

Instruction manual

Number 0-2006

PWH/M - 3A WELDING TORCH

THERMAL DYNAMICS
 ***CORPORATION***

12/3/85

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MANUAL NO. 0-2006

INTRODUCTION

This manual is divided into five sections:

- SECTION 1. **General Information**, describes the Thermal Arc 3A Plasma Welding Torch. It also gives theory of operation and specifications of system components.
- SECTION 2. **Installation**, provides detailed instructions for assembling and inspecting new torches.
- SECTION 3. **Operation**, lists the operating procedures which will include instructions for using the equipment and tips for safe, efficient welding.
- SECTION 4. **Service**, contains detailed service procedures for torch and components.
- SECTION 5. **Parts List**, lists all parts of the torch.

The information contained in this manual represents our best judgment but Thermal Dynamics Corporation assumes no liability for its use.

NOTES, CAUTIONS AND WARNINGS

Throughout this manual, notes, cautions and warnings are used to call attention to particular information.

The method used to identify these highlights, and the purpose for which each is used, are as follows:

NOTE:

An operation, procedure and background information which aids the operator in efficient use of the machine, helps the serviceman in performing maintenance or requires additional emphasis.

CAUTION

An operational procedure which, if not properly followed, may cause damage to the equipment.



WARNING

An operational procedure which, if not followed, may cause injury to the operator or others in the operating area.



PRECAUTIONS



Operation and maintenance of any plasma arc equipment involves potential hazards. Personnel should be alerted to the following hazards and precautions taken to prevent possible injury.



GASES AND FUMES can be dangerous and hazardous to your health.

Ventilation must be adequate to remove the smoke during welding. (Threshold limit values and how to measure the amounts to assure adequate ventilation are found in publication (A) below).

Vapors of chlorinated solvents can form the toxic gas Phosgene when exposed to ultraviolet radiation from an electric arc. All solvents, degreasers, and potential sources of these vapors must be removed from the welding area.

- Keep all fumes and gases from your breathing area.
- Use downdraft table or other ventilation system to capture and remove fumes and gases.
- Use air supplied respirator if ventilation is not adequate to remove all fumes and gases.



ELECTRIC SHOCK can kill.

- Install and maintain equipment according to USA Standard C1, National Electric Code.
- Proper grounding procedures must be adhered to when using plasma welding equipment. The work or metal upon which a person welds must be grounded to a good electrical ground.
- Do not contact electrically live parts.



WARNING

Read and Understand this Instruction Manual and Your Employer's Safety Practices.

- Insulate yourself from work and ground.
- Replace any cracked or damaged insulating parts— including torch bodies and hoses.
- Turn off primary power before working on torch parts— including changing cups and tips.
- When operating plasma arc welding apparatus in a damp or wet area, extra care should be taken.



ARC RAYS can injure eyes and burn skin.

- Use welding shield with #10 or darker filter.
- Wear proper clothing.
- Make sure others are protected from arc rays.

COMPRESSED GAS CYLINDERS

Compressed gas cylinders are potentially dangerous— refer to supplier for proper handling procedures.



FIRE can be caused by sparks.

- Remove combustibles from the working area or provide a fire watch.
- Do not weld containers that have held combustibles. All flammable and combustible materials in the welding area that might be ignited by welding sparks should be removed.



PRECAUTIONS



The following publications provide additional information on safety precautions:

(A) Bulletin No. A6.1-66 "Recommended Safe Practices for Gas-Shielded Arc Welding."

(B) American National Standard ANSI Z49.1-1973 "Safety in Welding and Cutting".

Both are available from:

American Welding Society Inc., 2501 Northwest 7th Street, Miami, Florida 33125, Tel. (305) 642-7090.

(C) OSHA Safety and Health Standards, 29CFR 1910, available from the U.S. Department of Labor, Washington, D.C. 20210

Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: Industrial Park #2
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEU) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements among them are:

- * CSA (Canadian Standards Association) standard C22.2 number 60-M1990 for Arc welding equipment.
- * UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.
- * ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) applicable to welding equipment and associated accessories.
- * Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: David Ashworth
Vice President & Managing Director
Thermadyne Europe
Chorley England.

Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of STAK PAK II and DRAG-GUN): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

The limited warranty period for STAK PAK II shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the further limitations on such three (3) year period (see chart below).

The limited warranty period for DRAG-GUN shall be as follows: A maximum of two (2) years from date of sale to an authorized distributor and a maximum of one (1) year from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

<u>PAK UNITS, POWER SUPPLIES</u>	<u>PARTS STAK PAK II</u>	<u>PARTS DRAG-GUN</u>	<u>PARTS All OTHERS</u>	<u>LABOR</u>
Main Power Magnetics	3 Years	1 Year	2 Years	1 Year
Original Main Power Rectifier	3 Years	1 Year	2 Years	1 Year
Control PC Board	3 Years	1 Year	2 Years	1 Year
All Other Circuits And Components Including, But Not Limited To, Starting Circuit, Contactors, Relays, Solenoids, Pumps, Power Switching Semi-Conductors	1 Year	1 Year	1 Year	1 Year
<u>CONSOLES, CONTROL EQUIPMENT, HEAT EXCHANGES, AND ACCESSORY EQUIPMENT</u>	1 Year		1 Year	1 Year
<u>TORCH AND LEADS</u>				
Maximizer 300 Torch	N/A		1 Year	1 Year
All Other Torches	180 Days	180 Days	180 Days	180 Days
<u>REPAIR/REPLACEMENT PARTS</u>	90 Days	90 Days	90 Days	None

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Effective May 19, 1998

GENERAL INFORMATION

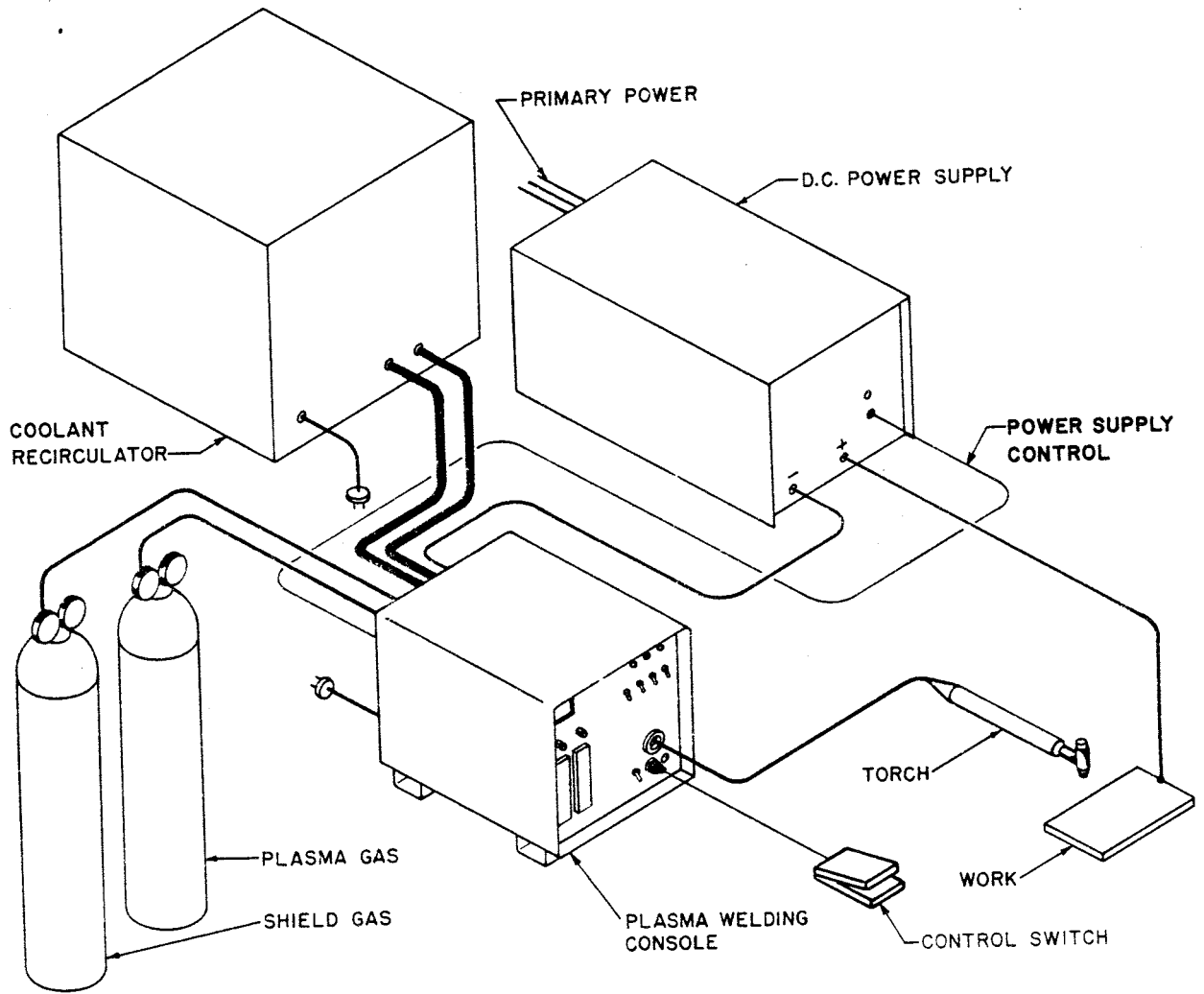


Figure .1-A Plasma Welding System

GENERAL INFORMATION

1.1. DESCRIPTION OF EQUIPMENT

The Thermal Arc 3A Plasma Welding Torch is designed for direct current plasma arc welding of ferrous and non-ferrous metals using the transferred arc plasma process. It is used as part of a welding system that includes a control console, a direct current power source, a coolant supply and a gas supply (Figure 1-A).

1.2. SPECIFICATIONS

- Straight Polarity Current Rating: 150 amperes DC maximum @ 60% Duty Cycle.
- Plasma Gas: Argon (Consumption: .25-3 SCFH (.12-1.5 lpm)).
- Shield Gas/Straight Polarity: Argon or Argon/Hydrogen (Consumption: 8-15 SCFH (3.8-7.1 lpm)).
- Shipping Weight: Hand torch PWH-3A - 2 lbs. (.9 kg); machine mounted torch PWM-3A - 3 lbs. (1.4 kg).
- Cooling Requirements: 4,000 BTU/hr; 1/3 gpm of TDC Torch Coolant @ 50 psi.

TORCH DIMENSIONS

	A		B		C		D	
	Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)
PWH-3A (70°)	8.75	(22.22)	2.62	(6.65)	.88	(2.24)	1.00	(2.54)
PWH-3A (90°)	8.50	(21.59)	2.62	(6.65)	.88	(2.24)	1.00	(2.54)
PWM-3A	19.25	(48.90)	1.00	(2.54)	9.25	(23.50)	1.38	(3.50)
					16.75	(42.54)		

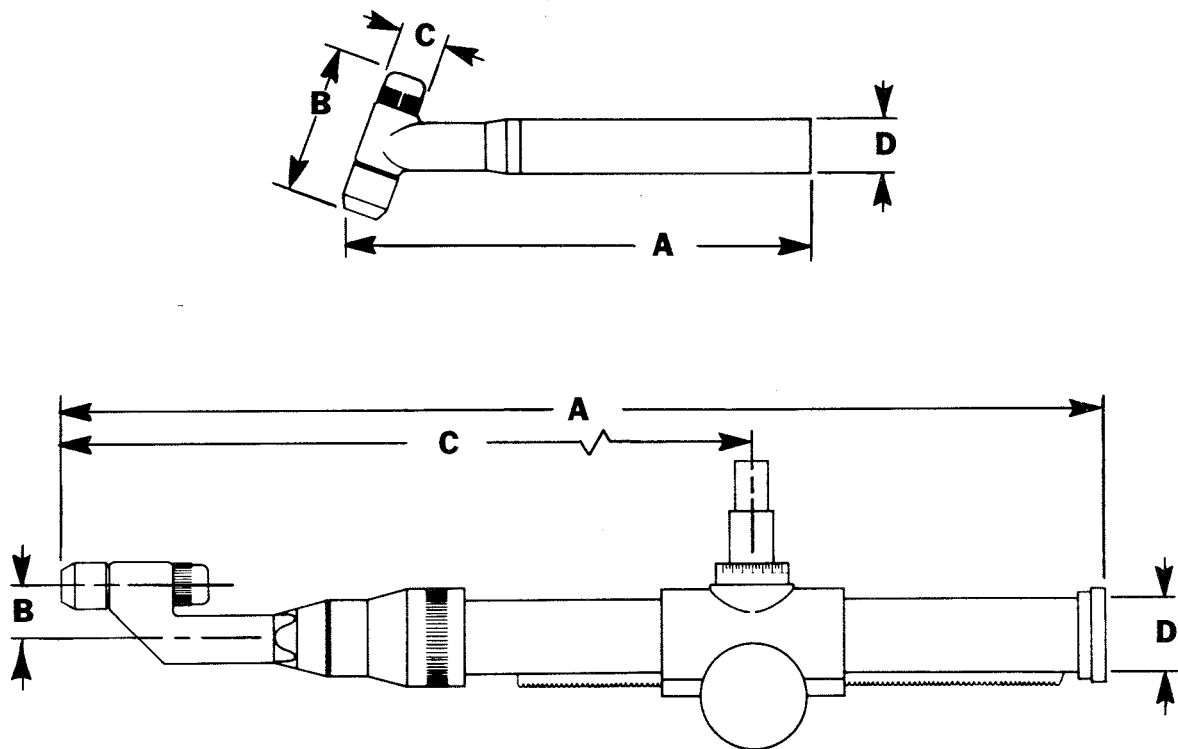


Figure 1-B
Page 2

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1.3. THERMAL ARC PLASMA

Plasma is a gas which has been heated to an extremely high temperature and ionized so that the gas becomes electrically conductive. The welding process uses this plasma to transfer an electric arc to the workpiece. The metal to be welded is melted by the heat of the arc.

In a Thermal Arc plasma torch, a cool gas such as Argon enters in Zone A, Figure 1-C. In Zone B a pilot arc between the electrode and the front of the torch heats and ionizes the gas. An arc transfers to the workpiece through a column of plasma gas in Zone C.

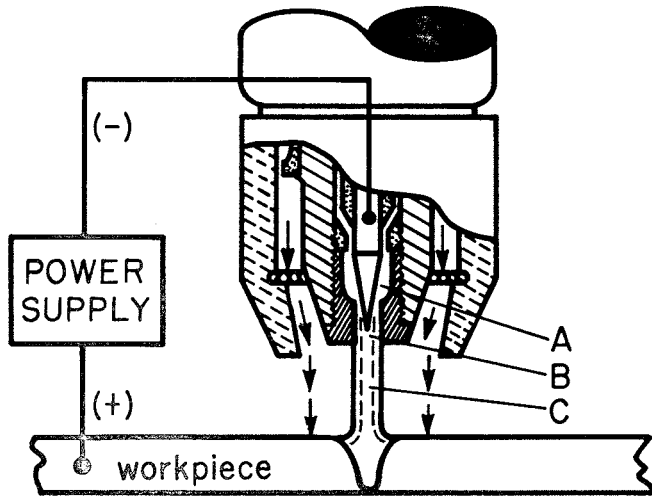


Figure 1-C Thermal Arc Plasma

By forcing the plasma gas and electric arc through a small orifice, Thermal Arc torches deliver a high concentration of heat to a very small area. The stiff, constricted plasma arc is shown in Zone C. Direct current straight polarity is used for most plasma welding, as shown in the illustration.

The Dual-Flow design of Thermal Arc welding torches uses a shield gas, shown by the small arrows. The shield gas surrounds the plasma arc and channels it to the workpiece, thus improving weld characteristics and shielding the weld puddle from atmospheric contamination.

Coolant from the coolant recirculator flows through the liquid cooled power leads to the torch head and back.

The plasma arc is infinitely variable from soft to stiff. Most applications can best be accomplished with a softer arc, i.e. lower plasma gas flow. Full penetration or "Key-hole" welds require a stiff arc, i.e. high plasma gas flow.

1.4. THEORY OF OPERATION

TORCH CONNECTIONS

The plasma gas flows to the torch through the black lead, around the electrode and gas distributor and out through the tip orifice.

The shield gas flows through the yellow torch lead, around the torch front end and out through the shield cup.

The torch coolant and negative (-) power flow to the torch through the green (color coded) lead.

PILOT ARC

When the torch is started, an arc is established between the electrode and welding tip. This pilot arc appears as a small "flame" at the front of the torch. This serves to illuminate the workpiece and assists in starting the main (welding) arc. It can also be left on while welding at low current levels to stabilize the welding arc.

GENERAL INFORMATION

HIGH FREQUENCY

A high voltage, high frequency current is superimposed on the direct current to establish the pilot arc (welding arc in the Plas-Weld units).

WELDING ARC

The power supply provides the direct current (DC) for welding. The negative output is connected to the torch electrode through the negative liquid cooled lead. The positive output is connected to the workpiece through the work cable. The electrically charged plasma gas serves to close this electrical circuit and thus becomes the welding arc.

INSTALLATION

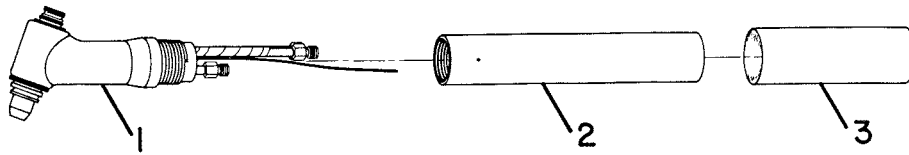


Figure 2-A

2.1. UNPACKING NEW EQUIPMENT

Unpack the equipment, check for possible damage during shipment. Check to be sure all items on the packing list are identified and accounted for.



WARNING

Check to be sure the main disconnect switch supplying power to the welding system is open.

2.2. HAND TORCH INSTALLATION (Figure 2-A)

If the torch is not already attached to the leads, assemble as follows:

- 1) Remove the handle (Item 2) from the head assembly (Item 1).
- 2) Feed the end of the leads with the torch fittings through the shrink tubing (Item 3) and then handle and connect to the torch, matching the color coded lead to the color coded torch fitting. Do not overtighten.
- 3) Screw the handle onto the torch.
- 4) Slide the shrink tubing over the handle until about 1/2 on. With a heat gun shrink the tubing until it is snug on the handle and the leads (Fig. 2-B).
- 5) Connect the other end of the leads to the appropriate fittings on the plasma welding console.

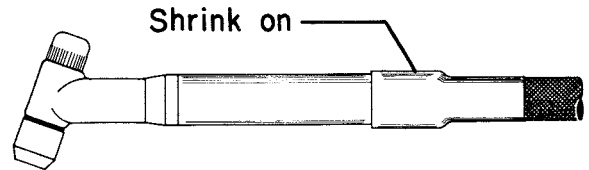


Figure 2-B

2.3. MACHINE TORCH INSTALLATION (Figure 2-C)

If the torch is not already attached to the leads, assemble as follows:

- 1) Loosen the nut (Item 2) and remove the positioning tube assembly (Item 4).
- 2) Unscrew the sleeve adaptor (Item 3).
- 3) Feed the end of the leads with the torch fittings through Items 4, 3 and 2 connect to the torch, matching the color coded lead to the color coded torch fitting. Do not overtighten.
- 4) Pass the sleeve adaptor through the nut and screw onto the torch.
- 5) Slide the positioning tube onto the sleeve adaptor and secure with the nut (Item 2).
- 6) Connect the other end of the leads to the appropriate fittings on the plasma welding console.

Check the instructions for the other components of the welding system to insure they are installed properly.

INSTALLATION

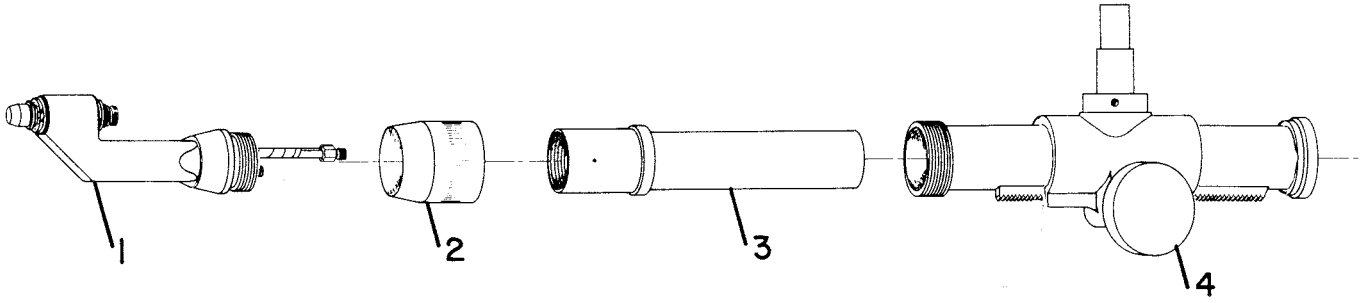


Figure 2-C

OPERATION

3.1. PRE-OPERATION SET-UP

The selection of specific parameters for a given welding application depend on the type of material, configuration of the joint and type of weld desired. Proper settings for a given joint have to be developed on the job.

Tables 3-A and 3-B give the maximum operating range of the various tips. These values are for a stiff collimated arc with the electrode setback at its maximum. A softer, less constricted arc can be obtained by decreasing the electrode setback (see Fig. 3-A). The minimum setback is with the electrode point flush with the face of the tip (see Fig. 3-B). By decreasing the electrode setback the plasma gas flow can be decreased while maintaining the higher current ratings of the tip. This gives a wider weld bead and in most cases allows for faster travel speeds.

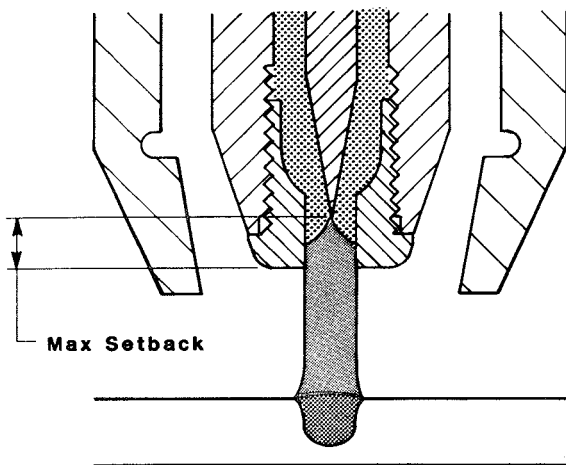


Figure 3-A

The electrode gauge values given in Table 3-A will result in maximum electrode setback for the given tip. This setback, when used with the given values for current and plasma gas flow will produce a stiff collimated arc that results in a narrower weld bead.

CAUTION

Decreasing the electrode standoff can only be done with tip orifice diameters of .046 or larger.

This procedure should be followed at the beginning of each shift:



WARNING

Check to be sure the main disconnect switch is open.

- 1) Check the torch to be sure that it has the proper components (see Section 4.1) and is adjusted properly (see Table 3-A).
- 2) Close the main disconnect switch supplying power to the welding system.

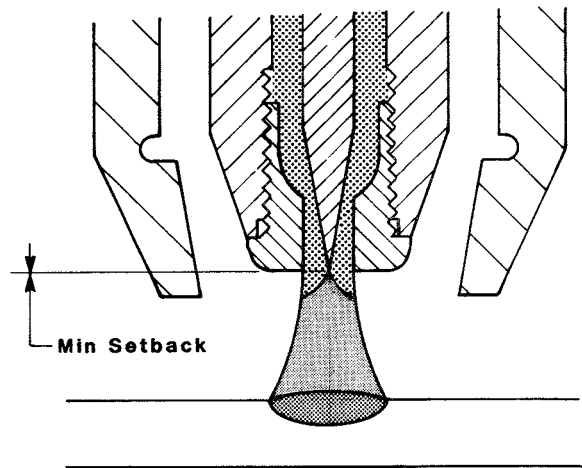


Figure 3-B

When the electrode is at minimum setback (flush with tip face) the plasma gas flow rate can be reduced below the levels given in Table 3-A while maintaining the given current levels. This produces a softer arc that results in less depth of penetration, giving a wider weld bead, and allowing faster travel speeds.

OPERATION

Table 3-A Suggested Starting Parameters for Manual Fusion Welding – Thermal Arc 3A Torch

Material/Thickness		Tip		Electrode			Current Range (Amps)	Plasma Gas (Argon) Flow		Shield Gas (3.8-7.1 LPM)
In.	(mm)	Cat. No.	Orifice Dia. In.	Cat. No. Std.	Cat. No. Ext.**	Gauge*		SCFH	LPM	
Stainless Steel										
.005	(.13)	8-3052	.014	9-1747	9-1775	0	3-6	.25-.5	.12-.24	Ar(95%)/H ₂ (5%) or Argon
		9-1788	.031			1	3-6	.25-.5	.12-.24	
.010	(.025)	8-3052	.014	↓	↓	0	3-10	.25-.5	.12-.24	
		8-3053	.022			0	4-10	.25-.5	.12-.24	
		9-1788	.031			1	3-10	.25-.5	.12-.24	
.020	(.051)	8-3053	.022	↓	↓	0	12-15	.25-.5	.12-.24	
		9-1782	.031			0	12-20	.25-.5	.12-.24	
		9-1789	.046			1	12-20	.25-.5	.12-.24	
1/32	(.80)	9-1782	.031	↓	↓	0	20-30	.4-.6	.19-.28	
1/16	(1.6)	9-1783	.046			0	30-45	.6-.9	.28-.42	
3/32	(2.4)	9-1783	.046			0	45-50	.9-1.0	.42-.47	
		9-1790	.062	1	45-55	.9-1.1	.42-.52			
		9-1784	.062	0	45-60	.9-1.2	.42-.57			
1/8	(3.2)	9-1784	.062	↓	↓	0	60-75	1.2-1.5	.57-.71	
		9-1791	.081			1	60-75	1.2-1.5	.57-.71	
		9-1811	.093			1	60-85	1.2-1.7	.57-.80	
		9-1795	.093			1	60-100	1.2-2.0	.57-.94	
						3	60-100	1.2-2.0	.57-.94	
Carbon Steel										
.050	(1.3)	9-1782	.031	↓	↓	0	25-30	.5-.6	.24-.28	Ar(95%)/H ₂ (5%) or Argon
		9-1783	.046			0	25-40	.5-.8	.24-.38	
1/16	(1.6)	9-1783	.046	↓	↓	0	30-50	.6-1.0	.28-.47	
		9-1790	.062			1	30-50	.6-1.0	.28-.47	
3/32	(2.4)	9-1784	.062	↓	↓	0	45-75	.9-1.5	.42-.71	
		9-1791	.081			1	45-75	.9-1.5	.42-.71	
1/8	(3.2)	9-1784	.062	↓	↓	0	60-75	1.2-1.5	.57-.71	
		9-1791	.081			1	60-75	1.2-1.5	.57-.71	
		9-1811	.093			1	60-85	1.2-1.7	.57-.80	
		9-1785	.081			0	60-100	1.2-2.0	.57-.94	
						3	60-100	1.2-2.0	.57-.94	
Titanium										
.010	(.25)	8-3052	.014	↓	↓	0	4-10	.25-.5	.12-.24	Argon
		9-1788	.031			1	4-10	.25-.5	.12-.24	
.020	(.51)	8-3053	.022	↓	↓	0	10-15	.25-.5	.12-.24	
		9-1782	.031			0	10-20	.25-.5	.12-.24	
		9-1789	.046			1	10-20	.25-.5	.12-.24	
						1	10-20	.25-.5	.12-.24	

* Gauge settings are identified by the number of rings on the gauge and are for maximum electrode setback. See Torch Assembly, step 4 on page 12 for proper adjustment procedure.

** A 9-1803 Extended Cap is required when the 9-1775 Electrode is used.

NOTE: This information represents our best judgement but Thermal Dynamics Corporation assumes no liability for its use. The parameters listed above may be varied to optimize performance.

OPERATION

**Table 3-B Suggested Starting Parameters for Keyhole
Welding – Thermal Arc 3A Torch**

Material/Thickness		Tip		Electrode Gauge *	Current Range (Amps)	Plasma Gas (Argon) Flow		Welding Speeds inches/min (meters/min)	Shield Gas 8-15 SCFH (3.8-7.1 LPM)	
In.	(mm)	Cat. No.	Orifice Dia. In.			SCFH	LPM			
Stainless Steel										
1/16	(1.6)	9-1783	.046	0	30-45	1.6-1.8	.76-.85	6-8 (.15-.20)	Ar(95%)/H ₂ (5%)	
3/32	(2.4)	9-1783	.046	0	45-50	1.8-2.0	.85-.94	6-8 (.15-.20)		
		9-1790	.062	1	45-65	1.8-2.0	.85-.94	6-8 (.15-.20)		
1/8	(3.2)	9-1784	.062	0	65-75	2.0-2.5	.94-1.18	8-10 (.20-.25)		
		9-1791	.081	1	65-75	2.0-2.5	.94-1.18	8-10 (.20-.25)		
		9-1811	.093	1	65-85	2.0-2.5	.94-1.18	8-10 (.20-.25)		
5/32	(4.0)	9-1811	.093	1	70-85	2.5-3.0	1.18-1.42	8-10 (.20-.25)		
		9-1785	.081	0	70-100	2.5-3.0	1.18-1.42	8-10 (.20-.25)		
Carbon Steel										
1/16	(1.6)	9-1783	.046	0	35-50	1.5-1.8	.71-.85	6-8 (.15-.20)		Argon
		9-1790	.062	1	35-50	1.5-1.8	.71-.85	6-8 (.15-.20)		
3/32	(2.4)	9-1784	.062	0	60-75	1.8-2.0	.85-.94	8-10 (.20-.25)		
		9-1791	.081	1	60-75	1.8-2.0	.85-.94	8-10 (.20-.25)		
1/8	(3.2)	9-1811	.093	1	75-85	2.0-2.5	.94-1.18	8-10 (.20-.25)		
		9-1785	.081	0	75-100	2.0-2.5	.94-1.18	8-10 (.20-.25)		
Inconel										
3/32	(2.4)	9-1784	.062	0	50-70	1.8-2.0	.85-.94	6-8 (.15-.20)	Ar(95%)/H ₂ (5%)	
		9-1791	.081	1	50-70	1.8-2.0	.85-.94	6-8 (.15-.20)		
1/8	(3.2)	9-1784	.062	0	60-75	2.0-2.5	.94-1.18	8-10 (.20-.25)		
		9-1791	.081	1	60-75	2.0-2.5	.94-1.18	8-10 (.20-.25)		
Hastelloy										
1/16	(1.6)	9-1782	.031	0	25-40	1.2-1.8	.57-.85	6-8 (.15-.20)		Ar(95%)/H ₂ (5%)
		9-1783	.046	0	25-40	1.2-1.8	.57-.85	6-8 (.15-.20)		
		9-1790	.062	1	25-40	1.2-1.8	.57-.85	6-8 (.15-.20)		

* Gauge settings are identified by the number of rings on the gauge and are for maximum electrode setback. See Torch Assembly, step 4 on page 12 for proper adjustment procedure.

** A 9-1803 Extended Cap is required when the 9-1775 Electrode is used.

NOTE: This information represents our best judgement but Thermal Dynamics Corporation assumes no liability for its use. The parameters listed above may be varied to optimize performance.

OPERATION

- 3) Turn the system on.
- 4) Set the gas supply pressure regulator at 30 psig. Adjust the gas flow rates as required (see Table 3-A).
- 5) Purge for approximately 3 minutes by letting the plasma gas run. This will remove any condensation of moisture that may have accumulated in the torch while it was shut down.

NOTE:

Only the plasma gas line needs to be purged.

- 6) Select the welding mode.
- 7) Set the current to the selected amperage level.

The torch is now ready for operation.



WARNING

Read and understand the precautions listed in the front of this manual. Be sure the operator is equipped with proper gloves, clothing and eye protection and that proper ventilation is provided.

3.2. HAND TORCH OPERATION

- 1) Pick up the torch and set the welding system to the operating mode.

CAUTION

The pilot arc is established at this time. Be careful of the direction

the torch tip is pointed in so as not to get burned.

- 2) Lower the welding helmet and position the torch at the beginning of the weld zone. The light from the pilot arc will help to find this position. Hold the torch approximately 3/16 inch from the workpiece and activate the control switch. When the welding arc transfers, adjust the torch standoff and amperage until the desired penetration is achieved. Move the torch along the line of weld at a speed to coincide with the weld puddle to achieve the desired weld quality.

- 3) Deactivate the control switch.
- 4) Switch the welding system to the standby mode (post purge).
- 5) Wait 5 minutes before shutting the system down to allow the torch to cool.

3.3. MACHINE TORCH OPERATION

- 1) Locate the torch at the required starting position for the weld. Adjust the height as required.
- 2) Activate control switch.
- 3) Rate of travel of the torch will depend on the material and type of weld. This will have to be determined by the operator.
- 4) After the weld is completed, deactivate the control switch.
- 5) Put the welding system in the standby mode (post purge).
- 6) Wait 5 minutes before shutting the system down to allow the torch to cool.

SERVICE

The Service Section is divided into two parts:

- 4.1. Torch Maintenance
- 4.2. Torch Leads

4.1. TORCH MAINTENANCE



WARNING

Check to be sure the main disconnect to the welding system is open before disassembling the torch.

Torch Disassembly and Inspection

CAUTION

The electrode cap has an O-ring seal to prevent gas leakage. It is important to observe the following precautions for the O-ring:

- A) Make sure that the groove and the surface that the O-ring will seal against are clean and free of nicks and scratches.

- B) Check to see that the O-ring is not cut or cracked.
- C) Lubricate O-ring with a light coating of Cat. No. 8-4025 O-ring lubricant. This should be used sparingly, just enough to make the O-ring slippery, but not enough to accumulate in the torch.

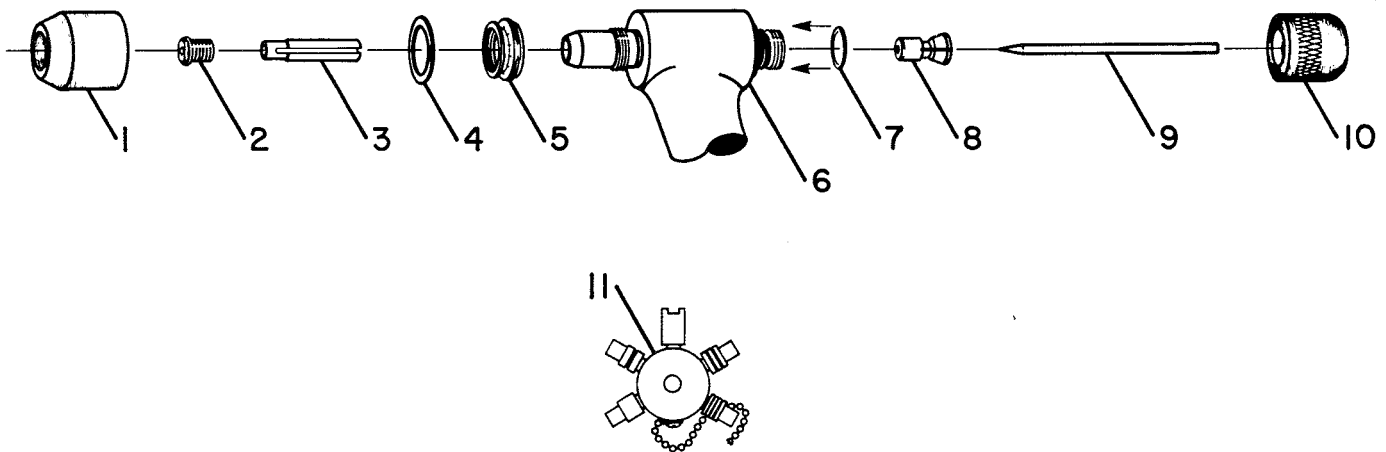
Disassemble the torch as follows:

- 1) Unscrew the ceramic shield cup (Item 1).

CAUTION

Hold the torch with the tip end up to prevent the gas distributor from falling out and breaking.

- 2) Using the tip wrench (Item 11), unscrew the tip (Item 2).
- 3) Unscrew the electrode cap (Item 10) while still holding torch (Item 6) tip end up.



- | | |
|------------------------|----------------------------|
| 1. Shield Cup | 6. Basic Head Assembly |
| 2. Tip | 7. O-ring |
| 3. Gas Distributor | 8. Collet |
| 4. Gasket (Shield Cup) | 9. Electrode |
| 5. Shield Gas Diffuser | 10. Electrode Cap |
| | 11. Wrench & Gage Assembly |

Figure 4-A Torch Parts Explosion

- 4) To remove the collet (Item 8), push the electrode (Item 9) back into the torch slightly. This pushes the collet out the back of the torch. The electrode should come out with the collet (Fig. 4-B).

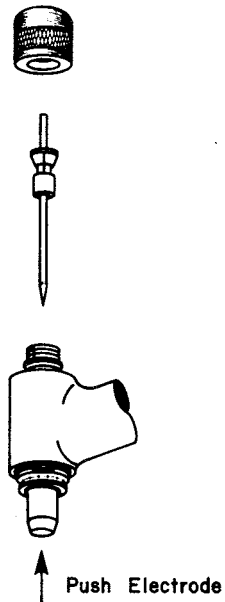
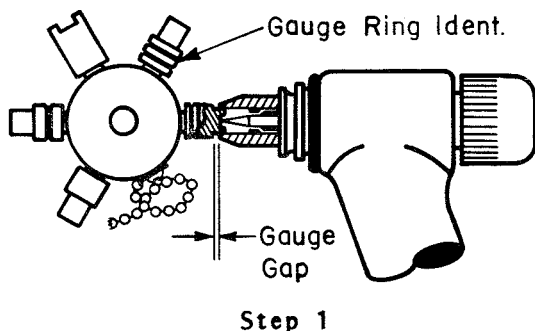


Figure 4-B Electrode & Collet Removal

- 5) Hold a finger over the tip end of the torch and turn the torch over. Carefully remove the finger until the gas distributor (Item 3) drops part way out the front of the torch. Grasp the gas distributor and remove.
- 6) The shield gas diffuser (Item 5) does not usually need to be removed. In the event that it does, use a 19/32 open end wrench to unscrew it.



Torch Assembly



WARNING

Primary power to the welding system must be disconnected before assembling the torch.

- 1) Insert the electrode (Item 9) in the collet (Item 8) and then this assembly into the rear of the torch (Item 6) head. Hold in place with finger.
- 2) Turn the torch upside down and slide the gas distributor (Item 3), notched end first, into the torch (as in Fig. 4-A).

CAUTION

Care must be taken to insure that the gas distributor (Item 3) is installed in the correct direction.

- 3) Screw the electrode cap (Item 10) on firmly then back off a couple of turns so that the electrode (Item 9) can be adjusted.
- 4) Select the proper gauge on the gauge and wrench assembly (Item 11). The electrode (Item 9) must contact the gauge to be properly adjusted (Step 1, Fig. 4-C). Insert the gauge into the front of the torch and press until the shoulder of the gauge contacts the torch anode (Step 2, Fig. 4-C). Tighten the electrode cap (Item 10) securely while holding pressure against the gauge.

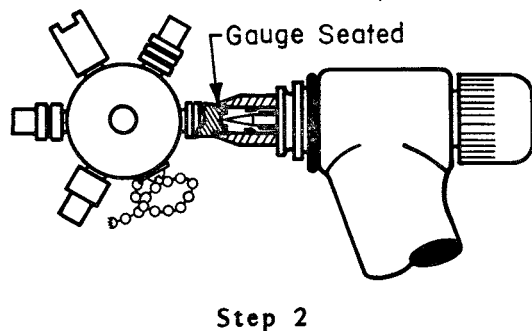


Figure 4-C

SERVICE

- 5) Install the welding tip (Item 2) and tighten gently with the tip wrench (Item 11).
- 6) If the shield gas diffuser (Item 5) was disassembled, replace at this time. Tighten firmly. Stretch the gasket (Item 4) over the shield gas diffuser and position against the torch body.
- 7) Screw on shield cup (Item 1).

The torch is now assembled and ready to be checked for possible leakage before operating. Turn on the torch coolant recirculator and observe the tip and orifice of the torch for possible sign of moisture.

Turn on the plasma gas and watch the gas stream for possible signs of moisture in the stream before operating. Do not attempt to operate the torch until the source of the moisture has been identified and corrected.

4.2. TORCH LEADS REPLACEMENT

Hand Torch

- 1) Cut off the shrink-on tubing that is at the end of the handle and leads sleeving.
- 2) Unscrew the handle from the torch.
- 3) Disconnect the four hoses from the torch.
- 4) Remove the handle from the old leads and insert on new leads.
- 5) Connect the new leads to the torch making sure the color coded leads mate with their color coded torch fittings. Do not over-tighten.
- 6) Screw the handle back onto the torch.

- 7) Slide the new shrink-on tubing over the handle until 1/2 of it is on the handle. Shrink the tubing with heat (not flame) until it is firm around the handle and sleeving.

Machine Mounted Torch

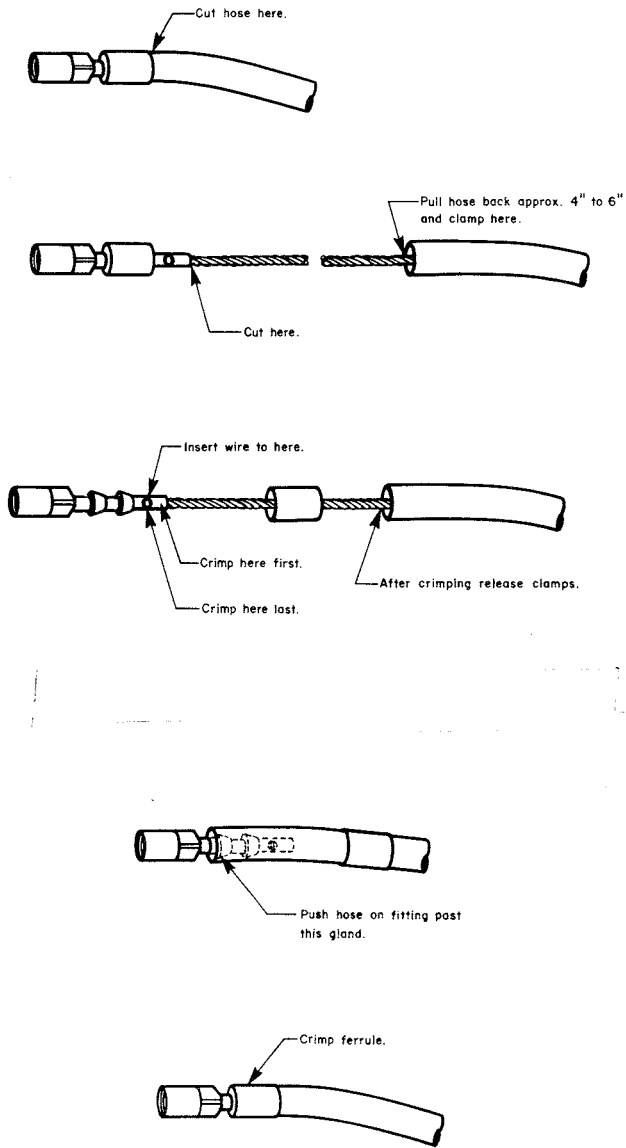
- 1) Unscrew the nut holding the positioning tube to the torch assembly. Slide the positioning tube back away from the torch.
- 2) Unscrew the sleeve adaptor from the torch. Slide up the leads until the torch fittings are accessible.
- 3) Disconnect the four hoses from the torch.
- 4) Remove the nut, sleeve adaptor and positioning tube from the old leads and install on the new leads at the torch end in the same order as they were on the old leads.
- 5) Connect the new leads to the torch making sure the color coded leads mate with their color coded torch fittings. Do not over-tighten.
- 6) Screw the sleeve adaptor back onto the torch.
- 7) Slide the positioning tube over the sleeve adaptor and secure with the nut.

Torch Leads Repair

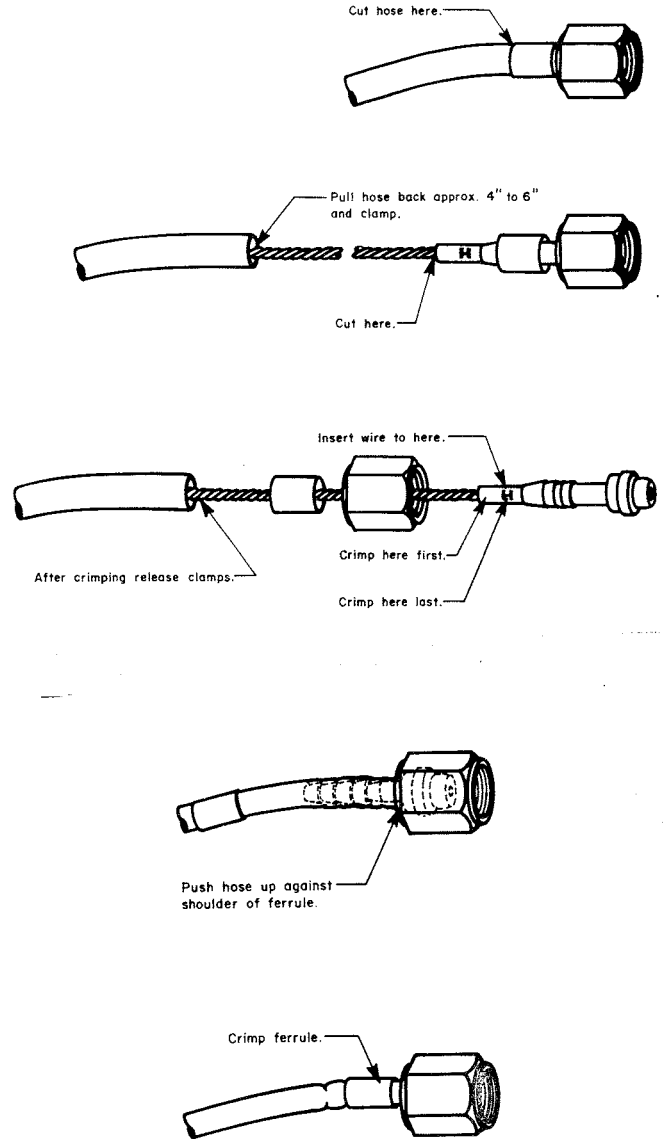


WARNING

Power to the system must be turned off.



TORCH END



CONSOLE END

Figure 4-D Leads Fitting Replacement

SERVICE

If repair is needed to the console end of the leads, then disconnect at the console. To repair the leads at the torch end, disconnect as in the preceeding steps according to the type of torch being used, then proceed as follows:

Positive and Negative Leads (Torch End)

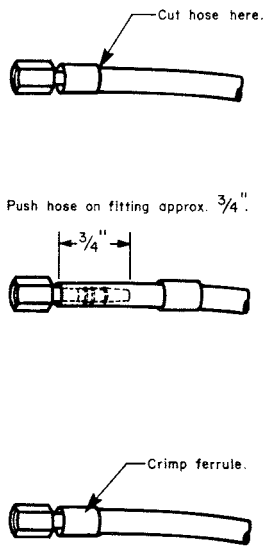
- 1) To replace the fittings at the torch end, cut the hose (only) just behind the ferrule. Grip the fitting and slide the hose back 4 to 6 inches. Clamp the wire lead at the end of the hose to prevent the hose from sliding back down over the fitting. Cut the old fitting off where the wire lead goes in.
- 2) Slide the new ferrule onto the wire lead.
- 3) Insert the wire lead into the small end of the new fitting up to but not beyond the stop.
- 4) Crimp the wire lead into place with a 18-22 AWG crimping tool. It is important to crimp the whole length of the solid diameter from the slot to the end.
- 5) Use the same crimping tool to crimp the wire stop in the slot out of the way. This is necessary to insure proper coolant flow.
- 6) Remove the clamp from the wire lead and push the hose over the glands onto the fitting.
- 7) Slide the ferrule onto the hose and fitting until it rests over the glands. Crimp using a 3/8 diameter crimping die, Scovill No. 44 or equivalent.

Positive and Negative Leads (Console End)

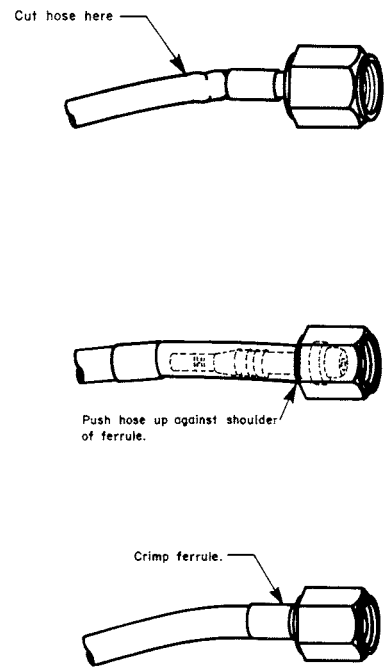
- 1) To replace the fittings on the console end, cut the hose (only) just behind the ferrule. Grip the fitting and slide the hose back 4 to 6 inches. Clamp the wire lead at the end of the hose to prevent the hose from sliding back down over the fitting. Cut the old fitting off where the wire lead goes in.
- 2) Slide the new ferrule onto the wire lead and then the nut (in the right direction).
- 3) Insert the wire lead into the small end of the new fitting up to but not beyond the stop.
- 4) Crimp the wire lead into place with a 10-12 AWG crimping tool. It is important to crimp the whole length of the solid diameter from the slot to the end.
- 5) Use the same crimping tool to crimp the wire stop in the slot out of the way. This is necessary to insure proper coolant flow.
- 6) Slide the nut onto the fitting.
- 7) Remove the clamp from the wire lead and push the hose over the glands, onto the fitting.
- 8) Slide the ferrule onto the hose and fitting until it rests over the glands. Crimp using a 7/16 diameter crimping die, Scovill No. 42 or equivalent.

Gas Hoses (Torch End)

- 1) Cut the gas hose just behind the ferrule.
- 2) Assemble the nut (threaded end first) over the fitting.



Torch End



Console End

Figure 4-E Gas Fitting Replacement

- 3) Slide the new ferrule over the hose and then slide the hose onto the fitting until it is approximately 1/4" past the last gland on the fitting.
- 4) Slide the ferrule over the hose and fitting until it rests over the glands. Crimp in place using a 1/4" diameter crimping die, Scovill No. 47 or equivalent.

Gas Hoses (Console End)

Follow Steps 1 through 3 for the torch end.

- 4) Slide the ferrule over the hose and fitting until it rests over the glands. Crimp in place using a 5/16 diameter crimping die, Scovill No. 46 or equivalent.

PARTS LIST

5.1. GENERAL ARRANGEMENT

Assembly Parts List

The Assembly Parts List consists of illustrated parts lists of the following:

- Figure 5-1. 3A Series Welding Torch
- Figure 5-2. 3A Torch Assembly
- Figure 5-3. 3A Torch Leads Assembly

An item number in parentheses indicates the item is located behind the item pointed to. An asterisk beside the item number indicates the part is a main assembly, not a component. Parts listed without item numbers are not illustrated, but may be ordered by the catalog number shown.

ORDERING INFORMATION

When ordering replacement parts, order by catalog number and complete description of the part or assembly, as given in the description column of the Assembly Parts List. Address all inquiries to your authorized Thermal Dynamics' distributor.

RETURNS

In the event that a Thermal Dynamics' product must be returned for service, contact your Thermal Arc distributor. Material returned to Thermal Dynamics without proper authorization will not be accepted.

PARTS LIST

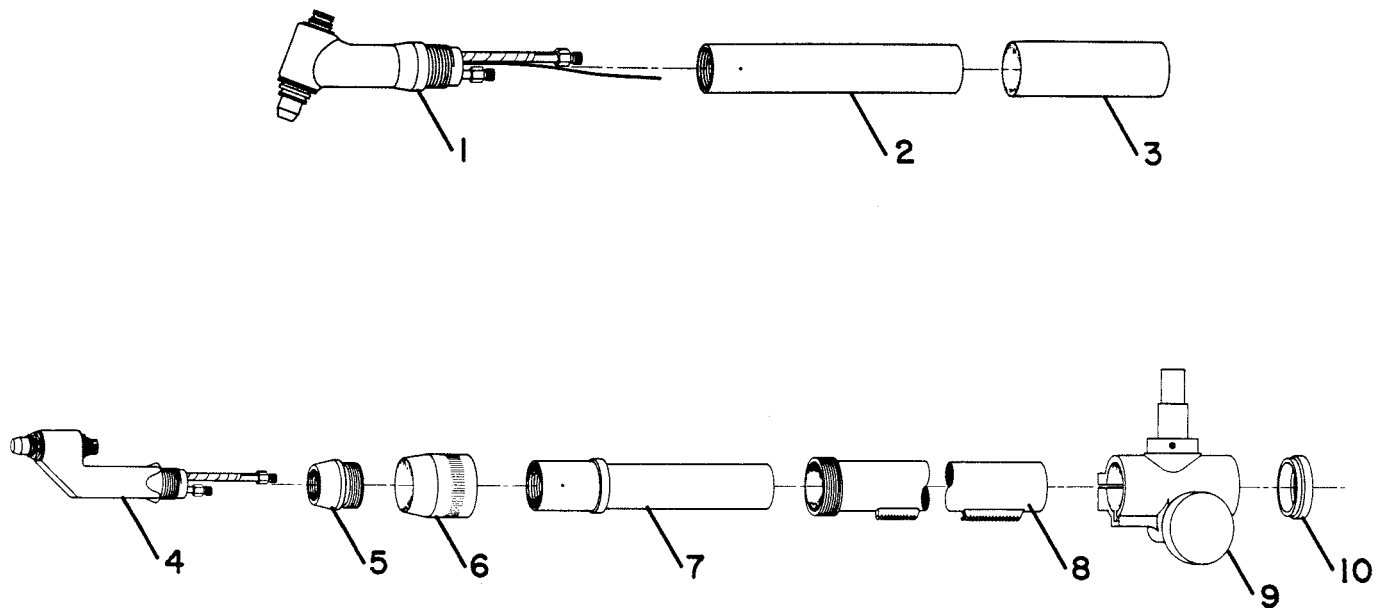


Figure 5-1 3A Welding Torch

Fig.	Item No.	Qty.	Catalog Number	Description
5-1	1	1	8-3030	70° Torch Head Assembly
5-1	1	1	9-3031	90° Torch Head Assembly
5-1	2	1	9-1757	Handle
5-1	3	1	8-1204	Shrink-on Tubing
5-1	4	1	8-3032	Machine Mounted Torch Head Assembly
5-1	5	1	9-1778	Sleeve
5-1	6	1	8-4018	Nut
5-1	7	1	9-1901	Sleeve Adaptor
5-1	8	1	8-5005	Positioning Tube
5-1	9	1	7-2827	Pinion Assembly
5-1	10	1	8-4204	Bushing

PARTS LIST

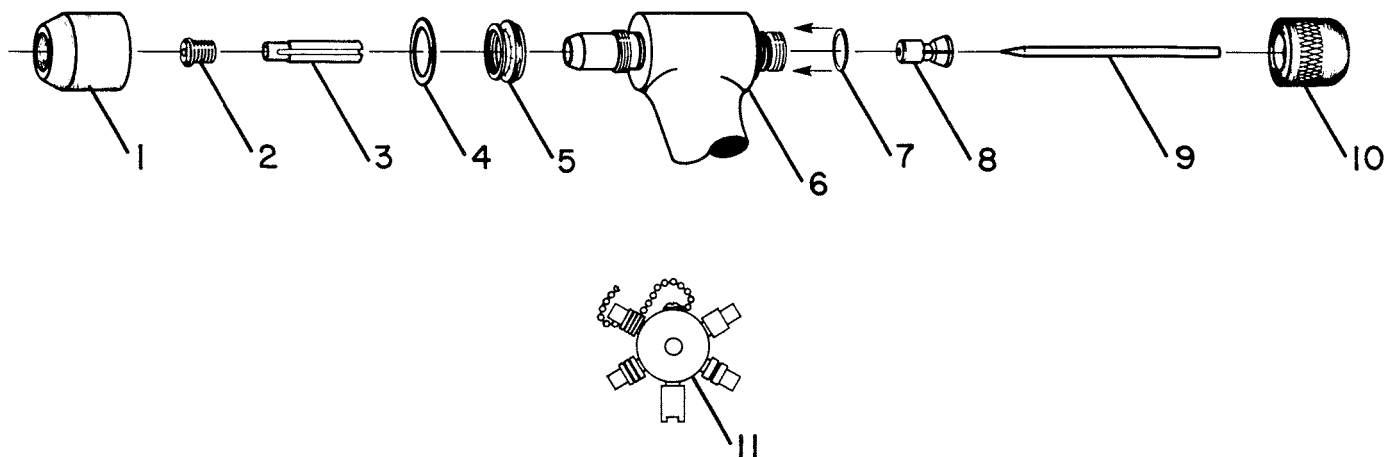


Figure 5-2 3A Torch Explosion

Fig.	Item No.	Qty.	Catalog Number	Description
5-2	1	1	8-3038	Shield Cup-Standard Weight
5-2	1	1	8-3040	Shield Cup-8-3038 with Gas Lens
5-2	1	1	8-3035	Shield Cup-Spot Welding
5-2	2	1		Tip (Packaged in Lots of 10)
	Standard:		8-3052	Tip - .014, 10 amp
			8-3053	Tip - .022, 15 amp
			9-1782	Tip - .031, 30 amp
			9-1783	Tip - .046, 50 amp
			9-1784	Tip - .062, 75 amp
			9-1785	Tip - .081, 100 amp
			9-1795	Tip - .093, 150 amp, High Power
	Long:		9-1790	TIP - .062, 55 AMP
			9-1791	TIP - .081, 75 amps
5-2	3	1	9-2240	Gas Distributor-Straight Polarity
5-2	4	1	8-3057	Gasket-Shield Cup
5-2	5	1	8-3059	Shield Gas Diffuser
5-2	6			Basic Head Assembly
5-2	7	1	8-0527	O-Ring
5-2	8	1	9-1780	Collet-Straight Polarity
5-2	9	1	9-1747	Electrode-Straight Polarity
5-2	9	1	9-1775	Electrode-Straight Polarity, Extended
5-2	10	1	9-1779	Electrode Cap-Standard
5-2		1	9-1803	Electrode Cap-Extended
5-2	11	1	9-1810	Gauge and Wrench Assembly

PARTS LIST

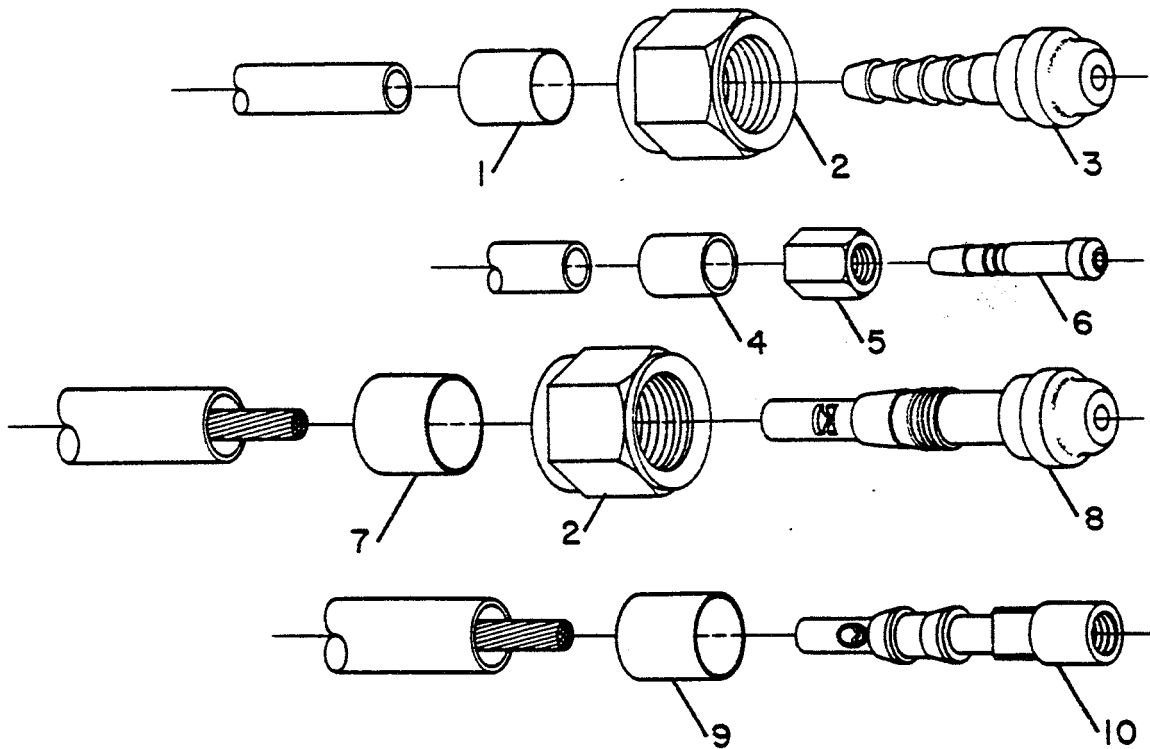


Figure 5-3 3A Torch Leads and Hose Fittings

Fig.	Item No.	Qty.	Catalog Number	Description
5-3		1	4-2615	3A Torch Leads - 12.5 ft.
5-3		1	4-2624	3A Torch Leads - 25 ft.
5-3		1	8-3028	Negative Torch Lead - 12.5 ft.
5-3		1	8-1499	Negative Torch Lead - 25 ft.
5-3		1	8-3029	Positive Torch Lead - 12.5 ft.
5-3		1	8-1500	Positive Torch Lead - 25 ft.
5-3		1	8-1074	Plasma Gas Hose - 12.5 ft.
5-3		1	8-1496	Plasma Gas Hose - 25 ft.
5-3		1	8-1075	Shield Gas Hose - 12.5 ft.
5-3		1	8-1497	Shield Gas Hose - 25 ft.
5-3		1	8-3138	Torch Leads Sleeving - 12.5 ft.
5-3		1	8-3139	Torch Leads Sleeving - 25 ft.
5-3		1	8-1204	Shrink-on Tubing
5-3		1	5-2896	Hand Remote Contact Switch - 12.5 ft.
5-3		1	5-2897	Hand Remote Contact Switch - 25 ft.
5-3	1	1	8-5012	Ferrule - Console End
5-3	2	1	8-5015	Nut - Console End (+ & -)
5-3	3	1	8-0328	Fitting, Console End
5-3	4	1	8-2064	Ferrule, Torch End
5-3	5	1	9-2061	Nut, Torch End
5-3	6	1	8-0335	Fitting, Torch End
5-3	7	1	8-5013	Ferrule - Console End
5-3	8	1	8-5010	Fitting - Console End (+ & -)
5-3	9	1	8-3013	Ferrule - Torch End
5-3	10	1	8-3033	Fitting - Torch End (+ & -)