ESAB Welding &
Cutting Products

Ultra-Graph

Shape Cutter

Installation

Operation

Maintenance

Replacement Parts

Form Number 0558005322

Date: 01/05

The equipment described in this manual is potentially hazardous. Use caution when installing, operating and maintaining this equipment.

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This manual is ESAB Part No. 0558005322

This manual is for the convenience and use of the cutting machine purchaser. It is not a contract or other obligation on the part of ESAB Cutting Systems.

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ESAB Welding &
Cutting Products

Preface

This machine is an advanced heavy duty numerically controlled gantry cutting machine manufactured by ESAB Cutting Systems of Florence, South Carolina. It may be equipped with various types of plasma cutting equipment. It is designed to provide years of dependable, accurate, repeatable part cutting, with a high degree of reliability, ease of service and ease of operation.

There are optional features and configurations available. For completeness, all of these are described in this manual. However, not all options described in this manual are present on all machines. In addition, more capabilities and features may be added in the future, which are not covered in this manual. ESAB Cutting Systems reserves the right to change or add features and capabilities without notice.Before operating the machine, one should become familiar with this manual in its entirety, with special attention to the SAFETY section.

Contents

Spacer Page

Table of Contents

Description

Introduction

Plasma Cutting with the Ultragraph

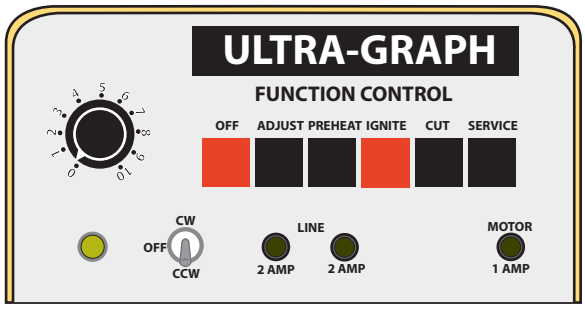
The Ultra-Graph and Porta-Graph Shape Cutters are single torch guidance machines used to cut parts from steel plate, using oxy-fuel cutting torches. The cutting torch is mounted on a pantograph type of arm supported by a vertical column which is part of the machine base assembly. All axes of the arm assembly hinge and the centerline of the cutting torch is parallel to the centerline of the base-mounted column. These hinges permit the torch to move over all points on the cutting area below the arm. On the outer arm assembly, directly above the cutting torch, is mounted a motor which drives a vertical spindle whose axis coincides with the centerline of the cutting torch, mounted on the outer arm below. This spindle is permanently magnetized so that it attaches itself to a ferrous metal template. The motorized rotating spindle will magnetically cling to the template outer edge and roll its way around the template, flexing the hinges of the arm and driving the cutting tip of the torch in a path which exactly duplicates the contour of the template. The Ultra-Graph system of magnetic tracing provides the simplest, most accurate methods developed for maintaining repeatability of flame cut parts. The use of these machines is almost unlimited because of the accuracy with which metal templates can be made.

The Ultra-Graph is designed for use in a semi-permanent location. The machine base assembly is equipped with four leveling screws for quickly and accurately adjusting the supporting column to its vertical position.

The Ultra-Graph operates on direct current, rectified from an alternating current power source.

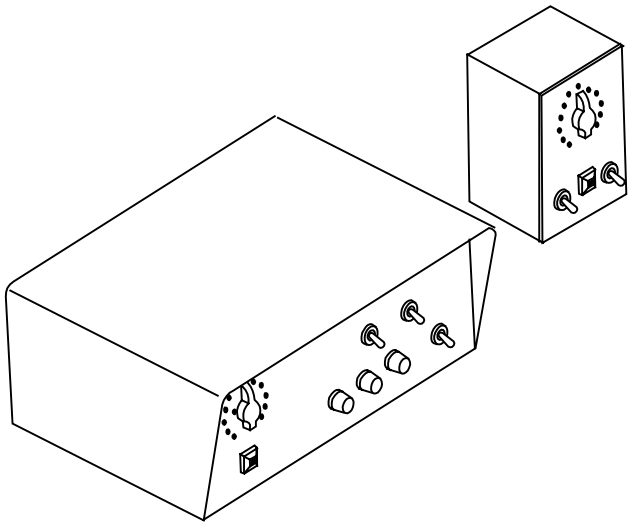
RC Series control is available on the Ultra-Graph and features a solid-state, single bridge rectified AC circuit to produce the widest possible speed range.

Control



Control of preheat gases, cutting gas and torch ignition is coordinated with motor operation by the exclusive ESAB Function Control. The interlocked pushbuttons of the Function Control provide extremely simple operation, since all cutting operations can be controlled by the operator in a logical sequence with the individual pushbuttons.

In addition to the Function Control, RC Series control panels include a power switch, a calibrated speed dial and speed adjusting knob. A clockwise-counterclockwise switch, having a center OFF position, with which direction of motor rotation may be selected.

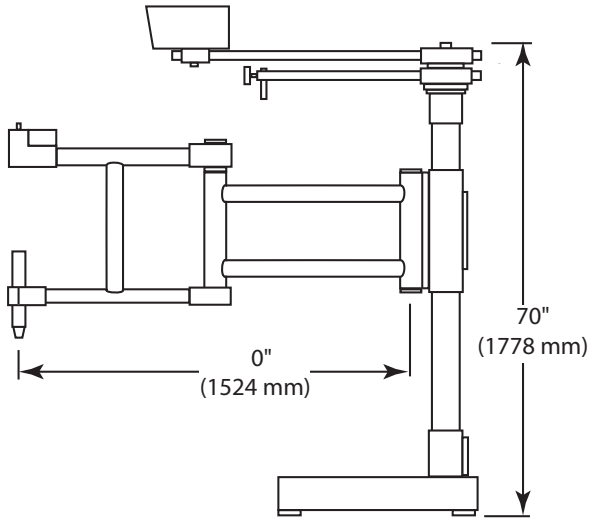


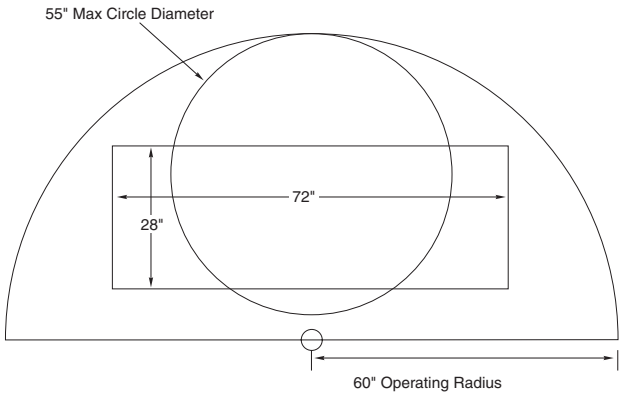
DC Series control is available on all Ultra-Graph and Porta-Graph models and features a solid-state, single bridge rectified AC circuit to produce the widest possible speed range. DC Series control panels include a power switch, a calibrated speed dial and speed adjusting knob. A clockwise-counterclockwise switch, having a center OFF position, with which direction of motor rotation may be selected. Gas control switches are not included.

Cutting torches are not furnished with the Ultra-Graph and must be provided by the user.

Other significant features and capabilities provided by the ESAB Ultra-Graph cutting machines are as follows:

- Cut ferrous metals up to 4 inches thick, operating on fuel gases such as acetylene, propane, or natural gas and oxygen.
- Cut straight lines, circles, or contours, following a ferrous metal template supported by the machine.
- Provide infinitely variable cutting speeds within the speed range of the drive motor. Cutting speed ranges may be varied by using rotors of different diameters.
- Powerful DC motor, driven by solid-state circuitry, from a 120-volt, 60 Hz, single phase power source.
- Motor bearings and worm gear reduction to drive spindle sealed and lubricated for life.
- Arm assembly hinge shafts that turn on permanently lubricated bearings.





Specifications

Outline Dimensions:

Outline dimensions for the Ultra-Graph and Porta-Graph are shown in figure 1-3.

Capacities:

- Operating Radius: 60" (1524 mm)
- Maximum Straight: 110" (2794 mm)
- Maximum Circle: 55"

Requirements:

- Power 115V AC, Single Phase, 60 Hz
- Torch RC control model, 3-hose
- DC control model, 2 or 3-hose

Weights:

Ultra-Graph Models

RC60Floor	265 lbs. (119.7 kg)
DC60Floor	250 lbs. (112.5 kg)
RC60Table	190 lbs. (87.1 kg)
DC60Table	175 lbs. (979.8 kg)

Installation

Receipt Of Components

Your Ultra-Graph Shape Cutter was assembled and tested for accuracy prior to shipment. It can provide you dependable performance only if carefully unpacked, properly assembled and installed. Check the shipment carefully and notify the freight carrier immediately if any loss or damage in shipment has occurred.

NOTICE

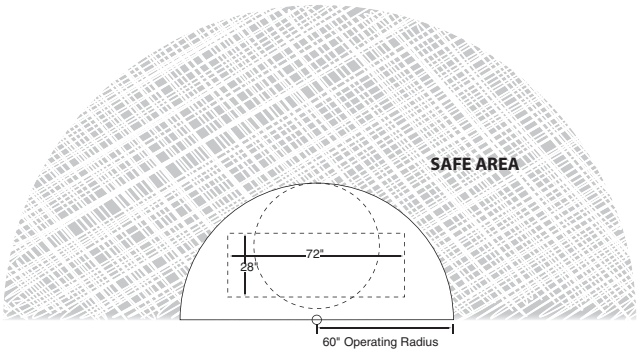
When installed, operated and maintained in accordance with the instructions in this manual, your Shape Cutter will give you many years of trouble-free service. Modifications of the machine, or any of its parts without the express approval of the factory will void the warranty. Examine all components and assemblies as they are unpacked and report any damage or shortages to the factory immediately for replacement. Contact the factory for an authorization number and instructions before returning damaged or defective parts.

Site Preparation

⚠ CAUTION

Do not install your Ultra-Graph near heavy machinery such as presses or cranes. Vibration may disturb the Ultragraph level adjustment, impairing accuracy.

Avoid locations adjacent to grinders and machine tools which might discharge metallic dust or chips. These foreign particles can impair operation of electrical components.

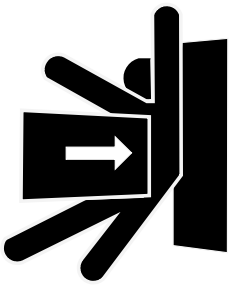


Locate the Ultragraph so:

- full range of motion may be utilized
- allow clearance around the layout to avoid pinch points
- away from flamable materials. Sparks from piercing and cutting can cause fires.

⚠ CAUTION

Motorized equipment may create pinch points.



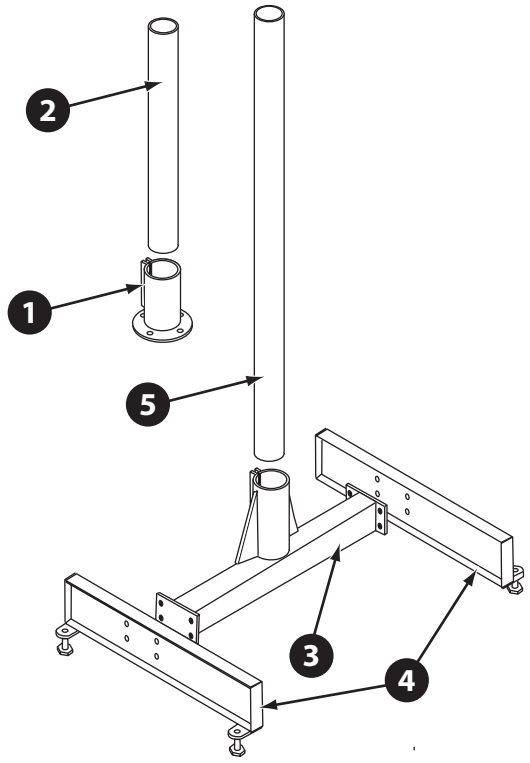
Allow a minimum of 36 inches (91 c) clearance between the equipment and any obstruction.

Ultra-Graph Set-Up

NOTICE

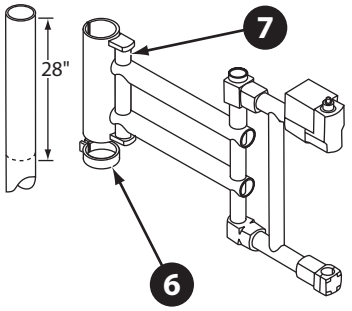
A leveling method must be included in the fabrication of the cutting table for a table mounted Ultragraph.

A major factor of accuracy is setting and maintaining a vertical torch.



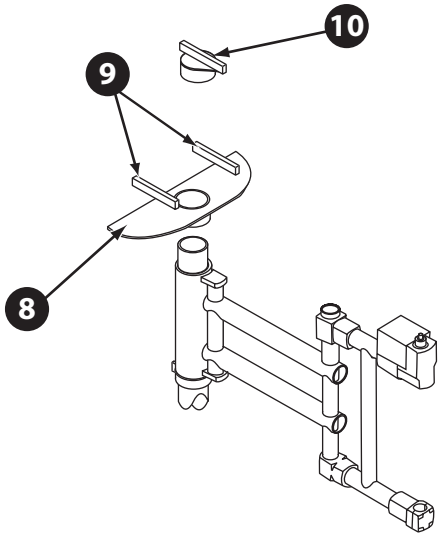
Omit step 1 in setting up floor models and step 2 and 3 in setting up table models.

1. Clamp the column base 1 of table models into position on the table. Insert the column 2 into the base and securely tighten bolts which clamp it in the base. See that leveling screws on the table are in a position which will permit adequate adjustment, either up or down, and adjust the base to place the column exactly at right angles to the work surface of the table. Then weld the base to the table or drill and bolt it into this position.
2. Assemble the base legs 3 of floor model to the base column support 4 with hex head capscrews and hex nuts.
3. Insert the column 5 in the base column support (2) or table base (3) and secure with the clamping bolts provided.



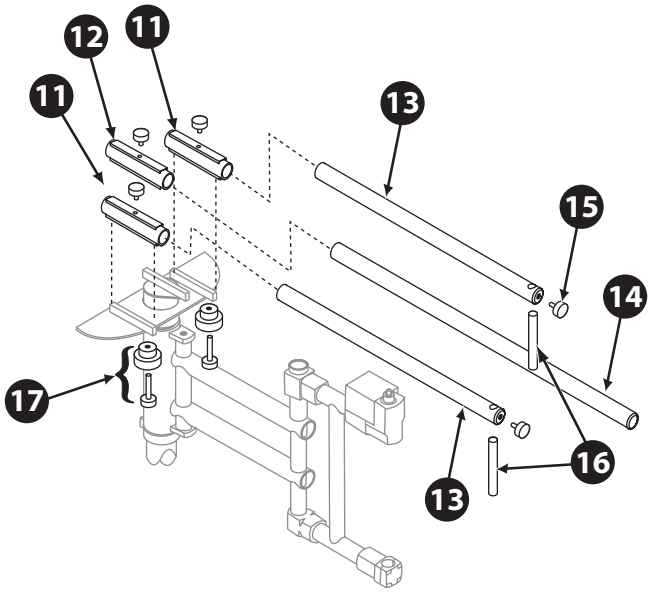
4. Slide the height adjustment collar 6 over the column and secure it with its clamping bolt approximately 28 inches from the top of the column.

5. Slide the hinge bracket of the arm assembly 7 over the column and tighten the clamping screws to secure it above the height adjusting collar,



6. Slide the support mount bracket 8 over the column and secure it to the column about six inches below the top of the column. See that pivot lugs 9 are secure in place on the bracket.

7. Slip the column cap 10 over column and secure it in place.

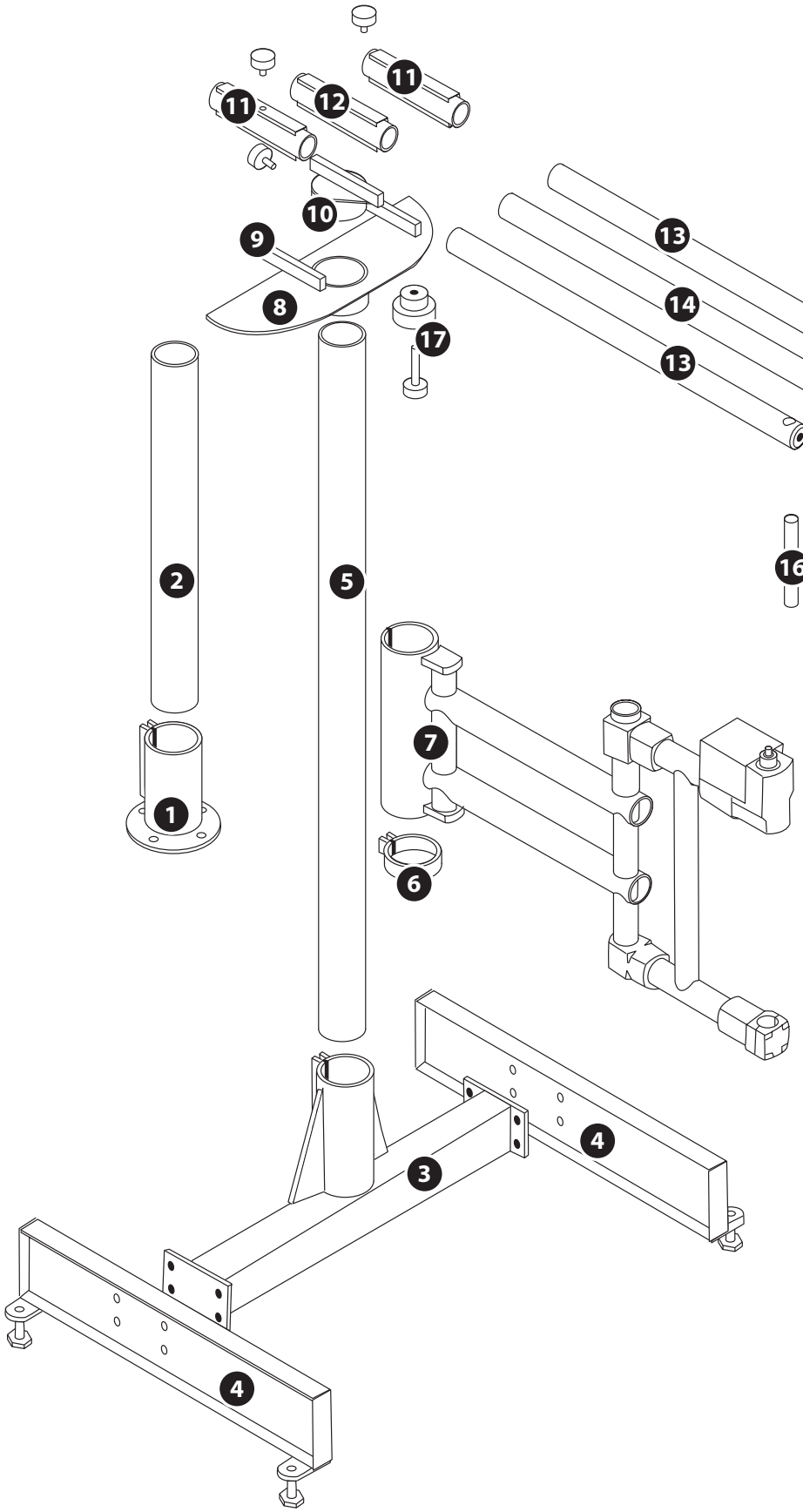


8. Attach the two template arm clamps 11 to the rear of the pivot lugs with hex head capscrews. Tighten the screws firmly but not enough to prevent the clamps from pivoting for adjustment. Attach the control support arm clamp 12 securely to the lug on the column cap.

9. Insert the control support arm 14 and the 2 template arms 13 into the arm clamps and secure them in place with the knurled lock knobs. Ensure the template arm 3/4 inch through holes are vertical before tightening.

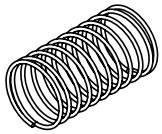
10. Insert template pilot pins 16 in the template arms and secure with lock knobs 15 .

11. Screw the leveling knobs 17 through the pivot lock knobs into the pivot lugs. Turn up the leveling knobs until the template arms are approximately level and lock in place with the lock knobs.

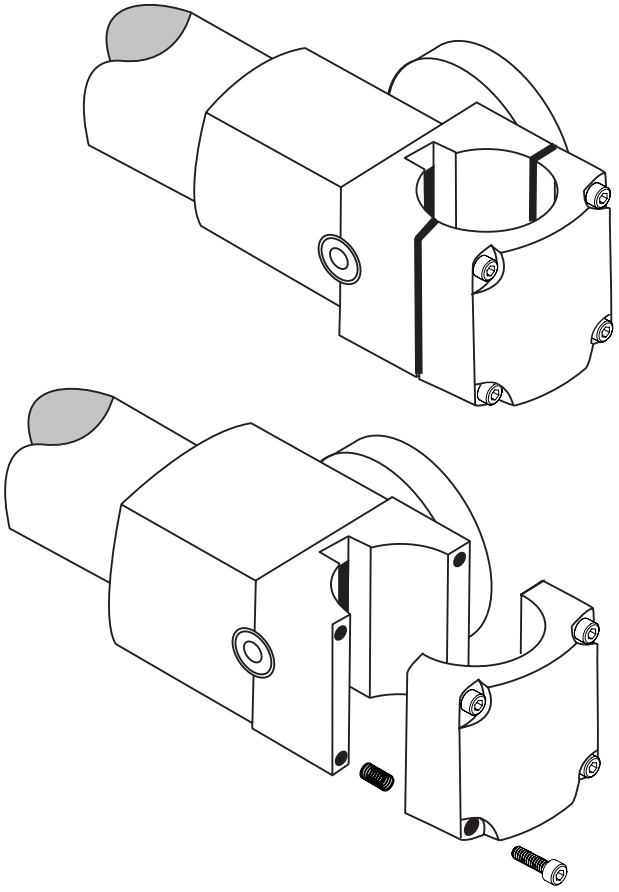


1. *Table Model Base*
2. *Table Model Column*
3. *Floor Model Column Support*
4. *Floor Model Legs*
5. *Floor Model Column*
6. *Height Adjusting Collar*
7. *Arm Assembly*
8. *Support Mount Bracket*
9. *Pivot Lug*
10. *Column Cap*
11. *Template Arm Clamp*
12. *Control Support Arm Clamp*
13. *Template Arm*
14. *Control Arm*
15. *Lock Knob*
16. *Template Pilot Pin*
17. *Pivot Lock Knob/Leveling Knob*

⚠ CAUTION

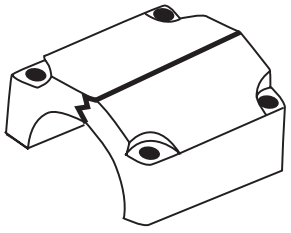


Use care not to lose the compression springs in the torch holder cap in performing the following step.



12. Remove the torch holder cap from the arm assembly and insert the cutting torch so that the arch on the torch engages the torch lift pinion. Be sure that the torch rack matches the pinion. (A 32-pitch pinion is standard, a 24-pitch pinion is optional). Then replace the torch holder cap and tighten it enough to prevent torch movement except by means of the torch lift knob.

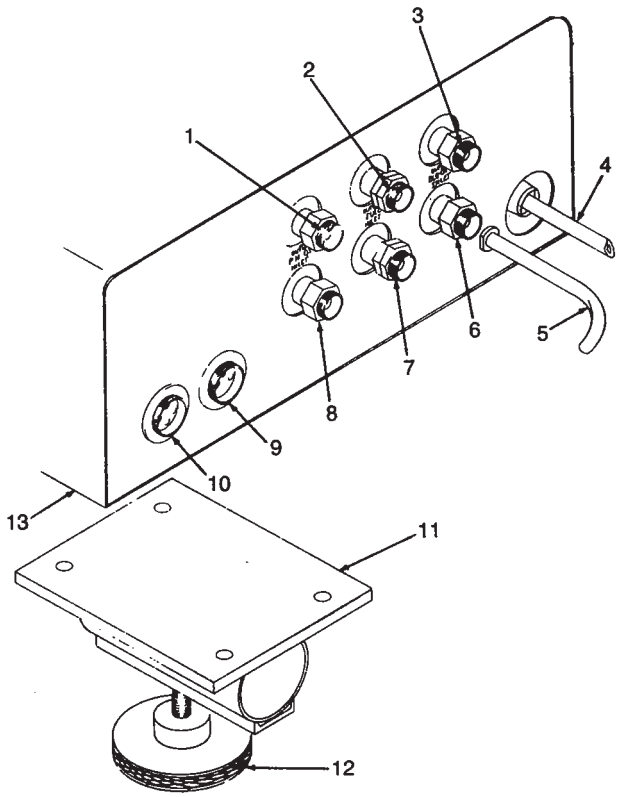
⚠ CAUTION



Overtightening torch holder cap screws may break the torch holder aluminum casting.

Tighten only enough to prevent torch from slipping in the holder.

RC Control Installation



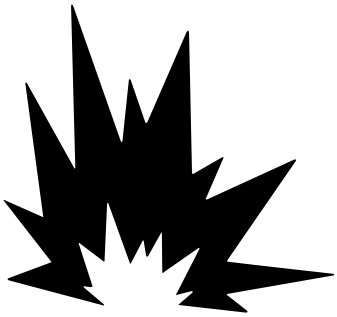
1. Preheat oxygen outlet fitting
2. Preheat fuel gas outlet fitting
3. Cutting oxygen outlet fitting
4. Ignitor
5. Power cable assembly
6. Cutting oxygen inlet fitting
7. Preheat fuel gäs inlet fitting
8. Preheat oxygen inlet fitting
9. Coil cable receptacle (E-Mag models only)
10. Motor cable receptacle
11. Mounting plate
12. Lock knob
13. RC Series Control assembly

Install the RC Series control as follows:

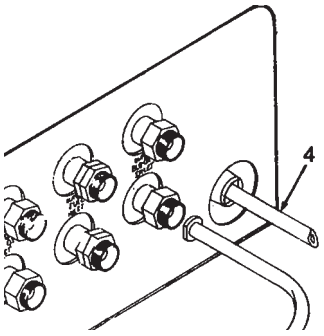
1. Check to ensure the control assembly (13) is securely attached to the control mounting plate (11) and slip the mounting plate over the control support arm. Secure the control mounting plate tot he arm with the knurled lock knob (12) so that the control is in a level position.
2. Make the electrical connection between the connector on the motor assembly and the motor cable receptacle (10), on the rear of the control, with the motor cable assembly. If the model being assembled is an E-Mag Ultra-Graph, make the connection between the connector on the coil assembly and the coil cable receptacle (9), on the rear of the control assembly, with the coil cable assembly.

INSTALLATION

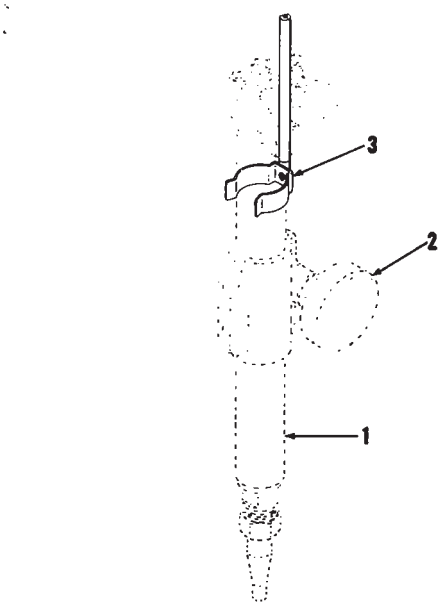
⚠ WARNING



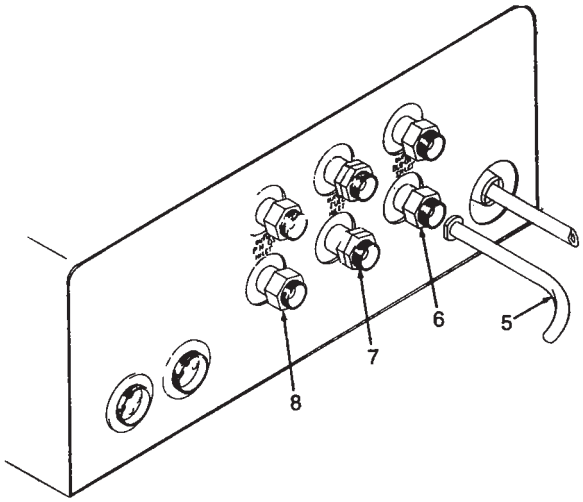
Be sure fittings on hoses are securely attached to adapters on RC control. A leak could cause build up of gasses inside the control which could be ignited by an electrical spark.



3. Plug the ignitor cable assembly (4) into the ignitor cable receptacle on the rear of the control and clip the other end of this cable assembly to the metal body of the torch, as shown in figure.

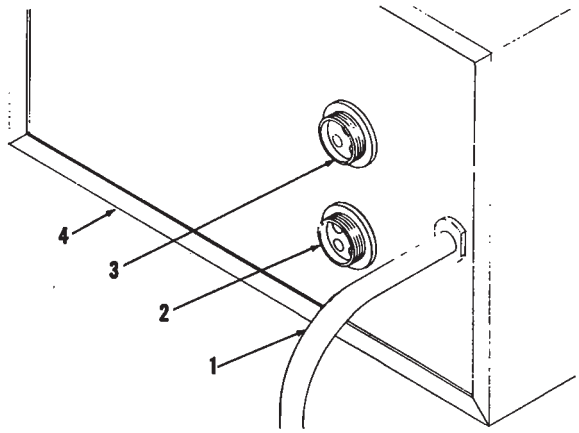


1. Cutting torch
2. Vertical adjustment knob
3. Ignitor cable assembly



4. Connect gas supply hoses to the inlet fittings (6, 7, 8) on the back of the control.
5. Plug the power cable assembly (5) into a properly grounded power source receptacle providing 115 vac, 60 Hz, single phase power.

DC Series Control Installation



1. Power cable assembly
2. Motor cable receptacle

Install the DC Series control as follows:

1. Check to ensure the control assembly is securely attached to the control mounting plate and slip the mounting plate over the template arm. It will be necessary to remove the template pilot pin to do this. Secure the control mounting plate tot he arm with the knurled lock knob so that the control is in a level position and replace the pilot pin.
2. Make the electrical connection between the connector on the motor assembly and the motor cable receptacle (2) (on the rear of the control) with the motor cable assembly.
3. Plug the power cable (1) into a properly grounded power source receptacle providing 115 volts, 60 Hz, single phase power.
4. Connect gas supply hoses directly to the torch.

Accessory Components

Cutting Torches Introduction

Any standard machine cutting torch, having a 1-3/8 inch barrel diameter is suitable for use with Ultra-Graph or Porta-Graph cutting machines. However, the torch must be straight and undamaged. The torch tip must be concentric with the torch barrel and the torch barrel must be the same diameter throughout its entire length. A worn, out of round torch will not seat properly in the torch holder and the tip will not be in alignment with the tracing rotor. Such misalignment will greatly impair the cutting accuracy of the machine. Torches with an overall length of approximately 14 inches are best suited for use with Ultra-Graph models. They should have a 32-pitch rack to mesh with the 32-pitch pinion provided on the torch holder of the machine. A 24-inch pinion is available for this purpose, when required for use with torches having a 24-pitch rack.

Either two-hose or three-hose torches may be used. The style selected will depend largely on the work requirement. Two-hose torches are less expensive and require only one oxygen regulator. On the other hand, three-hose torches have an independent oxygen supply line for the cutting oxygen jet which allows simple and precise settings of both the preheat flame and the cutting oxygen jet pressure. Three-hose torches are, therefore, recommended for more precise operation, ease in setting and for cutting materials of two inches or more in thickness. Three-hose torches must be used with Ultra-Graph models having the RC control in order to take advantage of the ease of operation and other features provided by the three solenoid-operated gas control valves included with the RC control.

Torch Installation

Torch Cutting Tips

Recommendations of the cutting torch manufacturer should be followed in selecting tip sizes for various material thicknesses. All torch manufacturers do not use the same code to identify tip size and if a cross-reference is required, oxygen jet diameters should be used. For straight line cutting, tips with a minimum of four orifices will generally be satisfactory. However, for contour cutting, tips with a minimum of six orifices should be used.

Arc Cutting, Mig And Tig Welding Torches

Most torches for arc cutting and welding require an adapter in order to use them with the Ultra-Graph or Porta-Graph. An adapter is available as an accessory for some styles of these torches. Other styles will require a 1-3/8 in. diameter sleeve or positioning tube which fits the machine torch holder. See your Authorized ESAB Distributor for recommendations.

Gases

Acetylene is widely used as a fuel gas for all cutting operations. Natural gas and propane may also be used for certain types of cutting. Most torches are specifically designed for a certain gas, although some universal torches are now available.

Gas Regulators

Any approved type of main line gas regulator may be used. Because of the wide variation in fuel gas and oxygen supply set-ups it is difficult to make a recommendation as to those best suited for a particular application in advance. However, your Authorized ESAB Distributor can help you provide a gas supply installation which will produce the best results.

Work Surface

A substantial work table is required. It must be large enough to handle the largest sheet of steel to be cut, and if is to be used with a table model Ultra-Graph, must be provided with leveling screws. A work table of a convenient working height of 24 to 30 inches from the floor is best for most operations.

Operation

General

The information in this section will familiarize the operator and serviceman with operating control, pre-operation checks and adjustments, and general operating procedure. The ESAB "Tooling and Cutting Manual for Magnetic Tracing Systems," supplied with your machine, gives detailed information on the templates (patterns) to be used, and how to make and mount them on the machine. It explains the kerf allowances required and gives information on selecting the proper rotor to follow the template edge for best results. It discusses torch and machine adjustments required features which affect the quality of the cut and gives useful data on cutting tips, gas consumption, and selection of gas pressures.

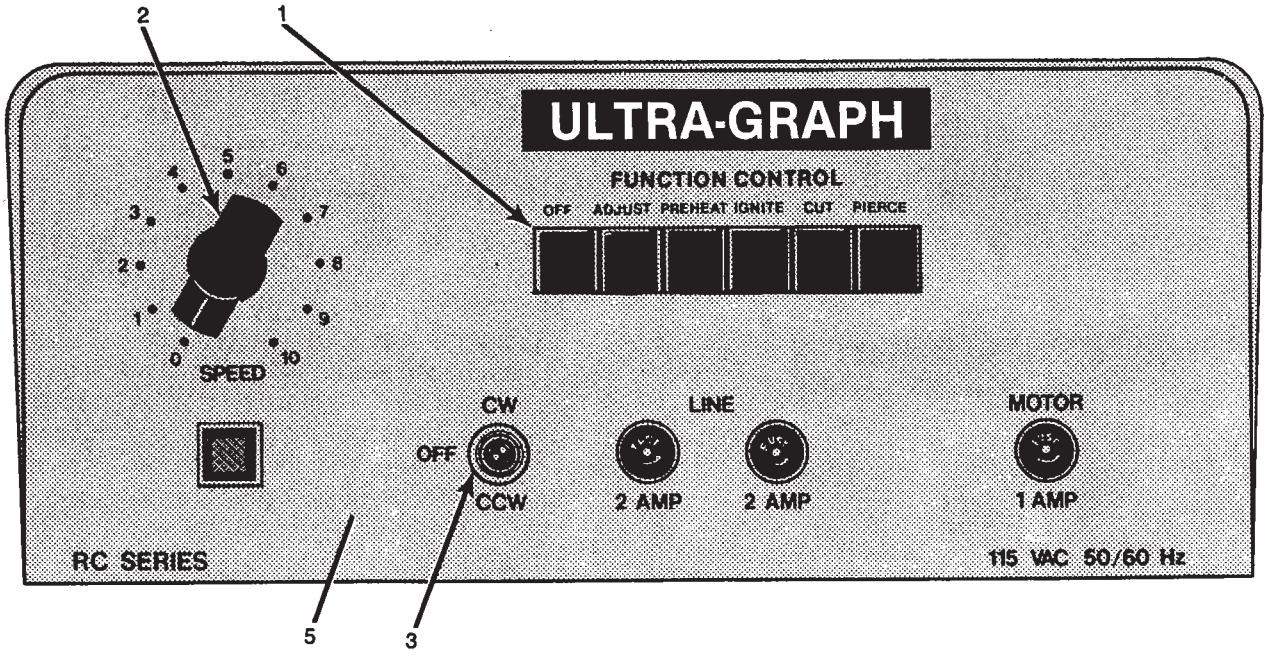
Basic Operation

RC Control

The RC Series Standard Ultra-Graph control panel is shown at left. The RC Series control assembly features the exclusive ESAB Function Control which includes six pushbutton switches that control all machine cutting functions. To provide this cutting function control, the RC Series control assembly also includes three electrically-operated solenoid valves, for control of all gases supplied to the cutting torch, and the sealed ignitor unit of ESAB's patented Positive Torch Ignition system.

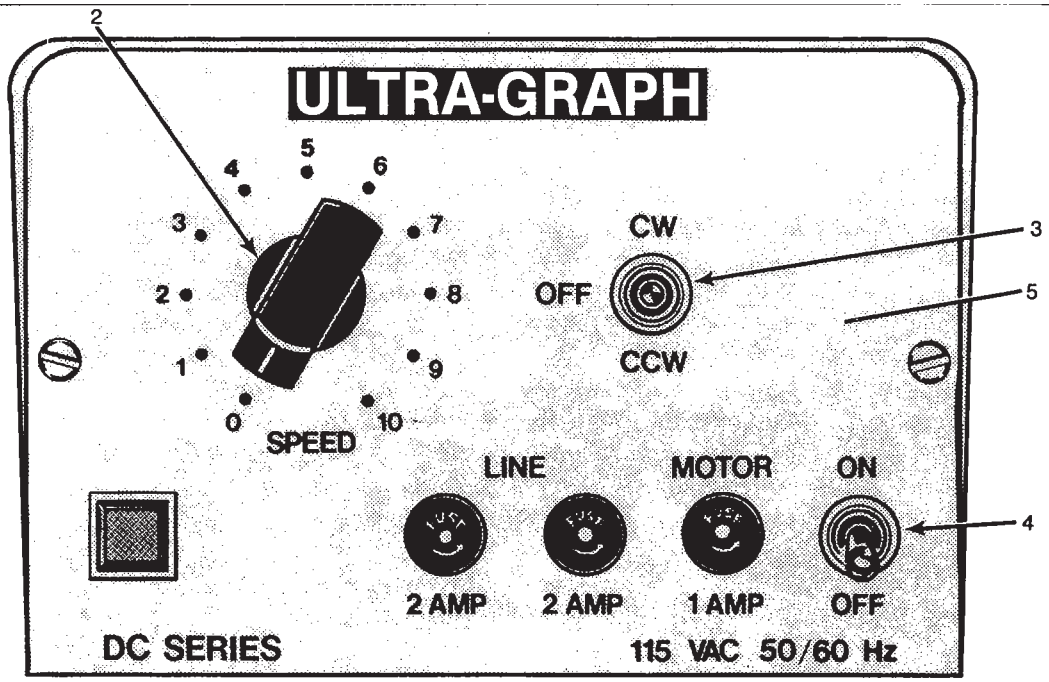
Control/Indicator	*Position*	*Function*
1. Function Control (RC Series only)	*Six section pushbutton assembly*	*Pressing any one button (except LIGHT button) will release other depressed buttons to their out (OFF) position.*
OFF switch	*Out position*	*Primary power for machine operation ON. Other function control pushbuttons now control machine functions. Power indicator light below SPEED control (2) will be ON when power is being applied to the machine.*
	Depressed position	*Terminates all machine functions and mechanically moves all other function switches to OUT position. Power indicator light will be OFF.*
ADJUST switch	*Out position*	*No power provided through this switch for motor operation or torch ignition.*
	Depressed position	*Power supplied through SPEED control to motor for speed adjustment and rotor rotation check.*
PREHEAT switch	*Out position*	*Preheat oxygen and fuel gas to torch is OFF or under control of CUT pushbutton.*
	Depressed position	*Solenoid valves energized to provide preheat oxygen and fuel gas flow to torch.*
BLOW switch	*Out position*	*Cutting oxygen to torch is OFF or under control of CUT pushbutton.*
	Depressed position	*Cutting oxygen solenoid valve energized to supply cutting oxygen to torch for piercing. (Drive motor remains OFF.)*
CUT switch	*Out position*	*Power to drive motor is OFF or under control of ADJ switch, preheat fuel gases OFF or under control of PRE switch, cutting oxygen OFF or under control of BLOW switch.*
	Depressed position	*Initiates cutting process by activating circuit to drive motor, maintaining or initiating flow of preheat gas and starting cutting oxygen flow to torch.*
IGNITE switch	*Out position*	*Positive Torch Ignition system is OFF.*
	Depressed position	*Torch ignition current supplied to torch when PRE switch is in depressed position.*

2.SPEED control	*Select from 0 to 10*	*Provides selection of motor speed which determines speed of torch movement. This is a continuous control with motor speed increasing from 0 to maximum speed with clockwise movement. Speed is reduced by counterclockwise movement.*
3.CW-CCW switch	*CW position* *OFF position* *CCW position*	*Drive motor rotation clockwise.Drive motor OFFDrive motor rotation counterclockwise.*
4. ON-OFF switchDepressed position	*ON position*	*Power applied to machine drive circuits (and E-Mag coil on E-Mag Ultra-Graph).*



DC Control

The DC Series Standard Ultra-Graph control panel is shown.



The DC Control Direction switch speed potentiometer and ON/OFF switch operate the same as the RC Control. The DC Control has no function buttons.

Pre-Operations Checks and Adjustments

Before operating the machine, perform daily inspection procedures outlined in Daily Inspection in the Maintenance Section. In addition, the following pre-operation checks and adjustments must be made.

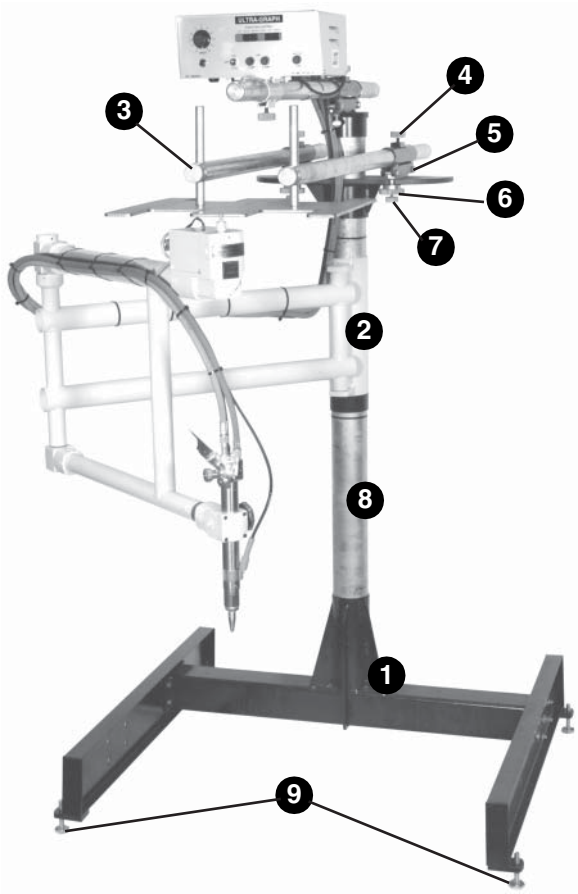
Leveling

NOTICE

For accurate cutting performance the cutting torch must be in a true vertical position.

Vertical torch position can only be obtained by carefully leveling the machine in accordance with the following procedures.

Periodically checking torch plumb is recommended. Frequency of this inspection must be increased if the machine is subjected to machine vibration from sources such as presses, cranes or forklift traffic. Periodic tightening of screws may also be required under these conditions.

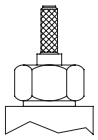


Leveling

1. Before leveling, check and tighten all capscrews on base 1 , hinge bracket 2 and template supports 3 4 5 6 7 .

2. Use the tube level supplied with the machine, or a similar rod level o reasonable sensitivity, to ensure the column 8 is in a vertical position. Adjust the four base levelers 9 or the table leveling screws to make the column exactly vertical. Place the level on the column at several points around the column when adjustment is being made to ensure it is exactly vertical.

Tube Level

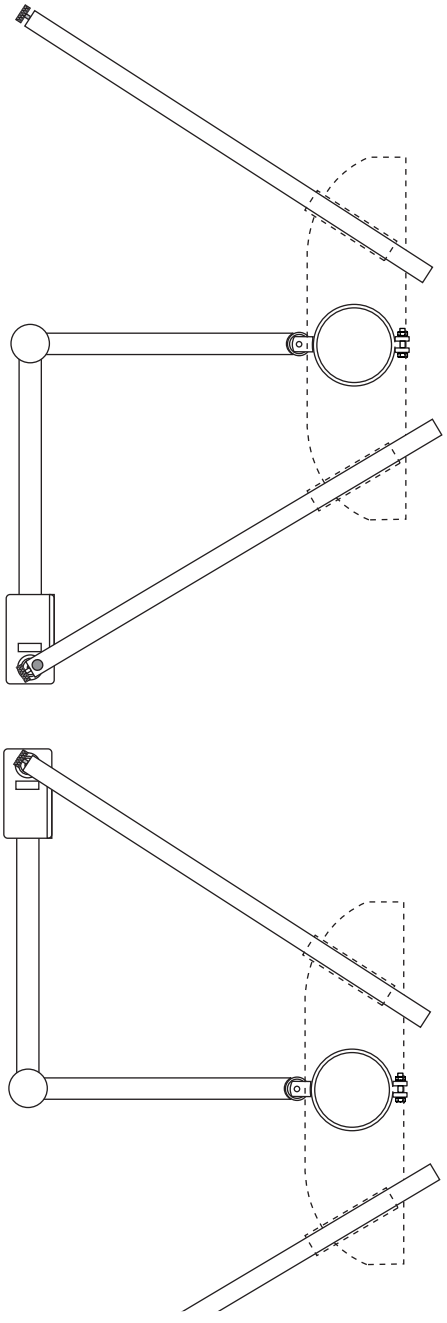


3. Install tracing rotor (see caution below).

⚠ CAUTION

Using a wrench to tighten the gland nut will damage the assembly

The gland nut tightens on an O-ring securing the rotor. Hand tighten the gland nut.



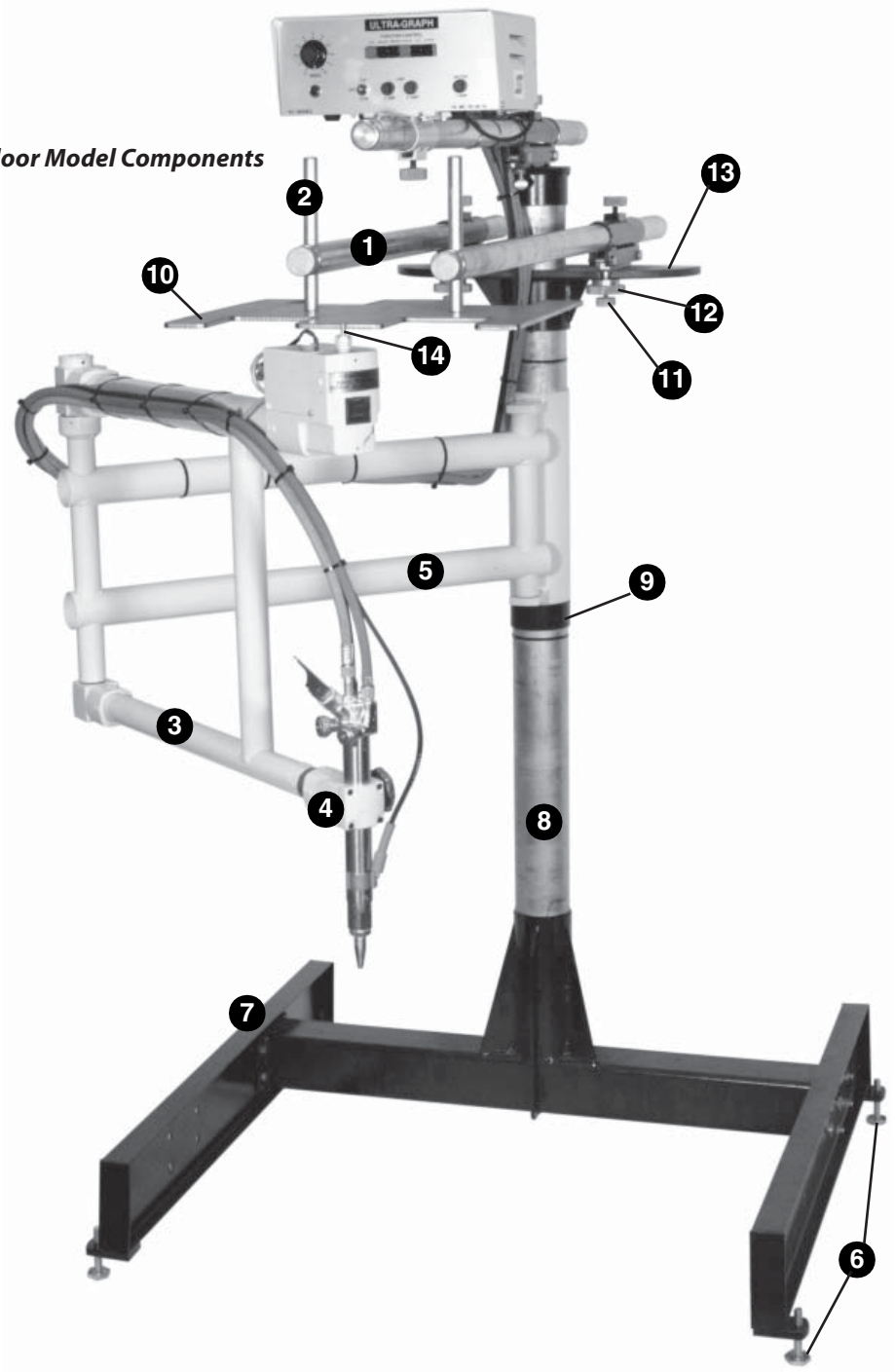
4. Move the outer arm (4) and the inner arm (6) of the arm assembly until they are approximately at a right angle to each other.

5. Adjust template support arm (1) so that its pilot pin (2) will contact the tracing rotor with the arms in this position. The magnetic attraction of the rotor will then hold the arm in position. This will free your hands for inspection and making adjustments.

6. Place the torch in the torch holder. If the torch is out of round or tapered, substitute a straight length of 1-3/8″ O.D. tubing approximately 12″ long in place of the torch for leveling purposes. Then check with the torch level supplied with the machine to see that the simulated torch is exactly vertical.

7. Reverse the fold of the arms, placing the rotor back in the same position, and repeat the check of the torch for vertical alignment. Readjust the leveling screws, as necessary, to provide the required vertical torch position.

Ultra-Graph Floor Model Components

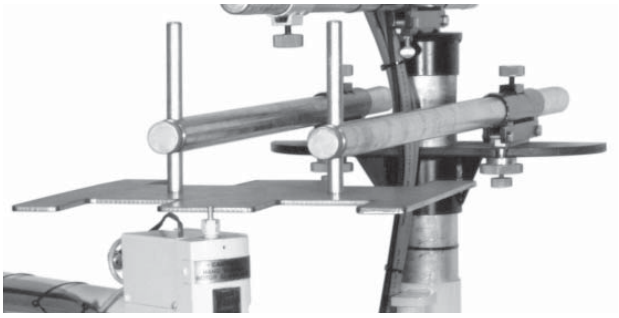


1. *Template Support Arm*
2. *Pilot Pin*
3. *Outer Arm*
4. *Torch Holder*
5. *Inner Arm*
6. *Leveling Jacks*
7. *Base Assembly*
8. *Column*
9. *Height Adjusting Collar*
10. *Template*
11. *Support Arm Leveling Screw*
12. *Pivot Lock Knob*
13. *Template Support Mount Bracket*
14. *Tracing Rotor*

Adjustments

Arm Assembly Position

Adjust the arm assembly vertically on the column to the desired working height by loosening the clamps in the hinge bracket (11) and raising the height adjusting collar (1). Secure height adjusting collar in place when the proper working height is obtained. Secure the hinge bracket to the column so that the pivot point of the arm assembly faces directly forward (the clamp bars on the hinge bracket should align with the clamp bars on the base).



Mounting the Template

Attach the template (pattern) (12) to either one or two of the pilot pins (2). Pilot pins are held in position with pilot lock knobs and may be adjusted vertically for positioning of the template. (See "Tooling and Cutting Manual" for additional information on mounting of templates). Mount the template securely to the pilot pins with mounting bolts. Adjust the pins to equal length and secure them with the lock knobs to prevent any movement of pins. Be sure that the template is level in all directions.

Adjusting Template Position

Adjust the Ultra-Graph template support assembly on the column (9) in relation to the arm assembly, so that the midpoint of the knurled tracing rotor (3) on the tracing head strikes the vertical surface of the template evenly at all points of contact. Then re-check to ensure that the template is exactly level. The template support arms of the Ultra-Graph may be adjusted in several directions: leveling knobs provide fine adjustment to level each support arm independently; pivot lock knobs secure the support arms in any position around the radial edge of the support mount bracket; and support arms (2) may be moved forward or back in the arm clamps and locked in any desired position with the lock knobs in the clamps.

Operating Procedures

RC Series Control Procedure

1. Apply power to machine and select direction of machine movement around the template by placing the CW-CCW switch in the correct position
2. Press the ADJUST pushbutton to start the drive motor. Select the desired cutting speed by adjusting the SPEED control knob. Then press the OFF pushbutton to release the ADJUST button.
3. Press the PREHEAT pushbutton and the IGNITE pushbutton to ignite the torch. Adjust preheat gas pressures at the torch to provide the desired preheat flame.
4. Press the PIERCE pushbutton to turn on the cutting oxygen. Adjust the pressure of cutting oxygen at the cutting torch to provide the desired cutting flame. Then press the OFF pushbutton to release the other buttons and turn off all gases.

Cutting Operation

1. Press PREHEAT pushbutton to turn on preheat gases.
2. Press IGNITE pushbutton to ignite preheat gases.
3. When preheating is completed, press BLOW pushbutton to turn on cutting oxygen for piercing.
4. Terminate the cut by pressing the OFF pushbutton or turn off cutting oxygen only and stop machine movement with preheat gases still on by pressing the PREHEAT pushbutton. Machine movement only may be stopped at any time by moving the CW-CCW switch to its center OFF position.

In the above sequence, if piercing is not required, omit step 3 and press the CUT pushbutton to start the motor and cutting oxygen simultaneously as soon as proper preheating has been accomplished.

DC Series Control Procedure

1. Apply power to machine and move the ON switch to ON position.
2. Start machine movement in desired direction by moving CW-CCW switch from its center OFF position and select cutting speed by positioning the SPEED control knob.
3. Turn on gases to torch, ignite the torch and adjust preheat gases and cutting oxygen at the torch for desired preheat and cutting flame.
4. Stop the motor by placing the CW-CCW switch in its center OFF position.

Cutting Operation

1. Turn on preheat gases, ignite the torch and preheat the material as required.
2. When material has been preheated properly, turn cutting oxygen on and start machine motion by moving the CW-CCW switch to the desired travel direction.
3. When cut has been completed, stop machine motion by moving the CW-CCW switch back to its center OFF position and turning off gases.

Positive Torch Ignition (PTI).

ESAB patented tip-to-plate torch ignition is positive, dependable and trouble-free. There is no ignitor electrode to get in the way and to require constant adjustment. Preheat gases are ignited instantly by sparks that pass directly from the tip of the electrically isolated torch to the workplate within the gas flow. Ignition takes place the instant the switch is pressed every time, provided torch height above the plate has been correctly set. The spark supplied is of high voltage and low current.

⚠ WARNING

Before torch ignition, assure that no one is in contact with the torch.

Ignition current to torch is a 20,000 volt high frequency charge and will induce a severe shock.

Maintenance

Introduction

The ESAB Ultra-Graph Cutters are designed to operate over a long period of time with a minimum of maintenance. However, continued satisfactory operation of the machines depend upon the careful performance of a few simple inspection and cleaning procedures, as outlined in this section. With proper care, problems will usually be detected and can be corrected before they result in loss of machine operating time. Troubleshooting procedures are included to help diagnose and correct problems as they occur before serious trouble arises.

Daily Inspection and Maintenance

Inspect the machine carefully each day before placing it in operation. Check the machine visually and perform the following steps which include an operating check of all machine components. If faults or malfunctions are noted in performing these procedures, refer to the Troubleshooting Chart.

- Check and tighten all capscrews on the base, hinge bracket and template support assemblies.
- Check the machine for level alignment, using the procedures given in Pre-Operation Checks of the Operation Section.
- Inspect all operating parts of the machine for cleanliness. Wipe off the polished cylindrical surface of the column and all other machine surfaces.
- Spray the polished surface of the column with rust inhibitor, such as Mobile ARMA 247 or equivalent. Wipe off the excess inhibitor with a clean, dry cloth.
- Check for free movement of the hinge pins which permit the arm assembly to swing freely in following the template. Apply a few drops of lightweight machine oil to the pins if any binding or sticking is detected.
- Apply power to the machine and check operation of all controls on the control panel in accordance with the procedures given in the Operation section. If any operating problems are detected, refer to the Troubleshooting Chart, starting on the next page, for possible causes and remedies.

Lubrication

No periodic lubrication is required on Ultra-Graph models. The hinge pins of the arm assembly may be lubricated with light machine oil, if sticking or binding is detected.

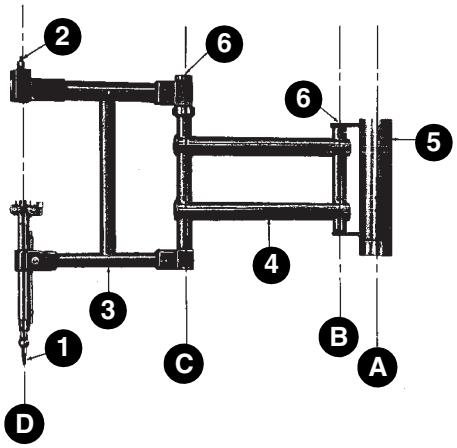
Troubleshooting

The Troubleshooting Chart serves as an aid in locating possible problems which may occur in operating the machine.

Problem	*Possible Cause*	*Remedy*
Motor will not operate	*No Power to the machine*	*Check power supply and power input cable*
	Fuse blown or faulty	*Check both line fuses and motor fuse located on the control front panel and replace. If a fuse has blown, determine the casue before operating the machine.*
	Faulty motor connector	*Check both connector plug and receptacle. Replace if required*
	Faulty power switch or reversing switch	*Check and replace as required*
	Faulty function switch	*Check and replace as required*
	Faulty rectifier	*Check and replace as required*
	Faulty speed control	*Check and replace as required*
	Faulty drive motor	*Check motor brushes and motor armature. Replace or service motor as required*
		Check motor gears and replace as required
Machine operates but the pilot light does not come on.	*Light burned out*	*Check and replace as required*
Motor will not reverse	*Faulty reversing switch*	*Check and replace as required*
No control of motor speed	*Faulty contorl autotransformer*	*Check and replace as required*
	Faulty motor connector	*Check both plug and receptacle and replace as required*
Jerky Motor	*Hoses dragging*	*Free hoses so the do not restrict machine motion*
	Worn or damaged drive rotor	*Check and replace as required*
	Arm Assembly movement restricted by sticking hinge pins	*Lubricate hinge pins with light machine oil*
	Drive rotor loose	*Tighten rotor gland nut*

Problem	*Possible Cause*	*Remedy*
Rotor slipping	*Hose dragging*	*Free hoses*
	Template too thin	*Use thicker template*
	Templae or mchine not level	*Level machine and /template*
	Worn or damaged drive rotor	*Check and replace as required*
	Arm assembly motion restricted by sticking hinge pins	*Lubricate hinge pins with light machine oil*
Rotor sticks in corners	*Hoses dragging*	*Free hoses*
	Template or machine not level	*Level machine and /template*
	Sticking hinge pins	*Lubricate hinge pins with light machine oil*
	Template corners not correct	*Correct template design*
Torch will not ignite	*Faulty function switch*	*Check and replace as required*
	Faulty ignition unit	*Check and replace as required*
	No preheat oxygen or fule gas flowing	*Check gas supply. RC series machines inspect Solenoids*
Ignition spark weak	*Faulty function switch*	*Check and replace as required*
	Faulty ignitor unit	*Check and replace as required*
Torch does not operate properly	*Gas supply to torch not correct*	*Check and correct external gas supply, if necessary. Check operation of function switch and replace, if necessary. Inspect and repair or replace solenoid valves, ifnecessary. (See Solenoid Valve Inspection in this section.)*

Understanding Operation

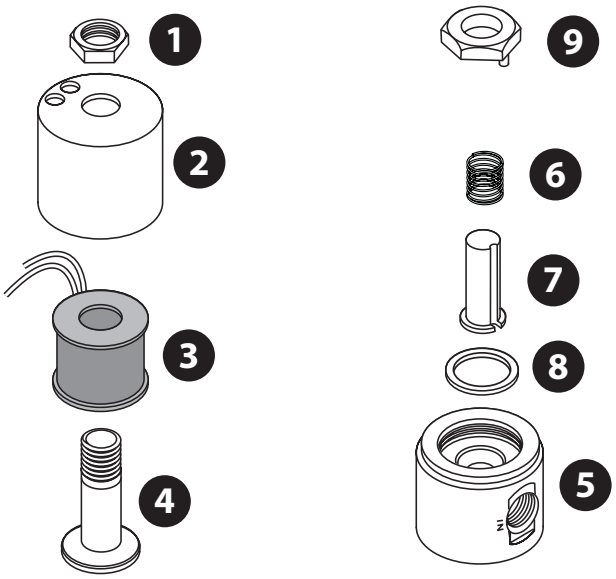


1. *Torch*
2. *Drive Rotor*
3. *Outer Arm*
4. *Inner Arm*
5. *Column Clamp*
6. *Hinge Pins*

A. *Column Centerline*
B. *Inner Hinge Pin CL*
C. *Outer Hinge Pin CL*
D. *Torch/Drive Rotor CL*

The pantagraph type arm used on all Ultra-Graphs keeps the hinge points of the arm parallel to the tracing rotor and the torch. This provides a direct guidance system. Note that all four centerlines A B C , and D , are exactly parallel. The centerline of the column is maintained in an exact perpendicular position (through proper leveling alignment procedures). The centerline, of the torch tip and rotor will remain exactly parallel to the centerline of the column throughout the entire working area of the machine. If the template and workpiece are exactly parallel, and perpendicular to the column centerline, the torch tip will precisely duplicate the template shape as the tracing rotor rolls around its edge.

Solenoid Valve Repair



1. *Hex Nut*
2. *Housing*
3. *Coil*
4. *Sleeve*
5. *Spring*
6. *Plunger*
7. *Gasket*
8. *Body*
9. *Valve Wrench*

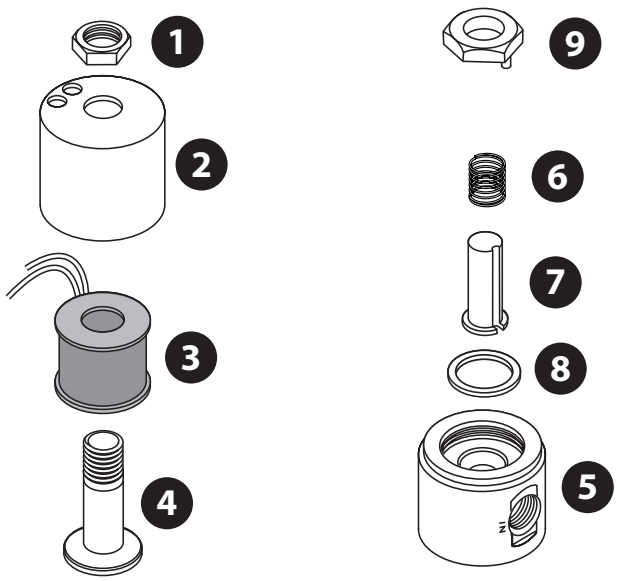
The electrically operated solenoid valves, are used for remote control of gas supplies to the torches on RC Series Ultra-Graphs. They require no lubrication and very little maintenance. An exploded view of a two-way, normally closed, fully automatic, direct acting valve is hown at the left. The solenoid plunger (6) moves up and down, depending on whether the coil (3) is energized or de-energized, to open or close the orifice which is part of the body (8). When de-energized, the orifice is closed by the pressure of spring (5). When energized, the plunger (6) is lifted from the seat to permit gas flow.

Operation of the valve may be checked by listening for the metallic click which the valve makes when it is energized. Absence of the click indicates that no power is being applied to the coil, the coil is burned out, there are broken wires or solder connections, or the valve is sticking. If a piece of ferrous metal, such as a steel rule, is laid across the nut (1) it will be magnetically attracted to the valve when the valve is energized and the coil is operating properly. If magnetic attraction is noted in this way and no click occurs, a sticking plunger is indicated. Voltage applied to the coil may be checked with a voltmeter and must be between 85% and 115% of the nameplate rating on the valve for the valve to operate properly. Make sure pressure to each valve is within the range indicated on the valve nameplate. If there is any leakage, disassemble the valve and clean all parts.

A periodic cleaning of valves is sometimes desirable. Time between cleanings will vary, depending upon the environmental conditions in which the valve operates. If the voltage to the coil is correct, sluggish valve operation or excessive leakage will indicate that cleaning is required. Valves need not be removed from the line for inspection or servicing, and solder connections should not be broken unless absolutely necessary.

⚠ CAUTION

Before working on any solenoid valve be sure that all electrical power is off and that valve line pressure has been turned off. Be sure to bleed all gas lines before cleaning or replacing parts.



1. *Hex Nut*
2. *Housing*
3. *Coil*
4. *Sleeve*
5. *Spring*
6. *Plunger*
7. *Gasket*
8. *Body*
9. *Valve Wrench*

Procedure

To disassemble and reassemble valve, proceed as follows:

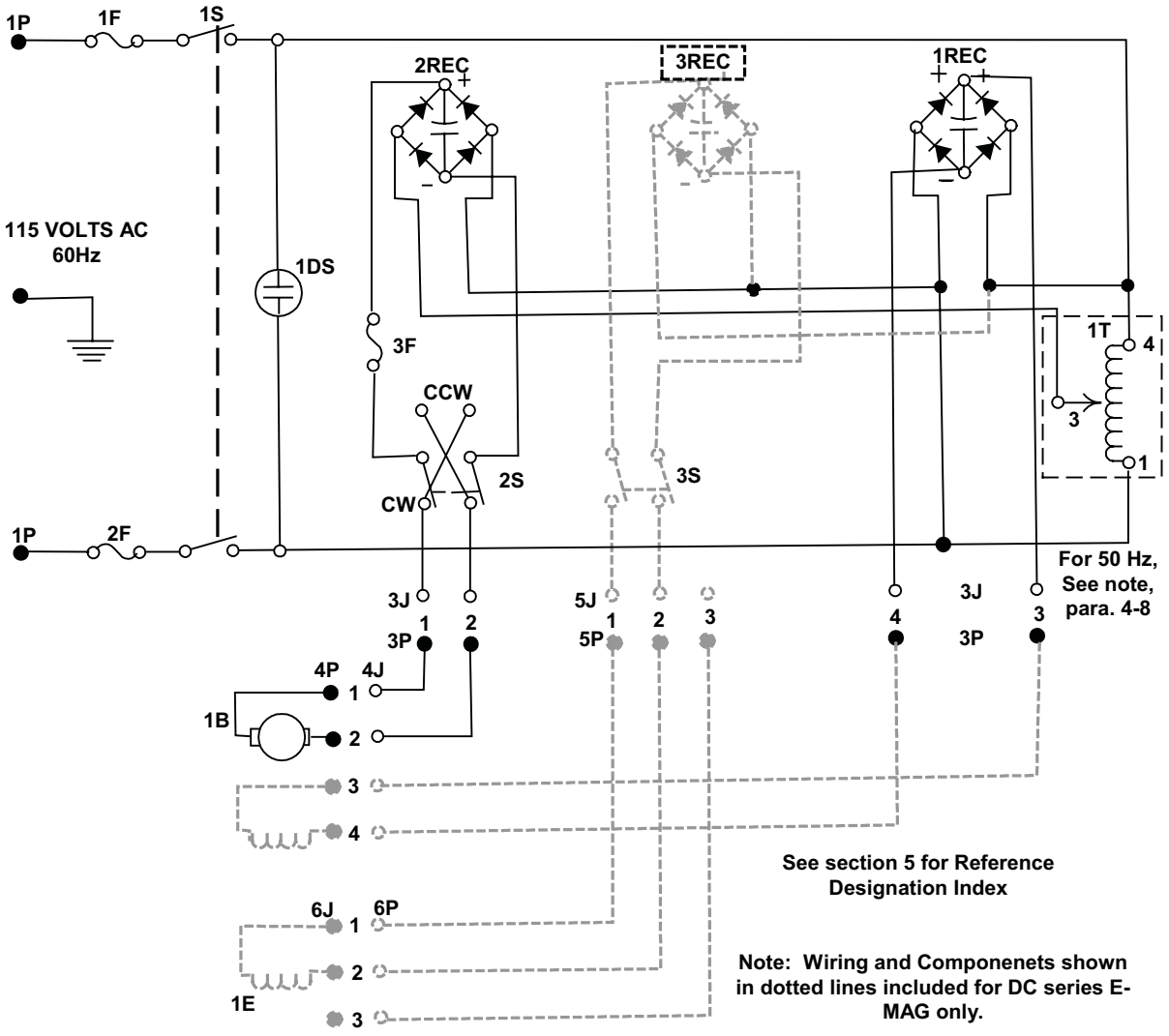
1. Remove the nut (1) from the top of the valve.
2. Slide the housing (2) and coil (3) from the sleeve assembly.
3. Unscrew the sleeve (4) from the body (8) using valve wrench (9).
4. If foreign matter is causing valve malfunction it will be between the plunger (6) and the seat in body (8), thus examine and clean these parts carefully.

Reassemble the valve in reverse order of disassembly, making certain that the gasket (7) and sleeve (4) seal properly.

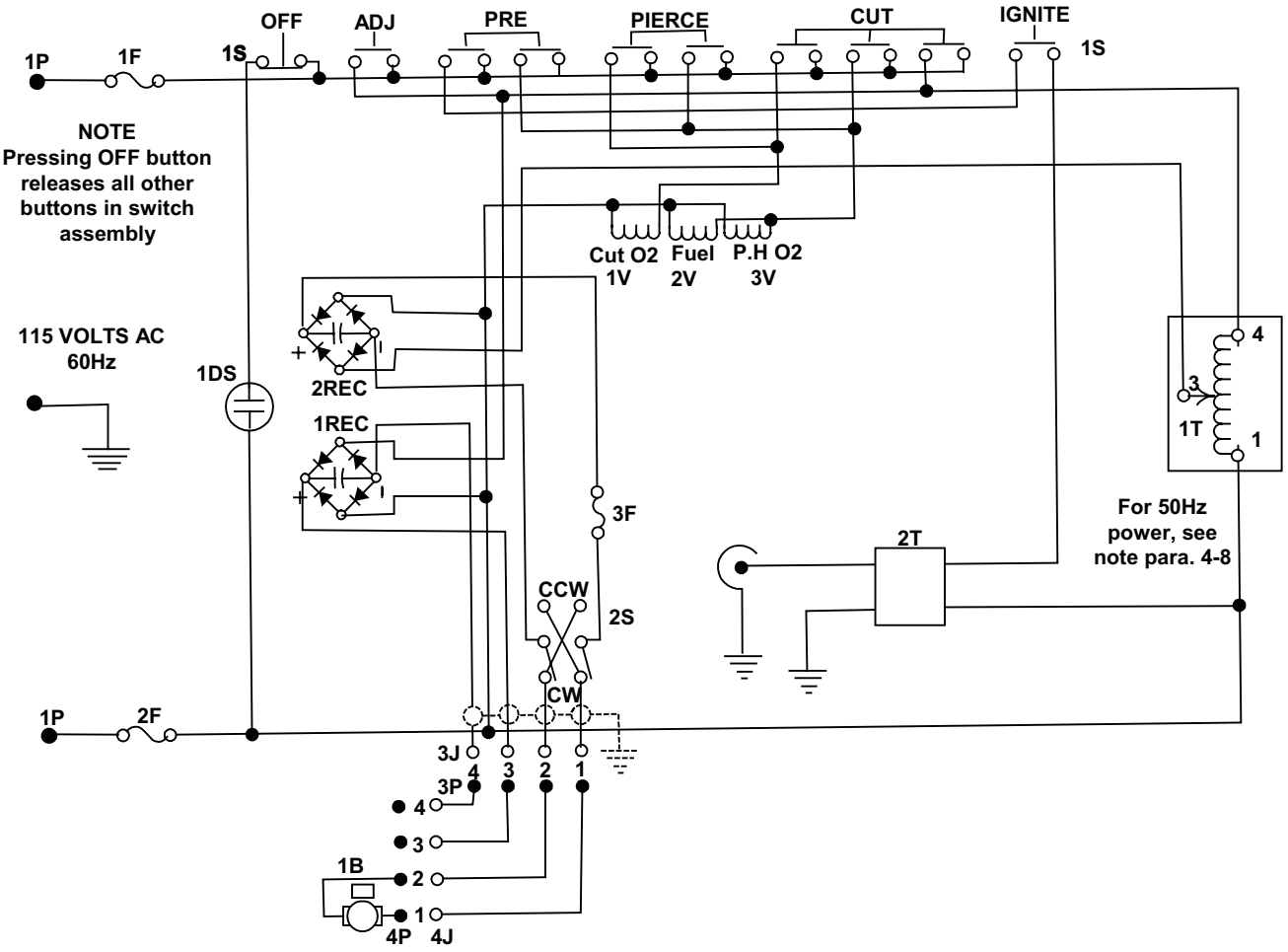
Electrical Schematics

The electrical systems of all Ultra-Graphs have been standardized and are designed with simple plug-in connections to all components.

DC Control Schematic



RC Control Schematic



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Replacement Parts

Information

This section provides replacement parts information. It is arranged by functional groups and identification of individual parts and replaceable assemblies.

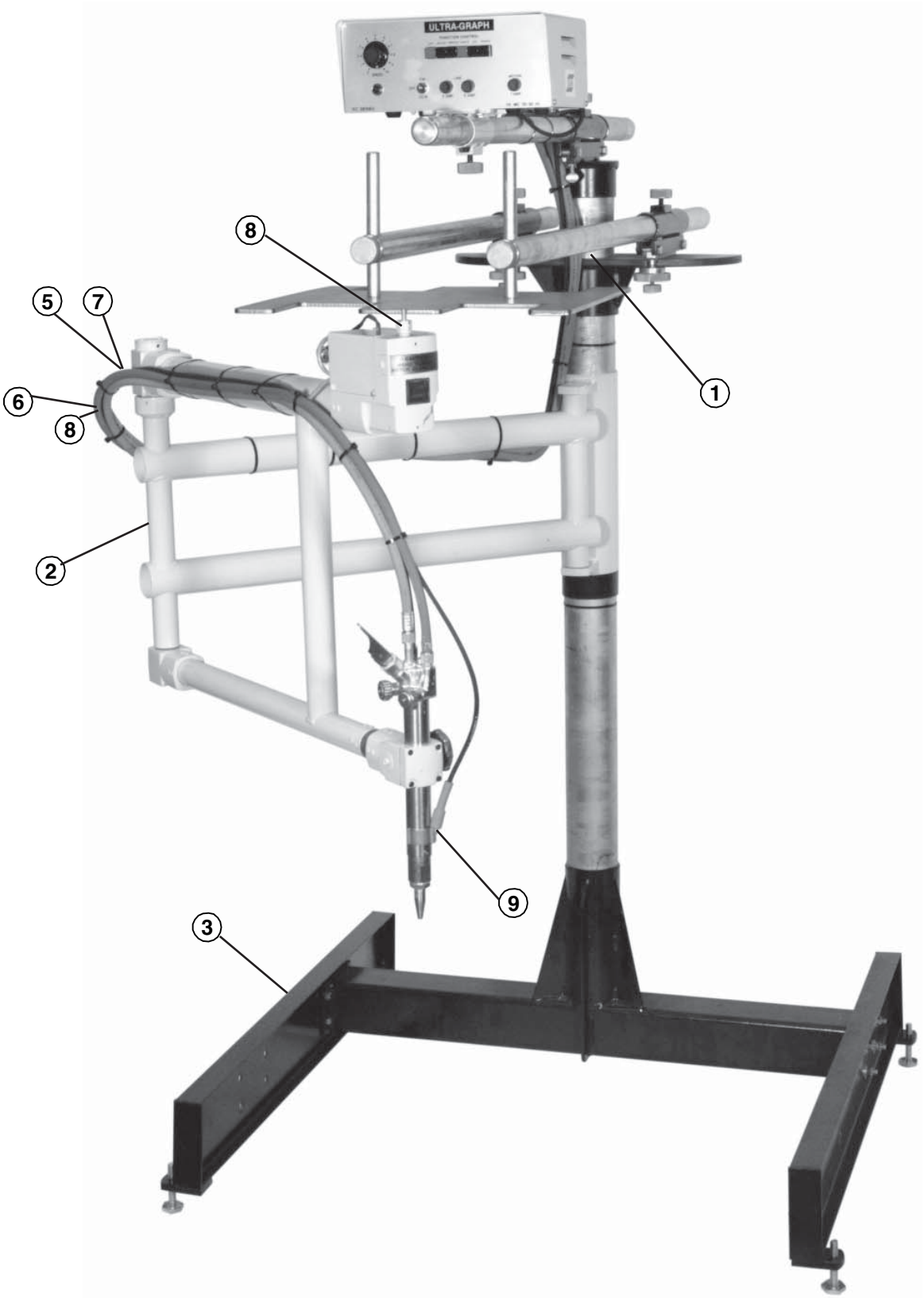
Ordering Information

When ordering replacement parts, order by part number and complete part description as given in the Description List column. In addition, give the machine model number and serial number. Address all inquiries to your local ESAB Distributor or to ESAB Cutting Systems, P.O. Box 100545, Florence, South Carolina, 29501.

NOTICE

This manual may contain part illustrations not applicable to your specific machine. To avoid unnecessary delays, positively identify the correct assembly before ordering replacement parts.

General Assembly



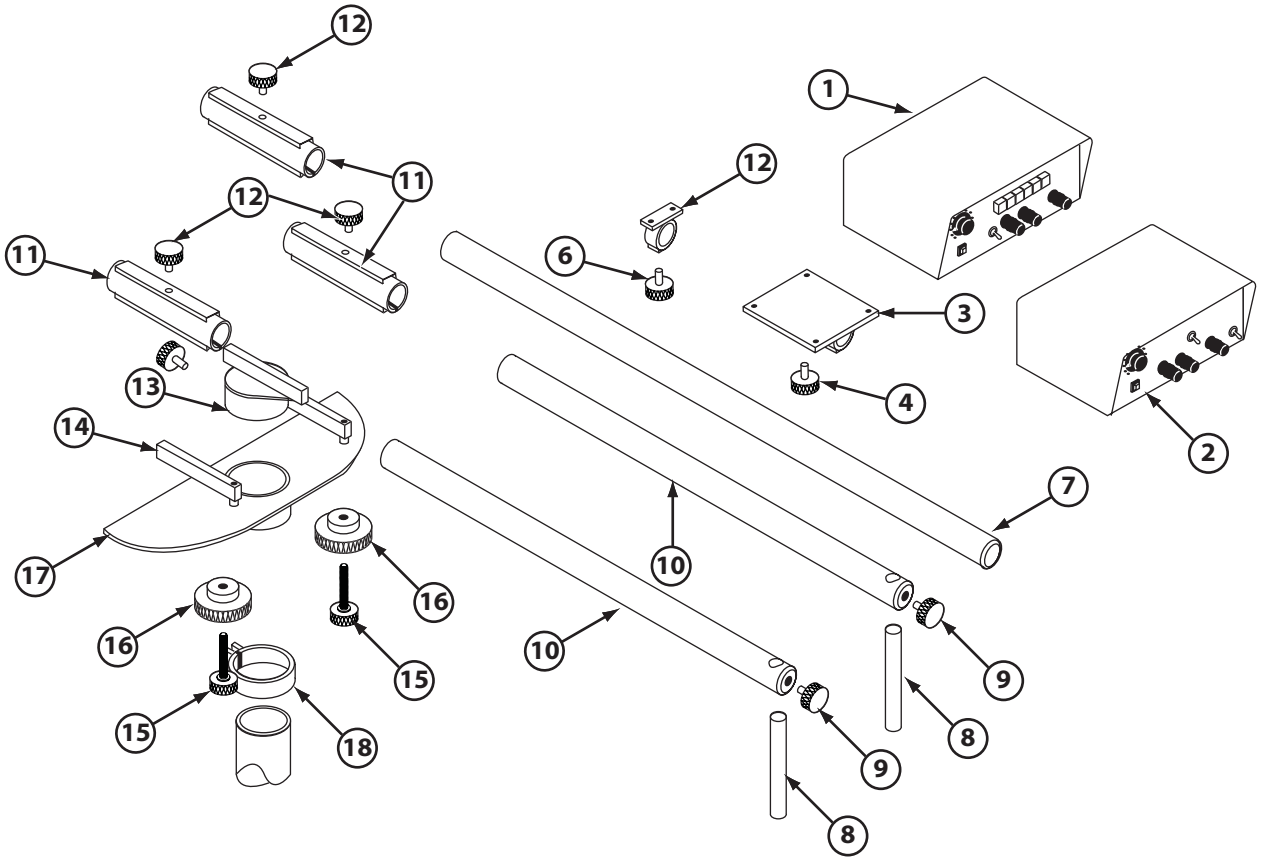
Item	Part #	Qty	Description
	1691211	1	Insulator
1	NPN	1	Template Support and Control Assy, RC Series, Standard
1001903 2	~~16901099~~	1	Arm Assy, Standard, 60" model
3	NPN	1	Base Assy, Floor Model Ultra-Graph
4	12901001	2	Adapter, 90° Oxygen
5	12901003		Adapter, 90° Fuel gas
6	1310149 1320149	2 2	Hose, Oxygen, 7 ft (for 46 " model)Hose, Oxygen, 10 ft (for 60" model)
7	1320159	1	Hose, Fuel-gas, 10 ft (for 60" model)
8	1301013 1301015 15517135 15517137	1 1 1 1	Rotor, ¼" Rotor ½" Rotor, 3/8" Rotor, ½" Rotor
9	12101459 50939	1 1	Cable Assy, Ignitor Level Tube Torch
	50915	1	Tooling and Cutting Manual

Standard Rotors For Ultragraph

1/8"	**1301017**	**4 to 20 ipm**
3/16"	**923107**	**4 to 30 ipm**
1/4"	**923074**	**4 to 40 ipm**
5/16"	**923108**	**4 to 50 ipm**
3/8"	**923075**	**4 to 60 ipm**
7/16"	**923109**	**4 to 75 ipm**
1/2"	**923076**	**4 to 85 ipm**
5/8"	**923110**	**4 to 105 ipm**
3/4"	**923111**	**4 to 125 ipm**
7/8"	**923112**	**4 to 150 ipm**

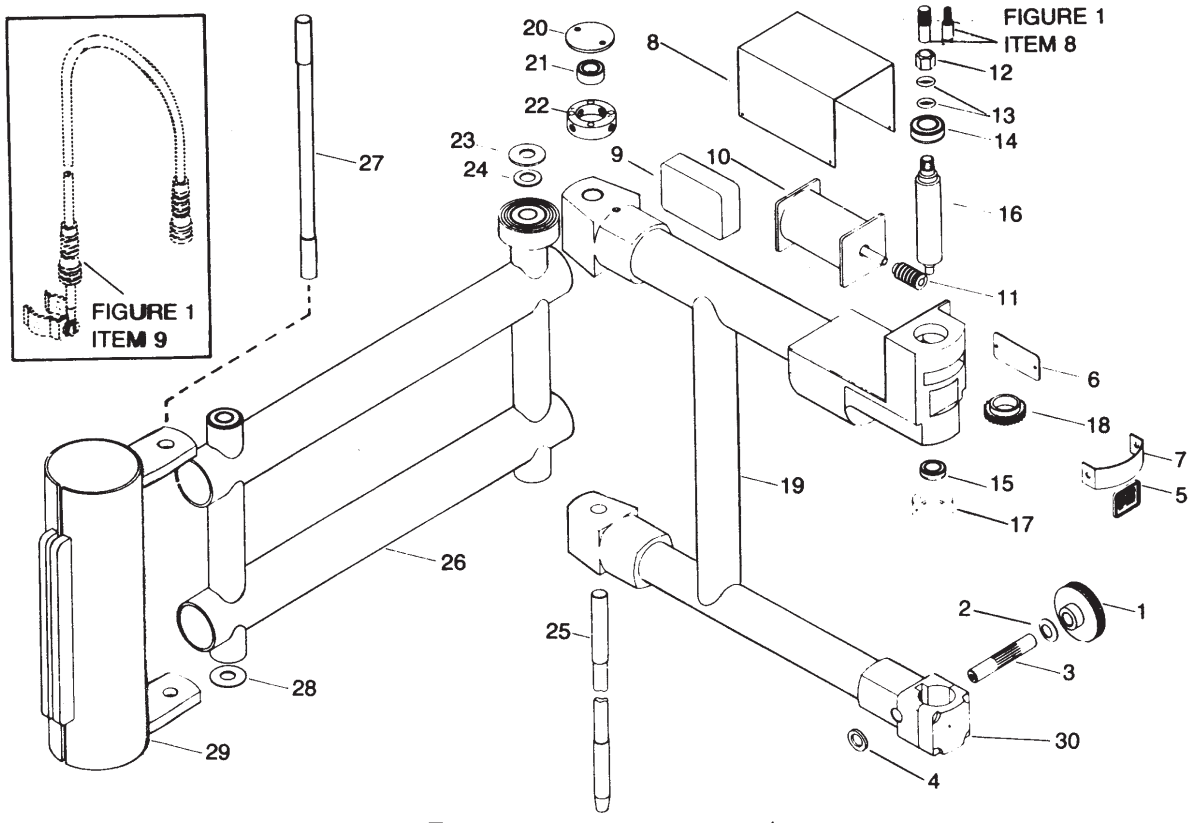
Rotor Set (10 pieces) 1251501

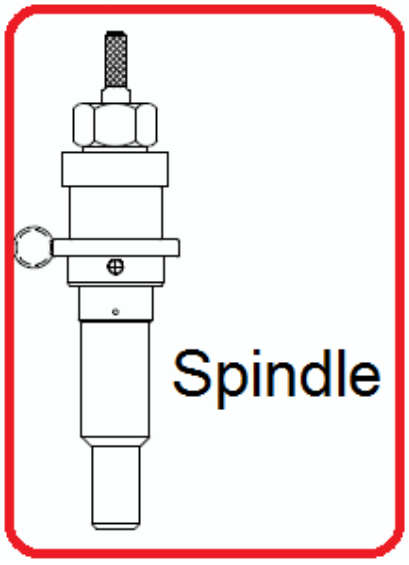
Control Mount Assembly



Item	Part #	Qty	Description
	NPN	1	Template Support and Control Assy, RC Series Standard (A)
	NPN	1	Template Support and Control Assy, DC Series Standard (C)
1	1251001	1	Control Assy, RC Series, Standard (for Assy A) (see Fig. 6 for detail parts)
2	1691001	1	Control Assy, DC Series, Standard (for Assy C) (see Fig. 7 for detail parts)
3	12801099	1	Plate, Mounting, RC Series, control (for Assy A, B)
4	16901119	1	Knob, Lock (for Assy A, B)
5	18701469	1	Plate, Mounting, DC Series, control (for Assy C, D)
6	22301129	1	Knob, Lock (for Assy C, D)
7	17401019	1	Arm, Control support
8	13014125	2	Pin, Template pilot
9	16901119	2	Knob, Lock
10	13201319	1	Arm, Template (for 60" model)
11	13001429	3	Clamp, Arm
12	16901119	3	Knob, Lock
13	13001419	1	Cap, Column
14	13501229	2	Lug, Pivot
15	16901129	2	Knob, Leveling
16	1691113	2	Knob, Pivot lock
17	13501219	1	Bracket, Support mount
18	1300139	1	Collar, Height adjusting

Standard Arm Assembly



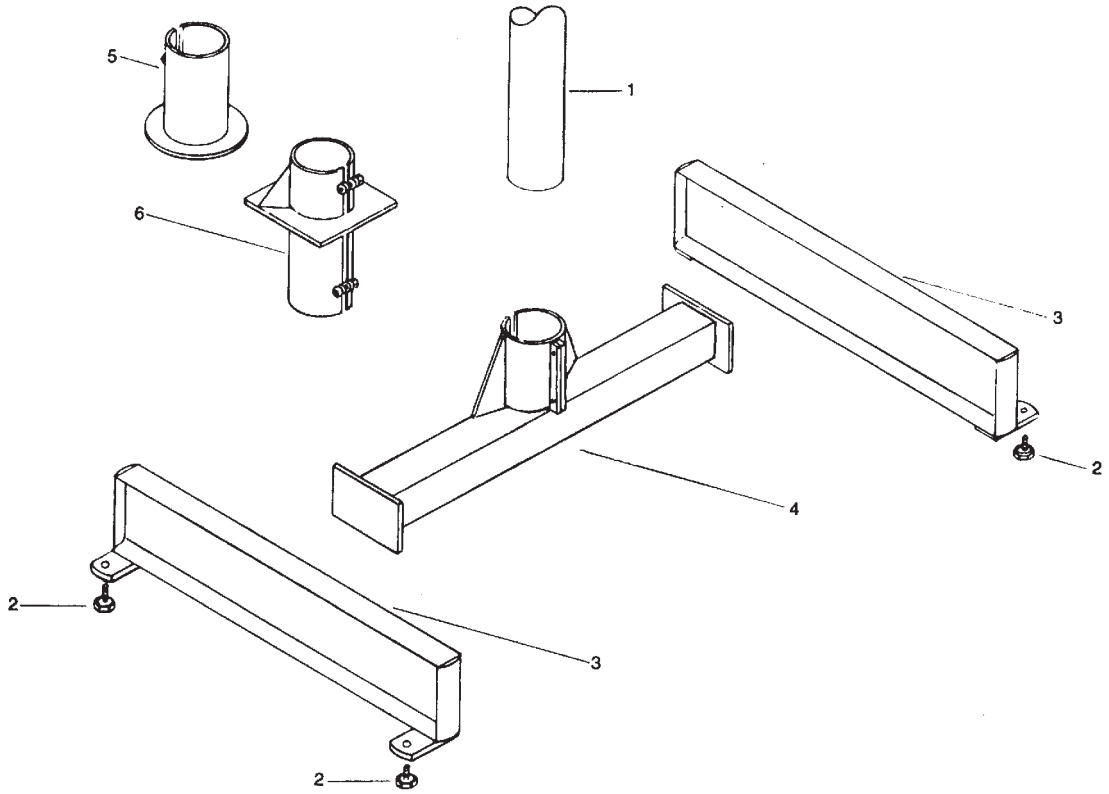


REPLACEMENT PARTS

Item	Part #	Qty	Description
1001903	~~2232880~~	1	Arm Assy, Standard, 60" model
1	1691111	1	Knob
2	50944	1	Washer, Spring
3	13012155	1	Pinion, Torch lift, 32-pitch (standard)
4	13012183	1	Washer, Pinion
5	1291011	1	Nameplate, Emblem
6	12510113	1	Nameplate, ESAB
7	23112141 23112143	1 1	Plate, Gear coverDecal, Gear coverplate
8	23112115	1	Cover, Motor
9	23101205	1	Dampener, Sound
10	2310139 13501107	11	Motor Assy, Standard (1B) Connector, Electrical, plug motor (4P)
11 16	23112117 2235227	11	Worm Spindle Assy
12	50941	1	Nut, Gland
13	50942	2	Packing, O-ring
14	51341	1	Bearing, Anti-friction
15	50951	1	Bearing, Anti-friction
~~16~~	~~13101199*~~	~~1~~	~~Spindle~~
17	18721137	1	Bushing
18	23112121	1	Gear, Worm
19	169010109	1	Arm, Outer for 60" model, standard
20	15513113	1	Cap, Eccentric
21	15513111	1	Center, Eccentric
22	1551317	1	Housing, Eccentric
23	50946	1	Spacer
24	50947	1	Spacer
25	1421111	1	Pin, Outer hinge
26	14201119	1	Arm, Inner for 60" model
27	1301217	1	Pin, Inner hinge
28	50946	1	Spacer
29	13001219	1	Bracket, Hinge
30	12901169	1	Torch Holder Assy

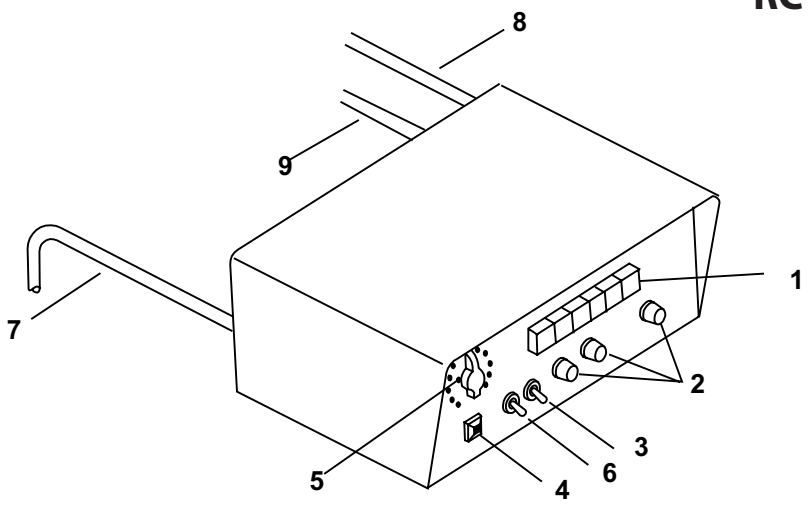
~~*NOT AVAILABLE AS SEPARATE PART. ORDER SPINDLE ASSEMBLY p/n 131011139~~

Base Assemblies



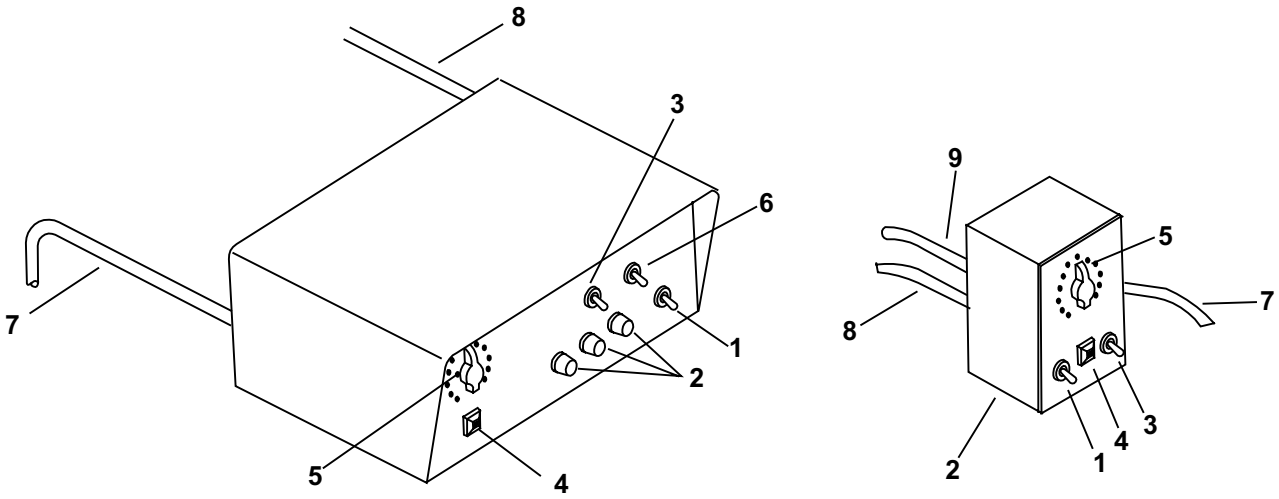
Item	Part #	Qty	Description
	1694201	1	Base Assy, Floor model Ultra-Graph (A)
	2232726	1	Base Assy, Table model Ultra-Graph (B)
1	1301011	1	Column, 5 ft
	1321011	1	Column, 4 ft
2	16901701	4	Leveler
3	16901049	2	Leg, Base
4	13201119	1	Support, Base column
6	1320169	1	Base, Table

RC Control



Item	Part #	Qty	Description
	1251001	1	Control Assy, RC series for standard Ultra-Graph and Porta-Graph (A)
1	51719	1	Switch Assy, Pushbutton (1S)
2	50927	321	Fuseholder, (Line 2 Amp, Motor 1 Amp)
	51913		Fuse, 3AG, 2 Amp, SioBio (1F, 2F)
	51880		Fuse, 3AG, 1 Amp, SioBio (3F)
3	12501049	1	Switch Assy, Toggle, 2-pole, 3-position, center off (CW-CCW) (2S)
4	42201405	1	Light, Indicator (1DS)
5	50922	1	Autotransformer, (Speed) (1T)
6	12801007	1	Switch, Toggle, DPST (Spindle) (for Assy B) (3S)
7	51881	1	Cable Assy, Power (with plug) (1P)
8	12501019	1	Cable Assy, Motor, for Ultra-Graph
	51879	1	Connector,Electrical, plug, motor cable (3P)
	50917	1	Connector, Electrical, receptacle, motor cable (4J)
9	15601449	1	Cable Assy, Coil (for Assy B)
	68235	1	Connector, Electrical, plug, coil cable (5P)
	68233	1	Connector, Electrical, receptacle, coil cable (6J)
	507014-49	A/R	Rectifier, Bridge (1REC, 2REC, 3REC)
	51432	1	Ignitor, Assy (2T)
	~~50932~~ 51914	1	Valve, Solenoid, cutting oxygen, preheat oxygen (1V, 3V)
	50933	1	Valve, Solenoid, preheat fuel gas (2V)
	68288	1	Connector, Electrical, receptacle, for motor cable (3J)
	52964	1	Connector, Electrical receptacle, for cable coil (for Assy B) (5J)

DC Series Control



Item	Part #	Qty	Description
	1691001	1	Control Assy, DC Series for standard Ultra-Graph (A)
	2310149	1	Control Assy, DC Series for Porta-Graph (C)
1	12801007	1	Switch, Toggle, DPST (Power Off) (1S)
2	50927	321	Fuseholder, (Line 2 Amp, Motor 1 Amp)
	51913		Fuse, 3AG, 2 Amp, SioBio (for Assy A, B) 1F, 2F)
	2017049		Fuse, 3AG, 1 Amp, SioBio (for Assy A, B) (3F)
3	50943	1	Switch Assy, Toggle, 2-pole, 3 position, center off (CW-CCW) (2S)
4	42201405	1	Light, Indicator (1DS)
5	50922	1	Autotransformer, (Speed) (1T)
6	12801007	1	Switch, Toggle, DPST (Spindle) (for Assy B) (3S)
7	51881	1	Cable Assy, Power (with plug) (1P)
8	12501019	1	Cable Assy, Motor, for Ultra-Graph
	18701479	1	Cable Assy, Motor, for Porta-Graph
	51879	1	Connector, Electrical, plug, motor cable (3P)
	50917	1	Connector, Electrical, receptacle, motor cable (4J)
9	15601449	1	Cable Assy, Coil (for Assy B)
	68235	1	Connector, Electrical, plug, coil cable (5P)
	68233	1	Connector, Electrical, receptacle, coil cable (6J)
	50701449	A/R	Rectifier, Bridge (1REC, 2REC, 3REC)
	68288	1	Connector, Electrical, receptacle, motor cable (3J)
	52964	1	Connector, Electrical, receptacle, coil cable (5J)

Spacer Page

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