

CE

BW3000

BW3000 AUTOBOREWELDER OPERATING MANUAL

ORIGINAL INSTRUCTIONS



 **CLIMAX**
Portable Machining & Welding Systems

P/N 52815
August 2022
Revision 10

 **CLIMAX** |  **BORTECH**  **CALDER**  **H&S TOOL**

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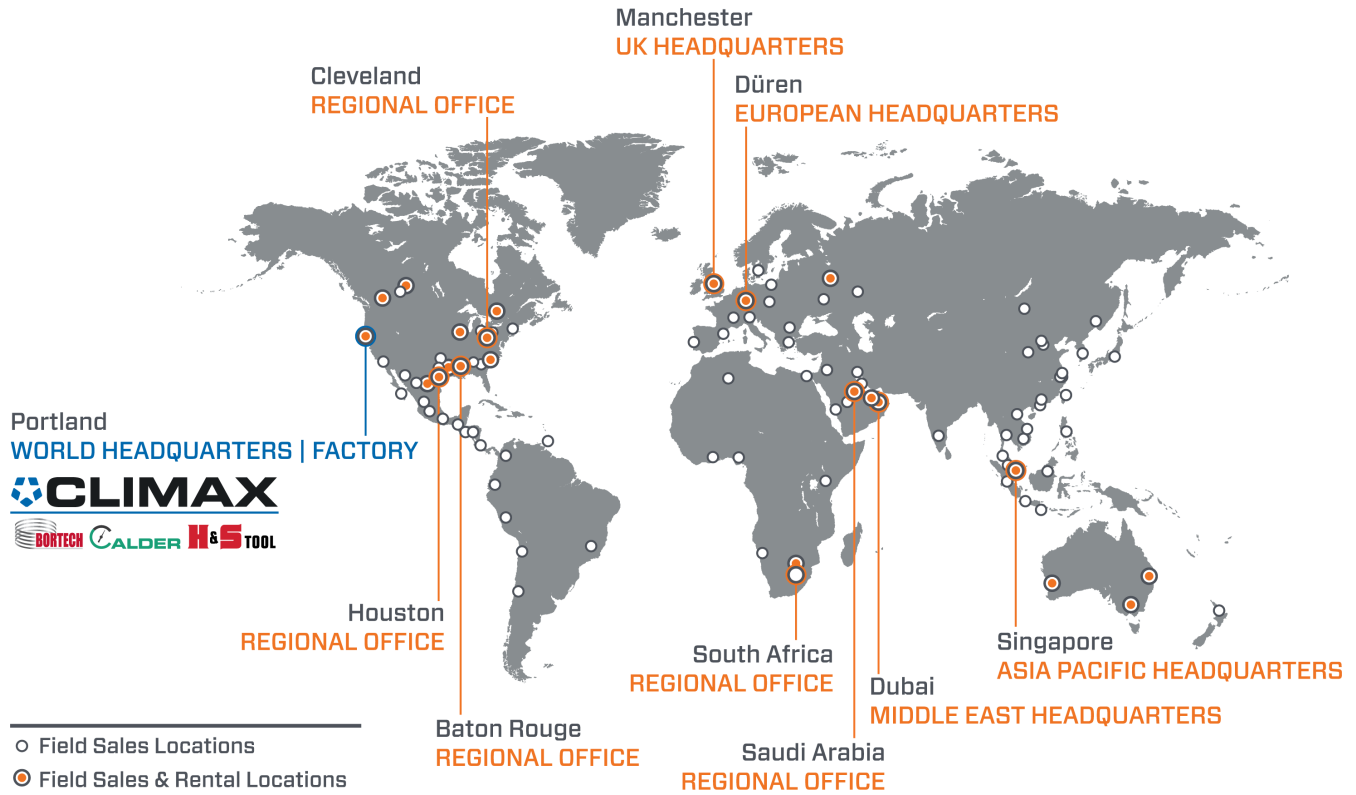
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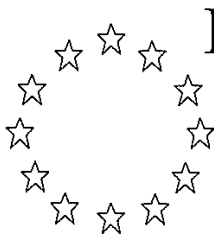
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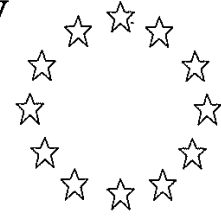
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CE DOCUMENTATION



Declaration of Conformity



2006/42/EC Machinery Directive
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Choose an item.

Name of Manufacturer:
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Document PN 102344

Full postal address including country of origin:
 2712 E. Second St., Newberg, OR 97132, USA

Object(s) of the Declaration:
 Bore Welders

Name, type or model, batch or serial number:
 BW1000, BW3000, BW5000

S/N Range: 22000266 - _____
 (Write in S/N after marking product)

Harmonised Standards used, including number:

EN ISO 12100:2010 - Safety for Machinery; Principles
 EN 349:1993+A1:2008 - Safety of Machinery; Gaps
 EN 894-1 thru 4+A1-Ergonomic Req for Displays
 EN 1005-1 thru 4:2001-Human Physical Performance
 EN ISO 3744:2010 - Acoustic Power
 EN ISO 11201:2010 - Acoustics; Noise Emitted
 EN ISO 13732-1:2008 - Temperature of Touchable Surfaces
 EN ISO 13849-1:2015 - Controls Systems
 EN ISO 13850:2015 Emergency stop function
 EN 61000 series - EMC Emissions and Immunity

EN 61310-1 thru 3:2008 Indication, Marking and Actuation
 EN 60204-1:2018 - Safety of Machinery; Electrical Equipment

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1 INTRODUCTION

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1.1 HOW TO USE THIS MANUAL

This manual describes information necessary for the setup, operation, maintenance, storage, shipping, and decommissioning of the BW3000.

The first page of each chapter includes a summary of the chapter contents to help you locate specific information. The appendices contain supplemental product information to aid in setup, operation, and maintenance tasks.

Read this entire manual to familiarize yourself with the BW3000 before attempting to set it up or operate it.

1.2 SAFETY ALERTS

Pay careful attention to the safety alerts printed throughout this manual. Safety alerts will call your attention to specific hazardous situations that may be encountered when operating this machine.

Examples of safety alerts used in this manual are defined here¹:

DANGER

indicates a hazardous situation which, if not avoided, **WILL** result in death or severe injury.

WARNING

indicates a hazardous situation which, if not avoided, **COULD** result in death or severe injury.

1. For more information on safety alerts, refer to *ANSI/NEMA Z535.6-2011, Product safety Information in Product Manuals, Instructions, and Other Collateral Materials*.

 **CAUTION**

indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

indicates a hazardous situation which, if not avoided, could result in property damage, equipment failure, or undesired work results.

1.3 GENERAL SAFETY PRECAUTIONS

CLIMAX leads the way in promoting the safe use of portable machine tools. Safety is a joint effort. You must do your part by:

- Being aware of your work environment
- Closely following the operating procedures and safety precautions contained in this manual
- Closely following your employer's safety guidelines

When operating or working around the machine, observe the safety precautions below.

Training – Before operating this or any machine tool, you should receive instruction from a qualified trainer. Contact CLIMAX for machine-specific training information.

Risk assessment – Working with and around this machine poses risks to your safety. Conduct a risk assessment (Section 1.5 on page 4 and Section 1.6 on page 5) of each job site before setting up and operating this machine.

Intended use – Use this machine in accordance with the instructions and precautions in this manual. Do not use this machine for any purpose other than its intended use as described in this manual.

Personal protective equipment – This machine produces radiation in the visible and ultraviolet spectrum range called arc rays. Always wear appropriate personal protective gear when operating this or any other machine tool.

- Always wear welding PPE for eyes and exposed skin when observing or working around the machine during operation.
- Wear flame-resistant clothing with long sleeves and legs (such as heavy shirts and cuffless pants made of a durable flame-resistant material for protection from sparks and flame) when operating the machine, as hot flying spatter from the workpiece may burn bare skin. Other personnel in the area must be protected from the arc rays by a screen or a warning not to watch or otherwise expose themselves to the rays or to any hot spatter.

- The operator and any personnel observing the machine when in use must use a protective shield with a filter and cover plates that conform to ANSI Z87.1 standards.
- Operators should use weld curtains and Shade 9 handheld shields, Shade 3 sunglasses with side shields for operators.

The hand-held helmet is held between the process and the operator, allowing the operator to view the control box without raising a conventional helmet. It's also easier to inspect the process with a hand-held helmet, as you can hold the helmet near the process without bumping into the BW3000 or the part being welded.

Work area – Keep the work area around the machine clear of clutter. Restrain cords and hoses connected to the machine. Keep other cords and hoses away from the work area.

Danger zone – The danger zone of this machine is inside the bore during welding operations. The main danger of this machine is from the arc flash, and is mainly visual in nature. All persons in the area of the machine need to have proper shielding from the radiation produced while welding. Keep combustibles or any other fire hazards well away from the work area. For in-shop use, have a fire extinguisher readily available.

Moving parts – Many CLIMAX machines have numerous exposed moving parts and interfaces that can cause severe impact, pinching, cutting, and other injuries.

During machine operation:

- Keep hands and tools away from moving parts.
- Wear proper PPE for welding and always maintain a clear working area to prevent tripping hazards.

Hot surfaces – During operation, torches and extensions will get hot enough to cause severe burns. Pay attention to hot-surface warning labels and wear gloves, avoiding contact with bare skin until the machine has cooled.

1.4 MACHINE-SPECIFIC SAFETY PRECAUTIONS

Hazardous environments – Do not operate the machine in environments where explosive materials, toxic chemicals, or radiation may be present. Do not expose the machine to rain or wet conditions.

Welding hazards – This machine produces radiation in the visible and ultra-violet spectrum range. Always wear welding PPE for eyes and exposed skin when observing or working around the machine during operation. For more information on welding hazards and safety precautions, refer to ANSI 749.1, *Safety in Welding and Cutting*.

Sound level – This machine produces potentially harmful sound levels. Always wear hearing protection when operating the machine or working

around it.

During testing, the machine produced the following sound levels.¹

TABLE 1-1. SOUND LEVELS

The declared sound power level is:	59.7 dBA
The declared operator sound pressure level is:	58.0 dBA
The declared bystander sound pressure level is:	56.4 dBA

Hoses, pendants, and electrical cables – Follow these rules:

- Do not abuse the pendant cable as this can damage the cable and pendant.
- Never use the cord for carrying, pulling, or unplugging.
- Remove any and all kinks before straightening the cable.
- Keep cords and hoses away from heat, oil, sharp edges, and moving parts.
- Plugs must match the outlet. Never modify the plugs in any way. Do not use an adapter plug with grounded power tools.
- Always examine hoses and cables for damage before use.

Adjustments and maintenance – Stop the machine and lock out all power sources before performing any adjustment, lubrication, or maintenance.

Controls – The machine controls are designed to withstand the rigors of normal use.

The on/off switches are clearly visible and identifiable. When you leave the machine, disconnect all power sources to the machine.

1.5 RISK ASSESSMENT AND HAZARD MITIGATION

Welding tools are specifically designed to perform precise overlay operations. Some welding tools are used in controlled environments such as factories and repair shops; however, portable welding tools are used in a wide variety of conditions. A portable welding tool typically attaches directly to the workpiece itself, or to an adjacent structure. The design intent is that the portable welding tool and the structure to which it is attached become one complete machine during the welding processes.

To achieve the intended results and to promote safety, the operator must understand and follow the design intent, setup, and operation practices that are unique to portable welding tools. Hazards include the potential for operator injury, as well as the potential for damage to the workpiece and to the welding equipment itself.

1. Machine sound testing was conducted in accordance with European Harmonized Standards EN ISO 3744:2010 and EN 11201:2010.

Precautions are required to avoid injury from burns, electric shock, vision damage, inhalation of poisonous gases and fumes, and exposure to intense ultraviolet radiation. When welding is performed on motorized equipment, precaution is required to minimize the risk of fuel ignition or electrical damage to vehicle instrumentation. Power sources must be evaluated for proper voltage and current rating. To avoid damaging generators, weld power supplies, and welding equipment, power cabling must be maintained and replaced as required.

The operator must perform an overall review and on-site risk assessment of the intended application. Due to the unique nature of welding tool applications, identifying one or more hazards that must be addressed is typical. When performing the on-site risk assessment, it is important to consider the portable welding tool and the workpiece as a whole.

1.6 RISK ASSESSMENT CHECKLIST

The following checklist is not intended to be an all inclusive list of things to watch out for when setting up and operating this Portable Machine Tool. However, these checklists are typical of the types of risks the assembler and operator should consider. Use these checklists as part of your risk assessment:

TABLE 1-2. RISK ASSESSMENT CHECKLIST BEFORE SET-UP

Before Set-up	
<input type="checkbox"/>	I took note of all the warning labels on the machine.
<input type="checkbox"/>	I removed or mitigated all identified risks (such as tripping, cutting, crushing, entanglement, shearing, or falling objects).
<input type="checkbox"/>	I considered the need for personnel safety including shielding from arc rays.
<input type="checkbox"/>	I read the machine assembly instructions (Section 3) and took inventory of all the items required but not supplied (Section 2.6).
<input type="checkbox"/>	I took inventory of all the items required but not supplied (Section 2.4).
<input type="checkbox"/>	I considered how this machine operates and identified the best placement for the controls, cabling, and the operator.
<input type="checkbox"/>	I have assessed for additional risks unique to this application of the Portable Welding tool.

TABLE 1-3. RISK ASSESSMENT CHECKLIST AFTER SET-UP

After Set-up	
<input type="checkbox"/>	I checked that the machine is safely installed (according to Section 3) and the potential fall path is clear. If the machine is installed at an elevated position, I checked that the machine is safeguarded against falling.
<input type="checkbox"/>	I planned for containment of any weld spatter produced by the machine.
<input type="checkbox"/>	I followed the required Maintenance Intervals (Section 5.2).
<input type="checkbox"/>	I checked that all affected personnel have the recommended personal protective equipment, as well as any equipment required by the site or other regulations.

TABLE 1-3. RISK ASSESSMENT CHECKLIST AFTER SET-UP

After Set-up	
<input type="checkbox"/>	I checked that all affected personnel understand the danger zone and are clear of it or UV guarding is present.
<input type="checkbox"/>	I examined the area surrounding the workpiece for flammable materials and removed them if possible.
<input type="checkbox"/>	I have a fire extinguisher nearby.
<input type="checkbox"/>	I have assessed for additional risks unique to this application of the Portable Machine tool.

1.7 GLOSSARY

TABLE 1-4. GLOSSARY

Term	Definition
Arc Interrupt	A BoreWelder function that lets you briefly stop the weld process yet maintain all other weld mode functions.
Arc Voltage	The length of the arc between the molten puddle and the end of the electrode, in this case, MIG wire.
Articulate	The hinging motion of the BoreWelder and radial mount to accommodate movement of the BoreWelder spindle towards and away from the mounting rod.
Auto Skip	A BoreWelder function that allows the operator to automatically skip keyways or fill in an out-of-round or worn section of a bore.
Carriage Return	A BoreWelder function that allows the operator to weld up worn areas of the bore up to 180° in a single weld direction. Carriage return is typically used when in a horizontal axis, when wear is present on an <u>uphill</u> or <u>downhill</u> section of the bore.
Cast	The diameter of the circle that a welding wire makes on the floor in its relaxed state.
Centering	Positioning the BoreWelder so that it's centered over the bore. Complete centering is called "centrality."
DIP Transfer	See short arc.
ESO	Electrical Stickout. See Stickout.
HAZ	Heat Affected Zone
Leveling	The process of aligning the axis of the BoreWelder to the axis of the bore to be welded.
MIG Welding	Metal inert gas welding, where the consumable metal electrode (wire) is mechanically fed into the arc, shielded by an inert gas.
Parallelism	Positioning the BoreWelder so that it's parallel to the axis of the bore to be welded.
Pie Mode	A BoreWelder function that allows the operator to weld up worn areas of the bore up to 180° in a dual-weld direction (or "up to 180 degrees bi-directionally"). Pie mode may be used when the BoreWelder axis is horizontal and the worn area is at the top or the bottom of the bore, or in any situation when the BoreWelder axis is vertical and there is wear present.
Porosity	The condition that results when the weld bead becomes sponge-like in appearance. Porosity is typically associated with loss of shielding gas coverage, excessive contaminants in or on the base metal, or excessive voltage.
Rotation Speed	How fast the spindle of the BoreWelder is turning, measured in seconds per rotation (SPR). It's calculated from the diameter of the bore and the target travel speed.

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2 OVERVIEW

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2.1 FEATURES AND COMPONENTS

The BW3000 AutoBoreWelder is an automated welding device. It passes current, welding wire, and metal inert gas (MIG) to a torch that moves in both rotary and axial directions. As the torch moves, it deposits a continuous layer of metal (contiguous weld beads) around the bore's circumference to build up the surface. Adjust the BW3000 to differences in the bore diameter by selecting a different torch and/or adjusting the offset head.

In addition, the BW3000 has an Auto Skip function that allows you to set up the BW3000 to not weld a portion of the bore, such as a keyway, or to weld only a portion of the bore, such as a worn section.

Principle components include:

- Variable step control allows for variable thickness of overlay
- Auto Skip for designating weld-only or skip-only areas
- Auto Stop and Position Indicator Collar to set stop and restart points
- Quick disconnect system for quick setup and disassembly
- Dedicated wire feeder
- Remote control of the power supply
- High current limit
- Precise angle control of the torch in relation to the part

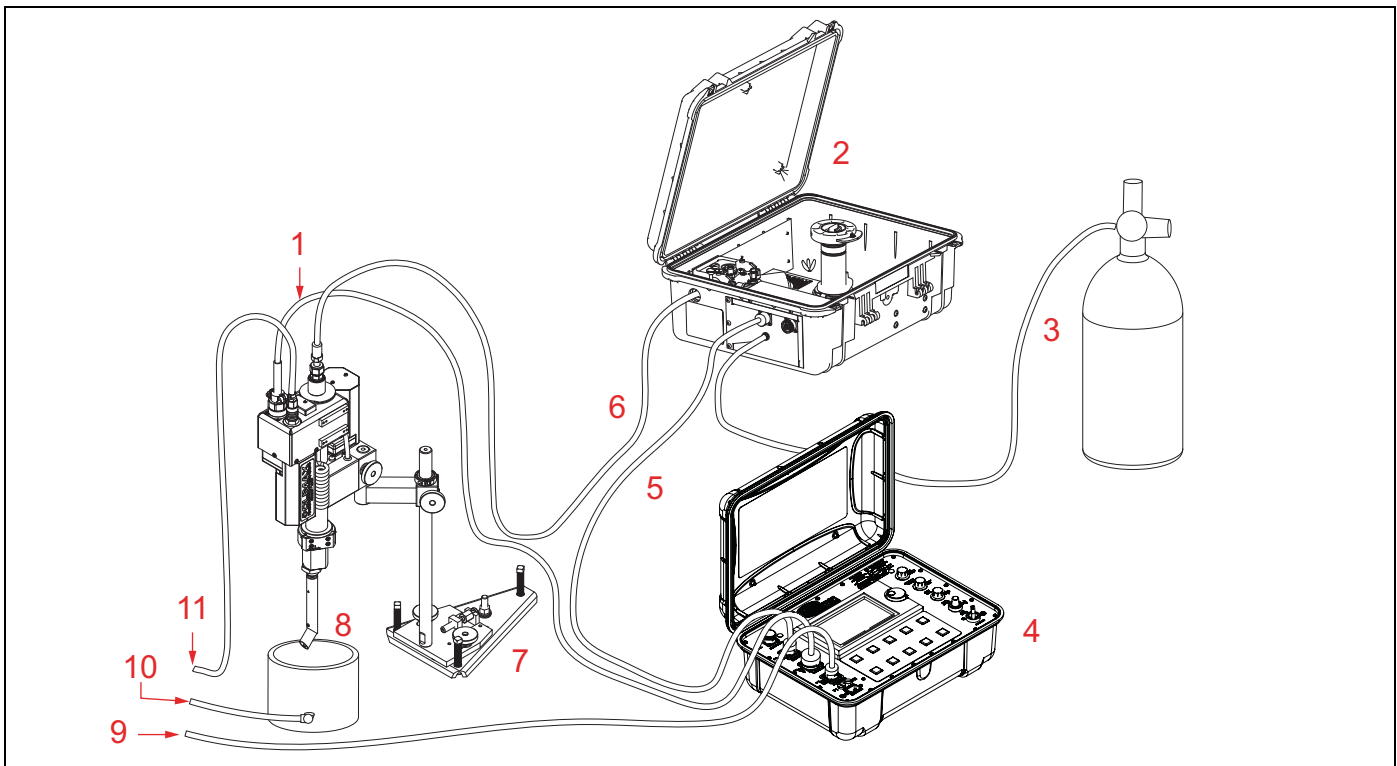


FIGURE 2-1. BW3000 AUTOBOREWELDER AND EXTERNAL COMPONENTS

TABLE 2-1. BW3000 EXTERNAL COMPONENT IDENTIFICATION

Number	Component
1	BoreWelder control cable
2	Enclosed wirefeeder
3	Gas hose (inert gas bottle and gas regulator [not provided])
4	Control box
5	Wirefeed control cable
6	Wirefeed conduit
7	Adjustable base
8	BoreWelder
9	Power supply control cable
10	Weld negative
11	Weld positive

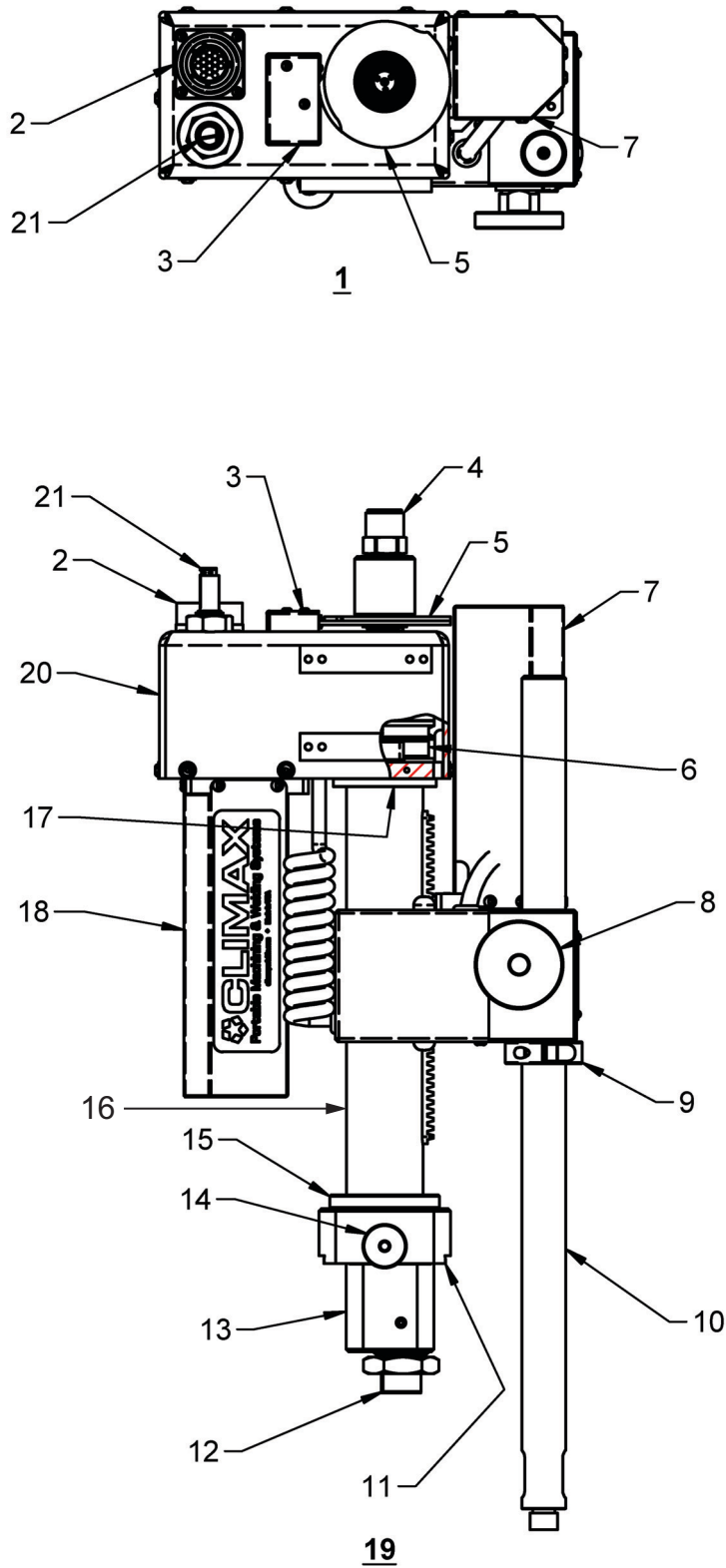


FIGURE 2-2. BW3000 COMPONENTS

TABLE 2-2. BW3000 COMPONENT IDENTIFICATION

Number	Component
1	Top view
2	Control cable connector
3	Auto Skip switch (with the auto skip cams, this allows the operator to skip keyways)
4	Swivel connector (attaches to the wirefeed conduit. It allows the spindle of the BoreWelder to rotate without twisting the conduit. Shielding gas and welding wire travel through the conduit and connector)
5	Auto Skip cams (the operator sets the detent in the cams to correspond with the area of the bore to be skipped. Also permits welding within the cam detent, for repairing worn or out-of-round bores)
6	Adjustable step collar (allows the operator to change the location of the step)
7	Step motor
8	Clamp hand knob
9	Locking collar (supports the BoreWelder in the vertical axis when not clamped)
10	Mounting rod (supports the BoreWelder when it's attached to the adjustable base or boring bar interface)
11	Dovetail
12	Orientation fitting and nut (couples torches to the Offset Head assembly. This system allows the torch to be removed without moving the BoreWelder quill, for quick tip replacements and restarts)
13	Offset Head assembly
14	Adjustment knob (adjusts torch diameter)
15	Auto stop collar
16	Quill
17	Position marker
18	Rotation motor
19	Front view
20	Shroud
21	Power connector (quick couple; attaches to the power cable, connecting the BoreWelder to the power supply.)

When setting up the BoreWelder, it is necessary to do the following:

1. Attach the BoreWelder to the part to be welded.
2. Align and center the BoreWelder to the bore
3. Determine the proper torch/bore clearance.
4. Make the initial control settings.

When welding, it is necessary to do the following:

- Start and stop the machine.

-
- Make minor adjustments in the rotational speed, voltage, and wire speed to maintain good weld quality.

2.1.1 Features

Principle features include the following:

Step process

- Complete weld coverage at the start and finish of the bore.
- Infinite step size (and weld bead) adjustment from 0.040" (1 mm) to 0.220" (5.6 mm).
- Ability to step in either direction.
- Adjustable step location.

Auto Skip

- Ability to designate weld-only or skip-weld areas up to 180 degrees.
- Automatic skipping of keyways and intersecting bores.
- Automatic repair of out-of-round bores without pre-machining, for any position or any axis.
- Elimination of re-welding by skipping good sections of the bore.

Auto stop and position marker

- The Auto Stop function allows you to set a stop point so that the Bore-Welder stops when the bore is complete.
- The Position Marker recalls the last stop point.

Control box

- One central location for adjustment of all welding and positioning parameters.
- Graphical display of all parameters, switch states, and functions.
- Remote control of welding power supply.
- Onboard rotation timer and bore diameter entry field provides full travel time and speed calculations.
- Wirespeed timer for quick accurate wirefeed measurements.
- Digital readout of all drive speeds with dual rate (high low) rotary encoder control.
- Double tap for full speed on Wire Jog, Rotate Jog and Extend / Retract.

Patented torch and extension system:

- Quick disconnect system with a captive liner allowing for fast setup and takedown.
- Easy replacement of consumables without moving the BoreWelder.
- Quick readjustment for bores longer than the stroke of the machine.
- 175 ampere current limit
- Extended arc time for high productivity.
- Up to five lbs/hour of weld deposition

2.1.2 Stock components

2.1.2.1 BoreWelder

The BoreWelder provides the circular and axial motion needed to build up a bore. It also provides for the rotational passage of current, welding wire, and shielding gas to the welding torch. Figure 2-1 on page 10 shows the BW3000 BoreWelder and its major assemblies, including the control box, wirefeeder, and adjustable base.

2.1.2.2 Control box

The control box controls all the welding functions. It contains the motor controllers for the wirefeeder step and rotation, plus relays for gas solenoid and power supply contactor control. Three rotary encoders allow adjustment of rotation speed, wire speed, and step. One potentiometer provides adjustment of arc voltage on the weld power supply. .

The control cables connect the control box to the BW3000, wirefeeder, welding power supply, and the 100 to 120V AC power.

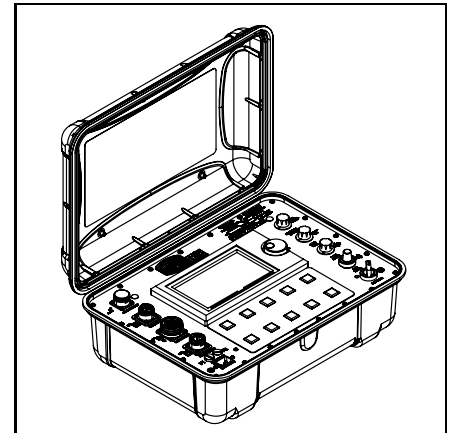


FIGURE 2-3. CONTROL BOX

2.1.2.3 Wirefeeder

The wirefeeder supports a standard 12" (305 mm) roll. The four-roll assembly and shielding gas solenoid are operated by the control box. Wirefeeders may be enclosed (Figure 2-4) or shop style (Figure 2-5).

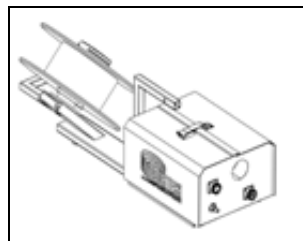


FIGURE 2-5. SHOP-STYLE WIREFEEDER

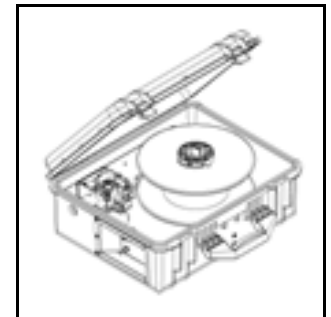


FIGURE 2-4. ENCLOSED WIREFEEDER

Wirefeed conduit – The Wirefeed Conduit provides passage of welding wire and shielding gas from the wirefeeder to the BoreWelder. Conduits are available in 2, 3, 4, 5, 6, 10 and 15-foot lengths (0.6, 0.9, 1.2, 1.5, 3, and 4.6 meters). Typical length is 5 feet (1.5 meters). Conduits that are 10 feet

(3 meters) and longer reduce the feeding capacity and should be avoided.

Gas hose – The gas hose connects the shielding gas (inert gas) regulator to the wirefeeder.

2.1.2.4 Adjustable base

The adjustable base enables quick setup and provides support for the BoreWelder while also allowing you to adjust parallelism and centering.

TABLE 2-3. ADJUSTABLE BASE AND RADIAL MOUNT IDENTIFICATION

Number	Component
1	Radial mount
2	Adjustable base

The jack screws help keep the BoreWelder parallel to the bore; the slider permits one axis of fine centering adjustments.

The mounting rod supports the BoreWelder. See Figure 2-6 and Figure 3-1 on page 40.

Radial mount – The radial mount is used to extend the distance of the BoreWelder from the mounting rod to the bore being welded. It's also used to help center the BoreWelder. See Section 2.2.1 for more information on these accessories.

Locking collar – The locking collar, installed on the mounting rod, prevents the BoreWelder from sliding down the mounting rod when the bore axis is vertical.

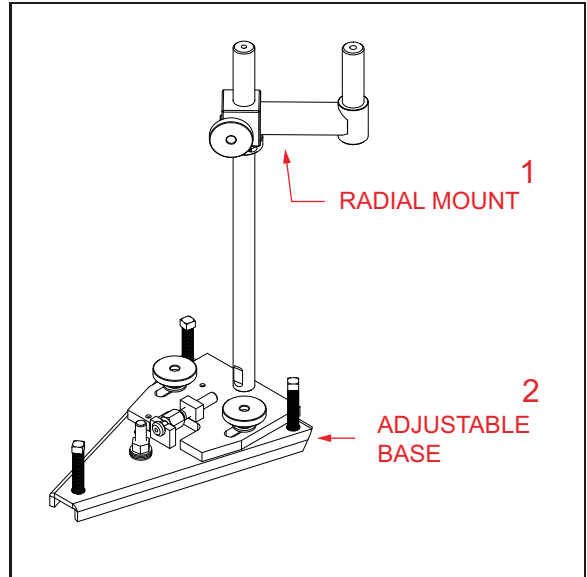


FIGURE 2-6. ADJUSTABLE BASE AND RADIAL MOUNT

2.1.2.5 Torches

The torches attach to the offset head assembly using the orientation fitting. Torches are available to weld holes from 0.5–56" (13–1422 mm) in diameter.

Torch extensions allow the torch to enter into deep or remotely located holes. The extensions come in 3", 6", 12", and 18" lengths (76, 152,

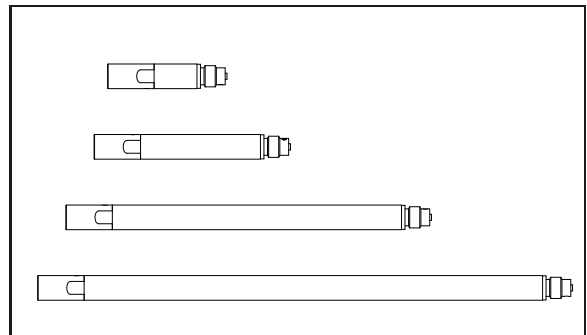


FIGURE 2-7. TORCH EXTENSIONS

305, and 457 mm). The extensions can also be used as an indicator for setting the BoreWelder parallel to the bore.

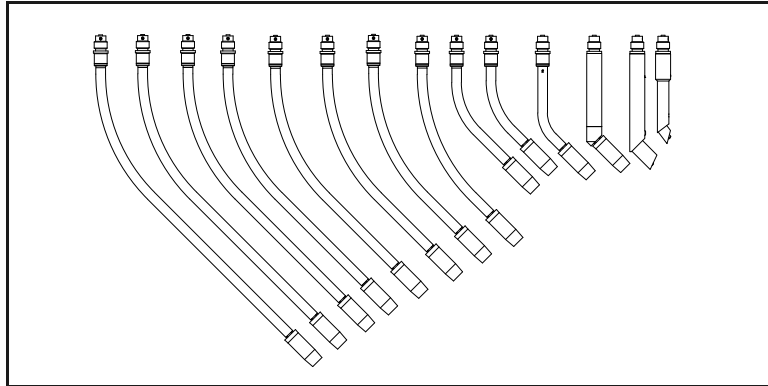


FIGURE 2-8. BORE TORCHES

See Section 2.2.2 on page 21 for more information about torches and torch accessories.

2.1.2.6 Offset head assembly

The offset head provides a total of 3" (76 mm) torch diameter adjustment without changing torch angle. The dovetail slide conducts welding current and provides a gastight seal for shielding gas. The orientation fitting provides means to align the torch to the slide travel direction, and the ability to remove and install the torch quickly and efficiently.

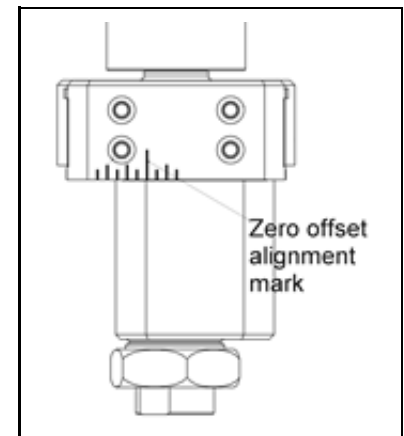


FIGURE 2-9. ZERO OFFSET ALIGNMENT MARK

2.1.2.7 Carrying case

The all-weather case protects the BoreWelder and base package while providing quick access to the components. The top tray holds torches #00 through 5, control cables, conduit, gas hose and positive weld cable. The bottom tray supports the BoreWelder, extensions, mounting rod, adjustable base, mounting hardware, radial mount, mounting rod extender and the locking collar.

2.1.2.8 Weld power supply

To use the full potential of the BW3000 ABW use a Weld Power Supply that a minimum 100% duty cycle of 200 AMPS. The Weld Power Supply must be a CV type with a remote control receptacle to access contactor and arc voltage control.

The #2 Positive Weld Cable transmits welding current from the weld power supply to the BoreWelder quick couple.

2.1.3 Consumables

2.1.3.1 EZ feed #0 and #00 tips

EZ feed tips are used when feeding wire through the #0 or #00 torch is difficult.

Installation and use of these tips is the same as for the standard #0 and #00 tips.

2.1.3.2 Heavy-duty tips, nozzles, and diffusers

The heavy-duty tips, nozzles, and diffusers may be fitted to any bore torch that uses a diffuser to increase time between tip changes. The torch diameter range is increased by 1.5" (38 mm) diameter (0.750" [19 mm] radius) due to the longer diffuser tip and nozzle.

TABLE 2-4. CONSUMABLE KIT (P/N 66947)

Part number	Description	Quantity
36530	NOZZLE #00 TORCH END	1
36531	NOZZLE #0 BW TORCH	1
67174	BOX PLASTIC TRANSLUCENT W/ ADJUSTABLE COMPARTMENTS 7 X 3-5/8 X 1-5/8	1
69520	TIP WELDING #0 STANDARD (.035/.9mm) (KB)	5
69521	TIP WELDING #00 (.035/.9mm) (KB)	5
69778	DIFFUSER WELDING	5
69865	TIP WELDING (.035/.9mm)	25
70763	LABEL CONSUMABLES KIT BW3000	1

2.1.4 Cables and conduits

2.1.4.1 Stick electrode holder

This cable plugs directly into the standard positive weld cable supplied with the BW3000. This cable allows very quick changeover from borewelding to stick welding. As most modern power supplies have both CV and CC capability, this attachment is very handy. This cable is essential for attaching the adjustable base

bolt, welding down boring bar bearing mounts, or touching up un-welded sections of the bore.

2.1.4.2 Positive weld cable, 90 degree connector

When attached to the BW3000, the positive weld cable with a 90 degree connector has an overhead clearance of under 1/2" (13 mm), compared to 6" (152 mm) with the standard positive weld cable. This cable is intended to plug into the standard positive weld cable.

2.1.4.3 2, 3, 4, 5, 10, and 15 feet conduits (0.6 to 68.6 m)

There are multiple conduit lengths available for your borewelding application. Consider the shortest conduit possible to lessen wire flip. Custom conduits are available for special applications.

2.1.4.4 Non-CLIMAX feeder conduits

Many different styles of conduits are available to attach the BoreWelder to wire-feeders other than the CLIMAX feeder. Most common brands of wirefeeders can be integrated with the CLIMAX BoreWelder.

These conduits change the stock BW3000 system in the following ways:

- The weld current is transmitted through the conduit itself, to a junction block at the BoreWelder end of the conduit. From the junction block there is a weld cable shunt that transmits weld current to the positive weld connector.
- The wire speed control, voltage control, purge, and wire jog are inoperative when using a non-CLIMAX feeder.
- Conduit lengths range from 96–180" (2,438–4,572 mm)
- The CLIMAX push/pull wirefeeder cannot be used with non-CLIMAX feeders.

2.1.4.5 Remote step non-rotate cable

The remote step non-rotate cable is designed to allow the operator to configure the BoreWelder into an accessory for weld positioner work.

The BoreWelder provides welding and step function without rotation while the remote step switch is fitted to the customer's welding positioner to trigger a step once per rotation.

Typically, the weld current positive lead is shunted directly to the offset head slide to eliminate the internal current-carrying members of the BoreWelder when continuous rotation is not required.

2.2 ACCESSORIES

This section presents a brief overview of optional equipment for the BoreWelder and its major components. The following table lists the optional equipment and related part numbers.

TABLE 2-5. ACCESSORIES

Item	Optional equipment	Part number
Torches and torch accessories	Face Welding Torch	48013
	Compact Face Torch	Consult CLIMAX
	Trammel Torch: standard	27013
	Trammel Torch: 28 inches	38506
	Trammel Torch: 56 inches	53004
	Conical Seat Torch	28020
	Extended Range Torch Kit (Includes slow rotation belt and pulley)	103289
	Adapter, Standard Torch to Trammel	36170
	Counterbalance Kit	30756
	Torch Extension Support Kit	33256
	#1A Torch	39723
	#000 Torch and Fast Rotation Motor	103311
Consumables	EZ Feed #0 Tips	69555
	EZ Feed #00 Tips	69554
	Heavy Duty Tips, Nozzles, and Diffusers	Consult CLIMAX
Wirefeeder accessories	Push/Pull Option	44992
	Wire Straightener (shop-style wirefeeder only)	35357
Mounting accessories	Radial Mount 5 Inch	31411
	Radial Mount 10 Inch	35006
	Mounting Rod Extender	30831
Cables and conduits	Stick Electrode Holder	36169
	Positive Weld Cable, 90 Degree Connector	34345
	2, 3, 4, 5, 10, and 15-Foot Conduits	Consult CLIMAX
	BoreWelder Cable Remote Step, No Rotate	Consult CLIMAX

TABLE 2-5. ACCESSORIES

Item	Optional equipment	Part number
BoreWelder accessories	Plate, Offset Head Protector (Inverted Operation)	Consult CLIMAX

2.2.1 Mounting accessories

2.2.1.1 Radial mounts (5–10") (127–254 mm)

When using the adjustable base to mount the BoreWelder, the radial mount accessory is used to distance the centerline of the BoreWelder away from the mounting rod.

Typically the radial mount length should be equal to or greater than the radius of the bore, pin or face being welded. Some torches have a large swing, and radial mounts are used to prevent interference with the mounting rod.

The resultant articulation of the BoreWelder in conjunction with the radial mount allows for fast rough centering when using the adjustable base. Radial Mounts are available in 5" and 10" lengths (127 and 254 mm).

2.2.1.2 Mounting rod extender

The mounting rod extender is designed to elevate the attachment point for the standard mounting rod 9" (229 mm) further away from the adjustable base. This increased axial clearance between the BoreWelder and the part allows use of the standard face torch, conical face torch, and (in some cases) the trammel torch.

The mounting rod extender is 9" long. Using the mounting rod extender retains the rigidity of the mounting rod .

2.2.2 Torches and torch accessories

2.2.2.1 Face welding torch

The face welding torch (P/N 28186) is a standard 8" (203 mm) swing face torch. It is used to apply weld buildup on faces up to 20" (508 mm) in diameter in a spiral fashion. With a 4 inch radial stroke, the face torch is provided with two different leadscrews so it can be used in any axis.

Parts not included but required to mount the torch include the following:

- One adjustable base (P/N 29037)
- Two 5" (127 mm) radial mounts (P/N 28208)
- One locking clamp collar (P/N 63596)
- One mounting rod extender (P/N 30831)

NOTICE

The standard face torch cannot be used underneath the standard CLIMAX BB5 bearing mount setup.

The standard face torch package comes with the following

- A fine leadscrew for horizontal axis facing applications (0.125" [3.2 mm] feed per revolution)
- A coarse leadscrew for vertical axis facing applications (0.166" [4.2 mm] feed per revolution)
- An over-center extension for reaching through a bore to weld inside faces
- 2" and 4" (51 and 102 mm) radial torch extender to vary the approximate diameter range of the face torch
- Straight and angle head torches for the best overall capability
- Extra conduit and liner

2.2.2.2 Compact face torch

The compact face torch was designed for use with the BB5000 boring bar.

The compact face torch's depth and swing clearances are 6" (152 mm). The facing stroke is 2" (51 mm). The diminished size allows for use underneath the standard CLIMAX BB5000 bearing mount.

The basis of operation is the same as for the standard face torch. The compact face torch cannot weld interior faces and only comes with one torch head. Fine and coarse leadscrew versions are provided.

For applications requiring extended welding capacity, in diameter and current, its best to choose the standard face torch.

2.2.2.3 Trammel torch

The trammel torch is designed to be used as an outside diameter (OD) welding torch. This is generally used with the adjustable base and radial mounts.

The OD range of the trammel torch is 0.88–14" (22–356 mm) in diameter, up to 10" (254 mm) down the shaft in stock form.

The trammel torch is supplied with a standard torch adapter, which allows standard BW3000 torches and extensions to be fitted, providing extended reach capacity.

The trammel torch can also be used as a BoreWelding torch with diameters from 9–14" (229–356 mm), but the performance of standard bore torches are superior.

The trammel torch is supplied with the following:

- Standard torch adapter
- Radial extender 2" (51 mm)
- Straight and angled torch heads
- Extra conduit and liner

2.2.2.4 Conical seat torch

The conical seat torch is a variable angle face torch for which the radial torch travel rails can be infinitely adjusted between -10 degrees and 90 degrees on the rotational axis. The welding progresses in a spiral fashion, like the other face torches.

The conical seat torch was designed to weld seat faces with efficiency and precisely from 1–20" (25–508 mm) in diameter. With a 4" (102 mm) radial stroke, the conical seat torch has two different leadscrews so it may be used in any axis.

Parts required but not included to mount the torch are the following:

- One adjustable base (P/N 29037)
- Two 5" (127 mm) radial mounts (P/N 28208)
- One locking collar (P/N 63596)
- Two mounting rod extenders (P/N 30831)

NOTICE

The conical seat torch cannot be used underneath the standard CLIMAX BB5000 bearing mount setup.

The conical seat torch package includes the following:

- A fine leadscrew for horizontal axis facing applications (0.125" [3.2 mm] feed per revolution)
- A coarse leadscrew for vertical axis facing applications (0.166" [4.2 mm] feed per revolution)
- 2" (51 mm) and 4" (102 mm) radial torch extender to vary the approximate diameter range of the face torch
- Straight and angle head torches for the best overall capability
- Extra conduit and liner

2.2.2.5 Extended range torch #13/#24 kit

This is a combination torch designed to span a borewelding range of 28–56" (711–1,422 mm).

Radial mount lengths equal to the radius of the bore must be used to provide swing clearance.

The slow rotation belt and pulley must be fitted to the BW3000 in order to attain correct output spindle speeds.

Extended Range Torch #13/#24 (P/N 103289) is for welders with the serial number 22001030 or later. It includes the following:

- Slow rotation pulley (P/N 103218)
- Slow rotation belt (P/N 32575)
- Torch #13/24 (P/N 34473)
- Radial mount 10" radius (P/N 35006)

For bore welders with serial number 22001029 or earlier, call CLIMAX to verify compatibility and ask for kit P/N 70196, which includes the following:

- Pulley slow rotation (P/N 32574)
- Slow rotation belt (P/N 32575)
- Torch #13/24 (P/N 34473)
- Radial mount 10" radius (P/N 35006)

2.2.2.6 Slow rotation pulley and belt

The slow rotation pulley and belt are fitted to the BoreWelder rotation drive when the diameter to be welded is over 27" (686 mm) in diameter. When these parts are installed, the rotation speed (spindle speed) is 50 percent of the original speed. The final output spindle speed allows welding of diameters from 1.75–54" (44–1,372 mm).

TIP:

Installation requires partial disassembly and should be handled only by qualified personnel with instruction from CLIMAX to prevent damage to the BoreWelder.

2.2.2.7 Counterbalance kit

This accessory provides counterbalance for the rotation drive when operating in the horizontal axis. Use the counterbalance with BoreWelder torch #6 and with face welding, trammel, extended range, and conical seat torches. This accessory maintains a consistent rotation speed for the torch.

The counterbalance is normally installed on a 3" (76 mm) extension that is fitted between the offset head and the torch being used. The weight is oriented opposite the torch, and should be moved in or out on its arm until it balances the weight of the torch.

2.2.2.8 Torch extension support kit

The torch extension support kit is used to provide extension and torch support when the distance from the BoreWelder to the torch is far enough to make torch stability questionable and alignment difficult.

This accessory is advisable when torch extensions reach over 48" (1,219 mm) in the horizontal axis.

The kit includes a remote offset head and an isolated steadyrest.

2.2.2.9 #1A torch

This torch has a welding diameter range of 3–5.5" (76–140 mm).

The #1A torch is designed to replace the #1 torch when exotic or highly alloyed wires and/or high preheats are being used. This torch consists of a one-piece

bronze body with the diffuser machined directly into the torch body, enhancing heat transfer away from the contact tip.

2.2.2.10 #000 torch kit

The #000 torch is designed to work down to bore sizes of 0.5" (13 mm). The maximum working depth of this torch is 5" (127 mm). The recommended wire has a 0.023–0.025" (0.58–0.64-mm) diameter. Typical parameters are 60–80 amps and 13 to 14 volts. Shielding gas can be fed from the opposite end of bore if applicable, or through the torch body if the bore is blind.

TIP:

CLIMAX recommends fitting the BW3000 with a push/pull wirefeeder to aid in feeding wire with low column strength.

The BW3000 BoreWelder must be fitted with a fast rotation motor to attain correct travel speeds.

The #000 Torch and Fast Rotation Motor Kit (P/N 103311) is for welders with serial number 22001030 or later, and it includes the following:

- Gearmotor (P/N 103314)
- #000 Torch (P/N 39724)

For Bore Welders with serial number 22001029 or earlier, contact CLIMAX to verify compatibility and ask for the following:

- Fast Rotation Retrofit Kit (P/N 73769)
- #000 Torch (P/N 39724)

TIP:

Installation requires partial disassembly and should be handled only by qualified personnel with instruction from CLIMAX to prevent damage to the BoreWelder

2.2.2.11 Fast rotation motor

The fast rotation motor can be fitted to the BoreWelder rotation drive when the diameter to be welded is under 0.875" (22 mm). When installed, the spindle speed is triple the original speed. The final output spindle speed allows welding of diameters from 0.5–9.3" (13–236 mm) at a travel speed of 20 IPM.

TIP:

Installation requires partial disassembly and should be handled only by qualified personnel with instruction from CLIMAX to prevent damage to the BoreWelder.

2.2.3 Wirefeeder accessories

2.2.3.1 Push/pull wirefeeder

The push/pull option is an extra wirefeeder mounted to the top of the BW3000. This wirefeeder is a single drive roll feeder that assists the main wirefeeder in feeding wires with low column strength or wires that are difficult to feed. To use this option, the main wirefeeder must be push/ pull capable. The following picture shows a BoreWelder equipped with a push/pull feeder.

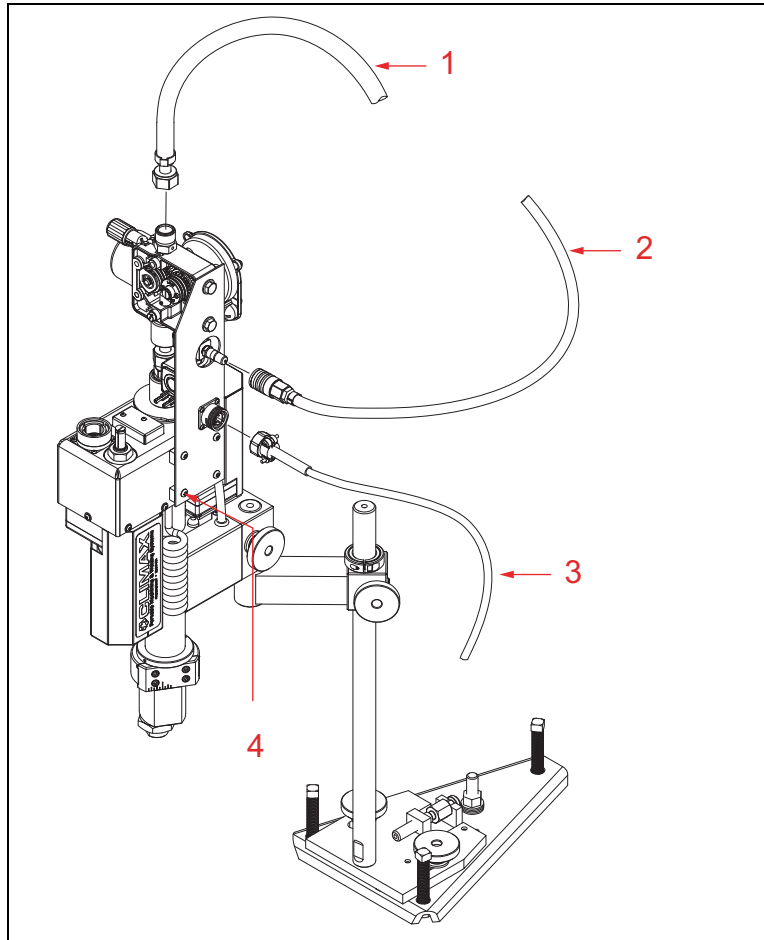


FIGURE 2-10. PUSH-PULL WIREFEEDER

TABLE 2-6. PUSH-PULL WIREFEEDER COMPONENT IDENTIFICATION

Number	Component
1	Cable to the wire feeder
2	Cable to the inert gas regulator
3	Cable to the wirefeeder's pull feeder connector
4	10-32 x 0.38 button head

2.2.3.2 Wire straightener

The wire straightener (P/N 35357) is intended to reduce the cast of the wire to reduce the effects of wire flip, which causes the weld to deviate from its intended track.

With the wirefeed conduit disconnected from the wirefeeder, the wire straightener is inserted into the wirefeed motor, oriented, and adjusted to attain a 60–70" (1,524–1,778 mm) cast.

TIP:

The wire straightener can be used only with the shop style wirefeeder.

2.2.4 Plate, offset head protector (inverted operation)

This shield is designed to protect the rack and rack slot from spatter when the BoreWelder is used in the inverted position.

This shield mounts over the orientation fitting on the offset head slide.

2.3 CONTROLS

Figure 2-11 shows the new 170 controller for the BoreWelder.

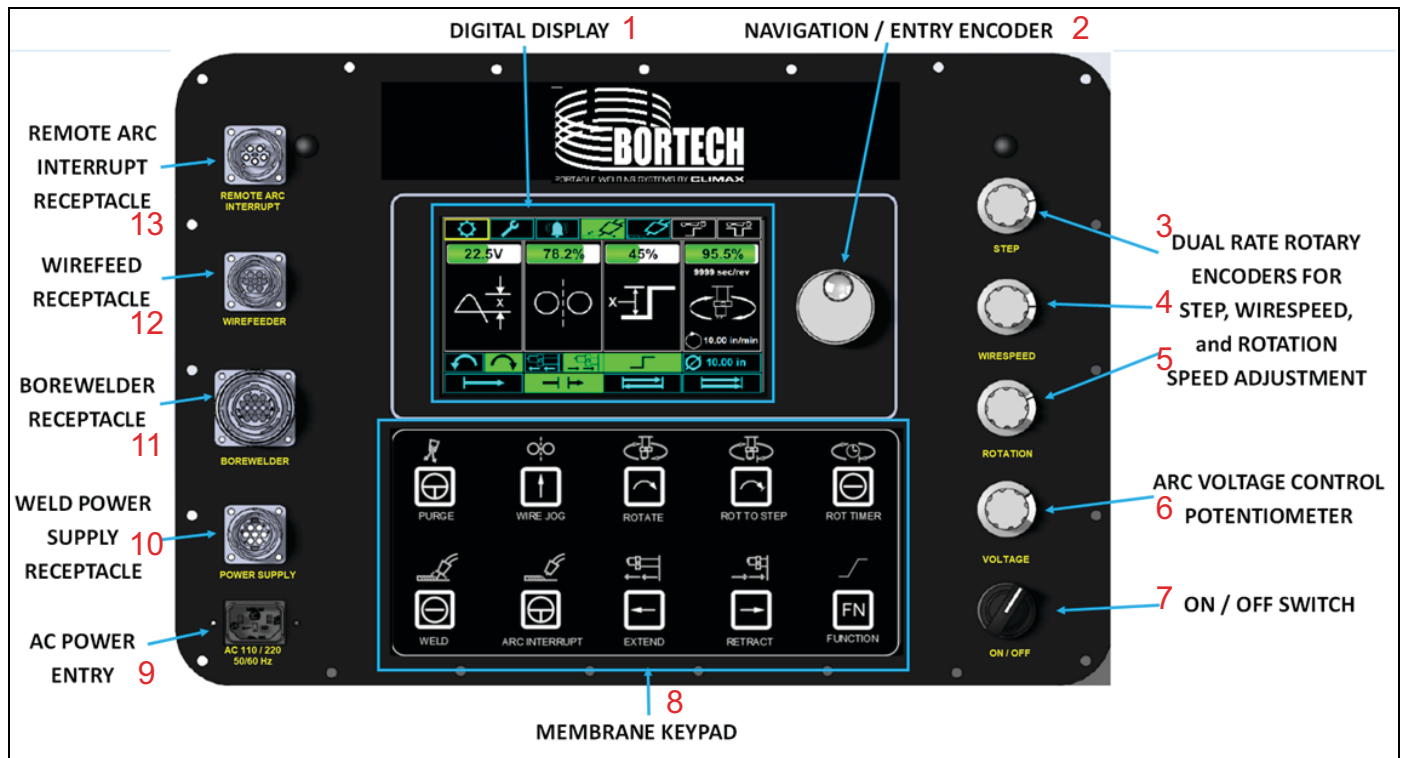


FIGURE 2-11. CONTROL BOX PANEL

TABLE 2-7. CONTROL PANEL COMPONENT IDENTIFICATION

Number	Component	Definition
1	Digital display	Digital readout for all positioning parameters, load states, and switch positions.
2	Navigation/entry encoder	Knob allows the operator to choose between editable and non-editable fields.
3	Step adjustment (dual rate rotary encoders)	Sets the step size between 0–100%
4	Wirespeed adjustment (dual rate rotary encoders)	Sets the wire speed between 0–100%
5	Rotation speed adjustment (dual rate rotary encoders)	Sets the rotation speed between 0–100%
6	Arc voltage control potentiometer	Remote control for the power supply arc voltage.
7	On/off switch	Allows the operator to connect or disconnect mains power.
8	Membrane keypad	See Table 2-8 on page 29
9	AC power entry	Connects the control box to the mains power.
10	Weld power supply receptacle	Connects the control box to the weld power supply remote control.
11	BoreWelder receptacle	Connects the control box to the BoreWelder.
12	Wirefeed receptacle	Connects the control box to the wirefeeder.
13	Remote arc interrupt receptacle	An accessory cable may be purchased and connected to this control to remotely stop the welding process at any time. Although the weld operation will stop, the welding head will continue to rotate.

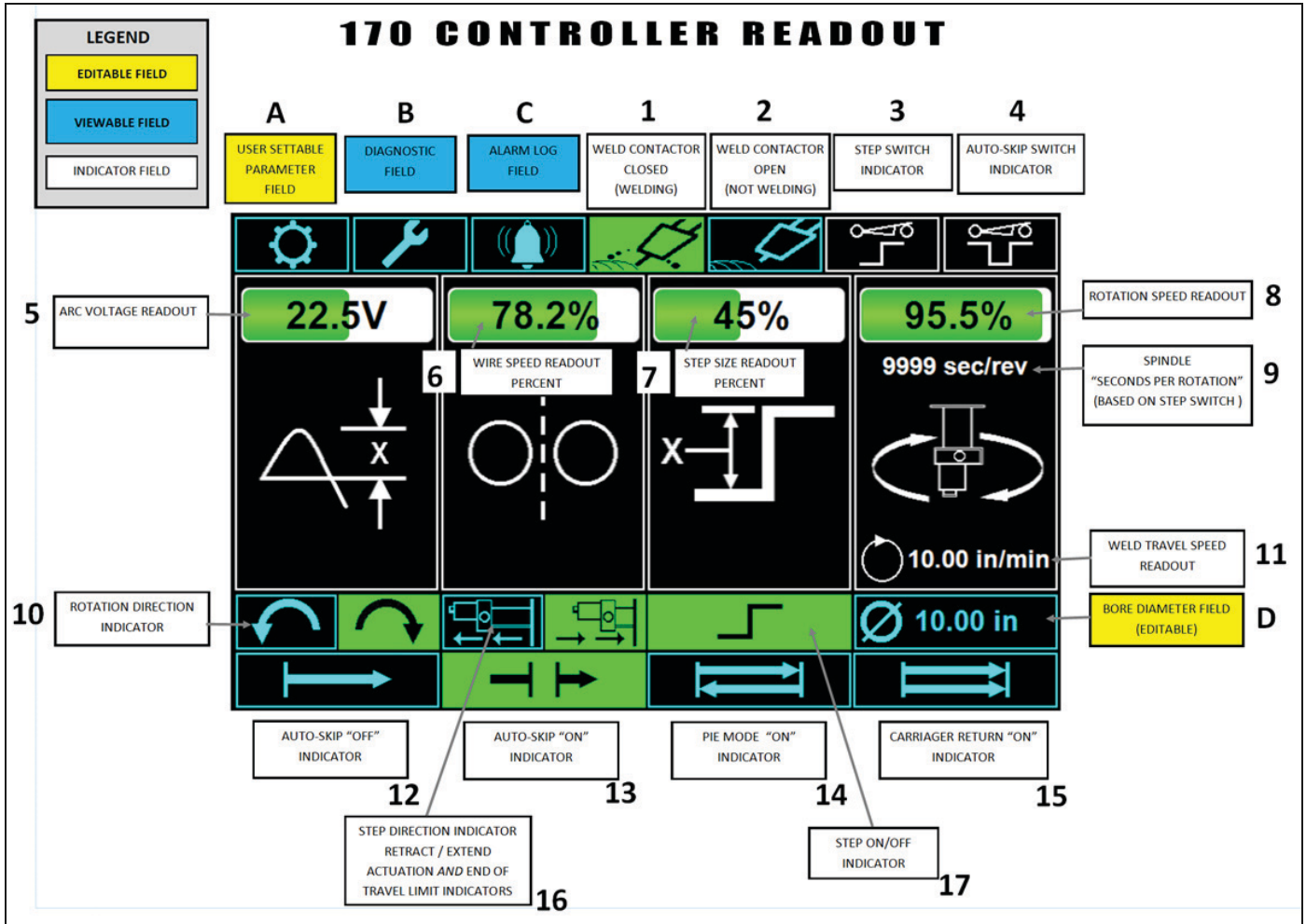


FIGURE 2-12. CONTROL LAYOUT DETAILS

TABLE 2-8. CONTROL PANEL DETAILS

Identifier	Function	Definition
A	User settable parameters	Accesses system settings for preflow postflow, burnback, motor parameters, power up defaults.
B	Diagnostics	Provides digital feedback of all switch states, and relevant.
C	Alarm log	Records any hardware or software errors.
D	Bore diameter entry	Field for the operator to enter the bore diameter to be welded, allowing the controller to calculate inches per minute (IPM) travel speed during the timing phase or welding phase.
1	Weld contactor closed (welding)	Indicates the contactor relay for the weld power supply. Weld current actuation "Weld"
2	Weld contactor open (not welding)	Indicates the contactor relay for the weld power supply. Weld current actuation "No Weld"

TABLE 2-8. CONTROL PANEL DETAILS

Identifier	Function	Definition
3	Step Switch	Indicates the step switch status.
4	Auto-skip switch	Indicates the easy setting of Auto Skip Cams in loud or dark environments.
5	Arc voltage	Indicates the arc voltage. Only operational while welding.
6	Wire speed	Indicates the percentage of wire speed.
7	Step size	Indicates the percentage of step size.
8	Rotation speed	Indicates the percentage of rotation speed.
9	Rotation speed timer	Displays the seconds per rotation of the spindle by timing the step switch actuation. Only operational after completing Rotate to Step.
10	Rotation direction	Indicates clockwise or counter-clockwise rotation. Selectable with the Function Rotate keystroke.
11	Weld travel speed	Displays inches per minute travel speed of weld, based on seconds per rotation and the bore diameter entered.
12	Auto Skip OFF	Green highlight indicates that the Auto Skip is <u>off</u> .
13	Auto Skip ON	Green highlight indicates that the Auto Skip is <u>on</u> .
14	Pie Mode ON	Green highlight indicates that the Pie Mode is <u>on</u> .
15	Carriage Return ON	Green highlight indicates that the Carriage Return is on. (Auto Skip Off/ On, Pie Mode, Carriage Return, are all selectable with the Function Weld keystroke.)
16	Step Direction, Extend/Retract, and End of Travel Limit	The step direction may be selected with the Function + Extend keystroke. Green highlight indicates the direction. Red highlight indicates the end of stroke / limit actuation.
17	Step ON/OFF	Select with the Function + Retract keystroke.

TABLE 2-9. MEMBRANE KEYPAD DEFINITIONS

Button	Purpose	Result with function key
Purge	Actuates the inert gas solenoid on the CLIMAX feeder for the preset flow time. This is a latching action, active until the button is pressed again.	Not applicable
Wire Jog	Jogs wire at the set percentage of speed set by the wire speed dial. This is a momentary action, active as long as the button is pressed.	In jog mode only: <ul style="list-style-type: none"> Function + Wire Jog: jogs wire backwards at preset dead slow value Function + Purge + Wire Jog: feeds wire for six seconds

TABLE 2-9. MEMBRANE KEYPAD DEFINITIONS

Button	Purpose	Result with function key
Rotate	Jogs the spindle rotation in the set direction at the set percentage of rotation speed. This is a momentary action, active as long as the button is pressed.	In jog mode only: Function + Rotate: toggles the rotation direction from clockwise to counter-clockwise
Rotate To Step	Jogs the spindle automatically at full speed to the step point (that is, the start point). This is a latching action, active until the button is pressed again. To stop the rotation, depress the button again to unlatch.	In jog mode only: Function + Rot to Step: cycles one step in the set step direction at the set step size
Rotate Timer	Available <u>only</u> after the Rotate to Step function is complete. Automatically times the spindle in seconds per rotation. The rotation timer uses the step switch as its “full revolution” timer. This is a latching action, active until the button is pressed again. The rotate timer drives the spindle for one revolution and then outputs the time upon completion. “Torch Travel Speed” displays as it is calculated in reference to the bore diameter entered by the operator just below the inch per minute (IPM) readout.	Not applicable
Weld	Starts or stops the Borewelding process. Available in either weld mode or jog mode. This is a latching action, active until the button is pressed again.	In jog mode only: Toggles through Auto Skip, Pie Mode, and Carriage Return
Arc Interrupt	Interrupts the welding process while maintaining the rotation, step, and purge processes. This is a momentary action, active as long as the button is pressed.	In jog or weld mode: Enables or disables auto skip when in auto skip mode. (Ignore or obey set cams)
Extend	In jog mode: extends the quill at high speed in jog mode. In weld mode: extends the quill at weld speed (about 1/3 jog speed). This is a momentary action, active as long as the button is pressed.	In jog or weld mode: switches the step direction (The power up default step is Retract.)
Retract	In jog mode: retracts the quill at high speed in jog mode. In weld mode: retracts the quill at weld speed (about 1/3 jog speed). This is a momentary action, active as long as the button is pressed.	In jog or weld mode: switches the step off or on (The power up default step is on.)

TABLE 2-9. MEMBRANE KEYPAD DEFINITIONS

Button	Purpose	Result with function key
Function	Provides a second function to the primary keypad when the operator simultaneously presses this key and the other key. This is a momentary action, active as long as the button is pressed.	Not applicable

TIP:

To achieve full speed for Wire Jog, Rotation, Extend and Retract (without changing the position of the rotary encoder): depress the button twice within two seconds, and the selected drive will go at full speed. This is only available when not in weld mode.

TABLE 2-10. SPECIAL COMBINATION FUNCTIONS

Special functions	Button combination	Result
Wirespeed Timer (only available in jog mode)	Function + Purge + Wire Jog	Advances the welding wire for six seconds. To calculate wirespeed IPM: measure the wire that exits the wire-feeder/torch for those six seconds, then multiply that value by 10. Note that all machines operate slightly different.
Function Wire Jog	Function + Wire Jog	Retracts the wire at a set dead slow speed (which the operator can define in user set parameters). This is advantageous for retracting wire when performing critical restarts deep in a bore when unable to reach the torch to clip the welding wire. With this feature, the operator does not need to adjust the wirespeed to obtain the dead slow speed.
High Speed Jog	Depress any of the following twice in a two-second timespan: <ul style="list-style-type: none"> • Rotate Jog • Extend • Retract • Wirefeed Jog 	Jogs at the highest speed of each function. With this feature, the operator does not need to adjust the potentiometer setting to its highest value in order to achieve high-speed movement. To slow from high speed, press the button once more to jog at the dial speed or normal jog speed (as in the case of Extend or Retract).

2.4 DIMENSIONS

Figure 2-13 on page 33 show the machine and operating dimensions.

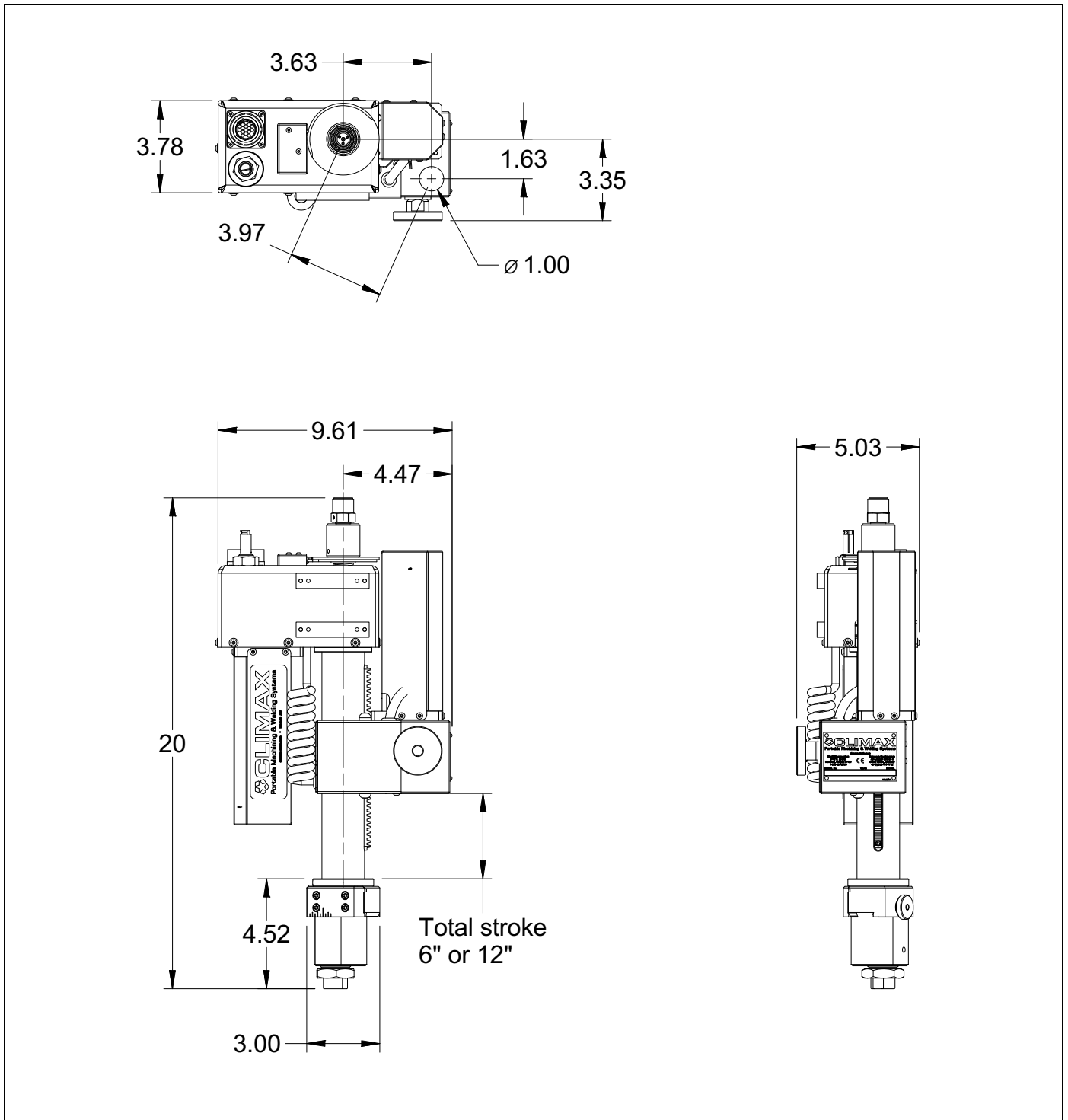


FIGURE 2-13. BOREWELDER DIMENSIONS

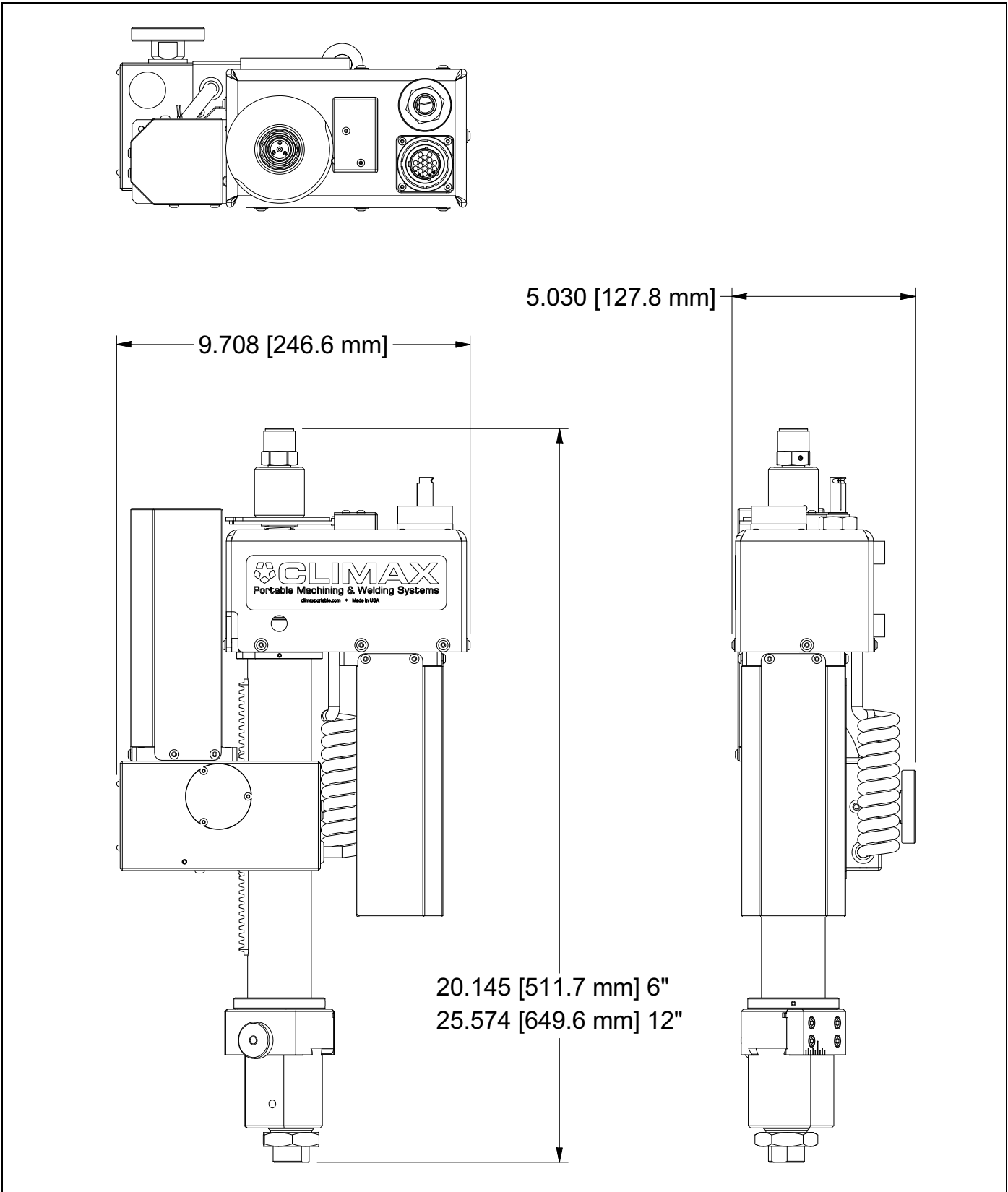


FIGURE 2-14. BW3000 DIMENSIONS (P/N 103159)

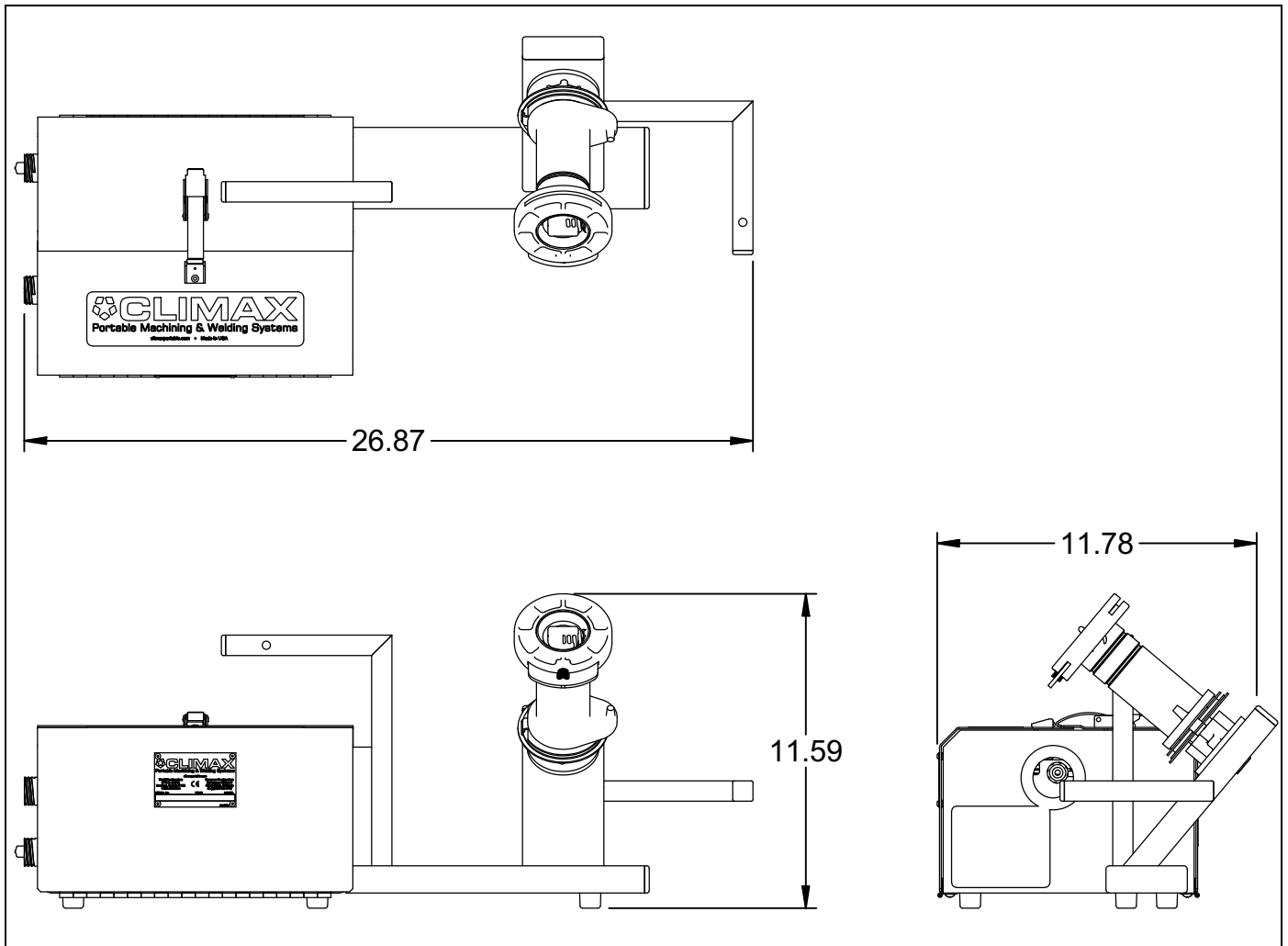


FIGURE 2-15. SHOP-STYLE WIREFEEDER DIMENSIONS

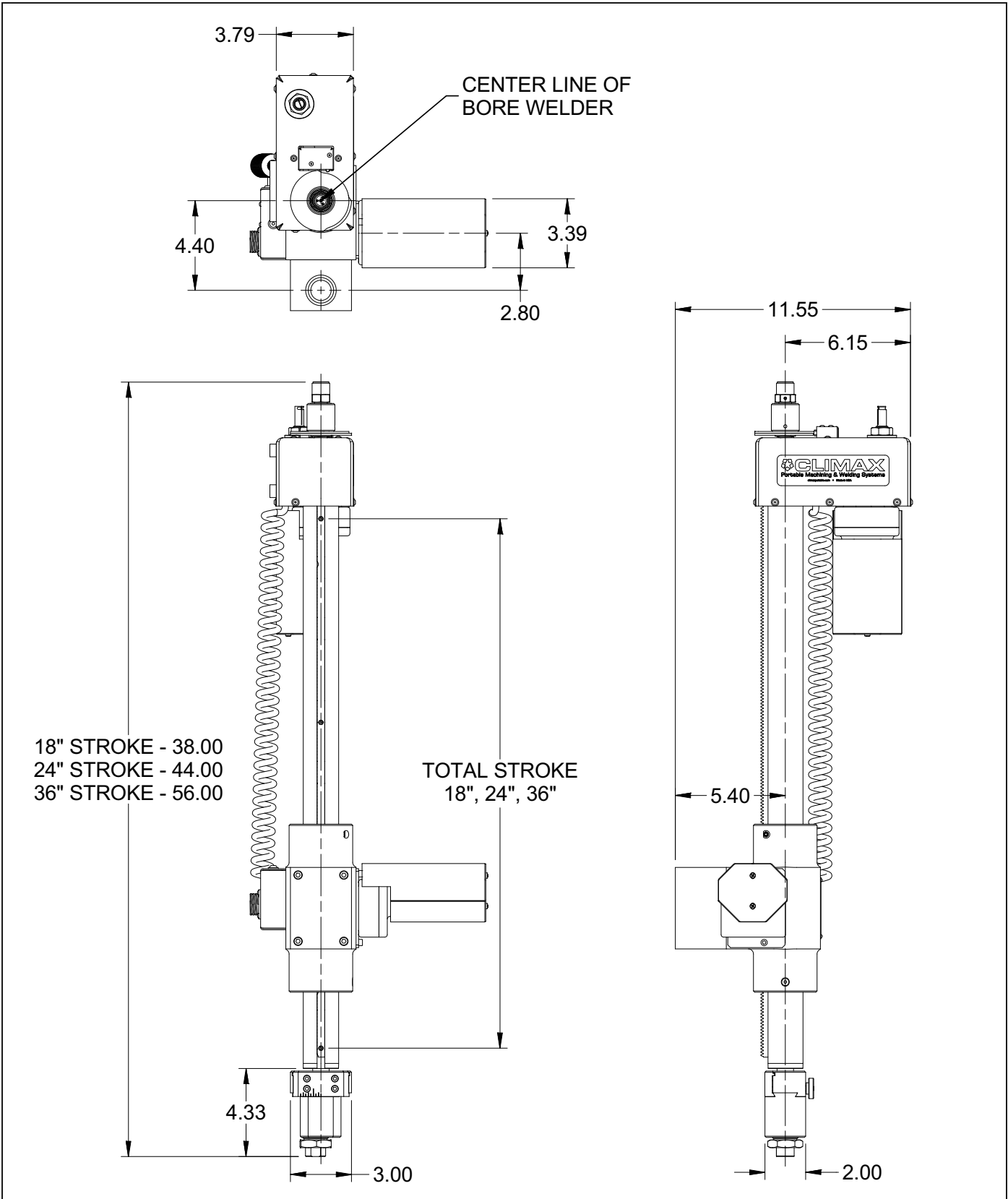


FIGURE 2-16. WELDING HEAD DIMENSIONS (P/N 91808)

2.5 SPECIFICATIONS

TABLE 2-11. SPECIFICATIONS

Specification	Description
Welding process:	Metal inert gas (MIG)
Wire diameter range:	0.023–0.045" (0.6–1 mm)
Buildup diameter ranges (standard model):	Bore: 1–27" (22–686 mm) Outside: 1–14" (22–356 mm) Face: 1–20" (22–508 mm)
Unsupported torch reach in vertical axis:	60" (1.5 meter)
Length of stroke:	6" (152 mm) and 12" (305 mm)
Step range:	0.40–0.220" (10–5.6 mm)
Maximum continuous welding current:	175 A
Welding power required:	Constant voltage (CV) 200 A minimum 100% duty cycle
Control box power requirements:	100–230 VAC, 5 A, 60/50 Hz
Remote voltage and contactor control:	10 K ohm potentiometer and dry contact
Typical weld voltage operating range (short arc/0.035 wire):	16–17.5 V
Component weights:	BoreWelder: 6" (152 mm) stroke, 22 lb. (9.4 kg) Control Box: 18 lbs (8.10 kg) Wirefeeder: 32 lbs (14.40 kg)

2.6 ITEMS RECOMMENDED BUT NOT SUPPLIED

The following items are required but not supplied in your CLIMAX product kit:

- Hand-held welding helmet, shade #9
- Safety glasses with side shields, shade #3
- Diagonal cutters
- Adjustable wrench
- Shielding gas regulator
- Shielding gas (for mild steel, CLIMAX recommends mixtures of 75% argon/25% carbon dioxide for welding in the horizontal axis and 92% argon/8% carbon dioxide for welding in the vertical axis)
- Welding wire (this chapter assumes the use of ER-70S-6).

-
- Negative cable and “C” type clamp to connect the power supply to the work piece
 - Stick electrode holder and stick welding rod
 - Weld power supply CC/CV 300 amperes

3 SETUP

IN THIS CHAPTER:

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This section describes the setup and assembly procedures for the BW3000 BW3000 AutoBoreWelder.

3.1 RECEIPT AND INSPECTION

Your CLIMAX product was inspected and tested prior to shipment, and packaged for normal shipment conditions. CLIMAX does not guarantee the condition of your machine upon delivery.

When you receive your CLIMAX product, perform the following receipt checks:

1. Inspect the shipping containers for damage.
2. Check the contents of the shipping containers against the included invoice to make sure that all components have been shipped.
3. Inspect all components for damage.

Contact CLIMAX immediately to report damaged or missing components.

NOTICE

Keep the shipping container and all packing materials for future storage and shipping of the machine.

3.2 MACHINE ASSEMBLY

3.2.1 Mounting system (when not using the boring bar interface)

A 1/2–13x3" bolt attaches the BW3000 adjustable base to the part being welded.

Do the following to use the mounting system:

1. Weld the bolt to the part. CLIMAX recommends stick welding, which provides quick setup and reliable performance in rough environments. The optional A-1086 stick electrode holder fits quickly into the A-1097 positive weld cable to allow stick welding.
2. Secure the adjustable base to it as described in Section 3.2.2 on page 40 later.

3.2.2 Attaching the BW3000 using the adjustable base

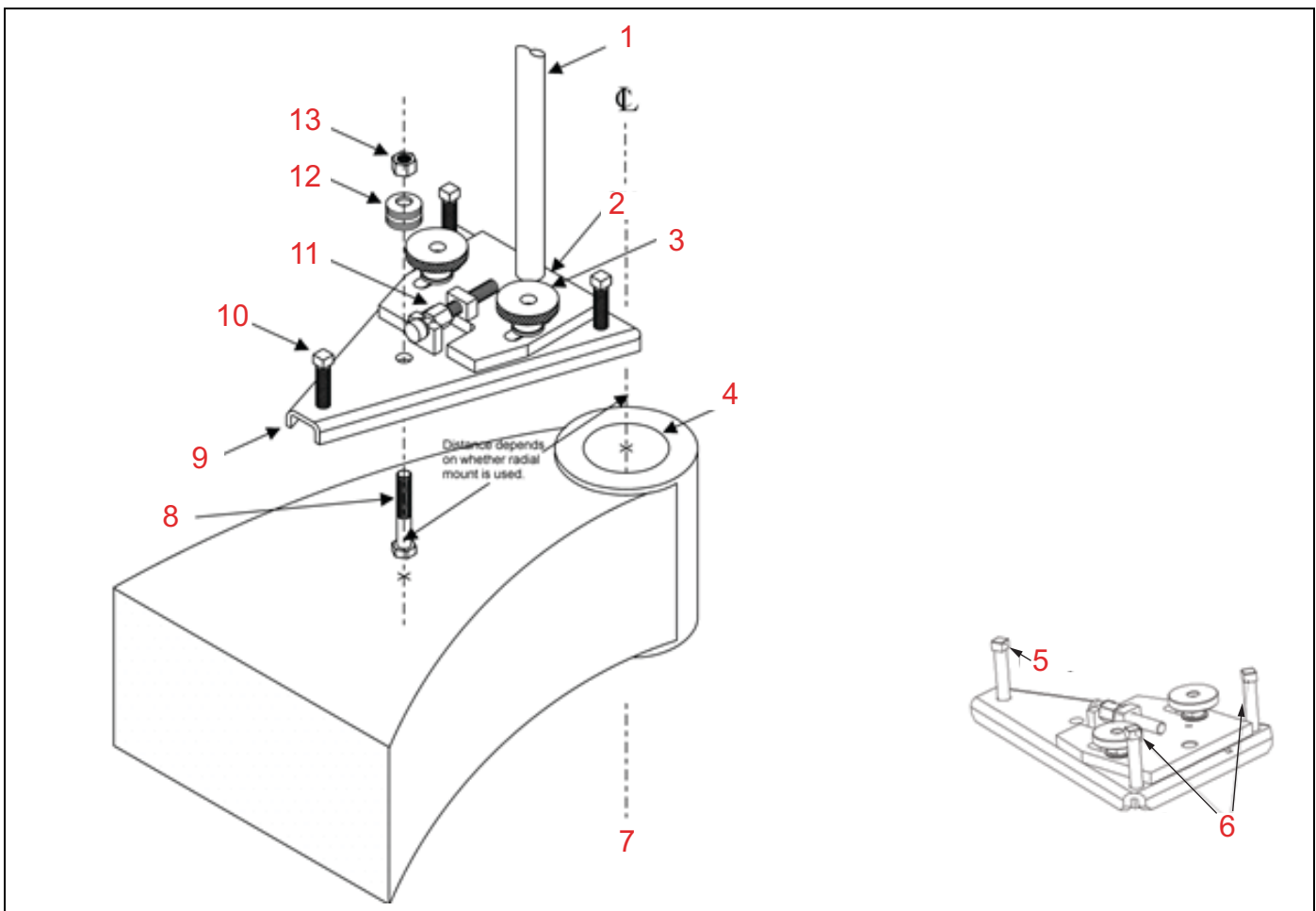


FIGURE 3-1. ADJUSTABLE BASE AND MOUNTING HARDWARE

TABLE 3-1. ADJUSTABLE BASE AND MOUNTING HARDWARE COMPONENT IDENTIFICATION

Number	Component
1	Mounting rod
2	Slider
3	Clamping knob type (2)
4	Workpiece bore
5	Rear jack screw
6	Front jack screws
7	Center line
8	Mounting bolt
9	Base plate
10	Leveling screw type (3)
11	Adjustment screw
12	Spring washers (see detail above)
13	1/2" (12 mm) hold-down nut

Do the following:

1. If using a radial mount: weld the 1/2–13x3" mounting bolt to a spot approximately 14" (36 mm) from the center of the bore to be built up (the workpiece bore).

If not using a radial mount, weld the mounting bolt to a spot approximately 11" (28 mm) from the center of the bore.

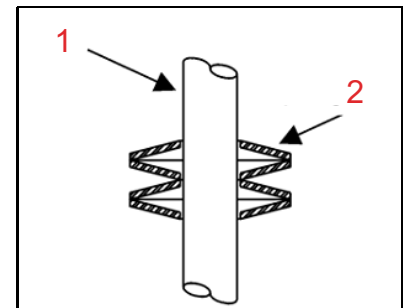


FIGURE 3-2. SPRING WASHER ALIGNMENT

TABLE 3-2. SPRING WASHER ALIGNMENT COMPONENT IDENTIFICATION

Number	Component
1	Mounting bolt
2	Spring washers

2. Place the adjustable base plate over the mounting bolt as shown in Figure 3-1 on page 40.
3. Secure the adjustable base to the part by installing the four spring washers and nut (see Figure 3-2). Tighten the nut one-half turn past finger tight with the 3/4 wrench provided.

The spring washers maintain consistent pressure on the leveling screws while you adjust the parallelism by doing the following:

1. Screw the mounting rod into the slider hole and tighten firmly. Torque to 15 ft-lbs (20 Nm).
2. If the BoreWelder is in the vertical axis: install the locking collar (P/N 10140) 8" (203 mm) from the top of the mounting rod. This sets the height of the BoreWelder and prevents the equipment from inadvertently sliding down the mounting rod.
3. If using a radial mount (A-1023; see Figure 3-3), install it over the mounting rod.
4. Slip the BoreWelder over the radial mount.
5. Move the BoreWelder and radial mount to bring the offset head directly over the bore to be welded.

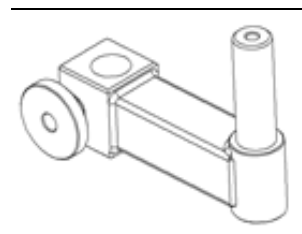


FIGURE 3-3. RADIAL MOUNT

3.2.3 Attaching the control box

Do the following to attach the control box:

1. Connect the following control cables as shown on Figure 2-1 on page 10:
 - Wirefeeder control cable
 - BoreWelder control cable
 - Power supply control cable
2. Connect the AC power cable to 115 or 230 VAC 60 Hz with ground.
3. Turn the power switch clockwise on the bottom right of the control panel. Power up time is approximately 55 seconds. All cables must be plugged into the control ports for the controller to operate. If the control cables are not plugged in properly, the central readout will turn red.

3.2.4 Adjusting parallelism using the torch extension as a guide

Do the following to adjust parallelism using the torch extension as a guide:

1. Set the offset head assembly to zero offset by lining up the large hash mark on the side plate with the edge of the offset side (see Figure 3-4).
2. Install an extension into the orientation fitting, long enough to project through the bore to be welded.
3. Move the BoreWelder left or right until the attached extension nears the bore surface at the 3 o'clock or 9 o'clock position.
4. Adjust the forward jack screws on the adjustable base (see Figure 3-5) as necessary to make the extension parallel to the bore.

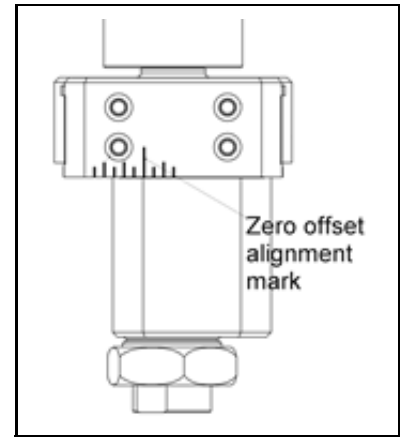


FIGURE 3-4. ZERO OFFSET ALIGNMENT MARK

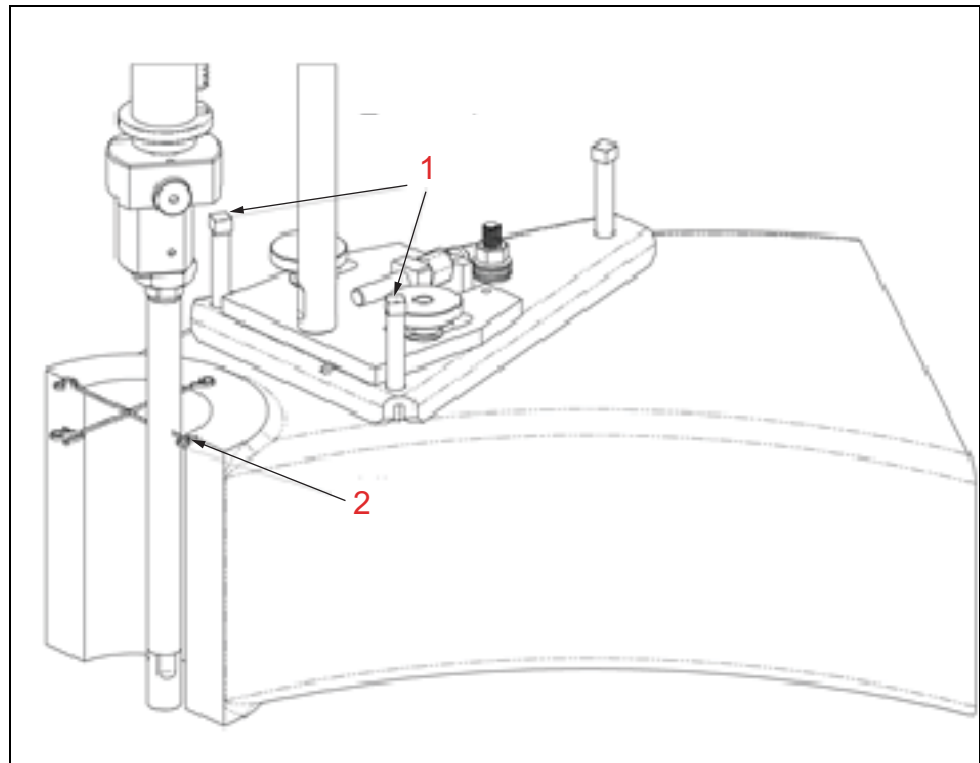


FIGURE 3-5. ALIGNMENT AT 9 O'CLOCK

TABLE 3-3. 9 O'CLOCK ALIGNMENT COMPONENT IDENTIFICATION

Number	Component
1	Forward jack screws

TABLE 3-3. 9 O’CLOCK ALIGNMENT COMPONENT IDENTIFICATION (CONTIN-

Number	Component
2	Align at the 9 o’clock and set the extension parallel to bore surface

5. Move the BoreWelder forward or back until the attached extension nears the bore surface at the 6 o’clock or 12 o’clock position (see Figure 3-6 on page 44). Adjust the rear jack screw as needed to make the extension parallel to the bore.

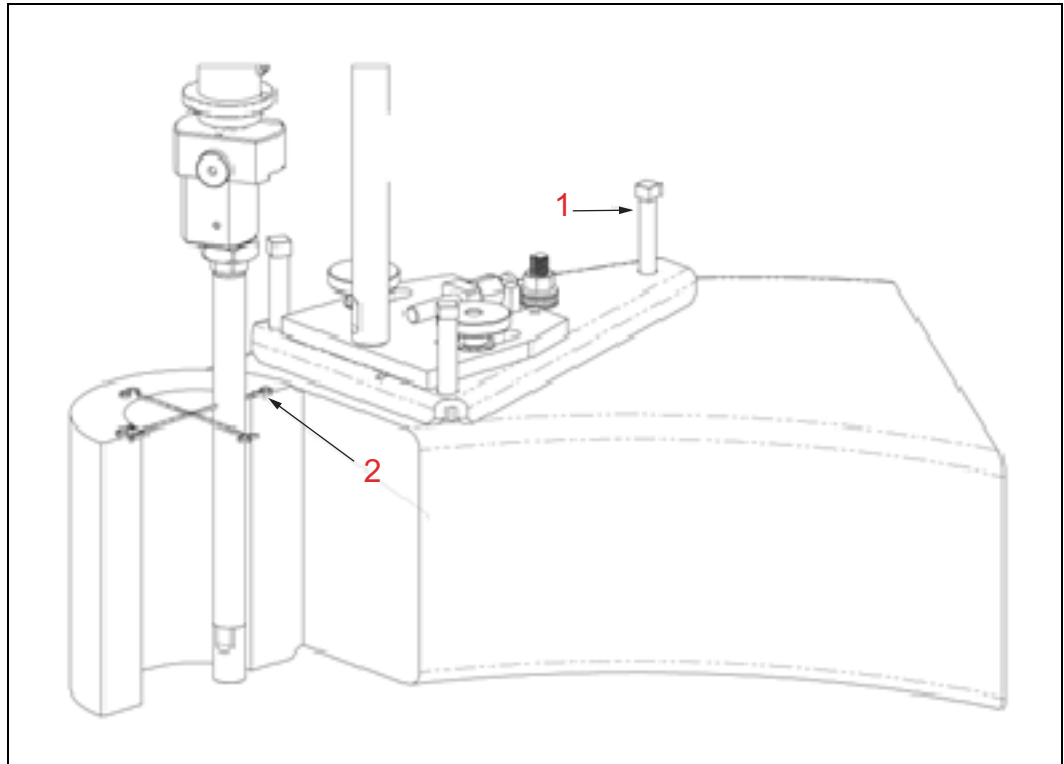


FIGURE 3-6. ALIGNMENT AT 6 O’CLOCK

TABLE 3-4. 6 O’CLOCK ALIGNMENT COMPONENT IDENTIFICATION

Number	Component
1	Rear jack screw
2	Align at the 6 o’clock and set the extension parallel to bore surface

3.2.5 Centering the BoreWelder with the torch extension (coarse center)

Do the following to center the BoreWelder with the torch extension:

1. Make slight adjustments to the BoreWelder and radial mount to move the attached extension to the center of bore. Estimate the center by eye or measure with a scale.

2. Lock the BoreWelder to the radial mount by tightening the clamp knob on the BoreWelder (15 ft-lbs [20 Nm] maximum torque).
3. Lightly tighten the radial mount clamp knob to the mounting rod.
4. Remove the extension from the orientation fitting.

3.2.6 Installing a welding torch and setting the clearance

Do the following to install a welding torch and set the clearance:

1. Select the appropriate torch for your project according to Table 3-5.

NOTICE

When working with a bore size that has a diameter smaller than 1", contact CLIMAX for support and for any necessary kits.

TABLE 3-5. AVAILABLE TORCHES

Torch used	Bore sizes for torch with standard diffuser	Bore sizes for torch with 52" diffuser
000	0.5–1.0" (13–25 mm)	
00	0.875–1.75" (22–44 mm)	
0	1.75–3" (44–76 mm)	
1	2.75–5.5" (70–140 mm)	4.25–7.00" (108–178 mm)
2	4.5–7.5" (114–191 mm)	6.00–9.00" (152–229 mm)
3	6–9" (152–229 mm)	7.5–10.5" (191–267 mm)
4	8–11" (203–279 mm)	9.5–12.5" (241–318 mm)
5	10–13" (254–330 mm)	11.5–14.5" (292–368 mm)
6	12–15" (305–381 mm)	13.5–16.5" (343–419 mm)
7	14–17" (356–432 mm)	15.5–18.5" (394–470 mm)
8	16–19" (406–483 mm)	17.5–20.5" (445–521 mm)
9	18–21" (457–533 mm)	19.5–22.5" (495–572 mm)
10	20–23" (508–584 mm)	21.5–24.5" (546–622 mm)
11	22–25" (559–635 mm)	23.5–26.5" (597–673 mm)
12	24–27" (610–686 mm)	25.5–28.5" (648–724 mm)

2. Attach the torch (and extensions, if needed) to the BoreWelder orientation fitting and secure the torch in position with the 1.5" (38 mm) orientation nut, as shown in Figure 3-7 on page 46.

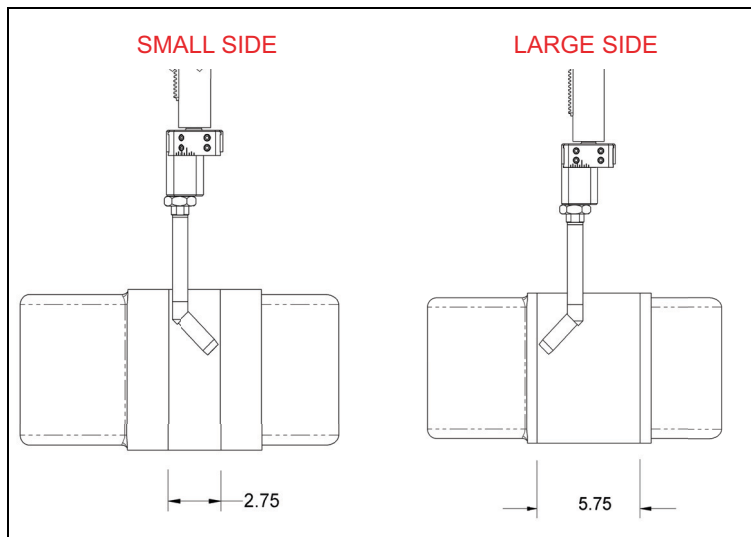


FIGURE 3-7. ORIENTATION FITTING AND TORCH POSITION (SMALL SIDE ON THE LEFT, LARGE SIDE ON THE RIGHT)

NOTICE

CLIMAX recommends that you remove the orientation fitting from the offset head when changing torches. Spinning the orientation fitting onto the torch is easier than rotating the torch into the orientation fitting when the fitting is fixed to the head.

CAUTION

Never use a wrench or pliers to adjust the knob on the offset head. A wrench or pliers could damage the equipment. See Section 5.2.2.1 on page 78 for more details about adjusting the offset head.

The range of the torch changes depending on which side of the offset head the torch is oriented toward.

3. Align the torch to the offset head dovetail travel. Using the adjustment knob on the offset head, shift the offset of the torch to adjust the diameter range. If the torch doesn't fit the bore as shown in the figure, turn the torch and orientation fitting clockwise 180 degrees in the slide. Then re-adjust the offset head to its opposite extreme to change the range of the torch.
4. Utilize the adjustment knob to set the torch nozzle to bore clearance to 1/4" (5.1 mm) for initial centering, then 1/8 for welding clearance.

TIP:

When the dovetail tension is properly set, use two hands to move the slide: one to turn the knob, and the other to help shear the slide along using the thumb and fingers (see Figure 3-8).

Improper setting of the offset head can result in overheating, arcing, and premature failure of the mating surfaces. Contact CLIMAX for more information if required.

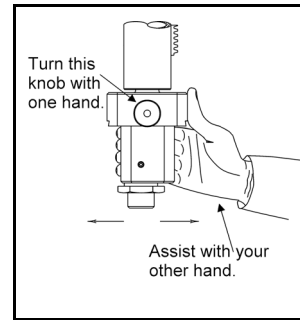


FIGURE 3-8. OFFSET HEAD ADJUSTMENT

3.2.7 Fine centering with the adjustable base

To center the BoreWelder to the bore, you must work in two axes, one after the other (referred to as X and Y for this discussion). The adjustable base lets you adjust the X-axis using a slide and lead screw arrangement and adjust the Y-axis by pivoting from the mounting rod. For the purposes of this discussion, assume the adjustable base is pointing in the 6 o'clock position when viewed from the top.

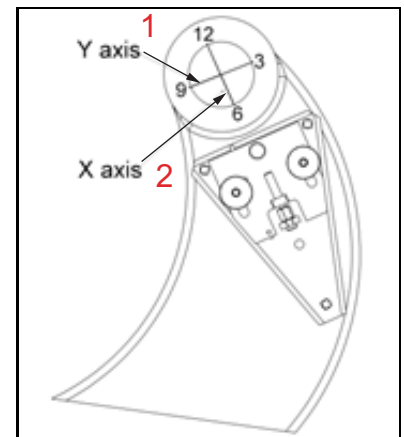


FIGURE 3-9. X AND Y AXES

TABLE 3-6. X AND Y AXES IDENTIFICATION

Number	Component
1	Y axis
2	X axis

Do the following:

1. Press the Rotate Jog button or manually rotate the offset head to rotate the torch from the 6 o'clock position (Point A) to the 12 o'clock position (Point B). Make a mental note of the distance from the torch nozzle to the bore surface at these positions.
2. Turn the adjustment screw on the adjustable base to center the torch between Points A and B. Move the screw clockwise to move the slider away from the base and counterclockwise to move the slider toward the base. Accuracy within 1/16" (1.6 mm) is sufficient for most applications.

3. Press the ROTATE JOG button or manually rotate the offset head to rotate the torch from the 3 o'clock position (Point C) to the 9 o'clock position (Point D). Note the distance from the torch nozzle to the bore surface at these positions.
4. Loosen the radial mount clamp knob and pivot on the mounting rod to center the torch between Points C and D. Accuracy within 1/16" (1.6 mm) is sufficient for most applications.
5. Lock the radial mount clamp knob (15 ft-lbs [20 Nm] maximum torque) to prevent movement of the BoreWelder and subsequent loss of centering.

3.2.8 Understanding the boring bar interface

A boring bar interface may be used instead of the CLIMAX adjustable base (for full details, please consult the operating manual from the boring bar manufacturer).

When using a boring bar interface in the horizontal axis, it's helpful to position the interface so the mounting rod is above the hole to be welded. This will ease centering adjustments since the BoreWelder will be hanging from the mounting rod.

Centrality adjustment is normally limited to one axis: the Y or swing axis from the mounting rod. Section 3.2.7 explain how to center on the Y axis.

In most cases the boring bar interface eliminates the need for parallelism adjustment, since the interface is trued to the boring bar and, consequently, the bore. In situations where parallelism is inaccurate, please refer to your boring bar manual for adjustment information or contact CLIMAX directly.

3.2.9 Adjusting the reach

The BoreWelder should be positioned on the mounting rod so that the axial torch travel will reach the beginning and end of the bore (if the bore is shorter than the stroke of the BoreWelder). You have two options for positioning the BoreWelder.

Option 1: Add or remove extensions to change the reach without moving the BoreWelder on the mounting rod.

Option 2: Slide the BoreWelder up or down the mounting rod.

3.2.10 Attaching the wirefeed conduit and loading wire

1. Attach the BoreWelder end of the wirefeed conduit to the swivel connector located at the top of the BoreWelder by engaging the attachment nut. Tighten by hand only, as the seal is obtained with an O-ring.
2. Open the wirefeeder case.
3. Loosen the thumb screw of the feeder conduit fitting.

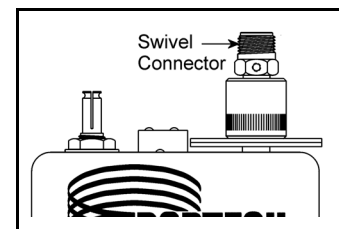


FIGURE 3-10. SWIVEL CONNECTOR

TIP:

If the wire does not feed freely:

- Especially with the #00 and #0 torch, you may need to momentarily increase the feed roll pressure by squeezing the roll down and forcing the feed wire through the bent tip. Apply pressure by hand only.
- In other cases (not with the #0 and #00 torches), the wire gets caught at the “funnel” entrance of the contact tip. Stop pressing the WIRE JOG switch. Instead, turn the spindle a revolution or two. You’ll hear a snap as the wire works its way into the contact hole. Now press the WIRE JOG switch. The wire will pass freely through the torch.

4. Attach the wirefeeder end of the wirefeed conduit by inserting the end into the feeder conduit fitting to a positive stop.
5. Secure the feeder conduit fitting with the thumb screw.
6. Place the roll of wire on the spool holder so that the wire will feed from the bottom of the roll. Straighten about 6" (152 mm) of wire at the end of the roll to prepare for feeding.
7. If your wirefeeder is equipped with the push/pull option, place the toggle switch in the normal position (see Figure 3-11) before you proceed with the following steps.
8. Disengage the pressure rolls on the wirefeeder by flipping the levers off the pressure roll arm.
9. Thread the wire into the feed mechanism inlet guide. Push the wire past the feed rolls and into the conduit fitting.
10. Engage the feed roll pressure levers.
11. Check that the control box is on and press the Wire Jog switch. The wire will be pushed through the wirefeed conduit and the BoreWelder and on to the torch.

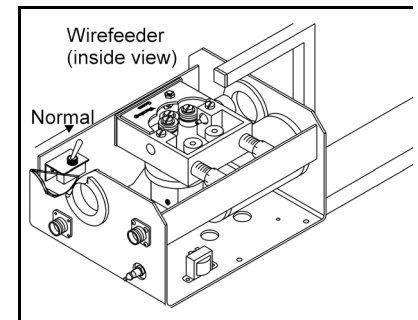


FIGURE 3-11. TOGGLE SWITCH IN NORMAL POSITION

3.2.11 Attaching the weld cables and gas hose

Do the following while referring to Figure 2-1 on page 10:

1. Attach one end of the positive weld cable to the BoreWelder quick connect, and the other end to the power supply.
2. Attach the negative weld cable to the part to be welded. The ground clamp should be attached to clean, bare metal, and be located near the bore being welded.

-
3. Attach one end of the gas hose to a regulated source of shielding gas, and the other end to the quick connect at the wirefeeder.
 4. On the control box, press the Purge button to check the gas flow rate and clear the system of unwanted gases. A flow of 35 cfh (1 m³/hour) is good.

 **CAUTION**

Always use #2 weld cable. Do not use a larger size to get a higher current capacity. Higher currents will damage the BoreWelder. Check that you have a good ground. Poor ground leads to poor arc quality, poor arc stability, and increased risk of electrical shock.

3.2.12 Setting the axial and rotational start positions

To set the axial start position, do the following:

1. Press the Extend button to jog the torch into the bore until the nozzle is beyond the intended start point of welding.
2. Press the Retract button to move to the start point, thus removing backlash in the step drive. (This is not necessary in vertical BoreWelder Axis welding.)

The weld wire will be in 1/16–1/8" (1.6–3.2 mm) from the edge of the bore. With all rigid Bortech torches, welding progresses towards the BoreWelder.

To set the rotation start position, momentarily depress the Rotate to Step button. This keystroke will automatically rotate the spindle until it reaches the step switch.

If the operator wishes to stop the automatic rotation of the spindle, push the Rotate to Step button again.

Starting the welding at the step point ensures complete build-up at the end of the bore.

See Section 5.2.2.1 on page 78 for details about adjusting the offset head.

To change the step point location mechanically, do the following with the BoreWelder's moveable knurled ring:

1. Reach into the rectangular hole in the blue shroud.
2. Use your finger to press the knurled brass ring.
3. Grasp the offset head and turn the spindle.

The ring will remain still, but the spindle will turn inside of it, allowing the step point to be changed.

TIP:

If you are welding horizontally, be sure to retract the starting point to remove backlash from the gear train. Do not adjust the step collar while the machine is welding.

Any twisted wire should be removed from the machine after reaching the Rotate to Step point and before the machine is retracted into the weld start position.

To remove twisted wire: feed out welding wire until it exits the torch consistently, and cut the wire without bending it where it exits the contact tip.

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4 OPERATION

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4.1 PRE-OPERATION CHECKS

Do the following checks before operating the machine:

1. Complete the risk assessment checklist in Table 1-3 on page 5.
2. Check that the work area is clear of non-essential personnel and equipment.
3. Check that the machine is securely mounted to the workpiece.
4. Check that all lines, cables, and hoses are properly connected and secured away from moving parts.
5. Check that all machine parts are secure.

-
6. Check that the welding parameters are set correctly (Section 4.3 on page 57).
 7. Check that all preventative maintenance is up to date (Section 5).
 8. Follow the pre-weld checklist in Table 4-8 on page 63.
-

4.2 MOTOR TUNING

4.2.1 Tuning the step speed

Do the following to tune the step speed on a model 170 controller, referring to Section 2.3 on page 27:

1. Connect the BoreWelder and controller as though to prepare for welding.
2. Rotate the Step Adjustment rotary encoder until the step size is 50%.
3. Lower the Position Marker until it touches the step gear housing.
4. Depress the Function and Rot to Step buttons simultaneously. The BoreWelder should then retract one step increment.

NOTICE

The BoreWelder will not step if the End Of Travel Limit switch is activated.

5. Measure the distance between the Position Marker and Step Gear Housing. Record the step increment.

If the measurement is $0.125" \pm 0.01"$ ($3.2 \text{ mm} \pm 0.25 \text{ mm}$), then the step speed tuning is completed.

6. Turn the navigation knob until the gear icon (A) is highlighted, then momentarily depress the navigation knob to enter the parameter menu.
7. Turn the knob until Parameter 18 Extend/Retract Speed Weld Mode is highlighted. Momentarily depress the navigation knob.
8. Rotate the navigation knob to adjust the voltage parameter value. Decrease the voltage if the step was too large. Increase the voltage if the step was too small.

NOTICE

Do not adjust the parameter more than 2 volts at a time.

9. Short press the navigation knob to exit the parameter editing interface.
10. Long press the navigation knob to exit the parameter menu and return the default readout.
11. Return to step 2 and repeat these steps until the step distance is correct.

4.2.2 Tuning the minimum and maximum step

TIP:

Most situations will not need less or more stepping capacity. The step speed must be tuned first.

Do the following to adjust the minimum and maximum step of the BoreWelder:

1. Connect the BoreWelder and controller as though to prepare for welding.
2. Rotate the Step Adjustment rotary encoder until the step size is 0%.
3. Lower the Position Marker until it touches the Step Gear Housing.
4. Depress the Function and Rot to Step buttons simultaneously. The BoreWelder should then retract one step increment.

NOTICE

The BoreWelder will not step if the end of travel limit switch is activated.

5. Measure the distance between the Position Marker and Step Gear Housing. Record the step increment.

If the measurement is less than 0.04" (1 mm), then the minimum step interval tuning is complete. Proceed to step 12.

6. Turn the Navigation Knob until the gear icon (A) is highlighted, then momentarily depress the navigation knob to enter the parameter menu.
7. Turn the knob until Parameter 21 Step Dwell Time Minimum is highlighted. Momentarily depress the navigation knob.
8. Rotate the navigation knob to adjust the dwell time value. Decrease the time interval by no more than 0.4 seconds at a time.
9. Short press the Navigation Knob to exit the parameter editing interface.
10. Long press the Navigation Knob to exit the parameter menu and return to the default readout.
11. Return to step 2 and repeat these steps until the minimum step interval is achieved.
12. Rotate the Step Adjustment rotary encoder until the step size is 100%.
13. Lower the Position Marker until it touches the Step Gear Housing.
14. Depress the Function and Rot to Step buttons simultaneously. The BoreWelder should retract one step increment.

NOTICE

The BoreWelder will not step if the end of travel limit switch is activated.

-
15. Measure the distance between the Position Marker and Step Gear Housing. Record the step increment.
 16. If the measurement is greater than 0.22" (5.6 mm), the maximum step interval tuning is completed.
 17. Turn the navigation knob until the gear icon (A) is highlighted, then momentarily depress the navigation knob to enter the parameter menu.
 18. Turn the knob until Parameter 22 Step Dwell Time Maximum is highlighted. Momentarily depress the Navigation Knob.
 19. Rotate the navigation knob to adjust the dwell time value. Increase the time interval by no more than 0.4 seconds at a time.
 20. Short press the navigation knob to exit the parameter editing interface.
 21. Long press the navigation knob to exit the parameter menu and return to the default readout.
 22. Return to step 12 and repeat these steps until the maximum step interval is achieved.

4.2.3 Tuning the rotation speed

TIP:

Most operational situations will not require rotation speed adjustment.

Adjusting the minimum or maximum speed changes the BoreWelder rotational speed at every incremental value. Therefore this process may be used to match the actual rotational speed to the stated values on the lid of the controller.

Do the following to adjust the minimum and maximum rotation of the BoreWelder:

1. Connect the BoreWelder and controller as though to prepare for welding.
2. Rotate the Rotation Speed Adjustment rotary encoder until the speed is 0%.
3. Using a stopwatch or the built-in rotation timer, record the amount of time it takes for the BoreWelder to complete one revolution while the Rotate button is depressed.

TIP:

Due to the slow movement speed at 0% setting, CLIMAX recommends to place markers at 90° spacing and record the time it takes to complete a one-quarter revolution. Multiply the recorded value by 4 to determine the seconds per revolution.

4. If the recorded time is greater than 300 seconds per revolution, the minimum rotation speed tuning is completed. Proceed to step 11.
5. Turn the navigation knob until the gear icon (A) is highlighted. Momentarily depress the navigation knob to enter the parameter menu.

6. Turn the knob until Parameter 100 Rotation Drive Min Speed is highlighted. Momentarily depress the navigation knob.
7. Rotate the navigation knob to adjust the minimum rotation voltage value. Decrease the voltage by no more than 0.5 volts at a time.
8. Short press the navigation knob to exit the parameter editing interface.
9. Long press the navigation knob to exit the parameter menu and return to the default readout.
10. Return to step 2 and repeat until the minimum rotational speed is achieved.
11. Rotate the Rotation Speed Adjustment rotary encoder until the speed is 100%.
12. Using a stopwatch, record the amount of time it takes for the BoreWelder to complete one revolution while the Rotate button is depressed.
13. If the recorded time is less than 9.7 seconds per revolution, the maximum rotation speed tuning is completed.
14. Turn the Navigation Knob until the gear icon (A) is highlighted, then momentarily depress the navigation knob to enter the parameter menu.
15. Turn the knob until Parameter 101 Rotation Drive Max Speed is highlighted. Momentarily depress the navigation knob.
16. Rotate the navigation knob to adjust the maximum rotation voltage value. Increase the voltage by no more than 2 volts at a time.
17. Short press the navigation knob to exit the parameter editing interface.
18. Long press the navigation knob to exit the parameter menu and return to the default readout.
19. Return to step 11 and repeat until the minimum rotational speed is achieved.

4.3 CHOOSING THE CONTROL SETTINGS

See Section 2.3 on page 27.

Rotation speed

Accurate setting of the rotation speed of the spindle of the BoreWelder is highly important for successful, repeatable Borewelding.

Due to the slow speed of the spindle, generally Seconds Per Rotation (SPR) defines rotation speed, as opposed to Revolutions Per Minute (RPM).

Rotation Speed is set specifically to the diameter of the bore, to insure that the travel speed is consistent through all different bore / pin / face diameters.

Travel speed

Travel speed describes the speed at which the weld is deposited on the bore surface. This measurement is defined in inches per minute (IPM) (or millimeters per minute: mm/min).

The travel speed range is between 18 to 22 IPM. When in the vertical BoreWelder Axis, 18 IPM travel speeds are acceptable, but when in the horizontal BoreWelder axis, its best to increase the travel speed to 22 IPM to prevent lack of fusion on the downhand.

Setting the rotation speed accurately provides a consistent relationship between wirespeed and step. The operator will know what to expect, and be able to perform high quality borewelding immediately, no matter the size of the bore, if they initially set the rotation speed correctly.

Calculating rotation speed

While the 170 Controller has a built in Rotation Speed Timer, its important to understand the formula for determining Rotation speed.

Take the diameter of the bore in inches, and multiply it by the following constant:

Diameter of Bore x 10.4 = Seconds per Rotation at 18 IPM travel speed (vertical axis BoreWelder)

Diameter of Bore x 9.4 = Seconds per Rotation at 20 IPM travel speed

Diameter of Bore x 8.4 = Seconds per Rotation at 22 IPM travel speed (horizontal axis BoreWelder)

Calculating rotation speed (SPR) exactly. The diameter of the bore and the target travel speed (IPM) provide the information necessary to exactly determine the rotation speed (SPR). The following is simple formula for quickly determining SPR:

Diameter x 10.4 = SPR @ 18 IPM (for a vertical axis)

Diameter x 9.4 = SPR @ 20 IPM

Diameter x 8.4 = SPR @ 22 IPM (for a horizontal axis)

Setting the rotation speed on the 170 controller

Do the following to set the rotation speed on the controller:

1. Turn the Navigation knob until the Diameter Box is highlighted, then momentarily depress the navigation knob to make the field editable.
2. Turn the knob to enter your target diameter then depress the navigation knob and hold for 1 second to lock the field.
3. Turn the Navigation Knob to one click counter-clockwise to highlight the gear icon. This keeps the operator from inadvertently changing the diameter field.
4. Momentarily depress the Rotate to Step button. The spindle will rotate around until the Step point is reached.
5. Consult the rotation speed in Table 4-1 and Table 4-2 on page 59 to find the estimated setting for rotation speed. Turn the rotation speed adjustment knob to roughly set rotation speed.

6. Momentarily depress the Rotate Timer button. The spindle will begin rotating, and simultaneously start a timer to measure the length of time it takes for one rotation. At the completion of the rotation, the actual travel speed will be shown. (screen shot)
7. Make necessary adjustments to the Rotation speed, and repeat the timer procedure. When your target travel speed is reached, make a note of the Rotation Speed Setting at that bore size for future reference.

TIP:

Operators familiar with typical manual MIG welding are used to high currents and voltages, combined with torch lead angles and weave movements. The BoreWelder runs with lower currents and voltages, neutral gun angle, and no weave motion. Therefore, travel speed is very important. Since the operator is not in manual contact with the process, the normal feedback loop has been removed.

TABLE 4-1. ROTATION SPEED 100–50% FOR REFERENCE ONLY

Rotation percent	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%
Seconds per revolution	7.4"	8.4"	9.5	10.9	12.5	14.4	17	20	24.3	29	36.6
Bore size at 18 IPM	0.7"	0.8"	0.9"	1.0"	1.2"	1.4"	1.6"	1.9"	2.3"	2.8"	3.5"
Bore size at 20 IPM	0.8"	0.9"	1.0"	1.2"	1.3"	1.5"	1.8"	2.1"	2.6"	3.1"	3.9"
Bore size at 22 IPM	0.9"	1.0"	1.1"	1.3"	1.5"	1.7"	2.0"	2.4"	2.9"	3.4"	4.3"

TABLE 4-2. ROTATION SPEED 45–0% FOR REFERENCE ONLY

Rotation percentage	45%	40%	35%	30%	25%	20%	15%	10%	5%	0%
Seconds per revolution	45	58	75	98	124	164	205	256	279	300
Bore size at 18 IPM	4.3"	5.6"	7.2"	9.4"	11.9"	15.8"	19.7"	24.6"	26.8"	28.8"
Bore size at 20 IPM	4.8"	6.2"	8.0"	10.4"	13.2"	17.4"	21.8"	27.2"	29.7"	31.9"
Bore size at 22 IPM	5.3"	6.8"	8.8"	11.5"	14.6"	19.3"	24.1"	30.1"	32.8"	35.3"

4.3.1 Setting the wire speed

Wire speed is the rate at which the wire travels through the BoreWelder system. The unit of measure is in IPM. With 0.035" (0.89 mm) wire, expect about 1.6" (40.6 mm) of wire per amp.

For the purposes of Borewelding, amperage is proportional to wirespeed. Most modern welding power supplies have an Ammeter so the operator can see what amperage they are running, but only when they are welding.

Some weld power supplies do not have an Ammeter, and therefore understanding IPM of wirespeed is especially important for consistent, repeatable borewelding.

TABLE 4-3. WIRE SPEED SETTINGS AND AMPERAGE (0.035" [0.89 MM] DIAMETER WIRE)

Wirespeed percentage	0	5	10	15	20	25	30	35	40<
Wire speed (IPM)	80	105	140	160	190	230	260	290	310
Approximate amperage with 0.035" (0.89 mm) steel wire	50	65	90	100	120	144	162	180	

Do the following to set the wire speed:

1. To check wirespeed before welding, the wire must be fed through the unit and be clipped off flush at the torch or some reference point.
2. Set the wirespeed dial to the approximate target percentage/wirespeed/ amperage which you intend to weld at.
For example: to produce a 120 AMP weld, 20% wire speed results in 190 IPM or approximately 120 AMPS.

NOTICE

All motor drivers, and open loop DC motors are slightly different, so the chart may not exactly match your machine.

3. Set the Wirespeed to 20 Percent, then verify the actual wirespeed by using the keystroke combo Function + Purge, then strike Wire Jog.
4. The wirefeeder will automatically begin feeding at that dial setting for exactly 6 seconds.
5. After the auto feed is complete, measure the wire that was fed out, and multiply that value times 10.
For example: 20" of wire in 6 seconds is 200 IPM
 $200 \text{ IPM} / 1.6 = 131 \text{ AMPS}$

NOTICE

IPM / Amperage relationship is approximate. Variations in arc voltage, stickout, etc can change this relationship.

After verifying the wirespeed dial settings for a certain amperage/wirespeed, there is no need to double check them again as the wirespeed percentage readout should be repeatable and accurate.

TIP:

Regardless of welding wire size, the current limit of the BW3000 is 175 amps continuous with mild steel wire. Welding at currents higher than this can reduce the longevity of the BoreWelder.

TABLE 4-4. WIRE SPEED VALUES AT STARTUP (WITH 0.035" [8.9 MM] DIAMETER WIRE) FOR REFERENCE ONLY

Axis	Percent wirespeed	Wire speed	Amperage
Vertical	22–45%	190–340 IPM	120–160
Horizontal	15–27%	160–265 IPM	100–130

4.3.2 Setting the step

Step is the amount of distance the BoreWelder automatically retracts once per revolution. This is initiated by a microswitch that reads a detent on the rotating section of the power coupling

Changing the step knob value changes the time the step motor is left on, thereby changing the size.

The range of step on the BW3000 is infinitely adjustable from 0.040–0.220" (1–5.6 mm).

TIP:

At 20 IPM torch travel speed, the step value (in inches) and amperage are nearly equal. For example, 125 amperes = 0.125" step.

To visually check whether the step is set correctly, watch the leading edge of the weld puddle and look to make sure the welding wire is at the junction between the previous bead and the base metal. The bead is half on the previous bead and half on the base metal.

Too short a step can cause lack of fusion to base metal, and too long a step can cause lack of fusion between beads.

TABLE 4-5. STEP SETTINGS AT A TRAVEL SPEED OF 20 IPM (0–50%) FOR REFERENCE ONLY

Step percentage	0	5	10	15	20	25	30	35	40	45	50
Step size in inches	0.040	0.045	0.050	0.060	0.070	0.075	0.085	0.090	0.100	0.110	0.125
Step size in mm	1.016	1.143	1.270	1.524	1.778	1.905	2.159	2.286	2.540	2.794	3.175

TABLE 4-6. STEP SETTINGS AT A TRAVEL SPEED OF 20 IPM (55–100%) FOR REFERENCE ONLY

Step percentage	55	60	65	70	75	80	85	90	95	100
Step size in inches	0.135	0.140	0.145	0.155	.0165	0.170	0.180	0.190	0.200	0.220
Step size in mm	3.429	3.556	3.683	3.937	4.191	4.318	4.572	4.826	5.080	5.588

4.3.3 Setting the arc voltage

Arc Voltage is the length of the arc between the electrode (MIG Wire) and the base metal.

The standard operating mode for the BoreWelder is short arc (16–19 volts). If the arc voltage is too low, stubbing may occur. Increase the weld voltage to attain a crisp consistent shorting.

NOTICE

Any change in the wire speed needs a corresponding change in arc voltage.

The BW3000 BoreWelder torch angle is designed for the shorting MIG process. Excessive arc voltage can result in shortened tip life, reduced current density and possible lack of fusion.

Weld power supply remote control settings. When interfacing with weld power supplies, the following settings need to be addressed. Due to the wide variation of power supplies, it may be necessary to consult the operator’s manual for your power supply or call CLIMAX.

- Set the voltage control on the power supply to Remote.
- Set the contactor control on the power supply to Remote, where applicable.

Setting arc voltage. The CLIMAX control box interfaces with most power supplies, allowing remote control of voltage at all times.

If your power supply has digital readouts, set the arc voltage to 18.5 volts as a startup value.

If your power supply has no digital readouts, wait until the arc is struck and then adjust the voltage to between 17–19 volts.

It may be necessary to re-adjust the arc voltage dial as soon as you begin welding.

NOTICE

The CLIMAX mounting mechanism must be in contact with the negative weld potential to actuate the voltmeter.

4.3.4 Choosing shielding gas and setting the gas flow rate

Shielding Gas Type. Shielding gas mixtures between 75% argon/25% carbon dioxide and 92% argon/8% carbon dioxide are normally used with mild steel buildup.

TABLE 4-7. SHIELDING GAS GUIDE

Gas type	Best use	Pros	Cons
75/25	Welding in horizontal axis	Good control for uphill/downhill welding	Generates more spatter
92/8	Welding in the vertical axis	Low spatter for long duration welding	More fluid puddle; harder to control

Checking the flow rate. The shielding gas flow rates should not exceed 35 cfh. To check the flow rate, press the PURGE button. The gas solenoid will open for 10 seconds, allowing you to check the flow rate and also clear unwanted gases from the system.

4.4 PRE-WELD CHECKLIST

TABLE 4-8. PRE-WELD CHECKLIST

<input type="checkbox"/>	Weld positive is connected to the BoreWelder and weld power supply.
<input type="checkbox"/>	Weld negative is connected to part and weld power supply.
<input type="checkbox"/>	Rotation speed is set (using Rotation Speed).
<input type="checkbox"/>	Wire speed is set (using Wire Speed).
<input type="checkbox"/>	Step is set (using Step Size).
<input type="checkbox"/>	Voltage is set (using Arc Voltage).
<input type="checkbox"/>	Shielding gas is connected and on (using Purge).
<input type="checkbox"/>	Torch is at the step point (using the Rotate to Step button).
<input type="checkbox"/>	Twisted wire is fed out from BoreWelder (using Wire Jog).
<input type="checkbox"/>	Quill is extended past the weld start point, then retracted to the start point (eliminating backlash).

4.5 STARTING, STOPPING, AND INTERRUPTING THE WELD PROCESS

4.5.1 Starting to weld

To start welding, press the Weld button on the control box.

If stubbing occurs, raise the voltage until the process stabilizes.

After the first rotation, you should be able to view the placement of the weld bead in relation to the previous bead and the base metal. As described in Section 4.3.2 on page 61, the correct step is attained when the weld is evenly placed between the previous bead and base metal.

Normally, only adjustments to step, wire speed, and voltage are necessary to maintain the required weld deposits and feed necessary for successful borewelding.

 **WARNING**

Use the appropriate light shield when making any visual inspection. Avoid both direct and indirect exposure to arc rays.

4.5.2 Stopping the weld

To stop welding, press the Weld button again.

4.6 USING ARC INTERRUPT

Arc Interrupt allows you to briefly stop the weld process yet maintain all other weld mode functions. For example, you can manually stop the process when welding over a grease hole.

Do the following to use Arc Interrupt:

1. When your torch approaches an area you don't want to weld, press the Arc Interrupt button on the control box. Welding stops.
2. Release the Arc Interrupt button. Welding resumes.

This procedure must be repeated for each revolution until the area where weld is not to be deposited is passed. When observing Arc Interrupt, check that you are using an appropriate light shield.

4.7 USING AUTO SKIP

Auto Skip is, first, a way to automatically skip keyways. However, with a quick keystroke, the Auto Skip system allows you to fill in an out-of-round or worn section of a bore.

This function greatly increases productivity, as it is possible to fix a worn section of the bore without excessive pre-machining and subsequent borewelding to fill in the over-bored area.

Program the skip area using two cam disks on the top of the BoreWelder.

Do the following if there are keyways to avoid or worn sections to weld:

1. Check that the BoreWelder is centered and parallel to the bore.

2. Rotate the torch manually or press the Rotate button. Rotate to the beginning of the “interrupt” or weld area.
3. Squeeze the outside diameter of the cam discs with the thumb and forefinger, and pull away from the spindle, opening a low spot in the cam discs.
4. Rotate the discs until the Auto Skip switch just falls into the low area.
5. Rotate the torch as in step 2 to the end of the interrupt area.
6. Hold the first disc where you set it in step 3. Then move the other disc until the Auto Skip switch actuates (that is, the switch rides up on the “high” leaving the low “interrupt” area).
7. Re-check the disc settings by rotating the spindle through the “interrupt” zone in the welding rotation direction.

For a clear indication of the switch actuation, watch the upper right field on the control readout for when the switch opens/closes. Make all final adjustments before welding.

4.8 USING PIE MODE AND CARRIAGE RETURN

Auto Skip

Auto Skip welds outside of the cam detents in the set rotation direction. It is essentially the same process as normal borewelding, but the cam detent (low spot) is a non-weld area.

The spindle speed automatically speeds up (High Speed Skip) in the non weld area. It is possible to change the spindle speed in the non weld area by Navigating to the User Set Parameters and changing the value of “Rapid Rotation During Skip Multiplier” to increase or decrease rotation speed in the non-weld area.

Turn off High Speed Skip by selecting High Speed Auto Skip Enable and changing the value to 0.

Pie Mode

Pie Mode welds inside the Auto Skip cam Detents bidirectionally. The weld is deposited in both rotation directions, with a step back at each weld end point. See Section 4.8.1 for more information.

Carriage Return

Carriage Return welds inside the Auto Skip Cam detents in the set rotation direction only. The weld is deposited in the set rotation direction to the weld end point, with step back and a non welding fast return to weld start point. See Section 4.8.2 on page 66 for more information.

Selecting the Mode

The Control defaults to Auto Skip upon Power Up. To change between Auto Skip, Pie Mode or Carriage Return Functions, use the keystroke Function + Weld.

The fields shown in Figure 4-1 (circled in red) will become high-lighted, indicating which mode is active. This keystroke is only available while not welding.

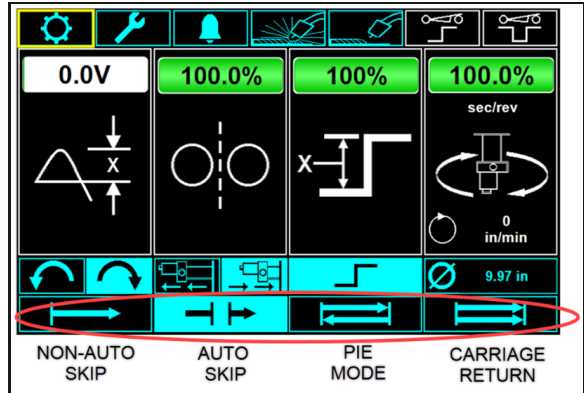


FIGURE 4-1. MODES HIGHLIGHTED IN THE BOTTOM ROW

4.8.1 Pie mode

Pie mode is used to weld up worn areas of bore in the vertical axis and worn areas of horizontal axis bores, when the worn area is on the top or the bottom of the bore. The following procedure assumes you have powered up the control and are in the Auto Skip mode.

Do the following to use Pie Mode:

1. Set up the BoreWelder as described in Section 3 and in this section.
2. Set the Auto Skip cams for the scenario of skipping the worn section (see Section 4.7 on page 64).
3. While not welding, hold down the Function key and press Weld once (to cycle from Auto Skip to Pie Mode).
4. Resume welding as for normal borewelding.

The BoreWelder will now weld back and forth inside the worn area, stopping the weld process, stepping, then beginning weld again in the opposite direction at each end point. The weld parameters are controlled exactly the same as for normal borewelding.

If multiple passes are needed to ensure complete correction of the worn bore, CLIMAX recommends starting with a small pie section for the first pass, widening the pie for the second pass, and so on. In this way, stickout is kept as short as possible, and stop-start areas are blended by overlapping weld passes..

4.8.2 Carriage return

Carriage Return is used to weld up a worn area of a bore in the horizontal axis, when the worn section occurs on the uphill or downhill side of the bore.

The following procedure assumes you have just powered up the control and are in the Auto Skip mode.

Do the following to use Carriage Return:

1. Set up the BoreWelder as described in Section 3 and in this section.

2. Set the Auto Skip cams for the scenario of skipping the worn section.
3. While not welding, hold down the Function key and press Weld twice (to cycle from Auto Skip to Carriage Return).
4. Set the rotation direction to the preferred weld direction for your application by holding down the Function key and pressing the Rotate button to toggle the rotation direction.
5. Resume welding as for normal borewelding.

The BoreWelder welds in the rotation direction inside the worn area, until it reaches the end of the set cam limit. It then stops welding and reverses rotation at full speed to the original starting point while stepping. The weld and rotation begin again. All parameters are set as for normal borewelding.

4.9 WELDING TIPS

4.9.1 Achieving the smoothest and least violent arc action

The length of time the BoreWelder can be used continuously depends mostly on spatter buildup in the welding nozzle. Therefore, a main objective when deciding what kind of wire, gas, and power supply to use is to choose the combination that produces the smoothest and least violent arc action. Such a combination typically produces less spatter buildup and longer welding times.

Wires with higher deoxidizer contents usually work best. Wires ER-70S-6 and ER-70S-2 work well. Any common inert gas can be used; but those with high argon contents are preferred. A mixture of 92% argon/8% CO₂ works well, as does 75% argon/25% CO₂. The former generally is preferred. Straight argon or helium should not be used for steel, and straight CO₂ produces excessive spatter.

TIP:

ER-70S-2 is an alternate choice for multilayer buildups because it deposits less silicon dioxide.

4.9.2 Avoiding wire flip by using a wire with a large cast

The term “wire flip” is used to describe an inherent condition in borewelding. The spindle and torch of the BoreWelder rotate around a nonrotating wire. Torque is applied to the wire by the rotating torch, and is affected by a number of variables including, but not limited to, extension lengths, stroke of machine, conduit length, conduit shape and configuration, orientation of wirefeeder in relation to BoreWelder, and the cast of the wire.

As the BoreWelder turns, the wire is twisted slightly between the torch and the wirefeeder. This twist (in extreme cases), unwinds once per revolution as the torch progresses around the bore, and produces a change in the track of the weld in a small area of the bore. In extreme cases, “flip” can cause a void in the weld. Typically, there are no detrimental effects to the finished product.

To avoid this problem, use a wire with a large arc or “cast.” Cast is the diameter of the circle that a wire makes on the floor in its relaxed state.

To check cast, cut about 4 feet (1.2 meters) from your roll of wire and toss it on the floor. The cast diameter should be as large as possible and at least 40" (1 meter). Casts under 30" (0.8 meter) are likely to cause difficulties. A cast of 40" (1 meter) or more will reduce or eliminate the effect of wire flip. Consult with CLIMAX if you are unable to find large cast wires.

Using the wire straightener (only with shop style feeder) is an efficient way to reduce the effects of flip when an open cast wire is not available.

Do the following to reduce the chances of wire flip:

- Avoid “Straight” or “S” bend conduit configurations where possible. The most stable conduit configuration is a “C” shape with the wire reel on the “inside” of the “C”.
- Alternately, position the conduit as shown in Figure 4-2. This method works particularly well with long conduits.
- If the wire has a tight cast and it still flips in this configuration, try tightening up the curve. Long torch extensions tend to negate any benefit that this conduit shape (see Figure 4-2) may have.

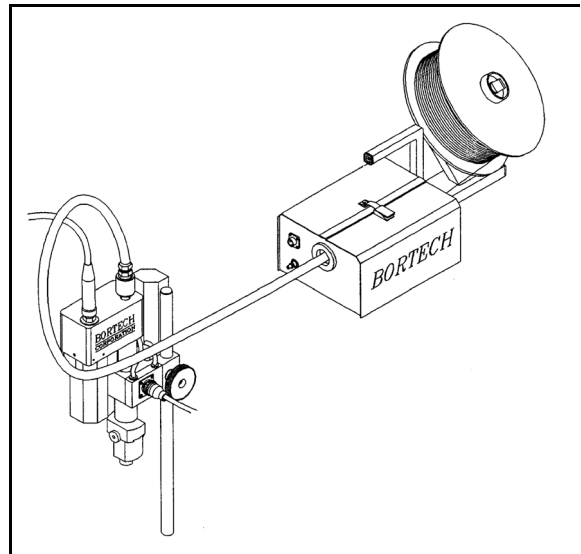


FIGURE 4-2. CONDUIT SHAPE FOR SMALL CAST WIRE WHEN USING LONGER CONDUITS

4.9.3 Cleaning glass inclusions from the bore

Welding wire usually contains some silicon as a deoxidizer. During the welding process, this changes to silicon dioxide (glass) and solidifies in clumps on the surface of the weld. These clumps normally do not cause a problem; but when many layers of buildup are applied one on top of another, the glass from the lower level is re-melted and added to the new glass, forming larger glass clumps. It is therefore a good practice to clean the glass from the bore after two layers have been applied.

4.9.4 Providing appropriate axial movement each revolution

During welding, check that the Step Size setting is providing appropriate axial movement during each revolution. If the step is too great, the bead will appear ropey, and spaces may appear between the beads. If the step is too little, the surface of the weld may appear smooth and flaw-free but it may have fused poorly to the base metal. Check that the arc is directed slightly above the intersection point between the base metal and the previous bead.

At the beginning of the welding process, the first circular bead has no previously laid bead to rely on for support and, therefore, is a different shape than those that follow. It is best if the first step (at the end of the first revolution) is made slightly smaller than those that follow. An alternative is to use a slightly slower wire speed or slightly higher rotation speed during the first revolution.

4.10 WELDING IN THE HORIZONTAL AXIS

Welding in the horizontal axis requires more attention to the machine settings than when welding in the vertical axis. In the horizontal axis, the weld bead must travel through the flat, vertical-up, overhead, and vertical-down positions. Flat and overhead positions of the bore present no problems for the BoreWelder. However, vertical-up and vertical-down positions may be challenging.

This section begins with a procedure for horizontal welding. This is followed by practical suggestions for vertical-up and vertical-down welding.

TIP:

Make sure you've mastered vertical axis bore buildup before you try welding in the horizontal axis.

4.10.1 Procedure for horizontal axis welding

There are two basis strategies for out-of-position (that is, horizontal) welding. The approximate strategies below assume the weld travel speed is 22 inches per minute (IPM).

TIP:

Always retract to the starting point to eliminate backlash in the gear train.

4.10.1.1 Strategy 1

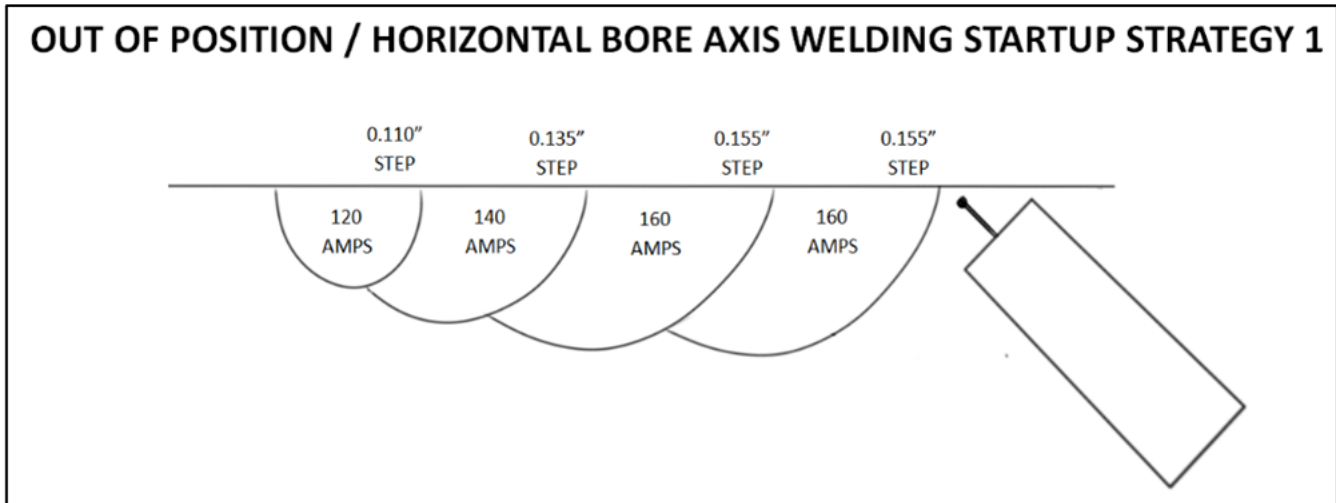


FIGURE 4-3. STRATEGY 1 FOR OUT OF POSITION/HORIZONTAL BORE AXIS WELDING STARTUP

The first bead, 110 to 120 AMPS and 17 to 18 volts, is small enough that it maintain its shape going uphill. Step set is at 0.110" / 0.120" (2.79 / 3.05 mm).

Immediately after the first rotation/step occurs, the wirespeed is increased to 130 / 140 AMPS, and arc voltage is trimmed up slightly to retain crisp shorting. Step is increased to 0.135" / 0.140" (3.43 / 3.56 mm).

Immediately after the second rotation/step occurs, the wirespeed is increased to 155 / 160 AMPS, arc voltage trimmed up slightly to retain crisp shorting. Step is increased to 0.155" (3.94 mm).

The operator then verifies after the third rotation/step that the step is correct, ensuring the wire is at the junction between the previous bead and the base metal. Make any adjustments needed and verify on the fourth rotation.

4.10.1.2 Strategy 2

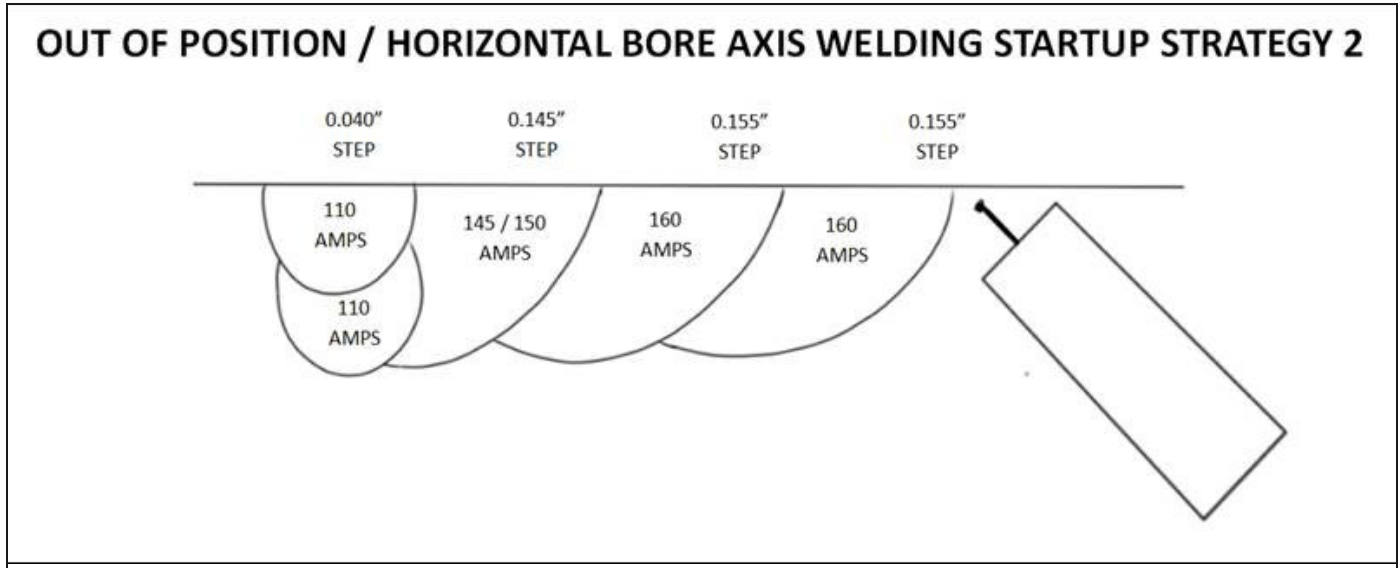


FIGURE 4-4. STRATEGY 2 FOR OUT OF POSITION/HORIZONTAL BORE AXIS WELDING STARTUP

TIP:

Strategy 1 is typically easier to master than Strategy 2, but Strategy 2 provides a more square edge which is easier to restart on when doing multiple passes, Strategy 2 also provides more metal at the beginning corner, allowing better machining results.

The first bead, 110 and 17 to 18 volts is small enough that it maintain its shape going uphill, even directly over the first bead. The step is set at 0.040" (3.56 mm).

After the first rotation / step occurs, the wirespeed is left alone a 110 AMPS, the step increased to 0.145" (3.68 mm).

Immediately after the second rotation / step occurs, the wirespeed is increased to 145 / 150 AMPS, arc voltage trimmed up slightly to retain crisp shorting. The tep is increased to 0.155" (3.94 mm).

Immediately after the third rotation / step is complete, wirespeed is increased to 160 AMPS and arc voltage trimmed up to retain crisp shorting.

The operator then verifies after the 4th rotation / step that the step IS correct, ensuring the wire is at the junction between the previous bead and the base metal. Make any adjustments needed and verify on the 5th rotation.

4.10.1.3 Continuing after completing strategy 1 or 2

Make any fine adjustments needed to the step, then let the machine finish applying the beads.

If the beginning of the weld is treated in this manner, the weld can be deposited into the “V” formed by the bore surface and the previously deposited weld metal. This “V” helps the weld bead to stay in place by:

- Providing increased heat sink area to freeze the weld.
- Forcing the bead into a more controllable shape so its surface tension can hold it in place.

Once the buildup is started in this way, you may increase the weld current. You should be able to weld smoothly at 150 amps using 0.035" wire.

A shielding gas of 75% argon/25% CO² helps to control the weld puddle by increasing the freeze rate. The CO² increases the penetration into the workpiece. To decrease spatter, decrease the CO² in the gas mixture as low as 8%. (The bead will be more difficult for the beginner to manage.)

TIP:

When doing multiple passes in the horizontal axis, be sure to alternate rotation direction between passes. This makes the uphill weld of the second pass travel up over the smooth downhill section of the first pass.

When building up a horizontal axis bore, it's important to eliminate any dirt or rust in the bore. Rust tends to make the puddle more fluid and harder to control. This causes bead-to-bead fusion problems that are accentuated in the horizontal axis.

Check that the step size is large enough. Insufficient step is one of the causes for lack of fusion to the base material. To be safe, check that the step size is too large rather than too small.

Check that the rotation speed is fast enough to prevent the puddle from flowing ahead of the arc. If the weld puddle flows ahead of the arc on the downhill, the weld bead may not adhere to the base metal. This is a common cause for lack of fusion on the downhill. Travel speeds of 22 IPM are generally sufficient to prevent this from happening. However, impurities in the base metal, choices of shielding gas, excessive voltage, excessive amperage, or a combination of all the above can contribute to lack of fusion on the downhill section of the bore.

Do not allow the arc voltage to climb too high. An arc voltage of 17 volts is normal. A high voltage (more than 19 volts) will make the weld bead difficult to control, especially on the downhill side.

The inductance of the power supply plays an important part in horizontal buildup also. If the power supply has an Inductance control, you may increase the inductance to help flatten out the bead, make it blend better, and, most important, keep it from piling up on the uphill side and forming a tall narrow bead. These tall narrow beads tend to spill and expose new base metal for the arc to gouge and spill again.

4.10.2 Offset head settings when using extensions in the horizontal axis

In horizontal axis welding, when reaching with extensions over 3 feet (0.9 meter), the weight of the torch and extensions can pry the slide from its seat. In this case, the clamping screws should be tightened to no greater than 20 in-lbs (2 Nm) to lock the slide and body together.

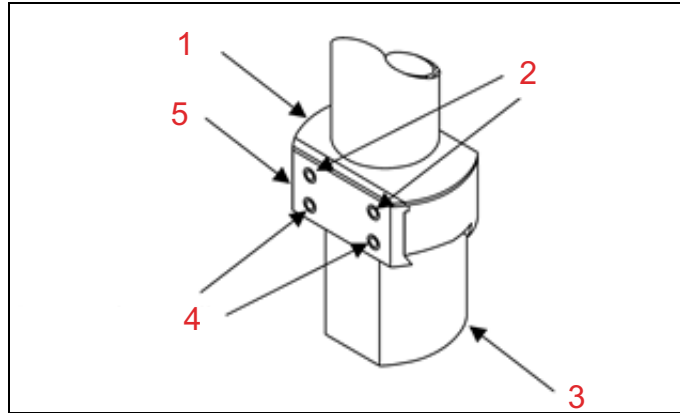


FIGURE 4-5. CLAMPING OFFSET HEAD

TABLE 4-9. LOCKING THE HEAD COMPONENT IDENTIFICATION

Number	Component
1	Body
2	Two gib screws to set constant dovetail tension
3	Slide
4	Two clamping screws for locking the head
5	Side plate

Consider using the torch extension support kit when reach extends past 4 feet (1.2 meters).

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5 MAINTENANCE

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 **CAUTION**

Failure to properly maintain the machine will result in premature wear or damage to the machine. Damaged caused by improper or inadequate machine maintenance is not covered by the machine limited warranty.

5.1 MAINTENANCE CHECKLIST

Table 5-1 lists maintenance intervals and tasks

TABLE 5-1. MAINTENANCE INTERVALS AND TASKS

Interval	Task	Reference
Before and after each use	Remove debris, oil, and moisture from machine surfaces.	--
After each use	Wipe down the quill and the mating surface of the offset head assembly with a clean shop towel, lightly sprayed with WD-40.	Section 5.2.1.1
Periodically	Inspect the following wirefeeder components for signs of wear: <ul style="list-style-type: none">• Drive rolls• Pressure rolls• Geared drive roll adapters• Axles• Rubber isolator feet on a shop-style wirefeeder	Section 5.2.3.1
	Clean the torch liners and replace as needed. Inspect the diffusers, tips, and nozzles for wear. Inspect the torch and extension threaded ends where they mate for dents and burrs.	Section 5.2.4 on page 80
	Inspect the O-rings that seal each end of the conduit. If the O-rings are cracked, worn or otherwise compromised, replace them.	Section 5.2.5.2 on page 82
	Wipe down the control overlay and buttons with a clean shop towel, lightly sprayed with WD-40.	Section 5.2.6 on page 83

5.2 MAINTENANCE TASKS

Maintenance tasks are described in the following sections.

5.2.1 BoreWelder maintenance

The BoreWelder requires little maintenance when properly cared for. Preventative maintenance is the most effective means of attaining a long service life.

5.2.1.1 Daily maintenance

Daily maintenance consists primarily of keeping the BoreWelder clean and protected. The BoreWelder is designed to survive in industrial environments that are usually dusty and gritty; however, it has close fitting parts and will last longer if kept clean.

The quill and offset head provide sliding movement. For this reason, clean both items daily under normal use.

Quill

Use a clean shop towel lightly sprayed with a lubricant such as WD-40, to remove iron oxide (and any other foreign materials) deposited on the quill from the weld process. Wipe off any excess lubricant with a clean cloth. This will keep the quill sliding freely in the quill positioner. Avoid using an excessive amount of a sticky lubricant that may trap foreign materials. Avoid spraying Anti Spatter on the quill tube.

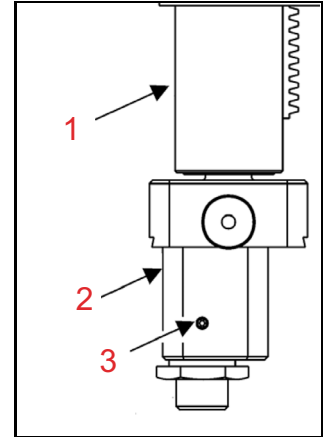


FIGURE 5-1. COMPONENTS FOR DAILY MAINTENANCE

TABLE 5-2. DAILY MAINTENANCE COMPONENT IDENTIFICATION

Number	Component
1	Quill
2	Offset head assembly
3	Liner holddown set screw

Offset head

After use, use a clean shop towel, lightly sprayed with lubricant such as WD-40, to clean the mating surface of the offset head assembly. It's best to move the slide to its full extent of travel in both directions and clean the exposed area of the body dovetail face.

Orientation fitting and nut

Check that the mating area of the orientation fitting and nut is kept free of spatter and dirt.

5.2.1.2 Replacing the BoreWelder liner

Do the following to replace the BoreWelder liner:

1. Set the offset head to zero offset.
2. Remove the swivel coupling and loosen the liner set screw in the offset head slide.
3. Push the liner out of the top of the spindle.
4. Remove the spindle conduit fitting from the old liner and install it onto a new liner of the correct length.

5. Slide the liner into the spindle and then into the offset head. The liner should be flush in the offset head slide, orientation fitting counterbore. At the top of the spindle, the spindle conduit fitting should rest 1/8" (3 mm) below the top of the spindle.
6. Reinstall the swivel coupling, and torque to 20 ft-lbs (27 Nm).

5.2.2 BoreWelder adjustments

There are only two adjustments that are required: the offset head and the quick connect for the positive weld attachment.

5.2.2.1 Offset head dovetail adjustments

The dovetail of the offset head must be adjusted to provide constant pressure on the sliding mating faces.

NOTICE

Failure to maintain proper dovetail adjustment will result in reduced performance (overheating) and damage to the offset head mating surfaces.

TABLE 5-3. OFFSET HEAD ADJUSTMENT COMPONENT IDENTIFICATION

Number	Component
1	Two gib screws
2	Side plate
3	Slide member
4	Orientation fitting
5	Two clamping screws

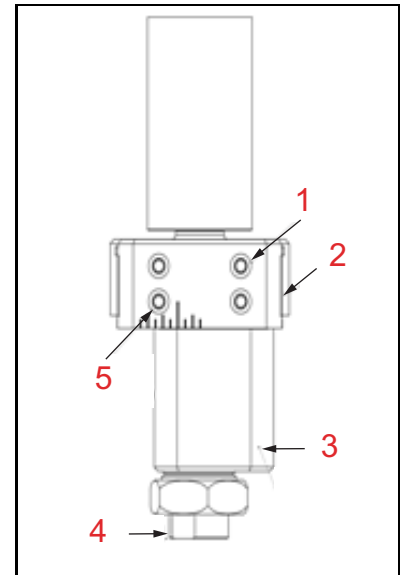


FIGURE 5-2. COMPONENTS FOR OFFSET HEAD ADJUSTMENTS

For best performance and long service life, adjust the two screws closest to the chrome tube (hereafter referred to as “gib screws”) to make the offset head movement only possible with two hands. One hand turns the knob and the other “shears” the moveable slide along using the thumb on the body and the forefinger on the slide. This tension creates good electrical contact, a nearly gastight seal, and mechanical prevention of materials entering the conductive contact surfaces of the offset head.

Over time, it will be necessary to readjust the slide as it wears and to remove iron oxide, etc., from the welding process (which is non conductive). Do the following:

1. Remove all the side plate screws and disassemble the slide from the body.
2. Clean with acetone or similar, and inspect for any problems.

3. Reassemble the offset head and utilize without lubrication.

For more details on the offset head, please call the technical support department at CLIMAX for field service of the offset head.

If the gib screws are too loose, the offset head assembly may overheat from increased resistance across the slide and body interface. Also porosity in the weld can result from contamination of the shielding gas.

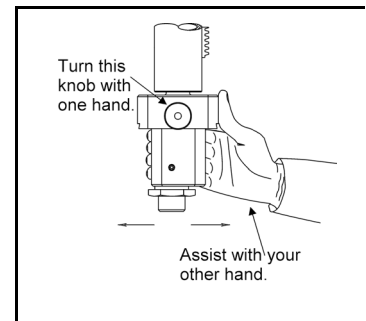


FIGURE 5-3. KNOB ROTATION

5.2.2.2 Welding positive lead quick coupling

The quick couple conducts all the welding current that is used in the welding process. The quick couple is rigged from the factory to have an interference fit with the mating female connector. The tangs of the quick couple should be spread slightly wider than the female connector, to ensure good electrical contact when assembled. The axial force required to assemble this connector should be 5 to 10 pounds. If the female connector slips on easily, it is a sign that the quick couple needs to be spread open slightly. Spread the quick couple by sliding a flat head screwdriver between the tangs and twisting slightly.

5.2.3 Wirefeeder maintenance and adjustments

5.2.3.1 Wirefeeder maintenance

The wirefeeders are built to last for years of service. Keeping the machine clean makes it easier to find and correct wear or maintenance issues.

Inspect the following items for signs of wear:

- Drive rolls
- Pressure rolls
- Geared drive roll adapters
- Axles
- Rubber isolator feet on a shop-style wirefeeder

For the shop-style wirefeeder, check that the inside of the case is clean and free of metallic objects. Also check that the wire feed motor is secure in the frame of the wirefeeder. Damage to the system can result if the wire feed motor is allowed to make contact with the frame of the wirefeeder.

5.2.3.2 Wirefeeder adjustments

The wire feed drive roll pressure has a wide range of acceptable settings. However, when the force transmitted to the wire exceeds its column strength, the wire collapses in the conduit (seen as a crinkle or wave in the wire), causing the wire to resist movement in its intended direction. Typically, the operator diagnoses this as a problem with wire feeding and quickly turns up the feed roll pressure, making the situation worse.

Do the following steps to determine the maximum possible feed roll pressure. In practice, it is advisable to operate the feed roll pressure below the maximum capable pressure, because of variations in the physical characteristics of the wire.

1. Attach the conduit to the wirefeeder only.
2. Jog the welding wire until it exits the free end of the conduit.
3. Clip off any excess wire flush with the end of the conduit fitting.
4. Hold the free end of the wire feed conduit up to a hard surface (like a table edge) and jog the wire feed rolls momentarily (2 to 3 seconds). The rolls should spin on the wire.
5. Remove the conduit end from the hard surface.
6. Jog the full length of wire out of the conduit, watching closely for any distortion in the wire.

If the feed roll pressure is just right, the wire that was inside the conduit should not have any “sine wave” effects—it should be “crinkle” free. Tighten the feed rolls slightly. Then, recheck for the sine wave effect. Repeat this until the effect appears.

If the feed roll pressure is too tight, the wire column will fail just after the feed rolls. There will be a visible crinkle or sine wave in the wire. Back off the pressure on the rolls until the effect disappears. This setting will be the highest possible feed roll pressure.

In other words, the wirefeeder drive rolls should be set so that, when a stoppage occurs, the wire feed rolls slip and the wire does not crinkle. As mentioned earlier, this is the highest possible tension. In most cases, CLIMAX recommends a wire-feed setting well below this.

For mild steel, 0.035" diameter wire, set the feed roll pressure from 2.5 to 3 on the adjuster barrels.

TIP:

Welding wire varies in consistency, so a feed roll pressure that was right for one wire may be too much for another wire. With each new wire, you may have to re-adjust the feed roll pressure.

5.2.4 Motor maintenance

If the operator needs to replace the gear motor (P/N 61210), use kit P/N 103173 as shown in Table 5-4 on page 81.

If the operator needs to replace the step motor (P/N 36627), use kit 103172 as shown in Table 5-5.

TABLE 5-4. MOTOR DRIVE REPLACEMENT KIT (P/N 103173)

Part number	Description	Quantity
10157	SCREW 10-32 X 5/8 SHCS	4
103140	SHROUD MOTOR DRIVE (MMP)	1
103142	GEARMOTOR 90 VDC 6.6 RPM 189 IN-LBS TORQUE 776.76:1	1
103146	PLATE ADAPTER MOTOR DRIVE (MMP)	1
103147	PULLEY ROTATION MOTOR (MMP)	1
103149	PLATE MOUNT BW3000 (MMP)	1
11256	SCREW 10-24 X 1/4 SSSCP	1
12599	SCREW 6-32 X 1/4 BHSCS	6
13863	SCREW 10-32 X 1-3/4 SHCS	1
67048	SPADE CONNECTOR MALE DBL CRIMP 22-18 AWG .25 WIDE RED	1
67050	SPADE CONNECTOR FEMALE DBL CRIMP 22-18 AWG .250 X .032 RED	1
70226	LABEL CLIMAX LOGO 1.5 X 5.5	1
82934	SCREW M4 X 0.7 X 12MM FHSCS ZINC	4

TABLE 5-5. MOTOR DRIVE REPLACEMENT KIT (P/N 103172)

Part number	Description	Quantity
103117	SHROUD MOTOR STEP (MMP)	1
103144	ASSY MOTOR AND MODIFIED STEP GEAR BW3000 (MMP)	1
103145	PLATE ADAPTER MOTOR STEP (MMP)	1
103209	GUIDE WORM AND THRUST PIN (MMP)	1
12599	SCREW 6-32 X 1/4 BHSCS	6
14779	SCREW 10-32 X 2 SHCS	2
44459	SCREW 6-32 X 5/8 FHSCS	1
67048	SPADE CONNECTOR MALE DBL CRIMP 22-18 AWG .25 WIDE RED	1
67050	SPADE CONNECTOR FEMALE DBL CRIMP 22-18 AWG .250 X .032 RED	1
69968	TUBING 1/4 ID 3/8 OD PVC BLACK	4
82918	SCREW M4 X 0.7 X 16MM FHSCS ZINC	4

5.2.5 Torches, conduits, and cables

5.2.5.1 Maintaining torches and extensions

Torch maintenance includes cleaning or replacing the liners and inspecting diffusers, tips, and nozzles for wear. Inspect the torch and extension threaded ends where they mate for “dings” and burrs. These areas require complete electrical contact and gas seal.

5.2.5.2 Maintaining conduits

Conduit maintenance includes an inspection of the O-rings that seal each end of the conduit in its part. The O-rings should be lubricated to allow easy assembly and disassembly. If the O-rings are cracked, worn or otherwise compromised, replace them.

The conduit liner can be blown out to remove foreign matter that might restrict feeding. If the liner needs to be replaced, see Section 5.2.5.3 on page 82.

5.2.5.3 Liner replacement

The replacement schedule for liners in the BoreWelder torches and conduits depends on many factors. These factors include, but are not limited to, workplace environment, welding wire used, welding parameters, feed roll pressure, and maintenance schedule.

Do the following when liner replacement is required:

1. When replacing the liner in any component which forms a curve that the liner has to follow, it is important to preload the liner. The liner is pressed into the torch or conduit until the liner is felt to be making contact with the outer wall of the bend in the torch or conduit. This pressure should not exceed 5 pounds.
2. When replacing the liner in a wirefeeder conduit, coil the conduit into a 24" (60 mm) circle and push the liner in so it makes contact with the outer wall of the conduit. Then secure it in place with the set screws while it's in this coiled position. Do not over-tighten the set screws when securing the liner.
3. Always clip the liner with a sharp set of diagonal cutters, in such a way that the end of the liner is recessed at the end of the conduit or torch. The distance of recession should not exceed one coil, or approximately 0.050" (1 mm). This procedure prevents sharp liner ends from being exposed.

5.2.5.4 Replacement of contact tips for torches #00 and #0

When replacing the contact tips of torches #00 and #0, check that the contact tip is positioned correctly in the nozzle. The tip should not be centrally located axially. Instead, the tip should be secured so its exit end is closer to the end of the torch nozzle. To determine the proper location and as a gauge between the tip and the cup, use the same Allen wrench used to tighten the set screw holding the tip in place. Do not preload the liner in either of these torches.

If replacement of the contact tip is required, it is not necessary to remove the liner. Instead, loosen the screw that holds the contact tip, remove the tip, and insert a new tip over the liner that is installed in the torch.

An alternative procedure is to remove the tip and the liner, and use a piece of welding wire as a “snake.” The welding wire is inserted into the liner hole in the threaded end of the torch, out through the nozzle. Then the combination of new tip and old liner can be slid onto the “snake” from the nozzle end, and the liner can easily be piloted into the liner attachment area on the threaded end of the torch.

Do the following when replacing the liner on the #0 and #00 torches:

1. Remove the old tip and liner.
2. Using a length of liner that is too long, insert the new liner from the threaded attachment end of the torch, out through the nozzle.
3. Install the contact tip on the liner, and move the combination up into the torch until correct placement is reached.
4. Lightly tighten the tip hold-down set screw, making sure your placement is as shown in Figure 5-4.
5. Trim the liner to the correct length by pulling the liner out two coils, and cutting in between the two.
6. Push the liner back into the torch with the 3/32 hex wrench used to tighten the liner hold-down set screw.

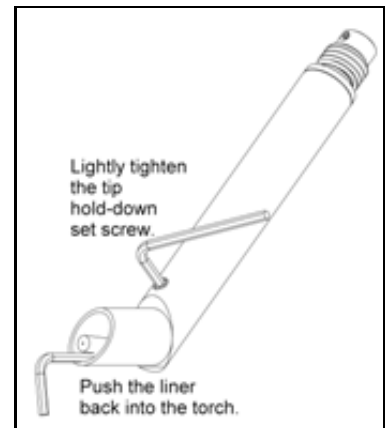


FIGURE 5-4. INSERTING THE LINER INTO THE TORCH

TIP:

For proper placement of the tip, use the Allen wrench as a gauge between the inside of the nozzle and the contact tip.

7. Tighten the liner and tip in place. The tip hold-down torque should not exceed 25 in-lbs.

5.2.6 Control box maintenance

The control box is designed to withstand the rigors of the work environment with minimal maintenance. However, care should be taken to avoid direct contact with water, weld spatter, high heat, and excessive impact.

The control box is provided with a cover to completely enclose the case when not in use and to partially protect the case when in use.

To clean the control overlay and membrane switches (also known as buttons), use a shop towel lightly sprayed with WD-40.

 **CAUTION**

The control box enclosure is made from polypropylene copolymer, so be careful not to set it on preheated parts or on parts that have been or are being welded.

5.3 TROUBLESHOOTING

This section is intended to help troubleshoot the BoreWelder BW3000 for both welding and mechanical problems, including lack of fusion, tip seizure, ropey beads, excessive spatter, a hot torch nozzle, porosity, a deposit that's too hard to machine, cutting tools that break, and weld graping.

For serious maintenance or if you have questions on the following procedures, contact CLIMAX.

TABLE 5-6. TROUBLESHOOTING

Problem	Remedy	Reference
Lack of fusion to bore surface	Direct the arc at the precise intersection between the bore surface and the previously laid weld deposit. Increase rotation speed.	Section 5.3.1.1 on page 86
Lack of fusion to the previous weld bead of the same layer	Direct the arc at the precise intersection between the bore surface and the previously laid weld deposit. Increase arc voltage.	Section 5.3.1.2 on page 86
Machine cannot be retracted or extended	Check for motor failure. Check for continuity of motor circuit (check the schematic). Check cable for continuity. Determine if worm roll pin is sheared or gear train is otherwise damaged.	Section 5.3.2.2 on page 90
Machine does not rotate	Verify motor continuity by checking BoreWelder receptacle pins (check the schematic). Check cable for continuity.	Section 5.3.2.3 on page 90
Porosity in the weld	Protect shielding gas from contamination from bore surface by lowering gas flow, preventing spatter buildup, cleaning bore surface, and/or using stick welding on laminated surfaces.	Section 5.3.1.7 on page 88
Too much spatter	Lower the arc voltage.	Section 5.3.1.5 on page 87

TABLE 5-6. TROUBLESHOOTING

Problem	Remedy	Reference
Step: Machine does not step	<p>Check that the step is enabled.</p> <p>Check that the STEP switch is working properly.</p> <p>Check the control cable for continuity. Check that the RETRACT and EXTEND buttons move the quill.</p>	Section 5.3.2.1 on page 89
Tip seizure	See "Wire feed: Wire feeding stops and wire burns back to tip" in this table.	--
Voltage control: No voltage control	<p>Check continuity of the power supply control cable.</p> <p>Check positive and negative ground leads for proper connection.</p>	Section 5.3.2.7 on page 91
Weld beads are ropey	<p>Increase arc voltage.</p> <p>Use less CO₂ in the shielding gas. Increase inductance.</p>	Section 5.3.1.4 on page 87
Weld breaks cutting tools when machined	<p>Hone the cutting edge of the tool.</p> <p>Check that the nose radius is not too small or too large.</p>	Section 5.3.1.9 on page 89
Weld graping during horizontal axis borewelding	<p>Lower weld current and voltage for the first revolution.</p> <p>Check that the step is not too great or too little.</p>	Section 5.3.1.10 on page 89
Weld graping during vertical axis borewelding	<p>Lower weld current. Increase travel speed.</p> <p>Check that the step is not too great or too little.</p>	Section 5.3.1.10 on page 89
Machine rotates, steps, and feeds wire out but does not weld	<p>Check continuity of the power supply control cable.</p> <p>Check positive and negative ground leads for proper connection.</p>	Section 5.3.2.6 on page 91
Nothing happens when the WELD button is pressed	<p>Press EXTEND to move the quill off its limit and try again.</p> <p>Check the inlet fuse.</p>	Section 5.3.2.5 on page 90
Steel weld deposit is too hard to machine	<p>Slow down the cooling rate by increasing the preheat of the part and/or decreasing the rotational travel speed of the torch.</p> <p>Deposit another weld layer on top of the hard layer to temper it.</p> <p>Post-heat the buildup after welding and allow to cool.</p>	Section 5.3.1.8 on page 88
No arc, no wire feed, but rotates at dial speed	Check that the control box is not in Pie Mode or Carriage Return.	Section 5.3.2.9 on page 91
No arc, no wire feed, but rotates at full speed	Check that the AUTO SKIP switch is horizontally aligned to the cams and engaging the cams properly.	Section 5.3.2.8 on page 91

TABLE 5-6. TROUBLESHOOTING

Problem	Remedy	Reference
Wirefeeder does not feed wire	<p>Check the motor for continuity (check the schematic).</p> <p>Check cable for continuity.</p> <p>Check whether wire is caught in torch.</p>	<p>Section 3.2.10 on page 48, Section 5.3.2.4 on page 90</p>
Wire feeding stops and wire burns back to tip (that is, tip seizure)	<p>Replace the contact tip.</p> <p>Check that the feed roll pressure is not too tight.</p> <p>Remove blockage of debris at the cone entrance of the contact tip.</p>	<p>Section 5.3.1.3 on page 86</p>
Wire flip	<p>Use short conduits and extensions. Avoid an “S” shape in the conduit. Tighten the curve of the wire.</p>	<p>Section 4.9.2 on page 67</p>

5.3.1 Common welding problems and solutions

5.3.1.1 Lack of fusion to the bore surface

Lack of fusion to the bore surface can be caused by the step being too small. If you are directing the welding arc mostly against the previously deposited bead, the newly deposited weld metal is likely to “cold lap” against the bore surface. It will fuse well with the previously deposited bead but not with the base metal. To cure the problem, set the step to direct the arc precisely at the intersection between the bore surface and the previously laid weld deposit or at an angle that slightly favors the base metal.

Another possible reason for lack of fusion is that the rotation speed is too slow. If rotation is too slow, the welding arc is directed on top of the currently melted weld puddle, preventing the arc from making direct contact with the base metal.

5.3.1.2 Lack of fusion to the previous weld bead of the same layer

Lack of fusion to the previous weld bead is usually caused by too much step. The welding arc is playing too much on the bore surface and not enough on the previously deposited bead. To prevent this problem, direct the arc at the exact intersection of the previous bead and the bore surface.

5.3.1.3 Wire feeding stops and wire burns back to tip

This problem is also referred to as tip seizure, and is usually caused by one of two reasons:

- A mechanical blockage of debris at the “cone” entrance to the contact tip. This debris jams between the wire and contact tip bore. When the wire stops and the welding power supply remains on, the wire burns back to the contact tip and the contact tip melts.

- Overheated or exhausted contact tip. When the contact tip is overheated or spent, the wire may seize to it. The contact tip is a consumable, so replacement is required at intervals that are determined by, but not limited to, the following factors: dimensions of bore, arc voltage, welding current, welding wire, shielding gas, preheat of part, quality of weld connections, and type of power supply used.

See Section 5.2.3.2 on page 80 for information on setting the feed roll pressure.

5.3.1.4 Weld beads are “ropey”

Do the following to make the beads wet out more and become less ropey:

- Increase the arc voltage up to 18 volts.
- Use less CO₂ in the mixture of shielding gas.
- Check that the travel speed is within acceptable parameters (18 to 22 IPM).
- Check that your welding wire is not contaminated with rust.
- Check that the base metal is not contaminated with rust, grease, or scale. A sandblasted pre-machined or ground part is desirable for best results.

If your weld power supply is equipped with inductance control, another strategy is to increase inductance. More inductance flattens the weld puddle.

TIP:

On Lincoln power supplies, turning the knob counterclockwise increases inductance.

5.3.1.5 Too much spatter

The usual cause for too much spatter is an arc voltage that’s too high. The arc should have an even sound that is not violent. A setting of 15.5 to 18 volts is normal.

The shielding gas also has a marked effect on weld spatter. For spatter control, a shielding of argon with less than 15% CO₂ is recommended (for example, 92% argon/8% CO₂). More CO₂ causes excessive spatter.

Certain types of welding wire create more spatter than others. If all other options have been exhausted, try wire from a different manufacturer. Contact CLIMAX for information on alternative wires.

5.3.1.6 Torch nozzle becomes too hot

A hot torch nozzle is usually the result of using an arc voltage that’s too high. Keep the voltage between 15½ and 18 volts.

5.3.1.7 Porosity in the weld

Porosity is indicated by a sponge-like appearance of the weld bead. Porosity is commonly caused by two factors: Lack or contamination of shielding gas; and a contaminated bore surface.

Spatter buildup in the nozzle can restrict flow, resulting in a lack of shielding gas. A gas flow that's too high can cause ambient air to contaminate the shielding gas. A flow rate of 20 to 40 CFH is recommended. If wind is a problem in the field, make wind blocking dams out of leather and aluminum foil. Use leather on the BoreWelder side of the bore, as leather does not conduct electricity. A 3-foot square piece of leather with a slit from the center out to one edge provides easy installation over the extension. You can use small magnets to hold the leather in place. Aluminum foil is used on the opposite end of the bore. Fold the aluminum foil around the part to hold it in place to shield the bore, then make a hole to view the process.

Excessive oil, rust, dirt, and grease can contaminate the bore surface and cause porosity. Sandblasting, pre-machining, and preheating may be required. In cases where the base metal is deeply contaminated, you may need to run a flux cored wire to manage the excessive contaminants.

In some cases, laminated sections in heavy equipment bores can have grease deposited in the spaces between the layers. You have a few options to handle this problem. You could pre-grind the lamination line, and pre-weld with stick welding rod to seal the lamination. This is very effective, but is time consuming and difficult on small bores. You could preheat in an attempt to drive out the grease. However, it's likely that grease will continue to leak out while welding continues. It's also possible to weld up to the lamination, stop the weld process, retract the machine over the lamination, and restart the weld process. The unfinished section can then be stick welded after borewelding is complete.

5.3.1.8 Steel weld deposit is too hard to machine

Assuming the wire is a mild steel wire (such as the 70s-series), the ability to harden must be attained from the base material. If the deposit is hard, it must have obtained carbon and possibly other alloys from the base material which cause it to be susceptible to heat treatment hardening.

Generally, to prevent hardening, slow down the cooling rate. To do so, increase the preheat of the part and/or decrease the rotational travel speed of the torch. Fast travel speeds produce a rapid quench of the weld beads.

If hard weld beads are encountered, you may be able to temper the hardened bead by welding another pass directly over it.

If the buildup is still too hard, post-heat to a temperature of about 1,100°F (593°C) to temper the weld bead and allow machining.

TIP:

Allow the part to cool to less than 400°F (204°C) before reheating. Do not allow any part of the weld to rise above the critical temperature (about 1,300°F [704°C]) even for a short time, unless you are prepared to do a full anneal with the associated heat soaking and slow cooling.

5.3.1.9 Weld breaks cutting tools when machined

A tungsten carbide tool bit edge can be “honed” to make it less susceptible to breakage. If you create a 45 degree chamfer that is 0.005–0.007" wide (0.127–0.178 mm), the toughness of the tool bit is increased.

5.3.1.10 Weld “graping”

Graping occurs when the molten puddle overcomes the surface tension that holds it in place. The term “graping” refers to the drooping globs of weld metal hanging from the bore surface.

Typically, this occurs on the uphill section when the BoreWelder is in the horizontal axis.

To remedy this problem, use lower currents and voltages for the first revolution and build a shelf that can support subsequent weld beads. Some operators weld two low amperage rotations directly on top of each other to create a large shelf. This shelf supports the third and subsequent rows of much larger beads. Step adjustments are required to provide the desired results.

In any case, step has a marked effect on graping. A step that is too great or too little reduces the required support for the molten puddle.

During most BoreWelder buildup operations in the vertical axis, graping should not be experienced within the current limits of the BW3000. If graping is experienced during the buildup operation, the weld current may be too high or the travel speed too slow. Again, it’s possible for graping to occur if the step is too great or too little. In these cases, the bead will be unsupported and its surface tension will no longer hold it in place.

5.3.2 Mechanical/electrical troubleshooting**5.3.2.1 Machine does not step**

The default setting on power up is step enabled. Step can be turned on and off by pressing the Function + Retract on the control box.

The STEP switch inside the BoreWelder head unit may not be working properly. To check it, hold Rotate To Step and wait for the spindle to rotate and stop at the step point. As an alternate means of checking the switch, separate the BoreWelder from the control system.

Consult the schematic and test the ohms across the pins relevant for the Step switch.

At the same time, rotate the BoreWelder spindle by hand until the step switch drops into the step detent. The meter should read continuity at this point. If not, remove the blue shroud and check the switch directly. The wiring or switch may be at fault.

Check the control cable for continuity.

Check that the Retract and Extend buttons move the quill. If not, see Section 5.3.2.2.

5.3.2.2 Machine cannot be retracted or extended

Do the following if the machine cannot be retracted or extended:

1. Check for a motor failure. If you can hear the motor operate when you press either the Retract or Extend button, skip to step 3.

TIP:

There should be continuity (through the motor armature). If there is no continuity, a light tap on the side of the motor may restore operation. If the light tap works, contact CLIMAX for a new style of motor brush. Or give the brush springs a slight kink to ensure electrical contact when at rest.

2. Check the cable for continuity.
3. Check whether the worm roll pin is sheared. If the motor operates but the quill does not move, it's likely that the roll pin is sheared or the gear train is otherwise damaged.

5.3.2.3 Machine does not rotate

First, verify motor continuity by checking BoreWelder receptacle pins (25–35 ohms). Check the schematic in Appendix B.

Then check the cable for continuity

If you still have a problem, contact CLIMAX.

5.3.2.4 Wirefeeder does not feed wire

First, check the motor for continuity (20 ohms) (check the schematic in Appendix B).

Then check the cable for continuity (check the schematic in Appendix B).

If you still have a problem, contact CLIMAX.

5.3.2.5 Nothing happens when the WELD button is pressed

First, check if the machine is completely retracted. Press Extend to move the quill off its limit, and try again.

Then check the AC power inlet fuse.

5.3.2.6 Machine rotates, steps, and feeds wire out but does not weld

Check the continuity of the power supply control cable (check the schematic in Appendix B).

Check the positive and negative ground leads for proper connection.

5.3.2.7 No voltage control

Check the continuity of the power supply control cable (check the schematic in Appendix B).

Check the positive and negative ground leads for proper connection.

5.3.2.8 No arc, no wire feed, but rotates at full speed

Check that the Auto Skip switch is horizontally aligned to cams (that is, the switch roller contacts both cams).

Check that the Auto Skip switch is radially engaging the cams properly (that is, the switch roller is actuated by the high spot on the cams).

5.3.2.9 No arc, no wire feed, but rotates at dial speed

Check that the control is not in Pie Mode or Carriage Return.

5.3.3 GFCI and mains power quality issues

Some GFCI protective devices trip at less than the 4 mA to 6 mA specification for Type A GFCI.

The Model 170 BoreWelder controllers (P/N 98040, 98041) have been tested and found to average between 2.0 and 2.4 mA leakage current. A properly functioning GCFI device should not trip when the Model 170 controller is plugged in to it.

TIP:

If nuisance tripping of the GFCI occurs, the best remedy is to replace the GFCI protective device. If replacing the GFCI is not possible, then an alternative is to make use of a 500VA Isolation transformer such as the Hammond 171E, Hammond 178DT, Tripp-Lite IS500, or a similar device.

NOTICE

Some portable welder/generators produce poor 120V utility quality power that may interfere with normal operations of the Model 170 BoreWelder controller.

The BW3000 Model 170 controllers have been CE certified and tested according to EN 61326 for immunity to electrostatic discharge, electrical fast transients (voltage spikes), conducted and radiated EMI/RFI interference, voltage surge, power flicker, magnetic field immunity, and voltage interruption.

NOTICE

Even though these controllers have been designed to perform well in a heavy industrial environment, some portable welders with insufficient power quality on the 120V utility outlets may experience some disruptions to normal operation of the BoreWelder.

The isolation transformers listed in the above tip will likely resolve most power quality problems.

Power line conditioners may resolve the problem, but they can contribute to leakage current and may exacerbate difficulty with a weak GFCI.

A weak GFCI may trip prematurely from the UPS as well.

6 STORAGE AND SHIPPING

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6.1 STORAGE

Proper storage of the BW3000 AutoBoreWelder will extend its usefulness and prevent undue damage.

6.1.1 Short-term storage

Before storing, do the following:

1. Clean the machine.
2. Set the quill stroke so the top of the blue shroud is level with the top of the step motor.
3. Store the BW3000 in the original shipping container.

Store the BW3000 AutoBoreWelder in its original shipping container.



FIGURE 6-1. PACKAGING ARRANGEMENT

6.1.2 Long-term storage

Do the following for long-term storage (longer than three months):

1. Follow the short-term storage instructions.

-
2. Add a desiccant pouch to the shipping container. Replace according to manufacturer instructions.
 3. Store the shipping container in an environment out of direct sunlight with temperature < 70°F (21°C) and humidity < 50%.

6.2 SHIPPING

The BW3000 AutoBoreWelder can be shipped in its original shipping container.

6.3 DECOMMISSIONING

Dispose of the machine components according to local scrap standards and regulations. See Appendix A for component assembly information.

APPENDIX A ASSEMBLY DRAWINGS

Drawing list

NOTICE

Figure A-1 through Figure A-4 apply to Bore Welder machines with the serial number 22001030 and later. Refer to Figure A-5 through Figure A-8 for Bore Welders earlier than the 22001030 serial number.

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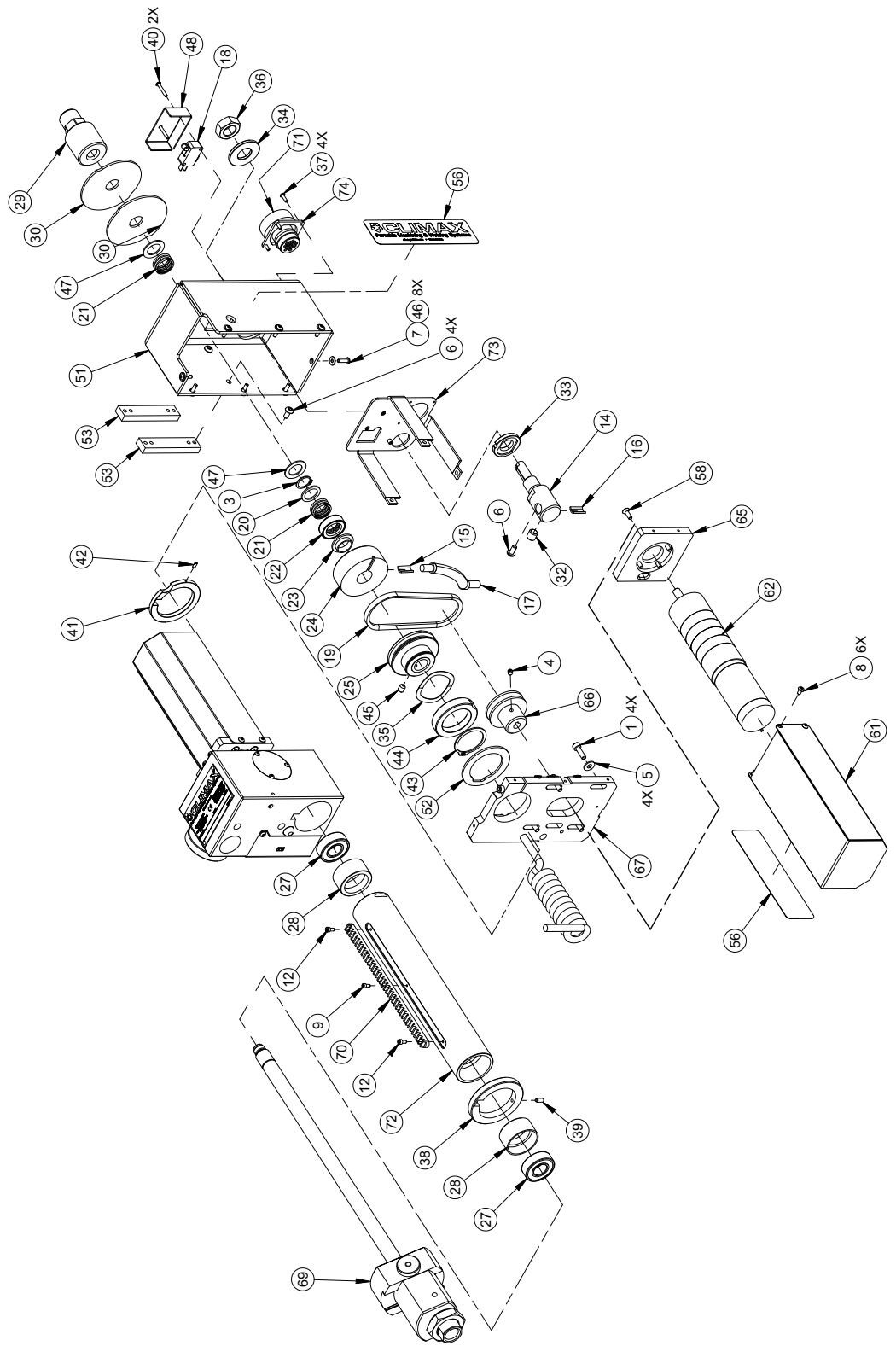
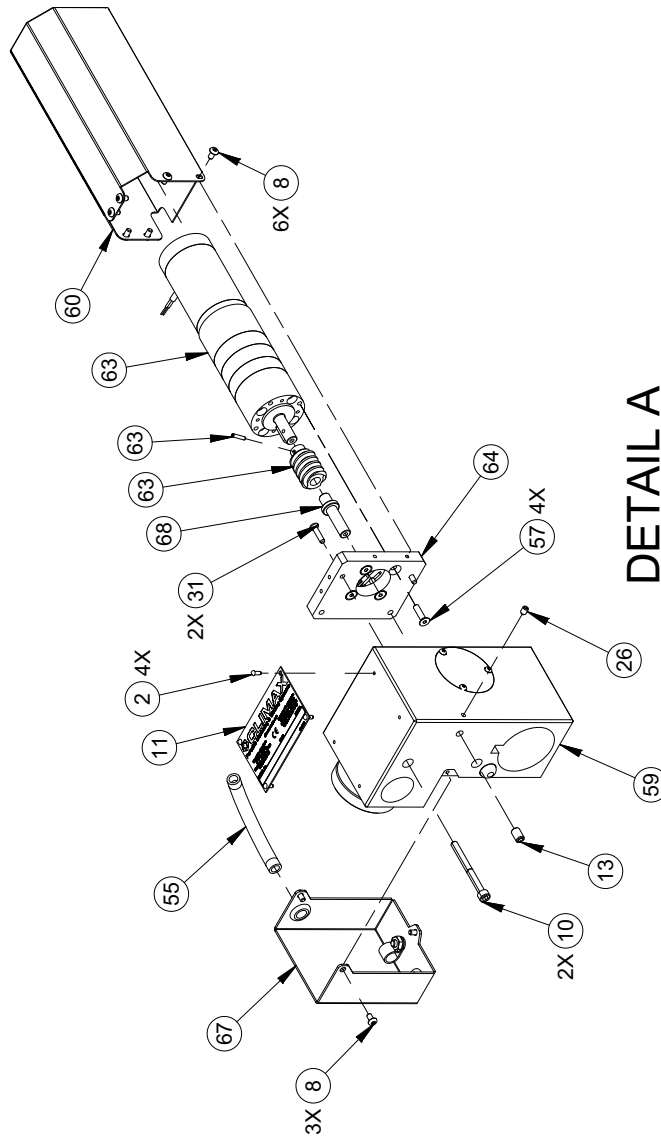


FIGURE A-1. BW3000 ASSEMBLY (P/N 103159)



DETAIL A

AVAILABLE CONFIGURATIONS									
PART NO.	DESCRIPTION	ITEM 69 P/N	ITEM 70 P/N	ITEM 71 P/N	ITEM 72 P/N	ITEM 73 P/N	ITEM 74 P/N		
103160	HEAD WELDING BW3000 6 INCH AUTO SKIP P/P READY PLASTIC CONNECTORS (MMP)	54273	72529	33988	67221	62507	62508		
103161	HEAD WELDING BW3000 6 INCH AUTO SKIP P/P READY METAL CONNECTORS (MMP)	54273	72529	58483	67221	62506	N/A		
103162	HEAD WELDING BW3000 12 INCH AUTO SKIP P/P READY PLASTIC CONNECTORS (MMP)	62468	72530	33988	67224	62507	62508		
103163	HEAD WELDING BW3000 12 INCH AUTO SKIP P/P READY METAL CONNECTORS (MMP)	62468	72530	58483	67224	62506	N/A		

FIGURE A-2. BW3000 ASSEMBLY DETAIL A (P/N 103159)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10157	SCREW 10-32 X 5/8 SHCS
2	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
3	1	11019	RING SNAP 5/8 OD X .035 THICK
4	1	11256	SCREW 10-24-UNC-2B X 1/4 SSSCP
5	4	11315	WASHER #10 FLTW BLACK OXIDE
6	5	11678	SCREW 10-32 X 3/8 BHSCS
7	8	11686	SCREW 6-32 X 1/2 BHSCS
8	15	12599	SCREW 6-32 X 1/4 BHSCS
9	1	12620	SHCS 4-40 X 1/4
10	2	14779	SCREW 10-32 X 2 SHCS
11	1	29154	PLATE SERIAL YEAR MODEL CE 2.0 X 3.0
12	2	30828	SCREW 5-40 X 1/4 SHCS
13	1	30901	SCREW 1/4-28 X 3/8 SSSFP
14	1	32947	CONNECTOR POWER QUICK COUPLE
15	1	36811	INSERT WELDING CABLE SHORT
16	1	36812	INSERT WELDING CABLE CLAMP
17	4.5"	36813	CABLE #2 AWG FLEX-A-PRENE BLACK
18	1	37407	SWITCH STEP LIMIT
19	1	40179	BELT V SPINDLE DRIVE GOODYEAR
20	1	40476	WASHER SHIM .625 ID .875 OD .062 THK STEEL
21	2	40477	SPRING COMP .845 OD X .067 WIRE X .875
22	1	40478	BRG THRUST
23	1	40479	BUSHING INSULATOR POWER COUPLING
24	1	40480	COUPLING POWER UPPER
25	1	40482	PULLEY POWER COUPLING
26	1	40572	SCREW 8-32 X 3/16 SSSDP BRONZE TIP
27	2	40575	BEARING QUILL
28	2	40576	BUSHING INSULATOR QUILL
29	1	42015	SWIVEL ASSEMBLY CONDUIT CONNECTOR
30	2	43874	CAM INTERRUPT
31	2	44459	SCREW 6-32 X 5/8 FHSCS
32	2	48846	SCREW 3/8-16 X 3/8 SSSCP
33	1	57844	BUSHING INSULATOR LOWER POWER CONNECTOR SUBFRAME
34	1	57845	BUSHING INSULATOR POWER COUPLER
35	1	57846	WASHER SPRING WAVE 1.404 ID X 1.819 OD
36	1	57847	NUT JAMN 5/8-18 X 3/8 THICK
37	4	58482	SCREW 4-40 X 3/8 BHSCS
38	1	62463	COLLAR QUILL LOWER AUTO SHUTOFF MODEL Z

FIGURE A-3. BW3000 ASSEMBLY PARTS LIST 1 (P/N 103159)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
39	1	62464	SCREW 8-32 X 3/8 SSSDP NYLON TIP
40	2	62487	SCREW 4-40 X 3/4 BHSCS
41	1	62490	COLLAR UPPER AUTO OFF MODEL Z
42	1	62491	SCREW 4-40 X 1/4 SSSDP NYLON TIP
43	1	62498	RING SNAP 1-3/8 ID X .05 TH BLACK FINISH
44	1	62499	COLLAR STEP ADJUSTABLE POWER COUPLING
45	1	62500	SCREW 1/4-28 X 5/16 SSSCP
46	8	62502	WASHER #6 BLACK OXIDE
47	2	62504	WASHER SHIM .625 ID 1.000 OD .048 THICK STEEL
48	1	62509	COVER SWITCH AUTO SKIP MODEL Z
49	2	67048	(NOT SHOWN) TERMINAL QUICK DISCONNECT DBL CRIMP MALE 22-18 AWG .250 X .032 RED
50	2	67050	(NOT SHOWN) CONNECTOR SOCKET DBL CRIMP 22-18 AWG .250 X .032 RED
51	1	67077	SHROUD PUSH PULL MODEL Z CLIMAX
52	1	67168	WASHER ISOLATING POWER COUPLING
53	2	67201	SPACER MOUNT PULL FEEDER
54	1	67313	(NOT SHOWN) WELD SAMPLE 2.750 ID X 3.500 OD X 2.000 (KB)
55	4"	69968	TUBING 1/4 ID 3/8 OD PVC BLACK
56	2	70226	LABEL CLIMAX LOGO 1.5 X 5.5
57	4	82918	SCREW M4 X 0.7 X 16MM FHSCS ZINC
58	4	82934	SCREW M4 X 0.7 X 12MM FHSCS ZINC
59	1	84532	POSITIONER QUILL ASSY BW3000
60	1	103117	SHROUD MOTOR STEP (MMP)
61	1	103140	SHROUD MOTOR DRIVE (MMP)
62	1	103142	GEARMOTOR 90 VDC 6.6 RPM 189 IN-LBS TORQUE 776.76:1
63	1	103144	ASSY MOTOR MODIFIED STEP GEAR BW3000WORM 16DP DOUBLE RH 1.0 14.5PA STEEL MODIFIED TO .3175 BORE (MMP)
64	1	103145	PLATE ADAPTER MOTOR STEP (MMP)
65	1	103146	PLATE ADAPTER MOTOR DRIVE (MMP)
66	1	103147	PULLEY ROTATION MOTOR (MMP)
67	1	103154	TOP PLATE ASSY BW3000 (MMP)
68	1	103209	GUIDE WORM AND THRUST PIN (MMP)
69	1	SEE CHART	SPINDLE OFFSET HEAD ASSEMBLY 6 INCH STROKE
70	1	SEE CHART	RACK QUILL 6 IN STROKE
71	1	SEE CHART	CONNECTOR RECEPTACLE 22-16 NICKEL PLATED
72	1	SEE CHART	QUILL 6 IN STROKE
73	1	SEE CHART	BRACKET COVER SUB FRAME METAL CONNECTORS
74	1	SEE CHART	BEZEL BW3000

FIGURE A-4. BW3000 ASSEMBLY PARTS LIST 2 (P/N 103159)

NOTICE

Refer to Figure A-5 through Figure A-8 for Bore Welders with the serial number 22001029 and earlier. Figure A-1 through Figure A-4 apply to Bore Welder machines with the serial number 22001030 and later.

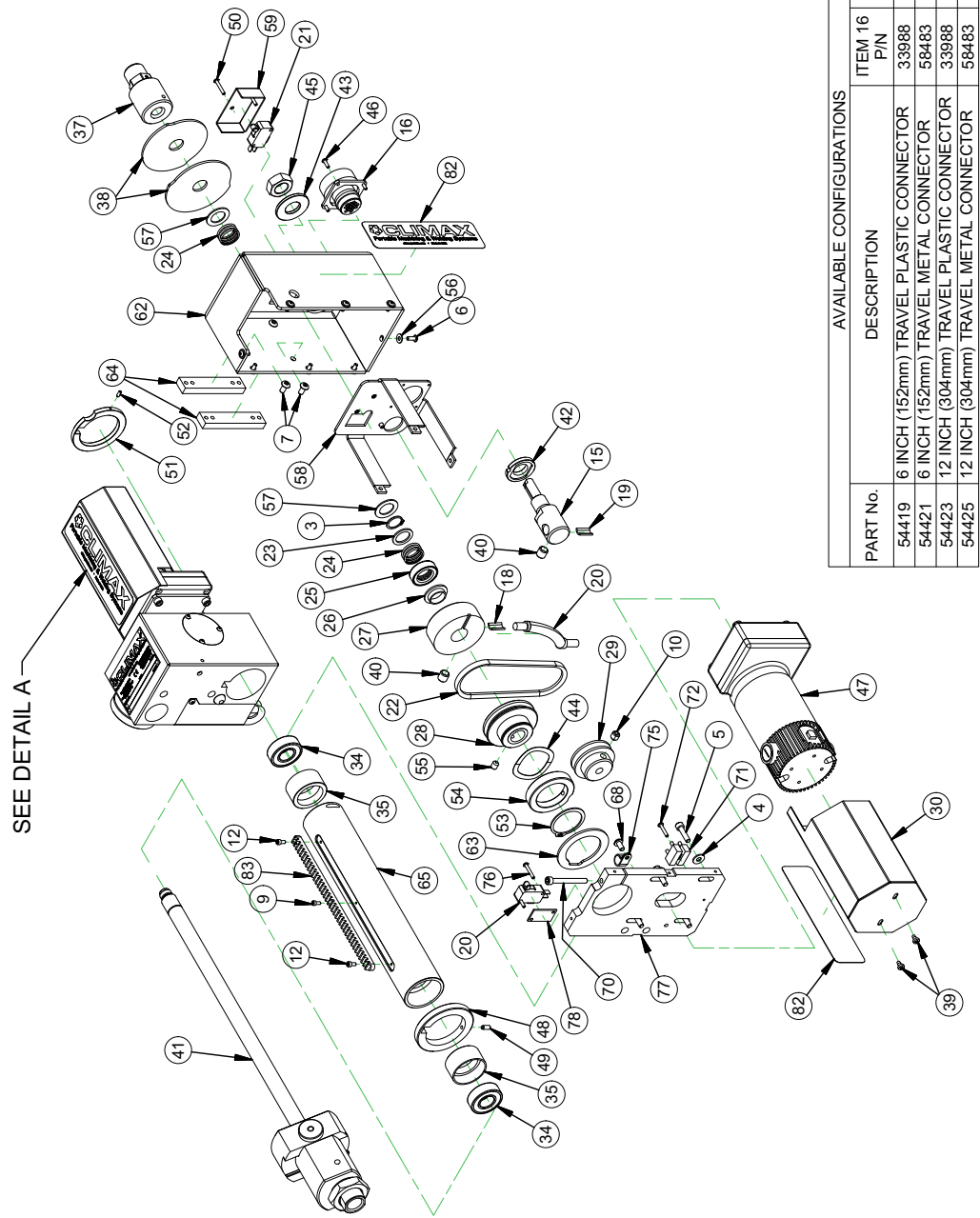
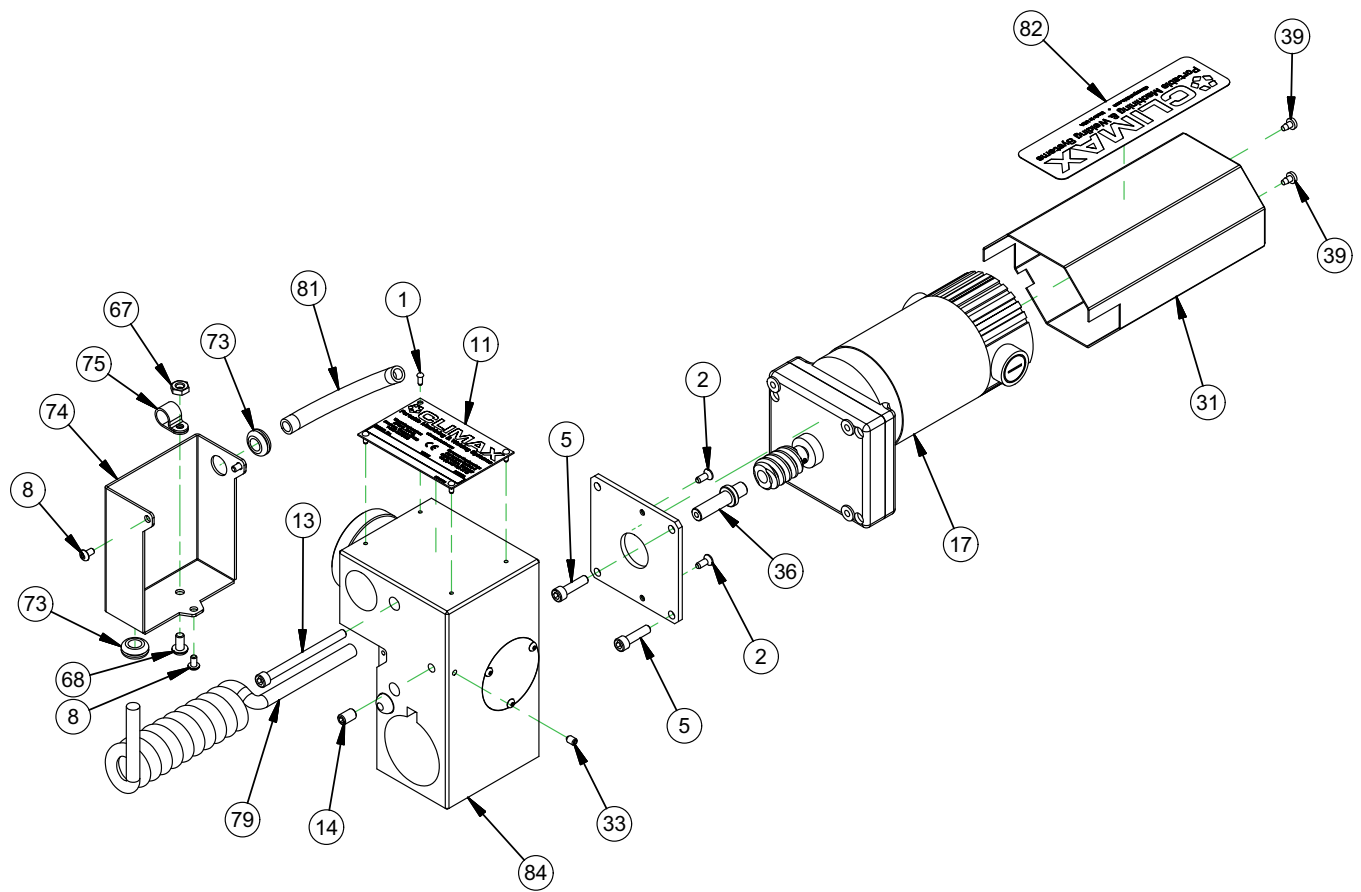


FIGURE A-5. BW3000 ASSEMBLY (P/N 85576)



DETAIL A

FIGURE A-6. BW3000 ASSEMBLY DETAIL A (P/N 85576)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
2	2	10844	SCREW 6-32 X 3/8 FHSCS
3	1	11019	RING SNAP 5/8 OD X .035 THICK
4	4	11315	WASHER #10 FLTW BLACK OXIDE
5	6	11676	SCREW 10-32 X 3/4 SHCS
6	8	11677	SCREW 6-32 X 3/8 BHSCS
7	4	11678	SCREW 10-32 X 3/8 BHSCS
8	3	12599	SCREW 6-32 X 1/4 BHSCS
9	1	12620	SHCS 4-40 X 1/4
10	1	27895	SCREW 5/16-18 X 5/16 SSSFP
11	1	29154	PLATE SERIAL YEAR MODEL CE 2.0 X 3.0
12	2	30828	SCREW 5-40 X 1/4 SHCS
13	2	30889	SCREW 10-32 X 2-1/2 SHCS
14	1	30901	SCREW 1/4-28 X 3/8 SSSFP
15	1	32947	CONNECTOR POWER QUICK COUPLE
16	1	33988	RECEPTACLE 16 PIN PLASTIC FLANGE
		58483	CONNECTOR RECEPTACLE 22-16 NICKEL PLATED
17	1	36627	MOTOR MODIFIED STEP GEAR
18	1	36811	INSERT WELDING CABLE SHORT
19	1	36812	INSERT WELDING CABLE CLAMP
20	1	36813	CABLE #2 AWG FLEX-A-PRENE BLACK
21	2	37407	SWITCH STEP LIMIT
22	1	40179	BELT V SPINDLE DRIVE GOODYEAR
23	1	40476	WASHER SHIM .625 ID .875 OD .062 THK STEEL
24	2	40477	SPRING COMP .845 OD X .067 WIRE X .875
25	1	40478	BRG THRUST
26	1	40479	BUSHING INSULATOR POWER COUPLING
27	1	40480	COUPLING POWER UPPER
28	1	40482	PULLEY POWER COUPLING
29	1	40558	PULLEY ROTATION MOTOR STD
30	1	40565	SHROUD MOTOR ROTATION
31	1	40566	SHROUD STEP MOTOR
32	1	40571	PLATE MOTOR ADAPTER
33	1	40572	SCREW 8-32 X 3/16 SSSDP BRONZE TIP
34	2	40575	BEARING QUILL
35	2	40576	BUSHING INSULATOR QUILL
36	1	40592	GUIDE WORM AND THRUST PIN
37	1	42015	SWIVEL ASSEMBLY CONDUIT CONNECTOR
38	2	43874	CAM INTERRUPT
39	4	48582	SCREW 6-32 X 1/4 PPHSTS SELF TAPPING BLACK OXIDE
40	2	48846	SCREW 3/8-16 X 3/8 SSSCP
41	1	54273	SPINDLE OFFSET HEAD ASSEMBLY 6 INCH STROKE
		62468	SPINDLE OFFSET HEAD ASSEMBLY 12 INCH STROKE
42	1	57844	BUSHING INSULATOR LOWER POWER CONNECTOR SUBFRAME
43	1	57845	BUSHING INSULATOR POWER COUPLER

FIGURE A-7. BW3000 ASSEMBLY PARTS LIST 1 (P/N 85576)

ITEM	QTY	P/N:	DESCRIPTION
44	1	57846	WASHER SPRING WAVE 1.404 ID X 1.819 OD
45	1	57847	NUT JAMN 5/8-18 X 3/8 THICK
46	4	58482	SCREW 4-40 X 3/8 BHSCS
16	1	33988 58483	RECEPTACLE 16 PIN PLASTIC FLANGE CONNECTOR RECEPTACLE 22-16 NICKEL PLATED
47	1	61210	GEARMOTOR PAINTED BW3000 90 VDC 7 RPM TENV
48	1	62463	COLLAR QUILL LOWER AUTO SHUTOFF MODEL Z
49	1	62464	SCREW 8-32 X 3/8 SSSDP NYLON TIP
50	2	62487	SCREW 4-40 X 3/4 BHSCS
51	1	62490	COLLAR UPPER AUTO OFF MODEL Z
52	1	62491	SCREW 4-40 X 1/4 SSSDP NYLON TIP
53	1	62498	RING SNAP 1-3/8 ID X .05 TH BLACK FINISH
54	1	62499	COLLAR STEP ADJUSTABLE POWER COUPLING
55	1	62500	SCREW 1/4-28 X 5/16 SSSCP
56	8	62502	WASHER #6 BLACK OXIDE
57	2	62504	WASHER SHIM .625 ID 1.000 OD .048 THICK STEEL
58	1	62506	BRACKET COVER SUB FRAME METAL CONNECTORS
59	1	62509	COVER SWITCH AUTO SKIP MODEL Z
60	2	67048	(NOT SHOWN) TERMINAL QUICK DISCONNECT DBL CRIMP MALE 22-18 AWG .250 X .032 RED
61	2	67050	(NOT SHOWN) CONNECTOR SOCKET DBL CRIMP 22-18 AWG .250 X .032 RED
62	1	67077	SHROUD PUSH PULL MODEL Z CLIMAX
63	1	67168	WASHER ISOLATING POWER COUPLING
64	2	67201	SPACER MOUNT PULL FEEDER
65	1	67221 67224	QUILL 6 IN STROKE QUILL 12 IN STROKE
66	1	68385	TOP PLATE ASSY BW3000
67	1	10837	NUT 10-32 STDN ZINC PLATED
68	2	11678	SCREW 10-32 X 3/8 BHSCS
69	1	13243	(NOT SHOWN) WIRE TIE MEDIUM .14 X 8
70	1	13863	SCREW 10-32 X 1-3/4 SHCS
71	1	40180	TERMINAL BLOCK EURO 2-POS 22-14AWG
72	1	40559	SCREW 4-40 X 5/8 SPHMS
73	2	40588	GROMMET 5/8 OD 5/16 ID
74	1	62484	COVER ELECTRICAL QUILL POSITIONER
75	2	62485	CLAMP 1/4 CABLE PLASTIC LOOP
76	2	62487	SCREW 4-40 X 3/4 BHSCS
77	1	62492	PLATE MOTOR MOUNT STEP MODEL P MODEL Z
78	1	68988	SHIM STEP LIMIT
79	1	70182	COIL CORD HARNESS
80	1	70183	(NOT SHOWN) KIT WIRE DISCRETE BW3000
81	4"	69968	TUBING 1/4 ID 3/8 OD PVC BLACK
82	3	70226	LABEL CLIMAX LOGO 1.5 X 5.5
83	1	72529 72530	RACK QUILL 6 IN STROKE RACK QUILL 12 IN STROKE
84	1	84532	POSITIONER QUILL ASSY BW3000

FIGURE A-8. BW3000 ASSEMBLY PARTS LIST 2 (P/N 85576)

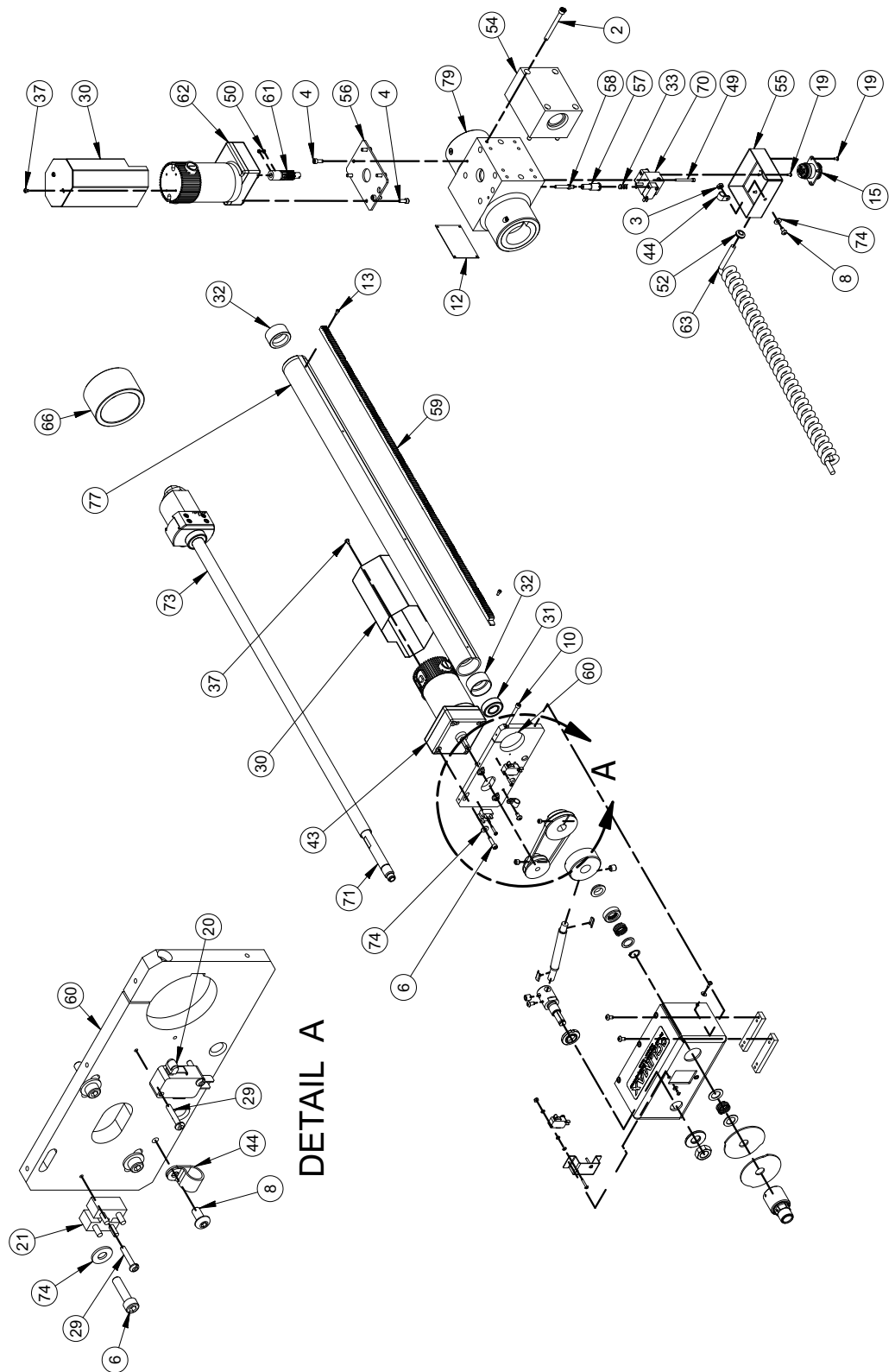


FIGURE A-9. WELDING HEAD (CUSTOM PRODUCT ONLY) ASSEMBLY 1 (P/N 91808)

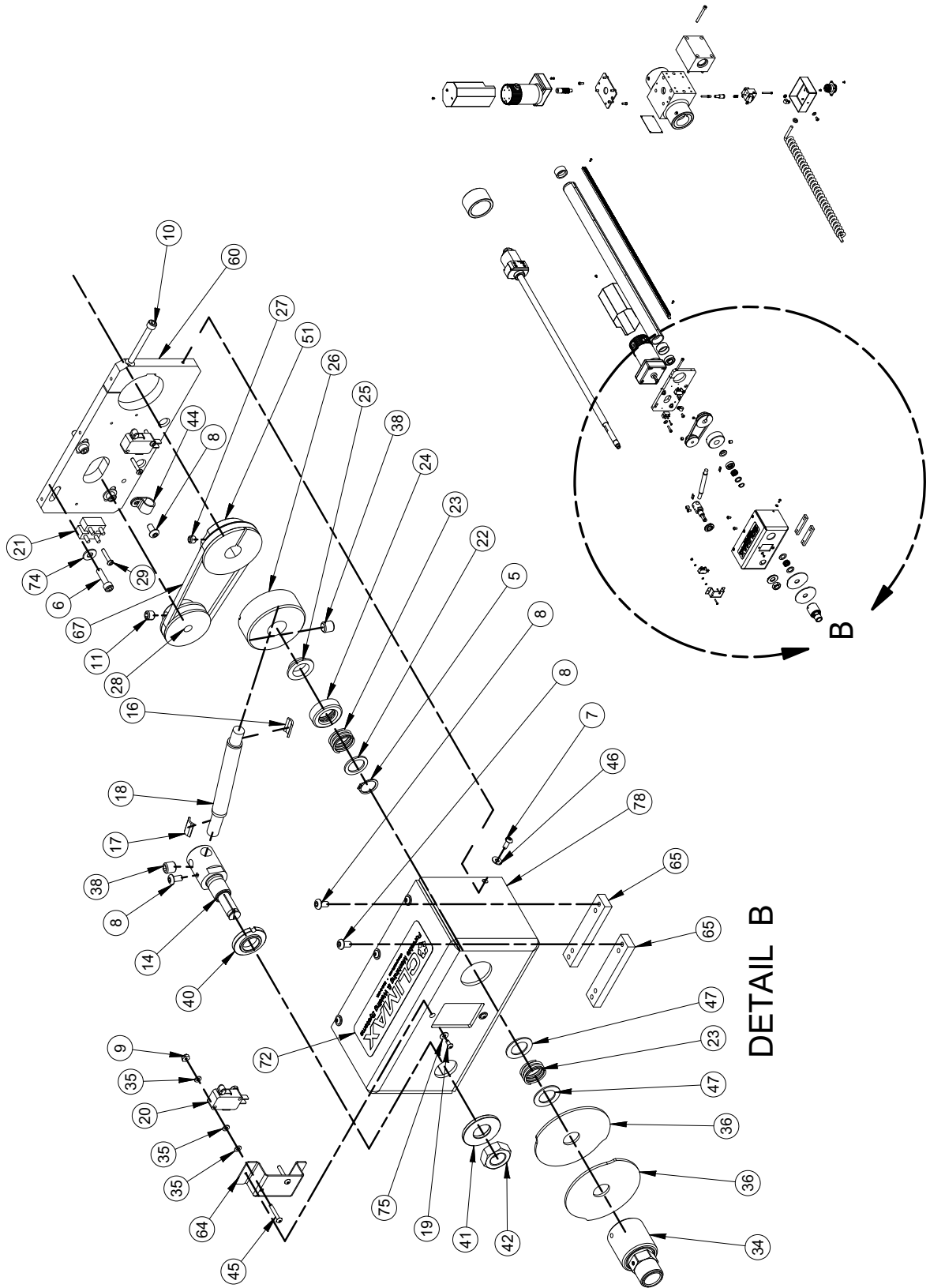


FIGURE A-10. WELDING HEAD ASSEMBLY 2 (P/N 91808)

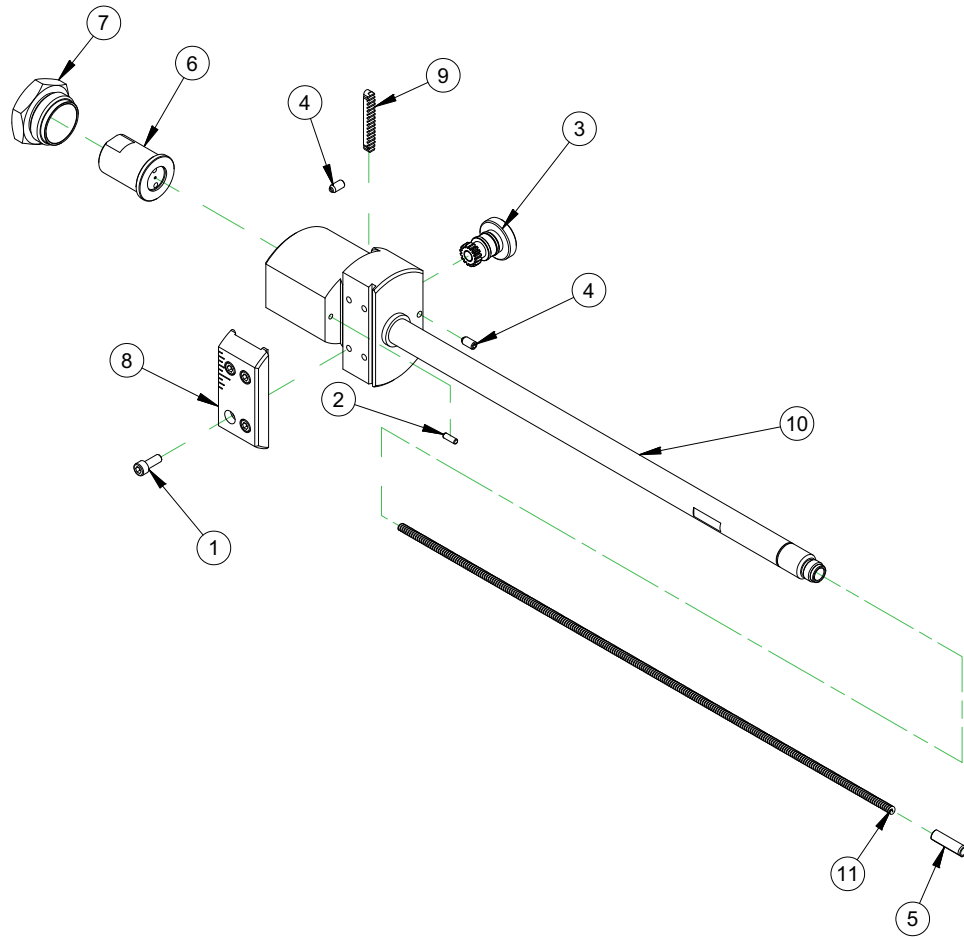
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
2	4	10701	SCREW 1/4-20 X 2 1/2 SHCS
3	1	10837	NUT 10-32 STDN ZINC PLATED
4	6	10877	SCREW 10-32 X 1/2 SHCS
5	1	11019	RING SNAP 5/8 OD X .035 THICK
6	4	11676	SCREW 10-32 X 3/4 SHCS
7	8	11677	SCREW 6-32 X 3/8 BHSCS
8	7	11678	SCREW 10-32 X 3/8 BHSCS
9	2	12442	NUT 4-40 STDN ZINC PLATED
10	1	13863	SCREW 10-32 X 1-3/4 SHCS
11	1	27895	SCREW 5/16-18 X 5/16 SSSFP
12	1	29154	PLATE SERIAL YEAR MODEL CE 2.0 X 3.0
13	SEE CHART	30828	SCREW 5-40 X 1/4 SHCS
14	1	32947	CONNECTOR POWER QUICK COUPLE
15	1	33988	RECEPTACLE 16 PIN PLASTIC FLANGE
16	1	36811	INSERT WELDING CABLE SHORT
17	1	36812	INSERT WELDING CABLE CLAMP
18	4.5	36813	CABLE #2 AWG FLEX-A-PRENE BLACK (INCH)
19	8	37397	SCREW 4-40 X 1/4 BHSCS
20	2	37407	SWITCH STEP LIMIT
21	1	40180	TERMINAL BLOCK EURO 2-POS 22-14AWG
22	1	40476	WASHER SHIM .625 ID .875 OD .062 THK STEEL
23	2	40477	SPRING COMP .845 OD X .067 WIRE X .875
24	1	40478	BRG THRUST
25	1	40479	BUSHING INSULATOR POWER COUPLING
26	1	40480	COUPLING POWER UPPER
27	1	40481	SCREW 1/4-20 X 1/4 SSSCP
28	1	40558	PULLEY ROTATION MOTOR STD
29	3	40559	SCREW 4-40 X 5/8 SPHMS
30	2	40565	SHROUD MOTOR ROTATION
31	1	40575	BEARING QUILL
32	2	40576	BUSHING INSULATOR QUILL
33	2	40583	SPRING COMP .30 OD X .022 WIRE X .625 LONG
34	1	42015	SWIVEL ASSEMBLY CONDUIT CONNECTOR
35	6	42846	WASHER #4 FLAT
36	2	43874	CAM INTERRUPT
37	4	48582	SCREW 6-32 X 1/4 PPHSTS SELF TAPPING BLACK OXIDE
38	2	48846	SCREW 3/8-16 X 3/8 SSSCP
39	7	53102	(NOT SHOWN) CONNECTOR PIN CRIMP CONTACT 24-20 AWG MULTIMATE
40	1	57844	BUSHING INSULATOR LOWER POWER CONNECTOR SUBFRAME
41	1	57845	BUSHING INSULATOR POWER COUPLER
42	1	57847	NUT JAMN 5/8-18 X 3/8 THICK
43	1	61210	GEARMOTOR PAINTED BW3000 90 VDC 7 RPM TENV
44	2	62485	CLAMP 1/4 CABLE PLASTIC LOOP
45	2	62487	SCREW 4-40 X 3/4 BHSCS

FIGURE A-11. WELDING HEAD ASSEMBLY PARTS LIST 1 (P/N 91808)

AVAILABLE CONFIGURATIONS						
PART NO.	DESCRIPTION	QUILL TUBE	QUILL HEAD	QUILL RACK	30828 QTY	70657 LENGTH
69279	HEAD WELDING BW3000 18 INCH AUTO SKIP P/P READY PLASTIC CONNECTORS	89686	69275	67118	4	27.06
69280	HEAD WELDING BW3000 24 INCH AUTO SKIP P/P READY PLASTIC CONNECTORS	89692	69276	67117	5	33.06
69270	HEAD WELDING BW3000 36 INCH AUTO SKIP P/P READY PLASTIC CONNECTORS	89713	69277	67116	6	45.06

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
46	8	62502	WASHER #6 BLACK OXIDE
47	2	62504	WASHER SHIM .625 ID 1.000 OD .048 THICK STEEL
48	1	66871	(NOT SHOWN) TERMINAL RING HIGH TEMP 22-18 AWG X #10HEAT-SHRINK RED
49	2	66948	SCREW 6-32 X 1-3/8 SHCS
50	2	66971	SCREW 10-32 X 3/16 SSSFP
51	1	66975	COUPLING POWER ROTATE MODEL P
52	1	67008	GROMMET 9/32 ID X 5/8 OD X 1/16 (FITS 7/16 DIA)
53	2	67028	(NOT SHOWN) CONNECTOR SPADE FEMALE DBL CRIMP 22-18 AWG .187 X .020 RED
54	1	67099	ADAPTER BLOCK MOUNTING
55	1	67110	COVER LIMITS
56	1	67111	PLATE STEP MOTOR
57	2	67114	GUIDE RACK FEELER
58	2	67115	FEELER RACK
60	1	67126	MOUNT MOTOR ROTATION
61	1	67157	PINION RADIAL FACING SLIDE
62	1	67190	GEARMOTOR PAINTED BW3000 90 VDC 11 RPM TENV
63	1	67195	CORD COIL LONG STROKE 18 IN / 24 IN / 30 IN / 36 IN
64	1	67197	BRACKET SWITCH INTERRUPT
65	2	67201	SPACER MOUNT PULL FEEDER
66	1	67313	WELD SAMPLE 2.750 ID X 3.500 OD X 2.000
67	1	67335	BELT V 2L140 14 IN OD
68	2	67403	(NOT SHOWN) TERMINAL SNAP-PLUG MALE 22-18AWG HEAT-SHRINK
69	2	67404	(NOT SHOWN) TERMINAL SNAP-PLUG FEMALE 22-18AWG HEAT-SHRINK
70	1	69015	BLOCK TRAVEL LIMIT SWITCH
72	1	70226	LABEL CLIMAX LOGO 1.5 X 5.5
73	SEE CHART	70657	TUBING HEAT SHRINK .75 ID CLEAR 2:1 SHRINK RATIO 50 FT SPOOL
74	5	72147	WASHER FLTW .220 ID X .500 OD MAX BLK OX
75	2	77983	WASHER #4 SS
76	1	89665	(NOT SHOWN) SCHEMATIC BW3000 BOREWELDER LONG STROKE
78	1	89731	TOP SHROUD BW3000
79	1	89755	HOUSING BODY MAIN QUILL POSITIONER
77	1	SEE CHART	QUILL TUBE
59	1	SEE CHART	QUILL RACK
71	1	SEE CHART	QUILL HEAD

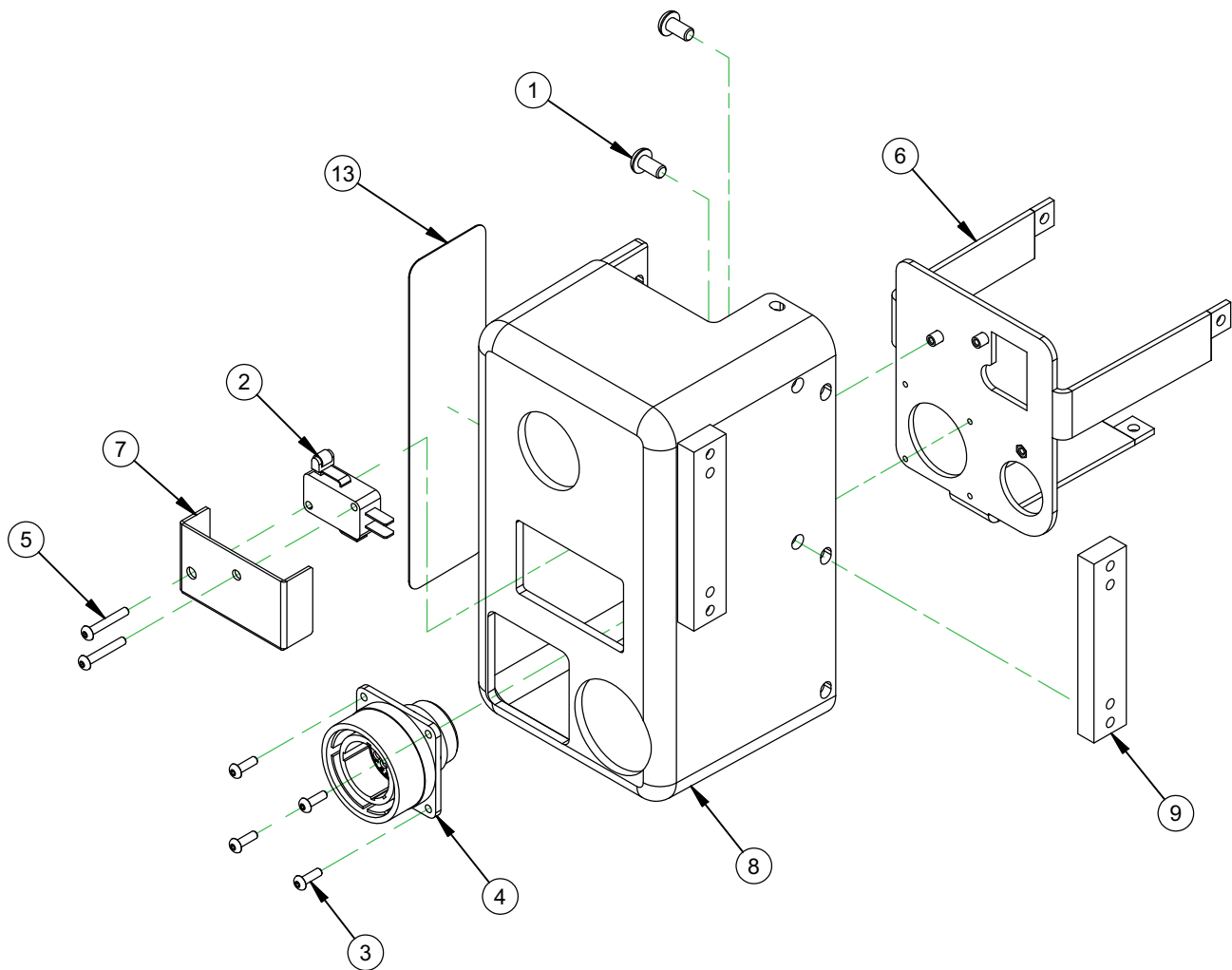
FIGURE A-12. WELDING HEAD ASSEMBLY PARTS LIST 2 (P/N 91808)



AVAILABLE CONFIGURATIONS			
PART NO.	DESCRIPTION	P/N 64162 LENGTH	ITEM 10 P/N
54273	SPINDLE OFFSET HEAD ASSEMBLY 6 INCH STROKE	17.0 in	62466
62468	SPINDLE OFFSET HEAD ASSEMBLY 12 INCH STROKE	22.5 in	62467

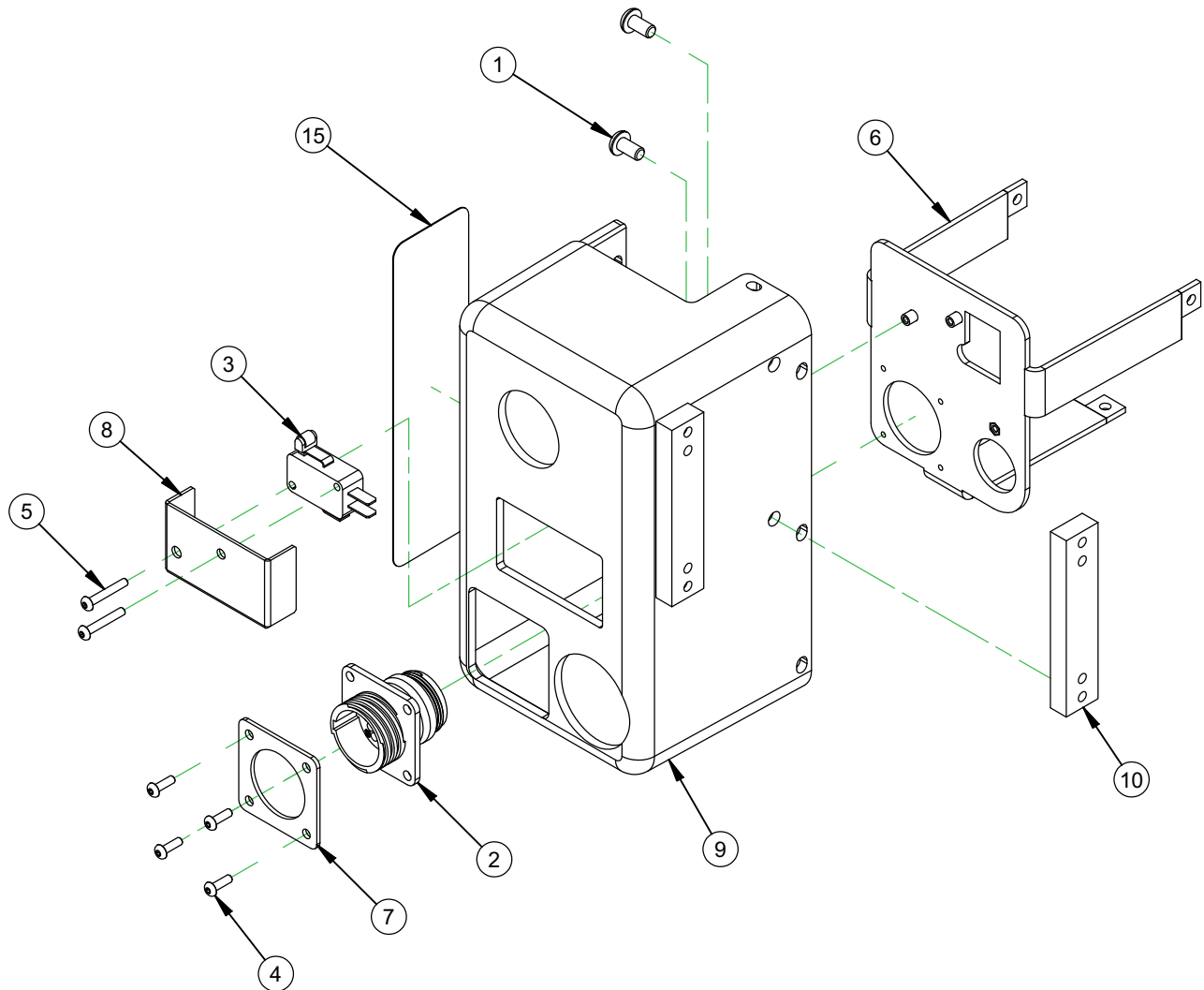
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10877	SCREW 10-32 X .5 SHCS
2	1	14248	PIN DOWEL HARDENED .125 X 3/8
3	1	31675	KNOB ASSEMBLY OFFSET HEAD
4	2	32012	SCREW 10-32 X 3/8 SSSCP
5	1	33955	FITTING CONDUIT SPINDLE
6	1	40283	FITTING TORCH ORIENTATION
7	1	40284	NUT TORCH ORIENTATION FITTING
8	1	40578	PLATE OFFSET HEAD SIDE
9	1	40579	RACK OFFSET HEAD
10	1	CHART	CHART SPINDLE OFFSET HEAD ASSEMBLY
11	CHART	67162	LINER BOREWELDER SPINDLE .065 ID X .188 OD

FIGURE A-13. OFFSET HEAD SPINDLE ASSEMBLY (P/N 83085)



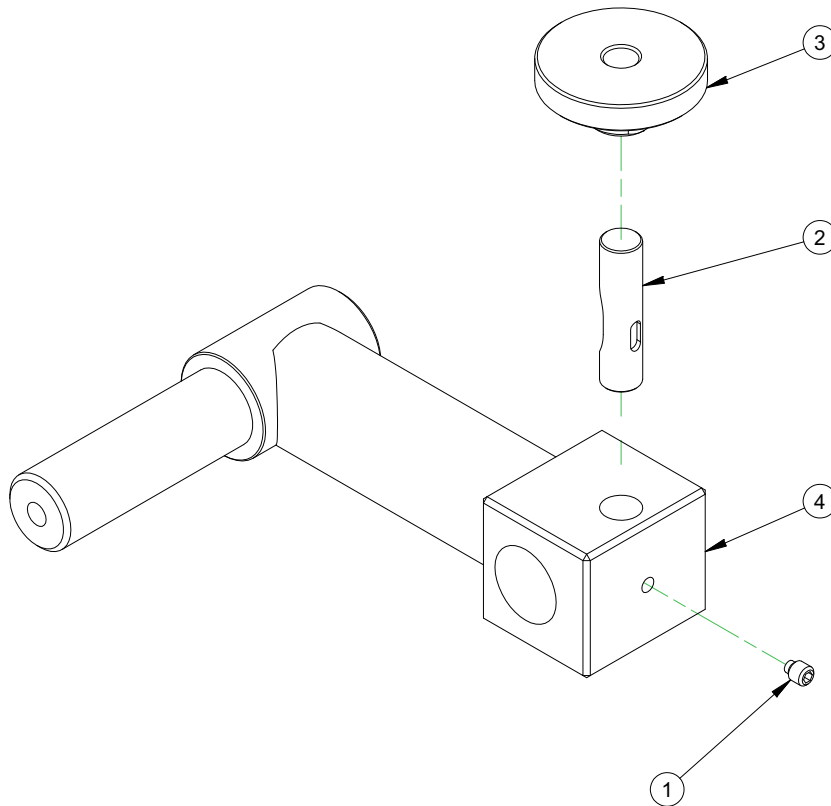
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	11678	SCREW 10-32 X 3/8 BHSCS
2	1	37407	SWITCH STEP LIMIT
3	4	58482	SCREW 4-40 X 3/8 BHSCS
4	1	58483	CONNECTOR RECEPTACLE 22-16 NICKEL PLATED
5	2	62487	SCREW 4-40 X 3/4 BHSCS
6	1	62506	BRACKET COVER SUB FRAME METAL CONNECTORS
7	1	62509	COVER SWITCH AUTO SKIP MODEL Z
8	1	67077	SHROUD AUTO SKIP PUSH PULL MODEL Z CLIMAX
9	2	67201	SPACER MOUNT PULL FEEDER
13	1	70226	LABEL CLIMAX LOGO 1.5 X 5.5

FIGURE A-14. SHROUD WITH METAL CONNECTOR ASSEMBLY (P/N 68374)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	11678	SCREW 10-32 X 3/8 BHSCS
2	1	33988	RECEPTACLE 16 PIN PLASTIC FLANGE
3	1	37407	SWITCH STEP LIMIT
4	4	58482	SCREW 4-40 X 3/8 BHSCS
5	2	62487	SCREW 4-40 X 3/4 BHSCS
6	1	62507	BRACKET COVER SUB FRAME PLASTIC CONNECTORS
7	1	62508	BEZEL BW3000
8	1	62509	COVER SWITCH AUTO SKIP MODEL Z
9	1	67077	SHROUD AUTO SKIP PUSH PULL MODEL Z CLIMAX
10	2	67201	SPACER MOUNT PULL FEEDER
15	1	70226	LABEL CLIMAX LOGO 1.5 X 5.5

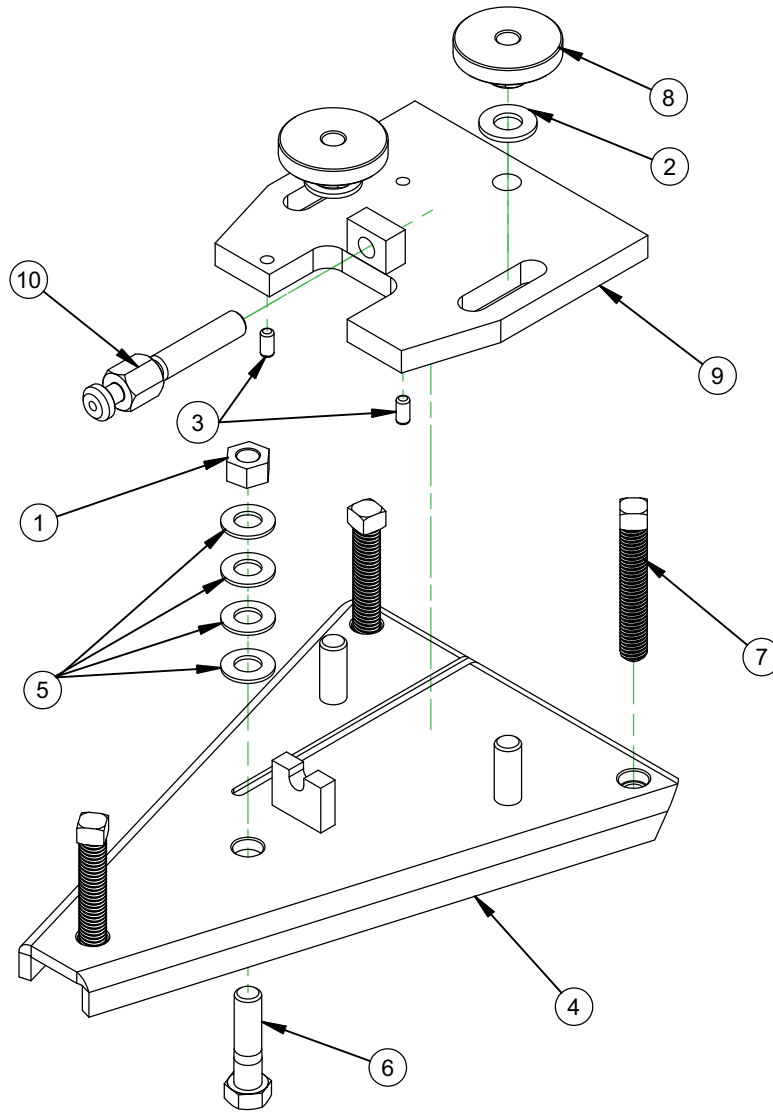
FIGURE A-15. SHROUD WITH PLASTIC CONNECTOR ASSEMBLY (P/N 68379)



AVAILABLE CONFIGURATIONS		
PART NO.	DESCRIPTION	ITEM 4 P/N
28208	MOUNT RADIAL 5 IN RADIUS (125 MM)	67227
35006	MOUNT RADIAL 10 IN RADIUS (250MM)	67287

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	15595	SCREW 1/4-20 X 1/4 SSSHDP
2	1	40586	CLAMP RADIAL MOUNT
3	1	40591	KNOB CLAMPING
4	1	CHART	BODY MOUNT RADIAL (SEE CHART)

FIGURE A-16. RADIAL MOUNT ASSEMBLY (P/N 83081)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10849	NUT 1/2-13 STDN
2	2	11779	WASHER 1/2 FLTW SAE
3	2	20166	PIN DOWEL 1/4 DIA X 1/2
4	1	35933	BASE ADJUSTABLE
5	4	37975	WASHER SPRING BELLEVILLE 1/2 ID X 1 OD X .073
6	1	39179	SCREW 1/2-13 X 2 HHHCS GRADE 8
7	3	39461	SCREW 1/2-13 X 3 SQHSSCP
8	2	40591	KNOB CLAMPING
9	1	66972	SLIDER BASE ADJUST
10	1	66973	SCREW ADJUSTMENT

FIGURE A-17. ADJUSTABLE BASE ASSEMBLY (P/N 29037)

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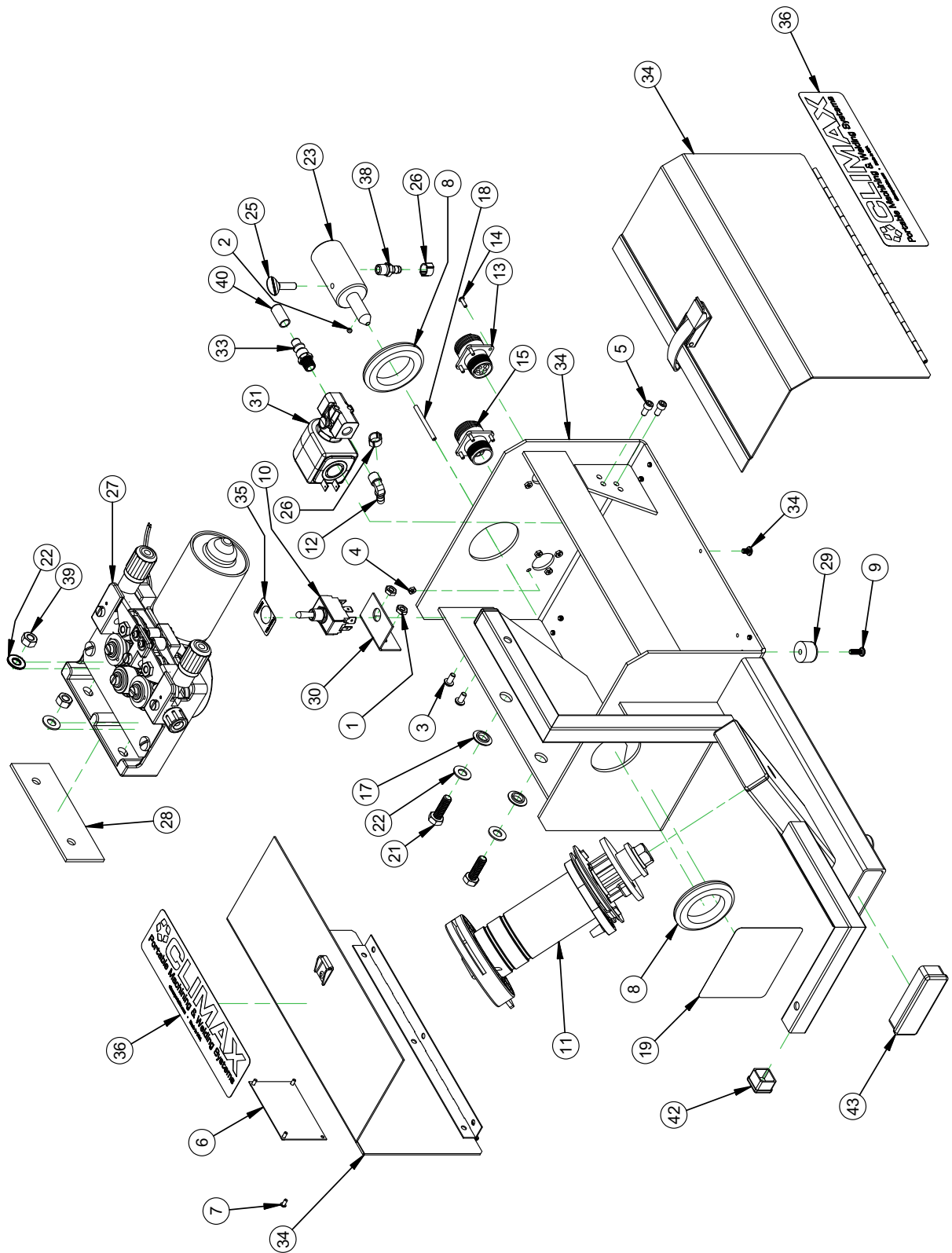
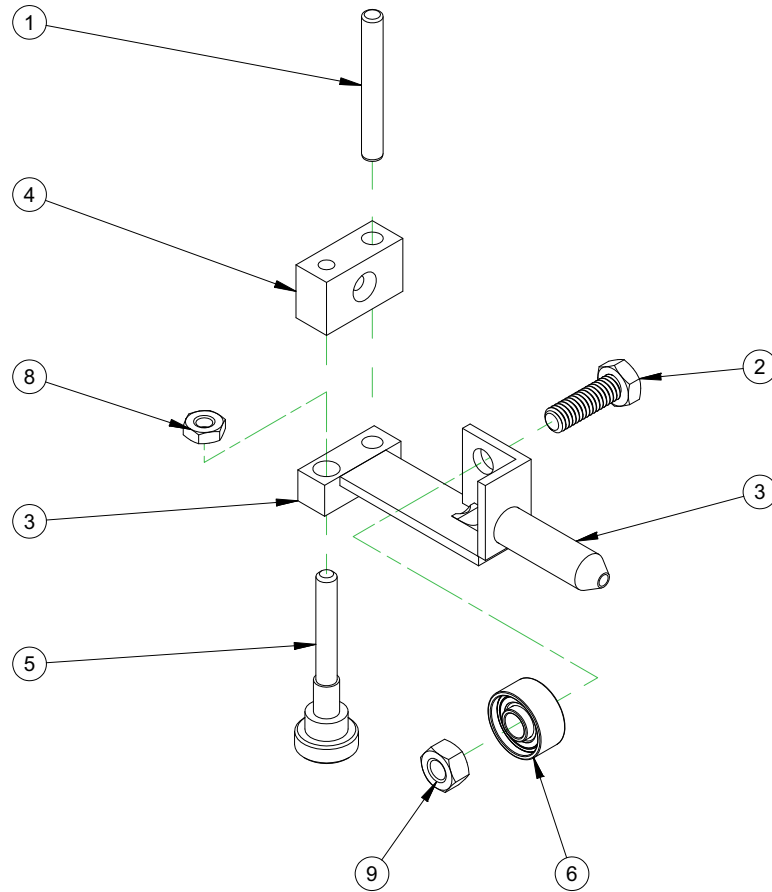


FIGURE A-18. SHOP-STYLE WIREFEEDER ASSEMBLY (P/N 82207)

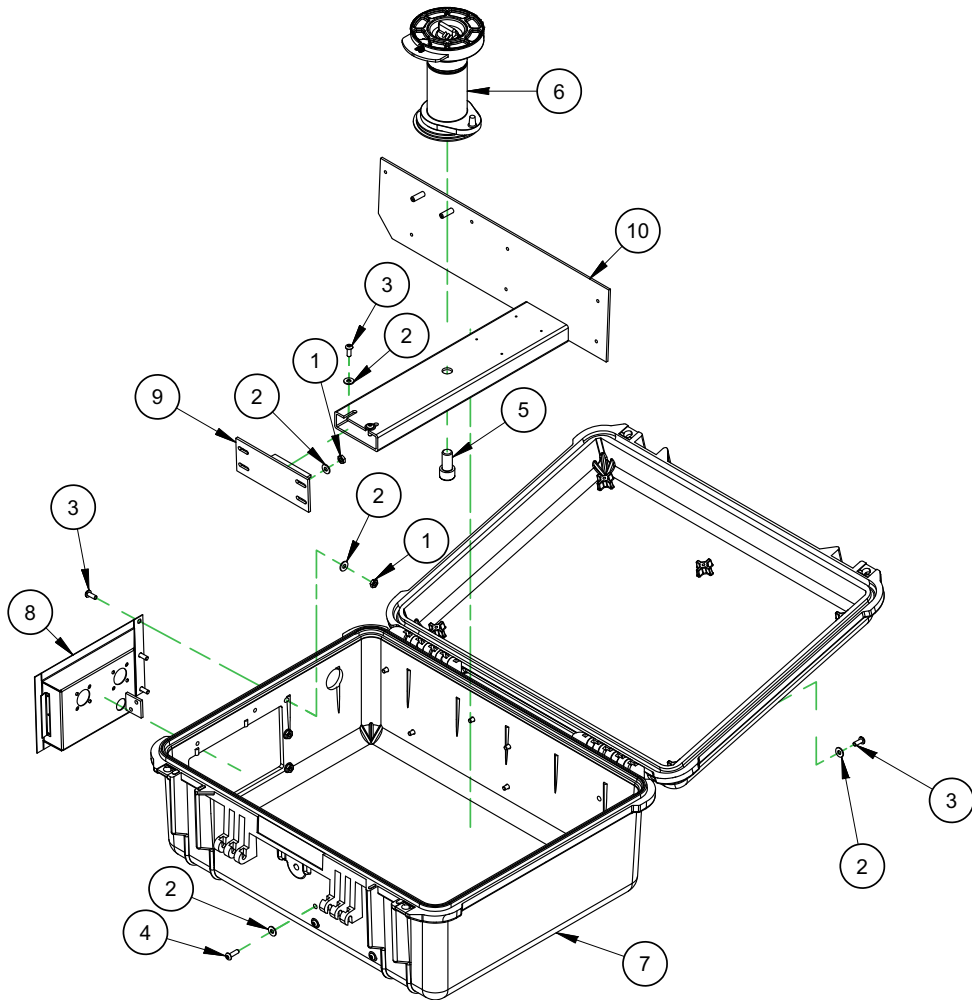
ITEM	QTY	P/N:	DESCRIPTION
1	2	10837	NUT 10-32 STDN ZINC PLATED
2	1	11058	SCREW 8-32 X 1/8 SSSCP
3	2	11678	SCREW 10-32 X 3/8 BHSCS
4	8	12442	NUT 4-40 STDN ZINC PLATED
5	2	19232	SCREW 10-24 X 3/8 SHCS
6	1	29154	PLATE SERIAL YEAR MODEL CE 2.0 X 3.0
7	4	37397	SCREW 4-40 X 1/4 BHSCS
8	2	40494	GROMMET 2-3/8 OD X 1-1/2 ID
9	6	40501	SCREW 8-32 X 1/2 PPHMS
10	1	40520	SWITCH SPDP 15/32" HOLE DIA
11	1	46555	SUPPORT WIRE REEL
12	1	48791	SP FTG BARB 1/8NPTM X 1/4 HOSE 90 DEG BRASS
13	1	58481 17919	METAL CONNECTOR RECEPTACLE 14-5 PLASTIC CONNECTOR RECEPTACLE SIZE 13
14	8	58482	SCREW 4-40 X 3/8 BHSCS
15	1	58486 67163	METAL CONNECTOR SOCKET RECEPTACLE 14-5 PLASTIC CONNECTOR SOCKET RECEPTACLE SIZE 11
16	1	58616 41852	(NOT SHOWN) CABLE WIRE FEED CONTROL 24V 12 FT METAL CONNECTORS (NOT SHOWN) CABLE WIRE FEED CONTROL 24V 12 FT PLASTIC CONNECTORS
17	2	61268	WASHER SHLDR SPACER 3/8 BLACK NYLON
18	1.7 in	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
19	1	63504	LABEL WARNING
20	8.5 in	67031	(NOT SHOWN) TUBING 1/4 ID 3/8 OD PVC CLEAR
21	2	67034	SCREW 5/16-18 X 1 HHCS BLK OX
22	4	67037	WASHER 5/16 FLTW SAE BLK OX
23	1	67039	FITTING CONDUIT FEEDER BW3000
24	2	67048	(NOT SHOWN) CONNECTOR PIN DBL CRIMP 22-18 AWG .250 X .032 RED
25	1	67059	THUMBSCREW 1/4-20 X 3/4 NO SHOULDER
26	2	67064	CLAMP HOSE 3/8 DIA DBL PINCH STEEL
27	1	67074	FEED MECHANISM WIRE FEEDER WITH FEED ROLLS
28	1	67075	ISOLATOR FEED MECHANISM
29	6	67076	BUMPER .78 OD X .56 TALL RUBBER W/WASHER
30	1	67203	BRACKET SWITCH PULL FEEDER
31	1	67331	SOLENOID COIL & VALVE 24V
32	1	69012	(NOT SHOWN) HARNESS WIRE FEEDER 24V PUSH/PULL SHOP STYLE
33	1	69332	FTG QUICK COUPLER 1/4B 1/8 NPT MALE AIR
34	1	69856	ASSY FRAME & COVER WIRE FEEDER SHOP STYLE
35	1	69977	LABEL WIRE FEEDER SWITCH PUSH/PULL
36	2	70227	LABEL CLIMAX LOGO 2 X 8
37	1	71107	(NOT SHOWN) CRATE 14.5 X 28 X 11.5 X 5/8 PLY SHOP STYLE WIRE FEEDER
38	1	71527	FTG BARB 1/8 NPTM X 1/4 HOSE BRASS
39	2	71570	NUT 5/16-18 STDN BLK OX
40	1	77159	CAP PUSH ON ROUND FOR 5/16 TO 3/8 OD X 3/4 INSIDE HEIGHT BLACK VINYL
41	1	77774	(NOT SHOWN) INSERT FOAM SHOP STYLE WIRE FEEDER BW3000
42	2	89609	PLUG END SQUARE 3/4 TUBE
43	2	89610	PLUG TUBING 1 X 3

FIGURE A-19. SHOP-STYLE WIREFEEDER ASSEMBLY PARTS LIST (P/N 82207)



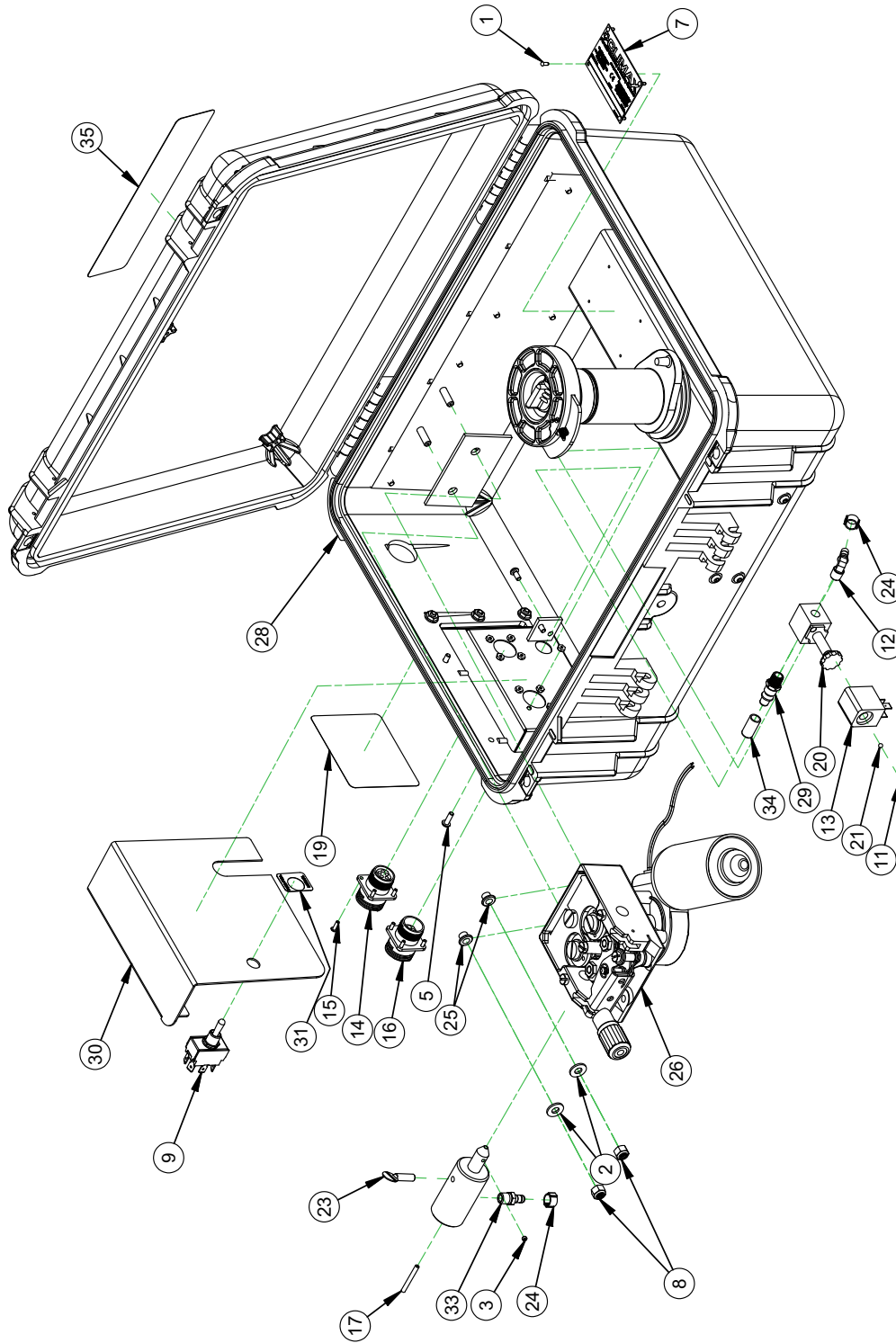
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	11877	PIN DOWEL 1/4 DIA X 2
2	1	67034	SCREW 5/16-18 X 1 HHCS BLK OX
3	1	67275	BODY WIRE STRAIGHTENER WELDED
4	1	67276	GUIDE WIRE STRAIGHTENER
5	1	67278	KNOB THREADED ROD ASSY
6	1	67279	BRG BALL 8MM ID X 22MM OD X .497 W/SEALS DEEP GROOVE
7	1	71322	(NOT SHOWN) MANUAL INSTRUCTION SHEET WIRE STRAIGHTENER SHOP STYLE WIRE FEEDER
8	1	71568	NUT 1/4-20 JAMN BLK OX
9	1	71570	NUT 5/16-18 STDN BLK OX

FIGURE A-20. WIRE STRAIGHTENER (FOR SHOP-STYLE WIREFEEDER ONLY) ASSEMBLY (P/N 35357)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	7	10837	NUT 10-32 STDN ZINC PLATED
2	20	11315	WASHER #10 FLTW BLACK OXIDE
3	12	11673	SCREW 10-32 X 1/2 BHSCS
4	4	11674	SCREW #10-32 x 5/8 BHSCS
5	1	15307	SCREW 1/2-13 X 1 SHCS
6	1	46555	SUPPORT WIRE REEL
7	1	67302	CASE PELICAN ENCLOSED W/FEED BOX NO LOGO NO CUSTOM FOAM
8	1	67315	WIRE FEED ENCLOSED PANEL BOX
9	1	67316	WIRE FEED ENCLOSED TOP SUPPORT
10	1	67317	WIRE FEED ENCLOSED SPOOL FRAME

FIGURE A-21. ENCLOSED WIREFEEDER ASSEMBLY (P/N 69018)

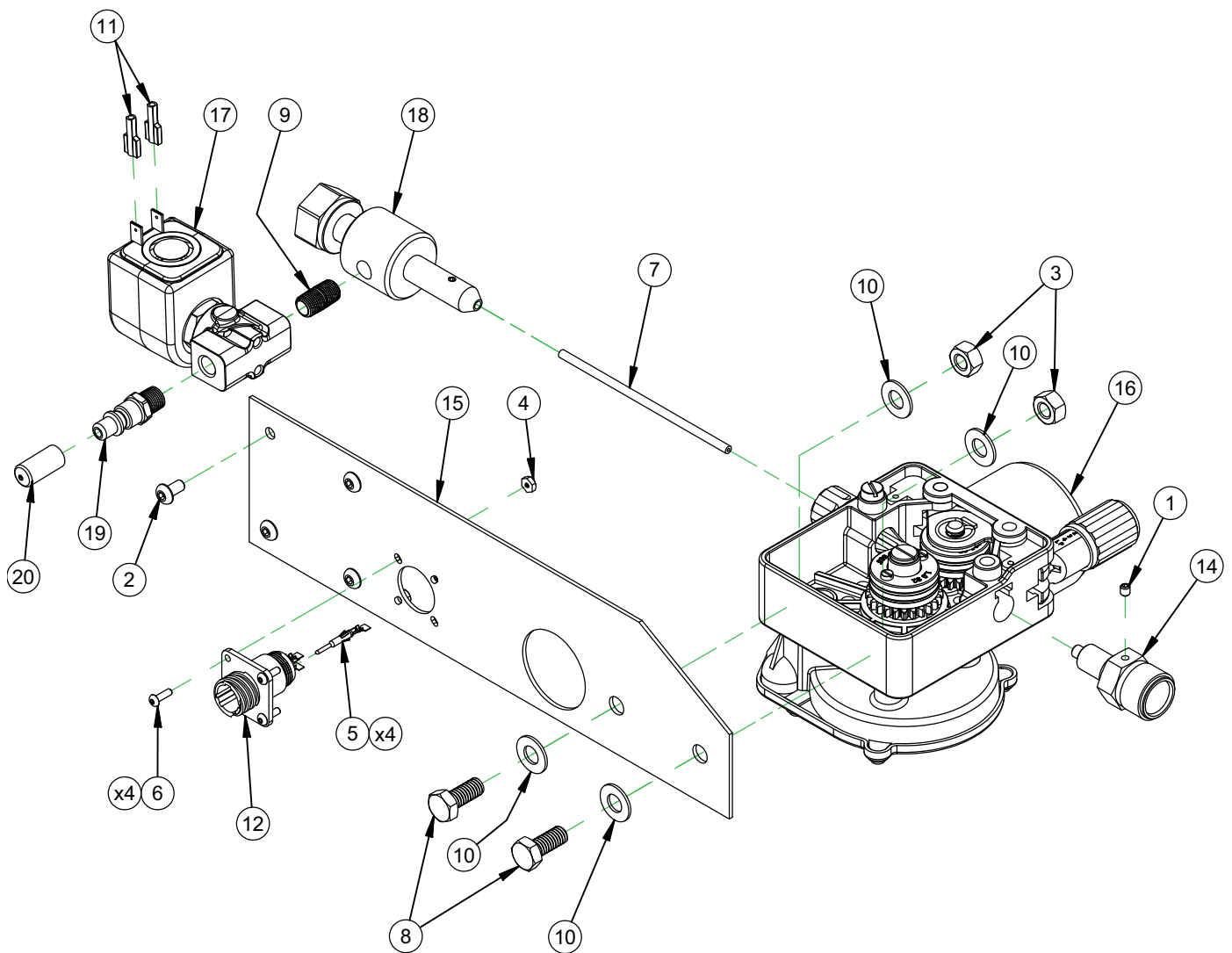


AVAILABLE ASSEMBLIES	PART No.
WIRE FEEDER ENCLOSED METAL CONNECTORS PUSH/PULL READY 24 VDC	66946
WIRE FEEDER ENCLOSED PLASTIC CONNECTORS PUSH/PULL READY 24 VDC	44993

FIGURE A-22. ENCLOSED WIRE FEEDER PUSH/PULL READY 24 VDC ASSEMBLY (P/N 82174)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
2	2	10702	WASHER 1/4 FLTW SAE
3	1	11058	SCREW 8-32 X 1/8 SSSCP
4	2	11359	SCREW 8-32 X 3/8 BHSCS
5	2	11852	SCREW 8-32 X 1/2 BHSCS
6	8	12442	NUT 4-40 STDN ZINC PLATED
7	1	29154	PLATE SERIAL YEAR MODEL CE 2.0 X 3.0
8	2	40512	NUT 1/4-20 LOCKING ZINC PLATED
9	1	40520	SWITCH SPDP 15/32" HOLE DIA
10	1	41852 58616	(NOT SHOWN) CABLE WIRE FEED CONTROL 24V 12 FT PLASTIC CONNECTORS (NOT SHOWN) CABLE WIRE FEED CONTROL 24V 12 FT METAL CONNECTORS
11	1	44800	SCREW 10-32 X 3/8 SSSFP
12	1	48791	SP FTG BARB 1/8NPTM X 1/4 HOSE 90 DEG BRASS
13	1	51617	SOLENOID COIL 24 VOLT
14	1	58481 17919	METAL CONNECTOR RECEPTACLE 14-5 PLASTIC CONNECTOR RECEPTACLE SIZE 13
15	8	58482	SCREW 4-40 X 3/8 BHSCS
16	1	58486 67163	METAL CONNECTOR SOCKET RECEPTACLE 14-5 PLASTIC CONNECTOR SOCKET RECEPTACLE SIZE 13
17	1.25 in	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
18	1	63213	FITTING CONDUIT FEEDER SHORT
19	1	63504	LABEL WARNING
20	1	65473	SOLENOID BODY 24V
21	1	65474	BALL 5/32 302 SS GRADE 100
22	8.5 in	67031	(NOT SHOWN) TUBING 1/4 ID 3/8 OD PVC CLEAR
23	1	67059	THUMBSCREW 1/4-20 X 3/4 NO SHOULDER
24	2	67064	CLAMP HOSE 3/8 DIA DBL PINCH STEEL
25	2	67179	SPACER SHOULDER FLANGED .260 ID X .312 OD
26	1	67300	FEED MECHANISM COMPACT 4 ROLL W/MOTOR & FEED ROLLS
27	1	69017	(NOT SHOWN) HARNESS ENCLOSED WIRE FEEDER PUSH/PULL
28	1	69018	ENCLOSED WIRE FEEDER ASSEMBLY
29	1	69332	FTG QUICK COUPLER 1/4B 1/8 NPT MALE AIR
30	1	69924	COVER SWITCH WIRE FEEDER ENCLOSED PUSH/PULL
31	1	69977	LABEL WIRE FEEDER SWITCH PUSH/PULL
32	1	70423	PAD ISOLATOR W/F ENCLOSED
33	1	71527	FTG BARB 1/8 NPTM X 1/4 HOSE BRASS
34	1	77159	CAP PUSH ON ROUND FOR 5/16 TO 3/8 OD X 3/4 INSIDE HEIGHT BLACK VINYL
35	1	70227	LABEL CLIMAX LOGO 2 X 8

FIGURE A-23. ENCLOSED WIRE FEEDER PUSH/PULL READY 24 VDC ASSEMBLY PARTS LIST (P/N 82174)



AVAILABLE ASSEMBLIES	PART No.
FEED SYSTEM TOP MOUNT METAL CONNECTORS PUSH PULL 24 VDC	64288
FEED SYSTEM TOP MOUNT PLASTIC CONNECTORS PUSH/PULL 24VDC	44992

FIGURE A-24. FEED SYSTEM ASSEMBLY (P/N 82097)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10841	SCREW 8-32 X 3/16 SSSCP
2	4	11678	SCREW 10-32 X 3/8 BHSCS
3	4	12442	NUT 4-40 STDN ZINC PLATED
5	4	58482	SCREW 4-40 X 3/8 BHSCS
6	1	58617	(NOT SHOWN) CABLE ASSY P/P WF CONTROL 10 FT METAL CONNECTORS
		70195	(NOT SHOWN) CABLE ASSY P/P WF CONTROL 10 FT PLASTIC CONNECTORS
7	4.0 in	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
8	2	67000	SCREW 5/16-18 X 3/4 HHCS
9	1	67006	FTG NIPPLE 1/8 NPTM X 1/8 NPTM X 3/4 BRASS
10	4	67037	WASHER 5/16 FLTW SAE BLK OX
11	2	67050	CONNECTOR SOCKET DBL CRIMP 22-18 AWG .250 X .032 RED
12	1	67063	CONNECTOR PLUG 11-4 PLASTIC
		58481	CONNECTOR RECEPTACLE 14-5 NICKEL PLATED
13	2	67155	CONNECTOR PIN CRIMP CONTACT 18/16 AWG
14	1	67199	ADAPTER INLET PULL FEEDER
15	1	67200	PLATE MOUNTING PULL FEEDER
16	1	67210	WIRE FEEDER TOP MOUNT 1 ROLL
17	1	67331	SOLENOID COIL & VALVE 24V
18	1	69003	FITTING PULL FEEDER SPINDLE
19	1	69332	FTG QUICK COUPLER 1/4B 1/8 NPT MALE AIR
20	2	71570	NUT 5/16-18 STDN BLK OX
21	1	77159	CAP PUSH ON ROUND FOR 5/16 TO 3/8 OD X 3/4 INSIDE HEIGHT BLACK VINYL
4	2	53102	CONNECTOR CRIMP CONTACT MALE 24-20 AWG MULTIMATE

FIGURE A-25. FEED SYSTEM ASSEMBLY PARTS LIST (P/N 82097)

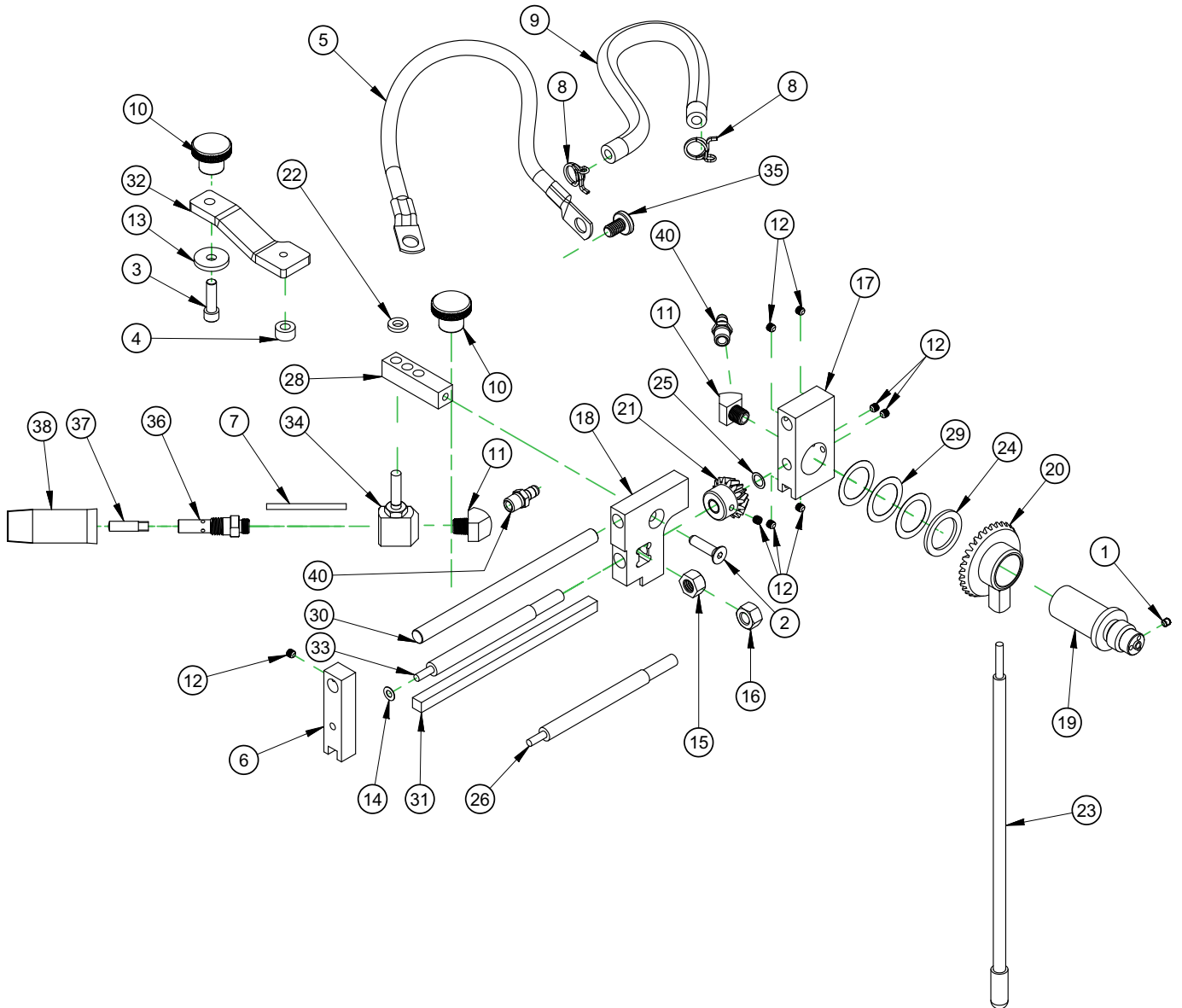


FIGURE A-26. COMPACT 6" (152 MM) FACE TORCH ASSEMBLY (P/N 48013)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10841	SCREW 8-32 X 3/16 SSSCP
2	1	10888	SCREW 1/4-20 X 1 FHSCS
3	1	17131	SCREW 1/4-20 X 7/8 SHCS
4	1	36625	SPACER STEP DRIVE
5	1	40546	CABLE ASSEMBLY TORCHES #4 AWG X 12 IN
6	1	48870	BLOCK END FACE TORCH
7	44 in	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
8	2	64062	HOSE CLAMP WIRE 1/2 ID STYLE SELF CINCHING
9	28 in	64063	HOSE AIR 1/4 ID X 1/2 OD
10	2	66965	KNOB KNURLED 1 IN. OD X 3/4 W/ 1/4-28 HOLE
11	2	66968	FTG ELBOW 1/8 NPTM X 1/8 NPTF STREET 45 BRASS
12	9	66971	SCREW 10-32 X 3/16 SSSFP
13	1	67026	WASHER FENDER 1/4 ID X 7/8 OD 11 GA
14	1	67027	WASHER 3/16 ID X 3/8 OD X .015 HARD FIBER GREY
15	1	67029	NUT 3/8-16 STDN LEFT HAND
16	1	67036	NUT FACE TORCH 3/8-12 LH ACME
17	1	67139	BLOCK HUB FACE TORCH
18	1	67140	BLOCK TRAVELING
19	1	67145	HUB FACE TORCH
20	1	67148	GEAR BEVEL MODIFIED
21	1	67149	GEAR BEVEL PINION
22	1	67150	SPACER TORCH ROD END .257 ID X .500 OD X .10
23	1	67153	ASSY ROD TORQUE RESTRAINT
24	1	67154	SPACER GEAR FACE TORCH .093 THICK
25	1	67175	WASHER SHIM .313 ID .438 OD .010 THK
26	1	67182	LEADSCREW SHORT 3/8-12 ACME LH
27	1	67250	(NOT SHOWN) CASE W/O LOGO COMPACT FACE TORCH
28	1	67272	BAR MOUNTING 6 IN RADIAL FACE TORCH
29	3	67289	SPACER GEAR FACE TORCH .010 THICK
30	1	67296	ROD ROUND GUIDE 6.25 LONG RADIAL TORCH
31	1	67297	GUIDE SQUARE FACE TORCH SHORT
32	1	67304	EXTENSION OVER-CENTER FACE TORCH
33	1	67321	LEADSCREW SHORT 3/8-16 LH
34	1	69019	HOLDER TRAMMEL TORCH NOZZLE W/ 1/4-20 STUD
35	1	69318	SCREW 5/16-18 X 1/2 SPHMS 18-8 STAINLESS
36	1	69778	DIFFUSER WELDING
37	1	69865	TIP WELDING (.035/.9mm)
38	1	69866	NOZZLE WELDING
39	1	71133	(NOT SHOWN) MANUAL INSTRUCTION COMPACT FACE TORCH
40	2	71527	FTG BARB 1/8 NPTM X 1/4 HOSE BRASS

FIGURE A-27. COMPACT 6" (152 MM) FACE TORCH ASSEMBLY PARTS LIST (P/N 48013)

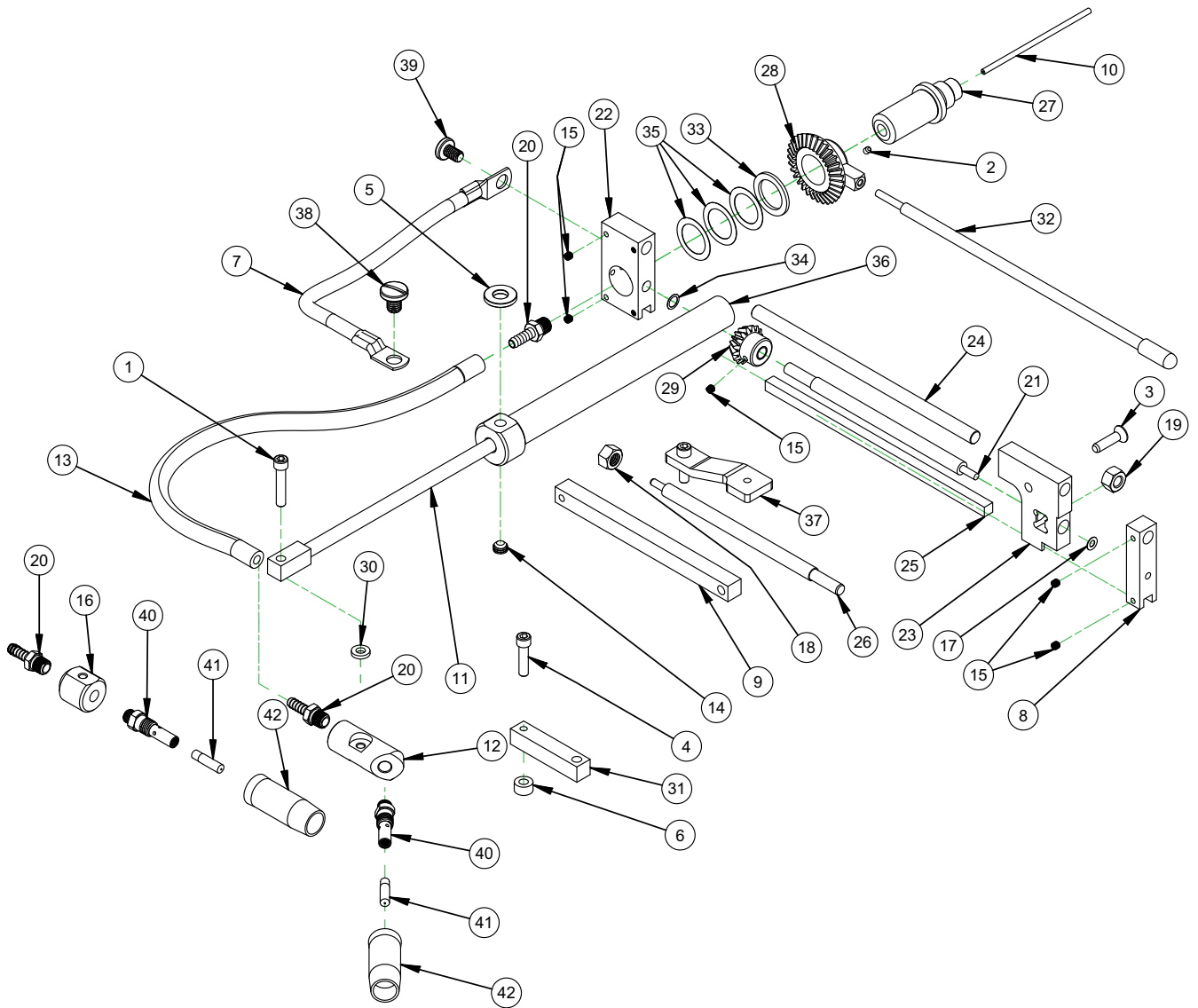


FIGURE A-28. 8" (203 MM) FACE TORCH ASSEMBLY (P/N 28186)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10671	SCREW 1/4-20 X 1-1/4 SHCS
2	1	10841	SCREW 8-32 X 3/16 SSSCP
3	1	10888	SCREW 1/4-20 X 1 FHSCS
4	1	11118	SCREW 1/4-20 X 1 SHCS
5	1	19236	WASHER 3/8 FLTW HARDENED
6	1	36625	SPACER STEP DRIVE
7	1	40546	CABLE ASSEMBLY
8	1	48870	BLOCK END FACE TORCH
9	1	61389	BAR 6 IN EXTENDER TORCH HEAD
10	50 in	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
11	1	64059	ROD TORCH HEAD
12	1	64060	TORCH TRAMMEL NOZZLE STYLE 2
13	36 in	64063	HOSE 1/4 ID X 1/2 OD
14	1	64064	SCREW 3/8-16 X 1/4 SSSFP
15	9	66971	SCREW 10-32 X 3/16 SSSFP
16	1	67004	HOLDER TRAMMEL TORCH NOZZLE
17	1	67027	WASHER 3/16 ID X 3/8 OD X .015 HARD FIBER GREY
18	1	67029	NUT 3/8-16 STDN LEFT HAND
19	1	67036	NUT FACE TORCH 3/8-12 LH ACME
20	3	67058	FTG HOSE END 1/4 HOSE TO 1/8 NPTF
21	1	67073	LEADSCREW FACE TORCH 3/8-12 LH ACME
22	1	67139	BLOCK HUB FACE TORCH
23	1	67140	BLOCK TRAVELING
24	1	67141	ROD ROUND GUIDE 8.25 LONG RADIAL TORCH
25	1	67142	CHART GUIDE BAR SQUARE
26	1	67144	LEADSCREW RADIAL TORCH 3/8-16 LH X 5.25
27	1	67145	HUB FACE TORCH
28	1	67148	GEAR BEVEL MODIFIED
29	1	67149	GEAR BEVEL PINION
30	1	67150	SPACER TORCH ROD END .257 ID X .500 OD X .10
31	1	67151	BAR 2 IN EXTENDER TORCH HEAD
32	1	67153	ASSY ROD TORQUE RESTRAINT
33	1	67154	SPACER GEAR FACE TORCH .093 THICK
34	1	67175	WASHER SHIM .313 ID .438 OD .010 THK
35	3	67289	SPACER GEAR FACE TORCH .010 THICK
36	1	68991	RADIUS ASSEMBLY FACE
37	1	69004	EXTENSION OVER CENTER
38	1	69316	SCREW 3/8-16 X 1/2 SPHMS 18-8 STAINLESS
39	1	69318	SCREW 5/16-18 X 1/2 SPHMS 18-8 STAINLESS
40	2	69778	DIFFUSER WELDING
41	2	69865	TIP WELDING (.035/.9mm)
42	2	69866	NOZZLE WELDING
43	1	71320	(NOT SHOWN) MANUAL INSTRUCTION FACING TORCH

FIGURE A-29. 8" (203 MM) FACE TORCH ASSEMBLY PARTS LIST (P/N 28186)

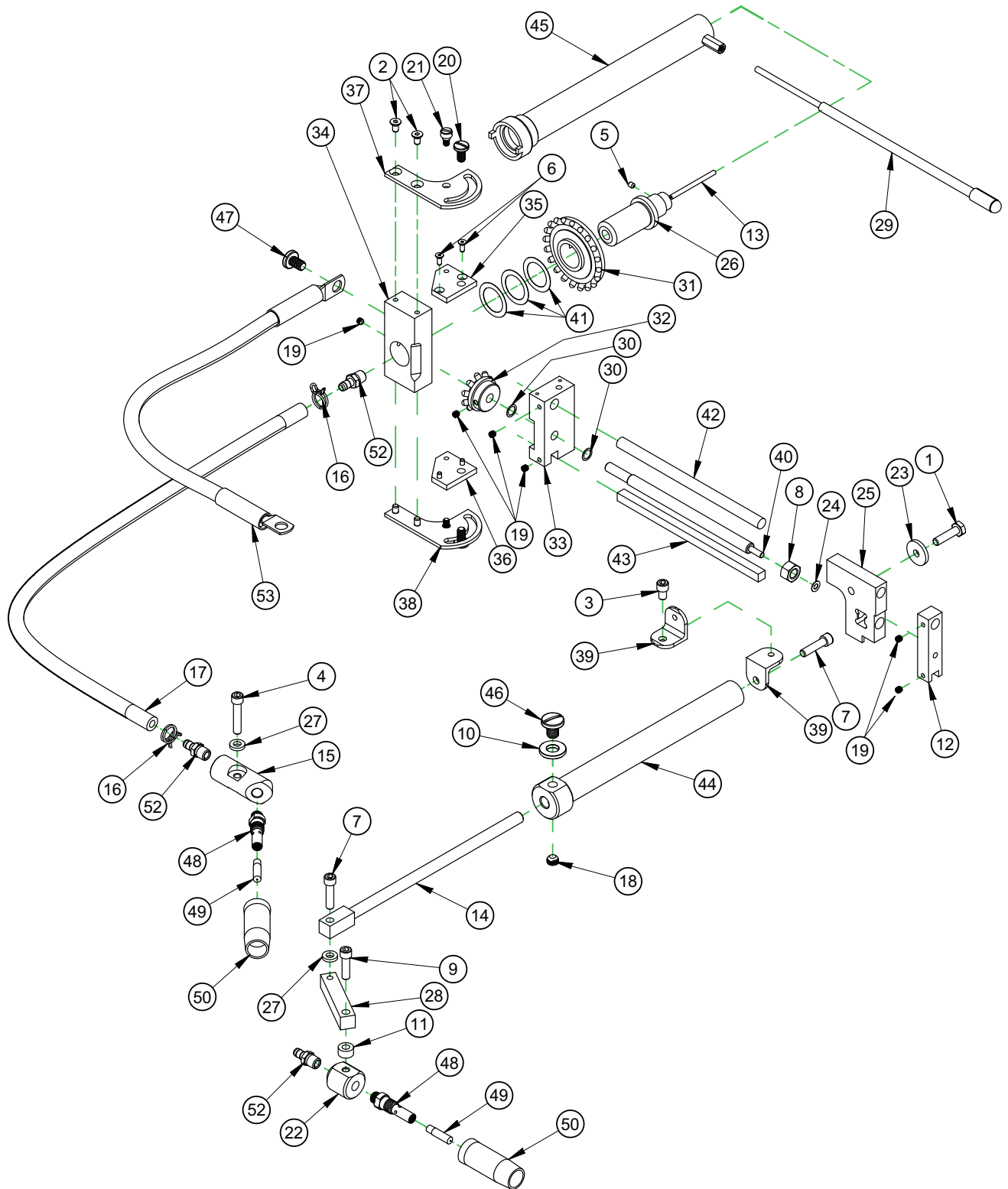


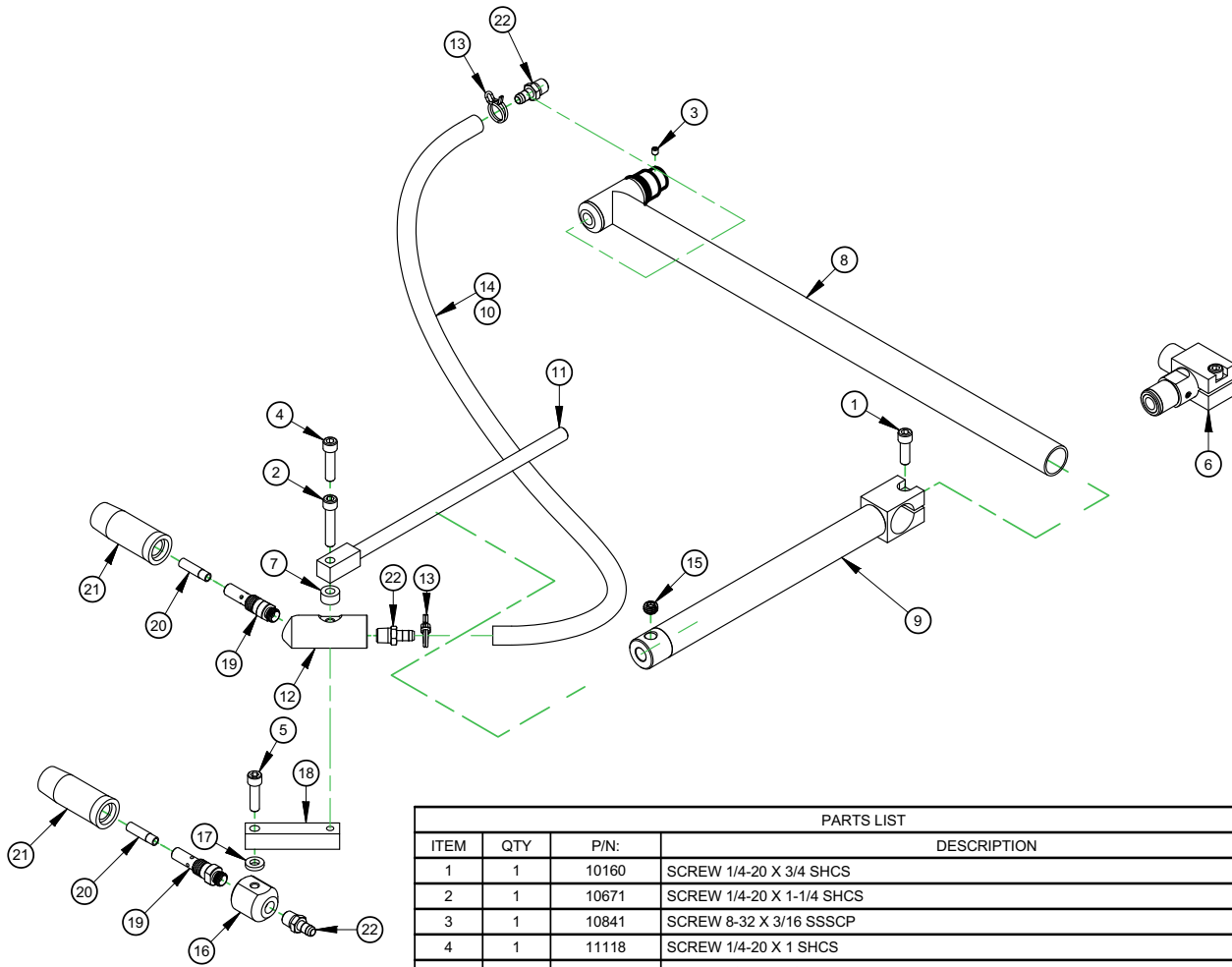
FIGURE A-30. CONICAL SEAT TORCH ASSEMBLY (P/N 28020)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10220	SCREW 1/4-20 X 1 HHSC
2	4	10560	SCREW 10-32 X 3/8 FHSCS
3	1	10670	SCREW 1/4-20 X 3/8 SHCS
4	1	10671	SCREW 1/4-20 X 1-1/4 SHCS
5	1	10841	SCREW 8-32 X 3/16 SSSCP
6	4	10844	SCREW 6-32 X 3/8 FHSCS
7	2	11118	SCREW 1/4-20 X 1 SHCS
8	1	13987	NUT 3/8-16 STDN ZINC PLATED
9	1	17131	SCREW 1/4-20 X 7/8 SHCS
10	1	19236	WASHER 3/8 FLTW HARDENED
11	1	36625	SPACER STEP DRIVE
12	1	48870	BLOCK END FACE TORCH
13	90in	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
14	1	64059	ROD TORCH HEAD
15	1	64060	TORCH TRAMMEL NOZZLE STYLE 2
16	2	64062	HOSE CLAMP WIRE 1/2 ID STYLE SELF CINCHING
17	72in	64063	HOSE AIR 1/4 ID X 1/2 OD X 72"
18	1	64064	SCREW 3/8-16 X 1/4 SSSFP
19	6	66971	SCREW 10-32 X 3/16 SSSFP
20	2	66981	SCREW 1/4-20 X 1/2 PHSMS
21	2	66984	SCREW 1/4 DIA X 1/8 X 10-32 SHLDCS
22	1	67004	HOLDER TRAMMEL TORCH NOZZLE
23	1	67026	WASHER FENDER 1/4 ID X 7/8 OD 11 GA
24	1	67027	WASHER 3/16 ID X 3/8 OD X .015 HARD FIBER GREY
25	1	67140	BLOCK TRAVELING
26	1	67145	HUB FACE TORCH

FIGURE A-31. CONICAL SEAT TORCH ASSEMBLY PARTS LIST 1 (P/N 28020)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
27	2	67150	SPACER TORCH ROD END .257 ID X .500 OD X .10
28	1	67151	BAR 2 IN EXTENDER TORCH HEAD
29	1	67153	ASSY ROD TORQUE RESTRAINT
30	2	67175	WASHER SHIM .313 ID .438 OD .010 THK
31	1	67243	GEAR SWING 20T
32	1	67245	GEAR SWING 10T
33	1	67252	BLOCK SEAT TORCH PINION
34	1	67253	BLOCK SEAT TORCH HUB
35	1	67254	PLATE PINION BLOCK RIGHT SIDE
36	1	67257	PLATE PINION BLOCK LEFT SIDE
37	1	67259	PLATE RIGHT HUB SIDE
38	1	67261	PLATE LEFT HUB SLIDE
39	2	67266	BRACKET SEAT TORCH TUBE
40	1	67269	SCREW 3/8-16 RH LEAD
41	3	67289	SPACER GEAR FACE TORCH .010 THICK
42	1	68154	ROD SEAT TORCH GUIDE
43	1	68157	GUIDE SEAT TORCH SQUARE
44	1	68991	RADIUS ASSEMBLY FACE
45	1	68997	TUBE TOMMY 8 INCH CONICAL SEAT TORCH
46	1	69316	SCREW 3/8-16 X 1/2 SPHMS 18-8 STAINLESS
47	1	69318	SCREW 5/16-18 X 1/2 SPHMS 18-8 STAINLESS
48	2	69778	DIFFUSER WELDING
49	2	69865	TIP WELDING (.035/.9mm)
50	2	69866	NOZZLE WELDING
51	1	71323	(NOT SHOWN) MANUAL INSTRUCTION CONICAL SEAT TORCH
52	3	71527	FTG BARB 1/8 NPTM X 1/4 HOSE BRASS
53	1	77828	CABLE ASSEMBLY TORCHES #4 AWG X 17 IN

FIGURE A-32. CONICAL SEAT TORCH ASSEMBLY PARTS LIST 2 (P/N 28020)



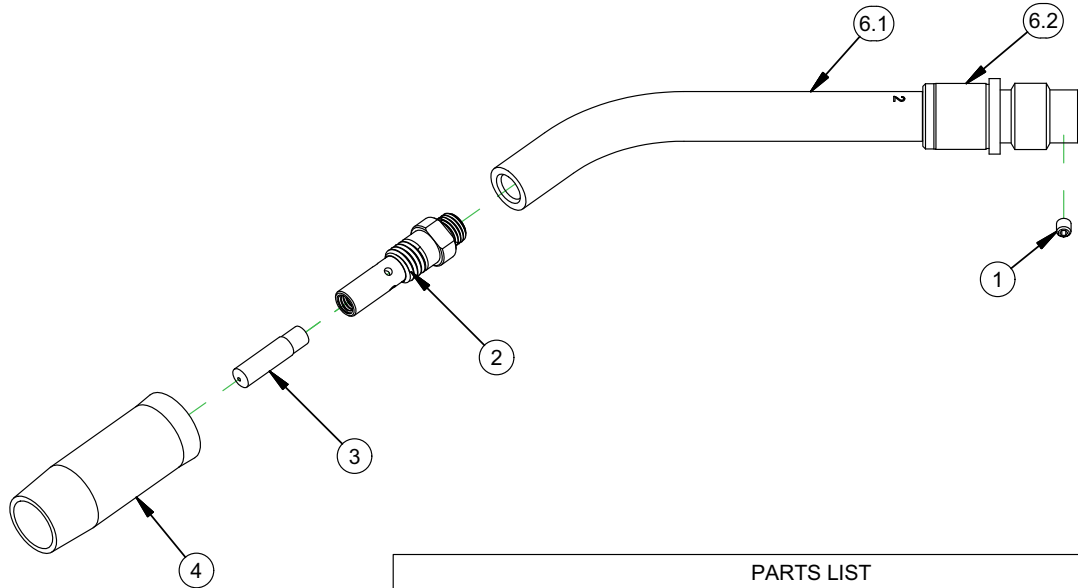
PART No.	AVAILABLE ASSEMBLIES
27013	TORCH TRAMMEL O.D.
38506	TORCH TRAMMEL EXTENDED DIA TO 28
53004	TORCH TRAMMEL EXTENDED DIA TO 56

NOTE:

1. LISTED QTY OF LINER AND AIR HOSE IS DOUBLE WHAT IS REQUIRED FOR THIS ASSEMBLY. THIS PROVIDES EXTRA FOR FUTURE REPLACEMENT.

PARTS LIST				
ITEM	QTY	P/N:	DESCRIPTION	
1	1	10160	SCREW 1/4-20 X 3/4 SHCS	
2	1	10671	SCREW 1/4-20 X 1-1/4 SHCS	
3	1	10841	SCREW 8-32 X 3/16 SSSCP	
4	1	11118	SCREW 1/4-20 X 1 SHCS	
5	1	17131	SCREW 1/4-20 X 7/8 SHCS	
6	1	36170	ADAPTER STANDARD TORCH TO FACE OR TRAMMEL	
7	1	36625	SPACER STEP DRIVE	
8	1	40554	HUB ASSEMBLY TRAMMEL TORCH STANDARD	
		69005	HUB ASSY TRAMMEL TORCH 28 INCH DIA RANGE	
		70128	HUB ASSY TRAMMEL TORCH 56 INCH DIA RANGE	
9	1	40555	RADIUS ASSEMBLY	
10	62	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE - PER INCH (NOT SHOWN)	
	84		28 DIA TRAMMEL	
	112		56 DIA TRAMMEL	
11	1	64059	ROD TORCH HEAD	
12	1	64060	TORCH TRAMMEL NOZZLE STYLE 2	
13	2	64062	HOSE CLAMP WIRE 1/2 ID STYLE SELF CINCHING	
14	42	64063	HOSE AIR 1/4 ID X 1/2 OD - PER INCH	
	60		28 DIA TRAMMEL	
	92		56 DIA TRAMMEL	
15	1	64064	SCREW 3/8-16 X 1/4 SSSFP	
16	1	67004	HOLDER TRAMMEL TORCH NOZZLE	
17	1	67150	SPACER TORCH ROD END .257 ID X .500 OD X .10	
18	1	67151	BAR 2 IN EXTENDER TORCH HEAD	
19	2	69778	DIFFUSER WELDING	
20	2	69865	TIP WELDING (.035/.9mm)	
21	2	69866	NOZZLE WELDING	
22	3	71527	FTG BARB 1/8 NPTM X 1/4 HOSE BRASS	

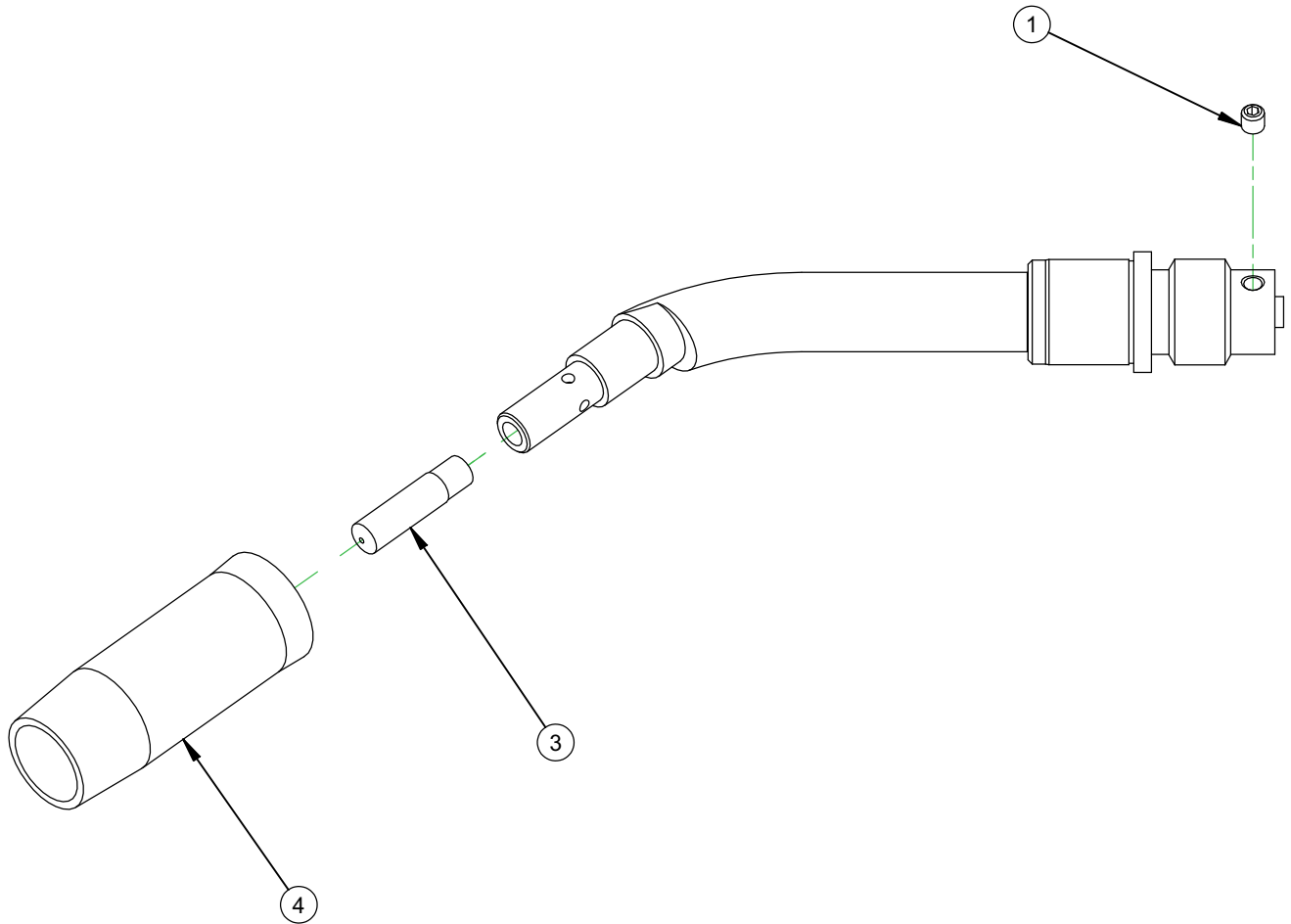
FIGURE A-33. OD TRAMMEL TORCH ASSEMBLY (P/N 81384)



AVAILABLE ASSEMBLIES	PART No.
TORCH #2 (114-190mm OR 4.5-7.5 in)	29032
TORCH #3 (152-228mm OR 6-9 in)	29033
TORCH #4 (203-279mm OR 8-11 in)	29034
TORCH #5 (254-330mm OR 10-13 in)	29035
TORCH #6 (305-381mm OR 12-15 in)	30345
TORCH #7 (356-432mm OR 14-17 in)	31792
TORCH #8 (406-482mm OR 16-19 in)	30346
TORCH #9 (457-533mm OR 18-21 in)	30710
TORCH #10 (508-584mm OR 20-23 in)	30711
TORCH #11 (558-635mm OR 22-25 in)	30712
TORCH #12 (609-685mm OR 24-27 in)	30713

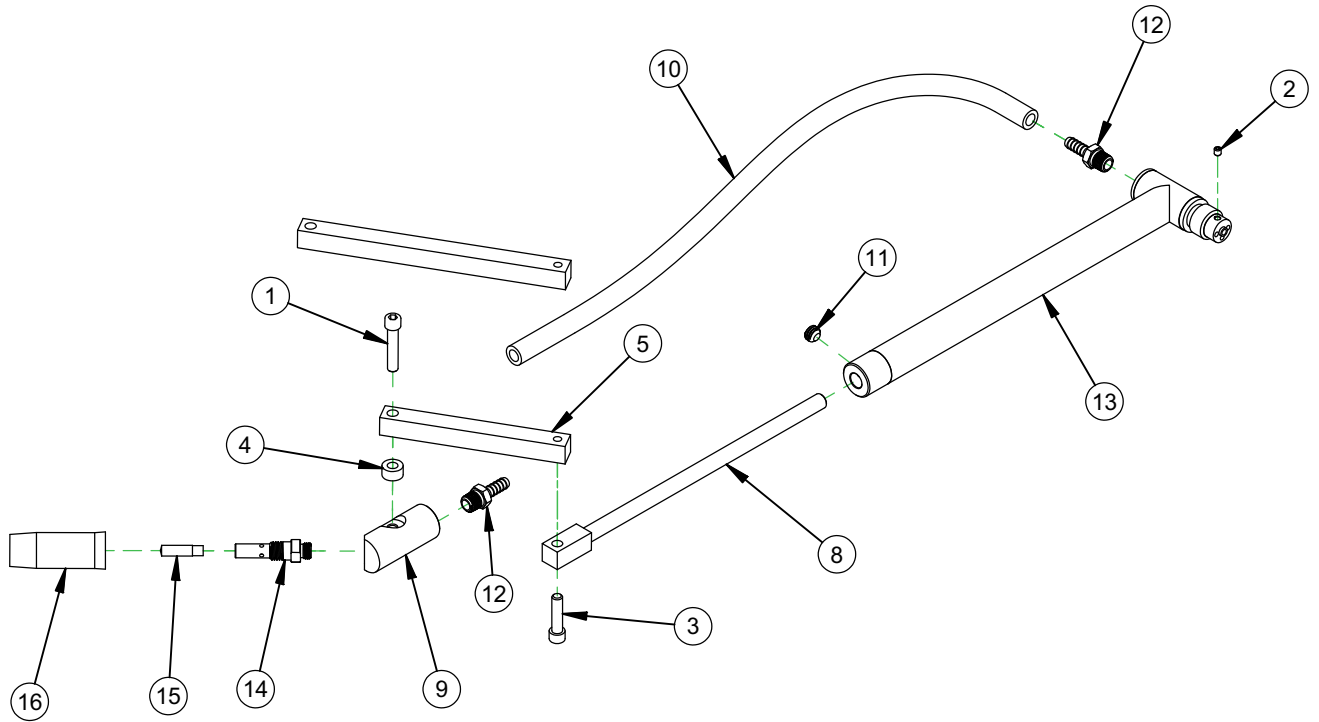
PARTS LIST			
ITEM	QTY	PART No.	DESCRIPTION
1	1	10841	SCREW 8-32 X 3/16 SSSCP
2	1	69778	DIFFUSER WELDING
3	1	69865	TIP WELDING (0.9mm/.035 in)
4	1	69866	NOZZLE WELDING
5	8.0 in	62505	(NOT SHOWN)LINER TORCH #2 (.065 in ID X .144 in OD)
	8.0 in	62505	(NOT SHOWN) LINER TORCH #3 (.065 in ID X .144 in OD)
	9.6 in	62505	(NOT SHOWN)LINER TORCH #4 (.065 in ID X .144 in OD)
	13.0 in	62505	(NOT SHOWN)LINER TORCH #5 (.065 in ID X .144 in OD)
	14.0 in	62505	(NOT SHOWN)LINER TORCH #6 (.065 in ID X .144 in OD)
	15.5 in	62505	(NOT SHOWN)LINER TORCH #7 (.065 in ID X .144 in OD)
	16.8 in	62505	(NOT SHOWN)LINER TORCH #8 (.065 in ID X .144 in OD)
	18.5 in	62505	(NOT SHOWN)LINER TORCH #9 (.065 in ID X .144 in OD)
	20.0 in	62505	(NOT SHOWN)LINER TORCH #10 (.065 in ID X .144 in OD)
	21.0 in	62505	(NOT SHOWN)LINER TORCH #11 (.065 in ID X .144 in OD)
	22.8 in	62505	(NOT SHOWN)LINER TORCH #12 (.065 in ID X .144 in OD)
6.1	1	67020	NFIS TORCH BODY #2
		69234	NFIS TORCH BODY#3
		69235	NFIS TORCH BODY #4
		69236	NFIS TORCH BODY #5
		69237	NFIS TORCH BODY #6
		69238	NFIS TORCH BODY #7
		69239	NFIS TORCH BODY #8
		69240	TORCH BODY #9
		69241	TORCH BODY #10
		69242	TORCH BODY #11
		69243	TORCH BODY #12
6.2	1	69829	FTG TORCH EXT MALE W/PILOT

FIGURE A-34. STANDARD TORCHES #2-12 ASSEMBLY (P/N 82215)



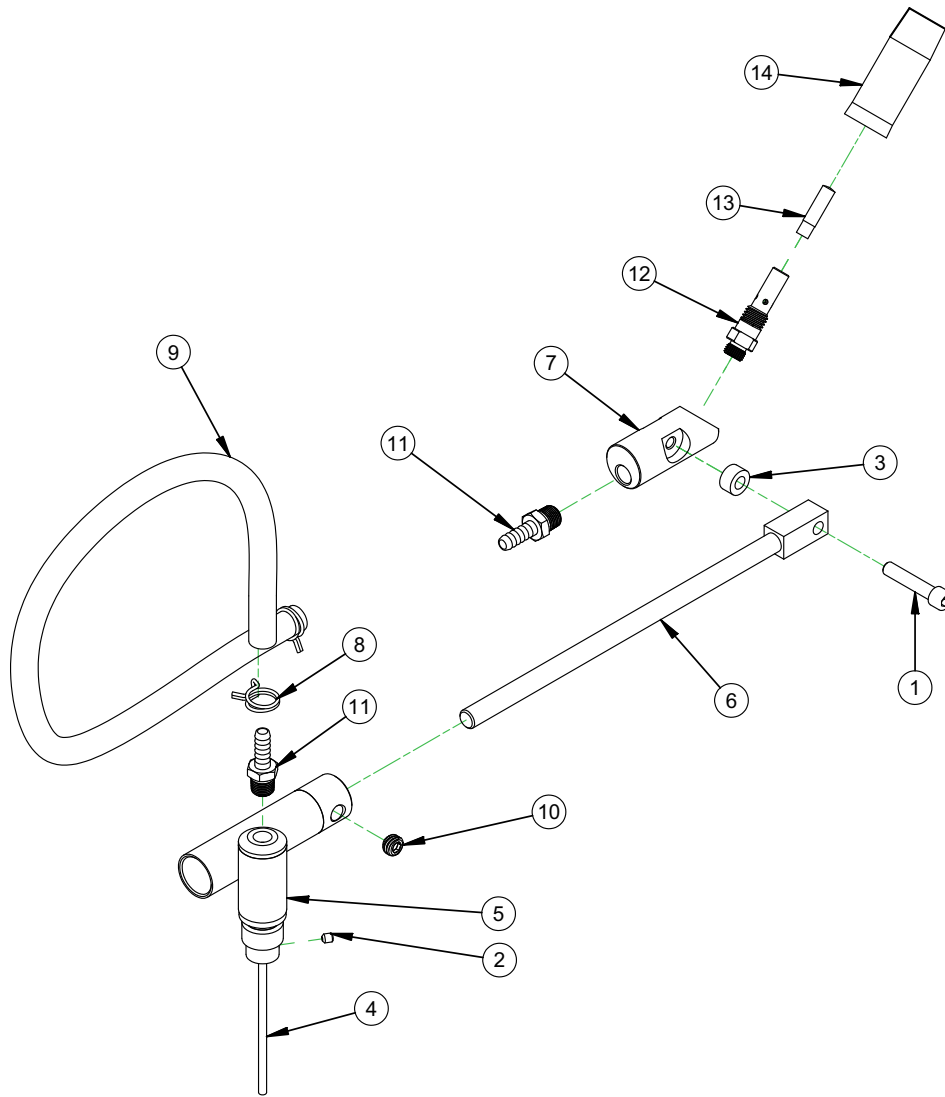
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10841	SCREW 8-32 X 3/16 SSSCP
2	6IN	62505	(NOT SHOWN) LINER .065IN ID X .144IN OD
3	1	69865	TIP WELDING (.035/.9mm)
4	1	69866	NOZZLE WELDING

FIGURE A-35. TORCH #1A ASSEMBLY (P/N 39723)



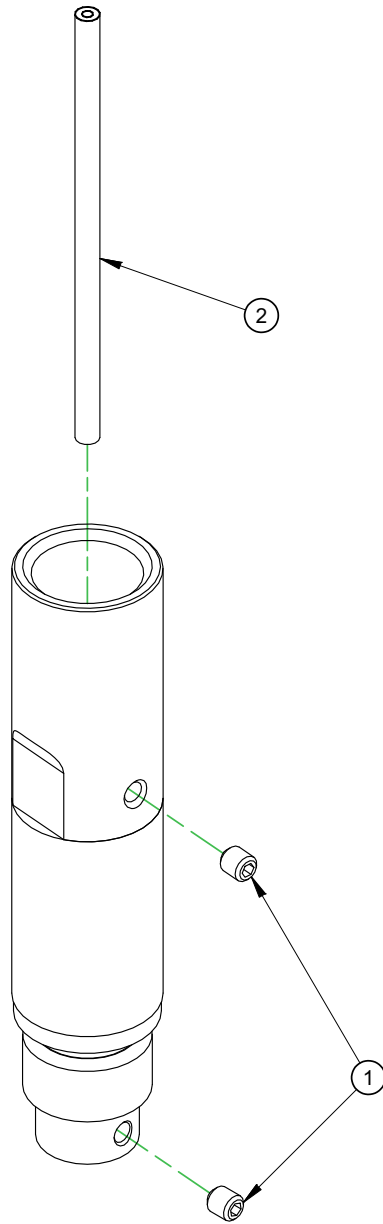
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10671	SCREW 1/4-20 X 1-1/4 SHCS
2	1	10841	SCREW 8-32 X 3/16 SSSCP
3	1	11118	SCREW 1/4-20 X 1 SHCS
4	1	36625	SPACER STEP DRIVE
5	1	61387	BAR 4 IN EXTENDER TORCH HEAD
6	1	61389	BAR 6 IN EXTENDER TORCH HEAD
7	120 in	62505	(NOT SHOWN) LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
8	1	64059	ROD TORCH HEAD
9	1	64060	TORCH TRAMMEL NOZZLE STYLE 2
10	102 in	64063	HOSE 1/4 ID X 1/2 OD
11	1	64064	SCREW 3/8-16 X 1/4 SSSFP
12	2	67058	FTG HOSE END 1/4 HOSE TO 1/8 NPTF
13	1	68998	HUB TELESCOPE 13/24 TORCH
14	1	69778	DIFFUSER WELDING
15	1	69865	TIP WELDING (.035/.9mm)
16	1	69866	NOZZLE WELDING
17	1	70496	(NOT SHOWN) MANUAL INSTRUCTION TORCH #13/24 EXTENDED RANGE

FIGURE A-36. TORCH #13/24 ASSEMBLY (P/N 34473)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10671	SCREW 1/4-20 X 1-1/4 SHCS
2	1	10841	SCREW 8-32 X 3/16 SSSCP
3	1	36625	SPACER STEP DRIVE
4	25.5 IN	62505	LINER BOREWELDER .065 ID X .144 OD
5	1	64058	HUB BEARING CLEARANCE TORCH #6 TO #12 RANGE
6	1	64059	ROD TORCH HEAD
7	1	64060	TORCH TRAMMEL NOZZLE STYLE 2
8	2	64062	HOSE CLAMP WIRE 1/2 ID STYLE SELF CINCHING
9	18.5 IN	64063	HOSE AIR 1/4 ID X 1/2 OD
10	1	64064	SCREW 3/8-16 X 1/4 SSSFP
11	2	67058	FTG HOSE END 1/4 HOSE TO 1/8 NPTF
12	1	69778	DIFFUSER WELDING
13	1	69865	TIP WELDING (.035/.9mm)
14	1	69866	NOZZLE WELDING

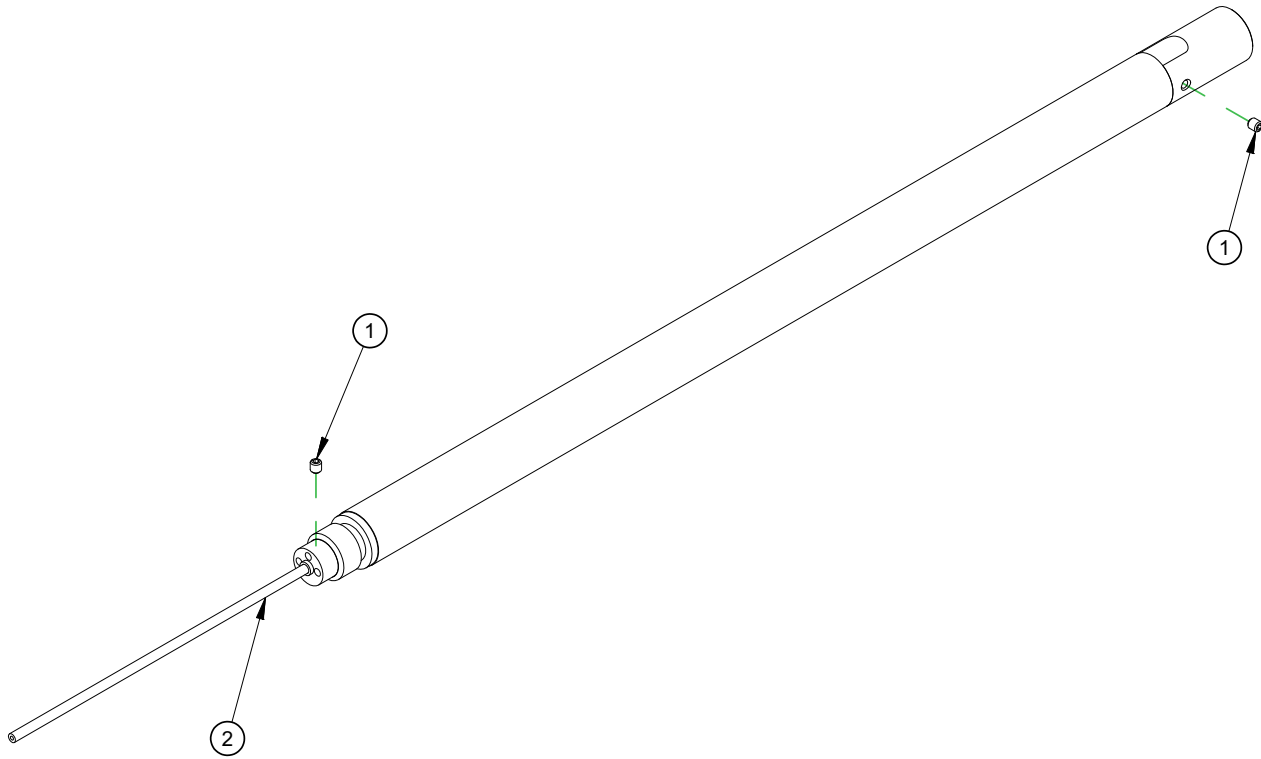
FIGURE A-37. TORCH BEARING MOUNT ASSEMBLY (P/N 70132)



AVAILABLE CONFIGURATIONS	
PART NO	DESCRIPTION
29038	EXTENSION TORCH 3IN
29039	EXTENSION TORCH 6IN

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	10841	SCREW 8-32 X 3/16 SSSCP
2	3IN 6IN	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE

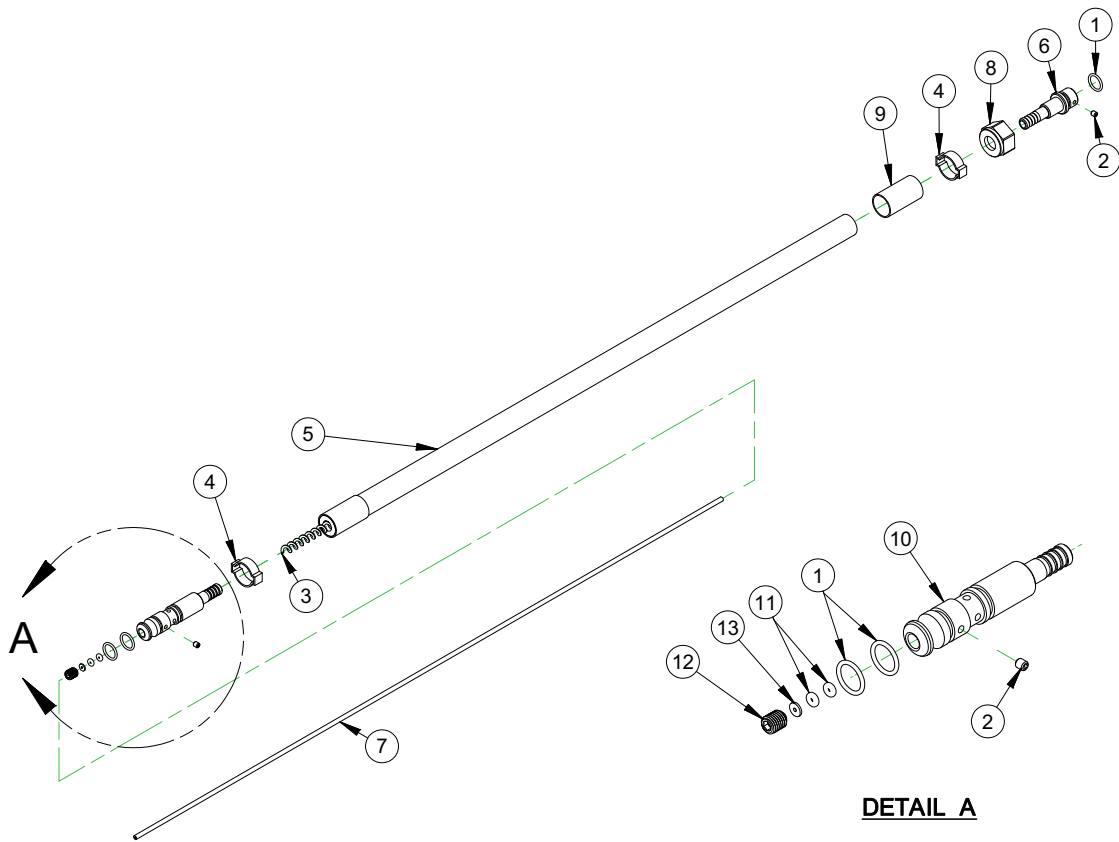
FIGURE A-38. EXTENSION TORCH 3" (76 MM) AND 6" (152 MM) ASSEMBLY (P/N 82155)



AVAILABLE CONFIGURATIONS	
PART NO	DESCRIPTION
29040	EXTENSION TORCH 12IN (305MM)
29065	EXTENSION TORCH 18IN (457MM)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	10841	SCREW 8-32 X 3/16 SSSCP
2	12IN 18IN	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE

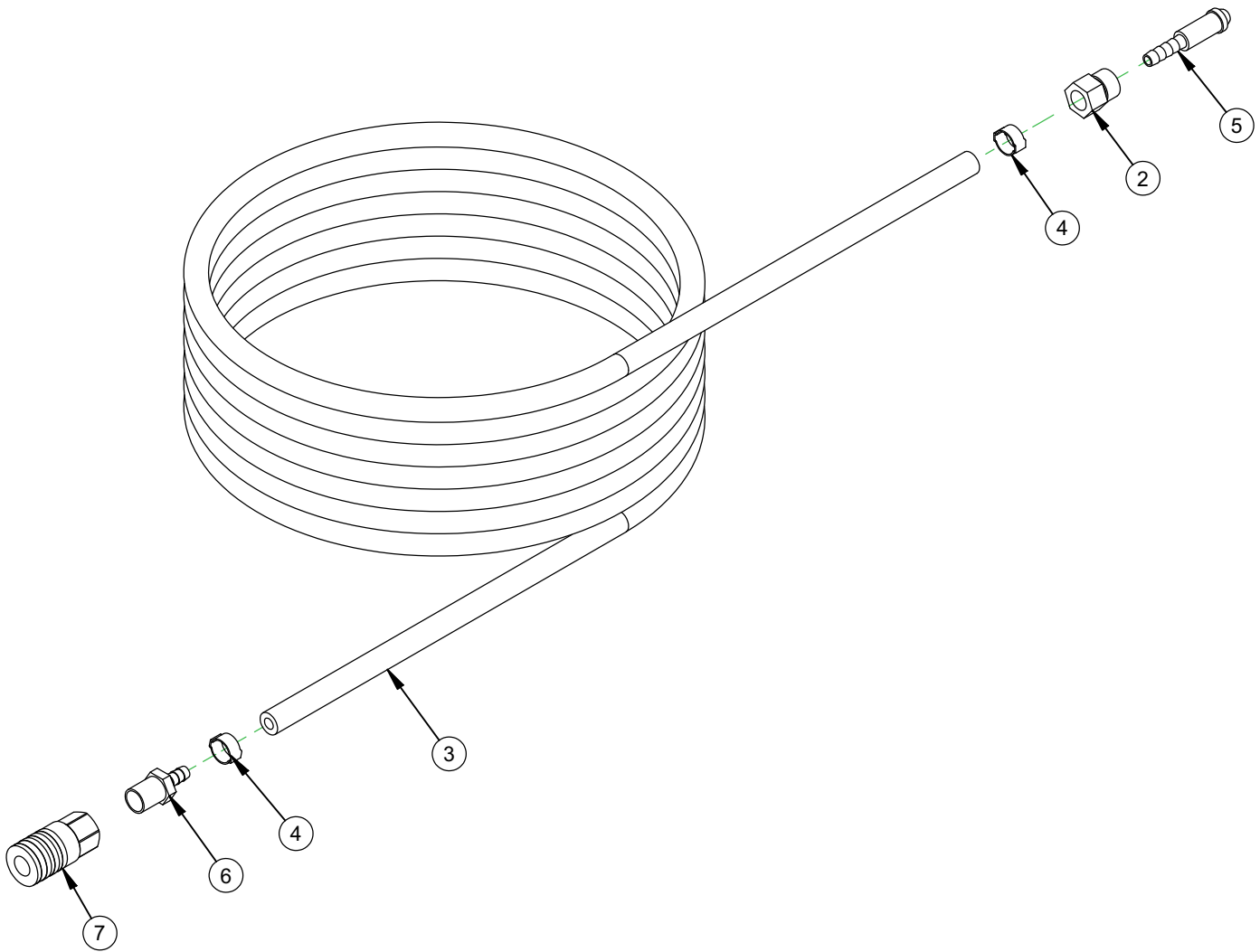
FIGURE A-39. EXTENSION TORCH 12" (305 MM) AND 18" (457 MM) ASSEMBLY (P/N 85213)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	3	10840	RING O 1/16 X 1/2 ID X 5/8 OD (VMI)
2	2	10841	SCREW 8-32 X 3/16 SSSCP
3	CHART	35011	STABILIZER - LINER
4	2	40549	CLAMP HOSE 3/4 DIA DBL PINCH
5	CHART	40550	HOSE HYDRAULIC 3/8 HIGH PRESSURE
6	1	40551	FTG CONDUIT SPINDLE UNION BW3000
7	CHART	62505	LINER STAINLESS STEEL .065 ID X .144 OD FOR .023/.045 WIRE
8	1	66987	NUT CONDUIT SPINDLE UNION
9	3in	76644	HEAT SHRINK TUBE 1 INCH DIA BLACK PVC
10	1	86832	NIPPLE CONDUIT FEEDER END BW3000
11	2	86835	O-RING 3/32" X 1/16" ID X 1/4" OD BUNA-N DASH 102
12	1	86836	SCREW WITH WIRE ORIFICE SEAL CONDUIT
13	1	86847	WASHER .25 OD .068 ID x .025 THK.

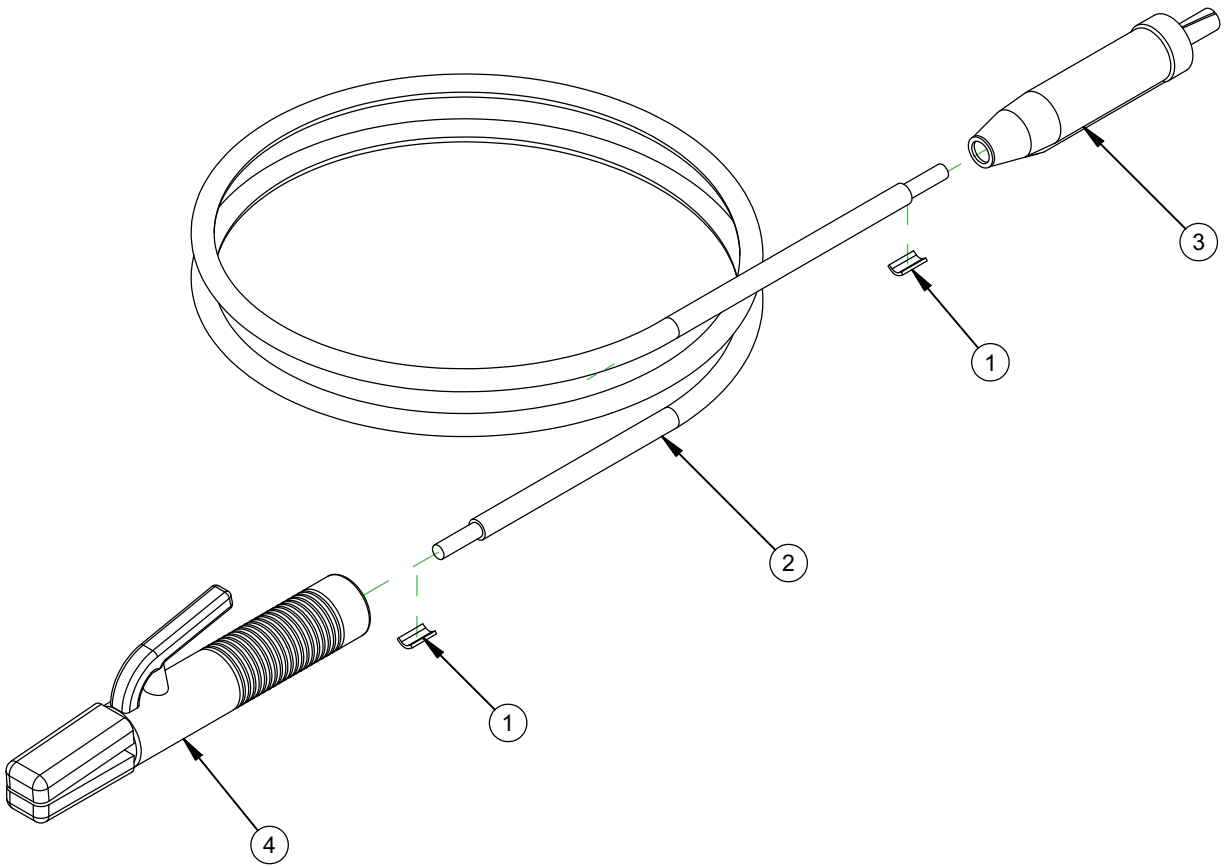
AVAILABLE CONFIGURATIONS				
PART NO.	DESCRIPTION	P/N 35011	P/N 40550	P/N 62505
31894	CONDUIT WIRE FEED 2FT (0.6M) LONG	22	24	27
31895	CONDUIT WIRE FEED 3FT (0.9M) LONG	34	36	39
35574	CONDUIT WIRE FEED 4FT (1.2M) LONG	46	48	51
34813	CONDUIT WIRE FEED 5FT (1.5M) LONG	58	60	63
69889	CONDUIT WIRE FEED 6FT (1.8M) LONG	70	72	75
69890	CONDUIT WIRE FEED 8FT (2.4M) LONG	94	96	99
34043	CONDUIT WIRE FEED 10FT (3.0M) LONG	118	120	123
55707	CONDUIT WIRE FEED 12FT (3.6M) LONG	142	144	147
45256	CONDUIT WIRE FEED 15FT (4.5M) LONG	178	180	183

FIGURE A-40. CONDUIT WIRE FEED ASSEMBLY (P/N 78533)



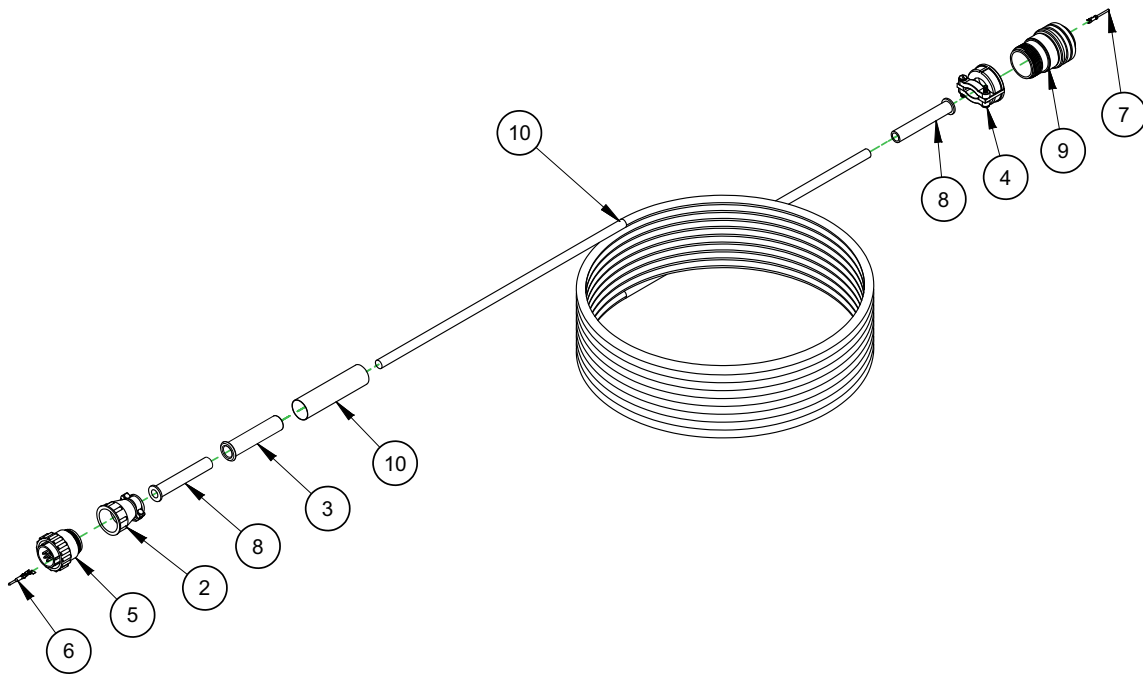
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13243	(NOT SHOWN)WIRE TIE MEDIUM .14 X 8
2	1	48939	NUT SIZE B INERT GAS
3	240 in	64063	HOSE 1/4 ID X 1/2 OD
4	2	67007	CLAMP HOSE 1/2 DIA DBL PINCH STEEL
5	1	67033	FTG NIPPLE INERT GAS B SIZE 1/4 HOSE
6	1	67065	FTG HOSE END 1/4 HOSE TO 1/4 NPTF
7	1	72570	FTG QUICK COUPLER 1/4B 1/4 NPTF FEMALE AIR ARO STYLE

FIGURE A-41. SHIELDING GAS HOSE ASSEMBLY (P/N 30774)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	36812	INSERT WELDING CABLE CLAMP
2	72 in	36813	CABLE POWER COUPLING
3	1	67159	CONNECTOR POWER MALE
4	1	67235	HOLDER ELECTRODE

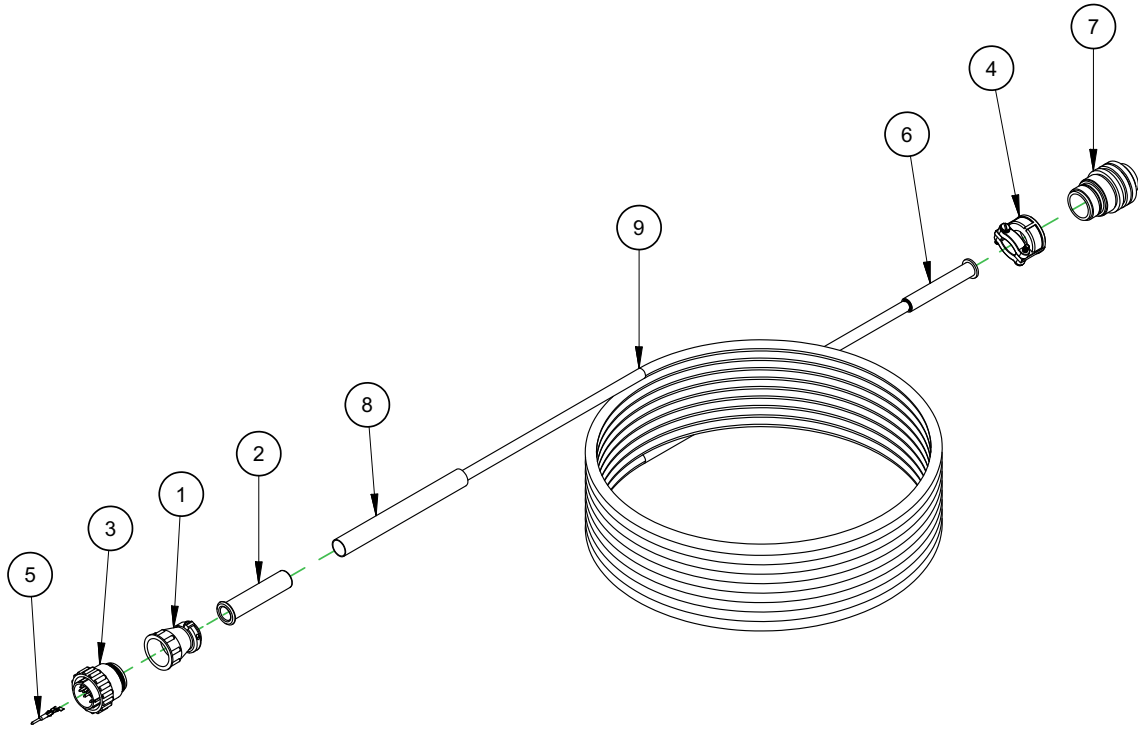
FIGURE A-42. ELECTRODE STICK HOLDER ASSEMBLY (P/N 36169)



AVAILABLE CONFIGURATION		
PART NO.	DESCRIPTION	P/N 83988 QTY
32042	CABLE ASSY POWER SUPPLY LINCOLN 14 PIN PLASTIC CONNECTORS 25 FT	301"
44232	CABLE ASSY POWER SUPPLY LINCOLN 14 PIN PLASTIC CONNECTORS 50 FT	601"
47767	CABLE ASSY POWER SUPPLY LINCOLN 14 PIN PLASTIC CONNECTORS 75 FT	901"
47766	CABLE ASSY POWER SUPPLY LINCOLN 14 PIN PLASTIC CONNECTORS 100 FT	1201"

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1"	22351	(NOT SHOWN) WIRE 18 AWG 600V RED TYPE MTW
2	1	34760	CONNECTOR CABLE CLAMP 17-3 PLASTIC
3	1	47013	BOOT #8 RUBBER
4	1	58480	CONNECTOR CABLE CLAMP STEP DOWN 20 TO 14 NICKEL PLATED
5	1	58576	CONNECTOR PLUG 17-14 PLASTIC
6	7	67155	CONNECTOR PIN CRIMP CONTACT 18/16 AWG
7	5	67169	CONNECTOR CRIMP PIN MALE 16-22 AWG
8	2	67214	RUBBER BUSHING FOR MS3057A CABLE CLAMP .312 ID
9	1	67298	CONNECTOR V300 14 PIN KEY
10	1	70657	TUBING HEAT SHRINK .75 ID 2:1 SHRINK RATIO CLEAR 1.5 LONG
11	CHART	83988	CORD TYPE SOOW 18 AWG 5 COND 600V .325 OD UNSHIELDED GRAY JACKET

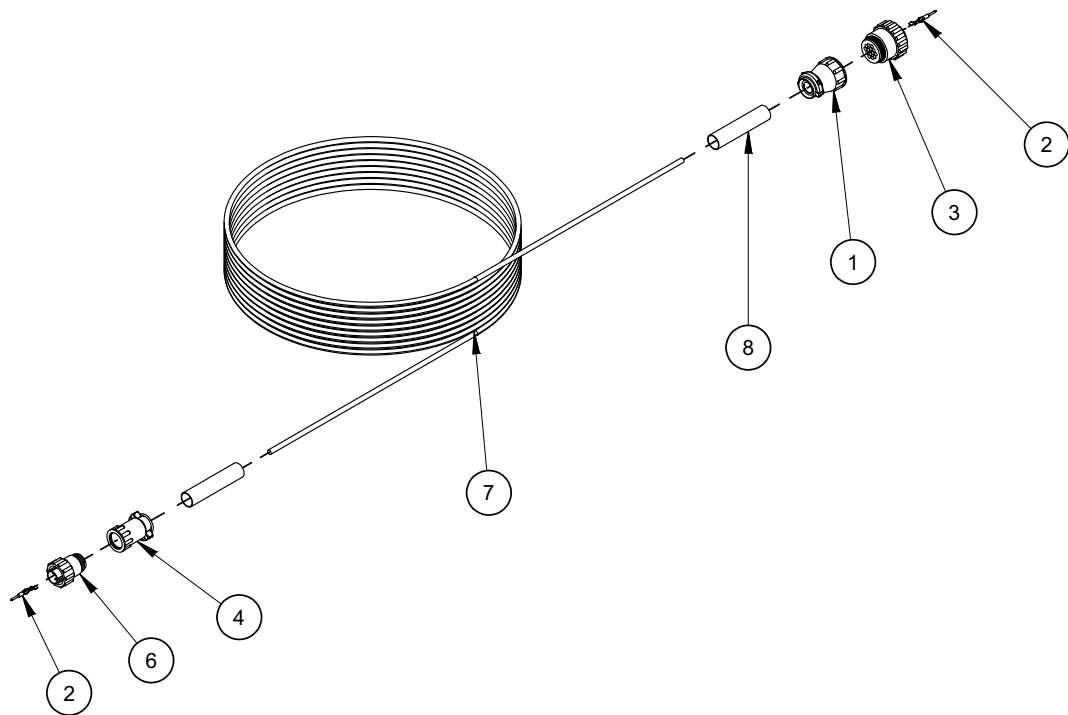
FIGURE A-43. POWER SUPPLY CABLE 14 PIN PLASTIC CONNECTORS ASSEMBLY (P/N 72101)



AVAILABLE CONFIGURATION		
PART No	DESCRIPTION	P/N 83988 QTY
55327	CABLE ASSY POWER SUPPLY LINCOLN MULTI WELD 6 PIN PLASTIC CONNECTORS 25 FT	301"

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	34760	CONNECTOR CABLE CLAMP 17-3 PLASTIC
2	1	47013	BOOT #8 RUBBER
3	1	58576	CONNECTOR PLUG 17-14 PLASTIC
4	1	67138	CONNECTOR CABLE CLAMP MS3057A SIZE 18
5	7	67155	TERMINAL PIN 18-16 AWG
6	1	67214	RUBBER BUSHING FOR MS3057A CABLE CLAMP .312 ID
7	1	70259	CONN PLUG 6 PIN
8	1	70655	TUBING HEAT SHRINK .5 ID 2:1 SHRINK RATIO CLEAR
9	CHART	83988	CORD TYPE SOOW 18 AWG 5 COND 600V .325 OD UNSHIELDED GRAY JACKET

FIGURE A-44. POWER SUPPLY CABLE 6 PIN PLASTIC CONNECTORS ASSEMBLY (P/N 72138)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	34760	CONNECTOR CABLE CLAMP 17-3 PLASTIC
2	6	53102	CONNECTOR CRIMP CONTACT MALE 24-20 AWG MULTIMATE
3	1	58576	CONNECTOR PLUG 17-14 PLASTIC
4	1	67060	CABLE CLAMP LARGE SIZE 11
5	2	67123	(NOT SHOWN) WIRE 20 AWG RED CU STRAND TYPE MTW
6	1	67160	CONNECTOR PLUG 4 PIN REVERSE MALE/FEMALE SIZE 11
7	300	67280	CABLE POWER 2 CONDUCTOR 18 AWG 300 VAC RUBBER JACKET BLACK
8	5	70655	TUBING HEAT SHRINK .5 ID 2:1 SHRINK RATIO CLEAR

FIGURE A-45. FEEDERLESS MILLER CABLE FOR P/N 69007 (P/N 69021)

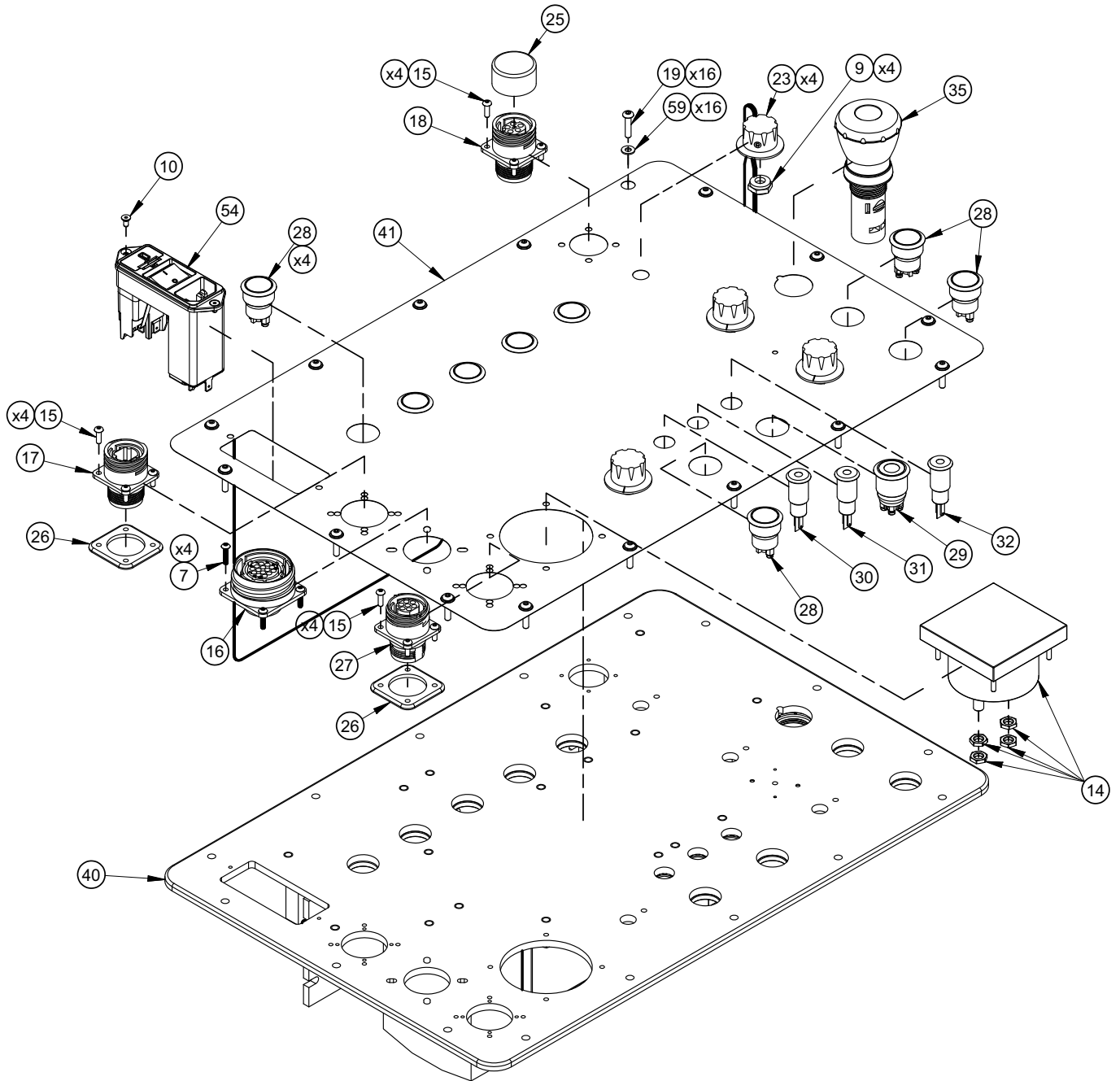


FIGURE A-46. BW3000 CONTROLLER PLASTIC/METAL CONNECTORS ASSEMBLY (P/N 87304)

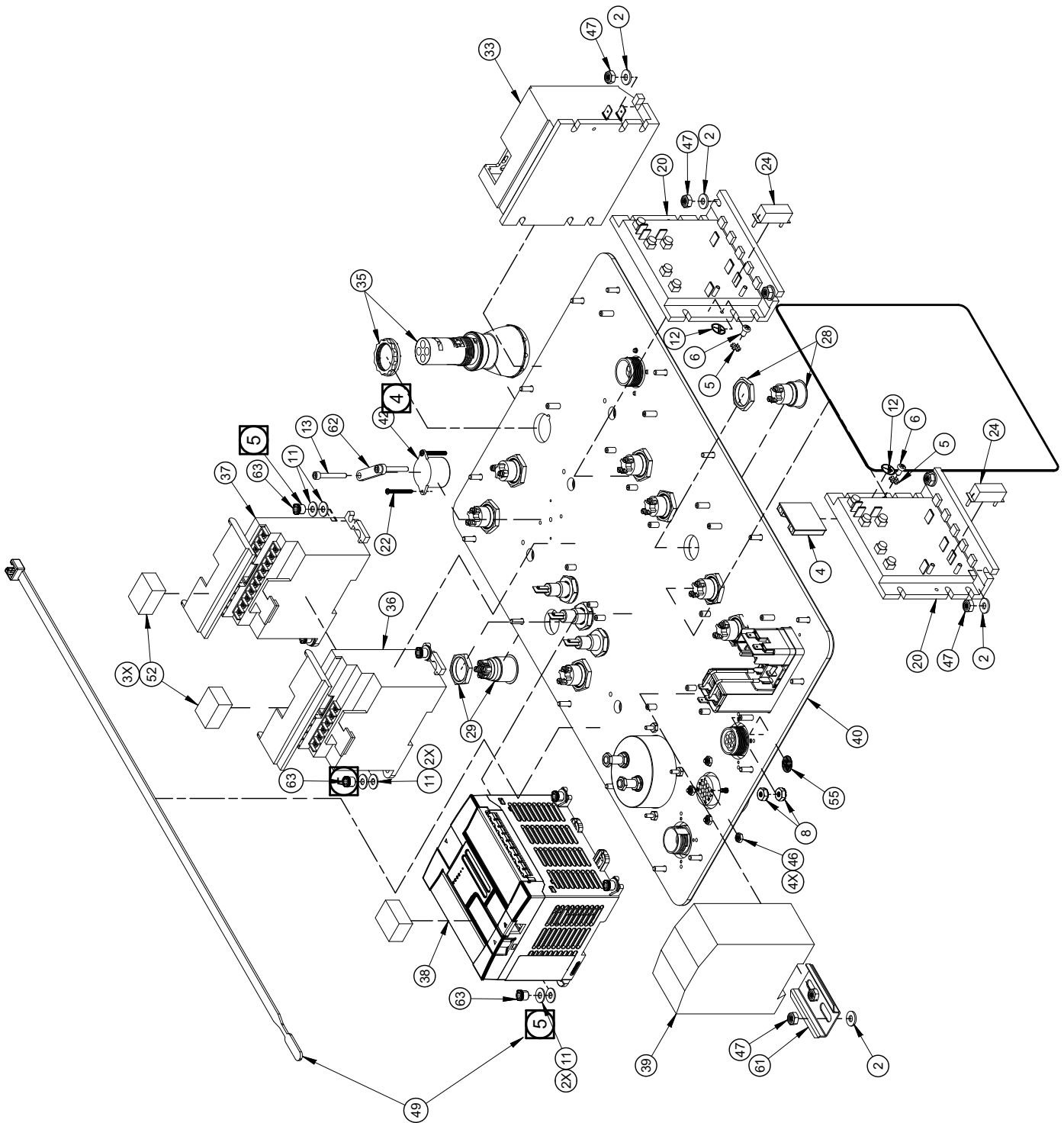


FIGURE A-47. BW3000 CONTROLLER METAL CONNECTORS ASSEMBLY (P/N 87304)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	30	10673	WIRE TIE SMALL .09 X 3.5 (NOT SHOWN)
2	8	11872	WASHER #8 FLTW SAE ZINC PLATED
3	3	12941	(NOT SHOWN) PLUG KEYING CIRCULAR CONNECTOR (PLASTIC ONLY)
4	1	13296	MOUNTING BASE WIRE TIE ADHESIVE BACKED LARGE
5	2	20758	WASHER #6 ITSTRW
6	2	20760	SCREW 6-32 X 1/4 PHSMS CROSSPOINT ZINC PLATED
7	4	23009	SCREW 4-40 X 1/2 BHCS
8	2	28617	NUT 8-32 LOCKING STAR WASHER
9	4	32926	SEAL POTENTIOMETER HEXNUT .25 SHAFT 3/8-32 TH
10	2	35857	SCREW 4-40 X 1/4 FHSCS
11	16	35923	WASHER #8 FLTW NYLON
12	2	37572	LABEL PE GROUND TERMINAL
13	2	40585	SCREW 6 - 32 X 1 SHCS
14	1	40610	METER VOLT 0-30VDC PANEL MOUNT SQUARE
15	12	58482	SCREW 4-40 X 3/8 BHSCS
16	1	58484 58580	CONNECTOR RECEPTACLE 22-14 NICKEL PLATED RECEPTACLE FLANGED 14 PIN AMP THERMOPLASTIC HOUSING
17	1	58485 58580	CONNECTOR RECEPTACLE 14-7 ZINC PLATED RECEPTACLE FLANGED 14 PIN AMP THERMOPLASTIC HOUSING
18	1	58486	CONNECTOR RECEPTACLE 14-5 METAL
19	16	62944	SCREW 6-32 X 5/8 BHSCS
20	2	63525	DRIVE MOTOR CONTROL 115/230VAC
21	1	66917	(NOT SHOWN) CORD POWER 5-15 120V 90 DEG C13 RIGHT 6 FT
22	2	66952	SCREW 2-56 X 7/8 PPHMS
23	4	67053	KNOB POTENTIOMETER 1/4 BLACK PLASTIC
24	2	67143	RESISTOR HORSEPOWER PLC CONTROL DRIVES CE BW3000
25	1	67173	CAP PUS ON 1.00 OD X 19/32 HT PLASTIC BLACK
26	2	67194	BEZEL CONNECTOR BW3000 CONTROLLER
27	1	67204 58580	CONNECTOR PLUG 7 PIN REVERSE MALE/FEMALE SIZE 14 RECEPTACLE FLANGED 15 PIN AMP THERMOPLASTIC HOUSING
28	8	67205	BUTTON PUSH MOMENTARY LOW PROFILE STAINLESS
29	1	67207	SWITCH PUSHBUTTON MOMENTARY ILLUMINATED BLUE
30	1	67213	INDICATOR LED RED 24 VDC SOLDER TAG PANEL MOUNT
31	1	67215	INDICATOR LED BLUE 24 VDC SOLDER TAG PANEL MOUNT

FIGURE A-48. BW3000 CONTROLLER PLASTIC/METAL CONNECTORS ASSEMBLY PARTS LIST 1 (P/N 87304)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
32	1	67216	INDICATOR LED GREEN 24 VDC SOLDER TAG PANEL MOUNT
33	1	67234	DC DRIVE 120/230 10A SCR REVERSING CHASSIS HIGH SPEED CURRENT CLAMPING
34	1	67237	(NOW SHOWN) RELAY 24V DPDT DIN RAIL MOUNT (PLASTIC ONLY)
35	1	67239	BUTTON EMERGENCY STOP RED
36	1	67242	OUTPUT MODULE ANALOG
37	1	67244	RELAY OUTPUT MODULE
38	1	67246	PLC MICROLOGIX 1200
39	1	67247	POWER SUPPLY SOLA 24V 50W
40	1	67249	PANEL CONTROL BOX BW3000
41	1	68306	OVERLAY CONTROL BOX BW3000
42	1	69330	BUZZER 12V 3800HZ
43	1	70573	CASE MODIFIED CONTROL BOX
44	1	70893	(NOT SHOWN) MEMORY MODULE PLC EEPROM
45	1	73025	(NOT SHOWN) DRAWER FUSE POWER ENTRY MODULE 2 POLE 5 X 20MM FUSE (230V ONLY)
46	4	73758	NUT 4-40 NYLON INSERT LOCKNUT ZINC PLATED
47	8	73763	NUT 8-32 NYLON INSERT LOCKNUT HEX ZINC PLATED
48	1	73773	(NOT SHOWN) DRAWER FUSE 2 POLE W/ SHORTING BAR 5 X 20MM FUSE
50	1	73776	WIRE TIE 20.5" LONG
51	3 IN	73786	FOAM STRIP .75W X .5 SQFT URETHANE ADHESIVE BACKED (PLASTIC ONLY)
52	3	73786	FOAM STRIP .75W X .5 SOFT URETHANE ADHESIVE BACKED
53	1	73878	(NOT SHOWN) CORD POWER CEE 7/7 230V 90 DEG C13 RIGHT 8 FT (230V ONLY)
54	1	75059	MODULE POWER ENTRY 2 POLE WITH LINE FILTER 10A
55	1	77568	LABEL PROTECTIVE EARTH 1/2" DIA
56	1	78487	(NOT SHOWN) PROGRAM PLC MODEL BW3000
58	1	79288	(NOT SHOWN) KIT WIRING BW3000 CONTROLLER 120/230V METAL CONNECTORS
		79289	(NOT SHOWN) KIT WIRING BW3000 CONTROLLER 120/230V PLASTIC CONNECTORS
59	16	79316	WASHER #6 NYLON .15 ID X .32 OD X .03 BLACK
60	1	79620	(NOT SHOWN) FUSE 10A TIME DELAY 5 X 20MM U.L LISTED
61	1	82109	DIN RAIL 35MM X 2 INCHES LONG
62	1	83309	CLAMP BUZZER HOLDER
63	8	85976	NUT SOCKET CAP 8-32 X .31 OD X .27 LG
64	1	86568	(NOT SHOWN) SET LABELS CONTROLLER ELECTRICAL COMPONENTS BW3000 METAL AND PLASTIC
49	1	73776	WIRE TIE 20.5" LONG (NOT SHOWN)
57	1	78747	LABEL REFERENCE SHEET CONTROLLER BW3000

FIGURE A-49. BW3000 CONTROLLER PLASTIC/METAL CONNECTORS ASSEMBLY PARTS LIST 2 (P/N 87304)

TABLE A-1. TOOL KIT P/N 69971

Part number	Description	Quantity
10600	WRENCH HEX 5/32 SHORT ARM	1
11082	WRENCH HEX 3/16 SHORT ARM	1
11094	WRENCH HEX 5/64 SHORT ARM	1
40424	SPLINER STAINLESS STEEL .065 ID X .144 OD X 16 FT FOR .023/.045 WIRE	1
52815	MANUAL INSTRUCTION MODEL BW3000 BOREWELDER	1
63846	WRENCH SPANNER 2 INCH	1
63847	WRENCH SPANNER 1.5 INCH	1
63848	WRENCH SPANNER 1/2 - 7/8 INCH MODEL Z	1
66947	KIT CONSUMABLE PACKAGE BW3000 .035/.9MM TIPS (KB)	1
67082	GLOVES WELDING CLIMAX BRANDED SIZE LARGE	1
67313	WELD SAMPLE 2.750 ID X 3.500 OD X 2.000 (KB)	1
67337	LUBRICANT 3 OZ WD-40	1
69866	NOZZLE WELDING (ALL EXCEPT #00 & #0) (1 EA) STANDARD 21-62	5

TABLE A-2. SPARE PARTS KIT P/N 97277

Part number	Description	Quantity
10840	O-RING 1/16 X 1/2 ID X 5/8 OD 70 DURO DASH 014	6
35830	ROLLER WIRE FEED .035/.045	2
37407	SWITCH STEP LIMIT	1
40424	SP LINER STAINLESS STEEL .065 ID X .144 OD X 16 FT FOR .023/.045 WIRE	1
56020	BEARING PRESSURE ROLL WIRE	2
62489	SP LINER BOREWELDER SPINDLE 12 INCH STROKE BW3000 22.6 LENGTH	1
66947	KIT CONSUMABLE PACKAGE BW3000 .035/.9MM TIPS	
82949	BAG TOOL 14 X 5.5 X 6 POLYESTER	1

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APPENDIX B SCHEMATICS

Schematic list

FIGURE B-1. BOREWELDER WITH METAL OR PLASTIC CONNECTORS SCHEMATIC (P/N 87413) - - - - - 150

FIGURE B-2. WIRE FEEDER WITH METAL CONNECTORS SCHEMATIC (P/N 87414) - - - - - 151

FIGURE B-3. WIRE FEEDER WITH PLASTIC CONNECTORS SCHEMATIC (P/N 87415) - - - - - 152

FIGURE B-4. POWER SUPPLY INTERFACE CABLE WITH PLASTIC CONNECTOR SCHEMATIC (P/N 87419) - - - - - 153

FIGURE B-5. POWER SUPPLY INTERFACE CABLE SCHEMATIC WITH PLASTIC CONNECTOR (P/N 87421) - - - - - 154

FIGURE B-6. 170 CONTROLLER METAL CONNECTORS ASSEMBLY 1 (P/N 98040) - - - - - 155

FIGURE B-7. 170 CONTROLLER METAL CONNECTORS ASSEMBLY 2 (P/N 98040) - - - - - 156

FIGURE B-8. 170 CONTROLLER METAL CONNECTORS ASSEMBLY 3 (P/N 98040) - - - - - 157

FIGURE B-9. 170 CONTROLLER ASSEMBLY METAL CONNECTORS PARTS LIST (P/N 98040) - - - - - 158

FIGURE B-10. 170 CONTROLLER METAL CONNECTORS SCHEMATIC 1 (P/N 98040) - - - - - 159

FIGURE B-11. 170 CONTROLLER METAL CONNECTORS SCHEMATIC 2 (P/N 98040) - - - - - 160

FIGURE B-12. 170 CONTROLLER PLASTIC CONNECTORS ASSEMBLY 1 (P/N 98041) - - - - - 161

FIGURE B-13. 170 CONTROLLER PLASTIC CONNECTORS ASSEMBLY 2 (P/N 98041) - - - - - 162

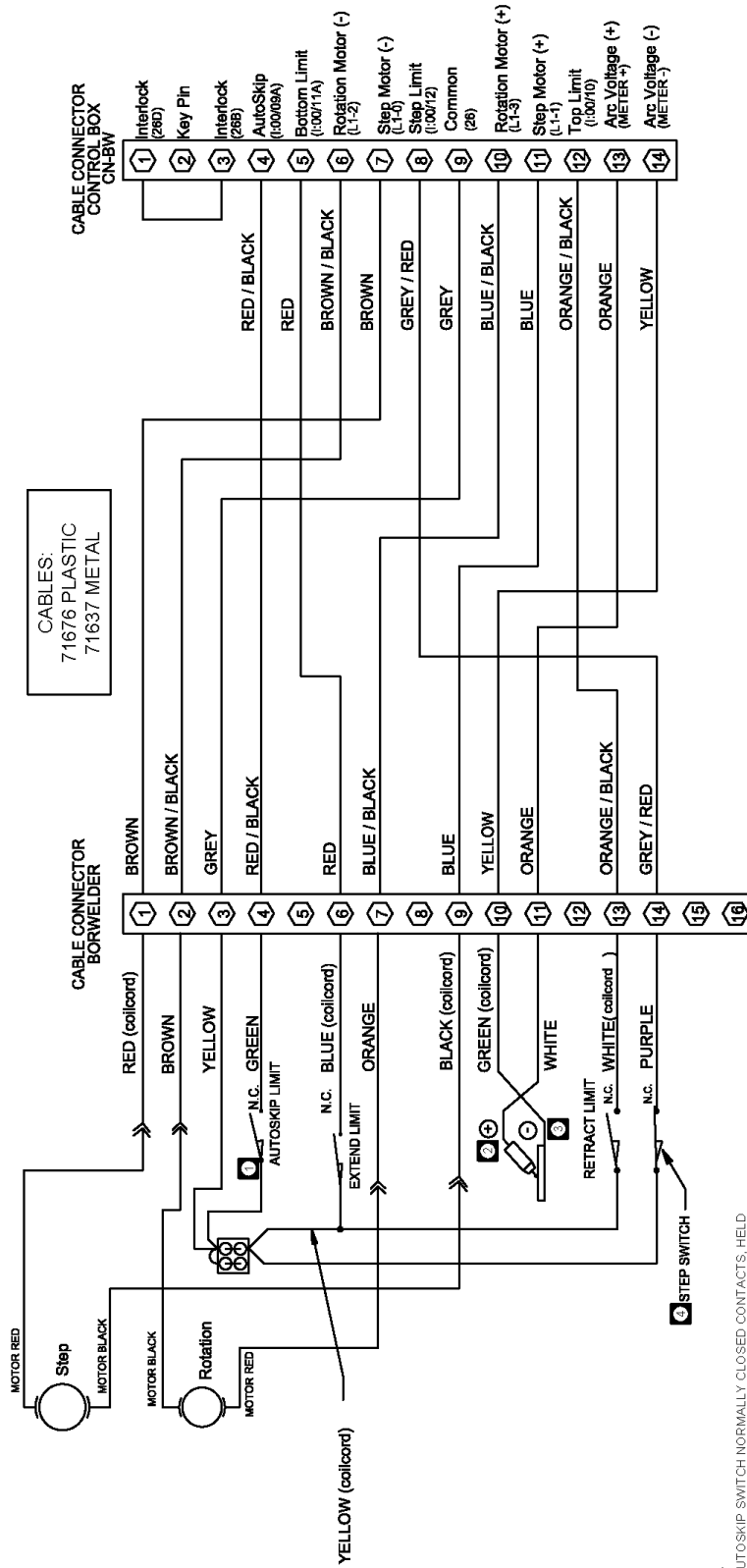
FIGURE B-14. 170 CONTROLLER PLASTIC CONNECTORS ASSEMBLY 3 (P/N 98041) - - - - - 163

FIGURE B-15. 170 CONTROLLER ASSEMBLY PLASTIC CONNECTORS PARTS LIST (P/N 98041) - - - - - 164

FIGURE B-16. 170 CONTROLLER PLASTIC CONNECTORS SCHEMATIC 1 (P/N 98041) - - - - - 165

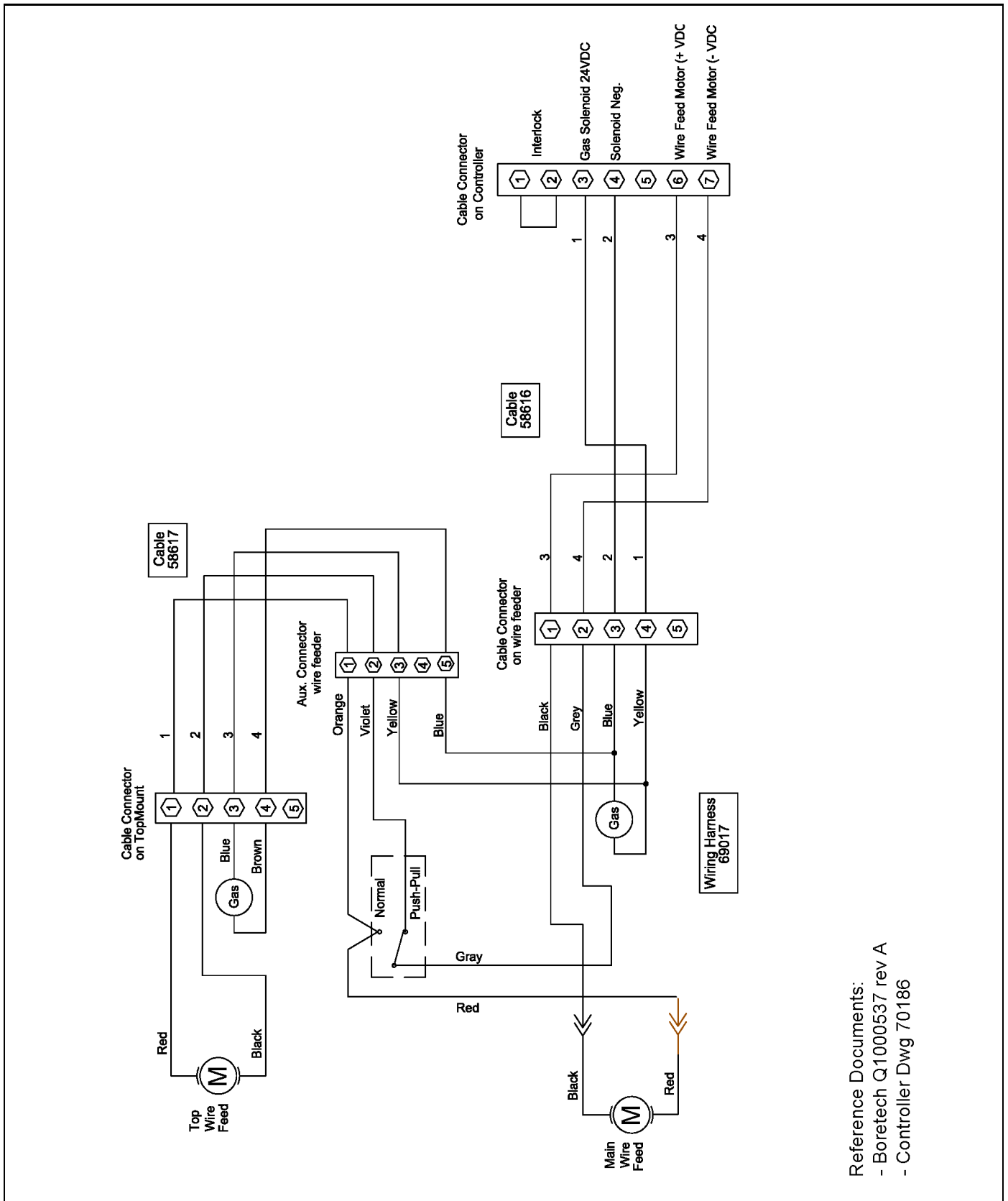
FIGURE B-17. 170 CONTROLLER PLASTIC CONNECTORS SCHEMATIC 2 (P/N 98041) - - - - - 166

THIS SCHEMATIC APPLIES TO BOREWELDER MODELS
54419, 54421, 54423, 54425



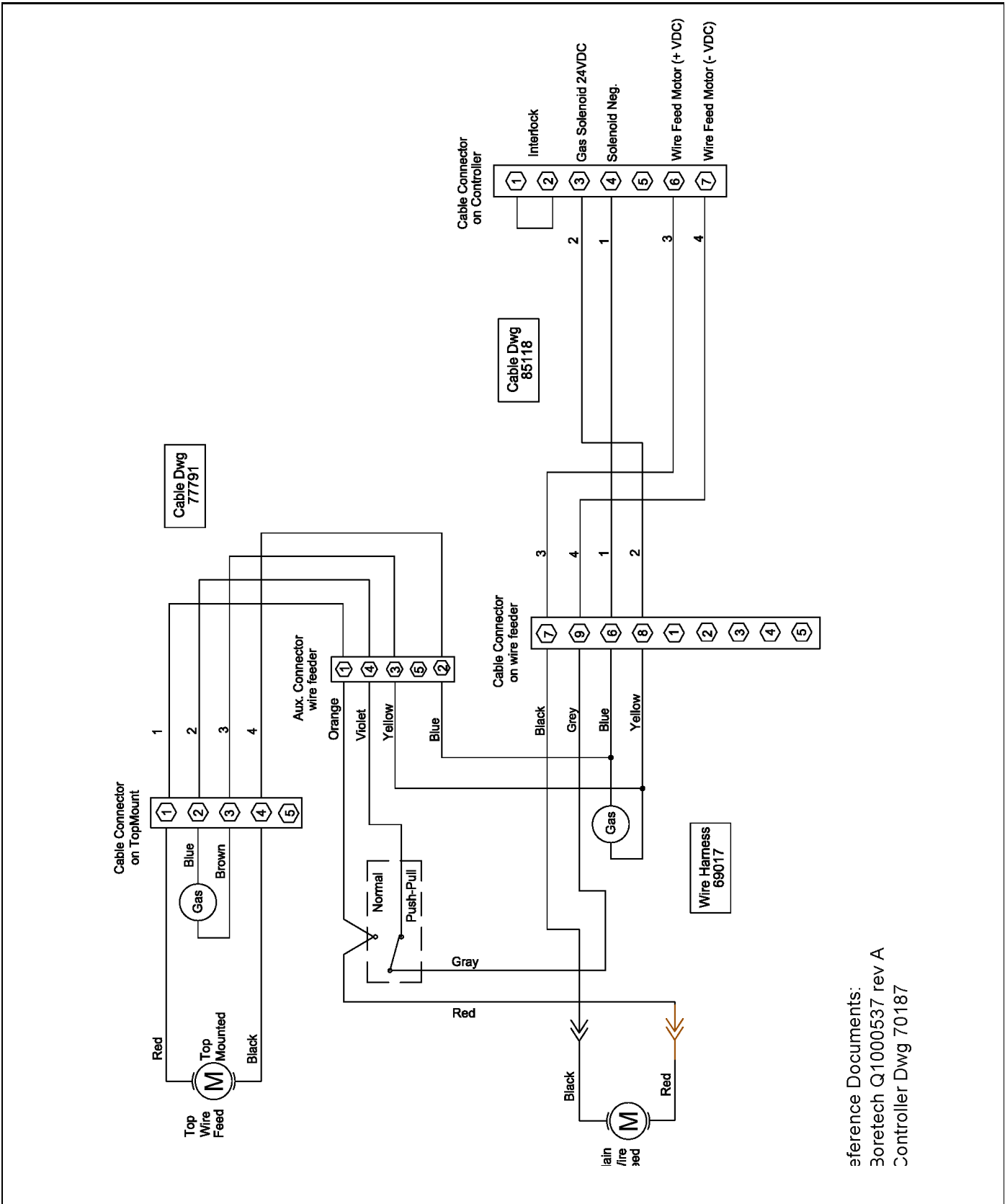
- ⑧ AUTOSKIP SWITCH NORMALLY CLOSED CONTACTS, HELD OPEN BY THE CAM DISCS. INTERRUPTS ON CLOSING OF CONTACTS
- ⑨ POSITIVE VOLTAGE SENSING CONDUCTOR ATTACHES TO THE POWER PIN BENEATH THE COVER.
- ⑩ NEGATIVE VOLTAGE SENSING CONDUCTOR CONNECTS TO GROUND AT THE EXTEND/RETRACT BLOCK.
- ⑪ STEP SWITCH - TORCH STEPS ON CLOSING OF THE CONTACTS
- ⑫ REFERENCE PREVIOUS BORTECH DRAWING Q100310
- ⑬ REFERENCE CONTROLLER DRAWINGS 70186-2 AND 70187-2

FIGURE B-1. BOREWELDER WITH METAL OR PLASTIC CONNECTORS SCHEMATIC (P/N 87413)



Reference Documents:
 - Boretech Q1000537 rev A
 - Controller Dwg 70186

FIGURE B-2. WIRE FEEDER WITH METAL CONNECTORS SCHEMATIC (P/N 87414)



reference Documents:
 Boretech Q1000537 rev A
 Controller Dwg 70187

FIGURE B-3. WIRE FEEDER WITH PLASTIC CONNECTORS SCHEMATIC (P/N 87415)

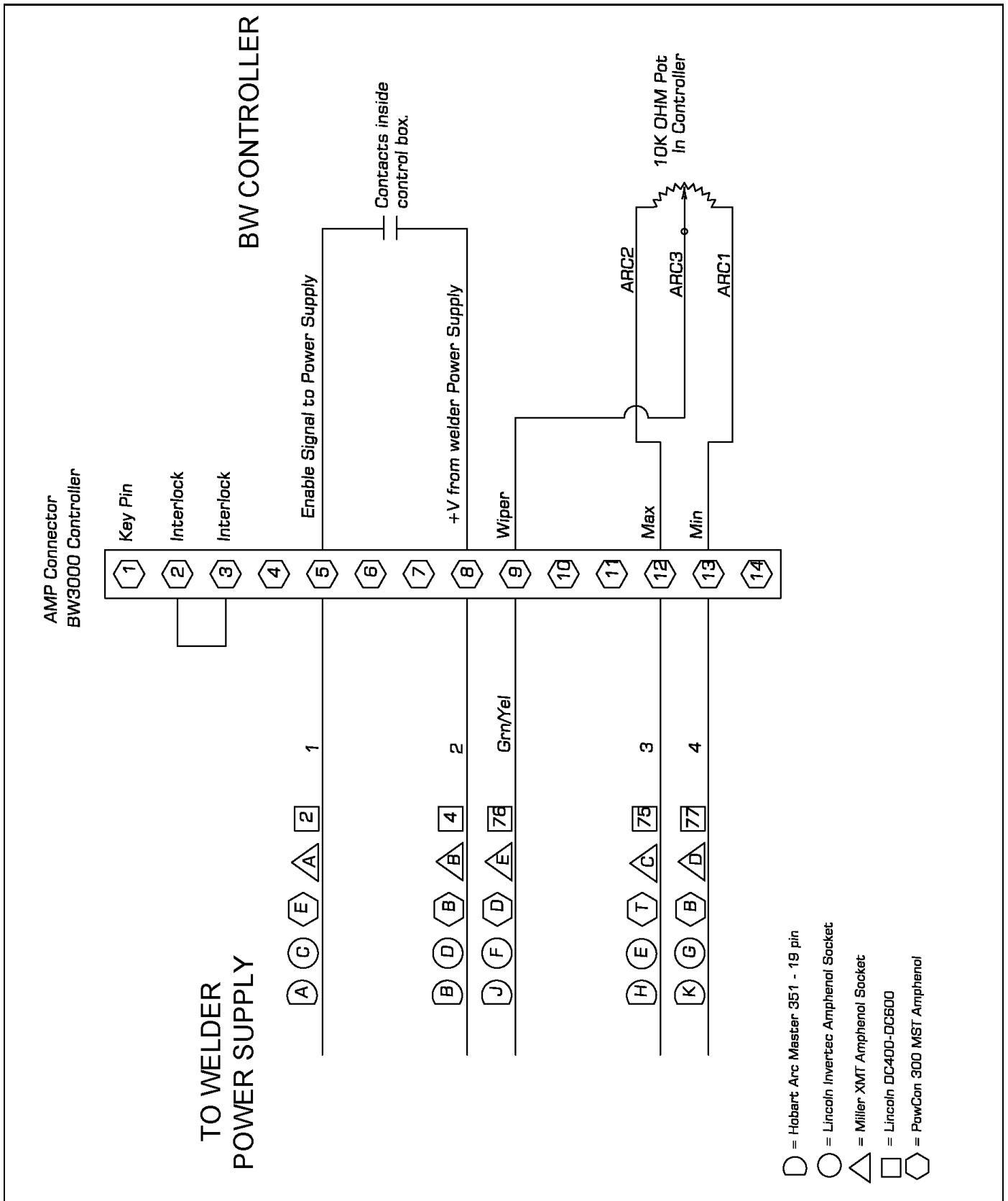
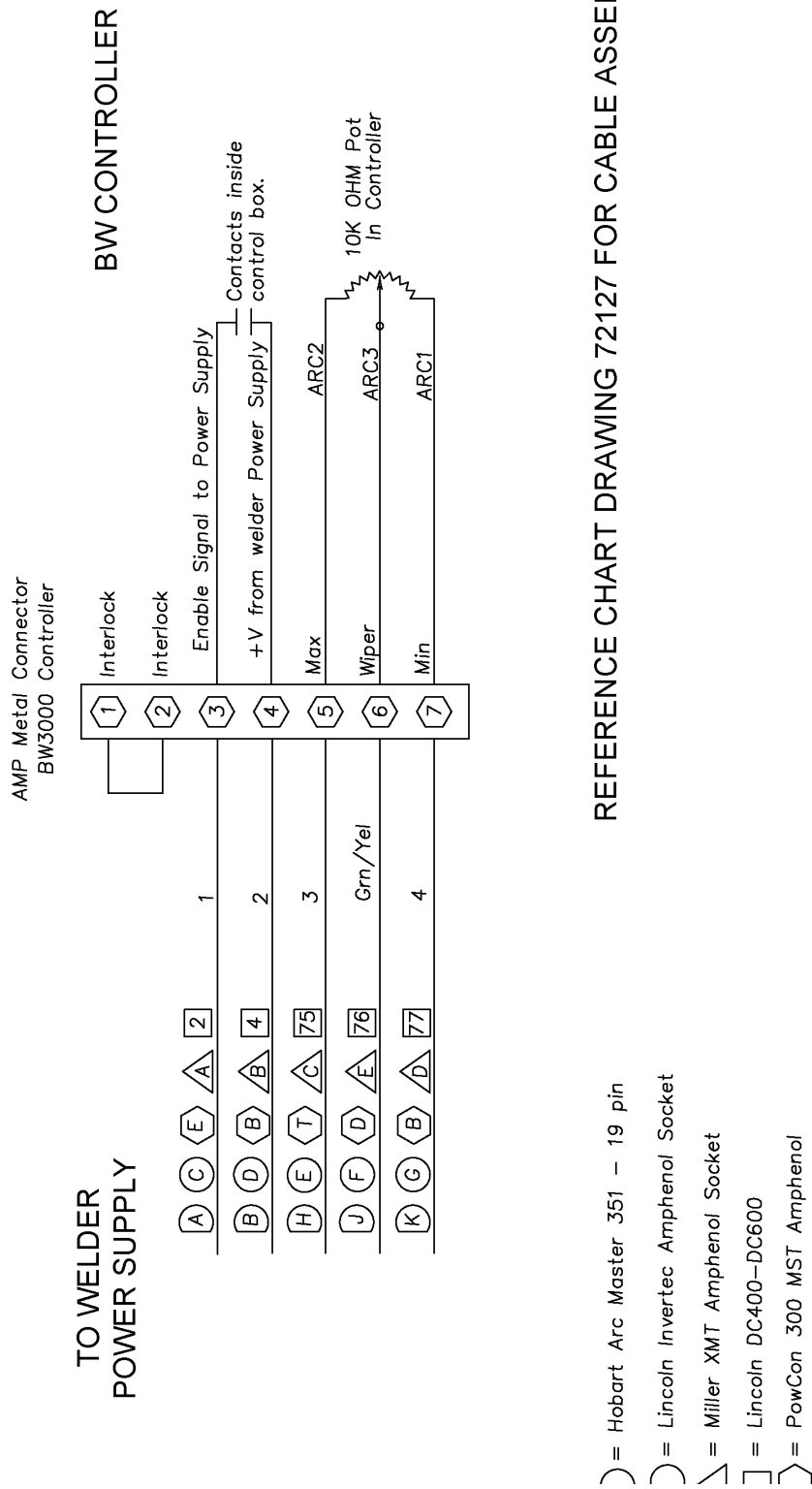


FIGURE B-4. POWER SUPPLY INTERFACE CABLE WITH PLASTIC CONNECTOR SCHEMATIC (P/N 87419)



REFERENCE CHART DRAWING 72127 FOR CABLE ASSEMBLY

- ⌋ = Hobart Arc Master 351 – 19 pin
- ⌋ = Lincoln Invertec Amphenol Socket
- ⌋ = Miller XMT Amphenol Socket
- ⌋ = Lincoln DC400–DC600
- ⌋ = PowCon 300 MST Amphenol

FIGURE B-5. POWER SUPPLY INTERFACE CABLE SCHEMATIC WITH PLASTIC CONNECTOR (P/N 87421)

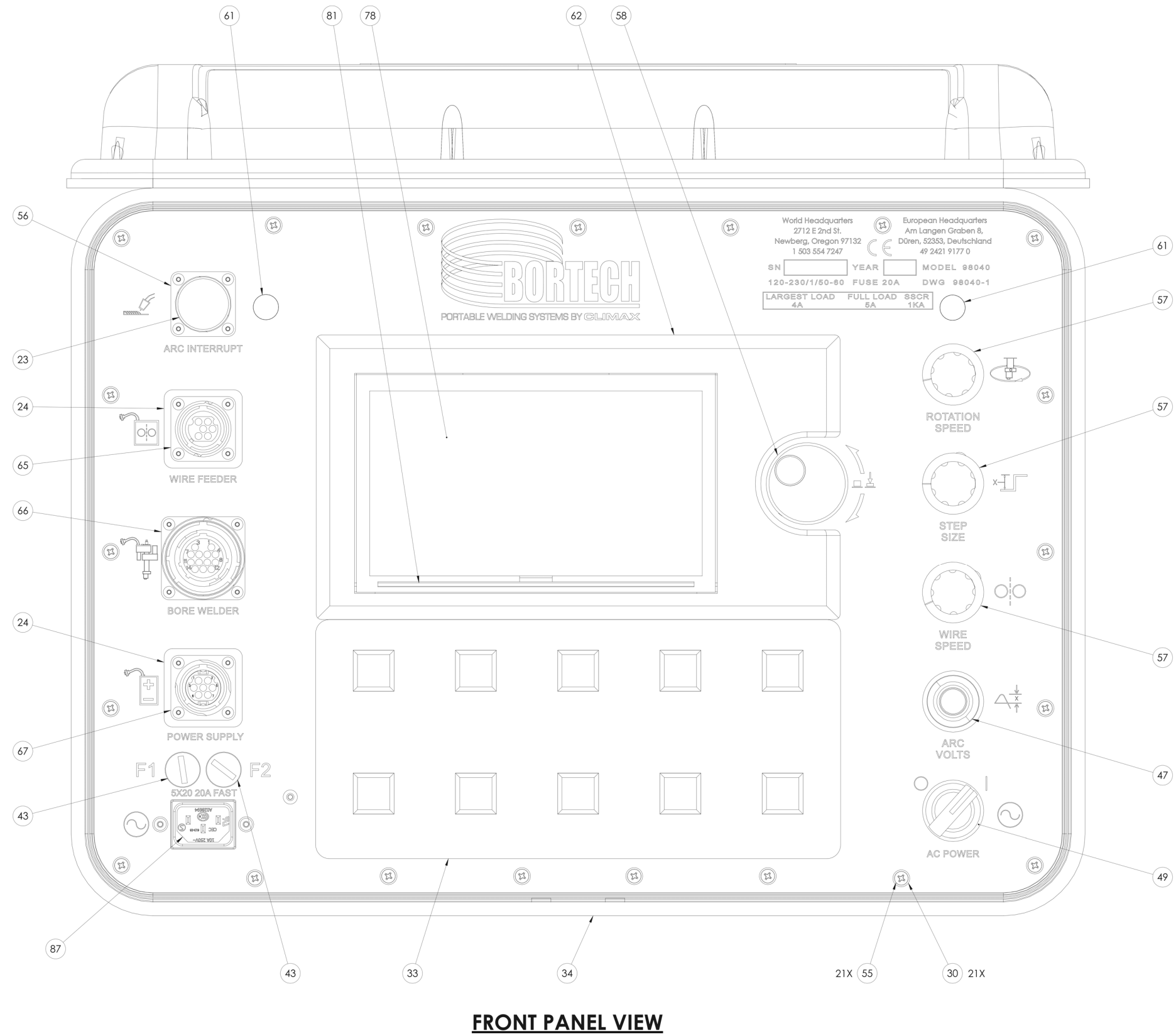
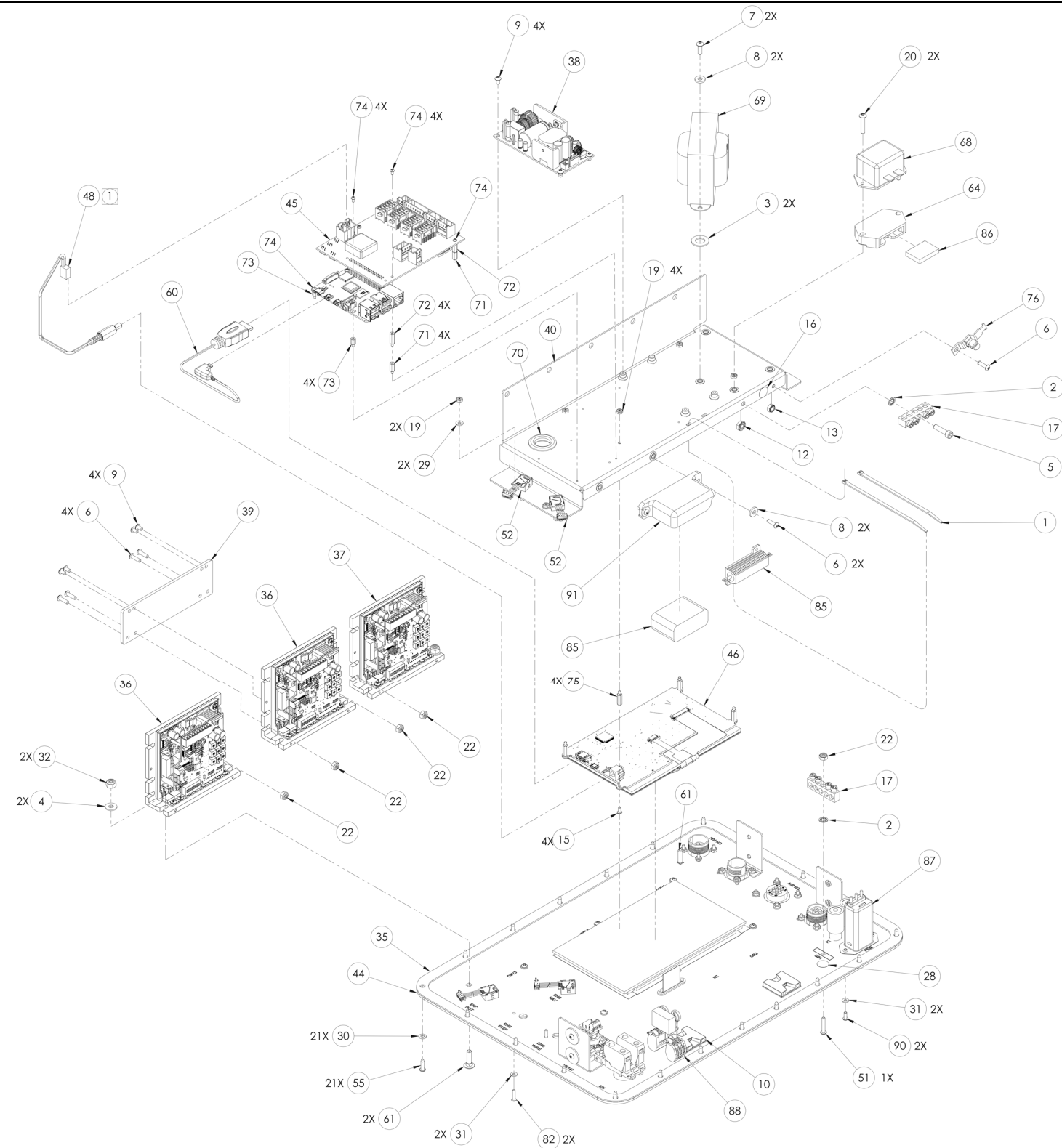
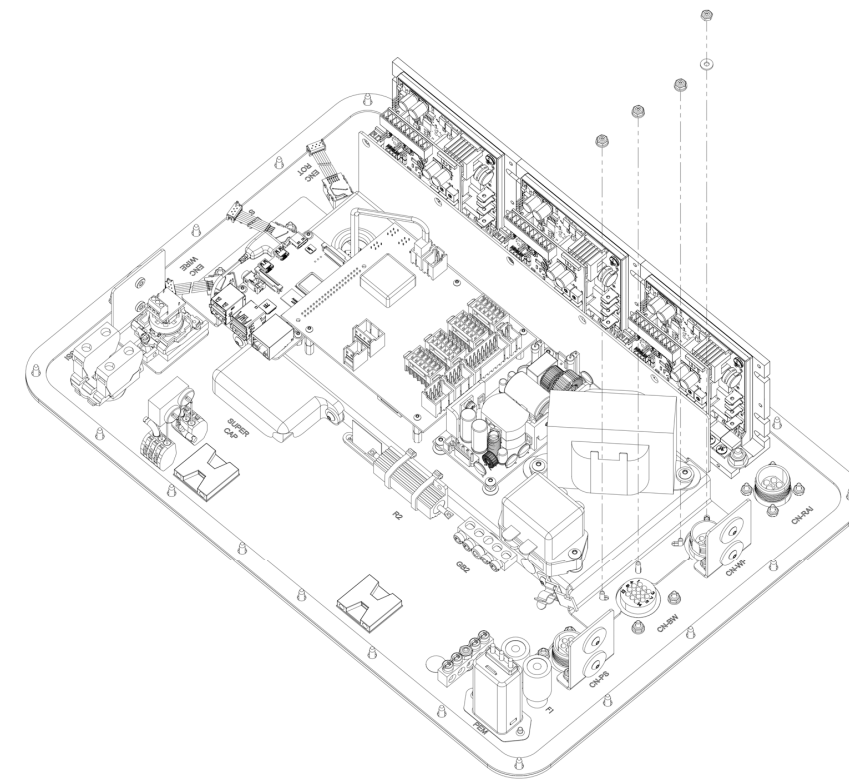


FIGURE B-6. 170 CONTROLLER METAL CONNECTORS ASSEMBLY 1 (P/N 98040)



REAR PANEL COMPONENT ASSEMBLY



CHASSIS TO REAR PANEL INSTALLATION

 CLIMAX Portable Machining & Welding Systems	CONFIDENTIAL PROPERTY OF CLIMAX PORTABLE MACHINING & WELDING DESCRIPTION: CONTROLLER BW3000 MODEL 170 CE METAL CONNECTORS	DWG NO: 98040
	CONTROLLER BW3000 MODEL 170 CE METAL CONNECTORS	

FIGURE B-7. 170 CONTROLLER METAL CONNECTORS ASSEMBLY 2 (P/N 98040)

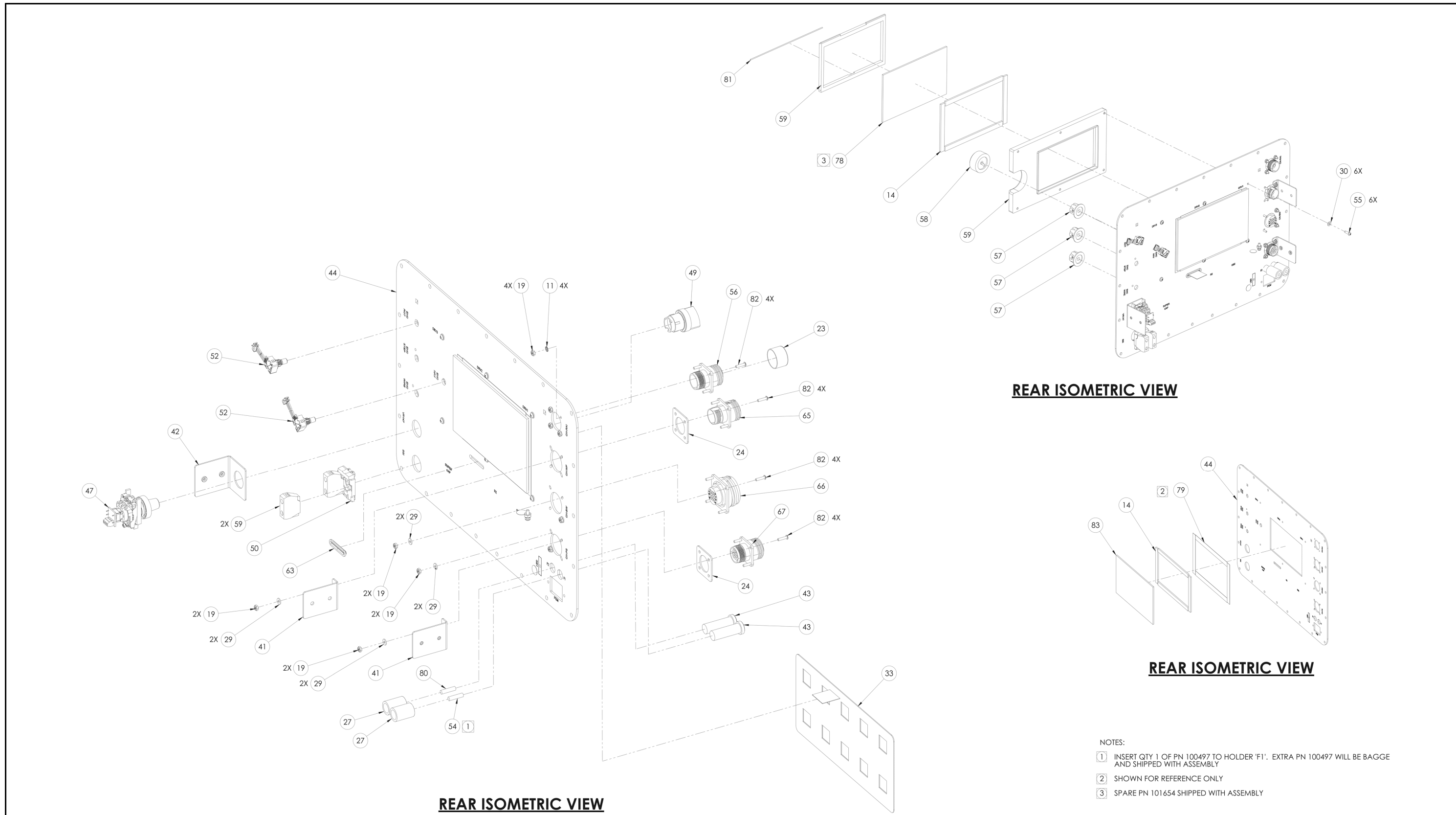
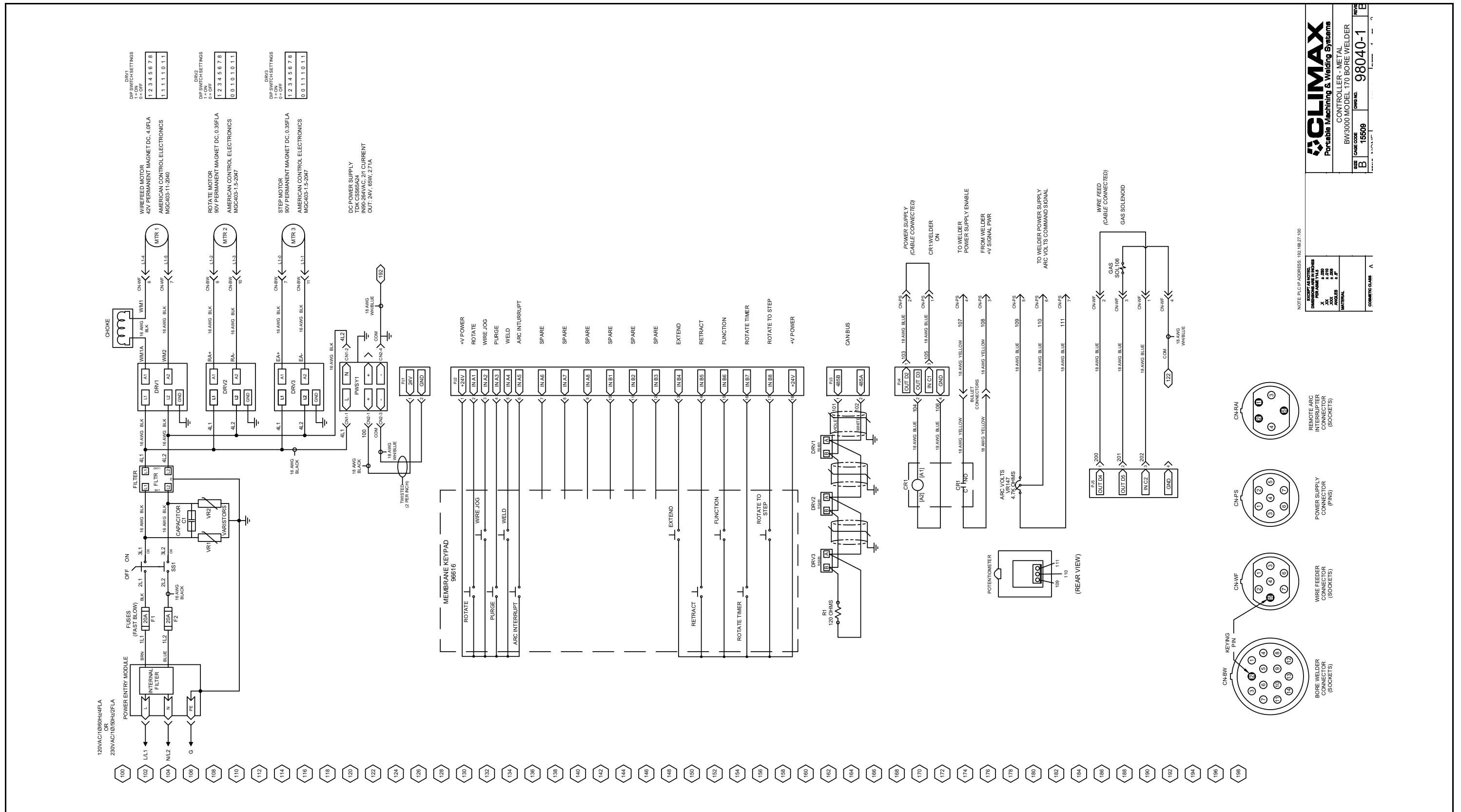


FIGURE B-8. 170 CONTROLLER METAL CONNECTORS ASSEMBLY 3 (P/N 98040)

ITEM NO.	QTY.	PART NO.	DESCRIPTION	ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	18	10673	WIRE TIE SMALL .09 X 3.5	46	1	100455	SP DISPLAY TFT HDMI 7IN 800 x 480
2	2	10889	WASHER #10 ITSTRW	47	1	100458	SP POTENTIOMETER W/HEAD LINEAR 1W 4.7K
3	2	11080	WASHER 3/8 FLTW SAE PLAIN STEEL	48	1	100459	KIT WIRE HARNESS BW3000 MODEL 170
4	2	11315	WASHER #10 FLTW BLACK OXIDE	49	1	100461	SELECTOR SWITCH HEAD 2 POS XB5 SERIES
5	1	11676	SCREW 10-32 X 3/4 SHCS	50	1	100463	MOUNTING COLLAR FOR 22MM PUSH BUTTON XB5A OPERATORS
6	7	11686	SCREW 6-32 X 1/2 BHSCS	51	1	100487	SCREW 6-32 x .75 STAINLESS BHCS HEX
7	2	11852	SCREW 8-32 X 1/2 BHSCS	52	4	100494	SP ENCODER OPTICAL ROTARY 32PPR
8	4	11872	WASHER #8 FLTW SAE ZINC PLATED	53	1	100496	EMI CAGE BW3000 CONTROLLER MODEL 170
9	14	12599	SCREW 6-32 X 1/4 BHSCS	54	2	100497	SP FUSE 20 AMP 5x20MM FAST ACTING
10	2	13296	MOUNTING BASE WIRE TIE ADHESIVE BACKED LARGE	55	27	100500	SCREW #6 X 1/2 ROUND HEAD THREAD FORMING FOR BRITTLE PLASTICS 410 SS PHILIPS
11	4	23008	WASHER #4 STAR LOCK	56	1	100501	SP ASSY RECEPTACLE WITH HARNESS BW3000 MODEL 170 REMOTE ARC INTERRUPT
12	1	28060	NUT 10-32 LOCKING STAR WASHER	57	3	100506	SP KNOB PLASTIC INDICATING 1-1/8 DIA BW3000 MODEL 170
13	1	29450	NUT 6-32 LOCKING STAR WASHER	58	1	100507	SP KNOB PLASTIC INDICATING 1-1/2 DIA BW3000 MODEL 170
14	41	35655	SEAL NEOPRENE SPONGE 3/8 X 5/32 ADHESIVE BACK	59	2	100514	SP CONTACT BLOCK N/O XB4 XB5 SERIES
15	4	37397	SCREW 4-40 X 1/4 BHSCS	60	1	100515	CABLE MICRO-HDMI TO HDMI 1.6FT 90DEG
16	1	37572	LABEL GROUND BOND TERMINAL (KB)	61	2	100530	BOLT CARRIAGE 10-24 X .75
17	2	38443	GROUND BUSS 4 POLE (KB)	62	1	100534	SP BEZEL COVER LENS HOLDER BW3000 MODEL 170
18	1	52815	(NOT SHOWN) MANUAL INSTRUCTION MODEL BW3000 BOREWELDER	63	1	100536	GROMMET RIBBON CABLE BW3000 MODEL 170
19	22	62478	NUT 4-40 NYLON INSERT THIN LOCKNUT	64	1	100538	HOLDER FOR RELAY BW3000 MODEL 170
20	2	63301	SCREW 8-32 X 7/8 SHCS	65	1	100606	SP ASSY METAL RECEPTICAL WITH HARNESS BW3000 MODEL 170 WIRE FEED
21	1	66917	(NOT SHOWN) CORD POWER 5-15 120V 90 DEG C13 RIGHT 6 FT	66	1	100607	SP ASSY METAL RECEPTACLE WITH HARNESS BW3000 MODEL 170 BORE WELDER
22	5	67161	NUT 6-32 NYLON INSERT ZINC PLATED	67	1	100608	SP ASSY METAL RECEPTACLE WITH HARNESS BW3000 MODEL 170 POWER SUPPLY
23	1	67173	CAP PUSH ON 1.00 OD X 19/32 HT PLASTIC BLACK	68	1	100611	SP POWER FILTER 250V 10AMP
24	2	67194	BEZEL CONNECTOR METAL PS AND WF BW3000 CONTROLLER	69	1	100752	FILTER CHOKE 56 MF 4 X 2-1/8 X 2-5/8
25	1	70227	LABEL CLIMAX LOGO 2 X 8	70	1	101575	BUSHING UNIVERSIAL OPEN-CLOSED .67 ID .875 MOUNTING HOLE
26	1	73878	(NOT SHOWN) CORD POWER CEE 7/7 230V 90 DEG C13 RIGHT 8 FT	71	4	101600	STANDOFF 3/16 HEX THREADED MALE FEMALE 2-56 .375 TALL
27	2"	76644	TUBING HEAT SHRINK 1 ID 2:1 SHRINK RATIO BLACK	72	4	101601	STANDOFF 3/16 HEX THREADED MALE FEMALE 2-56 .5 TALL
28	1	77568	LABEL PE PROTECTIVE EARTH TERMINAL 1/2 INCH DIA	73	4	101602	STANDOFF 3/16 HEX THREADED MALE FEMALE 2-56 .25 TALL
29	14	77983	WASHER #4 SS	74	8	101603	SCREW 2-56 X 3/16 BHSCS
30	27	79316	WASHER #6 NYLON .15 ID X .32 OD X .03 BLACK	75	4	101604	STANDOFF 3/16 HEX THREADED MALE FEMALE 4-40 .500 TALL
31	4	81705	WASHER #4 NYLON .12 ID X .28 OD X .031 WHITE	76	1	101618	CLAMP EMC SHIELD 6-8 MM ICOTEK 36920, LFZ/SKL
32	2	87533	NUT 10-24 STDNYLOC 316SS	77	27"	101633	(NOT SHOWN) TAPE COPPER FOIL CONDUCTIVE ELECTRICAL TAPE 1" WIDE
33	1	96616	MEMBRANE KEYPAD BW3000 MODEL 170	78	2	101654	COVER LENS EXTERIOR BW3000 MODEL 170
34	1	97524	CASE NANUK 925 BLACK 18.7 X 14.8 X 7.0	79	24"	101655	TAPE DOUBLE SIDED POLYESTER ACRYLIC .0075 X .5 X 36 YD CLEAR
35	1	100143	GASKET FOR TOP PLATE NANUK 925 CASE	80	1	101672	FUSE DUMMY 5MM X 20MM BRASS
36	2	100153	SP DC DRIVE 4 QUADRANT 120/230V INPUT 90VDC OUTPUT 1.5 AMPS CANBUS CTRL	81	7"	101674	WIRE 304 STAINLESS STEEL .063 SPRING BACK MULTIPURPOSE
37	1	100154	SP DC DRIVE 4 QUADRANT 120/230V INPUT 90VDC OUTPUT 11 AMPS CANBUS CTRL	82	18	101773	SCREW 4-40 X 1/2 BHSCS 18-8 SS
38	1	100236	SP POWER SUPPLY 24VDC 2.71 AMP 115-230VAC INPUT	83	1	101898	COVER LENS INSIDE BW3000 MODEL 170
39	1	100441	SUPPORT PLATE DC DRIVE BW3	84	1	101912	LABEL REFERENCE SHEET CE CONTROLLER BW3000 MODEL 170
40	1	100442	CHASSIS BW3000 CONTROLLER MODEL 170	85	1	101913	SP ASSY SUPERCAP AND RESISTOR BW3000 MODEL 170
41	2	100449	BRACKET EMC CAGE AT RECEPTACLES BW3000 MODEL 170	86	1	101914	SP ASSY RELAY BW3000 MODEL 170
42	1	100450	BRACKET EMC CAGE FOR POT BW3	87	1	101915	SP ASSY POWER MODULE BW3000 MODEL 170
43	2	100452	FUSE HOLDER 5x20	88	1	101916	SP ASSY MOV/CAPACITOR BW3000 MODEL 170
44	1	100453	TOP PLATE BW3000 CONTROLLER METAL MODEL 170	89	6	101918	WASHER FENDER #6 5/32 ID X 3/4 OD
45	1	100454	SP MICROCONTROLLER BW3000 MODEL 170	90	2	101925	SCREW M3 X 0.5 X 8MM 316 SS BHCS
				91	1	101963	BRACKET MOUNTING SUPERCAP BW3000 MODEL 170

FIGURE B-9. 170 CONTROLLER ASSEMBLY METAL CONNECTORS PARTS LIST (P/N 98040)



CLIMAX
 Portable Machining & Welding Systems

CONTROLLER - METAL
 BW3000 MODEL 170 BORE WELDER

REV B DATE CODE 15509 DWG NO. 98040-1

NOTE: ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
 DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
 MATERIAL: STEEL

CONTRACT CLASS A

FIGURE B-10. 170 CONTROLLER METAL CONNECTORS SCHEMATIC 1 (P/N 98040)

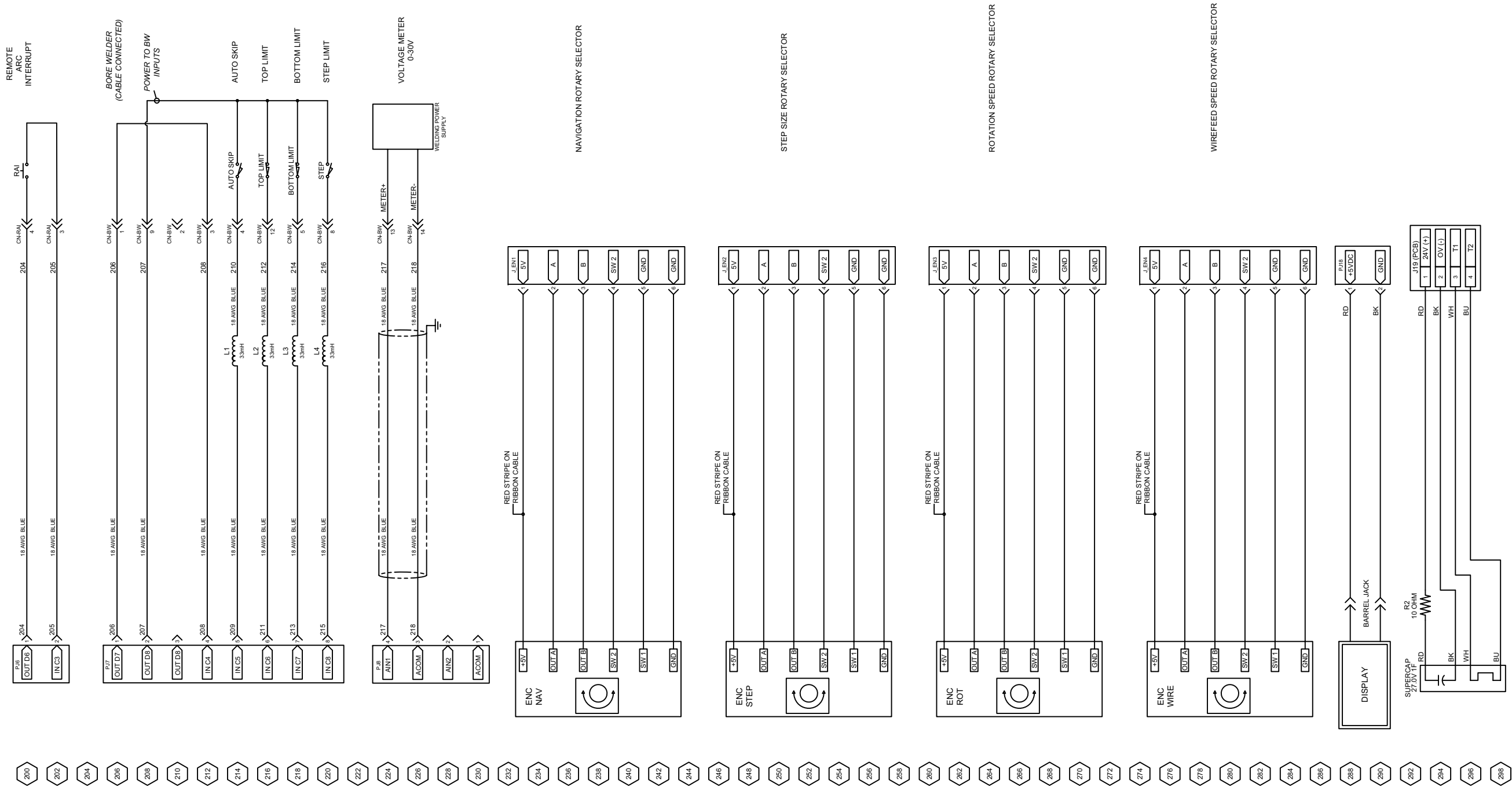


FIGURE B-11. 170 CONTROLLER METAL CONNECTORS SCHEMATIC 2 (P/N 98040)

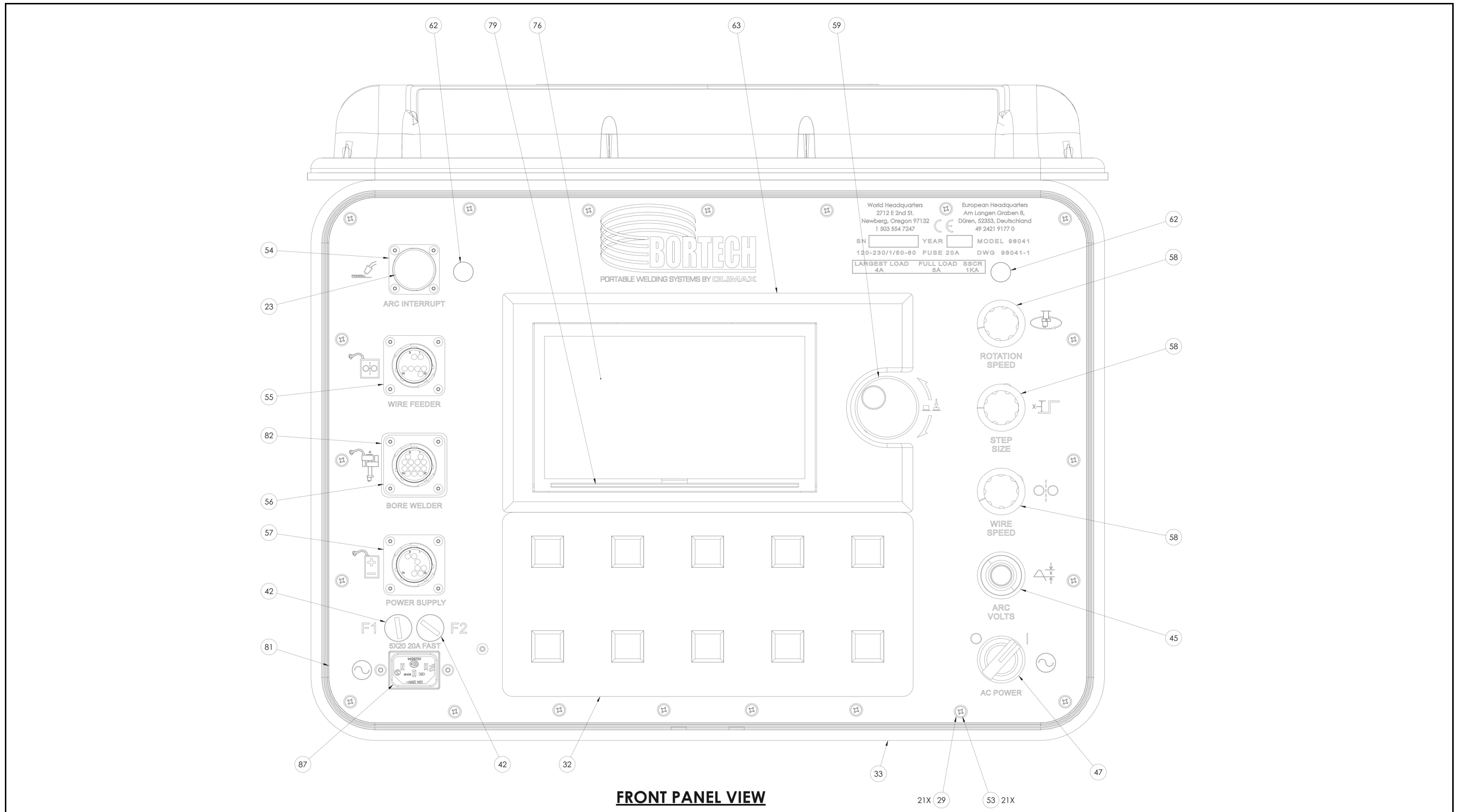
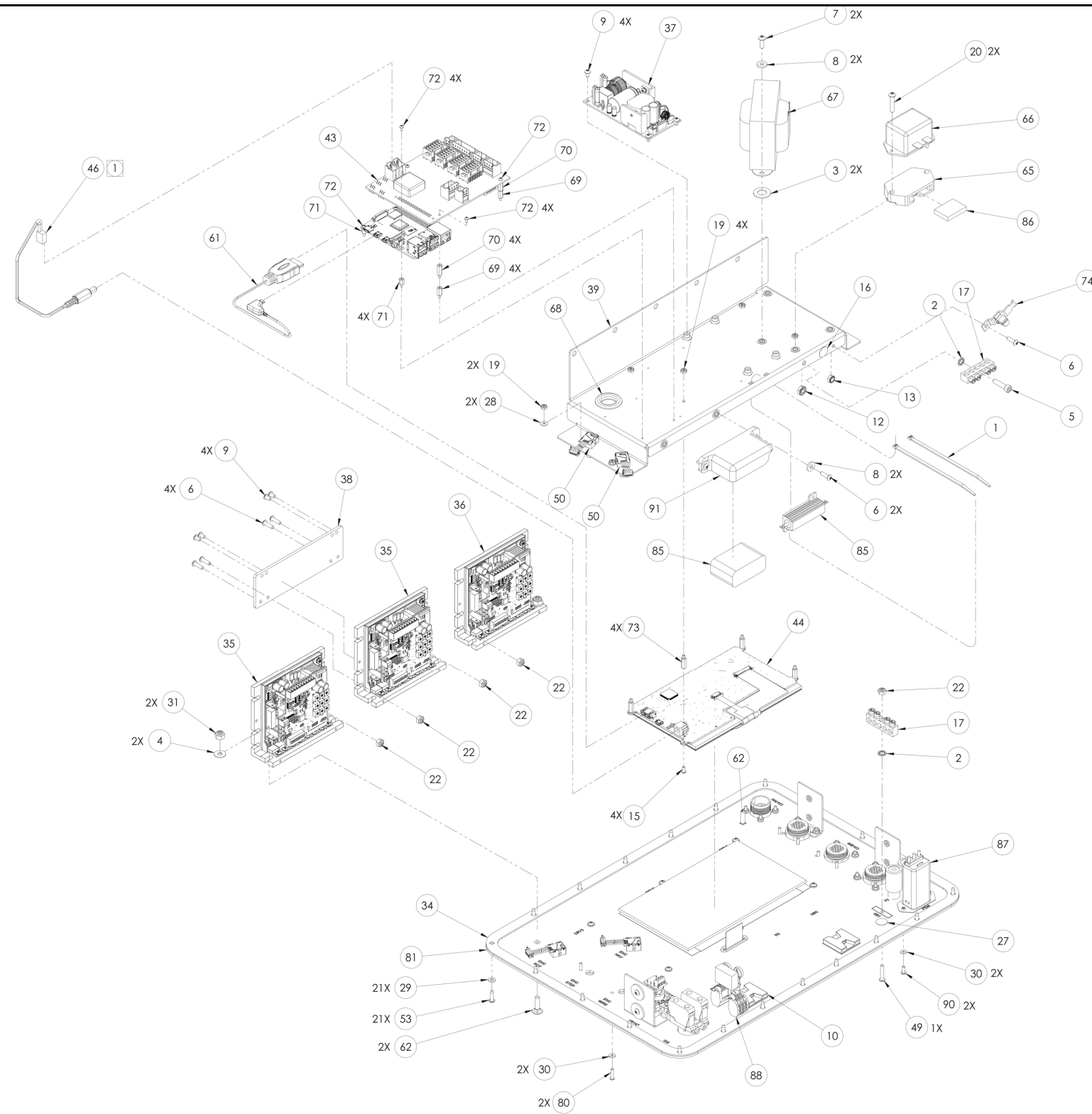
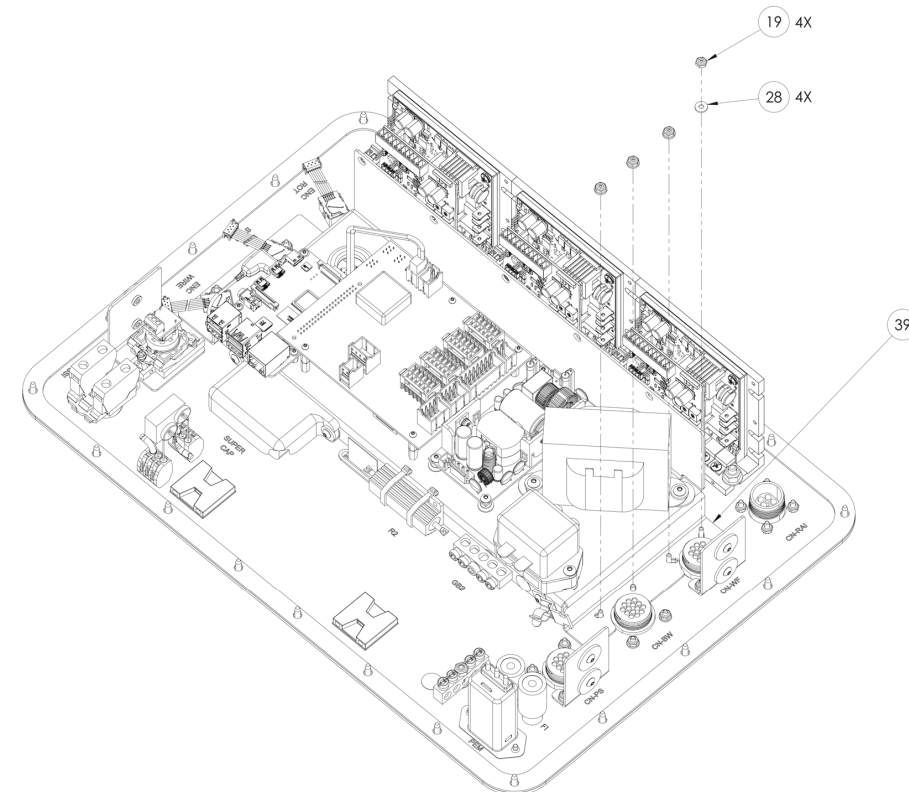


FIGURE B-6. 170 CONTROLLER PLASTIC CONNECTORS ASSEMBLY 1 (P/N 98041)



REAR PANEL COMPONENT ASSEMBLY

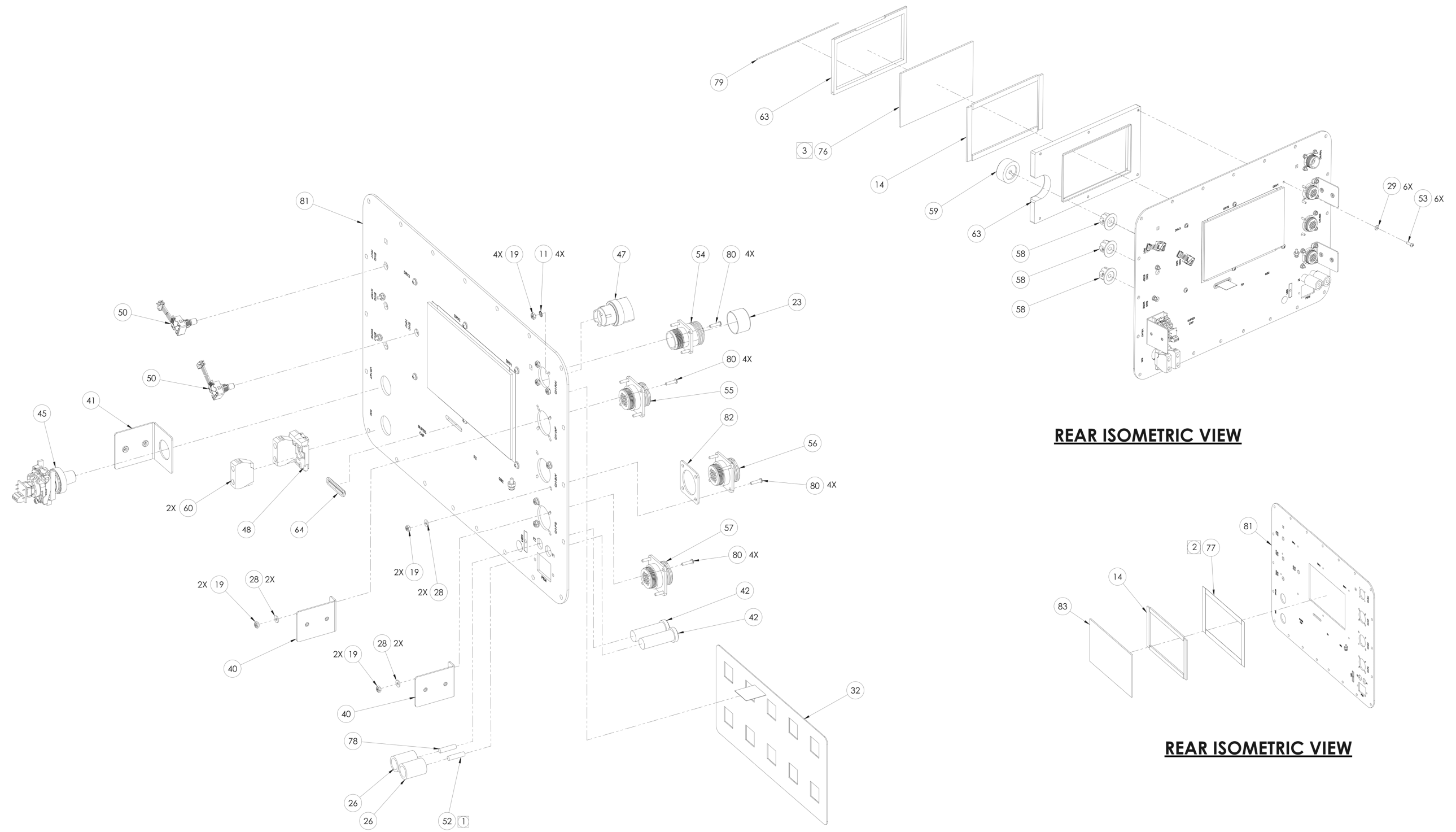


CHASSIS TO REAR PANEL INSTALLATION

NOTES:
 1 COMPONENT OF PN 100459 SHOWN FOR REFERENCE ONLY. OTHER COMPONENTS NOT SHOWN.

 CLIMAX Portable Machining & Welding Systems	CONFIDENTIAL PROPERTY OF CLIMAX PORTABLE MACHINING & WELDING DESCRIPTION: CONTROLLER BW3000 MODEL 170 CE PLASTIC CONNECTORS	DWG NO: 98041
	CLIMAX Portable Machining & Welding Systems	

FIGURE B-7. 170 CONTROLLER PLASTIC CONNECTORS ASSEMBLY 2 (P/N 98041)



REAR ISOMETRIC VIEW

REAR ISOMETRIC VIEW

REAR ISOMETRIC VIEW

NOTES:

- 1 INSERT QTY 1 OF PN 100497 TO HOLDER 'F1'. EXTRA PN 100497 WILL BE BAGGED AND SHIPPED WITH ASSEMBLY.
- 2 SHOWN FOR REFERENCE ONLY.
- 3 SPARE PN 101654 SHIPPED WITH ASSEMBLY

	DESCRIPTION:	CONFIDENTIAL PROPERTY OF CLIMAX PORTABLE MACHINING & WELDING	DWG NO.
	CONTROLLER BW3000 MODEL 170 CE PLASTIC CONNECTORS		98041

FIGURE B-8. 170 CONTROLLER PLASTIC CONNECTORS ASSEMBLY 3 (P/N 98041)

ITEM NO.	QTY.	PART NO.	DESCRIPTION	ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	18	10673	WIRE TIE SMALL .09 X 3.5	46	1	100459	KIT WIRE HARNESS BW3000 MODEL 170
2	2	10889	WASHER #10 ITSTRW	47	1	100461	SELECTOR SWITCH HEAD 2 POS XB5 SERIES
3	2	11080	WASHER 3/8 FLTW SAE PLAIN STEEL	48	1	100463	MOUNTING COLLAR FOR 22MM PUSH BUTTON XB5A OPERATORS
4	2	11315	WASHER #10 FLTW BLACK OXIDE	49	1	100487	SCREW 6-32 x .75 STAINLESS BHCS HEX
5	1	11676	SCREW 10-32 X 3/4 SHCS	50	4	100494	SP ENCODER OPTICAL ROTARY 32PPR
6	7	11686	SCREW 6-32 X 1/2 BHSCS	51	1	100496	EMI CAGE BW3000 CONTROLLER MODEL 170
7	2	11852	SCREW 8-32 X 1/2 BHSCS	52	2	100497	SP FUSE 20 AMP 5x20MM FAST ACTING
8	4	11872	WASHER #8 FLTW SAE ZINC PLATED	53	27	100500	SCREW #6 X 1/2 ROUND HEAD THREAD FORMING FOR BRITTLE PLASTICS 410 SS PHILIPS
9	14	12599	SCREW 6-32 X 1/4 BHSCS	54	1	100501	SP ASSY RECEPTACLE WITH HARNESS BW3000 MODEL 170 REMOTE ARC INTERRUPT
10	2	13296	MOUNTING BASE WIRE TIE ADHESIVE BACKED LARGE	55	1	100502	SP ASSY PLASTIC RECEPTACLE WITH HARNESS BW3000 MODEL 170 WIRE FEED
11	4	23008	WASHER #4 STAR LOCK	56	1	100503	SP ASSY PLASTIC RECEPTACLE WITH HARNESS BW3000 MODEL 170 BORE WELDER
12	1	28060	NUT 10-32 LOCKING STAR WASHER	57	1	100504	SP ASSY PLASTIC RECEPTACLE WITH HARNESS BW3000 MODEL 170 POWER SUPPLY
13	1	29450	NUT 6-32 LOCKING STAR WASHER	58	3	100506	SP KNOB PLASTIC INDICATING 1-1/8 DIA BW3000 MODEL 170
14	41	35655	SEAL NEOPRENE SPONGE 3/8 X 5/32 ADHESIVE BACK	59	1	100507	SP KNOB PLASTIC INDICATING 1-1/2 DIA BW3000 MODEL 170
15	4	37397	SCREW 4-40 X 1/4 BHSCS	60	2	100514	SP CONTACT BLOCK N/O XB4 XB5 SERIES
16	1	37572	LABEL GROUND BOND TERMINAL (KB)	61	1	100515	CABLE MICRO-HDMI TO HDMI 1.6FT 90DEG
17	2	38443	GROUND BUSS 4 POLE (KB)	62	2	100530	BOLT CARRIAGE 10-24 X .75
18	1	52815	(NOT SHOWN) MANUAL INSTRUCTION MODEL BW3000 BOREWELDER	63	1	100534	SP BEZEL COVER LENS HOLDER BW3000 MODEL 170
19	22	62478	NUT 4-40 NYLON INSERT THIN LOCKNUT	64	1	100536	GROMMET RIBBON CABLE BW3000 MODEL 170
20	2	63301	SCREW 8-32 X 7/8 SHCS	65	1	100538	HOLDER FOR RELAY BW3000 MODEL 170
21	1	66917	(NOT SHOWN) CORD POWER 5-15 120V 90 DEG C13 RIGHT 6 FT	66	1	100611	SP POWER FILTER 250V 10AMP
22	5	67161	NUT 6-32 NYLON INSERT ZINC PLATED	67	1	100752	FILTER CHOKE 56 MF 4 X 2-1/8 X 2-5/8
23	1	67173	CAP PUSH ON 1.00 OD X 19/32 HT PLASTIC BLACK	68	1	101575	BUSHING UNIVERSIAL OPEN-CLOSED .67 ID .875 MOUNTING HOLE
24	1	70227	LABEL CLIMAX LOGO 2 X 8	69	4	101600	STANDOFF 3/16 HEX THREADED MALE FEMALE 2-56 .375 TALL
25	1	73878	(NOT SHOWN) CORD POWER CEE 7/7 230V 90 DEG C13 RIGHT 8 FT	70	4	101601	STANDOFF 3/16 HEX THREADED MALE FEMALE 2-56 .5 TALL
26	2"	76644	TUBING HEAT SHRINK 1 ID 2:1 SHRINK RATIO BLACK	71	4	101602	STANDOFF 3/16 HEX THREADED MALE FEMALE 2-56 .25 TALL
27	1	77568	LABEL PE PROTECTIVE EARTH TERMINAL 1/2 INCH DIA	72	8	101603	SCREW 2-56 X 3/16 BHSCS
28	14	77983	WASHER #4 SS	73	4	101604	STANDOFF 3/16 HEX THREADED MALE FEMALE 4-40 .500 TALL
29	27	79316	WASHER #6 NYLON .15 ID X .32 OD X .03 BLACK	74	1	101618	CLAMP EMC SHIELD 6-8 MM ICOTEK 36920, LFZ/SKL
30	4	81705	WASHER #4 NYLON .12 ID X .28 OD X .031 WHITE	75	27"	101633	(NOT SHOWN) TAPE COPPER FOIL CONDUCTIVE ELECTRICAL TAPE 1" WIDE
31	2	87533	NUT 10-24 STDNYLOC 316SS	76	2	101654	COVER LENS EXTERIOR BW3000 MODEL 170
32	1	96616	MEMBRANE KEYPAD BW3000 MODEL 170	77	24"	101655	TAPE DOUBLE SIDED POLYESTER ACRYLIC .0075 X .5 X 36 YD CLEAR
33	1	97524	CASE NANUK 925 BLACK 18.7 X 14.8 X 7.0	78	1	101672	FUSE DUMMY 5MM X 20MM BRASS
34	1	100143	GASKET FOR TOP PLATE NANUK 925 CASE	79	7"	101674	WIRE 304 STAINLESS STEEL .063 SPRING BACK MULTIPURPOSE
35	2	100153	SP DC DRIVE 4 QUADRANT 120/230V INPUT 90VDC OUTPUT 1.5 AMPS CANBUS CTRL	80	18	101773	SCREW 4-40 X 1/2 BHSCS 18-8 SS
36	1	100154	SP DC DRIVE 4 QUADRANT 120/230V INPUT 90VDC OUTPUT 11 AMPS CANBUS CTRL	81	1	101896	TOP PLATE BW3000 CONTROLLER PLASTIC MODEL 170
37	1	100236	SP POWER SUPPLY 24VDC 2.71 AMP 115-230VAC INPUT	82	1	101897	ADAPTER PLASTIC BW CONNECTOR BW3000
38	1	100441	SUPPORT PLATE DC DRIVE BW3	83	1	101898	COVER LENS INSIDE BW3000 MODEL 170
39	1	100442	CHASSIS BW3000 CONTROLLER MODEL 170	84	1	101912	LABEL REFERENCE SHEET CE CONTROLLER BW3000 MODEL 170
40	2	100449	BRACKET EMC CAGE AT RECEPTACLES BW3000 MODEL 170	85	1	101913	SP ASSY SUPERCAP AND RESISTOR BW3000 MODEL 170
41	1	100450	BRACKET EMC CAGE FOR POT BW3	86	1	101914	SP ASSY RELAY BW3000 MODEL 170
42	2	100452	FUSE HOLDER 5x20	87	1	101915	SP ASSY POWER MODULE BW3000 MODEL 170
43	1	100454	SP MICROCONTROLLER BW3000 MODEL 170	88	1	101916	SP ASSY MOV/CAPACITOR BW3000 MODEL 170
44	1	100455	SP DISPLAY TFT HDMI 7IN 800 x 480	89	6	101918	WASHER FENDER #6 5/32 ID X 3/4 OD
45	1	100458	SP POTENTIOMETER W/HEAD LINEAR 1W 4.7K	90	2	101925	SCREW M3 X 0.5 X 8MM 316 SS BHCS
				91	1	101963	BRACKET MOUNTING SUPERCAP BW3000 MODEL 170


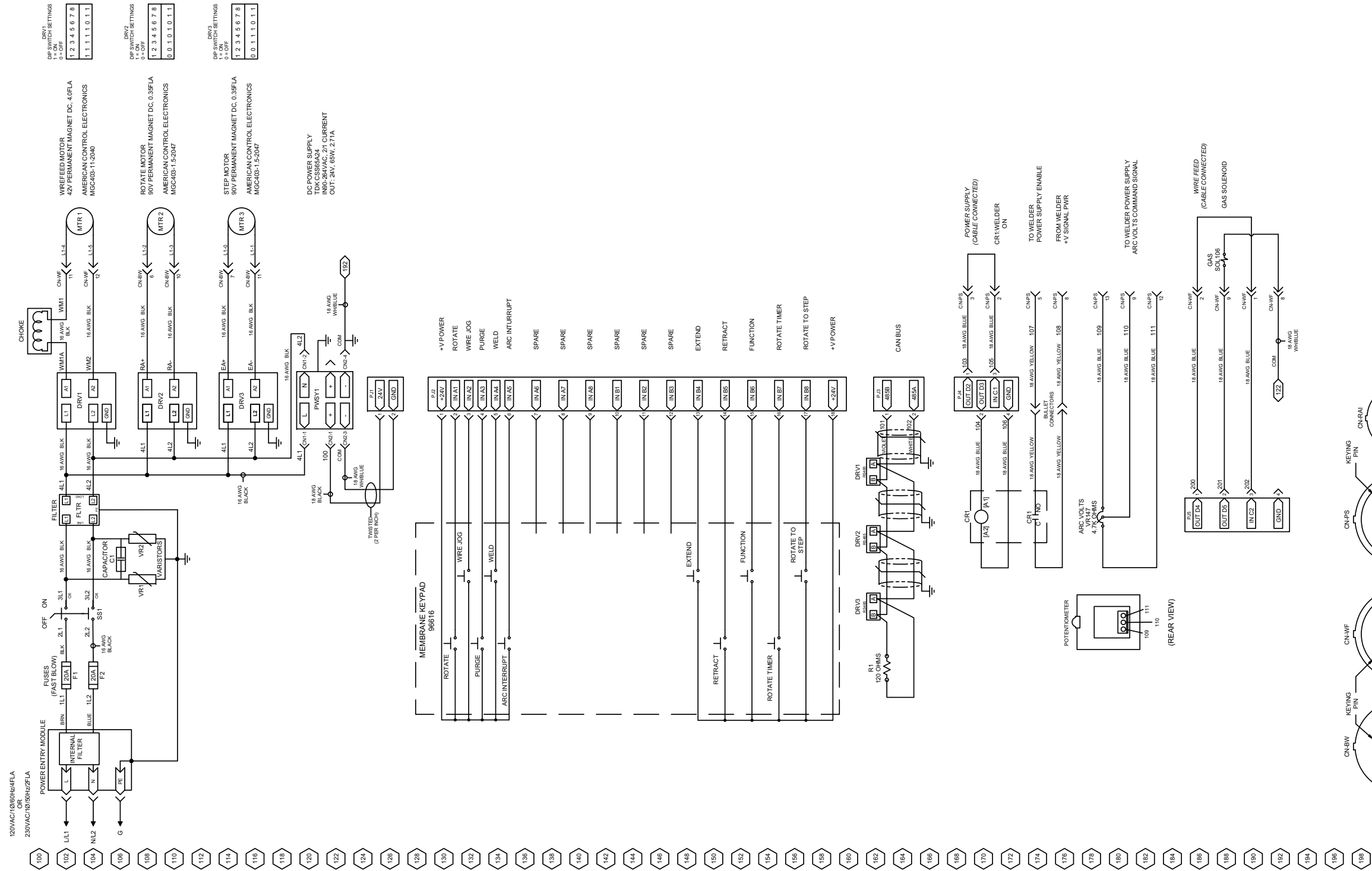
 CLIMAX Portable Machining & Welding Systems	CONFIDENTIAL PROPERTY OF CLIMAX PORTABLE MACHINING & WELDING DESCRIPTION: CONTROLLER BW3000 MODEL 170 CE PLASTIC CONNECTORS	DWG NO: 98041

FIGURE B-9. 170 CONTROLLER ASSEMBLY PLASTIC CONNECTORS PARTS LIST (P/N 98041)



NOTE: P/LC # ADDRESS: 102, 108, 27, 100

WIRE FEED MOTOR 42V PERMANENT MAGNET DC, 4.0FLA MIGC40B-11-2040	DRIVE SWITCH SETTINGS 1 = ON 0 = OFF 1 2 3 4 5 6 7 8 1 1 1 1 1 0 1 1
ROTATE MOTOR 90V PERMANENT MAGNET DC, 0.35FLA AMERICAN CONTROL ELECTRONICS MIGC40B-1.5-2047	DRIVE SWITCH SETTINGS 1 = ON 0 = OFF 1 2 3 4 5 6 7 8 0 0 1 0 1 0 1 1
STEP MOTOR 90V PERMANENT MAGNET DC, 0.35FLA AMERICAN CONTROL ELECTRONICS MIGC40B-1.5-2047	DRIVE SWITCH SETTINGS 1 = ON 0 = OFF 1 2 3 4 5 6 7 8 0 0 1 1 1 0 1 1
DC POWER SUPPLY TDK C5858A24 IN90-284VAC, 21I CURRENT OUT: 28V, 65W, 2.71A	

CLIMAX Portable Machining & Welding Systems	CONTROLLER - PLASTIC
BM3000 MODEL 170 BORE WELDER	
DATE CODE: 15509	REV: 98041-1
POLE: NONE	REVISION: B
	1 of 2

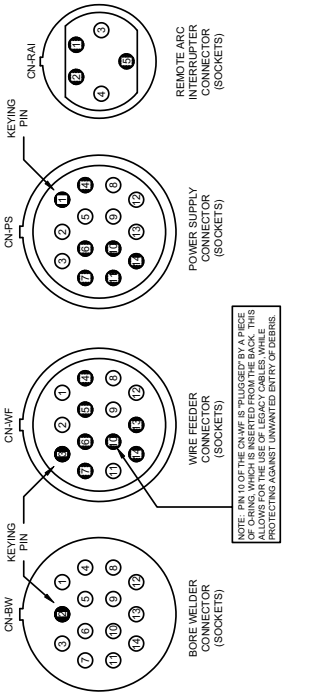


FIGURE B-10. 170 CONTROLLER PLASTIC CONNECTORS SCHEMATIC 1 (P/N 98041)

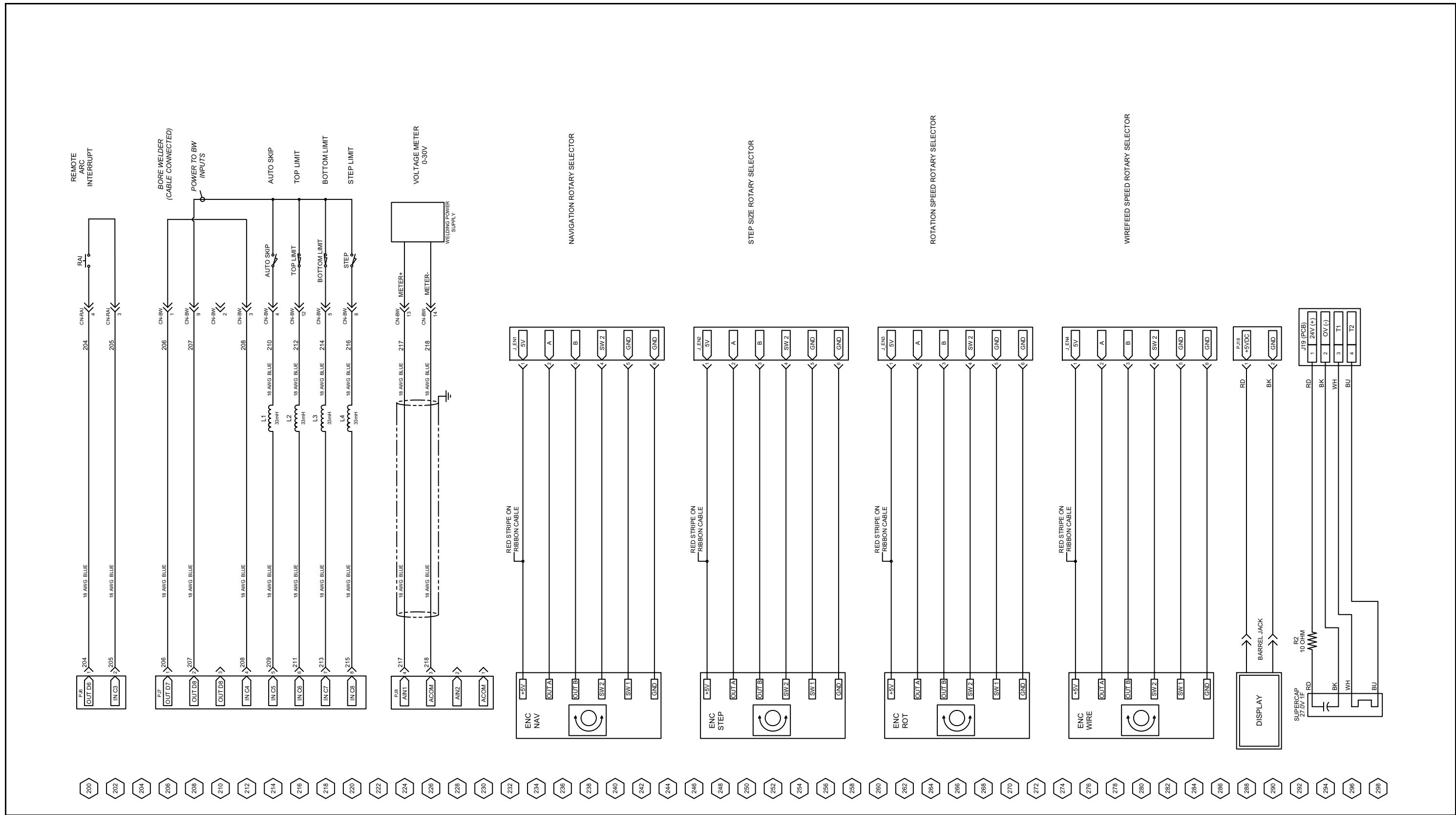


FIGURE B-11. 170 CONTROLLER PLASTIC CONNECTORS SCHEMATIC 2 (P/N 98041)

APPENDIX C SDS

Contact CLIMAX for the latest Safety Data Sheets.

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APPENDIX D CONTROLLER DEFAULT PARAMETERS

The following pages show the default values for the 170 controller's setup parameters.

Refer to these pages when resetting the parameters to their default settings.

Parameter Number	Initial Factory Setting	Min	Max	Units	Group	Parameter Name
1	1	1	6		Language	Language Selection
2	0	0	1		Welder Functions	Diameter Units
3	5	0	10	Seconds	Welder Functions	Manual Purge Dwell
4	0	0	10	Seconds	Welder Functions	Weld Start: Pre Flow Purge Dwell
5	0	0	1000	Milliseconds	Welder Functions	Weld Start: Rotation Delay
6	0	0	1000	Milliseconds	Welder Functions	Weld Start: Wire Feed Delay
7	0	0	1000	Milliseconds	Welder Functions	Weld Start: Weld Power Delay
8	0	0	1000	Milliseconds	Welder Functions	Welding Stop: Wire Feed Delay
9	135	0	500	Milliseconds	Welder Functions	Weld Stop: Burnback Dwell
10	3	0	10	Seconds	Welder Functions	Weld Stop: Post Flow Purge Dwell
11	2	1	4		Welder Functions	Welding Mode Select
12	1	1	100	%	Welder Functions	Coarse Wire Feed Increment
13	0.4	1	100	%	Welder Functions	Fine Wire Feed Increment
14	1.5	1	100	%	Welder Functions	Coarse Rotation Increment
15	0.1	1	100	%	Welder Functions	Fine Rotation Increment
16	5	1	10	%	Welder Functions	Coarse Step Dwell Increment
17	1	1	10	%	Welder Functions	Fine Step Dwell Increment

FIGURE D-1. BW3000 170 CONTROLLER PARAMETERS 1

Parameter Number	Initial Factory Setting	Min	Max	Units	Group	Parameter Name
18	17.5	0	50	Volts	Welder Functions	Extend/Retract Speed Weld Mode
19	70	0	90	Volts	Welder Functions	Extend/Retract Speed Weld Manual Jog
20	0	0	1		Welder Functions	Extend/Retract EOT Limit High/Low
21	0.7	1	30	Seconds	Welder Functions	Step Dwell Time Minimum
22	3.8	1	200	Seconds	Welder Functions	Step Dwell Time Maximum
23	50	0	1000	Milliseconds	Welder Functions	Button Debounce
24	5	0	1000	Milliseconds	Welder Functions	Step Switch Debounce
25	5	0	1000	Milliseconds	Welder Functions	Autoskip Debounce
26	5	0	1000	Milliseconds	Welder Functions	Limit Switch Debounce
27	15	100	400	%	Welder Functions	Rapid Rotation During Skip Multiplier
28	1	0	1		Welder Functions	High Speed Auto-Skip Enable
29	1	0	1		Welder Functions	Step Enable
99	250	50	4000	Milliseconds	DC Drives	Modbus Timeout
100	4.4	0	20	Volts	Rotation Drive	Min Speed
101	110	0	125	Volts	Rotation Drive	Max Speed
102	15	62	100	%	Rotation Drive	Max Torque Motoring
103	70	62	100	%	Rotation Drive	Max Torque Regen
104	1	0	1		Rotation Drive	Regen Stopping Enabled
105	0	0	500	Milliseconds	Rotation Drive	Stopping Reverse Duration
106	0	0	100	%	Rotation Drive	IR Compensation
107	0	0	100	%	Rotation Drive	Motor Overload Protection Threshold
108	100	1	500	Milliseconds	Rotation Drive	Acceleration
109	0	0	5000	Milliseconds	Rotation Drive	Deceleration
200	15	62	100	%	Step Drive	Max Torque Motoring
201	25	62	100	%	Step Drive	Max Torque Regen

FIGURE D-2. BW3000 170 CONTROLLER PARAMETERS 2

Parameter Number	Initial Factory Setting	Min	Max	Units	Group	Parameter Name
202	1	0	1		Step Drive	Regen Stopping Enabled
203	0	0	100	%	Step Drive	IR Compensation
204	0	0	100	%	Step Drive	Motor Overload Protection Threshold
205	150	1	5000	Milliseconds	Step Drive	Acceleration
206	0	0	5000	Milliseconds	Step Drive	Deceleration
300	25	20	100	%	Wire Feeder Drive	Max Torque Motoring
301	70	20	100	%	Wire Feeder Drive	Max Torque Regen
302	1	0	1		Wire Feeder Drive	Regen Stopping Enabled
303	0	0	500	Milliseconds	Wire Feeder Drive	Stopping Reverse Duration
304	0	0	100	%	Wire Feeder Drive	IR Compensation
305	0	0	100	%	Wire Feeder Drive	Motor Overload Protection Threshold
306	150	1	5000	Milliseconds	Wire Feeder Drive	Acceleration
307	0	200	5000	Milliseconds	Wire Feeder Drive	Deceleration
308	0	0	1		Wire Feeder Drive	Disable Wire Feeder
309	4	0	150	Volts	Wire Feeder Drive	Wirefeed Min Speed
310	4	0	150	Volts	Wire Feeder Drive	Wire Jog Reverse Speed
311	0	0	1		Wire Feeder Drive	Wire Feed Push/Pull Enable
312	34	0	50	Volts	Wire Feeder Drive	Wirefeed Max Speed Single Motor
313	90	0	100	Volts	Wire Feeder Drive	Wirefeed Max Speed 2 Motors
C001	0	0	1		Settings: Command	Reset to Factory Settings

FIGURE D-3. BW3000 170 CONTROLLER PARAMETERS 3

Parameter Number	Initial Factory Setting	Min	Max	Units	Group	Parameter Name
400	0	0	1		Settings: Command	Enable Full Navigator Control
401	2712	0	9999		Access Codes	Set Lead Access Code
402	9713	0	9999		Access Codes	Set Admin Access Code
403	0	0	1		Test Mode	Enable Basic Test Mode

FIGURE D-4. BW3000 170 CONTROLLER PARAMETERS 4

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