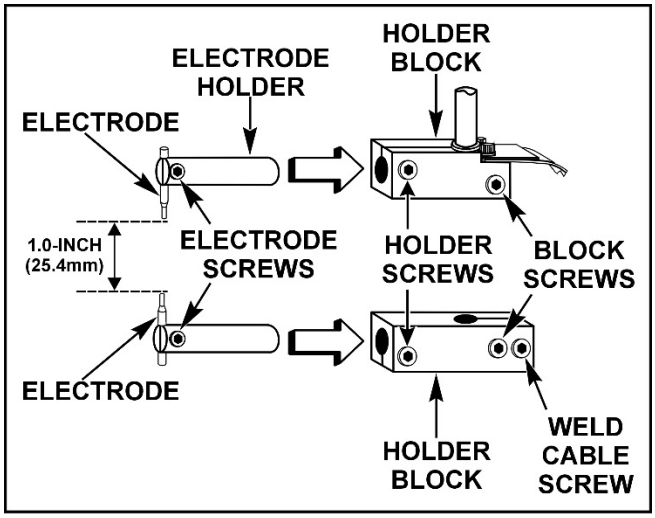
Do ***not*** modify the electrode holders or attach additional mechanisms to the moving parts of the head. Doing so may hurt welding performance, damage the head, and ***void the warranty***.

Model 80 and 84

1 Loosen screws and insert electrodes. Loosely tighten screws to hold electrodes in position.

2 Align the electrodes, then tighten into position.

NOTE: The maximum distance between the electrode tips is 1.0 in. (25.4 mm).

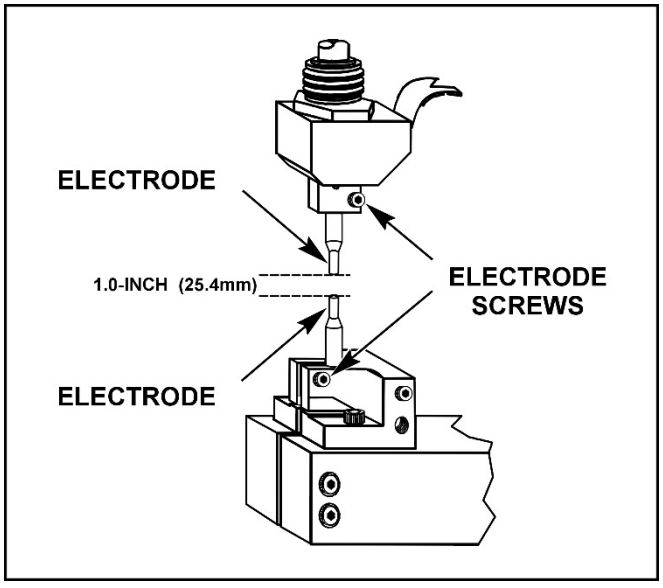


Model 82 and 83

1 ***Fully*** insert electrodes into electrode holder(s). Tighten quick release handle(s).

2 Align electrodes on Model 83 by adjusting the position of the lower electrode holder.

NOTE: The maximum distance between the electrode tips on the Model 83, or the tip of the top electrode on the Model 82 and the workpiece, is 1.0 in. (25.4 mm).



Model 88 and 89

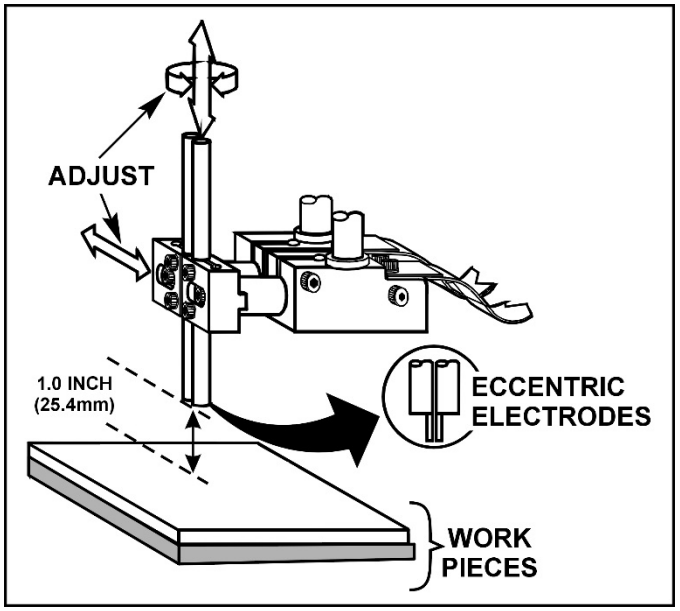
1 Insert electrodes into electrode holders.

2 Lower the electrodes onto a flat workpiece.

3 Align the electrodes so that they are parallel as well as perpendicular to the workpiece. Align the electrode tips.

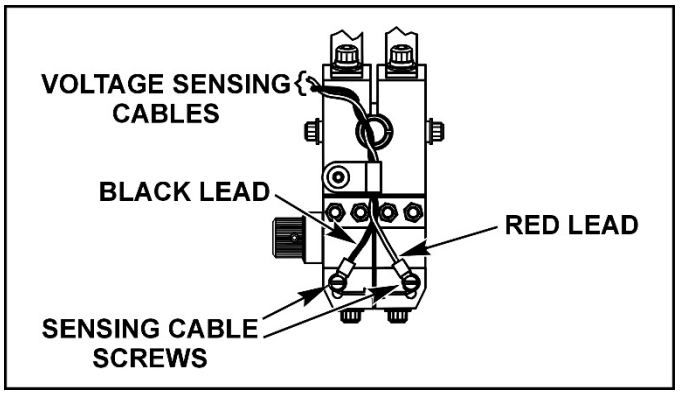
4 Rotate the electrodes to obtain the desired distance between the tips (gap). Tighten the screws on the electrode holders.

NOTE: The maximum distance between the electrode tips and the workpiece is 1.0 in. (25.4 mm).



Model 86 -- Unibond Electrodes

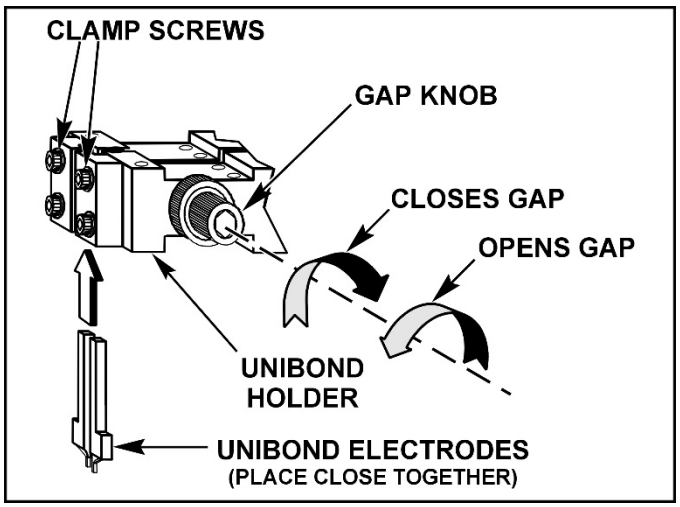
1 Check the voltage sensor cable located on the underside of the electrode arms. Verify that the two slotted head screws which attach the sensing cable to the flexure assemblies are securely tightened. *Erratic operation results if they are loose*.



2 Loosen the electrode holder clamp screws. Set the electrode gap adjustment knob for maximum gap width and insert the Unibond electrodes into the holders as illustrated.

3 Loosely hold the electrodes in place and rotate the gap adjustment knob to its fully-clockwise (closed) position.

4 Orient the electrodes so they contact each other along their entire length and are perpendicular to the surface of the workbench.



NOTE: Position the electrodes vertically in the holder so the electrode tips are aligned.

5 Tighten the electrode holder clamp screws.

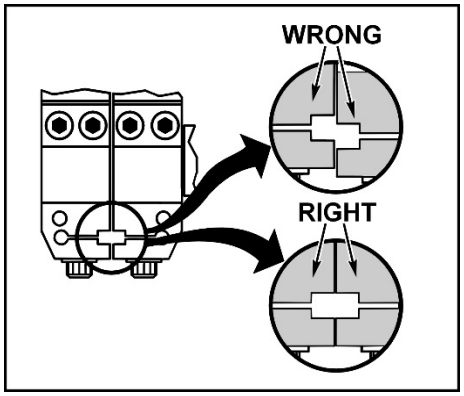
CAUTION: Do *not* over-torque the clamp screws. Doing so will deform the flexure, dramatically reducing its life.

6 Open the electrodes to the desired operating gap by turning the gap adjustment knob counterclockwise. The maximum distance between the tip of the electrode and the workpiece is 1.0 in. (25.4 mm).

Model 86 -- Unitip Electrodes

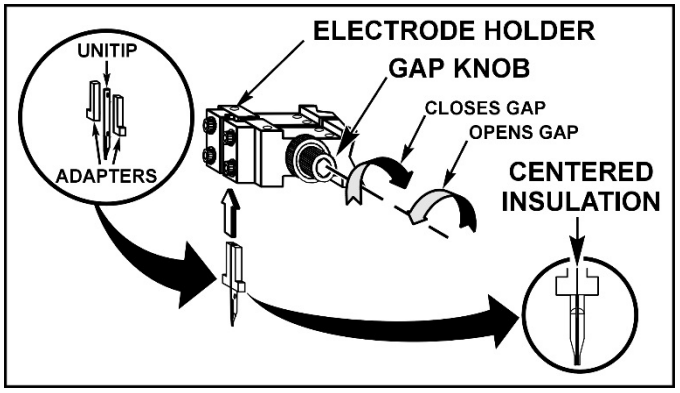
1 Look at the electrode holders from the top and verify that the holders are aligned from front-to-rear.

CAUTION: Unitip electrodes will be destroyed if the electrode holders are misaligned. The displacement will cause the Unitip to be sheared when the electrode holder clamp screws are tightened.



2 Assemble Unitip inside the Model UTA, Unitip Adapter, as shown. The vertical line (insulation) must be centered between the edges of the Unitip Adapter. Insert the assembled electrode into the electrode holder.

3 Rotate the gap adjustment knob clockwise until the assembled electrode is lightly held in place. The Unitip and Unitip Adapter should be flush with the top surface of the electrode holder.



NOTE: Unitip electrodes have a fixed gap which can ***not*** be adjusted. If necessary, rotate the Unitip so that the vertical line on the tip formed by the insulation layer is exactly between the two adapter halves as illustrated. Tighten the two screws on the electrode holder.

CAUTION: ***Unitips can be severely damaged by applying excessive bonding forces.*** The table on the right lists the maximum operational force limits in both kilograms force (kgf) and ounces (oz). See Chapter 4 for Unitip cleaning and dressing instructions.

Use of Unibond Electrodes and Unitips should be limited to footpedal actuated weld heads. Their use in air-actuated heads requires great caution in adjusting electrode forces.

The maximum distance between the tip of the electrode and the workpiece is 1.0 in. (25.4 mm).

MAXIMUM UNITIP FORCE

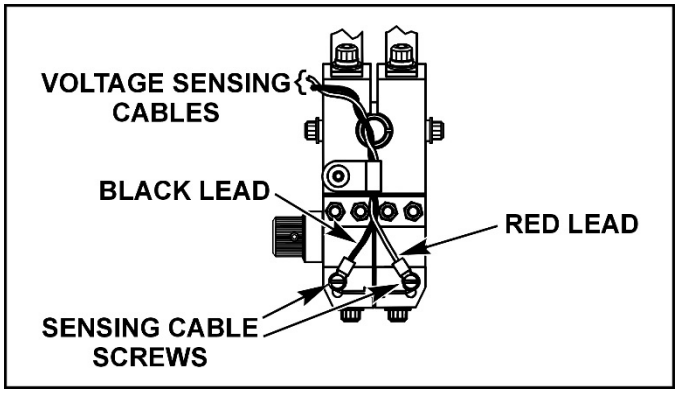
Unitip Model	Max. Force (kgf)	Max. Force (oz)
UTM111L	0.94	33
UTM112L	0.94	33
UTM152L	0.47	17
UTM222L	3.75	132
UTM111C	0.94	33
UTM112C	0.94	33
TM222C	3.75	132
UTM224C	3.75	132
UTM237C	4.57	161

Model 87 -- Unitip Electrodes

1 Check the voltage sensor cable located on the underside of the electrode arms. Verify that the two slotted head screws which attach the Sensing Cable to the Flexure Assemblies are securely tightened.

NOTE: Erratic operation results if the screws are loose.

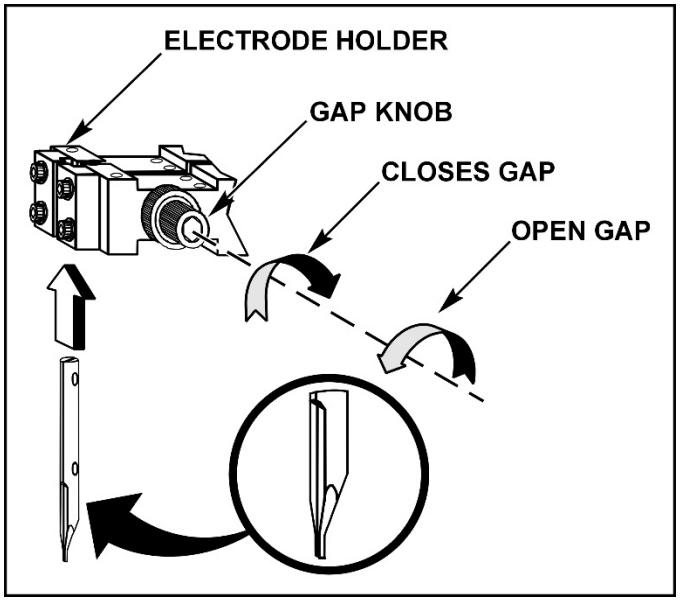
2 Loosen the electrode holder clamp screws. Set the electrode gap adjustment knob for maximum gap width.



3 Insert the Unitip between the concave inner surfaces of the electrode arms. The Unitip should be flush with the top of the electrode holder. *Rotate the Unitip so that the vertical line on the tip formed by the insulation layer is exactly between the two electrode arms when viewed from the front of the head.*

4 Clamp the Unitip by turning the Gap Adjustment Knob clockwise until the Unitip is firmly locked.

NOTE: Unitip electrodes have a fixed gap, which ***canno***t be adjusted.



The table on the right lists the maximum permissible force limits for Unitips. See *Chapter 4* for Unitip cleaning and dressing instructions.

Use of Unitips should be limited to footpedal actuated weld heads. When Unitips are used in air actuated heads caution is required when selecting and adjusting electrode forces.

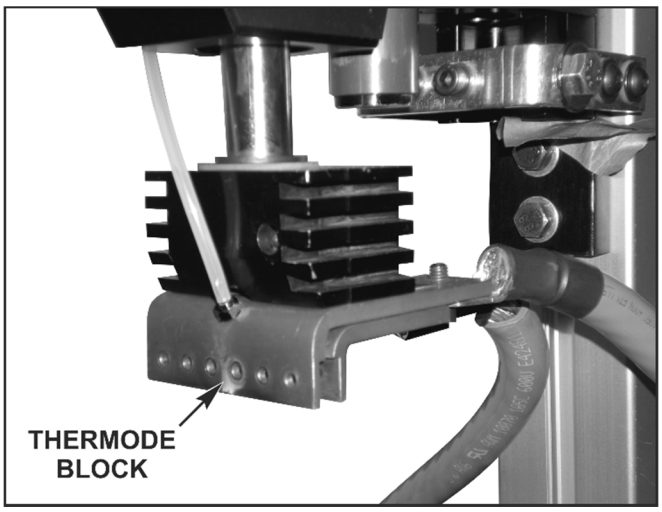
The maximum distance between the tip of the electrode and the workpiece is 1.0 in. (25.4 mm).

MAXIMUM UNITIP FORCE		
Unitip Model	**Max. Force (kgf)**	**Max. Force (oz)**
UTM111L	0.94	33
UTM112L	0.94	33
UTM152L	0.47	17
UTM222L	3.75	132
UTM111C	0.94	33
UTM112C	0.94	33
TM222C	3.75	132
UTM224C	3.75	132
UTM237C	4.57	161

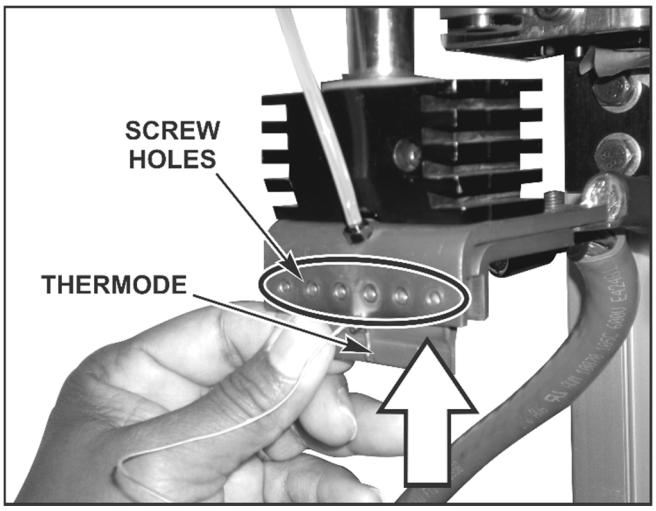
Section V. Install Thermodes for Reflow Soldering

Models 87SA and 84SA are similar to the Models 87A and 84A, respectively, except they are designed specifically for high-precision reflow soldering.

The 87SA includes a Model I7TDSB 177 mounting block and the 84SA includes a Model 17TDMB256 mounting block. The former can hold any thermode up to 1.5 in./38.lmm in length; the latter can hold any thermode up to 2.5 in./63.5mm in length.



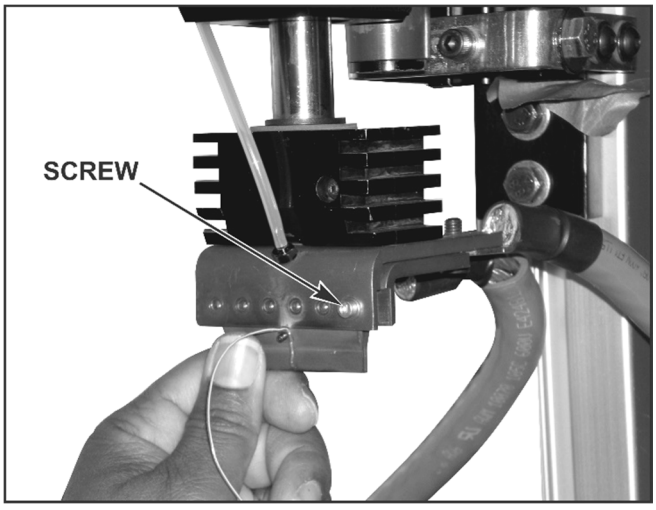
1. Slide the thermode up into the groove of the thermode block.
2. Adjust the position of the thermode so that the screw holes in the mounting block line up with the screw holes in the thermode.



NOTE: There are screw holes in the front and back of the thermode block. You must attach the thermode using ***all*** the screws necessary for the thermode on ***both*** sides of the block.

3. Insert the thermode screws alternating between the front and back.

   Do ***not*** tighten the screws when you insert them. This allows you to adjust the position of the thermode so that all screws will fit into the holes properly.



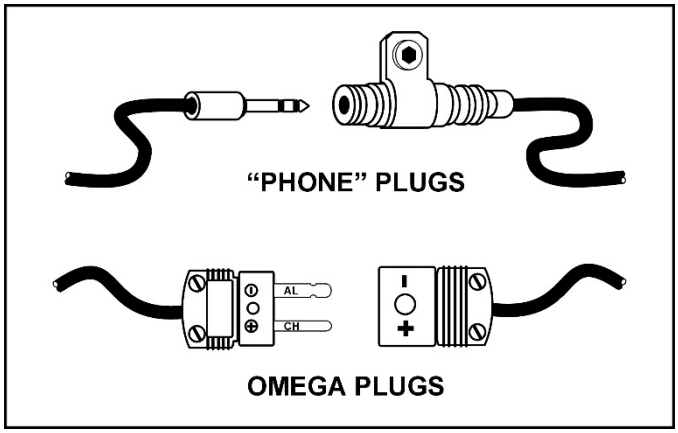
NOTE: Hot spots can occur on the contact surfaces of 17TD style thermodes if the mounting screws are not properly tightened. To assure good contact, perform the following steps.

4. Torque the thermode mounting screws to 18-27 lb.in. (2-3 N.m).
5. After a few reflow cycles, verify the torque values on the mounting screws.

   NOTE: If hot spots occur on the contact faces of the thermode, check the copper surfaces on the thermode mounting block for damage. Re-surface copper surfaces or replace if they are extensively damaged.

Model 87 -- 17F Fold-Up, 17P Peg Tip, or 17SR Single Point Thermodes

NOTE: Miyachi Unitek weld heads use two types of thermocouple connectors. Older models use telephone-type (or "**Phone**") plugs, newer models use **Omega** plugs. Both plugs work the same way. Illustrations in the rest of this manual show "typical" connectors, which represent ***both*** types of plugs. The cable coming from the thermocouple is plugged into a matching connector on the weld head.

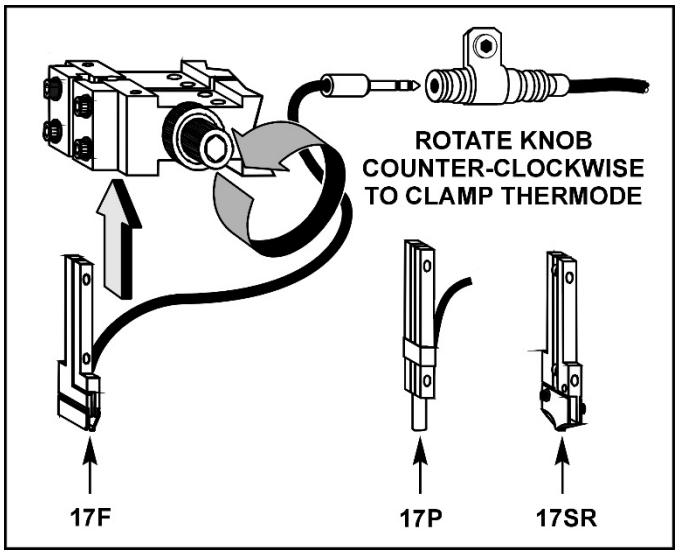


1 Loosen the electrode holder clamps on the head. Rotate the electrode gap adjustment knob counter-clockwise to its maximum gap opening.

2 Insert the 17F or 17P Thermode into the holders as illustrated at right. Position the thermode so that the thermocouple lead does not interfere with the workpiece.

3 Return the gap adjustment knob to its full clockwise position, clamping the thermode. Tighten the clamp screws.

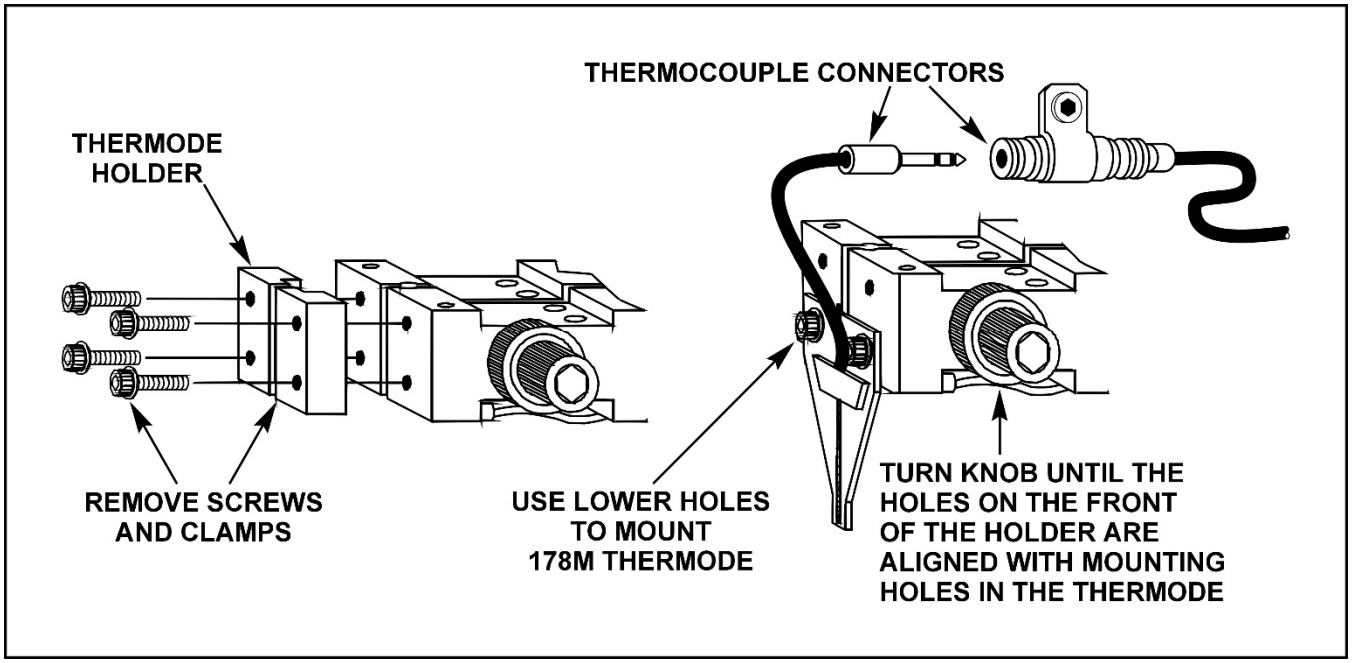
4 Connect the plug on the thermocouple to the jack which is located on the side of the Model 87.



NOTES:

- The maximum width thermode which should be used with the 87 Head is the 17F1000, which is 1.0 in. (25.4 mm) wide.
- Do ***not*** exceed a force of 60 oz. (16.68 N) on either the 17SF or 17SR series Single Point Fold-Up Thermodes. Forces in ***excess*** of 60 oz. (16.68 N) will deform the tips.
- The maximum distance between the tip of the thermode and the workpiece is 1.0 in. (25.4 mm).

Model 87 -- 17BM Blade Thermodes



1 Remove the clamps from the holder. Attach the thermode directly to the face of mounting block using the ***lower*** set of screw holes as illustrated.

2 Rotate the gap adjustment knob, in the appropriate direction, until the lower set of screw holes are aligned with the holes in the thermode.

3 Attach the blade thermode to the holder using the two screws which are supplied with the thermode. Position the blade and thermocouple so that they do not interfere with the workpiece.

4 To ensure efficient even heat transfer to the workpiece, adjust the bottom edge of the thermode so that it is parallel to the work surface. The maximum distance between the tip of the electrode and the workpiece is 1.0 in. (25.4 mm).

5 Connect plug on thermocouple to jack which is located on the side of the Model 87.

Section VI. Install Optional Equipment

Model 88 and 89 -- Install DFS/88 Series Firing Switch Junction Box

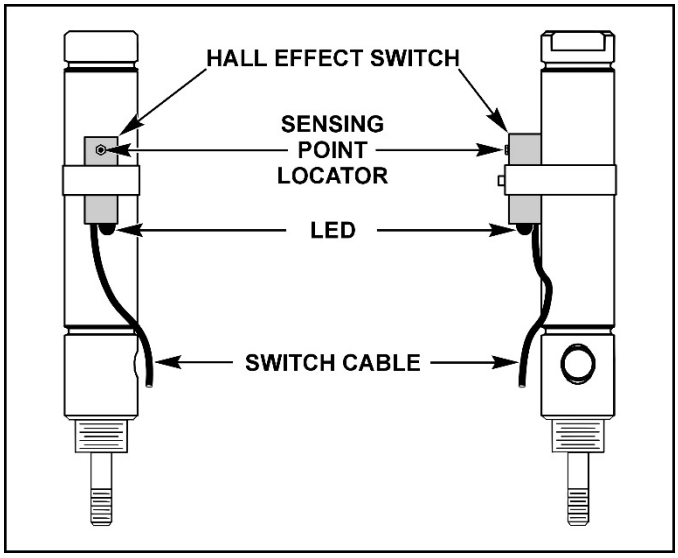
If the Model 88 or 89 is to be used as a *series* type welding head, then connect both Firing Switch Cables to the DFS/88, which is supplied with the head. The DFS/88 connects the Force Firing Switches, which are located inside the heads, in *series*. This means that the power source will *not* be triggered until *both* sides of the head exert the preset firing force on the workpiece.

Use the DFS when the Model 88 or 89 are used as parallel type welding heads.

Connect Optional Hall Effect Limit Switch

The Hall Effect Limit Switch cylinder's magnetic disk surrounds the actuation rod located on the top of its internal piston.

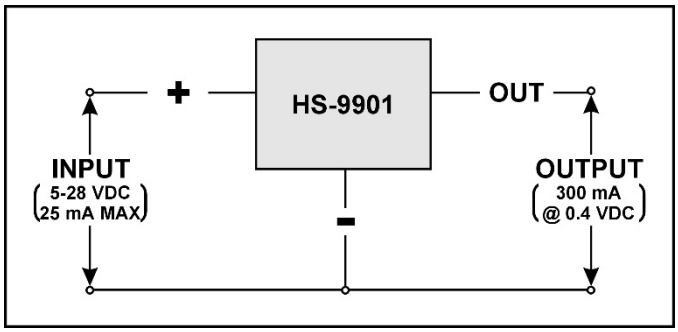
The magnetic field which is produced when the piston passes the sensor produces an output which can be used to control other equipment.



1 Mount the Hall Effect Switch using the clamp which is supplied.

2 Position the switch at the top (bottom) of the cylinder to detect when the head is in the *up (down)* position.

3 Wire the Hall Effect switch as shown in the schematic diagram on the right.



NOTES:

- **Resistor.** Be sure to include a resistor in series with the output which limits the output current to a ***maximum of 50 mA.***
- **Wire Colors.** Newer versions of the Hall Effect switch have different wire colors than older versions. The table at the right shows the wire colors for each version. Verify the colors on your switch, then connect them according to the schematic.

Old Version			New Version		
Red	=	+	Brown	=	+
Black	=	–	Blue	=	–
White	=	Out	Black	=	Out

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. Getting Started

Installation Checklists

INSTALLATION CHECKLIST FOR ALL HEADS	
✓	Check that the cables are correctly attached at both ends.
✓	Verify that the Firing Switch Cable is attached to the welding power supply or control.
✓	Set the **WELD/NO WELD** Switch, located on the front of the welding power supply (control), to the **NO WELD** position.
✓	Verify that the welding power supply (control) is connected to the appropriate power source and that the power is switched to ON.
✓	Switch the welding power supply (control) to ON. Follow the procedures in the manual to program and operate the welding power supply (control).
INSTALLATION CHECKLIST FOR AIR ACTUATED HEADS	
✓	Verify that the air lines are properly connected to the head and the main air supply (65 psi/448 kPa nominal) is turned ON.
✓	Verify that the line cord from the air solenoid is connected to the power supply (control) or to a 115 volt source, if required.
✓	Verify that the footswitch is connected to the welding power supply (control).

Welding Force Theory

Welding force (pressure) is a key variable in the resistance welding process. Excessive or insufficient welding force or pressure can cause a weak weld (see **Model 88F** and **89F**). Details on the basics of resistance welding are described in Appendices C and D. More information is available from Amada Miyachi America:

A) Resistance Welding Troubleshooting Guide

B) Electrode/Material Selection Guide

C) Resistance Welding Spot Welding Applications

D) Technical Service Bulletins on a variety of subjects

Troubleshooting

WELDHEAD TROUBLESHOOTING GUIDE			
SYMPTOM OR PROBLEM	**PRIMARY CAUSE** Weldhead-Related Cause	**PRIORITY***	**SOLUTION**
Overheating of Weldment	**Excess Welding Time**	**1**	Decrease Welding Time (A.C. Welding)
	Insufficient Force	2	Increase force in steps of 10-20%
	Wrong Electrode Material	2	Check Electrode/Material Selection Guide
	Dirty Electrodes	3	Clean electrodes and/or parts to be welded
	Electrode Tip Shape	3	Use constant area electrodes or shape to suit application
Discoloration	**Excess Welding Time**	**1**	Decrease Welding Time (A.C. Welding)
	Wrong Electrode Material	**1**	Check Electrode/Material Selection Guide
	Insufficient Force	2	Increase force in steps of 10-20%
Weak Weld	**Insufficient Current/Energy**	**1**	Increase current/energy in steps of 5-10%
	Dirty Electrodes	**1**	Clean electrodes and/or parts to be welded
	Electrode Tip Shape	**1**	Use constant area electrodes or shape to suit application
	Mushroomed Electrodes	**1**	Replace or reshape electrodes or increase cleaning schedule
	Excess Force	2	Decrease force in steps of 10-20%
	Insufficient Force	2	Increase force in steps of 10-20%
	Wrong Electrode Material	2	Check Electrode/Material Selection Guide
	Poor Weldhead Follow-up	3	Reduce mass of top electrode holder assembly

WELDHEAD TROUBLESHOOTING GUIDE			
SYMPTOM OR PROBLEM	**PRIMARY CAUSE** Weldhead-Related Cause	**PRIORITY***	**SOLUTION**
Insufficient Nugget **	**Insufficient Current/Energy**	**1**	Increase current/energy in steps of 5-10%
	Wrong Electrode Material	**1**	Check Electrode/Material Selection Guide
	Electrode Tip Shape	**1**	Use constant area electrodes or shape to suit application
	Mushroomed Electrodes	**1**	Replace or reshape electrodes or increase cleaning schedule
	Dirty Electrodes	2	Clean electrodes and/or parts to be welded
	Excess Force	2	Decrease force in steps of 10-20%
	Insufficient Force	3	Increase force in steps of 10-20%
Metal Expulsion	**Excess Current/Energy**	**1**	Decrease current/energy in steps of 5-10%
	Insufficient Force	**1**	Increase force in steps of 10-20%
	Poor Weldhead Follow-up	**1**	Reduce mass of top electrode holder assembly***
	Dirty Electrodes	2	Clean electrodes and/or parts to be welded
	Electrode Tip Shape	2	Use constant area electrodes or shape to suit application
Sparking	**Excess Current/Energy**	**1**	Decrease current/energy in steps of 5-10%
	Insufficient Force	**1**	Increase force in steps of 10-20%
	Poor Weldhead Follow-up	**1**	Reduce mass of top electrode holder assembly***
	Electrode Tip Shape	**1**	Use constant area electrodes or shape to suit application
	Wrong Electrode Material	2	Check Electrode/Material Selection Guide
	Dirty Electrodes	2	Clean electrodes and/or parts to be welded
Warping	**Excess Welding Time**	**1**	Decrease Welding Time (A.C. Welding)
	Excess Force	**1**	Decrease force in steps of 10-20%
	Electrode Tip Shape	2	Use constant area electrodes or shape to suit application
Electrode Sticking	**Insufficient Force**	**1**	Increase force in steps of 10-20%
	Wrong Electrode Material	**1**	Check Electrode/Material Selection Guide
	Electrode Tip Shape	**1**	Use constant area electrodes or shape to suit application
	Dirty Electrodes	2	Clean electrodes and/or parts to be welded
	Poor Weldhead Follow-up	3	Reduce mass of top electrode holder assembly ***

WELDHEAD TROUBLESHOOTING GUIDE			
SYMPTOM OR PROBLEM	**PRIMARY CAUSE** Weldhead-Related Cause	**PRIORITY***	**SOLUTION**
Electrode Damage	**Excess Current/Energy**	**1**	Decrease current/energy in steps of 5-10%
	Insufficient Force	**1**	Increase force in steps of 10-20%
	Electrode Tip Shape	**1**	Use constant area electrodes or shape to suit application
	Excess Force	2	Decrease force in steps of 10-20%
	Wrong Electrode Material	2	Check Electrode/Material Selection Guide
	Dirty Electrodes	2	Clean electrodes and/or parts to be welded

* Priority numbers refer to troubleshooting priority, with 1 as highest priority. Start troubleshooting with 1 and then proceed to 2 and so on. When there are multiple causes with the same priority, use personal judgement in determining which is more probable in the specific application.

** In most cases capacitor discharge welds do not have a significant nugget.

*** For non-Miyachi Unitek weld heads.

A certain amount of experimentation is necessary to achieve the proper welding force setting for a specific application. The following are some general rules to make quality welds:

a. Larger parts require higher force.

b. Larger diameter electrode faces require higher force.

c. Higher electrode forces require higher weld currents (energy).

Reflow Soldering Force

The reflow soldering process is not as sensitive to force as resistance welding. Sufficient force or pressure is necessary to ensure adequate thermal conduction and to hold the workpieces as the solder solidifies.

Section II. Model 80A, 82A, 83A, 84A, 86A, and 87A Standard Air-Actuated Head Setup

This Section describes the following adjustments:

- **Firing force** to the value required by the specific application.
- **Maximum force** the electrodes can exert on the workpiece during the welding cycle.
- **Down stroke** limits.

CAUTION: Excessive force can damage the electrodes and/or the workpiece.

In automated applications, the maximum repetition rate is usually limited by the stroke of the head and the air pressure on the top of the air cylinder. The higher the pressure, the faster the upper arm will move. The air pressure on the top of the cylinder will determine the *welding, but not the firing force*. If the welding force exceeds the firing force, which is set by the force adjustment knob on the head, by more than five percent, a noticeable decrease in weld (reflow soldering) quality often results.

1 Use the flow control on the bottom of the cylinder to reduce the down speed.

2 Use the force adjustment knob to set the weld head force indicator to "4". Indicator is located on the front of the force tube just below the force adjustment knob. Set heads with digital readouts to "100."

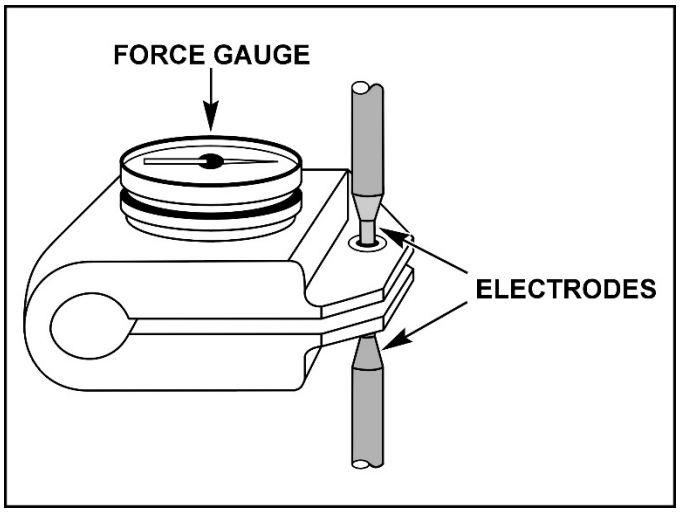
3 Close, but do not tighten, both air flow control valves.

4 Re-open each valve 3 or 4 turns.

5 Adjust the air pressure regulator to an indicated 10 psi (69 kPa).

6 Cycle the weld head by depressing and releasing the footswitch. Adjust the upspeed air flow control valve located at the ***top*** of the air cylinder, so that the upper arm moves up at a reasonable rate. It should not move so rapidly that it slams against the upstop.

7 If the application is a welding application, adjust the electrode spacing so that a Miyachi Unitek Force Gauge fits between the electrodes, as illustrated.



8 Depress and hold the footswitch. Note the force indication on the force gauge when the head firing switch "clicks." If the firing switch does not close, increase the pressure from the air pressure regulator until the firing switch does close. If the firing switch closure is inaudible, it is easily detected by observing the firing switch indicator on the welding power supply or control. For older or non-Miyachi Unitek controls, an ohmmeter or continuity checker can be connected to the pins on the firing switch connector.

9 Use the force gauge reading from the previous step as a starting point. Use the force adjustment knob to increase the indicated force if the initial force reading is less than the required force setting. If the initial force reading is greater than the required force setting, decrease the indicated force.

10 Release and depress the footswitch. Verify that the welding force applied by the upper arm does not exceed the force required to close the firing switch by more than five percent (5%). If necessary, adjust the pressure from the air pressure regulator and/or the force adjustment knob on the head.

11 After setting the required force, particularly in automated applications, remove the force adjustment knob by loosening the two set screws which secure it to the shaft. Invert the knob and place it on the shaft. Be sure to insert the locking tab on the knob into the slot on the force tube. Re-tighten both set screws.

12 If necessary, re-adjust the electrodes (thermode) in their holders to accommodate the workpiece.

13 Turn the downstop screw counter-clockwise to its fullest extension without actually disengaging it. This will allow maximum downward travel of the upper arm. The following downstop adjustment should be made only if the workpiece would be damaged if the upper arm travels too far. In most applications, use of the downstop is not recommended.

A) Depress and ***hold*** the footswitch. Slowly rotate the downstop counter-clockwise until the force firing switch in the head closes. Rotate the downstop one or two additional turns counter-clockwise. The additional turn(s) will allow for electrode wear and/or the slight variations of the position of the electrode (thermode) in its holder.

B) Re-check that the firing switch consistently closes.

CAUTION: Do ***not*** attempt to use the downstop adjustment to limit the force which is applied to the workpiece. This will result in inconsistent welds (reflow soldering).

14 Depress the footswitch. Adjust the downspeed air flow control valve so that the upper electrode arm descends slowly enough to prevent impact damage to the workpiece and electrodes (thermode).

15 Re-adjust upspeed air flow control valve if necessary.

16 Once the required firing force is setup, ***do not change the regulator setting*****!** Use only the air flow control valves to control the up and down speed of the upper arm. Changes in the regulator setting will change the welding (reflow soldering) force.

Section III. Model 80A/EZ and 86A/EZ EZ-AIR Air-Actuated Head Setup

This Section describes the following adjustments:

- **Welding force** to the value required by the specific application.
- **Down speed** of the electrode approaching the parts.
- Eliminating any **down stop** setting.

CAUTION: Excessive force can damage the electrodes and/or the workpiece.

Model 80A/EZ and 86A/EZ air-actuated weld heads are supplied with EZ-AIR, a pneumatic control that actuates the electrodes and maintains a preset firing force. At a predetermined firing force, EZ-AIR automatically closes the inlet and outlet valves to the weld head actuation cylinder and eliminates over-force.

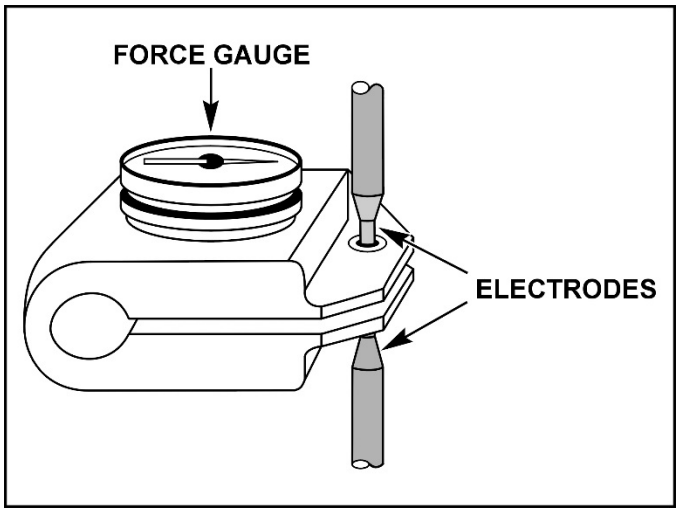
Down speed and welding force are the only two adjustments to be made when setting up the EZ-AIR. Down stops are ***not*** required.

NOTE: ***Before*** performing the following instructions, get the separate EZ-AIR Operator Manual supplied with the weld head and follow the detailed procedures for operating and adjusting EZ-AIR.

1 Use the force adjustment knob to set the weld head force indicator to "4." The indicator is located on the front of the force tube, just below the force adjustment knob. Set heads with digital readouts to "100."

2 If electrodes are being used, adjust the electrode spacing so that a Miyachi Unitek Force Gauge fits between the electrodes, as shown.

Depress and hold the footswitch. Note the force indication on the force gauge. When the head firing switch "clicks" (closes), the force will stabilize. If the firing switch does not close, or the force keeps increasing, verify that all of the connections have been properly made as described in the EZ-AIR manual.



3 Cycle the electrode up and down several times and adjust the down speed by turning the knob that is located on the back of the EZ AIR. The down speed should be adjusted to provide a comfortable speed for the operator or automation without excessive impact force to the parts.

4 The force gauge will indicate the electrode force. Use the force adjustment knob to increase the indicated force if the initial force reading is less than the required force setting for the welding application. If the initial force reading is greater than the required force setting, decrease the indicated force.

5 After setting the required force, particularly in automated applications, remove the force adjustment knob by loosening the two set screws, which secure it to the shaft. Invert the knob and place it on the shaft. Be sure to insert the locking tab on the knob into the slot on the force tube. Re-tighten both set screws.

6 If necessary, re-adjust the electrodes in their holders to accommodate the work piece.

7 A down stop is never required when using EZ-AIR. Turn the down stop screws counter-clockwise to their fullest extension without actually disengaging them. This will allow maximum downward travel of the upper arms.

Section IV. Model 88A and 89A Standard Air-Actuated Head Setup

This Section describes the following adjustments:

- **Firing force** to the value required by the specific application.
- **Maximum force** the electrodes can exert on the workpiece during the welding cycle.
- **Down stroke** limits.

CAUTION: Excessive force can damage the electrodes and/or the workpiece.

In automated applications, the maximum repetition rate is usually limited by the stroke of the head and the air pressure on the top of the air cylinder. The higher the pressure, the faster the upper arm will move. The air pressure on the top of the cylinder will determine the *welding, but not the firing force*. If the welding force exceeds the firing force, which is set by the force adjustment knob on the head, by more than five percent, a noticeable decrease in weld (reflow soldering) quality often results. Use the flow control on the bottom of the cylinder to reduce the down speed.

NOTE: Start with the ***right*** side of the head. Do ***not*** connect the DFS/88 switch box at this time.

1 Connect the right side firing switch cable to the power supply firing switch connector.

2 Use the force adjustment knob to set the weld head force indicator to "4". Indicator is located on the front of the force tube just below the force adjustment knob.

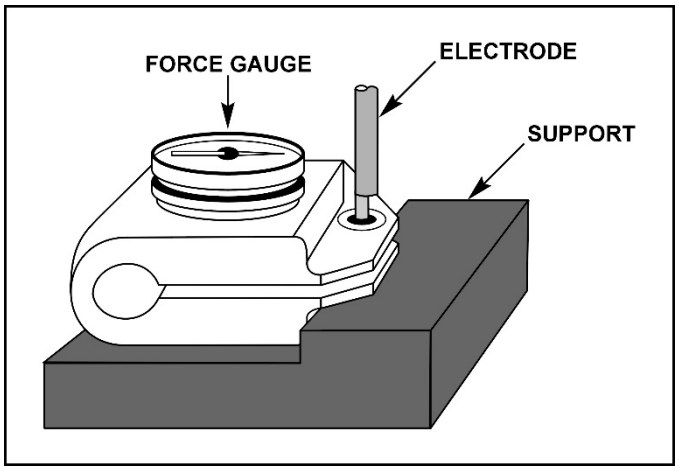
3 Close, but do not tighten, both air flow control valves.

4 Re-open each valve 3 or 4 turns. Adjust air pressure regulator to an indicated 10 psi (69 kPa).

5 Cycle the weld head by depressing and releasing the footswitch. Adjust the upspeed air flow control valve located at the ***TOP*** of the air cylinder, so that the upper arm moves up at a reasonable rate. It should not move so rapidly that it slams against the upstop.

6 Place a Miyachi Unitek Force Gauge beneath the electrode, as shown. The force gauge ***must*** be supported on the ***bottom*** for proper indication of force.

NOTE: If the application is a welding application, adjust the spacing so that a Miyachi Unitek Force Gauge fits between the right electrode and a workpiece.



7 Depress and hold the footswitch. **NOTE:** the force indication on the force gauge when the head firing switch "clicks."

8 If the firing switch does not close, increase the pressure from the air pressure regulator until the firing switch does close.

NOTE: If the firing switch closure is inaudible, it is easily detected by observing the firing switch indicator on the welding power supply or control. For older or non-Miyachi Unitek controls, an ohmmeter or continuity checker can be connected to the pins on the firing switch connector.

9 Use the force gauge reading from the previous step as a starting point. Use the force adjustment knob to increase the indicated force if the initial force reading is less than the required force setting. If the initial force reading is greater than the required force setting, decrease the indicated force.

10 Repeat steps 8 and 9 to set the firing force on the left side of the head. Disconnect the power supply firing switch connector from the right side firing switch cable and connect to the left side firing switch cable.

11 Release and depress the footswitch. Verify that the welding force applied by the upper arm does not exceed the force required to close the firing switch by more than five percent (5%). If necessary, adjust the pressure from the air pressure regulator and/or the force adjustment knob on the head.

12 After setting the required force, particularly in automated applications, remove the force adjustment knob by loosening the two set screws which secure it to the shaft. Invert the knob and place it on the shaft. Be sure to insert the locking tab on the knob into the slot on the force tube. Re-tighten both set screws. Reconnect the DFS/88 to both the right/left side firing cables and attach to the power supply firing switch connector.

13 If necessary, re-adjust the electrodes in their holders to accommodate the workpiece. The faces of both electrodes should be in the same plane and the gap (spacing) between the electrodes should be uniform.

14 Turn the downstop screws counter-clockwise to their fullest extension without actually disengaging them. This will allow maximum downward travel of the upper arms. The following downstop adjustments should be made only if the workpiece would be damaged if the upper arms travel too far. In most applications, use of the downstop is not recommended.

A) Start with the right downstop. Place the workpiece in the appropriate position. Rotate the downstop screw clockwise until the electrode no longer contacts the workpiece. Check the adjustment by depressing and releasing the footswitch.

B) Depress and ***hold*** the footswitch. Slowly rotate the downstop counter-clockwise until the force firing switch in the head closes. Rotate the downstop one or two additional turns counter-clockwise. The additional turn(s) will allow for electrode wear and/or the slight variations of the position of the electrode in its holder. Re-check that the firing switch consistently closes.

C) Repeat this procedure for the left downstop.

CAUTION: Do ***not*** attempt to use the downstop adjustments to limit the force which is applied to the workpiece. This will result in inconsistent welds.

15 Depress the footswitch. Adjust the downspeed air flow control valves so that the upper electrode arms descend slowly enough to prevent impact damage to the workpiece and electrodes.

16 Re-adjust upspeed air flow control valves if necessary.

17 Once the required firing force is setup, **DO NOT CHANGE THE REGULATOR SETTING!** Use only the air flow control valves to control the up and down speed of the upper arm. Changes in the regulator setting will change the welding force.

Section V. Model 89A/EZ
EZ-AIR Air-Actuated Head Setup

This Section describes the following adjustments:

- **Welding force** to the values required by the specific application.
- **Down speed** of the electrodes approaching the parts.
- Eliminating any **down stop** settings.

CAUTION: Excessive force can damage the electrodes and/or the workpiece.

The Model 89A/EZ air-actuated weld head is supplied with EZ-AIR, a pneumatic control that actuates the electrodes and maintains a preset firing force. At a predetermined firing force, EZ-AIR automatically closes the inlet and outlet valves to the weld head actuation cylinder and eliminates over-force.

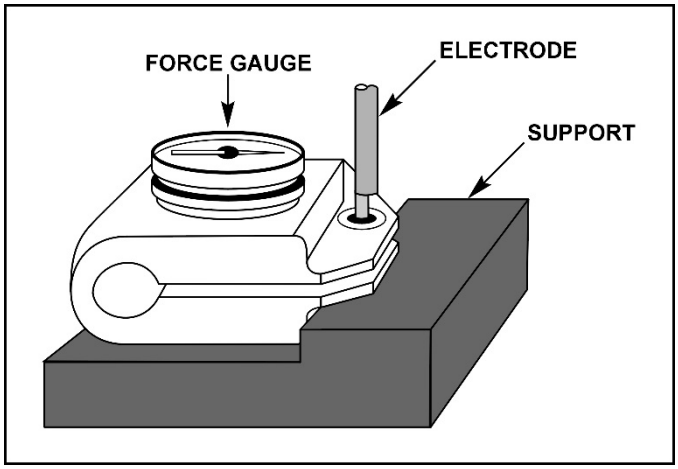
Down speed and welding force are the only two adjustments to be made when setting up the *EZ AIR*. Down stops are ***not*** required.

NOTE: ***Before*** performing the following instructions, get the separate EZ-AIR Operator Manual supplied with the weld head and follow the detailed procedures for operating and adjusting EZ-AIR.

1 Start with the ***right*** side of the head.

2 Use the force adjustment knob to set the weld head force indicator to "4." The indicator is located on the front of the force tube just below the force adjustment knob.

3 Place a Miyachi Unitek Force Gauge beneath the electrode, as shown. The force gauge ***must*** be supported on the ***bottom*** for proper indication of force.



Depress and hold the footswitch. Note the force indication on the force gauge. When the head firing switch "clicks" (closes), the force will stabilize. If the firing switch does not close, or the force keeps increasing, verify that all of the connections have been properly made per the instructions in the EZ-AIR manual.

4 Cycle the electrode up and down several times and adjust the down speed by turning the right hand knob that is located on the back of the *EZ AIR*. The down speed should be adjusted to provide a comfortable speed for the operator or automation without excessive impact force to the parts.

5 The force gauge will indicate the electrode force. Use the force adjustment knob to increase the indicated force if the initial force reading is less than the required force setting for the welding application. If the initial force reading is greater than the required force setting, decrease the indicated force.

6 Set the down speed and welding force on the ***left*** side of the head repeating steps 2 through 5.

7 After setting each electrode force, particularly in automated applications, remove the force adjustment knobs by loosening the two set screws that secure them to the shafts. Invert the knobs and place them on the shafts. Be sure to insert the locking tabs on the knobs into the slots on the force tubes. Re-tighten the set screws. If necessary, re-adjust the electrodes in their holders to accommodate the workpiece. The faces of both electrodes should be in the same plane and the gap (spacing) between the electrodes should be uniform.

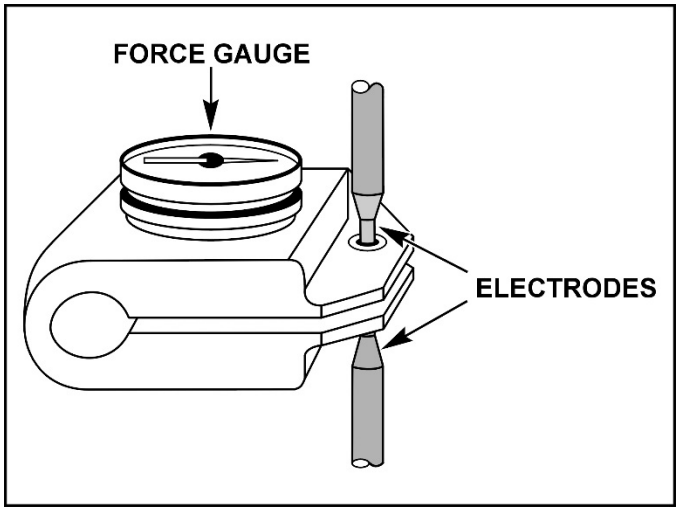
8 A down stop is never required when using EZ-AIR. Turn the down stop screws counter-clockwise to their fullest extension without actually disengaging them. This will allow maximum downward travel of the upper arms.

Section VI. Model 80F, 83F, 84F, 86F, and 87F Manually-Actuated Head Setup

This Section describes the following adjustments:

- **Firing force** to the value required by the specific application.
- **Maximum force** the electrodes can exert on the workpiece during the welding cycle.
- **Down stroke** limits.

CAUTION: Excessive force can damage the electrodes and/or the workpiece.



1 Use the force adjustment knob to set the weld head force indicator to "4." The indicator is located on the front of the force tube just below the force adjustment knob. Set heads with digital readouts to "100."

NOTE: If the application is a welding application, adjust the electrode spacing so that a Miyachi Unitek Force Gauge fits between the electrodes, as illustrated.

2 Depress and hold the footpedal. Note the force indication on the force gauge when the head firing switch "clicks." If the firing switch closure is inaudible, it is easily detected by observing the firing switch indicator on the welding power supply or control. For older or non-Miyachi Unitek controls, an ohmmeter or continuity checker can be connected to the pins on the firing switch connector.

3 Use the force gauge reading from the previous step as a starting point. Use the force adjustment knob to ***increase*** the indicated force if the initial force reading is ***less than*** the required force setting. If the initial force reading is ***greater than*** the required force setting, ***decrease*** the indicated force.

4 Depress and release the footpedal. Verify that the force applied by the operator does not exceed the force required to close the firing switch by more than five percent (5%).

5 After setting the required force, remove the force adjustment knob by loosening the two set screws that secure it to the shaft. Invert the knob and place it on the shaft. Be sure to insert the locking tab on the knob into the slot on the force tube. Re-tighten both set screws.

6 If necessary, re-adjust the electrodes (thermode) in their holders to accommodate the workpiece.

7 Turn the downstop screw counter-clockwise to its fullest extension without actually disengaging it. This will allow maximum downward travel of the upper arm. The following downstop adjustment should be made ***only*** if the workpiece would be damaged if the upper arm travels too far. ***In most applications, use of the downstop is not recommended***.

A) Place the workpiece in the appropriate position. Rotate the downstop screw clockwise until the electrode(s) or thermode no longer contacts the workpiece. Check the adjustment by depressing and releasing the footpedal.

B) Depress and ***hold*** the footpedal. Slowly rotate the downstop counter-clockwise until the force firing switch in the head closes. Rotate the downstop one or two additional turns counter-clockwise. The additional turn(s) will allow for electrode wear and/or the slight variations of the position of the electrode (thermode) in its holder. Re-check that the firing switch consistently closes.

CAUTION: Do ***not*** attempt to use the downstop adjustment to limit the force which is applied to the workpiece. This will result in inconsistent welds (reflow soldering).

Section VII. Model 88F and 89F Manually-Actuated Head Setup

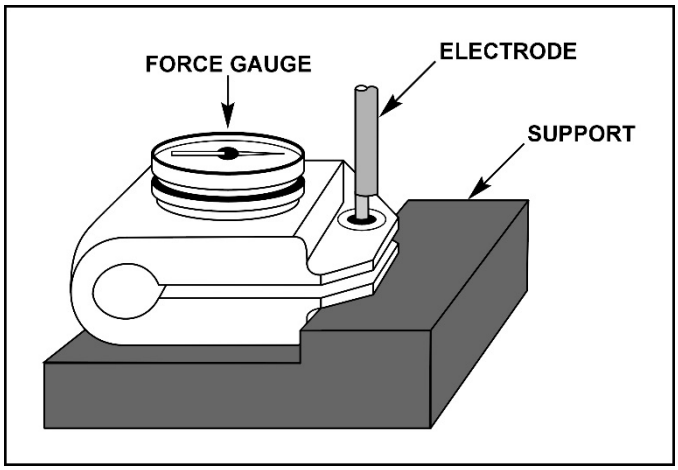
This Section describes the following adjustments:

- **Firing force** to the value required by the specific application;
- **Maximum force** the electrodes can exert on the workpiece during the welding cycle
- **Down stroke** limits.

CAUTION: Excessive force can damage the electrodes and/or the workpiece.

1 Start with the **right** side of the head. Do ***not*** connect the DFS/88 switchbox at this time. Connect the right side firing switch cable to the power supply firing switch connector. Use the force adjustment knob to set the weld head force indicator to "4." The indicator is located on the front of the force tube just below the force adjustment knob.

2 Place a Miyachi Unitek Force Gauge beneath the electrode, as shown. The force gauge ***must*** be supported on the ***bottom*** for proper indication of force.



NOTE: If the application is a welding application, adjust the spacing so that a Miyachi Unitek Force Gauge fits between the right electrode and a workpiece.

3 Depress and hold the pedal. Note the force indication on the force gauge when the head firing switch "clicks." If the firing switch closure is inaudible, it is easily detected by observing the firing switch indicator on the welding power supply or control. For older or non-Miyachi Unitek controls, an ohmmeter or continuity checker can be connected to the pins on the firing switch connector.

4 Use the force gauge reading from the previous step as a starting point. Use the force adjustment knob to ***increase*** the indicated force if the initial force reading is ***less than*** the required force setting. If the initial force reading is ***greater than*** the required force setting, ***decrease*** the indicated force.

5 Repeat steps 1 through 4 to set the firing force on the **left** side of the head. Disconnect the power supply firing switch connector from the right side firing switch cable and connect to the left side firing switch cable.

6 Depress and release the footpedal. Verify that the force applied by the operator does not exceed the force required to close the firing switch by more than five percent (5%).

7 After setting the required force, remove the force adjustment knob by loosening the two set screws that secure it to the shaft. Invert the knob and place it on the shaft. Be sure to insert the locking tab on the knob into the slot on the force tube. Re-tighten both set screws.

8 Reconnect the DFS/88 to both the right/left side firing cables and attach to the power supply firing switch connector.

9 If necessary, re-adjust the electrodes in their holders to accommodate the workpiece. The faces of both electrodes should be in the same plane and the gap (spacing) between the electrodes should be uniform.

10 Turn the downstop screws counter-clockwise to their fullest extension without actually disengaging them. This will allow maximum downward travel of the upper arms. The following downstop adjustments should be made ***only*** if the workpiece would be damaged if the upper arms travel too far. ***In most applications, use of the downstop is not recommended***.

11 Start with the right downstop. Place the workpiece in the appropriate position. Rotate the downstop screw clockwise until the electrode no longer contacts the workpiece. Check the adjustment by depressing and releasing the footpedal.

A) Depress and ***hold*** the footpedal.

B) Slowly rotate the downstop counter-clockwise until the force firing switch in the head closes. Rotate the downstop one or two additional turns counter-clockwise.

C) The additional turn(s) will allow for electrode wear and/or the slight variations of the position of the electrode in its holder.

D) Re-check that the firing switch consistently closes.

12 Repeat this procedure for the left downstop.

CAUTION: Do ***not*** attempt to use the downstop adjustments to limit the force which is applied to the workpiece. This will result in inconsistent welds.

CHAPTER 4
USER MAINTENANCE

Section I. General Maintenance

Inspection

Clean all electrical connections every six months to minimize welding circuit resistance. Inspect all bearings and braces for excessive wear every three years and replace as necessary.

Lubrication

All bearing surfaces are designed for non-lubricated operation. Do ***not*** oil any bearings or sleeves ***except*** for the use of a dry lubricant on weld heads used in automated, air actuated systems.

Section II. Standard Resistance Welding Electrode Cleaning

1 Re-surface tips periodically to remove oxides and welding debris from the electrodes.

2 Set the **WELD/NO WELD** Switch on the welding power supply, or control, to the **NO WELD** position.

3 Clean the electrodes using 400 to 600 grit emery paper. Fold the emery paper over a *flat, rigid backing* with the grit surface facing out. The rigid backing will maintain the "flatness" of the electrode face during cleaning.

4 Place emery paper and backing between electrodes. If the head is air actuated, reduce the pressure on the top of the cylinder. Actuate the head. The electrodes should contact with the paper with a force which is low enough to allow the paper to be moved without damaging its surface. Move the paper in a circular motion while maintaining the contact force.

5 Wipe the electrodes so that they are clean.

Section III. Unitip Electrode Maintenance

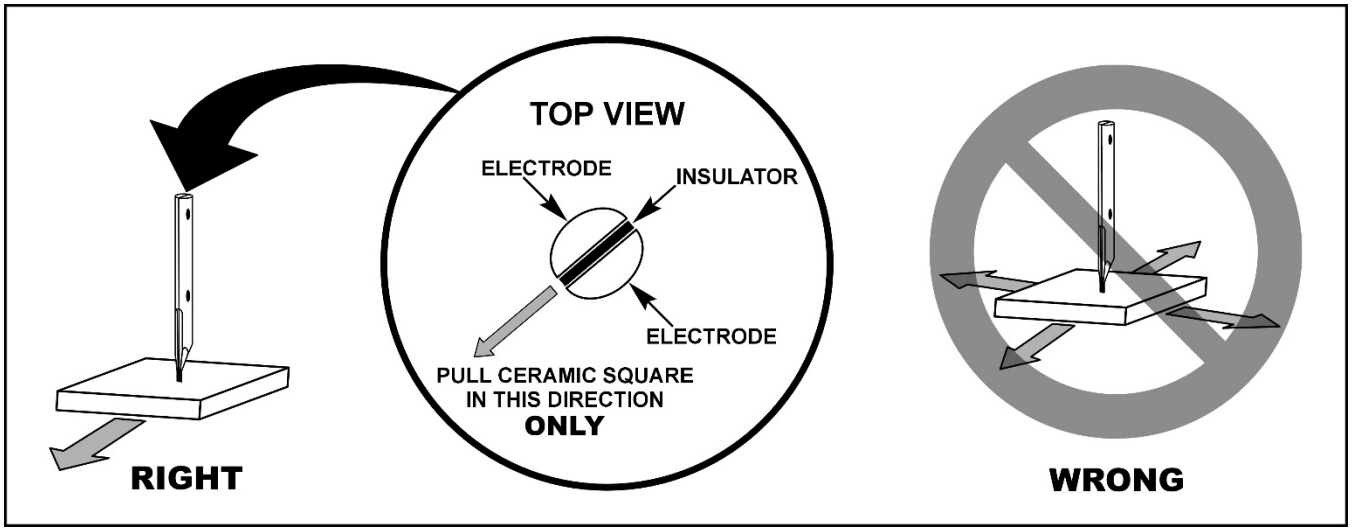
To ensure the best possible welds, new Unitip electrodes must be cleaned (or "dressed") before they are first used. This ensures that the electrode tip is flat, which is necessary to make maximum contact with the workpiece surface.

During normal welding operations, oxides build up as a natural result of the welding process. Oxide buildup limits the flow of current to the workpieces, so Unitips must be cleaned periodically. If the electrode starts to stick to the workpiece, the electrode has become dirty and needs to be cleaned.

CAUTION: The small size of the Unitip makes the electrode tip ***extremely susceptible to damage*** during cleaning. ***Never apply a force greater than 3 ounces (100 grams)*** when cleaning, because the, Ceramic Polishing Squares (Model CPD) have a hard surface which can cause the two halves of the electrode to split away from the insulator.

1 If necessary, install the Unitip in an electrode holder. Adjust the surface height of the work holder so that it is at the same level as the workpiece surface.

2 Place a polishing square on the work holder surface, directly beneath the tip of the electrode.



3 Bring the electrode tip into contact with the polishing square by applying a force ***less than 100 grams (3 ounces)***. Gently pull the polishing disk forward, ***keeping the direction of pull in a straight line parallel to the insulator as shown above***. Do ***not*** move the polishing square from side-to-side, or from front-to-back, or the two halves of the electrode will split away from the insulator.

4 After using the polishing square, clean the electrode tip with a small cotton swab saturated in alcohol.

5 Examine the electrode tip with a small mirror for flatness and direction of surface scratches. A properly dressed Unitip will have small scratch marks parallel to the insulator.

Section IV. Tare Spring Adjustment Model 80, 86, 87, and 88

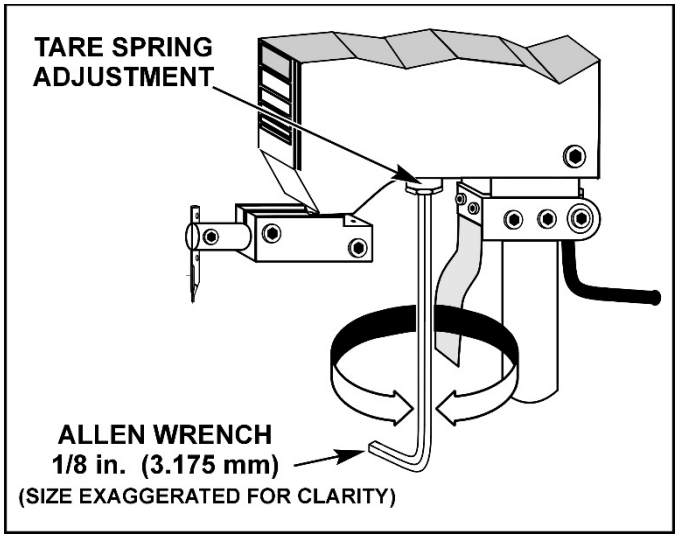
The tare spring adjustment compensates for the varying mass of different upper electrodes and adapters. Tare springs are ***not*** used in the model 82, 83, 84 or 89.

1 With the head in a vertical position and the upper arm and electrodes installed, set the force adjustment to ***minimum*** by turning the firing force adjustment knob fully counterclockwise.

2 Hold a measuring scale beside the upper electrode adapter block, grasp the block, and move the block up and down between the tare spring travel limits. The total travel will be about ⅛ inch (3.2 mm). Push the block down against the bottom limit, then gently release it. The tare spring should exert enough force to return the electrode to the center of its travel, approximately 1/16 inch (1.6 mm) from either extreme. If the electrode block does not re-center, adjust the tare spring.

3 If necessary, adjust the tare spring tension adjustment screw setting with a ⅛ inch (3.2 mm) Allen wrench. The adjustment screw is recessed in the center of the tare spring assembly at the bottom of the force spring tube.

4 Adjust the screw until the electrode block centers itself after being depressed and released. Tightening the screw increases tare spring tension, which increases the upward force on the upper electrode assembly. If the upper electrode interconnecting flexure interferes with the adjustment procedure, temporarily disconnect it from the upper electrode adapter block.



5 After adjusting the tare spring tension, recheck the firing force adjustment and readjust if required.

APPENDIX A.
Technical Specifications

Low-Force Weld Heads: 0.25 to 20 Lbs (2.2 to 89N)

FEATURES	80F(1)	80A	86F(2)	86A(2)	87F(1)	87A	88F	88A
Actuation	Manual	Air	Manual	Air	Manual	Air	Manual	Air
Weld Force Max. (lbs/N) Min. (lbs/N)	20/89 0.5/2.2	20/89 0.5/2.2	20/89 0.25/1.1	20/89 0.5/2.2	20/89 0.25/1.1	20/89 0.5/2.2	20/89 0.5/2.2	20/89 0.5/2.2
Maximum Rating (kVA) (watt-seconds)	2 250	2 250	1 125	1 125	2 125	2 125	5 250	5 250
Electrode Stroke (in) (mm)	1 25	1 25	1 25	1 25	1 25	1 25	1 25	1 25
Electrode Diameter (in) (mm)	1/8 3.2	1/8 3.2	Unibond Unitips	Unibond	Thermodes Unitips	Thermodes	0.245 6.2	0.245 6.2
Electrode Holder Type	Offset	Offset	Parallel Gap	Parallel Gap	Parallel Gap	Parallel Gap	Series	Series
Max. Throat Size (in) Height x Depth (mm)	1.94 x 6.0 49 x 152	1.94 x 6.0 49 x 152	3.38 x 5.2 86 x 132	3.38 x 5.2 86 x 132	2.55 x 5.25 65 x 133	2.55 x 5.25 65 x 133	6.2 x 6.25 157 x 159	6.2 x 6.25 157 x 159
Maximum Distance (in) between Electrodes (mm)	- -	- -	0.040 1.0	0.040 1.0	0.040 1.0	0.040 1.0	0.75 44.5	0.75 44.5
Electrode Series	ES-0400	ES-0400	EU	EU or UT	17(3) or UT	17(3)	ES-0800E	ES-0800E
Weld Cable Size: (AWG) Length: (in/cm)	#2 11/28	#2 11/28	#2 11/28	#2 11/28	#2 11/28	#2 11/28	#2/0 11/28	#2/0 11/28
Foot Pedal Model Number	CP	-	CP	-	CP	-	MSP	-
Air Solenoid Voltage (VAC) (all EZ-AIR: 24VAC or 24VDC)	-	24VAC ± 10% 24VDC -5% +10%	-	24VAC ± 10% 24VDC -5% +10%	-	24VAC ± 10% 24VDC -5% +10%	-	24VAC ± 10% 24VDC -5% +10%
Air Pressure for Max. Force (psi) (kPa)	-	50 345	-	50 345	-	50 345	-	50 345
Cylinder Inside Dia. (in/mm)	-	0.75/18.9	-	0.75/18.9	-	0.75/.189	-	0.75/18.9
Cycle Rate (full strokes/sec) at Min. Force at greater than 20% of Rated Force	-	1 2.5	-	1 2.5	-	1 2.5	-	1 2.5
Max. Dimensions: Height (in/mm) Width (in/mm) Depth (in/mm)	 13.7/348 7.6/193 1.7/ 43	 16.3/413 9.0/229 4.6/117	 16 /406 7.0/178 2.2/ 56	 16.5/419 9.1/231 4.7/119	 16 /406 7.0/178 2.2/ 56	 16.5/419 9.1/231 4.7/119	 16.7/429 13.5/343 4 /102	 19.3/490 13.5/343 10.5/267
Weight (lbs) (kg)	5 2.3	7 3.2	5.5 2.5	7 3.2	5.5 2.5	7 3.2	14 6.4	17 7.7

Add /24 for 24 VAC and /115 for 115 VAC Solenoid. 24 VAC is standard.

1) Model 80FLF and 87FLF have a force range of 0.25 10 lbs (1.1 - 45N).
2) Model 86FRE and 86ARE use 1/8 inch diameter Series E0-0400 35° Offset Electrode Holders and Electrodes.
3) 17BM, 17F, 17M, 17P or 17SR.

Low-Force EZ-AIR Weld Heads: 0.25 to 20 Lbs (2.2 to 89N)

FEATURES		80A/EZ	86A/EZ	88A/EZ
Actuation		Air	Air	Air
Weld Force	Max. (lbs/N) Min. (lbs/N)	20/89 1/4.4	20/89 1/4.4	20/89 1/4.4
Maximum Rating	(KVA) (watt-seconds)	2 250	1 125	5 250
Electrode Stroke	(in) (mm)	1 25	1 25	1 25
Electrode Diameter	(in) (mm)	1/8 3.2	Unibond	0.245 6.2
Electrode Holder Type		Offset	Parallel Gap	Series
Max. Throat Size Height x Depth	(in) (mm)	1.94 x 6.0 49 x 152	3.38 x 5.2 86 x 132	6.2 x 6.25 157 x 159
Maximum Distance between Electrodes	(in) (mm)	- -	0.040 1.0	0.75 44.5
Electrode Series		ES-0400	EU or UT	ES-0800E
Weld Cable Size: Length:	(AWG) (in/cm)	#2 11/28	#2 11/28	#2/0 11/28
Foot Pedal Model Number		-	-	-
Valve Driver Input (VAC)		24	24	24
Air Pressure for Max. Force [Unlubricated Air]	(psi) (kPa)	130 896	130 896	130 896
Cylinder Inside Diameter	(in/mm)	.75/18.9	.75/18.9	.75/18.9
Cycle Rate (full strokes/sec) at Min. Force at greater than 20% of Rated Force		1 2.5	1 2.5	1 2.5
Max. Dimensions:				
	Height (in/mm) Width (in/mm) Depth (in/mm)	15.9/404 13.3/338 3.4/87	16.0/406 13.3/338 3.4/87	19.3/490 15.6/396 5.6/142
Weight	(lbs) (kg)	9.4 4.3	9.4 4.3	21.8 9.9

Add /24 for 24 VAC and /115 for 115 VAC Solenoid. 24 VAC is standard.

4) Model 80FLF and 87FLF have a force range of 0.25 10 lbs (1.1 - 45N).
5) Model 86FRE and 86ARE use 1/8 inch diameter Series E0-0400 35° Offset Electrode Holders and Electrodes.
6) 17BM, 17F, 17M, 17P or 17SR.

High-Force Weld Heads: 4 to 40 Lbs (18 to 178N)

FEATURES		82A	83F	83A	84F	84A	89F	89A
Actuation		Air	Manual	Air	Manual	Air	Manual	Air
Weld Force	Max. (lbs/N) Min. (lbs/N)	40/178 6/27	40/178 4/18	40/178 6/27	40/178 4/18	40/178 6/27	40/178 4/18	40/178 6/27
Maximum Rating	(KVA) (watt-seconds)	5 250	5 250	5 250	5 250	5 250	5 250	5 250
Electrode Stroke	(in) (mm)	1 25	1 25	1 25	1 25	1 25	1 25	1 25
Electrode Diameter	(in) (mm)	1/4 6.4	1/4 6.4	1/4 6.4	1/4 6.4	1/4 6.4	0.245 6.2	0.245 6.2
Electrode Holder Type		In-Line	In-Line	In-line	Offset	Offset	Series	Series
Max. Throat Size Height x Width	(in) (mm)	N/A	1.8 x 3.1 46 x 79	1.8 x 4.8 46 x 122	3.3 x 6.1 84 x 155	3.3 x 7.8 84 x 198	8.7 x 5.6 221 x 142	8.7 x 8.2 221 x 208
Maximum Distance between Electrodes	(in) (mm)	- -	- -	- -	- -	- -	0.75 44.5	0.75 44.5
Electrode Series		ES-0800	ES-0800	ES-0800	ES-0800	ES-0800	ES-0800E	ES-0800E
Weld Cable Size Length:	(AWG) (in/cm)	#2/0 11/28	#2/0 11/28	#2/0 11/28	#2/0 11/28	#2/0 11/28	#2/0 11/28	#2/0 11/28
Foot Pedal Model Number			MSP	-	MSP	-	MSP	-
Air Solenoid Voltage	(VAC)	24 or 115	-	24 or 115	-	24 or 115	-	24 or 115
Air Pressure for Max. Force	(psi) (kg/cm^2)	50 345	-	50 345	-	50 345	-	50 345
Cylinder Inside Diameter	(in/mm)	1.0625	-	1.0625	-	1.0625	-	1.0625
Cycle Rate (full strokes/sec) At Min. Force At greater than 20% of Rated Force		 1 2.5	 -	 1 2.5	 -	 1 2.5	 -	 1 2.5
Max. Dimensions: Height (in/mm) Width (in/mm) Depth (in/mm)		 16.2/411 17.7/450 4.6/117	 17.4/492 7.9/201 2.6/ 66	 20.1/511 9.6/244 4.6/117	 16.7/424 10.0/254 2.6/ 66	 19.3/490 11.9/302 4.6/117	 21.9/556 14.6/371 4.9/124	 24.5/622 16.0/406 10.5/267
Weight	(lbs) (kg)		7 3.2	9 4.1	8 3.6	10 4.5	20 9	23 10

Add /24 for 24 VAC and /115 for 115 VAC Solenoid. 24 VAC is standard.

High-Force EZ-AIR Weld Heads: 4 to 40 Lbs (18 to 178N)

FEATURES		83A/EZ	84A/EZ	89A/EZ
Actuation		Air	Air	Air
Weld Force	Max. (lbs/N) Min. (lbs/N)	40/178 4/17.8	40/178 4/17.8	40/178 4/17.8
Maximum Rating	(KVA) (watt-seconds)	5 250	5 250	5 250
Electrode Stroke	(in) (mm)	1 25	1 25	1 25
Electrode Diameter	(in) (mm)	1/4 6.4	1/4 6.4	0.245 6.2
Electrode Holder Type		In-line	Offset	Series
Max. Throat Size Height x Width	(in) (mm)	1.8 x 4.8 46 x 122	3.3 x 7.8 84 x 198	8.7 x 8.2 221 x 208
Maximum Distance between Electrodes	(in) (mm)	- -	- -	0.75 44.5
Electrode Series		ES-0800	ES-0800	ES-0800E
Weld Cable Size Length	(AWG) (in/cm)	#2/0 11/28	#2/0 11/28	#2/0 11/28
Foot Pedal Model Number		-	-	-
Valve Driver Input	(VAC)	24	24	24
Air Pressure for Max. Force [Unlubricated Air]	(psi) (kPa)	130 896	130 896	130 896
Cylinder Inside Diameter	(in/mm)	1.0625	1.0625	1.0625
Cycle Rate (full strokes/sec) At Min. Force At greater than 20% of Rated Force		 1 2.5	 1 2.5	 1 2.5
Max. Dimensions: Height (in/mm) Width (in/mm) Depth (in/mm)		 20.25/514 14.5/368 4.6/117	 20.25/514 15.55/395 4.6/117	 21.5/546 21.4/544 10.5/267
Weight	(lbs) (kg)	11.4 5.17	12.4 5.62	27.8 12.6

Model 87SA and 84SA Reflow Soldering Heads

Feature		87SA (Low Force)	84SA (Medium Force)
Actuation		Air	Air
Weld Force Maximum	(lbs/N)	20/88.96	40/ 177.92
Minimum	(lbs/N)	2/8.9	5 / 22.2
Maximum Rating	KVA	5	5
	watt-second	250	250
Electrode Stroke	inch	1	1
	mm	25	25
Electrode Diameter	-- inch / mm	N/A *	N/A *
Electrode Holder Type		Thermode Style Mounting Block	Thermode Style Mounting Block
Max. Throat Size Height x Depth	-- (inch) -- (mm)	2.55 x 5.25 65 x 133	3.3 x 7.8 84 x 198
Maximum Distance between Electrodes	-- (inch) -- (mm)	-- --	-- --
Electrode Series		17TD	17TD
Weld Cable Size and Length	(AWG) (inch/cm)	#2/0 11 / 28	#2/0 11 / 28
Foot Pedal Model Number		--	--
Air Solenoid Voltage	(VAC)	24	24
Air Pressure for Max. Force	(psig)	80	80
Cylinder Inside Diameter	(inch / mm)	0.75 / 0.189	1.0625
Cycle Rate (full strokes/sec) at Min. Force at greater than 20% of Rated Force		1 2.5	1 2.5
Max. Dimensions	-- Height (inch / mm)	16.5 / 419	19.3 /490
	-- Width (inch / mm)	9.1 / 231	11.9 / 302
	-- Depth (inch / mm)	4.7 / 119	4.6 / 117
Weight	-- (Ibs)	7	10
	-- (kg)	3.2	4.5
Cooling Valve	-- VAC	24	24

* Thermodes range in lengths starting from 1.0 in. / 25.4mm up to 1.5 in. / 38.1 mm (for the 87SA) or up to 2.5 in. / 63.4 mm (for the 84SA) and in width from 0.059 in / 1.5mm to 0.118 in. / 3.0 mm (both units).

NOTE: Add /24 for 24 VAC and /115 for 115 VAC Solenoid. 24 VAC is standard.

APPENDIX B
ACCESSORIES

Accessories

MODEL	DESCRIPTION
80AK/24	**Air Kit,** 24V-50/60Hz. Includes Regulators, Gauges, Flow Controls, Cylinder, and Hardware.
80AK/115	**Air Kit,** 115V-50/60Hz. Includes Regulators, Gauges, Flow Controls, Cylinder, and Hardware. Converts Model 80F, 86F or 87F to Model 80A, 86A, 87A, respectively.
BLFOI	**Fiber Optic Illuminator System**, 115V-50/60Hz. Self-Supporting Gooseneck, Bifurcated Light Pipes, Focusing Lenses, and Mounting Adapter for Optic Mounting Assembly.
BLFOI/230	**Fiber Optic Illuminator System**, 230V-50/60Hz. Self-Supporting Gooseneck, Bifurcated Light Pipes, Focusing Lenses, and Mounting Adapter for Optic Mounting Assembly.
BPTL	**Base Plate, Teflon Coated**. Supports Optic Mounting Assembly.
CP	**Cable Pedal**, 1 in. stroke, with 6 foot cable. (Model 80F, 86F, or 87F)
CPD	**Polishing Disks, Ceramic,** 1 inch square x 0.025 in. thick, 20 pieces. Use to polish electrodes.
DFS	**Firing Switch Junction Box**. Connects 2 Firing Switch Cables to one Power Supply.
DFS/88	**Series Firing Switch Junction Box**. Connects two firing switch cables in Series. (Model 88 or 89)
FG100	**Electrode Force Gage**, 100 lb, SCALE 100 lb x 1 lb.
FG20	**Electrode Force Gage**, 20 lbs, SCALE 20 lb x 0.2 lb
FG10KG	**Electrode Force Gage**, 10 kg, SCALE 10 kg x 0.1 kg.
FSAC	**Footswitch, Single Level**. Switches 115V-50/60Hz to air heads. USE with UB2 and HFIC power supplies and/or any power supply or control which does NOT have a built-in Valve Driver.
FS1L	**Footswitch, Single Level**, for PM4.
FS2L	**Footswitch, Two Level**, for PM7 and 125DP, 250DP, 500HV or 875DP Power Supplies.
HS20	**Hall Effect Sensor Kit** for 20 lb. cylinders. Includes, Cylinder, Clamp and Sensor. Use on 80A, 86A, 87A. 88A requires two (2) Kits.
HS40	**Hall Effect Sensor Kit** for 40 lb. cylinders. Includes, Cylinder, Clamp and Sensor. Use on 82A, 83A, 84A. 89A requires two (2) Kits.
KR207	**Kovar Ribbon, Gold Plated**, 0.002 in. x 0.007 in. x 20 ft. spool.
KR310	**Kovar Ribbon, Gold Plated**, 0.003 in. x 0.010 in. x 20 ft. spool.
KR315	**Kovar Ribbon, Gold Plated**, 0.003 in. x 0.015 in. x 20 ft. spool.
KR320	**Kovar Ribbon, Gold Plated**, 0.003 in. x 0.020 in. x 20 ft. spool.
MSP	**Footpedal, Medium Force Swing Type**, 100 lb maximum, 5:1 mechanical advantage. (Model 83F, 84F, 88F, or 89F)

Accessories (Continued)

MODEL	DESCRIPTION
OMA	**Optic Mounting Assembly**. Use with SZO and BPTL.
PD	**Polishing Disks**, 600 grit, 1.5 in. diameter, 50 pieces. Use to polish electrodes.
SMZ-660	**Nikon SMZ 660 Stereo Zoom Microscope,** 10X wide eyepieces, object lens 0.5X wide field, 195 mm maximum working distance. Includes C-Bonder arm.
VDAC-24P	**Valve Driver Adapter Cable**, 115 V Receptacle, 4 pin Plug. Allows for Connection of OLD Style 115V Air Head Valve to NEW Type 115/24V Receptacle.
VDAC-115P	**Valve Driver Adapter Cable**, 4 pin Receptacle, 115 V Plug. Allows for Connection of Standard 24/115V Plug on NEW Style Air Head Valve to OLD Type 115V Receptacle.
WP	**Work Positioner**, 3 inch diameter, Height Adjustable from 1-7/16 to 2 inches.

Electrodes

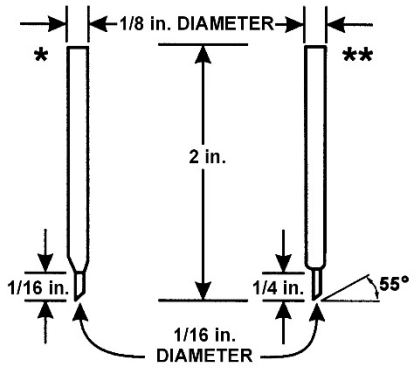
MATERIAL	DESCRIPTION
RWMA 1 -- Copper-Cadmium-Alloy	70B Rockwell Hardness, 90% conductivity. Used for welding aluminum and tin plate. Difficult to obtain in diameters under 1/2 inch. Gildcop is a substitute.
RWMA 2 -- Copper-Chromium Alloy	83B Rockwell Hardness, 85% conductivity. Used for welding steels, nickel alloys and other high resistance materials.
RWMA 3 -- Copper-Beryllium Alloy	100B Rockwell Hardness, 48% conductivity. Used for welding high resistance materials requiring high weld forces.
GLIDCOP -- AL-15 -- Dispersion Strengthened Copper With 0.15% Aluminum Oxide	68B Rockwell Hardness, 92% conductivity. Longer life, greater thermal stability, higher strength than RWMA 2. Generally interchangeable with RWMA 2 without changing schedules. GLIDCOP is a trademark of SCM.
RWMA 11 -- Copper-Tungsten Alloy	90B Rockwell Hardness, 46% conductivity. Usually inserted into an RWMA 2 shank. Used for welding cuprous and precious metals. Used for light projection welding dies.
RWMA 13 -- Tungsten	70A Rockwell Hardness, 32% conductivity. Usually inserted into an RWMA 2 shank. Cannot be machined but may be ground to the desired shape. Used to weld non-ferrous metals such as copper and brass.
RWMA 14 -- Molybdenum	90B Rockwell Hardness, 31% conductivity. Usually inserted into an RWMA 2 shank. Machineable. Used for welding copper, silver, gold, and their alloys.

1/8 Inch Electrodes

EO0400 1/8 INCH DIAMETER OFFSET ELECTRODES
Used with Series 80 Weld Heads

Model	Material
EO0402	RWMA 2
EO0403	RWMA 3
EO0411	RWMA 11 INSERT
EO0413	RWMA 13 INSERT
EO0420	MOLY INSERT

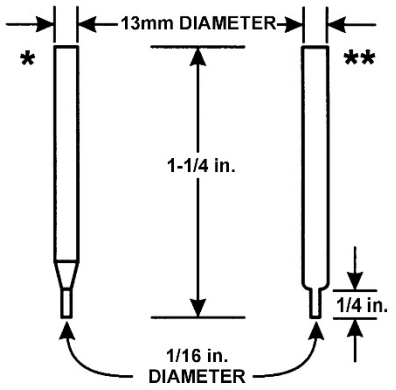
* Copper Alloy
** Refractory Alloy Insert



ES0400 13 mm DIAMETER STRAIGHT ELECTRODES
Used with 80 and 82 Series Weld Heads

Model	Material
ES0402	RWMA 2
ES0403	RWMA 3
ES0450	GLIDCOP
ES0411	RWMA 11 INSERT
ES0413	RWMA 13 INSERT
ES0420	MOLY INSERT

* Copper Alloy
** Refractory Alloy Insert



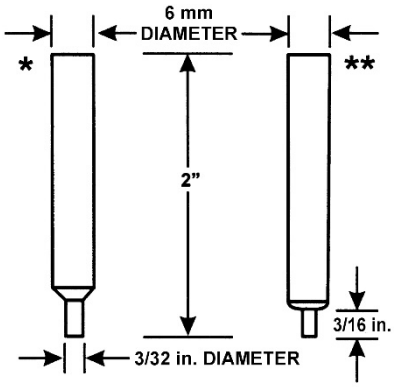
ES0800 6 mm DIAMETER STRAIGHT ELECTRODES

Used with 82, 83, and 84 Series Weld Heads

Model	Material
ES0802	RWMA 2
ES0803	RWMA 3
ES0850	GLIDCOP
ES0811	RWMA 11 INSERT
ES0813	RWMA 13 INSERT
ES0820	MOLY INSERT
ES0820A	1/8 IN. DIAMETER MOLY INSERT

* Copper Alloy

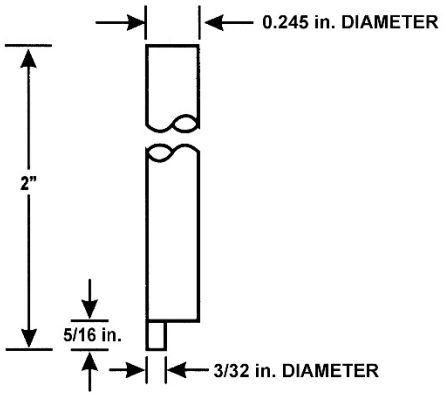
** Refractory Alloy Insert



ES0800E 0.245 INCH DIAMETER ECCENTRIC STRAIGHT ELECTRODES

Used with 88 Weld Heads and HE38V and HE88 Holders.

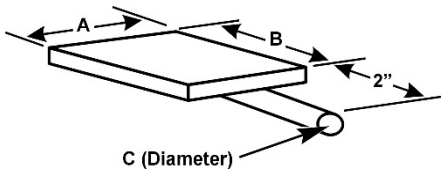
Model	Material
ES0802E	RWMA 2
ES0803E	RWMA 3
ES0850E	GLIDCOP
ES0820E	MOLY INSERT
ES0820E	GLIDCOP (0.062 FACE)



ETB2 AND ETB3 TABLE ELECTRODES

Used with 80 and 86 Series Weld Heads

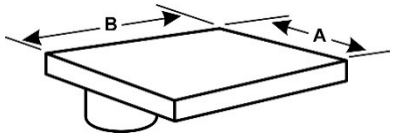
Model	A	B	C
ETB2 *	2 in.	1-3/4 in.	3/8 in.



ETB4 TABLE ELECTRODE

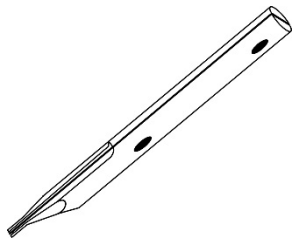
Used with 80 and 86 Series Weld Heads

Model	A	B
ETB4	3 in.	3-3/4 in.



12 INCH ELECTRODE RODS

MODEL	MATERIAL	DIAMETER (Inch)	MODEL	MATERIAL	DIAMETER (Inch)
ER0213	RWMA 13	1/16	ER0450	GLIDCOP	1/8
ER0220	MOLY	1/16	ER0802	RWMA 2	1/4
ER0402	RWMA 2	1/8	ER0803	RWMA 3	1/4
ER0403	RWMA 3	1/8	ER0850	GLIDCOP	1/4
ER0413	RWMA 13	1/8	ER1202	RWMA 2	3/8
ER0420	MOLY 1/8	1/8	ER2002	RWMA 2	5/8

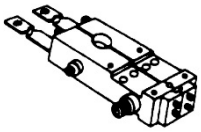
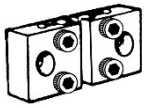
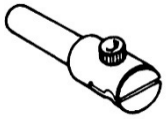
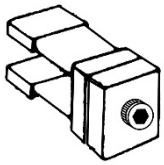
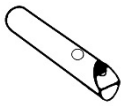
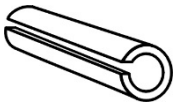
UNITIP ELECTRODES	

MODEL	FACE				MAXIMUM FORCE (oz)	MAXIMUM FORCE (kgf)
	Width	Depth	Gap	Length		
UTM111L	0.010	0.0009	0.001	0.025	33	0.94
UTM112L	0.010	0.010	0.002	0.025	33	0.94
UTM152L	0.010	0.005	0.002	0.025	17	0.47
UTM222L	0.018	0.020	0.002	0.050	132	3.75
UTM237L	0.030	0.020	0.007	0.050	161	4.57
UTM111C	0.009	0.010	0.001	0.025	33	0.94
UTM112C	0.010	0.010	0.002	0.025	33	0.94
UTM222C	0.018	0.020	0.002	0.050	132	3.75
UTM224C	0.020	0.020	0.004	0.050	132	3.75
UTM224L	0.020	0.020	0.004	0.050	132	3.75
UTM112CS	0.010	0.010	0.002	0.015	33	0.94
UTM112LS	0.010	0.010	0.002	0.015	33	0.94

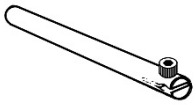
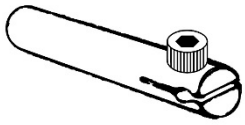
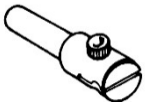
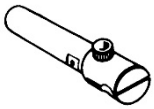
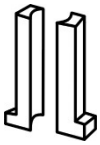
All dimensions in inches unless noted.

NOTE: Refer to Unitip and Unibond Electrodes Data Sheet 991-461

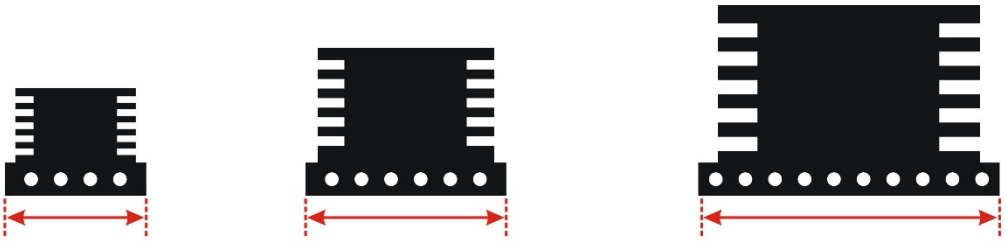
Electrode Holders

MODEL HE87	
	**Holders, Unitip/Thermode**. Used on Model 87A and 87F weld heads.
MODEL HE88	
	**Electrode Holder Blocks.** Holds 0.245 inch diameter electrodes. Adjusts Center-Center distance from 3/32 inch to 15/32 inch. Used on Model 88 weld heads.
MODEL HE1208	
	**Electrode Holder**, 3/8 inch diameter x 2 inch long, for 1/4 inch diameter electrodes. Used on Model 80 weld heads.
MODEL HE127SF	
	**Flexure Set.** Used on Model 86 weld heads.
MODEL HE127SFRE	
	**Flexure Set**, 1/8 inch diameter round electrodes. Used on Model 86 weld heads.
MODEL HE0435	
	**Offset Electrode Holder,** 35-degree for EO0400 Series electrodes.
MODEL HE0804	
	**Sleeves**, 5/8 in. outside diameter, 3/8 in. inside diameter. Convert large weld heads from 5/8 in. to 3/8 in. diameter holders for 1/8 in. diameter electrodes. Used on Model 88 weld heads.

Electrode Holders (Continued)

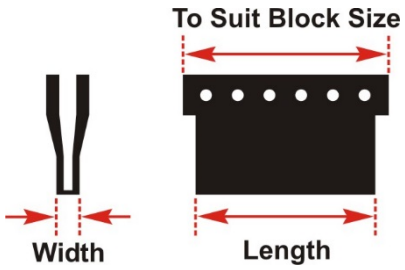
MODEL HE1200L	
	**Electrode Holder,** 3/8 inch diameter x 3.5 inch long, for 1/8 inch diameter electrodes. Used on Model 80 weld heads.
MODEL 1200S	
	**Electrode Holder, Standard,** 3/8 inch diameter x 3.5 inch long, for 1/8 inch diameter electrodes. Used on Model 80 weld heads.
MODEL 1208	
	**Electrode Holder,** 3/8 inch diameter x 2 inch long, for 1/4 inch diameter electrodes. Used on Model 80 weld heads.
MODEL 1600	
	**Standard Electrode Holder,** 1/2 inch diameter x 2.312 inch long, for 1/4 inch diameter electrodes. Used on Model 84 weld heads.
MODEL UTA	
	**Unitip Adapter**. Used on Model 86 weld heads.

Thermode Blocks



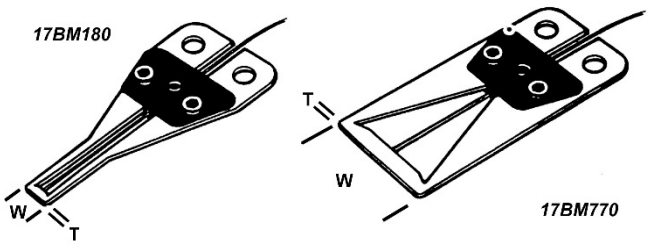
NOTE: **Thermodes** are normally supplied with **Type K Thermocouples** attached. You may order either **Type E** or **Type J Thermocouples** instead. Contact Amada Miyachi America for details.

Thermodes

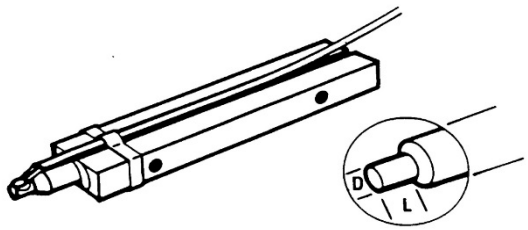
17TD THREE-DIMENSIONAL THERMODES			
CATALOG #	**TYPE**	**MATERIAL**	**SIZE (W x L)**
Used With 87, 84, and 180 SA Reflow Heads (Fits Small, Medium, and Large Blocks)			
17TDS1000/059	3-DIMENSIONAL	Special alloy	0.059” x 1.0” (1.5 mm x 25.4 mm)
17TDS1000/079	3-DIMENSIONAL	Special alloy	0.079” x 1” (2.0 mm x 25.4 mm)
17TDS1000/098	3-DIMENSIONAL	Special alloy	0.098” x 1” (2.5 mm x 25.4 mm)
17TDS1000/l18	3-DIMENSIONAL	Special alloy	0.118” x 1” (3.0 mm x 25.4 mm)
I7TDS1500/059	3-DIMENSIONAL	Special alloy	0.059” x 1.5” (1.5 mm x 38.1 mm)
I7TDS1500/079	3-DIMENSIONAL	Special alloy	0.079” x 1.5” (2.0 mm x 38.l mm)
I7TDS1500/098	3-DIMENSIONAL	Special alloy	0.098” x 1.5” (2.5” / 38.l mm)
17TDS 1500/118	3-DIMENSIONAL	Special alloy	0.118” x 1.5” (3.0 mm x 38.1 mm)
Used With 87, 84, and 180 SA Reflow Heads (Fits Medium and Large Blocks)			
17TDM2000/059	3-DIMENSIONAL	Special alloy	0.059” x 2” (1.5 mm x 50.8 mm)
17TDM2000/079	3-DIMENSIONAL	Special alloy	0.079” x 2” (2.0 mm x 50.8 mm)
I7TDM2000/098	3-DIMENSIONAL	Special alloy	0.098” x 2” (2.5 mm x 50.8 mm)
17TDM2000/118	3-DIMENSIONAL	Special alloy	0.118” x 2” (3.0 mm x 50.8 mm)
17TDM2500/059	3-DIMENSIONAL	Special alloy	0.059” x 2.5” (1.5 mm x 63 mm)
CATALOG #	**TYPE**	**MATERIAL**	**SIZE (W x L)**
Used With 87, 84, and 180 SA Reflow Heads (Fits Medium and Large Blocks)			
17TDM25001079	3-DIMENSIONAL	Special alloy	0.079” x 2.5” (2.0 mm x 63 mm)
17TDM2500/098	3-DIMENSIONAL	Special alloy	0.098” x 2.5” (2.5mm x 63 mm)
17TDM2500/118	3-DIMENSIONAL	Special alloy	0.118” x 2.5” (3.0 mm x 63 mm)
Used With 84, and 180 SA Reflow Heads (Fits Large Block)			
17TDL3000/059	3-DIMENSIONAL	Special alloy	0.059” x 3” (1.5 mm x 76.2 mm)
17TDL3000/079	3-DIMENSIONAL	Special alloy	0.079” x 3” (2.0 mm x 76.2 mm)
17TDL3000/098	3-DIMENSIONAL	Special alloy	0.098” x 3” (2.5 mm x 76.2 mm)
17TDL3000/118	3-DIMENSIONAL	Special alloy	0.118” x 3” (3.0 mm x 76.2 mm)

17B MULTIPLE LEAD BLADE THERMODE

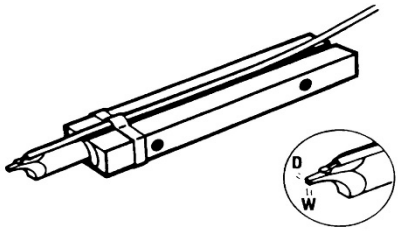
Used With 87 Reflow Heads



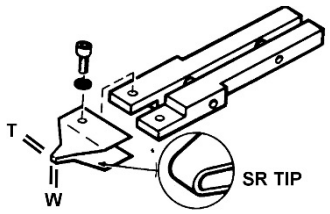
Model	Material	Size
17BM070	Molybdenum	0.075 inch wide x 0.030 inch thick (1.905 mm x 0.762 mm)
17BM180	Molybdenum	0.220 inch wide x 0.030 inch thick (5.588 mm x 0.762 mm)
17BM360	Molybdenum	0.400 inch wide x 0.030 inch thick (10.16 mm x 0.762 mm)
17BM770	Molybdenum	0.810 inch wide x 0.030 inch thick (20.574 mm x 0.762 mm)
17BM031/030	Molybdenum	0.031 inch wide x 0.030 inch thick (0.787 mm x 0.762 mm)
176M135/30	Molybdenum	0.135 inch wide x 0.030 inch thick (3.429 mm x 0.762 mm)
17BM400/60	Molybdenum	0.400 inch wide x 0.060 inch thick (10.16 mm x 1.524 mm)
17BM400/90	Molybdenum	0.400 inch wide x 0.090 inch thick (10.16 mm x 2.286 mm)
17BM600/30	Molybdenum	0.600 inch wide x 0.030 inch thick (15.24 mm x 0.762 mm)
17BM650/30	Molybdenum	0.650 inch wide x 0.030 inch thick (16.51 mm x 0.762 mm)
17BM770/60	Molybdenum	0.810 inch wide x 0.060 inch thick (20.574 mm x 1.524 mm)
17BM770/90	Molybdenum	0.810 inch wide x 0.090 inch thick (20.574 mm x 2.286 mm)
17BN870/30	Molybdenum	0.870 inch wide x 0.030 inch thick (22.098 mm x 0.762 mm)
17BM870/60	Molybdenum	0.870 inch wide x 0.060 inch thick (22.098 mm x 1.524 mm)
17BM900/30	Molybdenum	0.900 inch wide x 0.030 inch thick (22.86 mm x 0.762 mm)
17BM950	Molybdenum	0.950 inch wide x 0.030 inch thick (24.13 mm x 0.762 mm)
17BM1000	Molybdenum	1.000 inch wide x ,030 inch thick (25.4 mm x .762 mm)
17BMll00	Molybdenum	1.100 inch wide x 0.030 inch thick (27.94 mm x 0.762 mm)
17BM1300/30	Molybdenum	1.300 inch wide x 0.030 inch thick (33.02 mm x 0.762 mm)
17BM300/30	Molybdenum	0.300 inch wide x 0.030 inch thick (7.62 mm x 0.762 mm)

17P SINGLE POINT PEG TIP THERMODE Used With 87 Reflow Heads	

Model	Material	Size
17P20	Brazed Tungsten	0.020 inch diameter x 0.070 inch long (0.508 mm x 1.778 mm)
17P40	Brazed Tungsten	0.040 inch diameter x 0.070 inch long (1.016 mm x 1.778 mm)
17P50	Brazed Tungsten	0.050 inch diameter x 0.200 inch long (1.27 mm x 5.08 mm)
17P75	Brazed Tungsten	0.075 inch diameter x 0.070 inch long (1.905 mm x 1.778 mm)
17P93	Brazed Tungsten	0.093 inch diameter x 0.250 inch long (2.362 mm x 6.35 mm)
17P40/200D	Brazed Tungsten	0.40 inch diameter x 0.200 inch long (10.16 mm x 5.08 mm)
17P50/180	Brazed Tungsten	0.050 inch diameter x 0.180 inch long (1.27 mm x 4.572 mm)
17P50E	Brazed Tungsten	0.050 inch diameter x 200 inch long (1.27 mm x 5.08 mm)
17P062/10	Brazed Tungsten	0.062 inch diameter x 0.010 inch long (1.575 mm x 0.254 mm)
17P110/70	Brazed Tungsten	0.070 inch diameter x 0.110 inch deep (1.778 mm x 2.794 mm)
17P93-50	Brazed Tungsten	0.093 inch diameter x 0.500 inch long (2.362 mm x 12.7 mm)
17P93/E	Brazed Tungsten	0.93 inch diameter x 0.250 inch long (2.362 mm x 6.35 mm)

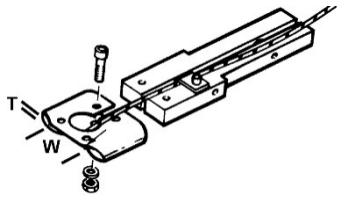
17T "T" TIP THERMODE Used With 87 Reflow Heads	

Model	Material	Size
17T08/10	Molybdenum	0.008 inch wide x 0.010 inch deep face (0.203 mm x 0.254 mm)
17T085/25	Molybdenum	0.0085 inch wide mm x 0.025 inch deep face (0.216 mm x 0.635 mm)
17T08/30	Molybdenum	0.008 inch wide x 0.030 inch deep face (0.203 mm x 0.762 mm)
17T04/04	Molybdenum	0.004 inch wide mm x 0.004 inch deep face (0.102 mm x 0.102 mm)

16SR SINGLE LEAD ROUNDED FOLD-UP THERMODE (Replaces 17SR) Used With 87 Reflow Heads	

Model	Material	Size
16SR40	Molybdenum	0.040 inch wide x 0.010 inch thick (1.016 mm x 0.254 mm)

NOTE: Amada Miyachi America Part Number 16SR40 replaces Amada Miyachi America Part Number 17SR40.

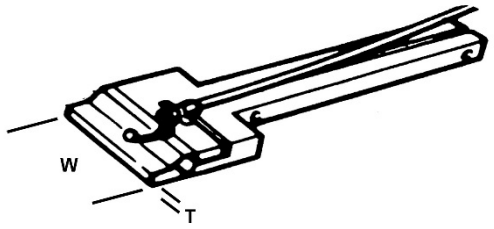
16 & 17M FINELINE MINIBAR THERMODE Used With 87 Reflow Heads	

Model	Material	Size
16M300	Nichrome Alloy	0.010 inch wide x 0.300 inch thick (0.254 mm x 0.762 mm)
17M300/20	Nichrome Alloy	0.020 inch wide x 0.300 inch thick (0.508 mm x 0.762 mm)

NOTE: Amada Miyachi America Part Number 16M300 replaces Amada Miyachi America Part Number 17M300.

17F MULTIPLE LEAD FOLD-UP BAND THERMODE

Used With 87 Reflow Heads



Model	Material	Size
17F1000	Nichrome Alloy	0.1 inch wide x 0.075 inch thick (25.4 mm x 1.905 mm)
17F250	Nichrome Alloy	0.250 inch wide x 0.075 inch thick (6.35 mm x 1.905 mm)
17F350	Nichrome Alloy	0.350 inch wide x 0.075 inch thick (8.89 mm x 1.905 mm)
17F380	Nichrome Alloy	0.375 inch wide x 0.075 inch thick (9.525 mm x 1.905 mm)
17F380K	Nichrome Alloy	0.375 inch wide x 0.075 inch thick (9.525 mm x 1.905 mm)
17F400	Nichrome Alloy	0.400 inch wide x 0.075 inch thick (10.16 mm x 1.905 mm)
17F500	Nichrome Alloy	0.500 inch wide x 0.075 inch thick (12.7 mm x 1.905 mm)
17F550	Nichrome Alloy	0.563 inch wide x 0.075 inch thick (14.30 mm x 1.905 mm)
17F630	Nichrome Alloy	0.625 inch wide x 0.075 inch thick (15.88 mm x 1.905 mm)
17F750	Nichrome Alloy	0.750 inch wide x 0.075 inch thick (19.05 mm x 1.905 mm)
17F850	Nichrome Alloy	0.850 inch wide x 0.075 inch thick (21.59 mm x 1.905 mm)

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