

BW2600

AUTOBOREWELDER

BW2600 OPERATING MANUAL

ORIGINAL INSTRUCTIONS















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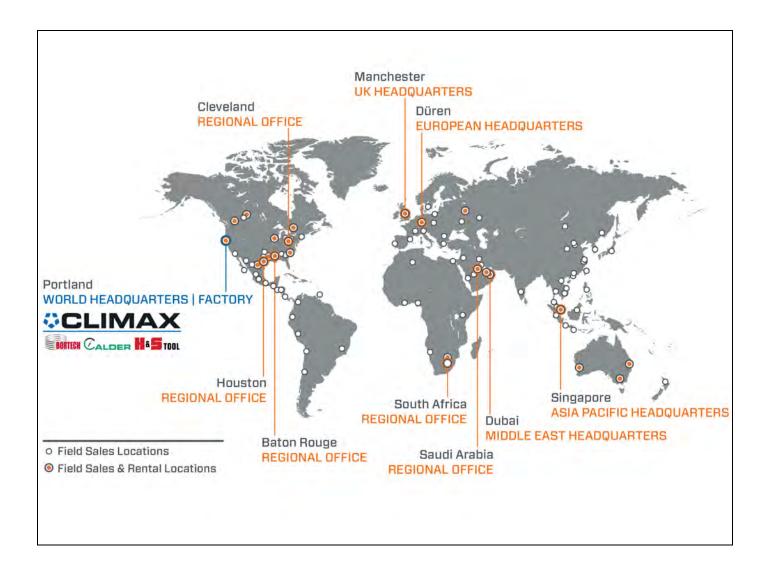
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CE DOCUMENTATION





2014/35/EU Low Voltage Directive 2014/30/EU EMC Directive



Name of Manufacturer:

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Full postal address including country of origin:

2712 E. Second St., Newberg, OR 97132, USA

This declaration of conformity is issued under the sole responsibility of the manufactured (stated above).

Object(s) of the Declaration:

Portable Bore Welder(s)

Name, type or model, batch or serial number:

BW1000, BW2600, BW3000, BW5000:

Electrically Powered S/N Range: 11016661 - 25000000

Harmonised Standards used, including number:

EN 1032:2003+A1:2008 - Mechanical Vibration Testing EN ISO 12100:2010 - Safety for Machinery; Principles EN ISO 13849-1:2015 - Safety of Machinery; Controls EN 61000 series - EMC Emissions and Immunity

EN ISO 3744:2010 - Acoustic Power EN ISO 13732-1:2008 - Temperature of Touchable Surfaces EN 60204-1:2018 - Safety of Machinery; Electrical Equipment

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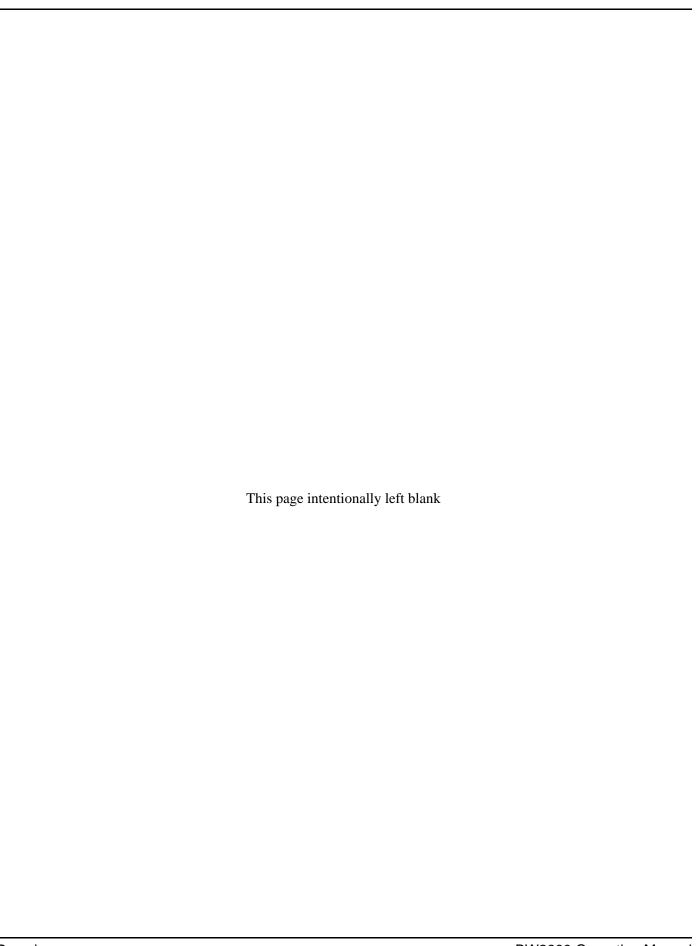
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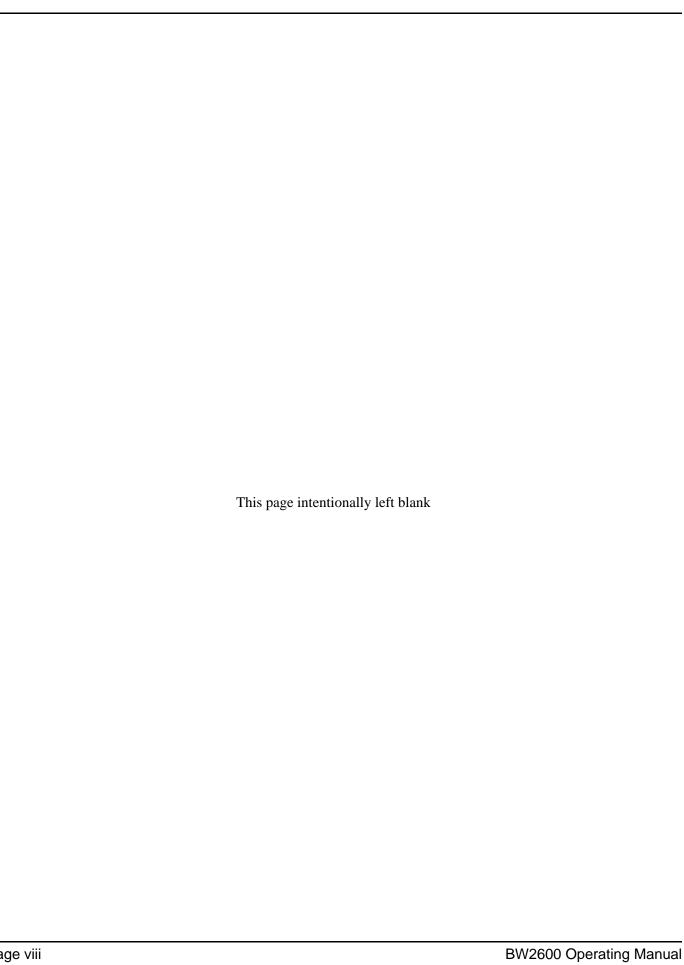
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1 INTRODUCTION

IN THIS CHAPTER:

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1.1 How to use this manual

This manual describes the setup, operation, maintenance, storage, shipping, and decommissioning of the BW2600 bore welding machine.

NOTICE

For maximum safety and performance, read this entire manual before attempting to set up or operate the machine.

The first page of each chapter includes a list of the chapter contents to help you locate specific information.

The appendices contain supplemental product information to aid in setup, operation, and maintenance tasks.

1.2 SAFETY ALERTS

Pay careful attention to the safety alerts in this manual. Safety alerts call your attention to dangerous situations that you may encounter when operating this machine. This manual uses the following types of safety alerts:¹



indicates a dangerous situation that, if not avoided, **WILL** result in death or serious injury.

^{1.} For more information on safety alerts, see ANSI/NEMA Z535.6-2011, Product safety Information in Product Manuals, Instructions, and Other Collateral Materials.



indicates a dangerous situation that, if not avoided, **COULD** result in death or serious injury.

CAUTION

indicates a dangerous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

indicates a dangerous situation that, if not avoided, could result in property damage, equipment failure, or undesirable 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 and Section 1.5 on page 4) 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** Always wear appropriate personal protective gear when operating this or any other machine tool. Wear flame-resistant clothing with long sleeves and legs when operating the machine, as hot flying spatter from the workpiece may burn bare skin. This machine produces radiation in the visible and ultraviolet spectrum range called arc rays. Always wear welding PPE for eyes and exposed skin when observing or working around the machine during operation.



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.

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 avoid contact with bare skin until the machine has cooled.

1.4 MACHINE-SPECIFIC SAFETY PRECAUTIONS

NOTICE

If welding and boring operations are conducted simultaneously, take care when choosing the location and quality of the weld ground conductor. Poor electrical grounding may result in irreparable damage to the equipment.

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 ultraviolet 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.

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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 metal-joining and 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.

Precautions are required to avoid injury from burns, electric shock, vision damage, inhalation of poisonous gases and fumes, and exposure to intense ultraviolet radia-

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



tion. 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.

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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 be considering. Use these checklists as part of your risk assessment:

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

| Before Set-up |
|---|
| I took note of all the warning labels on the machine. |
| I removed or mitigated all identified risks (such as tripping, entanglement, or falling objects). |
| I considered the need for personnel safety including shielding from arc rays. |
| I read the Machine Assembly instructions (Section 3). |
| I took inventory of all the items required but not supplied (Section 2.4). |
| I considered how this machine operates and identified the best placement for the controls, cabling, and the operator. |
| 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 |
|---|
| 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. |
| I planned for containment of any weld spatter produced by the machine. |
| I followed the required Maintenance Intervals (Section 5.2). |
| I checked that all affected personnel have the recommended personal protective equipment, as well as any equipment required by the site or other regulations. |
| I checked that all affected personnel understand the danger zone and are clear of it or UV guarding is present. |
| I examined the area surrounding the workpiece for flammable materials and removed them if possible. I have an appropriate fire extinguisher nearby. |
| I have a fire extinguisher nearby. |
| I have assessed for additional risks unique to this application of the Portable Machine tool. |



1.7 LABELS

Table 1-4 shows the labels that should be on your machine. If any are defaced or missing, contact CLIMAX immediately for replacements.

TABLE 1-4. LABELS

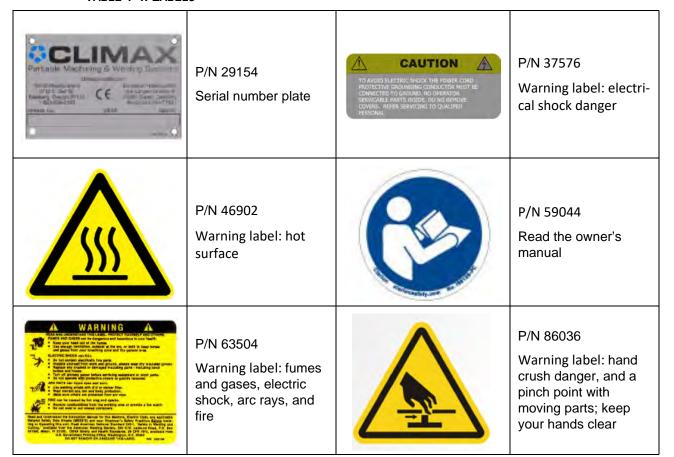
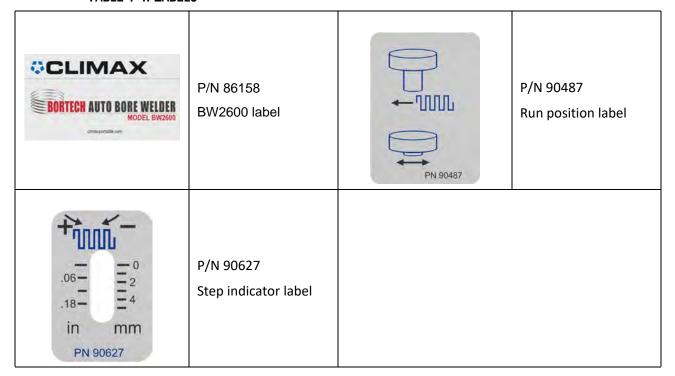


TABLE 1-4. LABELS



1.8 LABEL LOCATIONS

The following figures display the location of labels on each component of the BW2600 by part number. For further identification of label placement refer to Appendix A on page 79.



FIGURE 1-1. TOP LABEL LOCATIONS

Label P/N: 86036, 86158, 90487, 90627



FIGURE 1-2. BOTTOM LABEL LOCATIONS

Label P/N: 29154, 37576, 59044, 63504

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FIGURE 1-3. SIDE LABEL LOCATIONS

Label P/N: 46902, 90487



2 **OVERVIEW**

IN THIS CHAPTER:

| 2.1 FEATURES AND COMPONENTS |
|-------------------------------------|
| 2.1.1 Features |
| 2.1.2 Stock components |
| 2.1.3 Accessories |
| 2.2 CONTROLS |
| 2.3 Machine specifications |
| 2.4 ITEMS REQUIRED BUT NOT SUPPLIED |

Bore welders are highly configurable with many options and accessories. This manual covers the use and operation of all standalone options. The machine configuration purchased may not contain all of the options and accessories in this manual. If a specific machine application requires additional options or accessories, please contact CLIMAX for assistance.

2.1 FEATURES AND COMPONENTS

The BW2600 is a feature-rich bore welder based on the BW1000 architecture and provides some BW3000 features. The BW2600 can weld bores between the range of 0.87–5" (22–127 mm) with the full range of torches.

The range can be extended to 10" (254 mm) by carefully monitoring the step function. If step problems develop, push the axial feed knob in and pull it out again. This cycle resets the clutch. It is not necessary to interrupt the welding process during the reset.

NOTICE

Do not do this during a step process, as it will ruin the clutch.

The BW2600 provides circular and axial motion required to accomplish continuous bore buildup. This bore welding machine is equipped with a mechanically-actuated, infinitely-variable axial step feed and variable rotation speed. The BW2600 power swivel coupling allows for the passage of weld current, shielding gas, and welding wire.

The control for rotation speed is on the rear control panel, and the axial feed knob is on the side of the machine (see Figure 2-1 on page 12 and Figure 2-2 on page 13).

Principle features include:

- Skip or fill (described in page 13)
- Variable mechanical step (described on page 13)
- Feed engage/disengage (described on page 14)

- Wire feed control (also known as trigger control; described on page 15)
- Reversible rotation (described on page 15)
- Axial adjustment (described on page 13)

AXIAL FEED
KNOB
DRAG BRAKE
ADJUSTMENT
AXIAL FEED KNOB
POSITION LABEL

4 STEP AMOUNT
INDICATOR

1

AXIAL FEED KNOB
POSITION LABEL

FIGURE 2-1. BW2600 CONTROLS AND COMPONENTS

TABLEAU 2-1. CONTROL AND COMPONENT IDENTIFICATION

| Number | Component |
|--------|--------------------------------|
| 1 | Axial feed knob |
| 2 | Drag brake adjustment |
| 3 | Axial feed knob position label |
| 4 | Step adjustment knob |
| 5 | Step amount indicator |



2.1.1 Features

Skip or fill

This feature allows automated SKIP or FILL welding up to 180° within any radial location in the bore.

NOTICE

Wire feeders with burnback control are necessary to use this feature.

TABLE 2-2. SKIP OR FILL CONTROL IDENTIFI-CATION

| Number | Component |
|--------|-----------------------|
| 1 | Skip on/off |
| 2 | Fill or skip selector |
| 3 | Weld stop/start |

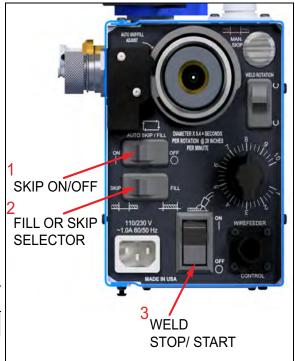


FIGURE 2-2. BW2600 SKIP OR FILL CONTROLS

The SKIP feature de-energizes

the welding where the cam detent is set by the operator, typically when avoiding key ways.

The FILL feature provides welding in the cam detent opening. It is typically used for buildup in worn areas.

See Section 4.6 on page 61 for how to set the detent for the SKIP or FILL feature.

Variable mechanical step

Variable mechanical step: an infinitely variable mechanical step ranging 0.05–0.175" (1.27–4.5 mm).

The amount of step may be varied according to the size of the weld bead. The step adjustment knob adjusts the step size, as shown in Figure 2-1.

The step size is shown by the step amount indicator. Manually rotate the spindle until the indicator reaches the highest value, then turn the step adjustment knob (clockwise to reduce the feed rate, or counter-clockwise to increase the feed amount).

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Feed engage/disengage

The BW2600 only feeds by retracting the spindle.

Pushing in the axial feed knob towards the housing disengages the feed and allows free movement of the spindle.

Pulling out the axial feed knob away from the housing engages the feed.:

NOTICE

The step indicator (see Figure 2-3) also shows the start and the peak of each feed actuation. The feed is at its peak when the indicator shows zero. The



FIGURE 2-3. STEP AMOUNT INDICATOR

feed is just starting when it begins to move from its maximum indication.

Axial adjustment of the spindle

The axial feed knob provides fine control of axial placement of the spindle at any time when the feed is disengaged. When the feed is engaged, axial adjustment can only be done in the spindle retract direction.

Feed drag brake adjustment

The drag brake has been factory adjusted. It prevents the spindle from re-extending when the BW2600 is mounted in the vertical position with the torch down. It also prevents the spindle from over-traveling when the machine is oriented vertically with the torch up. Take these actions to restore the proper drag brake setting:

If the feed is intermittent or less than the step indicator amount, loosen the drag brake slightly until the feed matches the step indicator amount.



FIGURE 2-4. DRAG BRAKE ADJUSTMENT



If the spindle re-extends between each feed step (torch down) then gradually tighten the drag brake adjustment until re-extending stops.

If the spindle over feeds with the torch up, then gradually tighten the drag brake adjustment until re-extending stops.

Reversible rotation

The reversible rotation direction easily allows for simplified, higher-quality multiple pass buildup when the bore welder is in the horizontal axis. See the rotation direction selector in Figure 2-5.

TABLE 2-3. CONTROL FEATURE IDENTIFICATION

| Number | Component |
|--------|----------------------------------|
| 1 | Arc interrupt |
| 2 | Rotation direction selector |
| 3 | Rotation speed knob |
| 4 | Wire feed contactor control port |
| 5 | Power input |
| 6 | Remote operator pendant port |

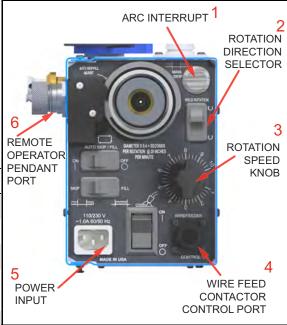


FIGURE 2-5. BW2600 CONTROL FEATURES

Interface with customer's existing MIG wire feed system

CLIMAX manufactures many interface kits for use with worldwide suppliers of MIG welding units. The customer's wire feed system connects to the BW2600 at the wire feed contactor control port, as seen in Figure 2-5.

Wire feed control

The wire feed contactor control port (shown in Figure 2-5) initiates the welding process via the wire feed control cable when the weld switch is turned on.

NOTICE

Power does not need to be applied to the machine for the wire feeder to be activated. The weld on/off switch will close the contactor, providing weld current, whether AC mains are connected or not.

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2.1.2 Stock components

Conduit assembly

The conduit assembly provides passage of welding current, welding wire, and shielding gas to the BW2600. It includes a wire feed control cable for actuation of the trigger circuit contactor.

Compatible conduits for the BW2600 include the following:

- Conduit & Switch Assembly – Euro Connection (P/N 85435)
- Conduit & Switch
 Assembly Miller (P/N 85476)
- Conduit & Switch Assembly Tweco (P/N 85534)
- Conduit & Switch Assembly Lincoln (P/N 85536)
- Conduit & Switch Assembly Lincoln PowerMig (P/N 85527)
- Conduit & Switch Assembly Lincoln Tweco Style with 5-pin Amphenol (P/N 86046)



The radial mount was designed for use between the mounting rod and the bore welder, extending the distance between them to 3.98" (101 mm). This mount is the correct distance for most boring bar interfaces designed for the BW3000.

The BW2600 is a center-mount system, enabling infinite rotational placement of the bore



FIGURE 2-6. CONDUIT ASSEMBLY (MILLER EXAMPLE SHOWN)

FIGURE 2-7. BW2600 RADIAL MOUNT

welder for clearance in tight spaces. The BW2600 radial mount also provides the means to use the adjustable base and the BW3000 radial mounts.



JAM NUT 2

Swivel head assembly (P/N 35603)

Designed for use with multiple torch heads, this ball-and-seat device performs the following functions:

- Provides a fine diameter adjustment for torches
 - Acts as a conductive path for weld current
- Passage for shielding gas
- Passage for welding wire

Angle changes of the 7/16–20 stem of up to 10 degrees off-center may be accommodated.

The swivel head has a locking nut on the brass stem that can be loosened to remove the torch.

Upon re-installation, the torch nozzle should point in the direction of the arc that the brass stem prescribes (that is, the swivel travel).

TABLE 2-4. SWIVEL AND TORCH IDENTIFICATION

| Number | Component |
|--------|-----------------|
| 1 | Swivel assembly |
| 2 | Jam nut |
| 3 | Torch |

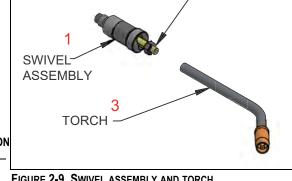


FIGURE 2-9. SWIVEL ASSEMBLY AND TORCH

FIGURE 2-8. SWIVEL HEAD ASSEMBLY

Standard torch sizes

Torch sizes #1 and #2 are standard equipment.



FIGURE 2-10. TORCH SIZES #1 AND #2

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Extension assemblies

The extension assemblies facilitate remote placement of the swivel head and torches for extended reach in the following positions:

- 3" (76 mm) with P/N 29038
- 6" (152 mm) with P/N 29039
- 12" (305 mm) with P/N 29040

Mounting rod (P/N 30773)

Use the mounting rod to mount the BW2600 to the adjustable base or boring bar interface.

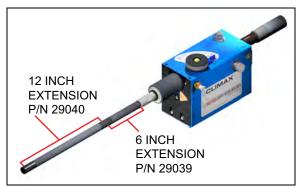


FIGURE 2-11. 12" AND 6" EXTENSIONS



FIGURE 2-12. DETAIL OF MOUNTING ROD P/N 30773

Carrying case (P/N 54282)

The carrying case is provided for the protection and storage of the bore welder.

Quick change torch

Torches may be changed easily with the torch connection system, allowing for fast changes between torch sizes. The torch extensions have a captive liner for rapid setup without impeding liner installation.

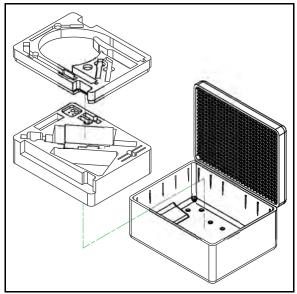


FIGURE 2-13. DETAIL OF BW2600 CARRYING CASE

2.1.3 Accessories

Accessories are not included with the basic BW2600 but are available for purchase. Contact CLIMAX for more information.



Torch assemblies #00 and #0 (P/N 39725 and P/N 39726)

When welding holes with a diameter smaller than 2.7" (68.6 mm), use torch assemblies #00 and #0.

The base model BW2600 ships with torch sizes #1 and #2 (for holes 2.7–12" [68.6–305 mm]).



FIGURE 2-14. TORCH SIZES #00 AND #0

Standard torch adapter kit (P/N 36750)

The standard torch adapter (shown in Figure 2-15) is for the #00 torch (P/N 29063) and the #0 torch (P/N 28448), enabling bore-welding range capability down to 0.87" (22 mm) diameter.



FIGURE 2-15. STANDARD TORCH ADAPTER KIT (SHOWN WITH SWIVEL INSTALLED)

Remote operator pendant (P/N 85341)

The remote operator pendant allows for control of the BW2600 while in close proximity to the weld process.

The pendant allows the operator to control a limited number of bore welder functions. See Section 2.2 on page 23 for information about the remote operator pendant controls.



FIGURE 2-16. REMOTE OPERATOR PENDANT

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Face torch

There are two face torches: compact and standard.

The compact face torch (P/N 48013) is used when the bore welder is interfacing with the BB5000 Boring Bar. A minimum of 6" (152 mm) swing in 6" (152 mm) axial clearance is necessary to use the compact face torch.



FIGURE 2-17. COMPACT FACE TORCH (P/N 48013)

The standard face torch (P/N 28186) is used with the adjustable base.

Both face torches have a range of 1–20" (25–508 mm).



FIGURE 2-18. STANDARD FACE TORCH (P/N 28186)



Adjustable base (P/N 29037)

The adjustable base provides support, leveling, and centering adjustments for the BW2600. This is generally required when a boring bar interface is not available.

The nonmagnetic base provides safe attachment and can be used on a variety of uneven surfaces.

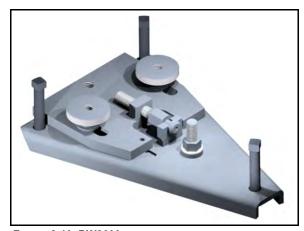


FIGURE 2-19. BW2600 ADJUSTABLE BASE

BW3000 radial mounts (P/N 23208, 35006)

The BW3000 5" and 10" (127 and 254 mm) radial mounts (shown in Figure 2-20) are used in conjunction with the adjustable base option only. They provide support, articulation, and add distance from the mounting rod to the bore welder spindle for larger jobs. It is commonly used with the standard face torch, trammel torch, and adjustable base.



FIGURE 2-20. BW2600 RADIAL MOUNT

Mounting rod extender (P/N 67090)

The mounting rod extender (shown in Figure 2-21) increases the distance between the bore welder and the work piece by 9" (229 mm). It is commonly used with the standard face torch, trammel torch, and adjustable base. It would not be used with the boring bar interface.

18-inch extension (P/N 29065)

Extensions allow the torch and swivel mechanism to be installed farther away from the BW2600, providing greater reach. When



FIGURE 2-21. MOUNTING ROD EXTENDER



reaching over 39" (991 mm), consider the use of the torch extension support kit (P/N 40877).

Torch extension support kit (P/N 40877)

The torch extension support kit is used for extensions that need more rigidity and an extension reach greater than 39" (991 mm). For more detail, see Section 3.4.3 on page 51.

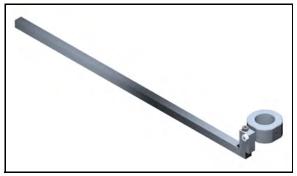


FIGURE 2-22. BW2600 TORCH EXTENSION SUPPORT



2.2 CONTROLS

SKIP/FILL ADJUST MAN. SKIP 5 WELD ROTATION DIAMETER X 9.4 = SECONDS SKIP / FILL PER ROTATION @ 20 INCHES
PER MINUTE 8 SKIP 110/230 V ~1.0A 60/50 Hz WIREFEEDER 2 OFF 9 CONTROL MADE IN USA

This section explains control locations and functions.

FIGURE 2-23. BW2600 FRONT PANEL CONTROLS

TABLE 2-5. BW2600 FRONT PANEL CONTROLS

| Item | Control | Action | Purpose | Notes |
|------|----------------------------|--|---|---|
| 1 | Main On/Off | Starts rotation and triggers the wire feeder system. | Starts and stops the bore welding process. | Contactor control with power switch is still operative when the AC mains are not connected. |
| 2 | Wirefeeder Control Port | Provides a connection point for dry contacts, controlling the wire feeder. | Necessary to provide syn- chronized "trigger" control to the feeder system. | Always check that the Main On/ Off switch is off before connecting the wire feeder (must be burn- back-enabled). |
| 3 | Rotation Speed Dial | Adjusts the spindle rotation speed. | Varies travel speed for different bore sizes and applications. | See Section 4.4.1 on page 55 for setting and checking rotation speed. Disabled when pendant is connected. |

TABLE 2-5. BW2600 FRONT PANEL CONTROLS

| Item | Control | Action | Purpose | Notes |
|------|------------------------|---|---|--|
| 4 | Weld Rotation | Controls the rotation direction. | Used for horizontal axis, multi-pass welding. | Never reverse direction while the machine is rotating. |
| 5 | Manual Skip | When in weld mode, this button stops the wire feed while spindle rotation continues. | Allows manual skip of small grease holes and cross-pin holes; aids during uneven stop-start sections. | Disabled when the pendant is connected. |
| 6 | Skip/Fill Cams | Sets up to 180° of bore to skip or fill, anywhere in a 360° rotation. | Welds within the cam detent (fill) or outside the cam detent (skip). | The BW2600 must rotate fully to provide mechanical step, or else skip/fill is not applicable. |
| 7 | Skip/Fill On/ Off | Enables or disables skip and fill function. | Disables the switch from reading the cams. | Useful for situations where cams are preset, but the operator needs to disable or enable during welding. |
| 8 | Skip/Fill | Selects Skip or Fill. Designates no weld (Skip) or weld-only area (Fill). | Designates no weld (Skip) or | Fill is for correcting moderately oblong bores. |
| 0 | Switch | | Skip is for skipping a key way or split line. | |
| 9 | AC Mains Receptacle | AC power inlet for the BW2600. 110/230 VAC 1 amp, 50/60 Hz. | To power the motor drive and circuitry of the BW2600. | NA |

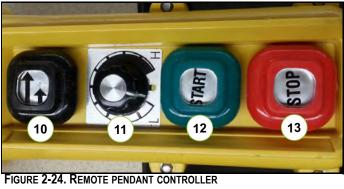


TABLE 2-6. REMOTE PENDANT CONTROLS

| Item | Control | Action | Purpose | Notes |
|------|------------------------------------|---|--|---|
| 10 | Rotation Jog / Man- ual Skip | When <u>not</u> in weld mode: provides Rotation Jog control. When <u>in</u> weld mode: stops the wire feed while spindle rotation continues. | Rotation Jog helps verify centering during setup. Manual Skip allows manual skip of small grease holes and cross-pin holes, or aids during uneven stop-start sections. | To use the pendant, turn on the panel Main On/Off switch. |
| 11 | Rotation Speed | Adjusts the rotation speed of the BW2600 spindle. | Varies the travel speed for different bore sizes and applications. | When using the pendant, the panel Rotation Speed control is locked out. |



TABLE 2-6. REMOTE PENDANT CONTROLS (CONTINUED)

| Item | Control | Action | Purpose | Notes |
|------|------------|--|----------------------------------|---|
| 12 | Weld Start | Starts rotation and triggers the wire feeder system to weld. | Starts the bore welding process. | To use the pendant, turn on the panel Main On/Off switch. |
| 13 | Weld Stop | Stops rotation and the wire feeder system. | Stops the bore welding process. | After removing the remote control, you must cycle the Main On/Off switch to restore control to the machine panel. |

2.3 MACHINE SPECIFICATIONS

Figure 2-25 shows the bore welder dimensions in inches.

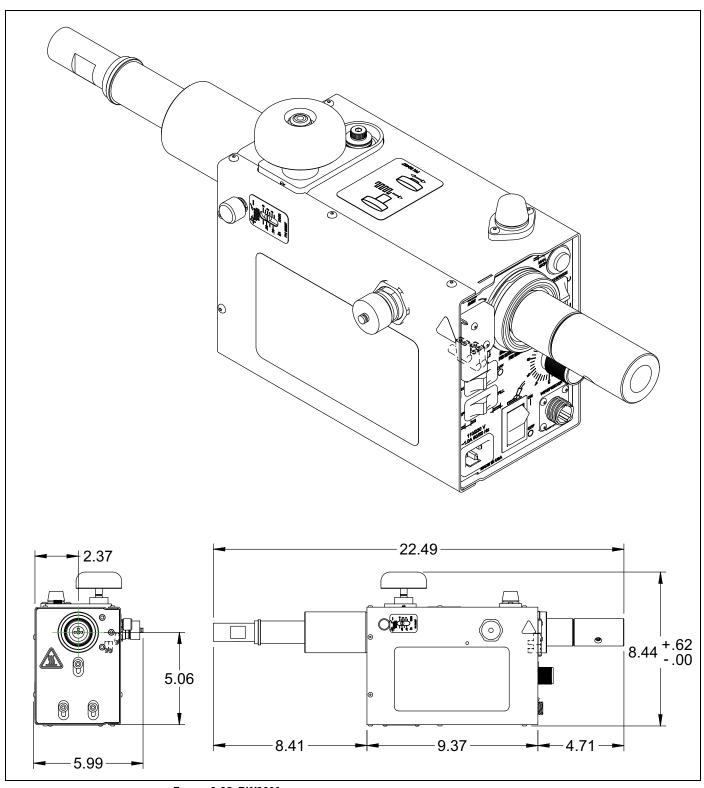


FIGURE 2-25. BW2600 DIMENSIONS



Machine specifications for the BW2600 are listed in Table 2-7.

TABLE 2-7. BW2600 SPECIFICATIONS

| Welding process: | metal inert gas (MIG) |
|--|--|
| Wire diameter range: | 0.030-0.045" (0.8-1.2 mm) |
| Unsupported torch extension: | 36" (914 mm) |
| Stroke length: | 9" (229 mm) |
| Mechanical step range: | 0.05-0.175" (1.3-4.45 mm) per revolution |
| Maximum continuous welding current: | 175 amps |
| BW2600 power: | 120v or 220v 50/60Hz VAC |
| Contactor control: | provided via on-board relays and remote operator pendant |
| Typical voltage operating range (short arc/.035 wire): | 17–19 volts |
| Component weight: | 17 lbs (7.7 kg) |

Table 2-8 shows buildup diameter ranges at 20 in/min 0.88–10" (22.35–254 mm).

TABLE 2-8. BUILDUP DIAMETERS PER SWIVEL HEAD

| Swivel head | Part number | Size |
|-----------------|-------------|--------------------------|
| Head # 1 Swivel | 39725 | 2.7-8.2" (68.6-208.3 mm) |
| Head # 2 Swivel | 39726 | 8.0–10" (203–254 mm) |

Table 2-9 shows optional torch size diameter ranges at 20 in/min 0.88–24" (22–610 mm).

TABLE 2-9. OPTIONAL TORCH DIAMETER RANGES

| Torch type | Part number | Size |
|------------|-------------|---------------------|
| #00 Torch | 29063 | .88–1.7" (22–46 mm |
| #0 Torch | 28448 | 1.7-3.0" (46-76 mm) |

2.4 ITEMS REQUIRED BUT NOT SUPPLIED

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

- Wire feeder with burnback control
- Welding power supply with 200-ampere minimum and 100% duty cycle
- Welding wire
- Standard hand tools
- Watch or clock with seconds display

- Shielding gas
- Regulator
- Negative welding lead
- Personal protective equipment
- Diagonal cutters

CLIMAX offers a wire feeder for purchase. Contact CLIMAX for more information.



3 SETUP

IN THIS CHAPTER:

| 3.1 Preparing the machine for use |
|--|
| 3.1.1 INSPECTING THE MACHINE |
| 3.1.2 Assessing the work area |
| 3.2 Lifting and rigging |
| 3.3 Installing the Bore welder |
| 3.3.1 Mounting to a Boring Bar |
| 3.3.1.1 Installing the Bore welder onto the mounting rod |
| 3.3.1.2 INSTALLING THE TORCH AND TORCH EXTENSIONS |
| 3.3.1.3 SETTING THE BORE WELDER STROKE |
| 3.3.1.4 CENTERING THE BORE WELDER |
| 3.3.1.5 ADJUSTING THE BORE WELDER EXTENSION "SAG" |
| 3.3.1.6 SETTING THE TORCH OFFSET |
| 3.3.2 INSTALLING THE BORE WELDER WITH AN ADJUSTABLE BASE |
| 3.3.2.1 ADJUSTING FOR PARALLELISM |
| 3.3.2.2 ACHIEVING CONCENTRICITY |
| 3.3.3 FINISHING THE INSTALLATION |
| 3.4 Installing accessories |
| 3.4.1 STANDARD TORCH ADAPTER |
| 3.4.2 TORCH #00 AND #0 |
| 3.4.3 TORCH EXTENSION SUPPORT KIT |

This chapter explains how to set up the machine for operation.

3.1 Preparing the machine for use

3.1.1 Inspecting the machine

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.
- 4. 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.

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3.1.2 Assessing the work area

The BW2600 often is used in dangerous locations (in elevated positions, near other operating equipment, overhead, etc.). CLIMAX cannot foresee where this machine will be used; therefore, you must perform a site-specific risk assessment (Section 1.5 on page 4 and Section 1.6 on page 6) for each job before starting work.

The BW2600 machine has an optional remote operator pendant that enables you to choose the optimum location to work from (Section 1.6 on page 6).



Always follow safe work practices, including site-specific safety requirements. It is your responsibility to perform a risk assessment before you set up the machine and each time before you operate the machine.

3.2 LIFTING AND RIGGING

There are no special rigging and lifting instructions for the BW2600.



Use caution and follow all site procedures such as a lift plan, never allowing anyone under the load, etc. Falling or uncontrolled swinging of machinery can cause serious injury or death to the operator and bystanders.

3.3 INSTALLING THE BORE WELDER

This section outlines the steps needed to get the BW2600 set up and ready to weld.

The bore welder may be used in any position with the boring bar interface or the adjustable base.

If using a boring bar interface, start with the installation procedure in Section 3.3.1.

If using an adjustable base, start with the installation procedure in Section 3.3.2 on page 40.

Whether using a boring bar interface or the adjustable base, both installation procedures conclude with Section 3.3.3 on page 45.



NOTICE

The procedure for vertical bore welding is similar to the horizontal bore welding installation, with the addition of a locking collar to prevent the bore welder from slipping on the mounting rod.

3.3.1 Mounting to a boring bar

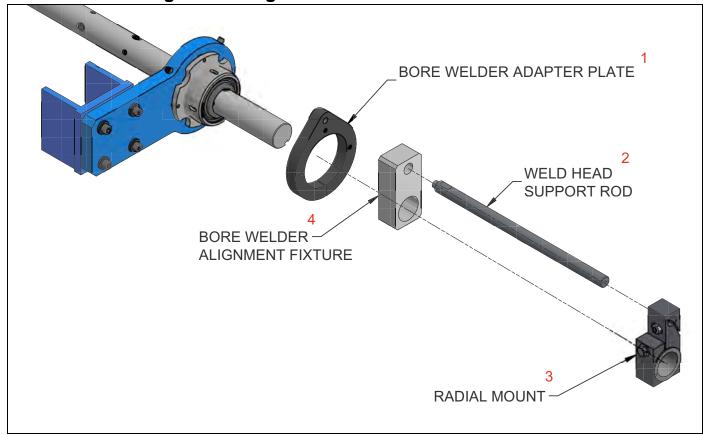


FIGURE 3-1. DETAIL OF INSTALLING THE BORING BAR ADAPTER KIT

TABLEAU 3-1. ADAPTER KIT IDENTIFICATION

| Number | Component |
|--------|------------------------------|
| 1 | Borewelder adapter plate |
| 2 | Weld head support rod |
| 3 | Radial mount |
| 4 | Borewelder alignment fixture |

Do the following to install the boring bar adapter kit:

1. Screw the mounting rod into the bore welder adapter plate and torque to a minimum of 10 ft-lbs (13 Nm).

- 2. Turn the two set screws at 3 o'clock and 9 o'clock until they protrude by 0.25" (6.4 mm) from the bearing side of the adapter plate (see Figure 3-2).
- 3. Slide the bore welder adapter plate over the external spherical mount on the bar with the mounting rod at 12 o'clock.



FIGURE 3-2. SET SCREWS IN ADAPTER PLATE

- 4. Slide the alignment tool over the mounting rod and the boring bar (see Figure 3-3).
- 5. Align the mounting rod to the boring bar by sliding the alignment tool back and forth, then tighten the interface plate clamp screw enough to prevent movement.

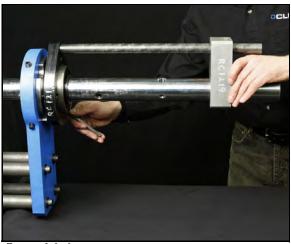


FIGURE 3-3. ALIGNMENT TOOL OVER THE MOUNTING ROD

NOTICE

Completing the tightening of the bore welder adapter plate before the bearing is removed will bind the bearing in the housing, preventing removal.

- 6. Remove the alignment tool.
- 7. Remove the boring bar.
- 8. Remove the cartridge bearing with the bearing removal tool.
- 9. Complete the final tightening on the bore welder adapter plate clamp.



10. Extend the two set screws (used in step 2) until they touch the bearing mount.



FIGURE 3-4. TIGHTENING THE SET SCREWS

3.3.1.1 Installing the bore welder onto the mounting rod

Do the following to install the bore welder onto the mounting rod:

1. Slide the BW2600 radial mount over the nose collar of the weld head assembly and hand-tighten the clamp bolt (see Figure 3-5).

TABLE 3-2. ASSEMBLY COMPONENT IDENTIFICATION

| Number | Component |
|--------|---------------------------|
| 1 | BW2600 radial mount |
| 2 | Mounting rod |
| 3 | Bore welder adapter plate |
| 4 | Weld head assembly |

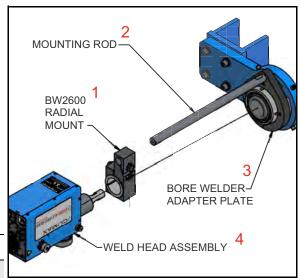


FIGURE 3-5. BW2600 ASSEMBLY COMPONENTS

- 2. Slide the BW2600 and radial mount halfway down the mounting rod (see Figure 3-6).
- 3. Hand-tighten the clamp to the mounting rod.



FIGURE 3-6. BW2600 AND RADIAL MOUNT ON MOUNTING ROD

3.3.1.2 Installing the torch and torch extensions

Do the following to install the torch and torch extensions:

1. Select the appropriate torch and (if necessary) extensions for the bore size, using Table 3-3.

TABLE 3-3. TORCH AND DIAMETER RANGE

| Torch type | Diameter range | Notes | |
|----------------------|------------------------|--------------------------------|--|
| #00 BW3000 torch | .88–1.7" (22–45 mm) | Included in the small bore kit | |
| #0 BW3000 torch | 1.7–3" (45–76 mm) | | |
| #1 Swivel torch head | 2.7–8.2" (70–209 mm) | Included as stock BW2600 | |
| #2 Swivel torch head | 8.2-12.2" (203-308 mm) | torches | |



All the torches in Table 3-3, except for the swivel torch heads, require a standard torch adapter to use with the swivel head.



- 2. Assemble the torch and swivel assembly by doing the following:
 - a) If the liner is in the torch, insert the liner extending from the torch into the swivel assembly.
 - b) Screw on the torch approximately half-way, or until the liner is flush with the back of the swivel assembly.

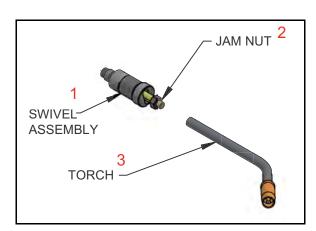


FIGURE 3-7. TORCH AND SWIVEL ASSEMBLY

TABLE 3-4. TORCH AND SWIVEL IDENTIFICA-

| Number | Component | |
|--------|-----------------|--|
| 1 | Swivel assembly | |
| 2 | Jam nut | |
| 3 | Torch | |

c) Align the torch with the travel direction of the swivel assembly (see Figure 3-8).



FIGURE 3-8. TORCH ALIGNED WITH THE TRAVEL SLOT

- d) Tighten the jam nut (see Figure 3-9).
- e) If liner was not in the torch, do the following:
 - Install the liner into the torch and swivel assembly.
 - ii. Cut the liner flush at the male 3/4-10 fitting.
 - iii. Secure the liner with the set screw.
- f) Check that the liner is visible through the diffuser gas holes (see Figure 3-10).



FIGURE 3-9. JAM NUT TIGHTENED



FIGURE 3-10. LINER THROUGH DIFFUSER GAS HOLES



- 3. Install the extensions, torch, and swivel assembly onto the BW2600.
- 4. Check that all the connections are tight in order to obtain good electrical contact and gas seal.

TABLE 3-5. TORCH EXTENSION IDENTIFICA-TION

| Number | Component |
|--------|-----------------------------|
| 1 | 6" and 12" torch extensions |
| 2 | Swivel assembly |
| 3 | Torch adapter |
| 4 | Torch |

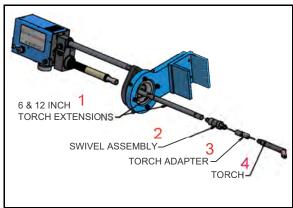


FIGURE 3-11. TORCH EXTENSION ASSEMBLY

3.3.1.3 Setting the bore welder stroke

Do the following to set the bore welder stroke, referring to Figure 3-12:

- 1. Push in the axial feed knob and then rotate it to move the spindle to the far end of the bore.
- 2. Check that the axial stroke of the machine is set to provide full coverage (maximum of 9" [229 mm]) of the bore. At full spindle extension, the torch should start at the end of the bore farthest away from the machine.

TABLE 3-6. SIDE CONTROLS IDENTIFICATION

| Number | Component |
|--------|-----------------------|
| 1 | Operator pendant port |
| 2 | Step adjustment knob |
| 3 | Axial feed knob |



FIGURE 3-12. BW2600 CONTROLS SIDE VIEW

NOTICE

If the stroke is less than the bore length, then the extensions may be used to extend the reach. After reaching the end of the stroke, extensions may be removed and the process restarted.

TIP:

The automated feed of the bore welder pulls the torch towards the machine incrementally while welding. Achieve correct stroke/torch placement by moving the machine axially on the mounting rod, or by adding extensions (sized 3", 6", 12", or 18" [76, 152, 305, 457 mm]).

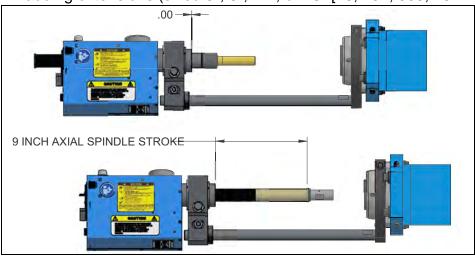


FIGURE 3-13. BW2600 AXIAL STROKE DISTANCE SHOWING 9" AXIAL SPINDLE STROKE (LOWER)

3.3.1.4 Centering the bore welder

Do the following to center the bore welder:

- 1. Connect the BW2600 to AC mains power with the provided power cord.
- 2. Rotate the bore welder spindle by connecting the AC mains cable (but not the wire feeder cable) and using the WELD switch, or by hand-turning it (see Figure 3-14). If the pendant is in use, push ROT/JOG (rotate/jog) on the remote control pendant.



3. Check the 3 o'clock and 9 o'clock positions (see Figure 3-14) using the torch as a guide, and "swing" the bore welder on the mounting rod to attain center (see Figure 3-15).

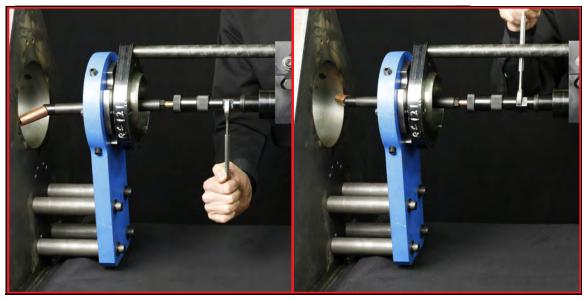


FIGURE 3-14. 3 O'CLOCK AND 9 O'CLOCK POSITIONS

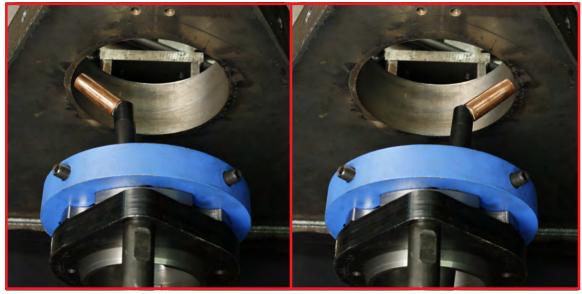


FIGURE 3-15. SWINGING THE BORE WELDER TO ATTAIN CENTER

NOTICE

The use of extensions installed as a "mandrel" reaching through the bore can facilitate quick centering of the machine. Use a scale or divider to find the center.

3.3.1.5 Adjusting the bore welder extension "sag"

In cases where sag may be an issue due to extended reach, the set screws (mentioned in step 10 of Section 3.3.1 on page 33) allow pivoting of the bore welder without losing left/right alignment.

While supporting the bore welder, the operator loosens the bore welder adapter plate slightly.

CAUTION

Failure to support the bore welder while loosening the bore welder adapter plate may result in machine damage or personnel injury.

The operator then pivots the bore welder adapter plate and BW2600 around the contact point of those two setscrews (see Figure 3-16).

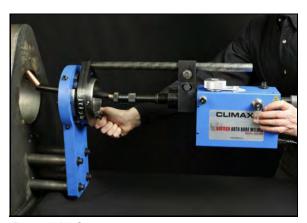


FIGURE 3-16. SUPPORTING THE BORE WELDER FOR SAG ADJUSTMENT (EXTENSIONS NOT SHOWN)

This allows for adjustment of the vertical height of the torch.

3.3.1.6 Setting the torch offset

Do the following to set the torch offset:

- 1. Set the torch nozzle approximately 1/8" (3.2 mm) away from the surface to be welded.
- 2. Check that the swivel nut in the swivel assembly is as tight as possible by hand (to make it secure enough to prevent the torch from inadvertently moving radially during welding).

Complete the bore welder setup by turning to Section 3.3.3 on page 45.

3.3.2 Installing the bore welder with an adjustable base

Do the following to install the BW2600 on the workpiece with an adjustable base:

- 1. Weld the mounting bolt of suitable length to a position approximately 11" (279 mm) from the center of the bore to be welded.
- 2. Place the adjustable base on the adjustment surface with the bolt protruding through the hole in the center of the base.
- 3. Orient the base to align the mounting rod with the mounting bolt and the center of the bore to be welded.



TIP:

The four spring washers and nut included with the adjustable base should be placed over the 0.5" (12 mm) bolt and finger tightened, plus a half turn with a wrench. See Figure 3-17.

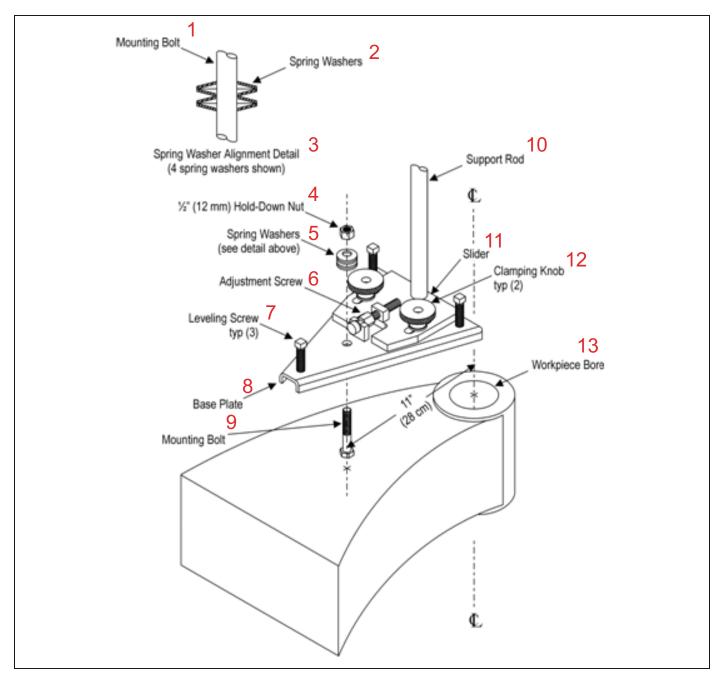


FIGURE 3-17. ASSEMBLY ON THE ADJUSTABLE BASE

TABLEAU 3-7. ASSEMBLY ON ADJUSTABLE BASE IDENTIFICATION

| Number | Component |
|--------|---|
| 1 | Mounting bolt |
| 2 | Spring washers |
| 3 | Spring washer alignment detail (4 spring washers shown) |
| 4 | 1/2" (12 mm) hold-down nut |
| 5 | Spring washers (see detail above) |
| 6 | Adjustment screw |
| 7 | Leveling screw (quantity 3) |
| 8 | Base plate |
| 9 | Mounting bolt |
| 10 | Support rod |
| 11 | Slider |
| 12 | Clamping knob (quantity 2) |
| 13 | Workpiece bore |

- 4. Screw the mounting rod into the slider hole on the adjustable base and tighten.
- 5. Slide the locking collar onto the mounting rod and install the radial mount onto the mounting rod (see Figure 3-18).

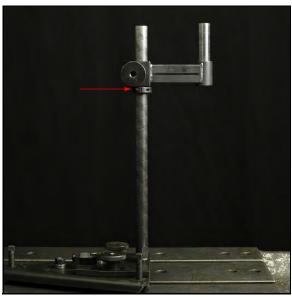


FIGURE 3-18. RADIAL MOUNT ON THE MOUNTING ROD



TIP:

If a greater distance from the BW2600 mounting rod is required, use the radial mount (P/N 28208). This will change the bolt setting to between 11–14" (279–356 mm).

Use the BW3000 radial mounts for a maximum of 5" (127 mm). If more radial torch clearance is required, use a 10" (254 mm) radial mount. BW3000 radial mounts can be joined together if required.

If a longer mounting rod is required, use the mounting rod extender to increase the length of the mounting rod without affecting stiffness.

- 6. Install the BW2600 onto the radial mount.
- 7. Attach the extensions to the BW2600 and reach through the hole to be welded for quick adjustment of the base (see Figure 3-19).

NOTICE

Use of a scale or dividers immediately clarify movements required to swing the bore welder spindle axis into the bore center.



FIGURE 3-19. BW2600 ON THE MOUNTING ROD

3.3.2.1 Adjusting for parallelism

Do the following to adjust for parallelism:

1. For axis-to-bore alignment, swing the BW2600 over until the extension is close to the 3 o'clock or 9 o'clock position.

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2. Adjust the two forward leveling jacks as a pair, while noting the distance from the extension to the bore surface at the top and bottom of the bore. (In the example in Figure 3-20, the adjustable base sits at 6 o'clock.)



FIGURE 3-20. PARALLELISM CHECK AT 3 O'CLOCK

3. Position the extension at the 6 o'clock position and adjust the rear-leveling jack until the extension appears parallel to the bore surface. In this way, the rear jack makes the base pivot on the forward jacks, not affecting the other axis as already set (see Figure 3-21).

TIP:

If clockwise adjustment of the rear jack causes the mounting rod to move toward the adjustable base, that indicates that the spring washers are at maximum capacity, thereby bowing the



FIGURE 3-21. PARALLELISM CHECK AT 6 O'CLOCK

adjustable base. Loosen the mounting bolt until the spring washers are no longer collapsed to allow further adjustment.

4. Tighten the 0.5" (12.7 mm) hold-down nut to a torque of 15 ft-lb (20 Nm).



3.3.2.2 Achieving concentricity

Do the following to achieve concentricity:

- 1. Articulate the BW2600 and extension to the approximate bore center and lock the articulation joint (see Figure 3-22).
- 2. Attach the correct torch for the bore (see Table 3-3).
- 3. Retract the BW2600 to bring the torch nozzle to the end of the bore.
- 4. Check the X axis by rotating the torch between the 12 o'clock and 6 o'clock positions, and adjust the slider on the base to center the torch in the X axis.



FIGURE 3-22. BW2600 ARTICULATED AT THE BORE CENTER (ARTICULATION JOINT SHOWN)

NOTICE

The torch and spindle may be rotated manually or by using the controls.

MARNING

When using the panel controls, unplug the wire feeder cable, or the wire feed circuit will be active. When using the remote control, Rot/Jog (rotate/jog) will not activate the wire feed circuit.

5. Check the Y axis by rotating the torch between the 3 o'clock and 9 o'clock positions, and swing the bore welder radial mount assembly from the mounting rod to center the torch in the Y axis.

3.3.3 Finishing the installation

Whether installing with a boring bar interface or an adjustable base, do the following to complete the installation:

1. Rotate the feed knob to move the spindle to the extended position.

2. Connect the power cord to the BW2600 (see Figure 3-23).



FIGURE 3-23. POWER CORD CONNECTION

3. Connect the wire feed conduit to the BW2600 (see Figure 3-24) and tighten the set screw.



FIGURE 3-24. WIRE FEED CONDUIT CONNECTED



4. Connect the wire feed control cable to the BW2600 (Figure 3-25).

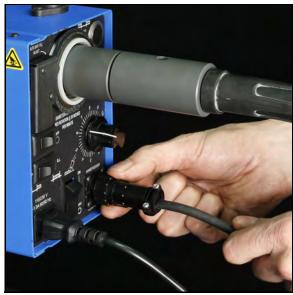


FIGURE 3-25. WIRE FEED CONTROL CABLE CONNECTED

5. Connect the wire feed conduit to the wire feeder (see Figure 3-26).

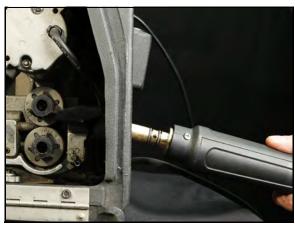


FIGURE 3-26. WIRE FEED CONDUIT CONNECTION

- 6. Connect the wire feed control cable to the wire feeder (see Figure 3-27).
- 7. Stage the wire into the feed rollers and clamp the feed rolls.



FIGURE 3-27. WIRE FEED CONTROL CABLE CONNECTED TO THE WIRE FEEDER

NOTICE

If there are issues feeding wire through the torches, straighten an 8" (203 mm) section of wire before loading the wire feeder (see Figure 3-28).



FIGURE 3-28. WIRE STRAIGHTENED BEFORE FEEDING

8. Without weld power hooked to the wire feeder, push the weld start switch to feed wire into the system (see Figure 3-29).



If your wire feeder does not have a Wire Jog function and does not easily disconnect the weld power, remove the weld ground connection before placing the BW2600 in weld mode.

9. Once wire has exited the torch, clip the excess wire.



FIGURE 3-29. WELD START SWITCH

NOTICE

If there are issues feeding wire through the torch system, remove the torch system from the BW2600 and manually feed wire through the torch system. Then reinstall the torch onto the machine.



- 10. Extend the spindle through the bore again by rotating the feed knob, and place the machine so that the wire will contact approximately 1/16–1/8" (1.6–3.2 mm) from the edge of the bore.
- 11. Connect the weld cable from the wire feed to the power supply.
- 12. Check that the shielding gas, power supply, and welding leads are properly connected and ready for welding.
- 13. Check that the approximate voltage and wire speed are appropriate for your application.



With MIG welding, the wire speed bears a direct relationship to the weld current.

3.4 INSTALLING ACCESSORIES

Setup of optional accessories are described in the following sections.

3.4.1 Standard torch adapter

The standard torch adapter is designed to utilize standard CLIMAX BW3000 torches.

Do the following to use the standard torch adapter:

- 1. Install the standard torch adapter onto the swivel.
- 2. Install the liner into the assembly (see Figure 3-30).

NOTICE

The liner length should be flush with the inner bore base of the female fitting and the top of the male fitting.



FIGURE 3-30. LINER AND STANDARD TORCH ADAPTER

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3. Tighten the liner in the male fitting of the swivel (see Figure 3-31).

NOTICE

The liner is secured in the male fitting on the swivel coupling and not in the adapter.

- 4. Screw the standard torch (#0 or #00) into the standard torch adapter.
- 5. Orient the torch nozzle so it is parallel with the swivel travel (see Figure 3-32).
- 6. Secure the locknut.



FIGURE 3-31. LINER TIGHTENED IN THE SWIVEL



FIGURE 3-32. TORCH NOZZLE ORIENTATION

3.4.2 Torch #00 and #0

These torches are used to build up bores ranging in diameter from 0.88–1.7" (22–44 mm) and 1.7–3" (44–76 mm) respectively. They are used with the standard torch adapter described in Section 3.4.1.



Because these torches have non-insulated nozzles, clearance between the nozzle and the workpiece is crucial.

If it is necessary to feed the wire through the BW2600 and swivel assembly with the torch detached, push the wire through the torch with pliers, and then re-attach the torch to the swivel head.



TIP:

Filing the wire to a point, straightening a short section at the end, or rotating the bore welder spindle may help automatic feeding of the wire.

Do the following to change torch tips:

- 1. Loosen the setscrew holding the tip.
- 2. Remove the tip from the torch body.
- 3. Insert the new tip into the body and the liner.
- 4. Hold the torch horizontally so that the tip falls into its seat.
- 5. Tighten the set screw to prevent movement.
- 6. Position the tip axially to a point slightly below center to the nozzle opening, using the hex wrench as a gauge, as shown in (Figure 3-33).

TIP:

Because the wire is curved when exiting the tip, the point of contact with the work is higher than might otherwise be expected. Therefore, position the tip slightly toward the end of the nozzle.



FIGURE 3-33. TIP POSITION WITH HEX WRENCHES

After rotating torches for setup, centering, or screwing into an

extension, jog the wire through the torch until it exits the tip in a stable condition, producing a clean spiral of wire. This relieves the torsional stresses built up in the wire (because wire was not fed while rotating), so that the weld process will not be affected by wire wandering at startup.

3.4.3 Torch extension support kit

The torch extension support kit is ideal when the distance from the bore welder to the torch is great enough to make torch stability uncertain and alignment difficult. Do the following to set up the torch extension support kit.

- 1. Slip the support body over an extension near the bore to be welded, at a position where the extension support rod may be clamped or tack welded to provide support.
- 2. Orient the support block so that both shoulder screws are at right angles to the extension string.
- 3. Obtain concentricity of the support body with the bore.

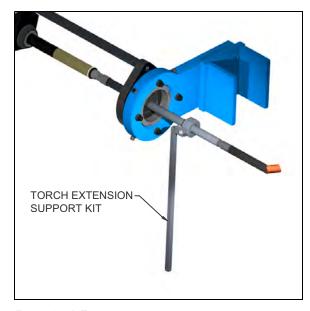


FIGURE 3-34. TORCH EXTENSION SUPPORT KIT

- 4. Attach the extension support rod to the foundation determined in step 1.
- 5. Continue with the set up as described in Section 3.3 on page 30.

TIP:

With MIG welding, the wire speed bears a direct relationship to the weld current. With variable step, it is possible to lay down a small bead and small step, or to lay down huge beads with a large step.



4 OPERATION

IN THIS CHAPTER:

4.1 OPERATION MODES 4.4 Preparing the Bore welder for welding -------55

4.1 OPERATION MODES

The BW2600 is capable of welding any cylindrical workpiece, including bores, faces, and outsider diameters.

Operation modes include:

- Standard bore welding
- Skip bore welding
- Fill bore welding

CAUTION

Weld spatter and other debris can damage the machine and degrade its performance. Remove all weld spatter and other debris from the machine before and after each use.

4.2 PRINCIPLES OF OPERATION

WARNING

Always follow safe work practices, including site-specific safety requirements. It is your responsibility to perform a risk assessment before you set up the machine and each time before you operate the machine.

Do not operate this machine without adequate training to fully understand safe setup, operation, and maintenance.



To avoid serious personal injury, keep clear of moving machinery during operation.

The BW2600 often is used in dangerous locations (such as in elevated positions or near other operating equipment). The operator must perform a site-specific risk assessment (Section 4.3 and Section 1.6 on page 6) for each job before starting work.

The BW2600 has an optional remote operation pendant that allows the operator to choose the best location to operate the machine.

4.3 Pre-operation checks



Rotating machinery can cause serious injuries. Turn off and lock out the machine before performing the pre-operation checks. When operating the machine, always be aware of the location of all people in the vicinity of the machine.

Each time before starting the machine, check the following:

- 1. The machine is securely mounted to the workpiece.
- 2. All lines, cables, and hoses are properly connected and secured away from moving parts.
- 3. All machine parts are secure.
- 4. The welding parameters are set correctly (Section 3.4 on page 49).
- 5. All handles and tools are removed from the machine.
- 6. All preventative maintenance is up to date (Section 5).



4.4 Preparing the Bore welder for welding

4.4.1 Setting the rotation speed

Do the following to set the rotation speed:

- 1. Set the rotation speed of the torch to the desired linear travel speed along the bore surface.
- 2. Use Table 4-1 for approximate adjustments.
- 3. Time the spindle for fine adjustments according to the following guidelines:
 - a) For horizontal axis welding, multiply the bore diameter in inches by 8.4 to get the total seconds per rotation of the spindle at 22 in/min (559 mm/min) of linear travel speed.
 - b) For vertical axis welding, multiply the bore diameter in inches by 10.4 to get the total seconds per rotation of the spindle at 18 in/min (457 mm/min) linear travel speed.

TABLE 4-1. ROTATIONAL SPEED IN INCHES AT 20 IN/MIN (508 MM/MIN)

| Dial settings | Bore size | Seconds per rotation |
|---------------|---------------|----------------------|
| 1 | 25" (635 mm) | 240 |
| 2 | 4.3" (109 mm) | 40 |
| 3 | 2.8" (71 mm) | 26 |
| 4 | 2.1" (53 mm) | 20 |
| 5 | 1.7" (43 mm) | 16 |
| 6 | 1.4" (36 mm) | 13 |
| 7 | 1.2" (30 mm) | 11 |
| 8 | 1.1" (28 mm) | 10 |
| 9 | 1.0" (25 mm) | 9 |
| 10 | 0.9" (23 mm) | 8 |

^{*.} Table 4-1 is for reference only.

Optimum travel speed for MIG welding is 20 in/min (508 mm/min). With vertical bore welder axis welding, travel speed may be decreased. With horizontal bore welder axis welding, travel speed should be increased to prevent lack of fusion on the downhill section. For accurate results, use a stopwatch to time the spindle rotation.

4.4.2 Setting the gas flow

Check that the shielding gas is connected to the feeder mechanism and that the flow is adequate for MIG welding (25–35 cfh).

The following gas compositions are recommended:

- 75% argon + 25% CO₂ for horizontal bore welder axis welding
- 92% argon + 8% CO₂ for vertical bore welder axis welding

4.4.3 Setting the wire speed

Follow the manufacturer's instructions for the customer-supplied wire feeder to set the wire speed.

NOTICE

With 0.035" (0.889 mm) wire, a wire speed of 250"/min equals approximately 125 amps. This setting is recommended as a baseline when starting welding. At a travel speed of 22"/min, the bead size is approximately 0.115" in depth.

4.4.4 Checking the step setting

Do the following to check the step setting:

- 1. Check that the bore welder is clear of rotational obstructions.
- 2. Disconnect the wire feed control cable.

TABLE 4-2. CONTROLS IDENTIFICATION

| Number | Component |
|--------|---------------------------------|
| 1 | Remote operator pendant port |
| 2 | Arc interrupt |
| 3 | Rotation speed knob |
| 4 | Wirefeed contactor control port |



FIGURE 4-1. CONTROLS FOR CHECKING THE STEP SETTING



3. Rotate the bore welder spindle by connecting the AC mains cable (but not the wire feeder cable) and using the WELD switch to turn the spindle. If the pendant is in use, push ROT/JOG on the remote control pendant.



Failure to disconnect the control cable in step 2 could result in unwanted weld activity.

4. Measure the length of feed in one rotation and set the step knob to provide an axial movement of 1/8" (3.2 mm).

TABLE 4-3. PORT AND KNOB IDENTIFICATION

| Number | Component |
|--------|-----------------------|
| 1 | Operator pendant port |
| 2 | Step adjustment knob |



FIGURE 4-2. LOCATION OF THE STEP ADJUSTMENT KNOB

NOTICE

Adjustments to step size and wire speed are

necessary to attain the desired buildup. Smaller bead size require a smaller step (with lower amperage and wire speed), and a larger bead size require a larger step (with higher amperage and wire speed).

4.4.5 Attaching the weld ground clamp

Attach the power supply ground clamp to the part to be welded. The surface to which the clamp is attached should be clean bare metal and located with a good conductive path to the workpiece. The C-clamp type is recommended (shown in Figure 4-3).



As with any electric welding process, a poor ground can be detrimental to weld quality and increase the risk of electrical shock.



FIGURE 4-3. C-CLAMP EXAMPLE

4.5 WELDING

WARNING

Welding must only be done by qualified persons. Welding requires a high degree of training, and qualified welders are aware of the possibility of an arc flash occurrence, hot surfaces, and burn hazard at the welding nozzle and workpiece. Wear appropriate PPE at all times during welding.

MARNING

The workpiece can become extremely hot during welding. Contact with a hot workpiece could cause severe burns to bare skin. Wear welding gloves when you touch or work around a workpiece that is being welded.

To begin welding, press the WELD switch.

Visual confirmation that the spindle axial feed rate matches weld deposition is crucial. Adjust the wire speed to place the bead at intersection of previous bead and the base metal or slightly above.

If the step is too small, increase the step by unscrewing the step adjustment knob; if the step is too large, decrease the step by screwing in the step adjustment knob (see Figure 4-2 on page 57).

When process is complete, turn off the WELD switch.

4.5.1 Welding safety during adjustments

As with any arc welding process, visual observation should only be made with an appropriate light shield. Many welders employ a combination of a #9 hand-held shield and #3 safety eyeglasses. This combination allows the operator to adjust the control while being protected from flash burn by the glasses.

View the arc through the combination of the hand-held shield and the glasses, to observe accurate definition of wire location.



4.5.2 Weld interrupt options

Figure 4-4 shows the difference in skip/fill capabilities.

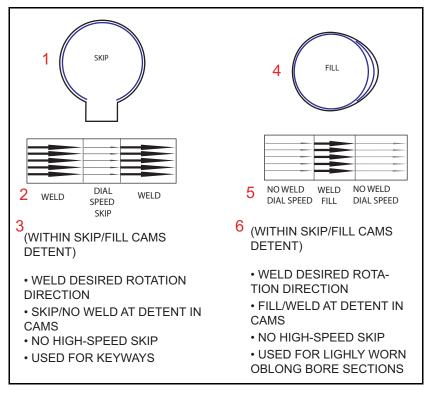


FIGURE 4-4. SKIP AND FILL COMPARISON

TABLEAU 4-4. SKIP AND FILL COMPARISON IDENTIFICATION

| Number | Component |
|--------|---|
| 1 | Skip |
| 2 | Weld – Dial speed skip – Weld |
| | (Within skip/fill cams detent) |
| | Weld in the desired rotation direction |
| 3 | Skip/no weld at the detent in cams |
| | No high-speed skip |
| | Used for keyways |
| 4 | Fill |
| 5 | No weld dial speed – Weld fill – No weld dial speed |
| | (Within skip/fill cams detent) |
| | Weld in the desired rotation direction |
| 6 | Fill/weld at the detent in cams |
| | No high-speed skip |
| | Used for lightly worn oblong bore sections |

Avoiding key ways

If skipping a key way is required, do the following when preparing for welding:

- 1. Set the SKIP/FILL switch to SKIP.
- 2. Turn the SKIP switch on.
- 3. Rotate the torch in the weld direction until the torch tip reaches the stop point or a point ahead of the key way.
- 4. Squeeze the outside diameter of the cam discs with the thumb and forefinger to open a low spot in the cam discs.
- 5. Rotate the discs until the SKIP switch falls into the low area.
- 6. Rotate the torch as in step 3 to the end of the interrupt area.
- 7. Hold the first disc where it was set in step 5. Then move the other disc until the SKIP switch actuates.
- 8. Re-check the disc settings by rotating the spindle through the "interrupt" zone in the welding rotation direction.

Filling oblong sections of the bore

The BW2600 is capable of correcting moderately oblong bores.

When filling oblong sections, do the following when preparing for welding:

- 1. Set the SKIP/FILL switch to FILL.
- 2. Turn the SKIP switch on.
- 3. Rotate the torch in the weld direction until the torch tip reaches where welding should begin.
- 4. Squeeze the outside diameter of the cam discs with the thumb and forefinger to open a low spot in the cam discs.
- 5. Rotate the discs until the cam microswitch (shown under the 6 in Figure 2-23 on page 23) falls into the low area.
- 6. Rotate the torch as in step 3 to the end of the interrupt area.
- 7. Hold the first disc where it was set in step 5. Then move the other disc until the SKIP switch actuates.
- 8. Re-check the disc settings by rotating the spindle through the "interrupt" zone in the welding rotation direction.

NOTICE

The BW2600 is limited in its capability of fixing oblong bores, as it must rotate 360°.

Manual interrupt over grease holes

For panel operation of manual skip, push the MANUAL SKIP button to halt welding while continuing rotation. To resume welding, release the button.

For remote pendant operation, push the rotation JOG / MANUAL SKIP button.



NOTICE

Repeat this procedure for each revolution until the non-weld area is passed.

4.6 WELDING POINTERS

4.6.1 Arc voltage

A voltage setting of 17–19 volts is a recommended initial range. Small changes to voltage on the power supply will be required to stabilize the weld process.

A lower voltage delivers a steady, less violent arc. This produces less spatter and smaller diameter spatter beads, allowing longer periods of continuous welding between nozzle cleanings and extends tip life.

NOTICE

The arc voltage should be adjusted during welding to maintain the best bead profile and shorting performance. Due to variations in the environment and welding systems, this manual cannot provide exact specifications. Contact CLIMAX for technical support related to welding parameters.

4.6.2 Using 0.035" wire

Follow these guidelines when using 0.035" wire:

- 100 amps = 200 in/min at 16-17 volts
- 125 amps = 240 in/min at 17-18 volts
- 150 amps = 300 in/min at 18-19 volts

NOTICE

These numbers are only guidelines and do not take into account the variations of equipment and consumables.

4.6.3 Shielding gas

A flow range of 25–35 cfh (1 m³/hour) is recommended. Avoid excessive flow, as this creates turbulence and could cause poor shielding.

If poor shielding is suspected, check for dirty nozzle or an obstructed gas flow from the diffuser. If wind is a problem, make a shield from leather or other available non-conductive materials.

4.6.4 Wire and gas

The BW2600 is designed for solid steel wire using the MIG welding process.

The length of time that the bore welder may be used continuously depends on spatter build-up in the welding nozzle. When deciding the type of wire, gas, and power supply to use, select a combination that produces the smoothest arc action. That will produce less spatter buildup.

Wires with higher de-oxidizer content usually work best. Wires E-70S-2 and E-70S-6 are recommended; E-70S-2 produces finer spatter and less glass buildup in multilayer buildups.

Any commonly used inert gas may be used, but those with high argon content are preferred, such as the following combinations:

- 75% argon + 25% CO₂ for horizontal bore welder axis welding
- 92% argon + 8% CO₂ for vertical bore welder axis welding

Straight argon or helium should not be used for steel. Straight CO₂ produces a significant amount of spatter.

Welding wire usually contains silicon as a de-oxidizer. During the welding process, this transforms to silicon dioxide (glass) and solidifies in clumps on the surface of the weld. If the wire speed is too high and rotational speed too low, these glass clumps might become large enough to interfere with the welding arc, producing small glass inclusions (this does not normally occur). Likewise, when many layers of buildup are stacked, the glass from the lower level re-melts and is added to the new glass, forming larger clumps. Therefore, it is good practice to clean the glass from the bore after each successive pass before applying more.

4.6.5 Spindle feed and wire location

During welding, check that the mechanical step feed is providing appropriate axial movement on each revolution, with the following guidelines:

- If the feed is too much for the parameters in use, the bead will appear ropey and might have spaces between the beads.
- If the step is feeding too little, the surface of the weld may appear smooth and flaw free, but it may be poorly fused to the base metal.

Check that the arc is directed slightly above the intersection point between the base metal and the previous bead.

The first step (ending the first revolution) should be made slightly smaller than those that follow. An alternative is to use a slightly lower wire speed during the first revolution.

4.6.6 Welding in the horizontal axis

Welding in the horizontal axis requires special attention to the machine settings. The weld bead must travel through the lower, vertical-up, overhead, and vertical-down positions. These correspond to the 6 o'clock, 9 o'clock, 12 o'clock, and 3 o'clock positions of the bore, in that order.



The following sections offer some practical suggestions for developing skills for work in the horizontal.

4.6.6.1 Welding on the vertical upside

The BW2600 has no difficulty with lower and overhead (that is, 6 and 12 o'clock) positions of the bore.

When the torch is welding in the vertical upside (the 9 o'clock position of the bore), the weld tends to run downward. With controls set correctly, the solidifying weld-metal forms a shelf that supports the molten metal, so vertical-up is nearly as easy as flat.

The first rotation may be more difficult to obtain a well-formed bead than the subsequent ones. The V produced by the previously laid bead and the base metal provide optimal conditions for successful out-of-position bore welding.

4.6.6.2 If welding current is too high

If the welding current (controlled by the wire speed) is too high, the arc may be too forceful and gouge the base metal. Gouged out metal will flow and form globules, or it may form a humped bead in less severe cases. This also produces undercutting at the edge of the weld bead.

Increasing the rotational speed of the bore welder helps cool the weld, but only to a point. Decreasing the weld current (by slowing the wire speed) should keep the weld metal in place. Using a smaller wire and proportionately lower current will produce a more manageable bead. A wire size of 0.030" (0.762 mm) should be easy to manage, and after some use, the operator should be able to master 0.035" (0.889 mm) wire horizontally. The preferred wire size is 0.035" in most instances.

4.6.6.3 Welding on the vertical downside

When welding on the vertical downside (the 3 o'clock position of the bore), different issues may arise, but the solution is the same as described in Section 4.6.6.2.

Deposited metal has a tendency to flow downhill with the welding arc. If the deposited metal does not solidify quickly enough, it will follow or even run ahead of the arc, and in the process use up all its de-oxidizers (the welding wire contains elements to cleanse the weld). This can produce porosity and contribute to lack of fusion on the down hand.

Do not increase gas flow. Instead, quickly solidify the weld metal in place with the following options (combine if necessary):

- Speeding up the BW2600's rotational speed
- Decreasing the welding current
- Using a smaller wire size

Another related problem is the arc playing on the molten metal rather than on the base metal, resulting in a lack of fusion to the base metal. This problem can go undetected until machining the bore to size, at which time large sections of the weld may separate from the base metal.

The solution for most problems in horizontal bore buildup is to run slightly faster travel speeds (at 22 in/min) and not to use excessive current. If the rotational speed becomes too great, the weld may also not flow in well and tend to undercut or hump into a stringy bead.

Starting with a wire size of 0.035" (0.889 mm) is recommended. A wire size of 0.030" (0.762 mm) with less current and a smaller step is also manageable - although if "wire flip" is present, "tie-in" is more difficult with 0.030" (0.762 mm) wire.

4.7 DISASSEMBLY

To disassemble the BW2600 bore welding machine, follow the setup instructions (Section 3.3 on page 30) in reverse.



5 MAINTENANCE AND TROUBLESHOOTING

| 5.1 OVERVIEW |
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| 5.4.9 IF THE WELD IS "GRAPING" IN THE HORIZONTAL AXIS |
| 5.4.10 IF THE WELD VOLTAGE IS HARD TO CONTROL |
| 5.5 Training |
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| 5.7 Tool kit |

5.1 **OVERVIEW**

This chapter explains periodic maintenance intervals and tasks and provides troubleshooting guidance.



Failure to properly clean and maintain the machine can result in machine damage and void the warranty.

Following the required maintenance schedule is critical to obtaining normal machine life.

Keep all machine components in clean, working condition.

To prevent corrosion, thoroughly rinse with fresh, clear water any machine parts that are exposed to salt water.

5.2 MAINTENANCE INTERVALS

Table 5-1 lists maintenance intervals and tasks.

TABLE 5-1. MAINTENANCE INTERVALS AND TASKS

| Interval | Task | See section |
|---------------------------|--|--------------|
| | Inspect O-rings and sealing surfaces. | |
| Before each use | Inspect all components for damage in conducting areas. | |
| | Check hoses and cables for damage or kinks. | |
| Before and after each use | Remove debris, oil, and moisture from machine surfaces. | |
| Periodically | Clean the liners, replacing as needed. | Section 5.3. |
| - | Inspect the torch and extension ends for dings or burrs. | Section 5.3 |

5.3 MAINTENANCE TASKS

Daily maintenance consists primarily of keeping the BW2600 clean and protected. The BW2600 is designed to tolerate industrial environments that are dusty and gritty. However, the BW2600 is a machine tool with close-fitting parts that will last longer if cared for.

Long-term maintenance includes cleaning or replacing the liners. Occasionally inspect the torch and extension ends where they mate for dings and burrs. These parts require smooth surfaces for a gas seal.

If it becomes difficult to insert the conduit into the BW2600, the O-ring may be dry or badly worn. If worn, replace with CLIMAX P/N 36379. It may be helpful to apply a small amount of O-ring grease to the ring, though the unit is shipped with a lubricated O-ring.

The needle bearings that support the spindle are greased for the life of the machine.

5.3.1 Replacing liners

When a liner needs replacement, follow these guidelines:

- If the liner is installed in any curved BW2600 accessory, pre-load the liner.
- If replacing the liner in a wire feeder conduit, do the following:
 - a) Coil the conduit into a 24" (60 mm) circle.
 - b) Push the liner into so that it contacts the outer wall of the conduit.
 - c) Secure it in place with the setscrews while in the coiled position.



This procedure is helpful in assuring consistent wire feeding. Be careful not to over-tighten the setscrews that secure the liner.

5.3.2 Motor maintenance

If the operator needs to replace the gear motor (P/N 61210), use kit P/N 103306 as shown in Table 5-2 on page 67.

TABLE 5-2. MOTOR DRIVE REPLACEMENT KIT (P/N 103306)

| Part number | Description | Quantity |
|-------------|---|----------|
| 103142 | GEARMOTOR 90 VDC 6.6 RPM 189 IN-LBS TORQUE 776.76:1 | 1 |
| 103280 | BRACKET MOTOR DRIVE (MMP) | 1 |
| 103281 | PULLEY ROTATION MOTOR STD (MMP) | 1 |
| 103282 | PLATE BASE MOTOR MOUNT (MMP) | 1 |
| 103284 | CLAMP LOOP VIBRATION DAMPENING 1-1/2 ID | 1 |
| 103285 | NUT CLIP ON 8-32 0.04IN MAX THICKNESS | 1 |
| 103632 | SCREW 8-32 X 1 BHSCS | 1 |
| 103633 | STUD PARTIALLY THREADED M4 X 0.70 X 12MM LG STEEL | 1 |
| 10877 | SCREW 10-32 X 1/2 SHCS | 1 |
| 11256 | SCREW 10-24 X 1/4 SSSCP | 1 |
| 11315 | WASHER #10 FLTW BLACK OXIDE | 6 |
| 11676 | SCREW 10-32 X 3/4 SHCS | 3 |
| 11852 | SCREW 8-32 X 1/2 BHSCS | 3 |
| 17986 | SCREW 10-32 X 1-1/4 SHCS | 2 |
| 20758 | WASHER #6 ITSTRW | 1 |
| 26468 | SCREW 6-32 X 3/16 BHSCS | 1 |
| 32575 | BELT SLOW ROTATION | 1 |
| 67403 | TERMINAL SNAP-PLUG MALE 22-18AWG HEAT-SHRINK | 1 |
| 67404 | TERMINAL SNAP-PLUG FEMALE 22-18AWG HEAT-SHRINK | 1 |

5.4 TROUBLESHOOTING

This section is intended to help solve basic machine performance problems. Contact CLIMAX for serious maintenance or for questions on the following procedures.

5.4.1 If the feed will not work

The feed will not work under the following conditions:

- The feed knob is not fully pulled out to engage the feed.
- The drag brake is set too tight. A maximum of 10 in-lbs (1.13 Nm) is required to allow manual axial spindle movement, yet also allow retraction of the spindle and torch components when the spindle feed is engaged.
- The cam follower arm is not resetting. For example, the indicator on top of the machine is not returning to the "maximum feed amount" indication after each step. This could be due to the loosening of the spring that keeps the cam follower up against the cam, or if something is jamming the cam follower arm.

5.4.2 If there is a lack of fusion to the bore surface

Lack of fusion in MIG welding occurs when the weld metal lacks a metallurgical bond to the base metal.

Reasons for lack of fusion include the following:

- The rotational travel speed is too slow. Proper travel speed allows the arc to play on the puddle and the base metal simultaneously, providing complete fusion. Slowing rotation speed prevents the arc from playing on the base metal, limiting fusion.
- The step size is too short, causing the weld to play on the previous bead and not the base metal, causing a lack of fusion.

5.4.3 If the wire feeding stops and wire burns back to tip

A mechanical blockage of the welding wire causes wire feeding to stop and wire burn back.

This may be caused by a pile-up 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 as it becomes the new electrode.

In addition, as the contact tip becomes too hot, the wire may seize to it. If this happens, it probably means the arc voltage is too high and lowering it should prevent the seizing and may improve the welding.

Changing the liners is usually not necessary in cases of wire stoppage. Occasionally the liner at the torch nozzle overheats and should be replaced. Generally, liners last a long time.

5.4.4 If weld beads are "ropey"

"Ropey" is defined as the undesirable excessive "crown" of the weld metal, such as narrow tall beads that deviate from the preferred convex shape of the bead profile. Causes include mill scale, rust, contamination of wire or base metal, improper shielding gas, high-resistance weld ground/positive connection, or welding parameters.



To make the beads wet-out more and become less ropey, an increase in the arc voltage up to about 18 volts may help. However, most wetting will be obtained with increased inductance of the system. Most welding power supplies have an inductance control. Observe what happens as you rotate the inductance knob. Higher inductance tends to spread out the weld puddle.

NOTICE

As the inductance is changed, the arc voltage will need to be adjusted to compensate for the variation in inductance.

If the power supply does not have an inductance control, you can create inductance by wrapping either welding cable around a steel core. A piece of heavy wall 4" (102 mm) pipe or a 4" solid bar works well. Try one wrap at a time while welding. Typically, 2–20 wraps should be sufficient.

A sign of too much inductance is difficulty in starting the arc. The wire tends to "stub" and has trouble recovering. In addition, if the electrode tends to stub excessively while welding and arc voltage is not too low, high inductance is likely.

5.4.5 If there is too much spatter

Spatter is the formation and ejection of molten droplets of welding consumable due to repetitive arc extinguishments (short circuiting) and arc reestablishments. Factors that reduce spatter include changes in voltage, inductance, welding consumables, and travel speed.

Within the bore welding scope, spatter is usually a problem due to its buildup on the nozzle and its undesirable effect on gas flow and / or interruption of continuous welding.

The usual cause for too much spatter is that the arc voltage is too high. The arc should have an even sound that is not violent. A setting of 15.5–18 volts is normal. If higher than 18 volts, the arc will become much more uneven and labored and the metal transfer will become globular. Avoid this range.

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. (CLIMAX often uses 92% argon, 8% CO₂.) More CO₂ than this tends to cause excessive spatter.

5.4.6 If the weld is porous

Porosity is an undesirable sponge-like matrix of small voids in the weld metal, caused by reactive gases and impurities in or around the molten weld puddle. Although the welding wires used contain substantial amounts of de-oxidizer and cleansers, there is a point at which these additives cannot keep up with the impurities.

Some other reasons for porosity are listed in the following sections.

5.4.6.1 Problem with shielding gas

This might include a restriction in flow due to spatter buildup, etc. Alternatively, the gas flow rate may be too high causing turbulence. A flow rate of 20 to 40 CFH is recommended. If the weld is not shielded from the atmosphere, the oxygen and nitrogen will react with the weld metal, causing porosity.

5.4.6.2 Dirty bore surface

Although the BW2600 usually handles these problems well, excessive oil or other organic compounds could cause porosity. These may be on the surface or embedded in crevices or grease holes. A thorough cleaning should be done prior to welding; sandblasting or even pre-machining may be in order. In certain cases preheating before buildup may drive out the grease.

If the porosity affects the entire weld bead, it can be related to shielding gas not properly shielding the process from drafts or flow restrictions. If drafts are an issue, creating screens out of leather or aluminum foil can help.

NOTICE

Aluminum foil is a good conductor of electricity, so be careful not to short bore welder components to the piece being welded.

5.4.7 If experiencing wire flip

Wire flip is a weld defect caused when the weld wire is twisted due to torch rotation, to the point that it can overcome the forces twisting it. When this occurs, the wire untwists violently and cause the weld puddle to disperse.

If experiencing "wire flip," try the following to eliminate it:

- 1. Avoid an S shape in the conduit. A circular shape is preferred.
- 2. Position the wire conduit in such a way that the conduit makes only one continuous curve. The conduit should begin curving at its attachment point on top of the BW2600 and continue this curve for about 270°, then straighten out as it heads toward the wire feeder. This method works particularly well with long conduits.

TIP:

If the wire has a tight cast and it still flips in this configuration, try "tightening up" the curve. However, long torch extensions tend to negate any benefit that this conduit shape may have.

5.4.8 If steel weld deposits are too hard to machine

Assuming the wire is a mild steel wire (such as 70s-series), the ability to harden must be coming from the base material. Ordinarily, mild steel with its lack of carbon will not harden. If the deposit is hard, it must have obtained carbon and



possibly other elements from the base material, which make it susceptible to hardening. When welding wire is deposited on this base metal, some elements of the base metal melt and flow with the welding wire. Thus, if enough carbon is added, the weld wire becomes susceptible to hardening.

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

Keep in mind that once the weld bead is hardened, it can be annealed to soften it. For this to happen, the weld must be allowed to cool below about 400°F and then reheated to about 950–1,250°F (510–676°C). The welding arc often can be used to accomplish this). Slow travel speeds allow the welding arc to reheat the previous beads, thus having an annealing effect. In addition, sometimes it is advantageous to deposit another layer of weld on top of the hard layer solely to temper it.

If the buildup is still too hard, re-heat it after welding. If the buildup is brought to a temperature of about 1,100°F (593°C) and allowed to cool slowly, it will then be machinable. It is important that the part is allowed to cool to below 400°F (204°C) before the reheating is done. It is also important not to allow any part of the weld to rise above the critical temperature (about 1,300°F [704°C]) even for a short time, as undesired changes to the weld metal atomic structure may occur.

5.4.9 If the weld is "graping" in the horizontal axis

Graping is the undesirable breach of surface tension of the molten puddle (i.e. "dripping" of the molten weld metal). This typically occurs on the overhead section of a bore welded in the horizontal axis. It can also occur when the bore is in the vertical axis. Causes include excessive voltage, amperage, interpass temperature, too slow a travel speed, too small or too large a step, and contamination.

During the first revolution, the weld bead must be applied to the vertical cylinder bore. During this first time around, there is not yet a previous weld bead to act as a shelf to help support the bead. For most normal work, this is not a problem. If it becomes a problem, use lower current and voltage for the first revolution.

Often it may be advantageous to increase the travel speed slightly. Maintain 22 in/min travel speed.

During the remainder of the buildup operation, graping should not be experienced within the current limits of the BW2600. If graping is experienced during the remainder of the buildup operation, the weld current probably is too high or the travel speed is too slow. The bead becomes so large that its weight overcomes the surface tension that otherwise would hold it in place and the bead spills.

It also is 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.

5.4.10 If the weld voltage is hard to control

Sometimes the weld voltage is hard to control resulting in a ropey bead or an inability to clear stubbing in the bead. In some cases, during welding, the weld bead will not wash out properly, the voltage is difficult to stabilize, (i.e. the process is stubbing or spray, never settling into a stable short arc mode, no matter what adjustments are made to voltage and wire speed.)

In this case, look for issues in the positive and negative weld current path. High resistance connections in cable junctions can cause intermittent issues that are frustrating and time consuming to track down. A thorough inspection of all connections, in weld cables and all connections to power supply and work piece should be double checked for signs of corrosion, overheating, or being loose.

5.5 TRAINING

The following are suggested training practices:

- Work with mild steel before attempting work with any other alloys.
- Use a wire with a large arc or "cast" (that is, the diameter of the circle that the welding wire makes as it leaves the wire reel). To determine the cast: cut about 72" (1,828 mm) from the roll of wire and toss it on the floor. It will form a circle on the floor, which is the "cast" of the wire.

TIP:

The cast diameter should be as large as possible and at least 40" (1,016 mm), as casts below 30" (762 mm) likely cause difficulties; a cast of 40" or more will reduce or eliminate the effect of the "Wire Flip" that can occur at each rotation). Consult with your sales representative if you are unable to find large cast wires.

Practice welding on a vertical axis bore. This position should be mastered before any other is attempted. Short sections of heavy wall pipe make good coupons.

TIP:

It is recommended to bore the coupons to be sure they are round and clean. This enables the trainee to focus on learning without complicating the experience with a contaminated base metal.

- Re-find the center each time a coupon is welded, rather than placing the coupon in a fixture to hold the piece in a centered position. Repeating this technique will allow the operator to center the machine in under a couple of minutes, particularly if also following the suggestions in Section 3.3.1.4 on page 38 on centering.
- Bore coupons to check for proper fusion.



- Perform multi-layered build-ups.
- Measure and record the step size, rotation time, and wire speed. Then the operator may compare the data with Section 4.4.1 on page 55 to determine how to repeat successful buildups.
- Measure the wire speed in inches/minute by jogging the wire for six seconds, measuring the amount fed, and multiplying that number by 10.
- Calculate the spindle rotation time/travel speed with the following formula: (diameter x 3.14 x 60) / desired travel speed in/min.

TIP:

Example for 3" (76 mm) bore: (3 * 3.14 * 60) / 20 inches/minute = 28.26 seconds per revolution

While performing the buildups, the operator may vary each of the parameters to measure the effect on the buildup operation. Experimentation is a key element to building proficiency.

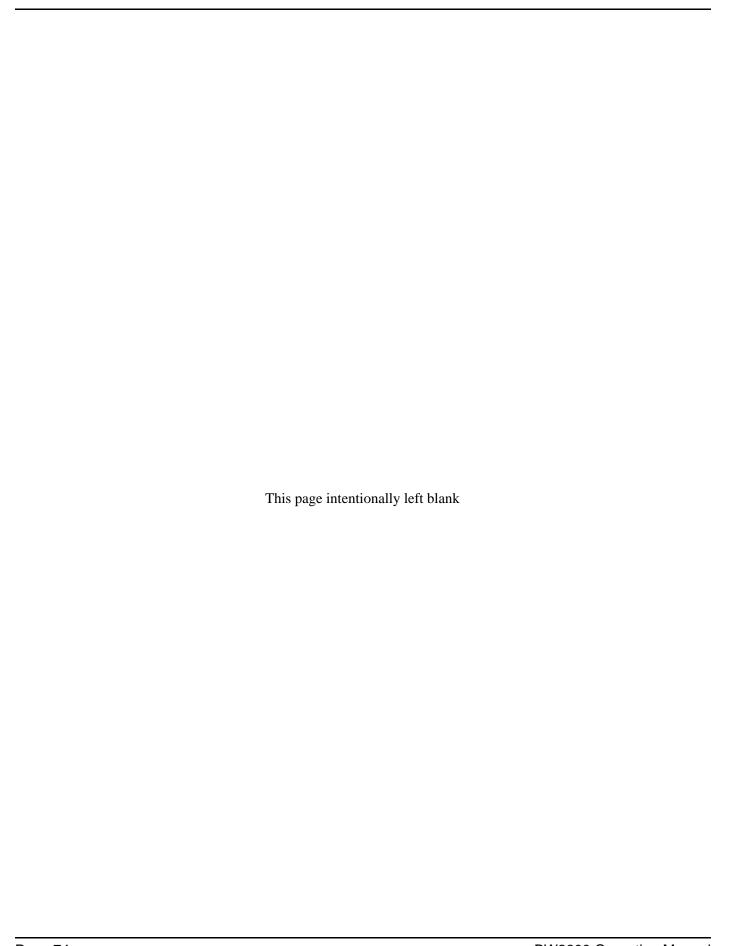
5.6 DECOMMISSIONING

To decommission the BW2600 before disposal, dispose or recycle machine parts according to local regulations.

5.7 TOOL KIT

TABLE 5-3. P/N 86863 TOOL KIT

| Part number | Name | 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 | SP LINER STAINLESS STEEL .065 ID X .144 OD X 16 FT FOR .023/.045 WIRE (KB) | 1 |
| 66860 | WRENCH OPEN END 3/4 X 6.0 LONG | 1 |
| 66861 | WRENCH OPEN END 11/16 X 6-3/8 LONG | 1 |
| 66862 | WRENCH HEX L-KEY 1/8 X 2-5/16 LONG | 1 |
| 67082 | GLOVES WELDING CLIMAX BRANDED SIZE LARGE | 1 |
| 67337 | LUBRICANT 3 OZ WD-40 | 1 |
| 70176 | CONSUMABLE PACKAGE BW1000 .035/.9MM TIPS (KB) | 1 |
| 85555 | MANUAL INSTRUCTION BW2600 | 1 |





6 STORAGE AND SHIPPING

6.1 STORAGE

Proper storage of the BW2600 will extend its usefulness and prevent undue damage.

Store the BW2600 in its original shipping container. Keep all packing materials for repackaging the machine.

6.1.1 Short-term storage

Short term storage is defined as less than or equal to three months. For short-term storage:

- 1. Clean and dry the machine to remove grease, metal chips, and moisture.
- 2. Package the machine in its shipping container as shown in Figure 6-1.

6.1.2 Long-term storage

Long term storage is defined as longer than three months. For long-term storage:

- 1. Clean and dry the machine to remove grease, metal chips, and moisture.
- 2. Package the machine in its shipping container as shown in Figure 6-1.
- 3. Add a desiccant pouch to the shipping container. Replace the pouch according to the manufacturer's instructions.
- 4. Store the shipping container out of direct sunlight in an environment where the temperature is between -4–160 °F (-40–70 °C).

6.2 SHIPPING

The BW2600 should be shipped in its original shipping container.

Package the machine as shown in Figure 6-1.

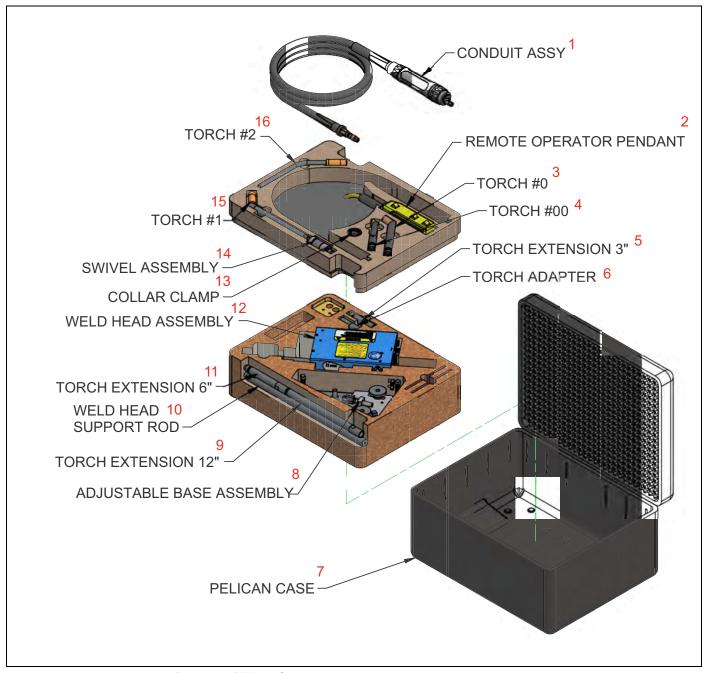


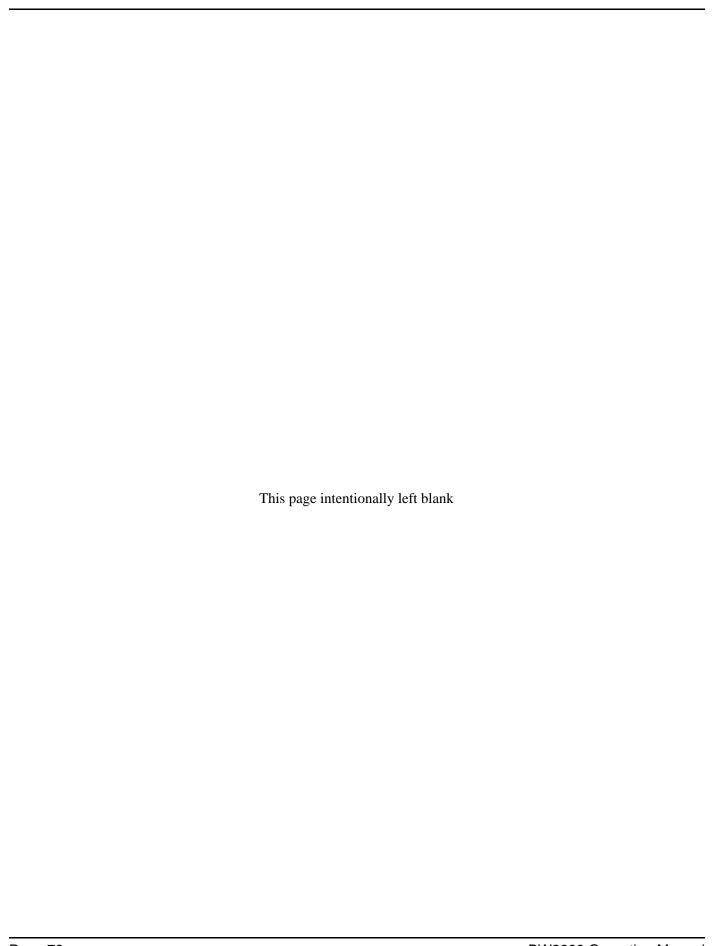
FIGURE 6-1. BW2600 SHIPPING CONTAINER WITH COMPONENTS PACKED

TABLEAU 6-1. SHIPPING CONTAINER AND COMPONENTS IDENTIFICATION

| Number | Component |
|--------|-------------------------|
| 1 | Conduit assembly |
| 2 | Remote operator pendant |
| 3 | Torch #0 |
| 4 | Torch #00 |

TABLEAU 6-1. SHIPPING CONTAINER AND COMPONENTS IDENTIFICATION

| Number | Component |
|--------|--------------------------|
| 5 | Torch extension 3" |
| 6 | Torch adapter |
| 7 | Pelican case |
| 8 | Adjustable base assembly |
| 9 | Torch extension 12" |
| 10 | Weld head support rod |
| 11 | Torch extension 6" |
| 12 | Weld head assembly |
| 13 | Collar clamp |
| 14 | Swivel assembly |
| 15 | Torch #1 |
| 16 | Torch #2 |





APPENDIX A EXPLODED VIEWS AND PARTS LISTS

NOTICE

Figure A-4 through Figure A-6 apply to Bore Welder machines with the serial number 22001030 and later. Refer to Figure through Figure A-3 for Bore Welders earlier than the 22001030 serial number.

IN THIS CHAPTER:

| FIGURE A-1. WELD HEAD ASSEMBLY (P/N 103268) |
|---|
| FIGURE A-2. WELD HEAD ASSEMBLY (P/N 103268) |
| FIGURE A-3. WELD HEAD ASSEMBLY (P/N 103268) |
| FIGURE A-4. BW2600 ASSEMBLY (P/N 91579) |
| FIGURE A-5. BW2600 ASSEMBLY PARTS LIST 1 (P/N 91579) |
| FIGURE A-6. BW2600 ASSEMBLY PARTS LIST 2 (P/N 91579) |
| FIGURE A-7. STEP POSITIONER ASSEMBLY (P/N 90590) |
| FIGURE A-8. STEP POSITIONER ASSEMBLY PARTS LIST (P/N 90590) |
| FIGURE A-9. RADIAL ISOLATION MOUNT ASSEMBLY (P/N 85771) |
| FIGURE A-10. PELICAN CASE ASSEMBLY (P/N 85771) |
| FIGURE A-11. BASE UNIT AND PELICAN CASE ASSEMBLY (P/N 85824) |
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| FIGURE A-13. CONDUIT ASSEMBLY WITH EURO CONNECTOR (P/N 85435) |
| FIGURE A-14. POWER SUPPLY FOR SWITCH MILLER ASSEMBLY (P/N 85475) |
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| FIGURE A-17. CONTACTOR ASSEMBLY FOR HOBART AND THERMAL ARC (P/N 85530) |
| FIGURE A-18. CONDUIT ASSEMBLY FOR HOBART AND THERMAL ARC HEFTY II (P/N 85532) |
| FIGURE A-19. CONDUIT ASSEMBLY FOR TWECO (P/N 85534) |
| FIGURE A-20. CONDUIT ASSEMBLY FOR LINCOLN (P/N 855360) |
| FIGURE A-21, CONTACTOR ASSEMBLY FOR LINCOLN 5 PIN (P/N 85540) 100 |

NOTICE

The following diagrams and parts lists are for your reference purposes only. The machine Limited Warranty is void if the machine has been tampered with by anyone who has not been authorized in writing by CLIMAX to perform service on the machine.

Note: Refer to Figure A-1 through Figure A-3 for Bore Welders with the serial number 22001030 and later. Figure A-4 through Figure A-6 apply to Bore Welder machines with serial number 22001029 and earlier.

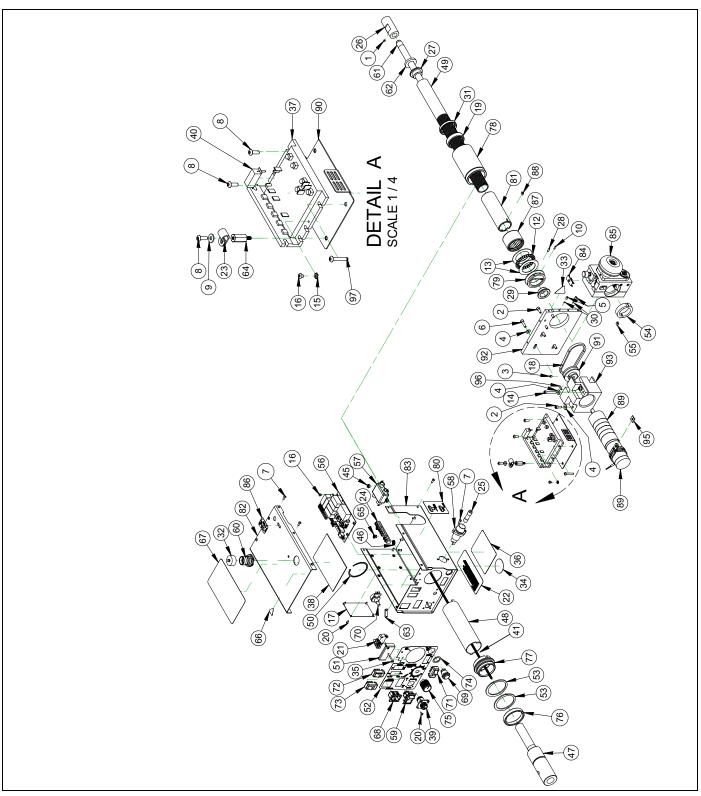


FIGURE A-1. WELD HEAD ASSEMBLY (P/N 103268)



| | | | PARTS LIST |
|------|-----|-------|--|
| ITEM | QTY | P/N: | DESCRIPTION |
| 1 | 1 | 10841 | SCREW 8-32 X 3/16 SSSCP |
| 2 | 4 | 10877 | SCREW 10-32 X 1/10 333CF |
| 3 | 1 | 11256 | SCREW 10-32 X 1/2 STICS SCREW 10-24-UNC-2B X 1/4 SSSCP |
| 4 | 6 | 11315 | WASHER #10 FLTW BLACK OXIDE |
| 5 | 2 | 11672 | SCREW 10-32 X 1/4 SSSCP |
| 6 | 3 | 11672 | SCREW 10-32 X 1/4 333CF SCREW 10-32 X 3/4 SHCS |
| 7 | 14 | 11677 | SCREW 10-32 X 3/4 SHCS SCREW 6-32 X 3/8 BHSCS |
| 8 | 3 | 11852 | SCREW 8-32 X 1/2 BHSCS |
| 9 | 1 | 11872 | WASHER #8 FLTW SAE ZINC PLATED |
| 10 | 1 | 13111 | PIN ROLL 1/8 DIA x 3/8 |
| 11 | 10 | 13243 | (NOT SHOWN) WIRE TIE MEDIUM .14 X 8 |
| 12 | 1 | 16113 | BEARING THRUST 1.500 DI X 2.187 OD X .0781 |
| 13 | 2 | 16568 | WASHER THRUST 1.500 ID X 2.187 OD X .0781 |
| 14 | 2 | 17986 | SCREW 10-32 X 1.25 SHCS |
| 15 | 1 | 20758 | WASHER #6 ITSTRW |
| 16 | 5 | 26468 | SCREW 6-32 X 3/16 BHSCS |
| 17 | | 29154 | PLATE SERIAL YEAR MODEL CE 2.0 X 3.0 |
| | 1 | | |
| 18 | 1 | 32575 | BELT SLOW ROTATION |
| 19 | 1 | 34740 | BRG NEEDLE 1-1/2 ID X 1-7/8 X 1/2 OPEN |
| 20 | 8 | 37397 | SCREW 4-40 X 1/4 BHSCS |
| 21 | 1 | 37407 | SWITCH STEP LIMIT |
| 22 | 1 | 37576 | LABEL ELECTRICAL WARNING |
| 23 | 1 | 37941 | CABLE MOUNT CLIP .50 OD MAX #10 SCREW |
| 24 | 1 | 38444 | GROUND BUSS 7 POLE COPPER CE CERTIFIED |
| 25 | 1 | 38575 | FUSE LP-CC-5 13/32X1 1/2 600VAC 5AMP REJ |
| 26 | 1 | 40966 | TORCH ADAPTER SPINDLE |
| 27 | 1 | 40968 | ISOLATOR TORCH END SPINDLE TUBE |
| 28 | 1 | 40980 | SCREW 6-32 X 3/8 SSSDPPL |
| 29 | 1 | 40991 | BUSHING ISOLATOR SWIVEL |
| 30 | 2 | 43489 | BALL NYLON 1/8 DIA |
| 31 | 1 | 44724 | SEAL 1.500 X 1.874 X .250 MODIFIED |
| 32 | 1 | 46446 | CONNECTOR CLOSURE CAP FOR MALE M23 |
| 33 | 1 | 46902 | LABEL WARNING HOT SURFACE GRAPHIC 1.13" TALL |
| 34 | 1 | 59044 | LABEL WARNING - CONSULT OPERATOR'S MANUAL 1.5 DIA |
| 35 | 2 | 62487 | SCREW 4-40 X 3/4 BHSCS |
| 36 | 1 | 63504 | LABEL WARNING |
| 37 | 1 | 63525 | DRIVE MOTOR CONTROL 115/230VAC |
| 38 | 1 | 66867 | INSULATION SHEET HIGH TEMPERATURE BW1000 220V CE |
| 39 | 1 | 67063 | CONNECTOR PLUG 11-4 PLASTIC |
| 40 | 1 | 67143 | RESISTOR HORSEPOWER PLC CONTROL DRIVES CE BW3000 |
| 41 | 19 | 67162 | LINER BOREWELDER SPINDLE .065 ID X .188 OD |
| 42 | 1 | 67313 | (NOT SHOWN) WELD SAMPLE 2.750 ID X 3.500 OD X 2.000 |
| 43 | 1 | 67403 | (NOT SHOWN) TERMINAL SNAP-PLUG MALE 22-18AWG HEAT-SHRINK |
| 44 | 1 | 67404 | (NOT SHOWN) TERMINAL SNAP-PLUG FEMALE 22-18AWG HEAT-SHRINK |
| 45 | 2 | 73763 | NUT 8-32 NYLON INSERT LOCKNUT HEX ZINC PLATED |
| 46 | 1 | 77568 | LABEL PROTECTIVE EARTH 1/2" DIA |
| 47 | 1 | 80019 | BW1 POWER SWIVEL COUPLING |
| 48 | 1 | 84399 | TUBE CAM DRIVE WIRE GUARD |
| 49 | 1 | 84411 | SPINDLE TUBE 9 IN STROKE |
| 50 | 1 | 84431 | RING SPIRAL EXTERNAL RETAINING 1.922 ID |

FIGURE A-2. WELD HEAD ASSEMBLY (P/N 103268)

| | | | PARTS LIST |
|----------|-----|--------|--|
| ITEM | QTY | P/N: | DESCRIPTION |
| 40 | 1 | 67143 | RESISTOR HORSEPOWER PLC CONTROL DRIVES CE BW3000 |
| 52 | 1 | 84511 | PANEL OVERLAY BW2600 CLIMAX CE |
| 53 | 2 | 84519 | AUTO SKIP CAM |
| 54 | 1 | 84530 | COLLAR CAM DRIVE |
| 55 | 1 | 84594 | KEY 1/8 X 1/4 X 5/16 LONG RADIUS BOTH ENDS |
| 56 | 1 | 84636 | CIRCUIT BOARD, COMPONENT LAYOUT, POPULATED |
| 57 | 1 | 84752 | LINE FILTER 3 AMP 250 VAC 50/60 HZ QUICK CONNECTION |
| 58 | 1 | 84757 | FUSE HOLDER |
| 59 | 1 | 84898 | CABLE ASSY ROCKER SWITCH BW2600 |
| 60 | 1 | 85037 | REMOTE PENDANT CONNECTOR ASSY |
| 61 | 1 | 85449 | DRAWBAR 5/8 DIA X 13.31 |
| 62 | 1 | 85520 | WASHER 17mm ID X 32mm OD X 3.9mm BLACK OXIDE |
| 63 | 1 | 85869 | PLATE AUTO SKIP BACK |
| 64 | 1 | 85880 | STANDOFF 8-32 MALE X 8-32 FEMALE X 3/4" LONG |
| 65 | 2 | 85976 | NUT SOCKET CAP 8-32 X .31 OD X .27 LG |
| 66 | 1 | 86036 | LABEL WARNING - HAND PINCH / MOVING PARTS - GRAPHIC .69 TALL |
| 67 | 1 | 86158 | LABEL BORTECH BW2600 LOGO 6.3 X 3.5 |
| 68 | 1 | 86514 | ASSY POWER ENTRY MODULE BW2600 |
| 69 | 1 | 86516 | ASSY HARNESS POWER AND CONTROL BW2600 |
| 70 | 1 | 86517 | ASSY POTENTIOMETER AND HARNESS BW2600 |
| 71 | 1 | 86518 | ASSY SWITCH ROTATION AND HARNESS BW2600 |
| 72 | 1 | 86520 | ASSY SWITCH AUTO-SKIP ON/OFF HARNESS BW2600 |
| 73 | 1 | 86521 | ASSY SWITCH SKIP/FILL AND HARNESS BW2600 |
| 74 | 2 | 87039 | WASHER 5/8 ID X 7/8 OD X .015 THK HARD FIBER |
| 75 | 1 | 89797 | KNOB POTENTIOMETER 1/4 SHAFT X 1.01 TALL X .92 DIA BLACK PLASTIC |
| 76 | 1 | 89798 | RING LOCKING AUTO SKIP CAM |
| 77 | 1 | 89799 | COLLAR CAM HOLDER |
| 78 | 1 | 90481 | BARREL SHEATH TUBE |
| 79 | 1 | 90483 | SHEAVE DRIVE AND CAM |
| 80 | 1 | 90487 | LABEL - RUN POSITION BW2600 |
| 81 82 | 1 | 90488 | SHEATH TUBE COVER SHROUD |
| 83 | 1 | 90489 | ENCLOSURE SHROUD |
| 84 | 1 | 90539 | INDICATOR FEED |
| 85 | 1 | 90599 | ASSY BW2600 POSITIONER 2ND GEN |
| 86 | 1 | 90627 | LABEL - RUN POSITION BW2600 |
| 87 | 1 | 90843 | BRG NEEDLE 1-1/2 ID X 1-7/8 X 1.312 OPEN 1 SEAL |
| 88 | 1 | 90865 | KEY 1/8 X 3/16 X 5/16 LONG RADIUS BOTH ENDS |
| 89 | 1 | 103142 | GEARMOTOR 90 VDC 6.6 RPM 189 IN-LBS TORQUE 776.76:1 |
| 90 | 1 | 103280 | BRACKET MOTOR DRIVE (MMP) |
| 91 | 1 | 103281 | PULLEY ROTATION MOTOR STD (MMP) |
| 92 | 1 | 103282 | PLATE BASE MOTOR MOUNT (MMP) |
| 93 | 1 | 103283 | BLOCK MOTOR MOUNT BW2600 / BW1000 (MMP) |
| 94 | 1 | 103284 | CLAMP LOOP VIBRATION DAMPENING 1-1/2 ID |
| 95 | 1 | 103285 | NUT CLIP ON 8-32 0.04IN MAX THICKNESS |
| 96 | 1 | 103633 | STUD PARTIALLY THREADED M4 X 0.70 X 12MM LG STEEL |
| 97 | 1 | 103632 | SCREW 8-32 X 1 BHSCS |

FIGURE A-3. WELD HEAD ASSEMBLY (P/N 103268)

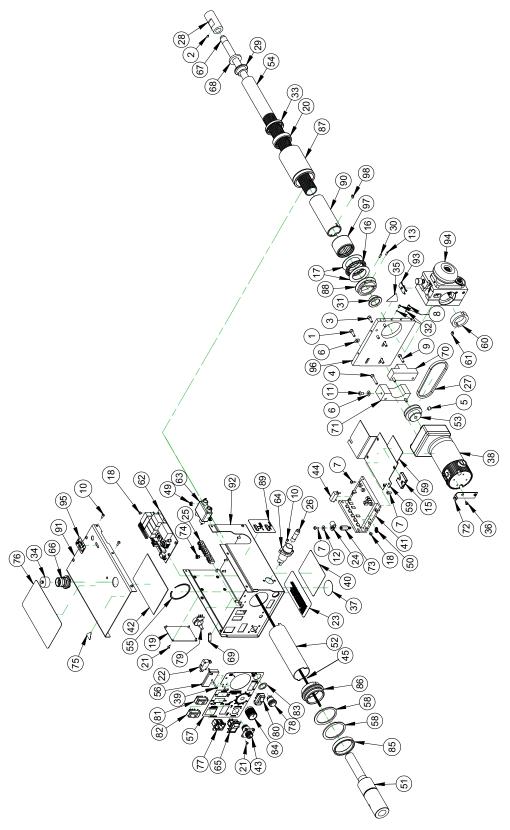


FIGURE A-4. BW2600 ASSEMBLY (P/N 91579)

| ITEM QTY P/N: DESCRIPTION 1 3 10157 SCREW 10-32 X 5/8 SHCS 2 1 10841 SCREW 8-32 X 3/16 SSSCP 3 3 10877 SCREW 10-32 X 1/2 SHCS 4 2 10935 SCREW 10-32 X 1 SHCS 5 1 11206 SCREW 5/16-18 X 5/16 SSSCP 6 4 11315 WASHER #10 FLTW BLACK OXIDE 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/8 BHSCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS 11 1 11678 SCREW 10-32 X 3/8 BHSCS | |
|--|--|
| 2 1 10841 SCREW 8-32 X 3/16 SSSCP 3 3 10877 SCREW 10-32 X 1/2 SHCS 4 2 10935 SCREW 10-32 X 1 SHCS 5 1 11206 SCREW 5/16-18 X 5/16 SSSCP 6 4 11315 WASHER #10 FLTW BLACK OXIDE 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 3 3 10877 SCREW 10-32 X 1/2 SHCS 4 2 10935 SCREW 10-32 X 1 SHCS 5 1 11206 SCREW 5/16-18 X 5/16 SSSCP 6 4 11315 WASHER #10 FLTW BLACK OXIDE 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 4 2 10935 SCREW 10-32 X 1 SHCS 5 1 11206 SCREW 5/16-18 X 5/16 SSSCP 6 4 11315 WASHER #10 FLTW BLACK OXIDE 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 5 1 11206 SCREW 5/16-18 X 5/16 SSSCP 6 4 11315 WASHER #10 FLTW BLACK OXIDE 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 6 4 11315 WASHER #10 FLTW BLACK OXIDE 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 7 5 11359 SCREW 8-32 X 3/8 BHSCS 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 8 2 11672 SCREW 10-32 X 1/4 SSSCP 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 9 2 11676 SCREW 10-32 X 3/4 SHCS 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| 10 14 11677 SCREW 6-32 X 3/8 BHSCS | |
| | |
| | |
| 12 1 11872 WASHER #8 FLTW SAE ZINC PLATED | |
| 13 1 13111 PIN ROLL 1/8 DIA x 3/8 | |
| 14 10 13243 (NOT SHOWN) WIRE TIE MEDIUM .14 X 8 | |
| 15 1 13296 MOUNTING BASE WIRE TIE ADHESIVE BACKED LARGE | |
| 16 1 16113 BEARING THRUST 1.500 DI X 2.187 OD X .0781 | |
| 17 2 16568 WASHER THRUST 1.500 ID X 2.187 OD X .030 | |
| 17 2 10306 WASHER THROST 1.300 ID X 2.107 OD X .030 18 5 26468 SCREW 6-32 X 3/16 BHSCS | |
| 19 1 29154 PLATE SERIAL YEAR MODEL CE 2.0 X 3.0 | |
| 20 1 34740 BRG NEEDLE 1-1/2 ID X 1-7/8 X 1/2 OPEN | |
| | |
| | |
| | |
| 23 1 37576 LABEL ELECTRICAL WARNING | |
| 24 1 37941 CABLE MOUNT CLIP .50 OD MAX #10 SCREW | |
| 25 1 38444 GROUND BUSS 7 POLE COPPER CE CERTIFIED | |
| 26 1 38575 FUSE LP-CC-5 13/32X1 1/2 600VAC 5AMP REJ | |
| 27 1 40179 BELT V SPINDLE DRIVE | |
| 28 1 40966 TORCH ADAPTER SPINDLE | |
| 29 1 40968 ISOLATOR TORCH END SPINDLE TUBE | |
| 30 1 40980 SCREW 6-32 X 3/8 SSSDPPL | |
| 31 1 40991 BUSHING ISOLATOR SWIVEL | |
| 32 2 43489 BALL NYLON 1/8 DIA | |
| 33 1 44724 SEAL 1.500 X 1.874 X .250 MODIFIED | |
| 34 1 46446 CONNECTOR CLOSURE CAP FOR MALE M23 | |
| 35 1 46902 LABEL WARNING HOT SURFACE GRAPHIC 1.13" TALL | |
| 36 2 48582 SCREW 6-32 X 1/4 PPHSTS SELF TAPPING BLACK OXIDE | |
| 37 1 59044 LABEL WARNING - CONSULT OPERATOR'S MANUAL 1.5 DIA | |
| 38 1 61210 GEARMOTOR PAINTED BW3000 90 VDC 7 RPM TENV | |
| 39 2 62487 SCREW 4-40 X 3/4 BHSCS | |
| 40 1 63504 LABEL WARNING | |
| 41 1 63525 DRIVE MOTOR CONTROL 115/230VAC | |
| 42 1 66867 INSULATION SHEET HIGH TEMPERATURE BW1000 220V CE | |
| 43 1 67063 CONNECTOR PLUG 11-4 PLASTIC | |
| 44 1 67143 RESISTOR HORSEPOWER PLC CONTROL DRIVES CE BW3000 | |
| 45 19 67162 LINER BOREWELDER SPINDLE .065 ID X .188 OD | |
| 46 1 67313 (NOT SHOWN) WELD SAMPLE 2.750 ID X 3.500 OD X 2.000 | |
| 47 1 67403 (NOT SHOWN) TERMINAL SNAP-PLUG MALE 22-18AWG HEAT-SHRINK | |
| 48 1 67404 (NOT SHOWN) TERMINAL SNAP-PLUG FEMALE 22-18AWG HEAT-SHRINK | |
| 49 2 73763 NUT 8-32 NYLON INSERT LOCKNUT HEX ZINC PLATED | |
| 50 1 77568 LABEL PROTECTIVE EARTH 1/2" DIA | |
| 51 1 80019 BW1 POWER SWIVEL COUPLING | |
| 52 1 84399 TUBE CAM DRIVE WIRE GUARD | |

FIGURE A-5. BW2600 ASSEMBLY PARTS LIST 1 (P/N 91579)



| | | | PARTS LIST | | | |
|------|---|-------|--|--|--|--|
| ITEM | | | | | | |
| 53 | 1 | 84400 | MOTOR PULLEY | | | |
| 54 | 1 | 84411 | SPINDLE TUBE 9 IN STROKE | | | |
| 55 | 1 | 84431 | RING SPIRAL EXTERNAL RETAINING 1.922 ID | | | |
| 56 | 1 | 84510 | COVER SWITCH AUTO SKIP | | | |
| 57 | 1 | 84511 | PANEL OVERLAY BW2600 CLIMAX CE | | | |
| 58 | 2 | 84519 | SKIP FILL CAM | | | |
| 59 | 1 | 84527 | BRACKET MOTOR DRIVE | | | |
| 60 | 1 | 84530 | COLLAR CAM DRIVE | | | |
| 61 | 1 | 84594 | KEY 1/8 X 1/4 X 5/16 LONG RADIUS BOTH ENDS | | | |
| 62 | 1 | 84636 | CIRCUIT BOARD, COMPONENT LAYOUT, POPULATED | | | |
| 63 | 1 | 84752 | LINE FILTER 3 AMP 250 VAC 50/60 HZ QUICK CONNECTION | | | |
| 64 | 1 | 84757 | FUSE HOLDER | | | |
| 65 | 1 | 84898 | CABLE ASSY ROCKER SWITCH BW2600 | | | |
| 66 | 1 | 85037 | REMOTE PENDANT CONNECTOR ASSY | | | |
| 67 | 1 | 85449 | DRAWBAR 5/8 DIA X 13.31 | | | |
| 68 | 1 | 85520 | WASHER 17mm ID X 32mm OD X 3.9mm BLACK OXIDE | | | |
| 69 | 1 | 85869 | PLATE AUTO SKIP BACK | | | |
| 70 | 1 | 85875 | T-BLOCK MOTOR CE | | | |
| 71 | 1 | 85876 | BLOCK MOTOR MOUNT WORM GEAR BW1000 | | | |
| 72 | 1 | 85878 | BRACKET MOTOR DRIVE SUPPORT | | | |
| 73 | 1 | 85880 | STANDOFF 8-32 MALE X 8-32 FEMALE X 3/4" LONG | | | |
| 74 | 2 | 85976 | NUT SOCKET CAP 8-32 X .31 OD X .27 LG | | | |
| 75 | 1 | 86036 | LABEL WARNING - HAND PINCH / MOVING PARTS - GRAPHIC .69 TALL | | | |
| 76 | 1 | 86158 | LABEL BORTECH BW2600 LOGO 6.3 X 3.5 | | | |
| 77 | 1 | 86514 | ASSY POWER ENTRY MODULE BW2600 | | | |
| 78 | 1 | 86516 | ASSY HARNESS POWER AND CONTROL BW2600 | | | |
| 79 | 1 | 86517 | ASSY POTENTIOMETER AND HARNESS BW2600 | | | |
| 80 | 1 | 86518 | ASSY SWITCH ROTATION AND HARNESS BW2600 | | | |
| 81 | 1 | 86520 | ASSY SWITCH SKIP FILL ON/OFF HARNESS BW2600 | | | |
| 82 | 1 | 86521 | ASSY SWITCH SKIP/FILL AND HARNESS BW2600 | | | |
| 83 | 2 | 87039 | WASHER 5/8 ID X 7/8 OD X .015 THK HARD FIBER | | | |
| 84 | 1 | 89797 | KNOB POTENTIOMETER 1/4 SHAFT X 1.01 TALL X .92 DIA BLACK PLASTIC | | | |
| 85 | 1 | 89798 | RING LOCKING AUTO SKIP CAM | | | |
| 86 | 1 | 89799 | COLLAR CAM HOLDER | | | |
| 87 | 1 | 90481 | BARREL SHEATH TUBE | | | |
| 88 | 1 | 90483 | SHEAVE DRIVE AND CAM | | | |
| 89 | 1 | 90487 | LABEL - RUN POSITION BW2600 | | | |
| 90 | 1 | 90488 | SHEATH TUBE | | | |
| 91 | 1 | 90489 | COVER SHROUD | | | |
| 92 | 1 | 90490 | ENCLOSURE SHROUD | | | |
| 93 | 1 | 90539 | INDICATOR FEED | | | |
| 94 | 1 | 90590 | ASSY BW2600 POSITIONER 2ND GEN | | | |
| 95 | 1 | 90627 | LABEL - RUN POSITION BW2600 | | | |
| 96 | 1 | 90628 | PLATE BASE MOTOR MOUNT WG | | | |
| 97 | 1 | 90843 | BRG NEEDLE 1-1/2 ID X 1-7/8 X 1.312 OPEN 1 SEAL | | | |
| 98 | 1 | 90865 | KEY 1/8 X 3/16 X 5/16 LONG RADIUS BOTH ENDS | | | |

FIGURE A-6. BW2600 ASSEMBLY PARTS LIST 2 (P/N 91579)

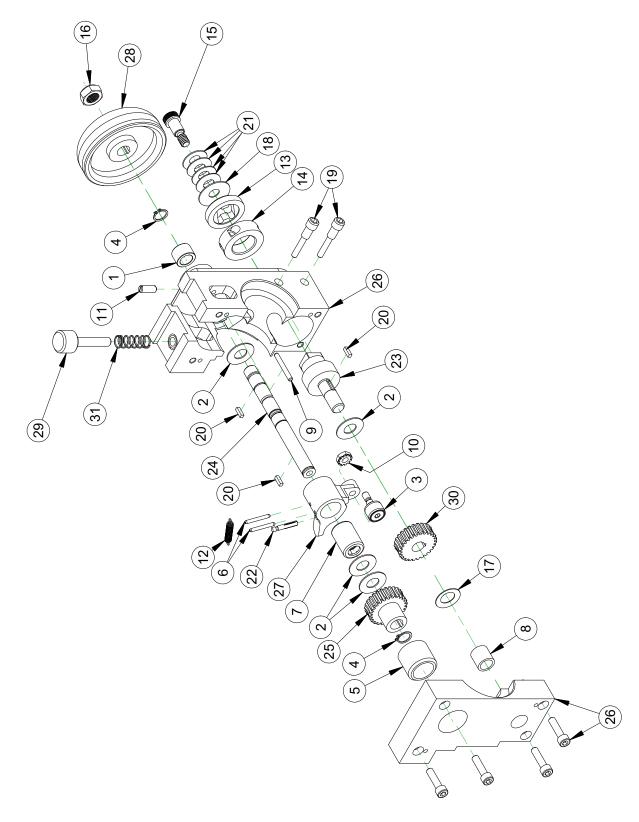
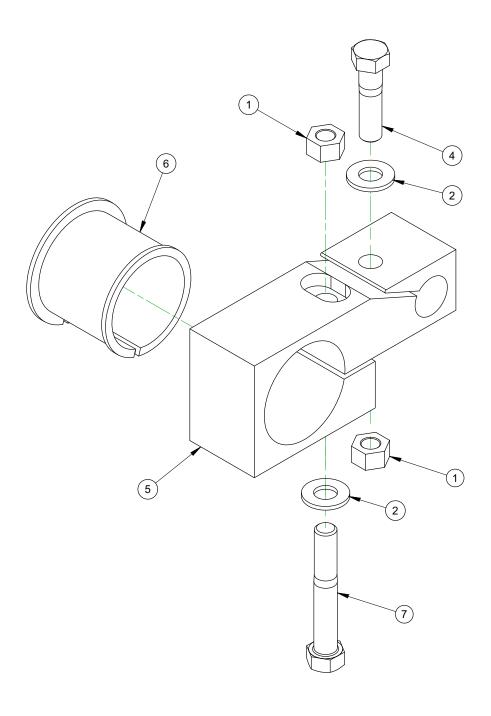


FIGURE A-7. STEP POSITIONER ASSEMBLY (P/N 90590)



| | | | PARTS LIST |
|------|-----|-------|---|
| ITEM | QTY | P/N: | DESCRIPTION |
| 1 | 1 | 10056 | BUSHING OILITE 3/8 (.378) ID X 9/16 (.565) OD X 3/8 |
| 2 | 4 | 10058 | WASHER THRUST .375 ID X .812 OD X .032 |
| 3 | 1 | 10836 | BRG CAM FOLLOW .500 X .344 |
| 4 | 2 | 11808 | RING EXTERNAL SNAP 3/8 ID X .025 THK |
| 5 | 1 | 12258 | BUSHING DRILL 5/8 ID X 7/8 OD X 3/4 |
| 6 | 2 | 12895 | PIN ROLL 3/32 DIA X 3/4 |
| 7 | 1 | 13492 | BRG ROLLER CLUTCH 3/8 ID X 5/8 OD X .875 |
| 8 | 1 | 16377 | BUSHING OILITE 3/8 ID X .5 OD X 1/2 |
| 9 | 1 | 17153 | PIN DOWEL 1/8 DIA X 1 |
| 10 | 1 | 28060 | NUT, 10-32 UNF KEPS |
| 11 | 1 | 28930 | PLUNGER BALL 10-32 NYLON PATCH |
| 12 | 1 | 44970 | SPRING EXT .187 OD X .023 WIRE X 1.00 LONG |
| 13 | 1 | 84404 | FRICTION DISK PRE-LOAD |
| 14 | 1 | 84407 | BEARING CLUTCH SIDE, STEP DIRVE |
| 15 | 1 | 84476 | SCREW 5/16 DIA X 7/16 X 1/4-20 SHLDCS |
| 16 | 1 | 84493 | NUT 3/8-24 NYLON INSERT LOCKING GRADE 8 LOW PROFILE |
| 17 | 1 | 84565 | WASHER SPRING BELLEVILLE .438 ID X .75 OD X .02 THICK |
| 18 | 1 | 85154 | WASHER SPRING BELLEVILLE .317 ID X .937 OD .030 THICK |
| 19 | 2 | 85750 | SCREW 5/16-18 X 1-3/4 SSSDP MODIFIED |
| 20 | 3 | 85877 | KEY 3/32 SQ X .31 SQ BOTH ENDS |
| 21 | 4 | 85884 | WASHER SPRING BELLEVILLE .323 ID X .787 X .027 THICK |
| 22 | 1 | 90250 | PIN DOWEL 1/8 DIA X 3/4 GROOVED |
| 23 | 1 | 90482 | SHAFT DRAG BRAKE |
| 24 | 1 | 90484 | SHAFT FEED |
| 25 | 1 | 90485 | GEAR SPUR 24 DP 26 TOOTH |
| 26 | 1 | 90486 | HOUSING FEED ASSY |
| 27 | 1 | 90491 | CAM FOLLOWER ARM |
| 28 | 1 | 90834 | KNOB FEED SELECTOR |
| 29 | 1 | 90844 | SCREW 1/4-20 X 1-1/4 THUMB KNURLED |
| 30 | 1 | 90849 | GEAR SPUR 24 DP 26 TOOTH NO HUB |
| 31 | 1 | 91542 | SPRING COMP .36 OD X .032 WIRE X 1.00 LONG |

FIGURE A-8. STEP POSITIONER ASSEMBLY PARTS LIST (P/N 90590)



| | PARTS LIST | | | | |
|------|------------|-------|----------------------------------|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | |
| 1 | 2 | 10849 | NUT 1/2-13 STDN | | |
| 2 | 2 | 11779 | WASHER 1/2 FLTW SAE PLAIN FINISH | | |
| 4 | 1 | 39179 | SCREW 1/2-13 X 2 HHHCS GRADE 8 | | |
| 5 | 1 | 85769 | MOUNT RADIAL | | |
| 6 | 1 | 85770 | SLEEVE MOUNT RADIAL ISOLATION | | |
| 7 | 1 | 85773 | SCREW 1/2-13 X 3-1/4 HHCS | | |

FIGURE A-9. RADIAL ISOLATION MOUNT ASSEMBLY (P/N 85771)



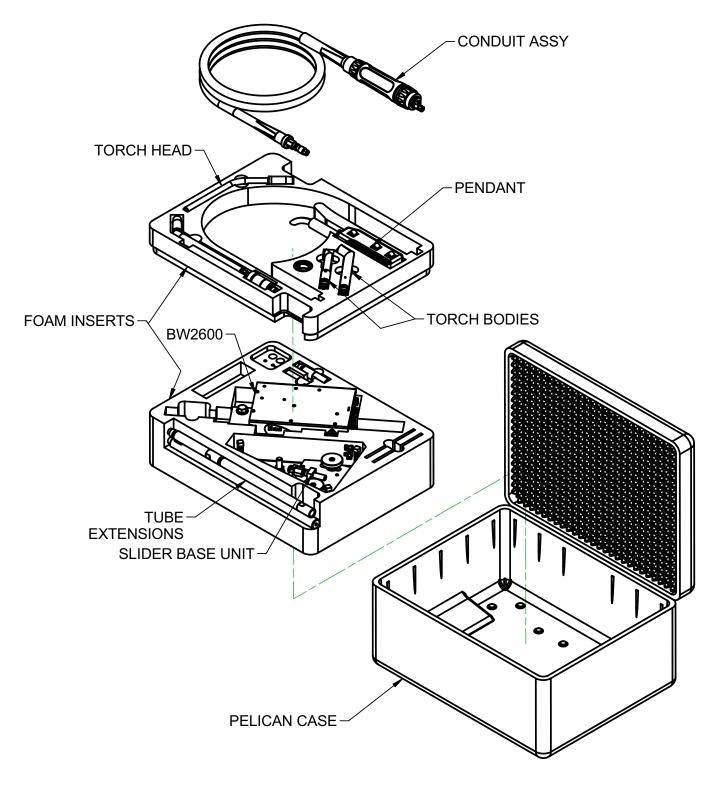
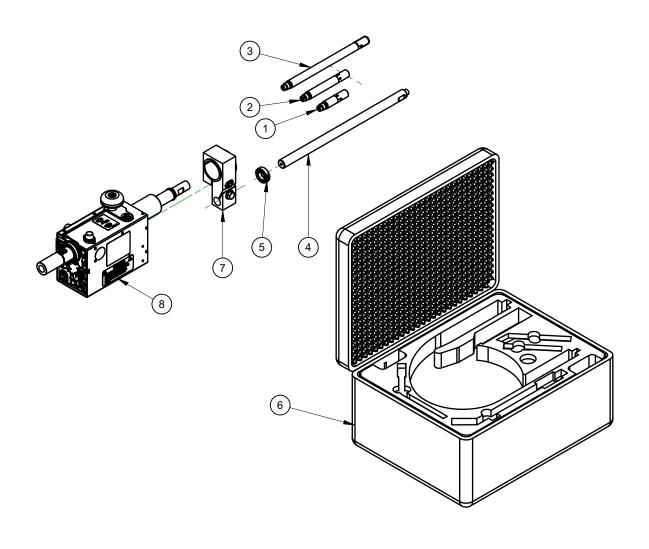


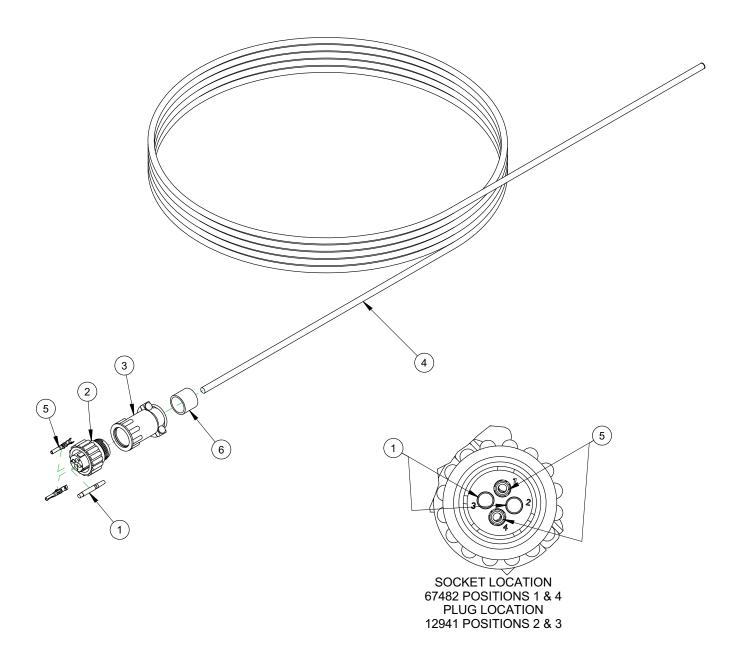
FIGURE A-10. PELICAN CASE ASSEMBLY (P/N 85771)



| | PARTS LIST | | | | |
|------|------------|--------|--|--|--|
| ITEM | QTY | P/N: | I: DESCRIPTION | | |
| 1 | 1 | 29038 | FORCH EXTENSION 76MM (3) | | |
| 2 | 1 | 29039 | ORCH EXTENSION 152MM (6) | | |
| 3 | 1 | 29040 | TORCH EXTENSION 305MM (12) | | |
| 4 | 1 | 30773 | SUPPORT ROD WELD HEAD | | |
| 5 | 1 | 63596 | CLAMP COLLAR 1 ID X 1-3/4 OD X 1/2 WIDE ONE PIECE | | |
| 6 | 1 | 85731 | ASE PELICAN ALL WEATHER B/BW2600 CUSTOM FOAM 1620NL | | |
| 7 | 1 | 85771 | ASSY MOUNT RADIAL ISOLATION | | |
| 8 | 1 | 103268 | ASSY WELD HEAD BW2600 120/230VAC CE GEN II | | |
| 9 | 1 | 34396 | (NOT SHOWN) CORD POWER IEC 320 X NEMA 5-15 7.5 FT | | |
| 10 | 1 | 73879 | 73879 (NOT SHOWN) CORD POWER 230V 3 METER 16 AWG IEC320 C13 X CEE7/7 BLACK | | |
| 11 | 1 | 86863 | (NOT SHOWN) KIT TOOL MODEL BW2600 | | |

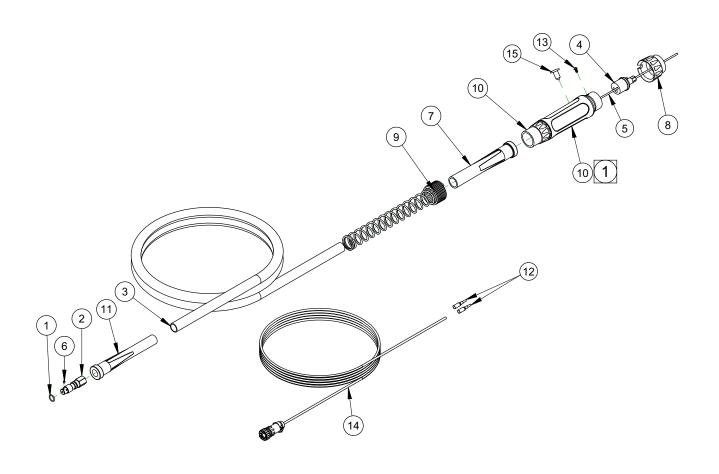
FIGURE A-11. BASE UNIT AND PELICAN CASE ASSEMBLY (P/N 85824)





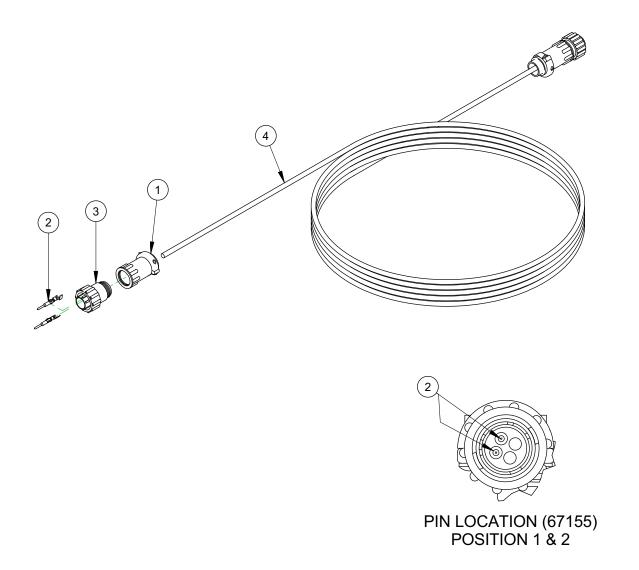
| | PARTS LIST | | | | |
|------|------------|-------|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | |
| 2 | 1 | 67057 | CONNECTOR PLUG 11-4 METAL SHELL | | |
| 3 | 1 | 67060 | CABLE CLAMP LARGE SIZE 11 | | |
| 4 | 1 | 67280 | CABLE POWER 2 CONDUCTOR 18 AWG 300 VAC RUBBER JACKET BLACK | | |
| 5 | 2 | 67482 | CONTACT SOCKET AWG 18-16 CRIMP | | |
| 6 | 1 | 67734 | HEAT SHRINK TUBE 1/2 DIA BLACK | | |
| 1 | 2 | 12941 | PLUG KEYING CIRCULAR CONNECTOR | | |

FIGURE A-12. BLANK END CONTACTOR WITH FOUR PIN ASSEMBLY (P/N 85396)



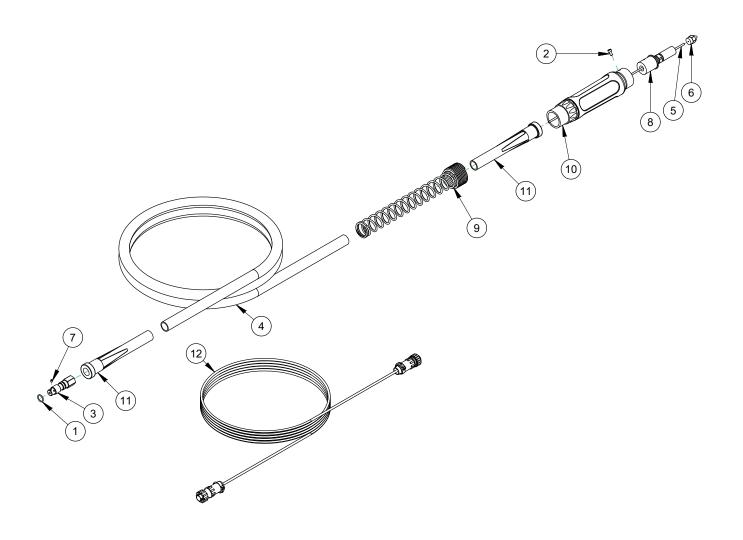
| | PARTS LIST | | | |
|------|------------|-------|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | |
| 1 | 1 | 10840 | RING O 1/16 X 1/2 ID X 5/8 OD (VMI) | |
| 2 | 1 | 41003 | FTG QUICK COUPLER MALE | |
| 3 | 1 | 41006 | CABLE ASSY 8FT | |
| 4 | 1 | 41010 | END CONNECTOR EURO | |
| 5 | 1 | 48552 | LINER TWECO .023 .045 WIRE X 15 FT LONG | |
| 6 | 1 | 66872 | SCREW 6-32 X 3/16 SSSCP | |
| 7 | 1 | 67307 | SUPPORT CABLE LARGE | |
| 8 | 1 | 67336 | NUT EURO 174X-2 | |
| 9 | 1 | 67338 | SUPPORT CABLE SPRING | |
| 10 | 1 | 67341 | PLUG HOUSING EURO | |
| 11 | 1 | 67342 | SUPPORT CABLE EURO BACK END | |
| 12 | 2 | 67403 | TERMINAL SNAP-PLUG MALE 22-18AWG HEAT-SHRINK | |
| 13 | 1 | 79219 | SCREW M4 X 0.7 X 8MM BHSCS | |
| 14 | 1 | 85396 | CONTACTOR BW2600 BLANK END W / 4 PIN ASSY | |
| 15 | 1 | 86557 | RIVET RIBBED DIA .394 X .06787 THICK NYLON BLK | |

FIGURE A-13. CONDUIT ASSEMBLY WITH EURO CONNECTOR (P/N 85435)



| | PARTS LIST | | | | | | |
|------|------------|-------|--|--|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | | | |
| 1 | 1 | 67060 | CABLE CLAMP LARGE SIZE 11 | | | | |
| 2 | 2 | 67155 | TERMINAL PIN 18-16 AWG | | | | |
| 3 | 1 | 67160 | CONNECTOR PLUG 4 PIN REVERSE MALE/FEMALE SIZE 11 | | | | |
| 4 | 1 | 85396 | CONTACTOR BW2600 BLANK END W / 4 PIN ASSY | | | | |

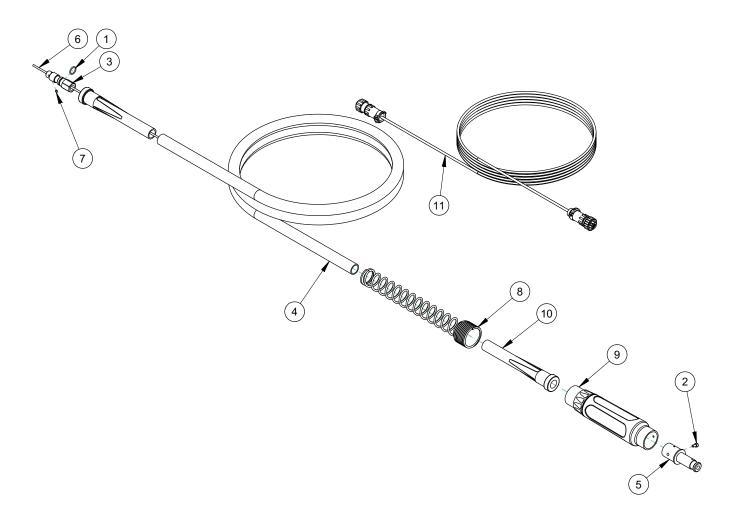
FIGURE A-14. POWER SUPPLY FOR SWITCH MILLER ASSEMBLY (P/N 85475)



| | DADTOLIOT | | | | | |
|------|------------|-------|---|--|--|--|
| | PARTS LIST | | | | | |
| ITEM | QTY | P/N: | DESCRIPTION | | | |
| 1 | 1 | 10840 | RING O 1/16 X 1/2 ID X 5/8 OD (VMI) | | | |
| 2 | 1 | 35910 | SCREW M4 X 0.7 X 8MM SHCS | | | |
| 3 | 1 | 41003 | FTG QUICK COUPLER MALE | | | |
| 4 | 1 | 41006 | CABLE ASSY 8FT | | | |
| 5 | 1 | 48552 | LINER TWECO .023 .045 WIRE X 15 FT LONG | | | |
| 6 | 1 | 66853 | NUT POWER PIN | | | |
| 7 | 1 | 66872 | SCREW 6-32 X 3/16 SSSCP | | | |
| 8 | 1 | 67333 | BODY POWER PIN MILLER | | | |
| 9 | 1 | 67338 | SUPPORT CABLE SPRING | | | |
| 10 | 1 | 67341 | PLUG HOUSING EURO | | | |
| 11 | 2 | 67342 | SUPPORT CABLE EURO BACK END | | | |
| 12 | 1 | 85475 | SWITCH MILLER PWR SUPPLY BW2600 | | | |

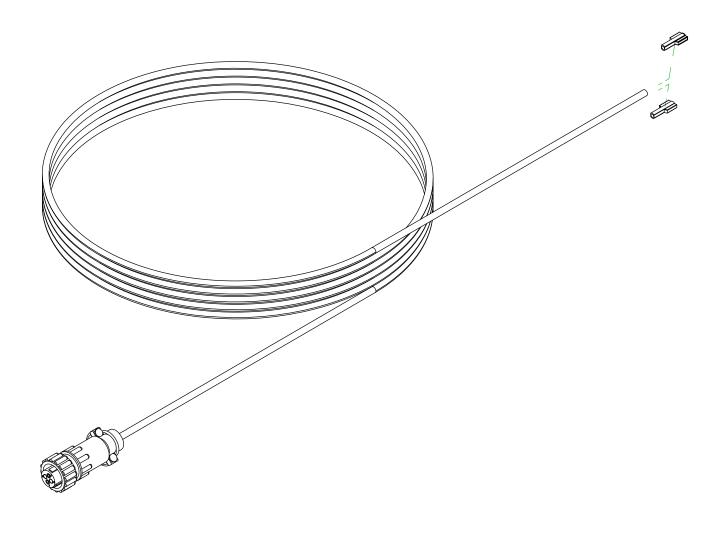
FIGURE A-15. CONDUIT ASSEMBLY FOR MILLER (P/N 85476)





| | PARTS LIST | | | | | |
|------|------------|-------|---|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | | |
| 1 | 1 | 10840 | RING O 1/16 X 1/2 ID X 5/8 OD (VMI) | | | |
| 2 | 1 | 35910 | SCREW M4 X 0.7 X 8MM SHCS | | | |
| 3 | 1 | 41003 | FTG QUICK COUPLER MALE | | | |
| 4 | 1 | 41006 | CABLE ASSY 8FT | | | |
| 5 | 1 | 41008 | SP END TWECO | | | |
| 6 | 1 | 48552 | LINER TWECO .023 .045 WIRE X 15 FT LONG | | | |
| 7 | 1 | 66872 | SCREW 6-32 X 3/16 SSSCP | | | |
| 8 | 1 | 67338 | SUPPORT CABLE SPRING | | | |
| 9 | 1 | 67341 | PLUG HOUSING EURO | | | |
| 10 | 2 | 67342 | SUPPORT CABLE EURO BACK END | | | |
| 11 | 1 | 85475 | SWITCH MILLER PWR SUPPLY BW2600 | | | |

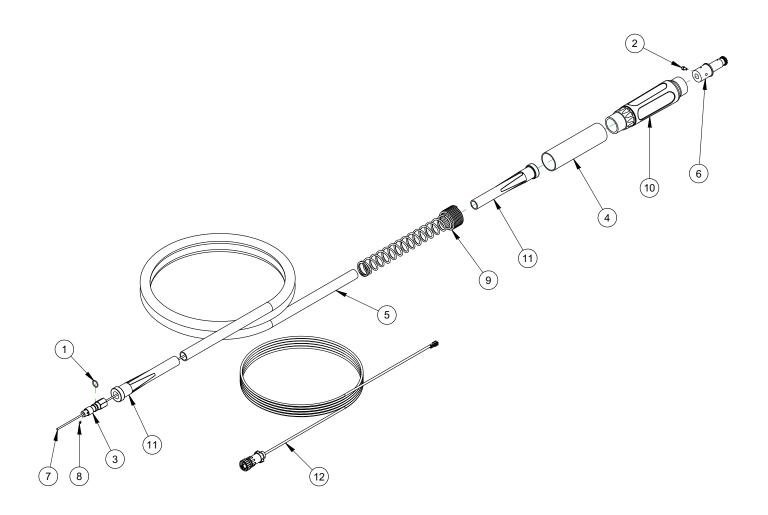
FIGURE A-16. CONDUIT POWER ASSEMBLY FOR MIG 225 LINCOLN (P/N 85527)



| | PARTS LIST | | | | |
|------|------------|-------|--|--|--|
| ITEM | QTY | P/N: | P/N: DESCRIPTION | | |
| 1 | 2 | 67050 | CONNECTOR SOCKET DBL CRIMP 22-18 AWG .250 X .032 RED | | |
| 2 | 1 | 85396 | CONTACTOR BW2600 BLANK END W / 4 PIN ASSY | | |

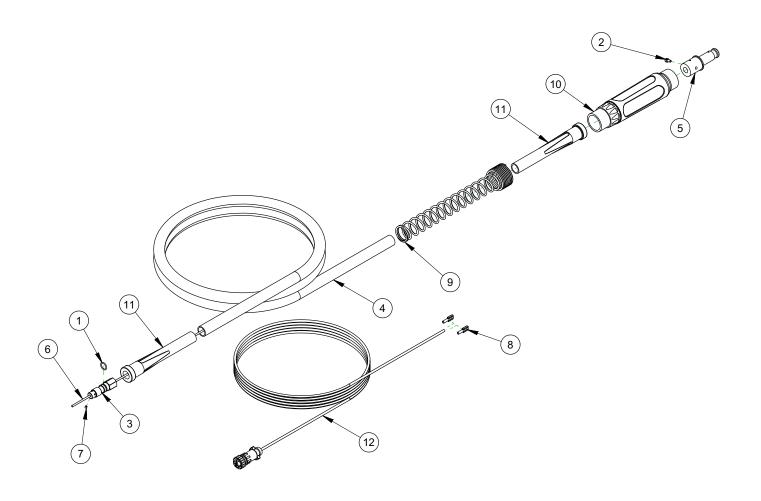
Figure A-17. Contactor assembly for Hobart and Thermal arc (P/N 85530)





| PARTS LIST | | | | | |
|------------|-----|-------|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | |
| 1 | 1 | 10840 | RING O 1/16 X 1/2 ID X 5/8 OD (VMI) | | |
| 2 | 1 | 35910 | SCREW M4 X 0.7 X 8MM SHCS | | |
| 3 | 1 | 41003 | FTG QUICK COUPLER MALE | | |
| 4 | 1 | 41005 | HEAT SHRINK TUBE 1-1/2 DIA BLACK | | |
| 5 | 1 | 41006 | CABLE ASSY 8FT | | |
| 6 | 1 | 41008 | SP END TWECO | | |
| 7 | 1 | 48552 | LINER TWECO .023 .045 WIRE X 15 FT LONG | | |
| 8 | 1 | 66872 | SCREW 6-32 X 3/16 SSSCP | | |
| 9 | 1 | 67338 | SUPPORT CABLE SPRING | | |
| 10 | 1 | 67341 | PLUG HOUSING EURO | | |
| 11 | 2 | 67342 | SUPPORT CABLE EURO BACK END | | |
| 12 | 1 | 85530 | CONTACTOR ASSY HOBART & THERMAL ARC BW2600 | | |

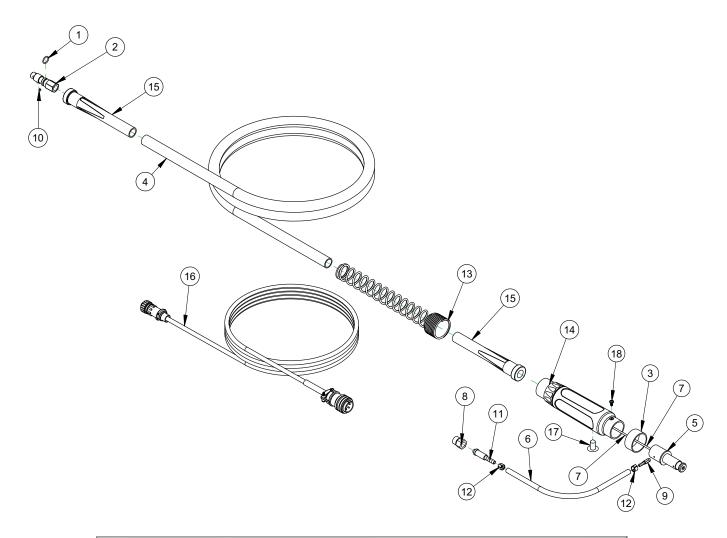
FIGURE A-18. CONDUIT ASSEMBLY FOR HOBART AND THERMAL ARC HEFTY II (P/N 85532)



| | PARTS LIST | | | | | |
|------|------------|-------|--|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | | |
| 1 | 1 | 10840 | RING O 1/16 X 1/2 ID X 5/8 OD (VMI) | | | |
| 2 | 1 | 35910 | SCREW M4 X 0.7 X 8MM SHCS | | | |
| 3 | 1 | 41003 | FTG QUICK COUPLER MALE | | | |
| 4 | 1 | 41006 | CABLE ASSY 8FT | | | |
| 5 | 1 | 41008 | SP END TWECO | | | |
| 6 | 1 | 48552 | LINER TWECO .023 .045 WIRE X 15 FT LONG | | | |
| 7 | 1 | 66872 | SCREW 6-32 X 3/16 SSSCP | | | |
| 8 | 2 | 67048 | TERMINAL QUICK DISCONNECT DBL CRIMP MALE 22-18 AWG .250 X .032 RED | | | |
| 9 | 1 | 67338 | SUPPORT CABLE SPRING | | | |
| 10 | 1 | 67341 | PLUG HOUSING EURO | | | |
| 11 | 2 | 67342 | SUPPORT CABLE EURO BACK END | | | |
| 12 | 1 | 85396 | CONTACTOR BW2600 BLANK END W / 4 PIN ASSY | | | |

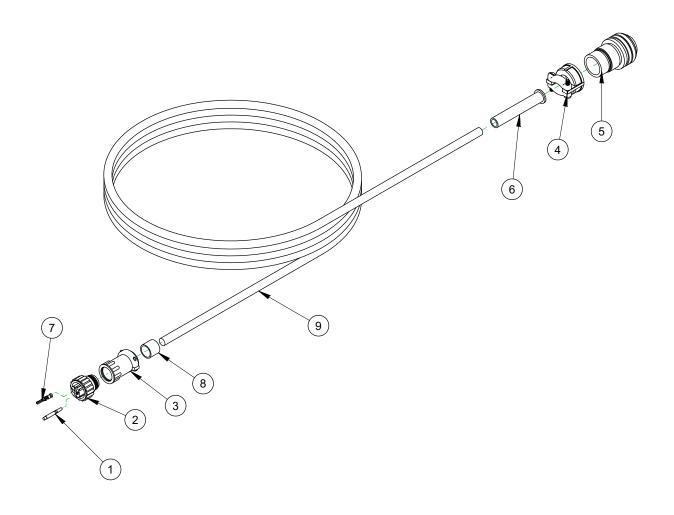
FIGURE A-19. CONDUIT ASSEMBLY FOR TWECO (P/N 85534)





| | PARTS LIST | | | | |
|------|------------|-------|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | |
| 1 | 1 | 10840 | RING O 1/16 X 1/2 ID X 5/8 OD (VMI) | | |
| 2 | 1 | 41003 | FTG QUICK COUPLER MALE | | |
| 3 | .75" | 41005 | HEAT SHRINK TUBE 1-1/2 DIA BLACK | | |
| 4 | 1 | 41006 | CABLE ASSY 8FT | | |
| 5 | 1 | 41009 | SP END LINCOLN | | |
| 6 | 12" | 43546 | TUBING 3/16 ID 3/8 OD PVC CLEAR | | |
| 7 | 1 | 48552 | LINER TWECO .023 .045 WIRE X 15 FT LONG | | |
| 8 | 1 | 48939 | NUT SIZE B INERT GAS | | |
| 9 | 1 | 64119 | NIPPLE BARBED FOR A 41009 | | |
| 10 | 1 | 66872 | SCREW 6-32 X 3/16 SSSCP | | |
| 11 | 1 | 67033 | FTG NIPPLE INERT GAS B SIZE 1/4 HOSE | | |
| 12 | 2 | 67064 | CLAMP HOSE 3/8 DIA DBL PINCH STEEL | | |
| 13 | 1 | 67338 | SUPPORT CABLE SPRING | | |
| 14 | 1 | 67341 | PLUG HOUSING EURO | | |
| 15 | 2 | 67342 | SUPPORT CABLE EURO BACK END | | |
| 16 | 1 | 85540 | CONTACTOR ASSY LINCOLN BW2600 | | |
| 17 | 1 | 86557 | RIVET RIBBED DIA .394 X .06787 THICK NYLON BLK | | |
| 18 | 1 | 86565 | SCREW M4 X 0.7 X 8MM PPHMS ZINC | | |

FIGURE A-20. CONDUIT ASSEMBLY FOR LINCOLN (P/N 855360)



| PARTS LIST | | | | | | |
|------------|-----|-------|--|--|--|--|
| ITEM | QTY | P/N: | DESCRIPTION | | | |
| 1 | 2 | 12941 | PLUG KEYING CIRCULAR CONNECTOR | | | |
| 2 | 1 | 67057 | CONNECTOR PLUG 11-4 METAL SHELL | | | |
| 3 | 1 | 67060 | CABLE CLAMP LARGE SIZE 11 | | | |
| 4 | 1 | 67138 | CONNECTOR CABLE CLAMP MS3057A SIZE 18 | | | |
| 5 | 1 | 67147 | CONNECTOR STRAIGHT PLUG SIZE 18 5-PIN | | | |
| 6 | 1 | 67214 | RUBBER BUSHING FOR MS3057A CABLE CLAMP .312 ID | | | |
| 9 | 1 | 83988 | CORD TYPE SOOW 18 AWG 5 COND 600V .325 OD UNSHIELDED | | | |
| | | | GRAY JACKET | | | |
| 7 | 2 | 67482 | CONTACT SOCKET AWG 18-16 CRIMP | | | |
| 8 | 1 | 67734 | HEAT SHRINK TUBE 1/2 DIA BLACK | | | |

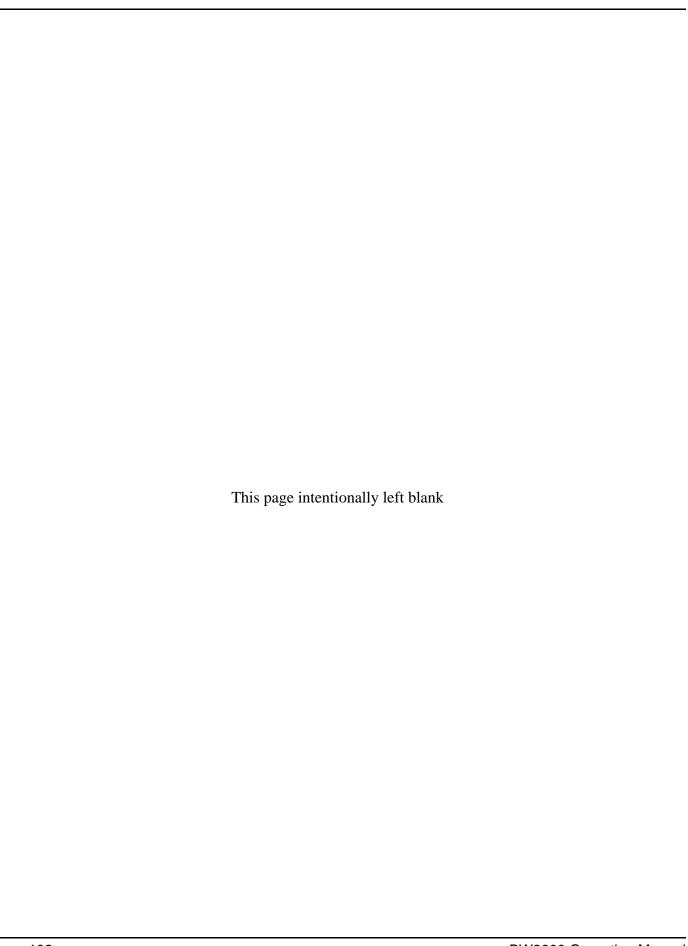
FIGURE A-21. CONTACTOR ASSEMBLY FOR LINCOLN 5 PIN (P/N 85540)



APPENDIX B SCHEMATICS

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| Figure B-1. Schematic (P/N 84635) | 1 | 03 |
|--|---|----|
| Figure B-2. Cable assembly rocker switch (P/N 84898) | 1 | 05 |
| FIGURE B-3. CONNECTOR ASSEMBLY REMOTE PENDANT (P/N 85037) | 1 | 06 |
| Figure B-4. Pendant assembly (P/N 85341) | 1 | 07 |
| FIGURE B-5. POWER ENTRY MODULE ASSEMBLY (P/N 86514) | 1 | 80 |
| FIGURE B-6. POWER AND CONTROL HARNESS ASSEMBLY (P/N 86516) | 1 | 09 |
| FIGURE B-7. POTENTIOMETER AND HARNESS ASSEMBLY (P/N 86517) | 1 | 10 |
| FIGURE B-8. SWITCH ROTATION AND HARNESS ASSEMBLY (P/N 86518) | | |
| FIGURE B-9. SWITCH SKIP FILL ON/OFF HARNESS ASSEMBLY (P/N 86520) | 1 | 12 |
| Figure B-10. Switch skip fill and harness assembly (P/N 86521) | 1 | 13 |
| | | |





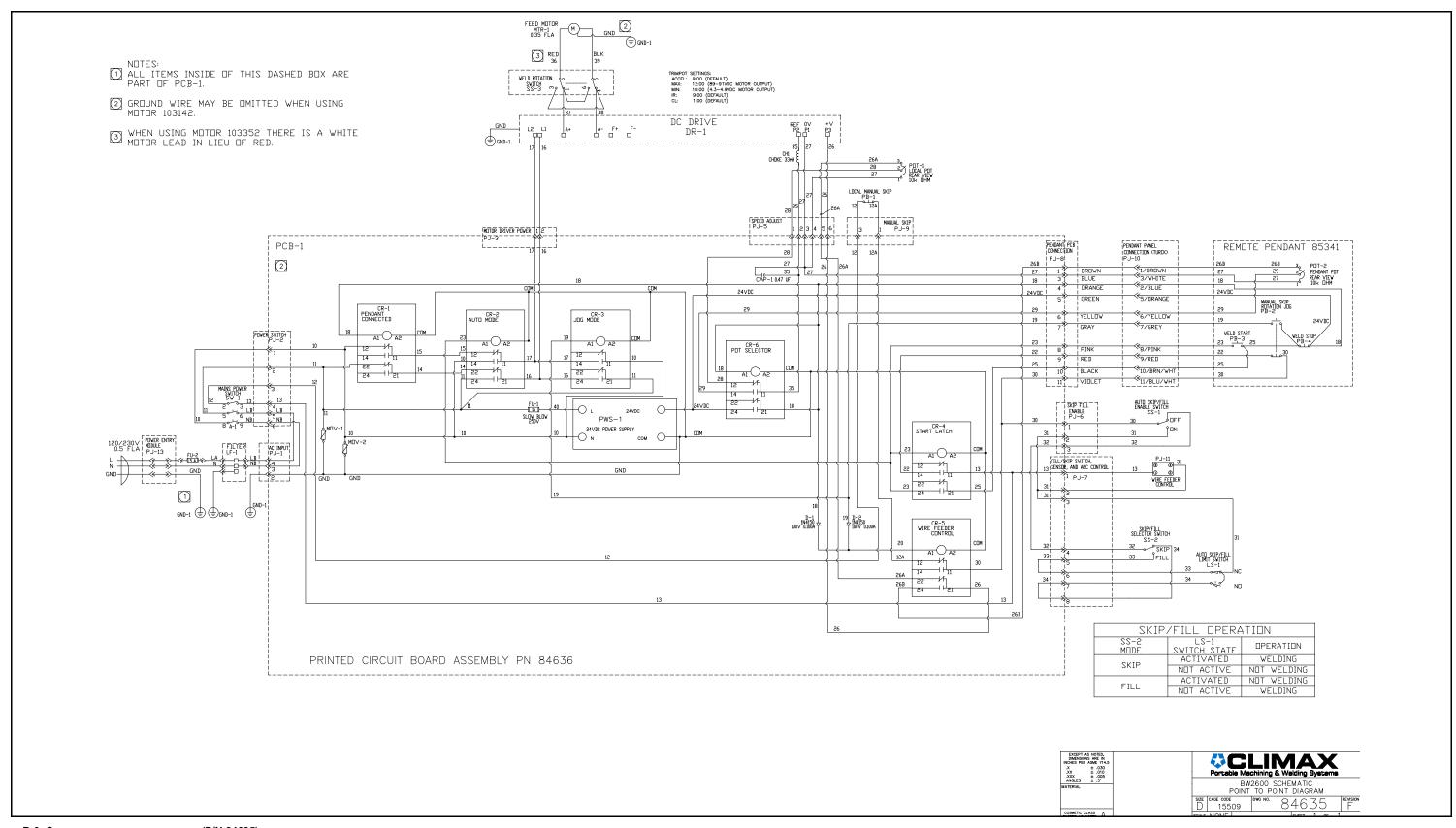


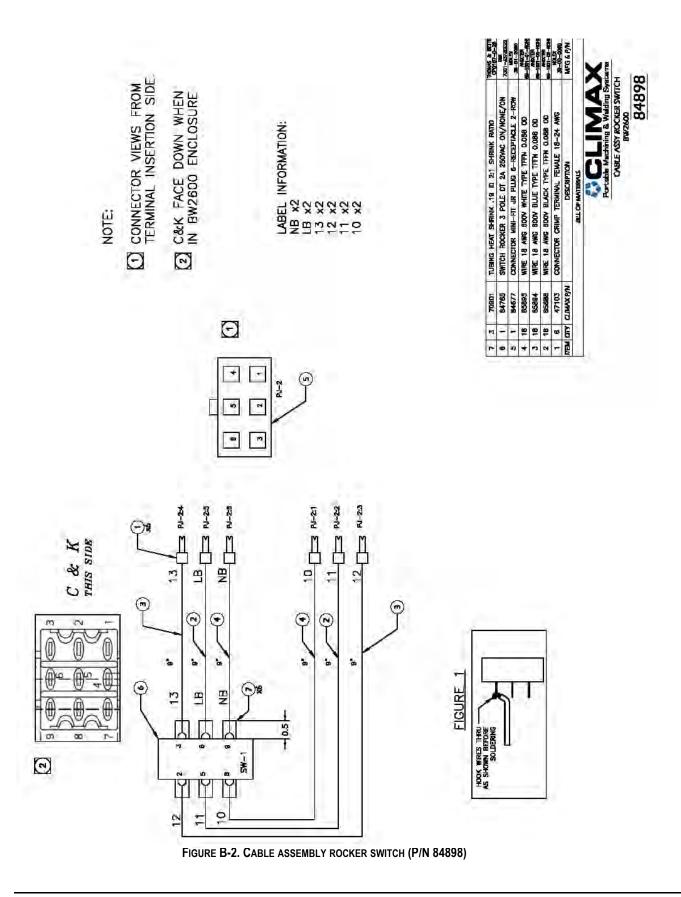
FIGURE B-3. CONTROL ENCLOSURE SCHEMATIC (P/N 84635)

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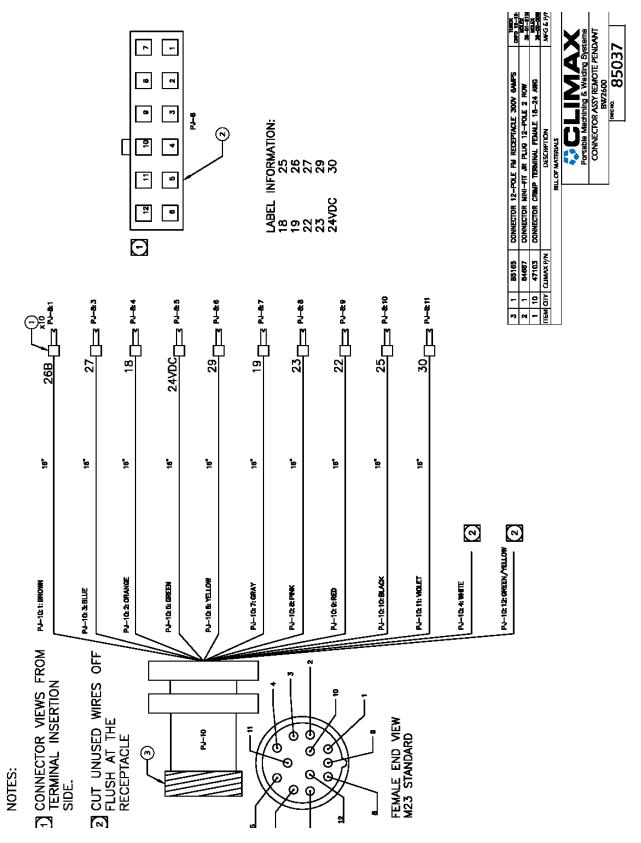
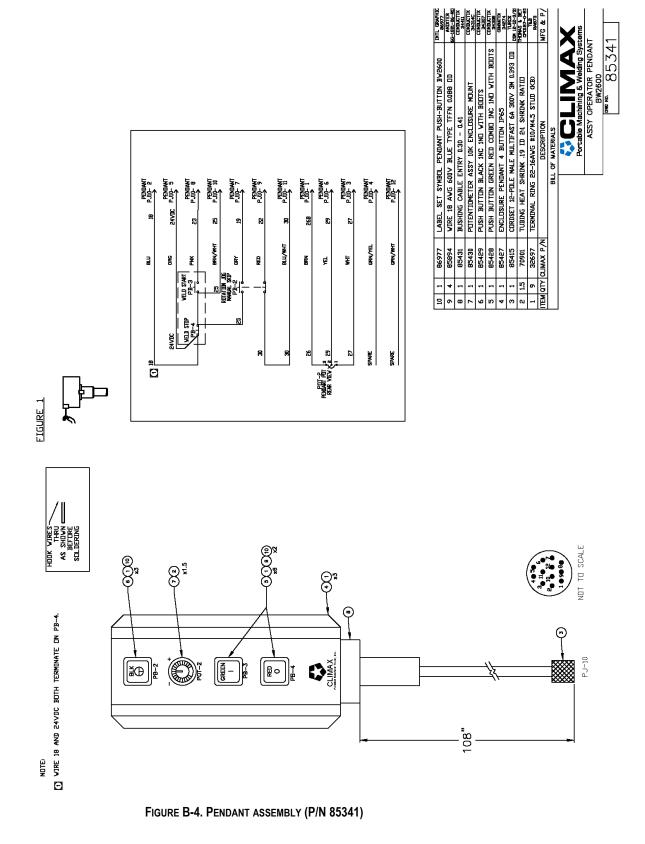


FIGURE B-3. CONNECTOR ASSEMBLY REMOTE PENDANT (P/N 85037)



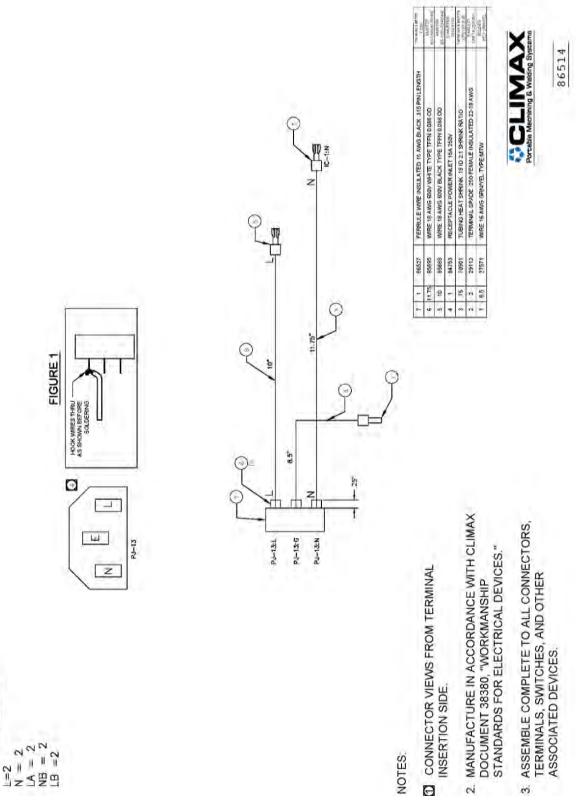


FIGURE B-5. POWER ENTRY MODULE ASSEMBLY (P/N 86514)

LABEL INFORMATION:

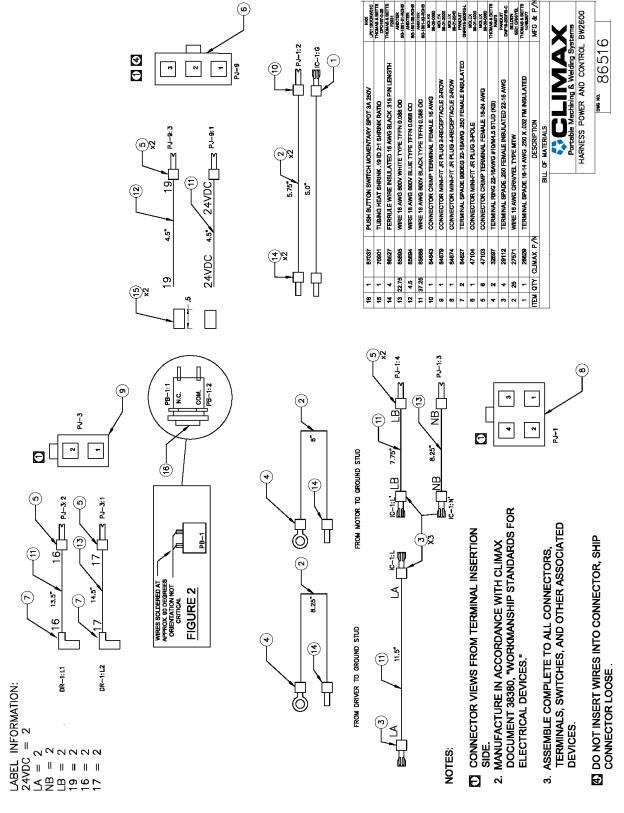
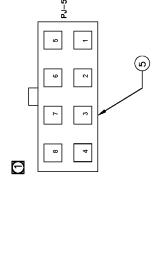
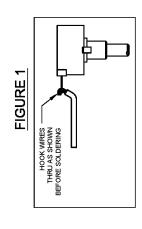


FIGURE B-6. POWER AND CONTROL HARNESS ASSEMBLY (P/N 86516)

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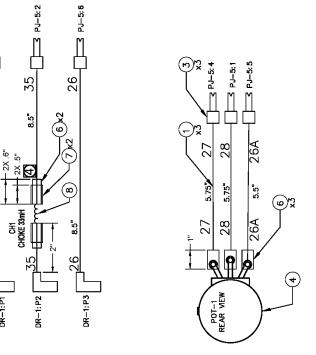
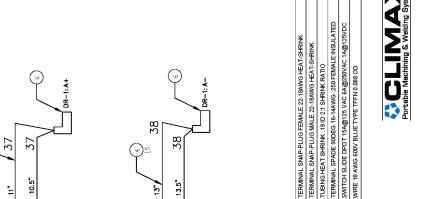


FIGURE B-7. POTENTIOMETER AND HARNESS ASSEMBLY (P/N 86517)

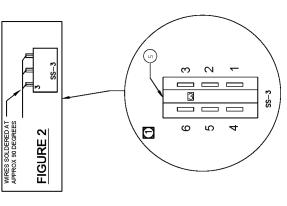
NOTES:

- CONNECTOR VIEWS FROM TERMINAL INSERTION SIDE.
- MANUFACTURE IN ACCORDANCE WITH CLIMAX DOCUMENT 38380, "WORKMANSHIP STANDARDS FOR ELECTRICAL DEVICES."
- 3. ASSEMBLE COMPLETE TO ALL CONNECTORS, TERMINALS, SWITCHES, AND OTHER ASSOCIATED DEVICES.
- SHRINK .19 ID OVER THE SOLDERED CONNECTION OF THE CHOKE THEN SHRINK .25 ID SHRINK TUBE OVER TOP.



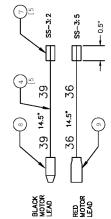
38 38

> ss-3:3 SS-3: 4



37

SS-3:1 SS-3:6



| SS-3:2 | SS-3:5 |
|----------------|-------------------|
| (8) (4.5° / 39 | 36 14.5" 36 |
| LACK | ED OTOR EAD |

FIGURE B-8. SWITCH ROTATION AND HARNESS ASSEMBLY (P/N 86518)

NOTES:

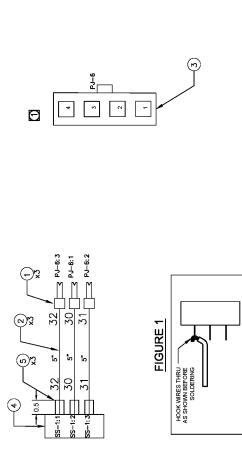
67404 67403 70901 27377 84701 85894

MANUFACTURE IN ACCORDANCE WITH CLIMAX DOCUMENT 38380, "WORKMANSHIP STANDARDS FOR ELECTRICAL DEVICES." κi

ASSEMBLE COMPLETE TO ALL CONNECTORS, TERMINALS, SWITCHES, AND OTHER ASSOCIATED DEVICES. က်

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LABEL INFORMATION: 39 ×2 36 ×2 37 ×4 38 ×4



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NOTES:

CONNECTOR VIEWS FROM TERMINAL INSERTION SIDE. \Box

MANUFACTURE IN ACCORDANCE WITH CLIMAX DOCUMENT 38380, "WORKMANSHIP STANDARDS FOR ELECTRICAL DEVICES." $^{\circ}$

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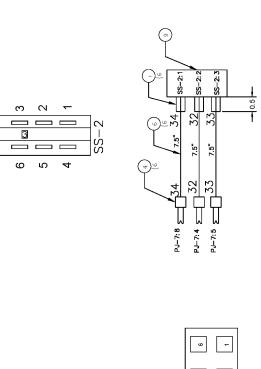
ASSEMBLE COMPLETE TO ALL CONNECTORS, TERMINALS, SWITCHES, AND OTHER ASSOCIATED DEVICES.

FIGURE B-9. SWITCH SKIP FILL ON/OFF HARNESS ASSEMBLY (P/N 86520)

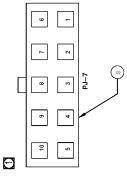
LABEL INFORMATION: 30 ×2 31 ×2 32 ×2



86521



| SWITCH SLUDE DEDT 13 A&PLES VAC 64 @250/AC1 A&PLES VAC CONNECTOR MINI-FIT IR PLUG 10-RECEPTACLE 2-ROW TERMINAL SPADE 90 DEG 22-18 AWG 0.187" RED WIRE 18 AWG 600Y BLUE TYPE TRPR 0.088 OD CONNECTOR PINI TERMINAL 18-18 AWG CONNECTOR PINI TERMINAL 18-18 AWG | 70901 | THRING HEAT SHRINK 19 ID 2-1 SHRINK RATIO | THOMAS & BETTS |
|---|-------|--|---------------------|
| SWITCH SLIDE DPDT 15A@125 VAC 6A@250VAC 1A@125VDC CONNECTOR MINH-IT I.R PLUG 10-RECEPTACLE 2-ROW TERMINAL SPADE 90 DEG 22-18 AWO 0.187* RED WIRE 18 AWG 800 BLLE TYPE TFN 0.088 OD CONNECTOR POR RING FORMST 18-16 AWG | 1000 | | CPO187-0-25 |
| CONNECTOR MINI-FIT JR PLLOS 10-RECEPTACLE 2-ROW TERMINAL SPADE 90 DEG 22-18 AWG 0.187" RED WIRE 18 AWG 600V BLLE TYPE TERN 0.088 OD CONNECTOR PRORING TOWN TOTAL 18-18 AWG | 84701 | SWITCH SUDE DPDT 15A@125 VAC 6A@250VAC 1A@125VDC | PANDUIT |
| CONNECTOR MINI-FIT. IR PLUG 10-RECEPTACLE 2-ROW TERMINAL SPADE 90 DEG 22-18 AWO 0.187* RED WIRE 18 AWG 800 BLUE TYPE TFN 0.088 0D CONNECTOR POR RING FOR TRANS 15 4 AWG | |) | S802C21S2070 |
| TERMINAL SPADE 90 DEG 22-18 AWG 0.187* RED WHEE 18 AWG 600V BLLE TYPE TERN 0.088 OD CONNECTOR PIN CRIMP CONTACT 18-18 AWG CONNECTOR OF DING TERMINAL REMAIL 8-10 A AWG | 84680 | CONNECTOR MINI-FIT JR PLUG 10-RECEPTACLE 2-ROW | MOLEX 39-01-2100 |
| UNEE 18 ANG 800 BLUE TPPN LOBS OD CONNECTOR PIN CRIMP CONTACT 18-16 ANG CONNECTOR PIN CRIMP CONTACT 18-16 ANG | 23033 | CTC #50% O CO CTC OO TC #00 10 ###CTF | MCMASTER |
| WIRE 18 AWG 600V BLUE TYPE TFEN 0.088 OD CONNECTOR PIN CRIMP CONTACT 18-16 AWG | 79699 | LERIMINAL SPADE 30 DEG 22-10 AWG 0.107 RED | 7820K11 |
| CONNECTOR PRODUCTION THAN SOURCE CONNECTOR PRINCE FRANCE FRANCE | 06004 | MIDE 10 ANAIC COOK DILIE TVDE TEEN 0.000 OD | ANKTER |
| CONNECTOR PIN CRIMP CONTACT 18-16 AWG | +5000 | WINCE IS ANY SECOND FILE II IN SECOND SECOND | 60-1801-06-ROHS |
| CONNECTOR CRIMP TERMINAL FEMALE 18.34 A.W.C. | 67155 | CONNECTOR PIN CRIMP CONTACT 18-16 AWG | TE CONNECTIVITY |
| CONNECTOR CRIMO TERMINAL ETA-24 ANG | | | 1-80000 |
| | 47103 | CONNECTOR CRIMP TERMINAL FEMALE 18-24 AWG | MOLEX |



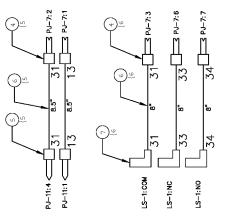
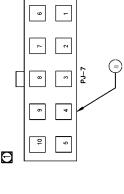


FIGURE B-10. SWITCH SKIP FILL AND HARNESS ASSEMBLY (P/N 86521)



MANUFACTURE IN ACCORDANCE WITH CLIMAX DOCUMENT 38380, "WORKMANSHIP STANDARDS FOR ELECTRICAL DEVICES." ςi

CONNECTOR VIEWS FROM TERMINAL

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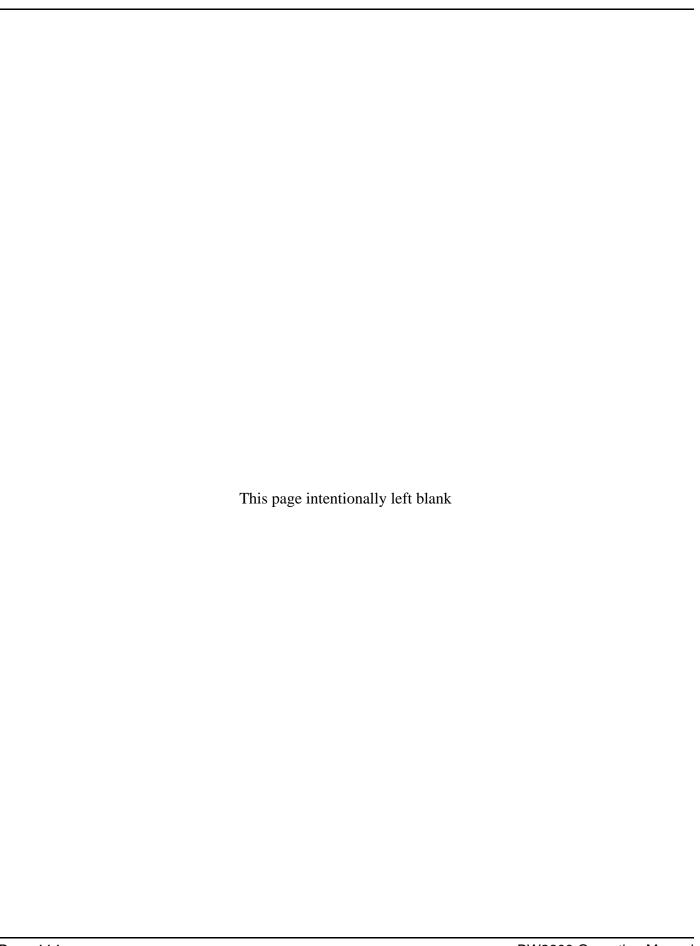
NOTES:

INSERTION SIDE.

ASSEMBLE COMPLETE TO ALL CONNECTORS, TERMINALS, SWITCHES, AND OTHER ASSOCIATED DEVICES. က

LABEL INFORMATION: 13 x2 31 x4 32 x2 33 x4 34 x4

P/N 85555, Rev. 7





APPENDIX C SDS

Contact CLIMAX for the latest Safety Data Sheets.

