

Motoman XRC Controller
ArcWorld III-1000
System Manual
for UP/SKX-Series Robots

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SECTION 1

INTRODUCTION

The ArcWorld III-1000 is part of the ArcWorld family of standardized arc welding solutions. It is a fully integrated welding system, and is supported from wire to weld by Motoman, Inc.

The ArcWorld III-1000 features a Motoman arc welding robot and XRC controller with menu-driven arc welding application software, complete welding package, indexing rotary positioner, operator interface, and a total safety environment.

1.1 About this Document

This manual is intended as an introduction and overview for personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman robot model. For more detailed information, refer to the manuals listed in Section 1.3. This manual contains the following sections:

SECTION 1 - INTRODUCTION

Provides general information about the ArcWorld III-1000 and its components, a list of reference documents, and customer service information.

SECTION 2 - SAFETY

Provides information regarding the safe use and operation of the ArcWorld III-1000 system.

SECTION 3 - DESCRIPTION OF EQUIPMENT

Provides a detailed description of the major components of the ArcWorld III-1000 system. This section also includes a table of component specifications.

SECTION 4 - INSTALLATION

Provides instructions for set up and installation of the ArcWorld III-1000 system.

SECTION 5 - OPERATION

Provides instructions for basic operation of the ArcWorld III-1000 system. This section provides procedures for start-up, loading, normal operation, fault recovery, and shutdown. Sample robot programs are also included in this section.

SECTION 6 - MAINTENANCE

Contains a table listing periodic maintenance requirements for the components of the ArcWorld III-1000 cell.

1.2 System Overview

The ArcWorld III-1000 provides a complete arc welding solution in a standardized configuration. The system is designed around a Motoman arc welding robot and an XRC and includes a complete welding package. An indexing rotary positioner allows an operator to prepare and set up parts on one side while the robot welds on the other side. The cell provides a full complement of safety features designed to protect both personnel and equipment. Figure 1-1 illustrates the system layout of the ArcWorld III-1000 cell.

1.2.1 System Layout

The robot manipulator and positioner share a common base for ease of installation and to help maintain proper alignment between the two components. The XRC and welding power source also share a common base. The robotic cell is fully enclosed by safety fencing and an interlocking door. Standing on the safety mat prevents positioner cycling. All operator controls, including those on the XRC and welding power supply, are accessible from outside the robotic enclosure.

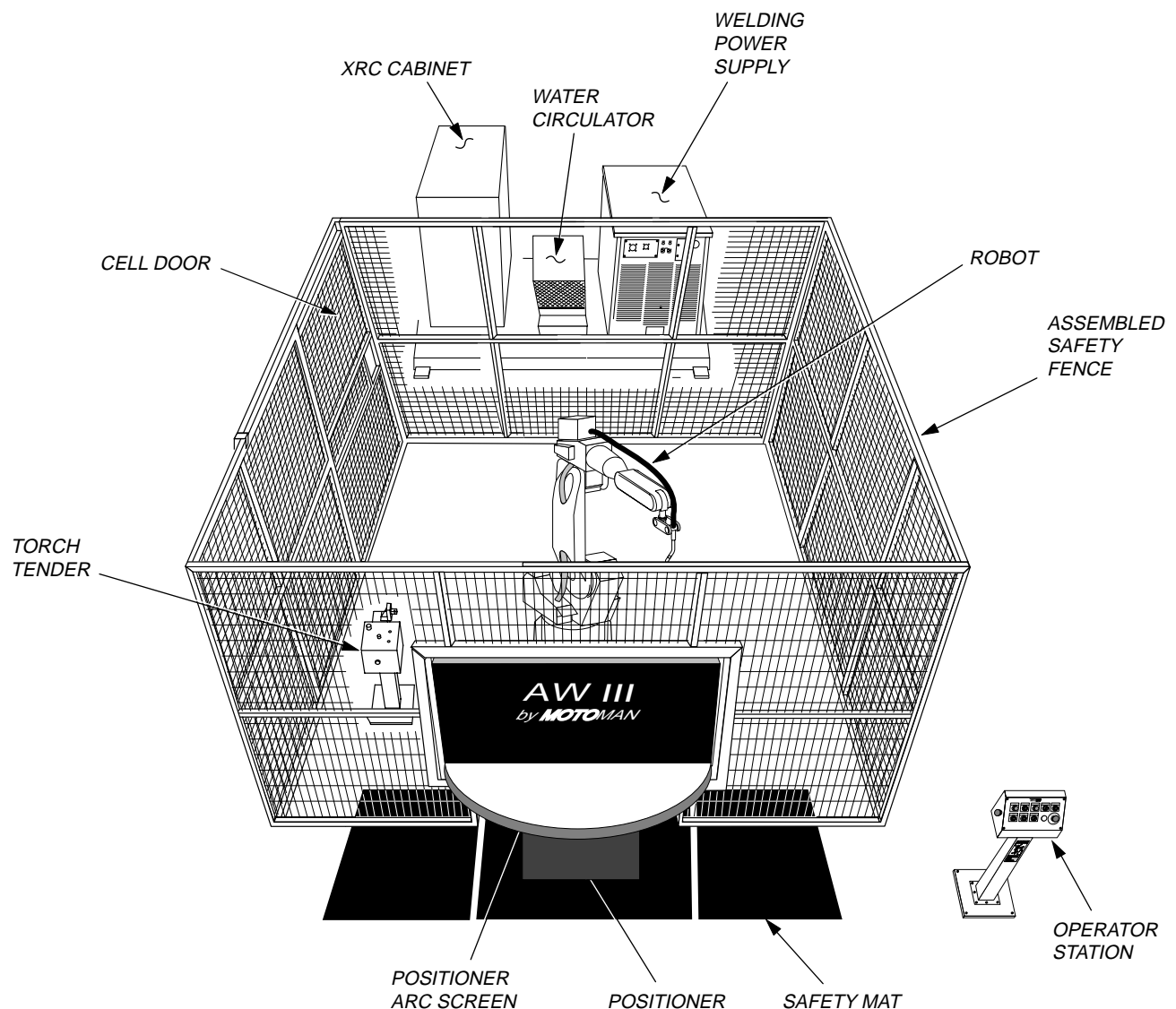


Figure 1-1 System Layout

The ArcWorld III-1000 includes the following major components:

- Two Motoman UP6 or SK16X manipulators and XRC controller
- MR-series indexing rotary positioner
- Master operator station
- Welding equipment, including the following:
 - Welding power source
 - Motoman torch (water-cooled or air-cooled)
 - Wire feeder
 - Applicable welding interface
 - Torch mount
- Safety equipment, including the following:
 - Safety fencing with arc curtains
 - Interlocked safety mats
 - Interlocked cell door
 - Positioner arc screen

1.2.2 Optional Equipment

The following optional equipment is available for use with the ArcWorld III-1000:

- Torch tender
- Wire cutter
- Com-Arc III seam tracking unit
- Water circulator

1.3 Reference to Other Documentation

For additional information refer to the following:

- Motoman UP6 Manipulator Manual (P/N 142104-1)
- Motoman SK16X Manipulator Manual (P/N 142105-1)
- Motoman Operator's Manual for Arc Welding (P/N 142098-1)
- Motoman Concurrent I/O Parameter Manual (P/N 142102-1)
- Com-Arc III Instruction Manual (P/N 132753-1)
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (UP6 or SK16X)
- Application Type (welding)
- System Type (ArcWorld III-1000)
- Software Version (5.101A)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on back side of XRC controller)

SECTION 2

SAFETY

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

2.2 Standard Conventions

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

- DANGER
- WARNING
- CAUTION
- NOTE

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).



DANGER!

Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.



WARNING!

Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.



CAUTION!

Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

NOTE:

Information appearing in a NOTE caption provides additional information which is helpful in understanding the item being explained.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 **Installation Safety**

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 **Programming Safety**

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

- Any modifications to PART 1 of the MRC controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will **VOID YOUR WARRANTY!**
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. **YOUR WARRANTY WILL BE VOID** if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place.
- Check the E-STOP button on the teach pendant for proper operation before programming.
- Carry the teach pendant with you when you enter the workcell.
- Be sure that only the person holding the teach pendant enters the workcell.
- Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Be sure all safeguards are in place.
- Use proper replacement parts.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

SECTION 3

EQUIPMENT DESCRIPTION

3.1 UP/SKX-Series Robot Description

The Motoman UP6 and SK16X robots and XRC robotic controller represent state-of-the-art technology in robotics today. The six-axis UP6 robot has a payload of 6 kg (13.2 lbs). It features a 1,325 mm (52.1 in.) reach and has a relative positioning accuracy of ± 0.08 mm (0.004 in.). The six-axis SK16X robot has a payload of 16 kg (35.2 lbs). It features a 1,555 mm (61.2 in.) reach and has a relative positioning accuracy of ± 0.1 mm (0.004 in.).

Each robot can reach below its own base as well as behind itself and can be mounted on the floor, wall, or ceiling with few modifications. However, the S-axis has been restricted by hardstops for use in this system. For more information, refer to the manipulator manual that came with your system.

3.2 XRC Controller

The XRC robotic controller, shown in Figure 3-1, coordinates the operation of the ArcWorld III-1000 system. It controls manipulator movement and welding power supply, processes input and output signals, and provides the signals to operate the welding system. It maintains variable data and performs numeric processing to convert to and from different coordinate systems. In addition, the controller provides the following: main logic functions, servo control, program and constant data memory, and power distribution. For more information, refer to the manipulator manual that came with your system.

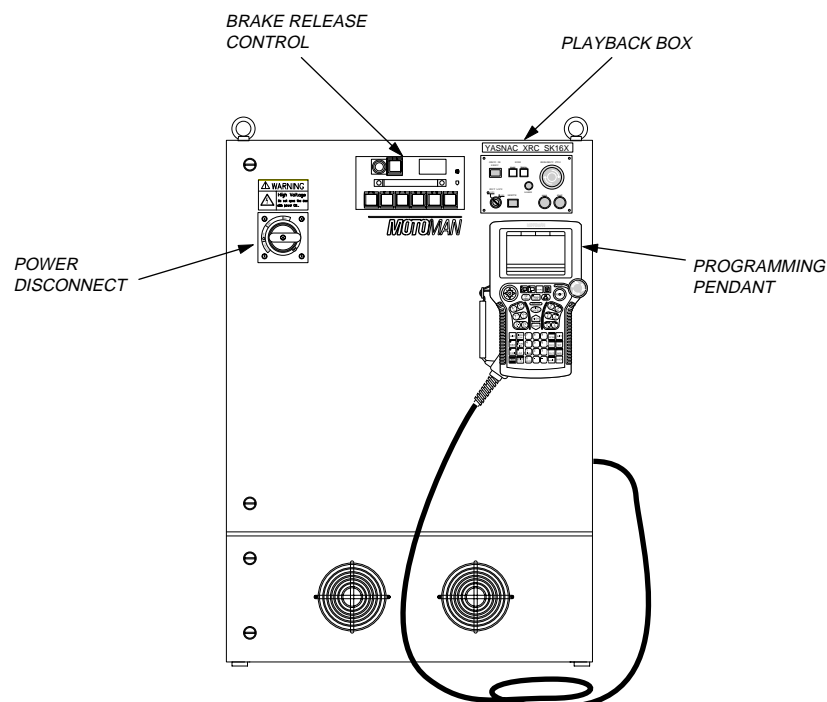


Figure 3-1 XRC Controller

3.2.1 Playback Panel

The playback panel (see Figure 3-2) contains the primary system controls and consists of the features described below. For more information, refer to the manipulator manual that came with your system.

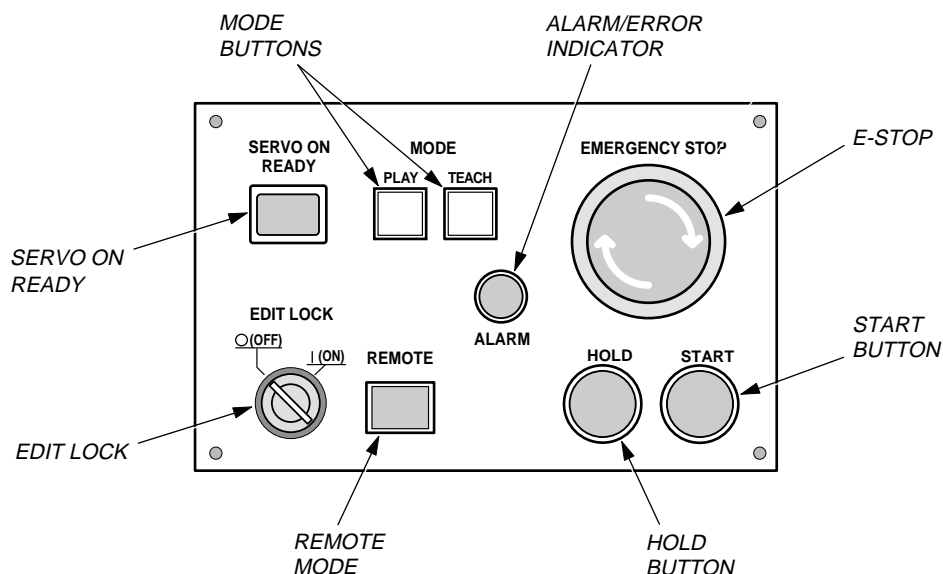


Figure 3-2 XRC Playback Panel

Servo On Ready

The SERVO ON READY pushbutton turns servo power ON. The switch lights when servo power is on. In TEACH mode, the SERVO ON READY pushbutton operates only when the TEACH LOCK button on the programming pendant is ON and the ENABLE switch on the programming pendant is held in.

Mode

The Mode push buttons (PLAY, TEACH and REMOTE) set the robot's mode of operation.

NOTE: Changing modes from PLAY to TEACH, during playback, will cause the program to cease execution (similar to HOLD); to resume operation, press PLAY and then START.

Alarm/Error

The ALARM/ERROR indicator light turns ON whenever an alarm or error condition occurs.

Emergency Stop (E-STOP)

The E-STOP button on the playback panel is connected in series with the system Emergency Stop circuit. Pressing E-STOP ceases all system operation.

Start

Pressing the START button while in PLAY mode with servo power on, causes playback execution of the current job to begin.

Hold

The HOLD button is a normally closed, momentarily actuated switch. Pressing HOLD halts operation of the manipulator until another Start signal is sent.

3.2.2 Programming Pendant

The programming pendant (see Figure 3-3) is the primary user interface for the system. The pendant has a 4x5-inch 12-line, 40-character LCD display and keypad. The system uses the INFORM II robot language and a menu-driven interface to simplify operator interaction with the robot. By using the pendant, the operator can teach robot motion, and perform programming, editing, maintenance, and diagnostic functions. The programming pendant consists of the items described below. For more information, refer to the manipulator manual that came with your system.

NOTE: *The programming pendant LCD display goes dark after a few minutes of inactivity. Press any key to restore screen.*

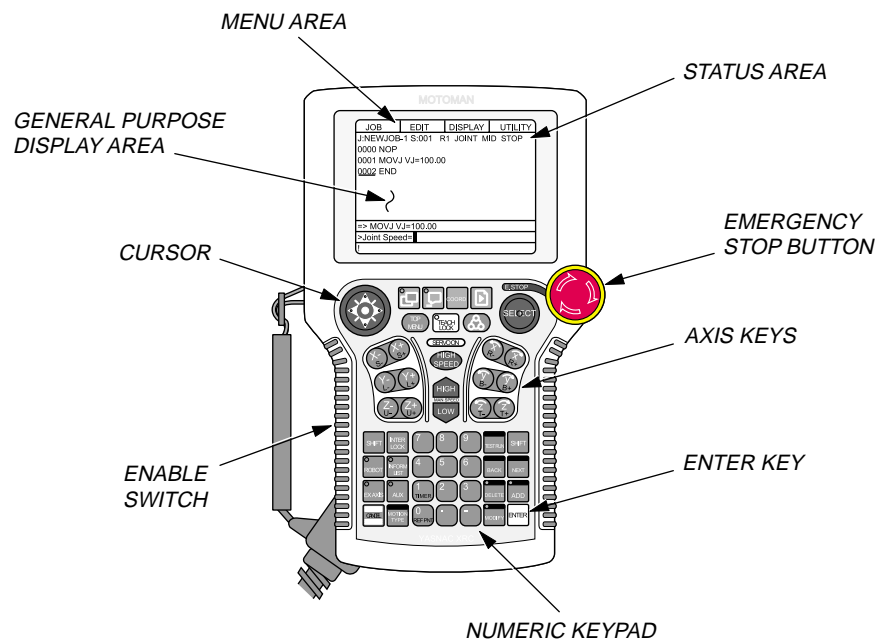


Figure 3-3 Programming Pendant

General Purpose Display Area

The General Purpose Display Area displays the currently selected menu choice.

Menu Area

The Menu Area contains menu selections for the currently selected screen.

Emergency Stop (E-STOP)


















The E-STOP button on the programming pendant is connected in series with the system Emergency Stop circuit. Pressing the E-STOP button interrupts this circuit and stops all system operation.

Keypad

The user keypad on the programming pendant serves as an input device. The keys are grouped into different functional sections to simplify operator use.

Status Area

The Status Area shows system status via the following symbols:

- **Active Robot, External Axis, or Base Axis**
R1, R2, R3; S1, S2, etc.; or B1, B2, etc.
- **Coordinate System**
 Joint,  World,  Cylindrical,  Tool, or  User Frame
- **Manual Speed Setting**
 Inching,  Low,  Medium, or  High
- **Cycle Mode**
 Step,  1-Cycle, or  Auto
- **System Status**
 E-Stop,  Stop,  Running/Start,  Hold, or  Alarm
- **Additional Pages** (when applicable)

TOP MENU Key

The TOP MENU key returns the pendant display to the initial start-up menu. The cursor key can then be used to choose from the following menu icons:

- **JOB**
This icon accesses job selections including: Master Job, Select Job, Job Capacity, and Create New Job while in TEACH mode.
- **ARC WELDING, GENERAL, HANDLING, and SPOT WELDING**
This icon allows you to select the applications available to the controller.
- **VARIABLE**
This icon accesses the display and editing menu for the arithmetic variables and display of position variables.
- **IN/OUT**
This icon accesses DETAIL and SIMPLE displays of all XRC I/O signals. In EDITING or MAINT. mode, Universal Outputs can be forced ON or OFF.
- **ROBOT**
This icon accesses robot information including: CURR.POS, POWER ON/OFF, POS, COMMAND POS, SECOND HOME POS, OPE ORIGIN POS, and TOOL and USER COORDINATE.
- **SYSTEM INFO**
This icon provides Version information for both hardware and software, Alarm History, and Monitoring Time.

Area Key

The Area key moves the cursor to the different areas of the display screen.

Cursor Key

The Cursor key is an 8-way, directional key that moves the up, down, left or right to highlight a desired item that can then be chosen using the SELECT key.

SELECT Key

The SELECT key is used to choose the item currently highlighted by the cursor.

TEACH LOCK Key

The TEACH LOCK key locks operation of the robot with the programming pendant. Operation is not possible from the playback panel or operator station. Servo power can not be applied in TEACH mode unless TEACH LOCK is ON.

RS-232C Serial Port

This 9-pin serial port is used for data communication between the XRC and a floppy disk controller (FC1 or FC2), FDE (Floppy Disk Emulator) software, or other form of communication (see Figure 3-4).

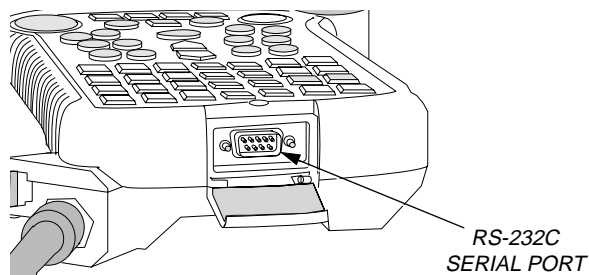


Figure 3-4 RS-232C Serial Port

ENABLE Switch

The ENABLE switch (see Figure 3-5) is a three-position switch located on the left rear of the programming pendant. It is a safety feature that controls servo power while in TEACH mode. When pressed in, this switch enables servo power to be turned on. However, should the operator release the switch, or grasp it too tightly, servo power is immediately disabled, preventing further robot movement.

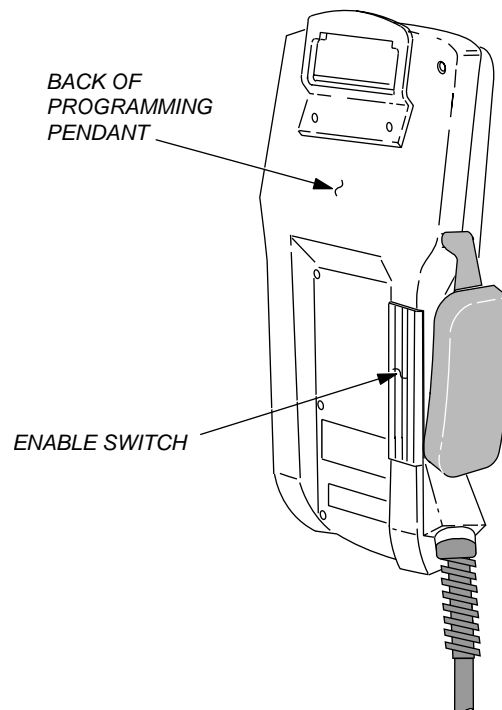


Figure 3-5 Enable Switch

3.2.3 Brake Release



WARNING!

Releasing brakes could cause personal injury or machine damage. Always support the axis to be released *BEFORE* you release it.

The Brake Release Control is a safety feature that allows you to release the automatic brakes on the robot in case of an emergency or robot failure. The Brake Release Control is mounted on the front of the XRC cabinet (see Figure 3-1).

3.3 Operator Station

The operator station (see Figure 3-6) includes a NEMA enclosure on a stand-alone pedestal. The following paragraphs describe the operator station controls.

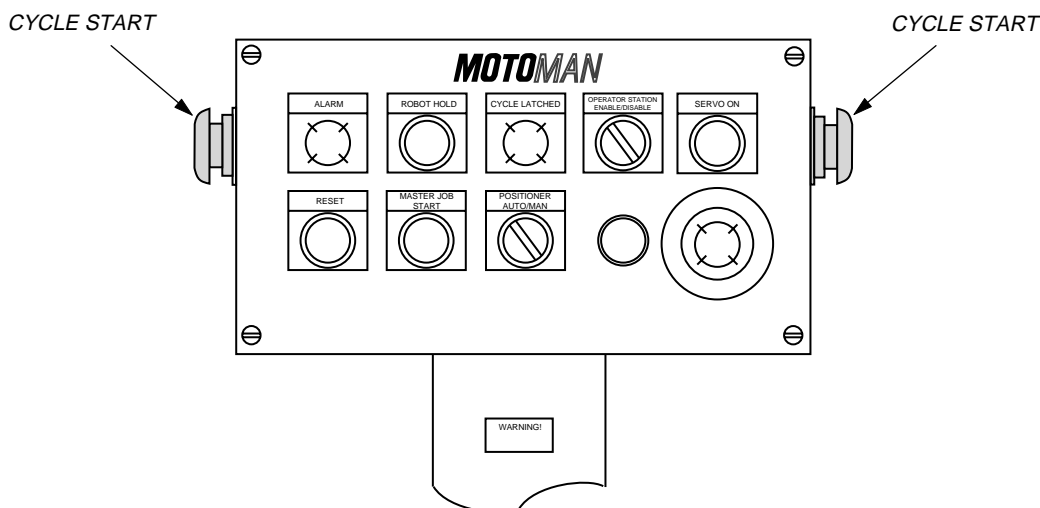


Figure 3-6 Operator Station

3.3.1 Cycle Start



WARNING!

The operation of the *CYCLE START* palm buttons is dependent on the structure of the Master job. Altering the Master job could result in injury to personnel or damage to the equipment.

The green *CYCLE START* palm buttons, located on the sides of the operator station, initiate a positioner sweep cycle if the robot is in the Safe or Home position (Cube 1). If the *CYCLE START* buttons are pressed while the robot is outside Cube 1, the *CYCLE START* command is latched into the XRC. Once the robot returns to Cube 1 and Output #1 is on, the *CYCLE START* command is executed and the positioner sweeps. An anti-tiedown timer, normally set to 10 seconds, prevents the operator from holding the palm buttons down and continuously cycling the positioner. For more information, refer to Appendix B.

3.3.2 Emergency Stop (E-STOP)

The operator station E-STOP, the robot E-STOP, and the sliding door interlocks are connected in series in the Emergency Stop circuit. Pressing an E-STOP button or interrupting a door interlock interrupts this circuit and stops all system operation. Brakes are applied to the robot and all servo power is removed from the system. The system E-STOP lights come on and all positioner motion is stopped.

3.3.3 Hold

The HOLD button is a normally closed, momentarily actuated switch. Pressing the HOLD button stops the operation of the manipulator until another Start signal is sent. The indicator light stays ON only while the HOLD button is pressed. Operation resumes at the point in the program where the HOLD state was initiated. Refer to the manipulator manual for more information.

3.3.4 Cycle Latched

The CYCLE LATCHED lamp operates as an indicator light showing that the positioner CYCLE START command has been latched. It is not necessary to wait for the robots to finish welding and return to the Safe position (Cube 1) before pressing the CYCLE START palm buttons to sweep the positioner. Pressing the Cycle Start palm buttons while either robot is still in motion locks the CYCLE START command into the XRC. The CYCLE LATCHED light comes on, indicating CYCLE START latching. The positioner sweeps once the robots finish the current job and return to the Safe position (Cube 1). Stepping on the safety mats will unlatch the CYCLE START command from the XRC.

3.3.5 Alarm

The ALARM lamp is connected to the robot SERVO ON and ALARM OCCURRENCE outputs. The ALARM lamp turns on when the robot encounters an alarm condition or when servo power is cut.

3.3.6 Positioner Auto/Manual

The POSITIONER AUTO/MANUAL selector switch is used to select AUTOMATIC or MANUAL mode for the positioner. The selector switch is connected to robot Input #2. When the selector switch is in the AUTOMATIC position, the robot processes the part after the positioner sweeps. In MANUAL mode, the robot does not process the part after the positioner sweeps, but remains in the Safe position.

NOTE: This function is dependent on the structure of the Master job.

3.3.7 Master Job Start

The MASTER JOB START button is connected to the robot external start input. The robot will start the current active job when MASTER JOB START is pressed. The operator station must be enabled and servo power ON for the MASTER JOB START button to work.

3.3.8 Operator Station Enable/Disable

The OPERATOR STATION ENABLE/DISABLE selector switch transfers primary control of the ArcWorld cell from the XRC to the operator station. The REMOTE MODE button on the XRC playback panel lights when the Op-station is enabled. Most programming pendant functions are disabled while in REMOTE.

3.3.9 **Reset**

The RESET button is connected to the robot alarm reset input. A minor alarm or error condition is cleared when this button is pressed. In addition, the RESET button and the RIGHT CYCLE START buttons are interlocked and, when pressed simultaneously, reset the positioner when servo power is ON in Play mode. In Teach mode, the positioner is automatically reset when servo power is turned ON. The positioner only needs to be reset after initial power-up and after an emergency stop while in Play mode.

NOTE: *Resetting the positioner may cause some positioner motion. You must be careful when you reset the positioner with the robot close to tooling. If an Emergency Stop occurs during programming, be sure to reset the positioner before resuming programming.*

3.3.10 **Servo On**

The SERVO-ON pushbutton turns servo power ON. In TEACH mode, the SERVO ON pushbutton operates only when the ENABLE switch on the programming pendant is held in.

3.4 **MR1540S Positioner**

The MR1540S positioner uses a reciprocating rotary motion to sweep each side of the circular turntable from the operator's loading zone, into the robot's work zone, and back to the operator side again. The optional continuous rotation package continues the sweep around in the same direction, clockwise or counterclockwise, as the previous sweep. Refer to your Continuous Rotation instruction manual for more information.

A steel, sheet metal arc screen divides the positioner in half, providing two semicircular work areas labeled Side A and Side B. When Side A is in the robot's welding zone, Side B is facing the operator and ready to be loaded or unloaded with parts, and vice versa. *Loading fixtures are supplied by the customer.* For positioner specifications, refer to Table 3-1. Refer to Section 6.2 for maintenance procedures.

Table 3-1 MR1540S Positioner Specifications

Conditions	Specifications
Table Diameter	152.4 cm (60 in.)
Maximum Tooling Weight with Part	700 kg (1540 lbs) total weight, or 350 kg (770 lbs) per side, at a radius of 0.6 m (23.6 in.) from the center of the table. Load must be balanced within 20%. Center of gravity is located 10 inches above the table tooling plate surface. Access hole for tooling utilities is located in center of table.
Maximum Tooling Size	914 x 508 x 889 mm (36 x 20 x 35 in.)
Sweep Time with Capacity	2.5 seconds for 180° sweep with maximum load of 700 kg (1,540 lbs)
Sweep Times for Increased Total Load Capacities	3.0 seconds for 180° sweep with total load of 1,400 kg (3080 lbs) 3.5 seconds for 180° sweep with total load of 2,000 kg (4,400 lbs)
Temperature Operating Range	4–43°C (40–110°F)

Table 3-1 MR1540S Positioner Specifications - continued

Conditions	Specifications
Humidity (max.)	Non-condensing 10–90% relative humidity
Shock (max.)	Less than 0.5 G
Electrical Requirements	115VAC/60 Hz/Single-Phase supplied by the XRC controller
Welding Current Rating	600 amperes at 100% duty cycle

3.4.1 Arc Shield



WARNING!

Do not operate this equipment unless the arc screen is in place or eye damage can occur!

The Motoman ArcWorld III-1000 (MR1540S) positioner is provided with a steel sheet metal screen that runs the diameter of the positioner table and visually separates the loading zone from the welding zone. This screen acts as a shield to protect the operator from the arc radiation and sparks produced by the welding operation. Do not operate this equipment unless the arc screen is in place.

3.4.2 Welding Ground System

The welding ground system consists of a spring-loaded copper brush block that contacts a large ring mounted below the surface of the table. The welding power source ground cable is connected to the insulated ground stud located on the back side of the positioner base when facing the front of the ArcWorld III-1000 cell.

NOTE: The ground cable connection to the insulated ground bar must be tight. If the connection is loose, arcing can occur and cause the insulator to melt.

3.5 Welding Equipment

The ArcWorld system provides a complete complement of arc welding equipment. In its standard configuration, the ArcWorld system includes a power source, wire feeder, torch, and torch mount. Optional equipment including water circulators, Com-Arc units, and torch tenders may also be included with your system.

3.5.1 Power Sources

Motoman offers several different power sources for use with the ArcWorld III-1000 system depending on your system's application. The following are some of the more common power sources used. However, the power source your system uses may be different. For more specific information, refer to the vendor manual that came with your system.

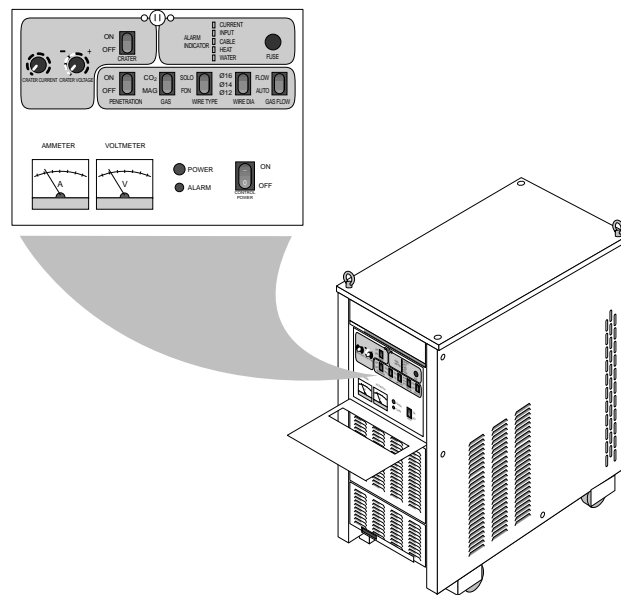


Figure 3-7 Kobelco UC350 Power Source

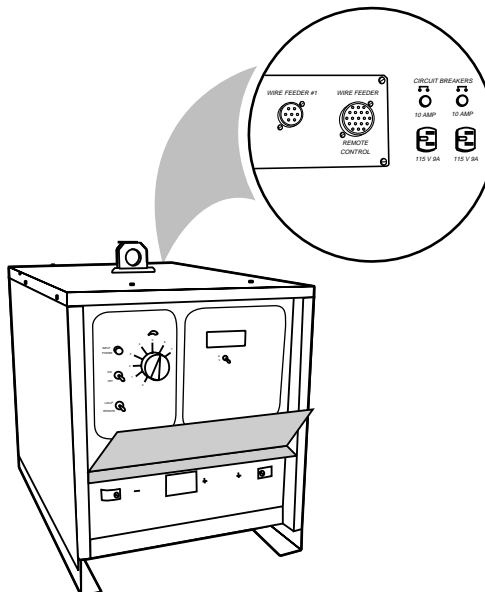


Figure 3-8 MotoArc 450 Power Source

3.5.2 PWF4 Wire Feeder

The PWF4 wire feeder mounts on the robot arm. This 4-roll wire feeder provides reliable wire feeding at rates up to 750 inches per minute (IPM). An integral gas valve provides fast gas response time. The wire feeder has an inch forward button to help simplify set-up and reduce change-over time. Interchangeable feed rolls are used to accommodate different types and sizes of wire. A Shock Sensor Override switch located on the front of the feeder is used to recover from torch impact.

3.5.3 **Universal Welding Interface (UWI)**

The UWI provides microprocessor control to the wire feeder and MotoArc series power source. It scales the signals from the XRC controller to the appropriate levels required for control of the welding components. It also provides isolation of the power source analog signals.

NOTE: Some power sources available with the ArcWorld III-1000 system do not use the UWI. For more information specific to your system, refer to the vendor manuals shipped with your system.

3.5.4 **GMAW Torch**

The ArcWorld system uses either an air-cooled or a water-cooled robotic/automatic GMAW torch. These are heavy-duty torches designed for quick replacement while requiring minimum robot reprogramming. The GMAW torch is installed at the end of the robot wrist. For applications that use the water-cooled torch, the ArcWorld system includes a suitable water circulator kit.

3.5.5 **Motoman Torch Mount**

A Motoman Torch Mount protects the robot, workpiece, fixture, and positioner. It provides multi-directional impact detection, including Z-axis collisions. Torch impact causes a system E-STOP and immediately stops all system operation. Servo power is removed from the system and brakes are applied to the robot. All positioner and door motion is also stopped.

3.6 **Safety Features**

The ArcWorld system incorporates a host of safety equipment. When all standard safety precautions are taken, the safety equipment helps to ensure safe operation of the robotic cell. The ANSI/RIA R15.06 Robot Safety Standard stipulates the user is responsible for safeguarding. *Users are responsible for determining whether the provided safeguards are adequate for plant conditions. Users must also ensure that safeguards are maintained in working order.*

3.6.1 **Arc Screens**



WARNING!

Although the arc curtain blocks dangerous arc radiation, never look directly at the arc without protective eyewear!

Two separate arc screens are used on the ArcWorld system. The first is a metal arc screen on the positioner. This screen blocks arc radiation and sparks from the welding operation. The material used to cover the safety fencing of the entire robotic cell acts as the second arc screen. This material reduces the amount of ultra-violet radiation that escapes from the robotic cell.

3.6.2 **Fencing**

The safety fencing provided with the ArcWorld system encloses the entire robotic cell. It forms a physical barrier preventing entry into the robot envelope during automatic operation.

3.6.3 Safety Mats

The safety mats help prevent serious injury to anyone entering the positioner area during the sweeping process. In PLAY mode, if the positioner is sweeping and a safety mat is activated, servo power is removed from the system and all positioner motion stops. Servo power is reapplied by pressing SERVO ON. However, the positioner will only continue its motion after it is reset using the RESET and right CYCLE START buttons on the operator station.

If the positioner is not in motion but the CYCLE START input has been latched (indicated by the CYCLE LATCHED light), the CYCLE START input is unlatched and the CYCLE LATCHED light turns off when the safety mat is activated. Servo power remains ON.

3.6.4 Emergency Stops (E-STOPS)

In addition to the safety features described above, the ArcWorld III-1000 has strategically placed E-STOPS. These are operator actuated devices that, when activated, immediately stop all system operation. Brakes are applied to the robot and all servo power is removed from the system. The system E-STOP lights come on and all positioner motion is stopped. The following is a list of their locations:

- The playback panel on the controller has one E-STOP button.
- The programming pendant has one E-STOP button.
- The operator station has one E-STOP button.

3.6.5 ENABLE Switch

The ENABLE switch is a safety feature which controls servo power while in TEACH mode. When pressed in, this switch allows the operator to turn servo power ON and initializes the system. However, should the operator release the switch or grasp it too tightly, servo power is immediately disabled, preventing further robot movement.

3.6.6 Interlocked Cell Door

A safety interlock on the cell entrance door prevents entry into the cell during PLAY mode. Opening the cell door with the robot in PLAY causes an E-STOP. Brakes are applied to the robot and all servo power is removed from the system. The system E-STOP lights come on and all positioner motion is stopped.

3.6.7 **Interference Cubes**

Cubic interference zones prevent interference between multiple manipulators or a manipulator and peripheral devices. The XRC monitors the robot tool center point (TCP) during operation. If the TCP enters one of these software-defined interference zones, an output is turned on in the XRC. These outputs can be used to interlock the activity of other manipulators or peripheral devices. The XRC has eight possible cubes available. These cubes are internally tied to Specified Outputs:

R1 = SOUT #081 - 088

The ArcWorld III-1000 uses interference cubes to interlock robot position with table motion. The robot Safe position (Cube 1) is defined behind the positioner, clear of the sweep zone. Each axis is placed in a position that provides the least amount of strain on the servo motors, with the U- and L- axes at 90° angles and the B axis in a relaxed, vertical position. This prevents drifting when servo power is off. Before the positioner can sweep, the robot must be in this safe position.

Setup of these cubes is done at the factory prior to shipment. However, should any of these cubes need redefined or modified due to changes in tooling or system components, refer to Appendix A for basic interference cube setup.

3.6.8 **Brake Release**



WARNING!

Releasing brakes could cause personal injury or machine damage. Always support the axis to be released BEFORE you release it.

The Brake Release Control is a safety feature that releases the automatic brakes on the robot in case of an emergency or robot failure. The Brake Release Control is mounted on the front of the XRC cabinet (see Figure 3-1). See Section 5.3.4 “Using the Brake Release” for more information.

NOTES

SECTION 4

INSTALLATION

The ArcWorld system can be installed easily in just a short time by three workers. The more people involved (within reason), the more quickly installation can be completed. Follow established safety procedures **at all times** throughout the installation process. Failure to use safe work practices can result in damage to the equipment and injury to the workers.



CAUTION!

Installation of the ArcWorld System is not a task for the novice. The ArcWorld System is not fragile, but it is a highly sophisticated robotic system. Handle components with care. Rough handling can damage system electronic components.

4.1 Materials Required

All system hardware necessary for installing the ArcWorld system is included with the system, except for the air line fitting on the filter/regulator/lubricator (FRL). This section identifies customer-supplied items and tools required to complete installation.

4.1.1 Customer-Supplied Items

- Gas bottles for the welding torches
- Incoming power supply
- Two earth ground cables with two earth ground stakes
- Weld wire
- Incoming air supply: 0.04 cmm at 620.5 kPa (1.5 scfm at 90 psi) for torch tender or wire cutter options
- Stepladder
- Forklift and/or overhead crane

4.1.2 List of Tools

- | | |
|---|--------------------------------------|
| • Safety glasses | • Hammer |
| • Face shields | • Socket set |
| • Gloves | • Forklift and/or overhead crane |
| • Level | • Air-impact gun with 3/4-in. socket |
| • Ratchet with 3/4-in. socket | • Open-end wrench set |
| • Adjustable wrench set | • Two socket-head (Allen) |
| • Hammer drill with appropriate concrete bits | • Wrench sets (standard and metric) |
| • Phillips and flat screwdrivers | |

4.2 Site Preparation

To prepare your site, proceed as follows:

1. Clear floor space needed for unit (see Figure 4-1).

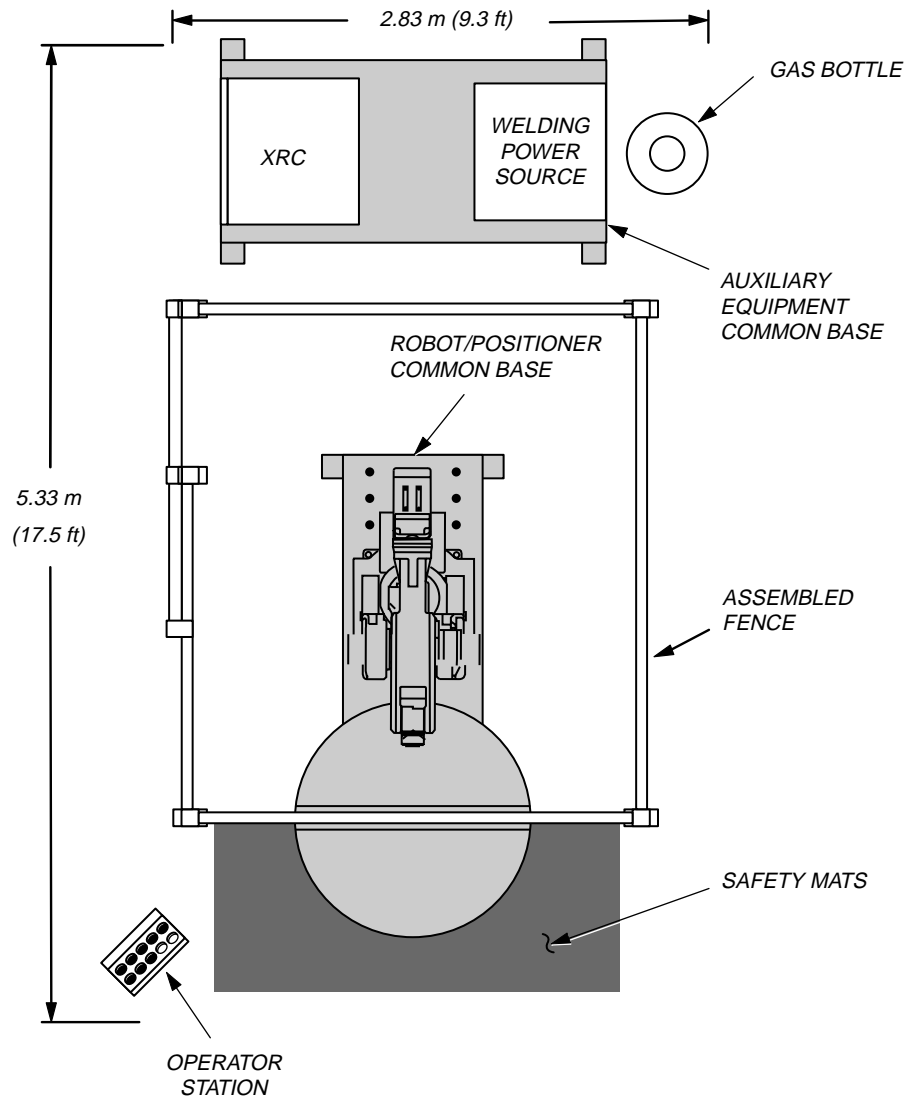


Figure 4-1 Area Needed for Installation

NOTE: The ArcWorld III-1000 will require a minimum area of 2.83 m by 5.33 m (9.3 ft x 17.5 ft). To make installation easier, however, an additional 2.43 to 3.05 m (8 to 10 ft) on all sides is recommended.

2. Gather all customer-supplied items and required tools listed in Section 4.1.

4.3 Installing the Robot/Positioner Common Base

The robot/positioner common base and operator station are shipped on a wooden shipping skid. To install the robot/positioner common base, proceed as follows:



CAUTION!
Handle ArcWorld III-1000 components carefully to avoid damage.

1. Unbolt robot/positioner common base from the wooden shipping skid using a 3/4-in. socket (see Figure 4-2).

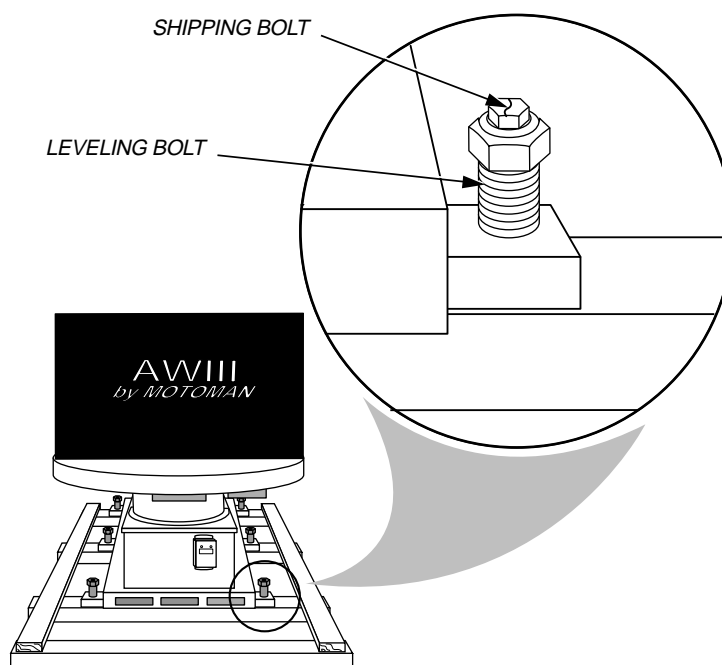


Figure 4-2 Unbolting the Robot/Positioner Common Base



WARNING!
The robot/positioner common base weighs 1588 kg (3500 lbs). Be sure that your crane or forklift is capable of handling this weight or damage to the equipment or injury to personnel can result.

2. Using a forklift, remove common base from wooden shipping skid.
3. Place robot/positioner common base in position (see Figure 4-1).

NOTE: *Make sure there is adequate room on all sides of the positioner for the fencing, the operator station, the safety mats, and the auxiliary equipment common base.*

4. Carefully remove protective plastic wrapping from robot and torch.
5. Inspect robot, torch, and positioner for shipping damage.

NOTE: *If damage is found, notify shipper immediately.*

6. Remove operator station from skid and set safely aside.

4.3.1 Changing the Position of the Robot

The robot and riser are bolted to the spanner in their optimum shipping position. However, certain special welding applications may require a different positioning in relation to the positioner. Therefore, the robot is designed so its position can be changed. To change the position of the robot, proceed as follows:

NOTE: *If position of robot must be changed, shipping brackets must be in place and torch assembly not installed.*

1. Attach a chain hook to each eyebolt on robot body.



CAUTION!

Use a spreader bar to prevent dual chains from pulling against robot assembly and causing damage.

2. Attach chains to a forklift or overhead crane.

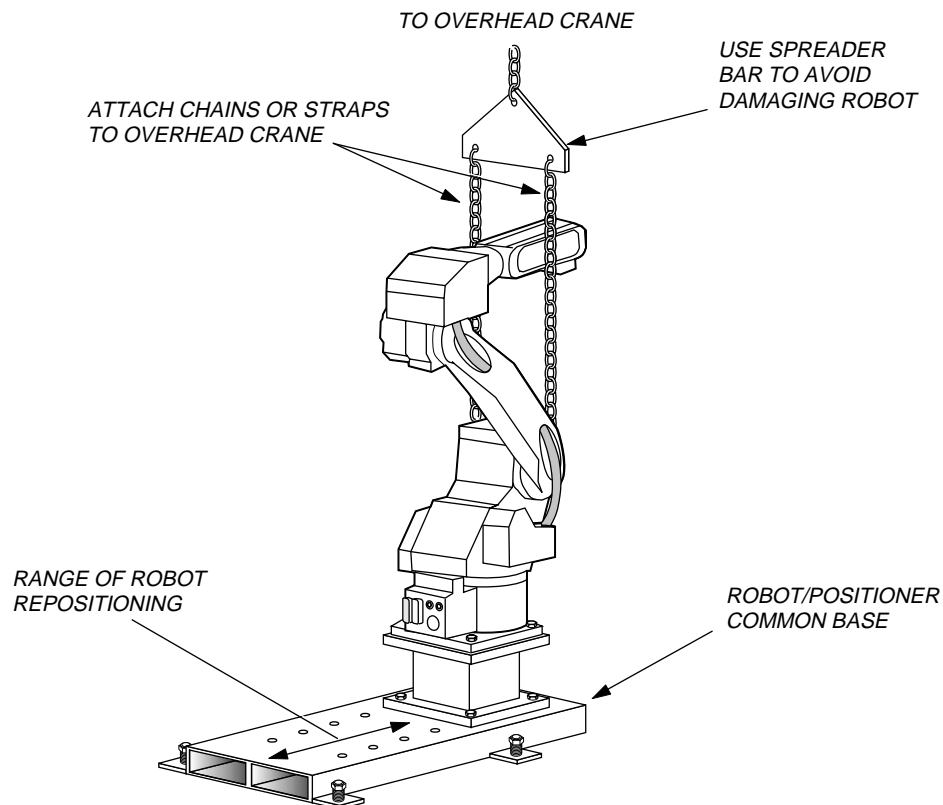


Figure 4-3 Changing Position of Robot



CAUTION!

The robot must be supported by a crane or lift before it is unbolted; otherwise, it will topple.

3. Remove four bolts connecting robot riser to common base.
4. Use forklift or overhead crane to carefully lift and move robot to desired position on common base.
5. Align holes in robot riser with holes in common base.
6. Bolt robot securely to common base.

4.3.2 Removing the Shipping Brackets



CAUTION!

Failure to remove shipping brackets from robot before operating the ArcWorld III-1000 may result in damage to the robot drive mechanisms.

Three yellow brackets (see Figure 4-4) prevent the robot from moving during shipping. Two rod brackets secure the lower arm assembly to the S-axis housing. The smaller bracket on the rear of the robot prevents the S-axis housing from pivoting. After the robot is in place, remove the shipping brackets. The positioner also has shipping brackets or bolts to prevent movement during shipment. After the positioner is in place, remove the shipping brackets or bolts.

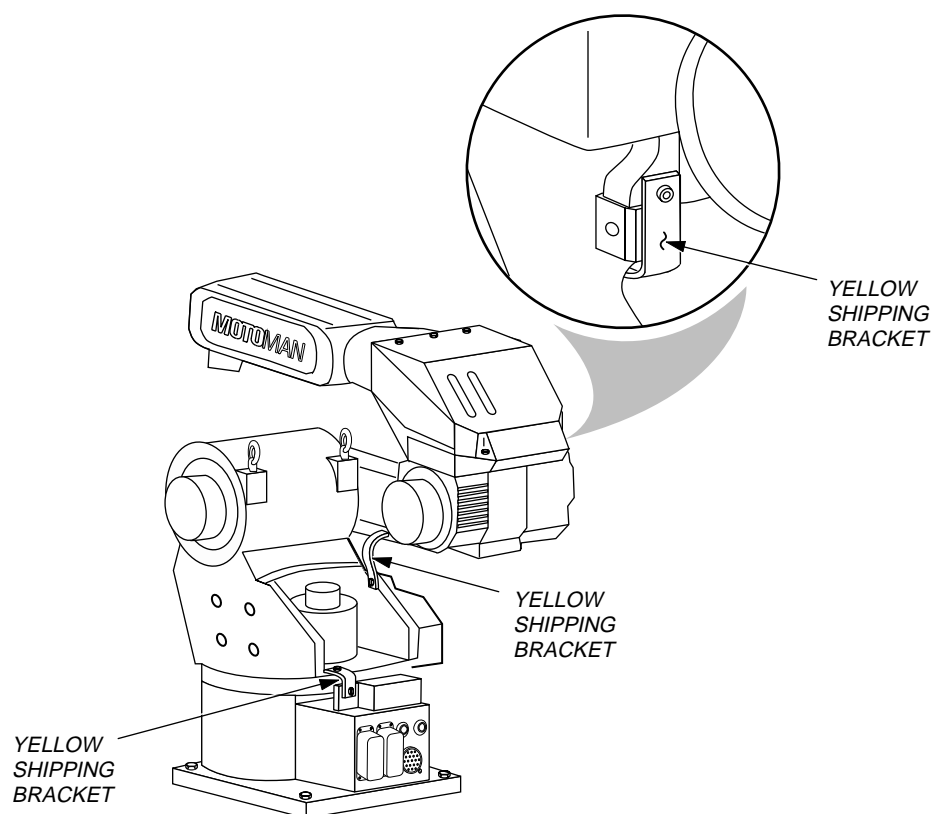


Figure 4-4 Location of Shipping Brackets

4.4 Installing the Torch Tender Option

The optional torch tender is shipped on the auxiliary equipment common (AEC) base. To install the torch tender, proceed as follows:

1. Remove torch tender from robot shipping crate.
2. Place torch tender next to robot as shown in Figure 4-6.
3. Insert 1/4 in. concrete drill bit through center of lag holes in torch tender base and drill holes for lag bolts.
4. Vacuum concrete dust from holes.
5. Lag torch tender to floor.

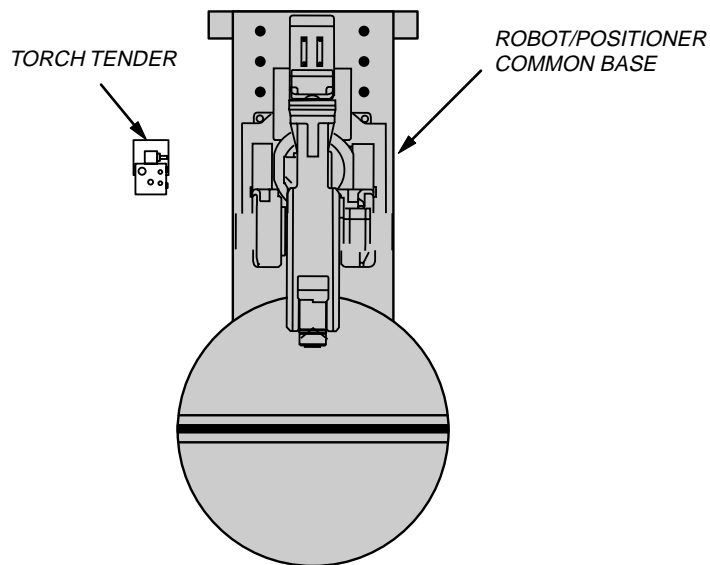


Figure 4-5 Location of the Torch Tender (Option)

4.5 Installing the Fencing

The fencing that makes up the welding cell's protective walls is shipped on its own skid, along with the safety mats, safety mat trim, all necessary hardware, and specific assembly documentation. To install weld-cell fencing, proceed as follows:



CAUTION!

Metal bands are under tension and, when cut, may cause injury. Be cautious when cutting the metal bands.

1. Cut bands that secure metal fencing, safety mats, and safety mat trim and remove all items from skid (see Figure 4-7).

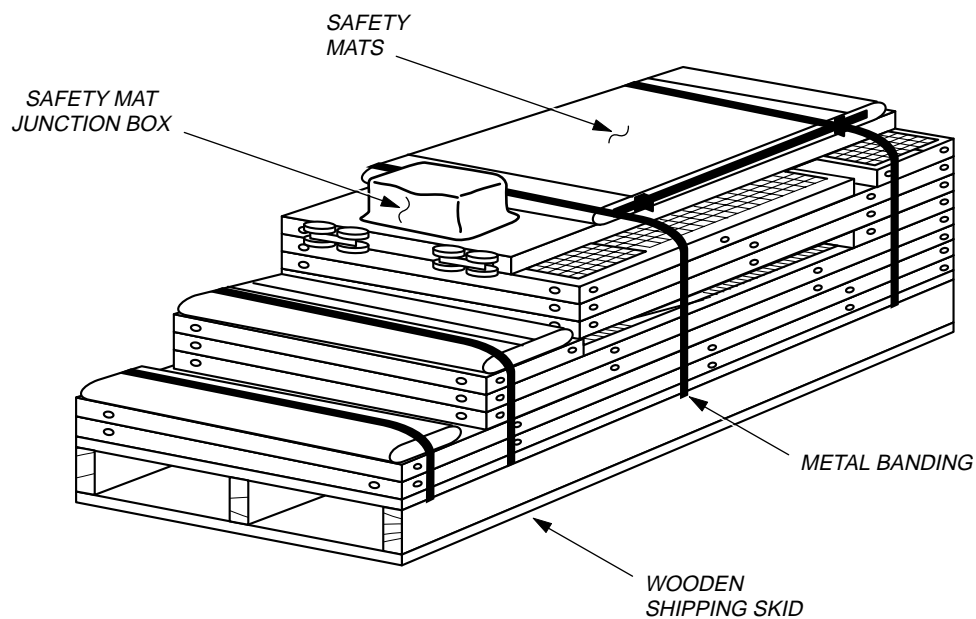


Figure 4-6 Crated Fencing Skid

NOTE: The rear wall is the wall behind the robot, and the front wall is the wall in front of the positioner. The right wall is the wall that is on the right as you are facing the front wall, and the left wall is the wall that is on the left as you are facing the front wall.

- Place fence components on floor around robot/positioner (see Figure 4-8).

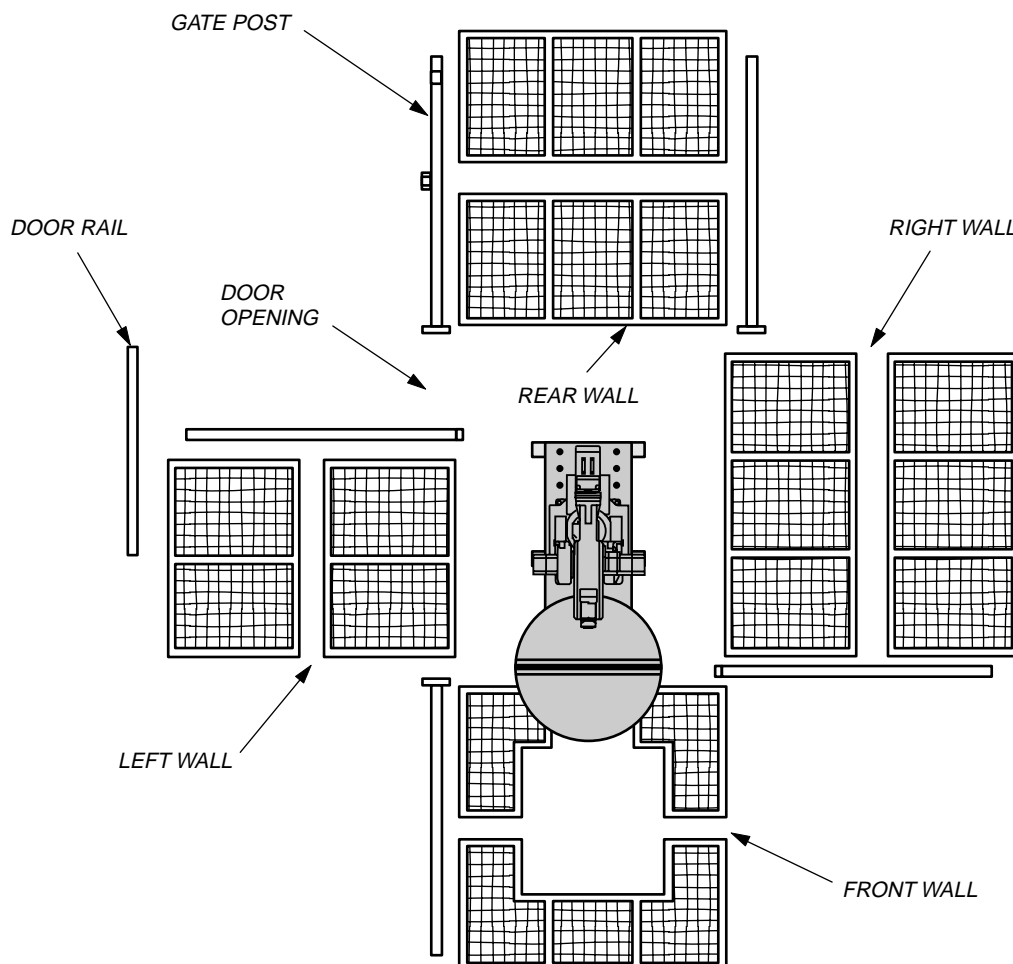


Figure 4-7 Fencing Placed on Floor Around Robot

- Connect rear wall, bottom section to fence post and gate post (see Figure 4-9, Step A).

NOTE: Gate post must be connected to left side of rear wall. Gate post has a latch and a stop.

- Connect a fence post to front end of right wall, bottom section (see Figure 4-9, Step B).
- Raise walls and bolt them together at corner post (see Figure 4-9, Step C).
- Connect a fence post to left side of front wall, top section (see Figure 4-9, Step D).

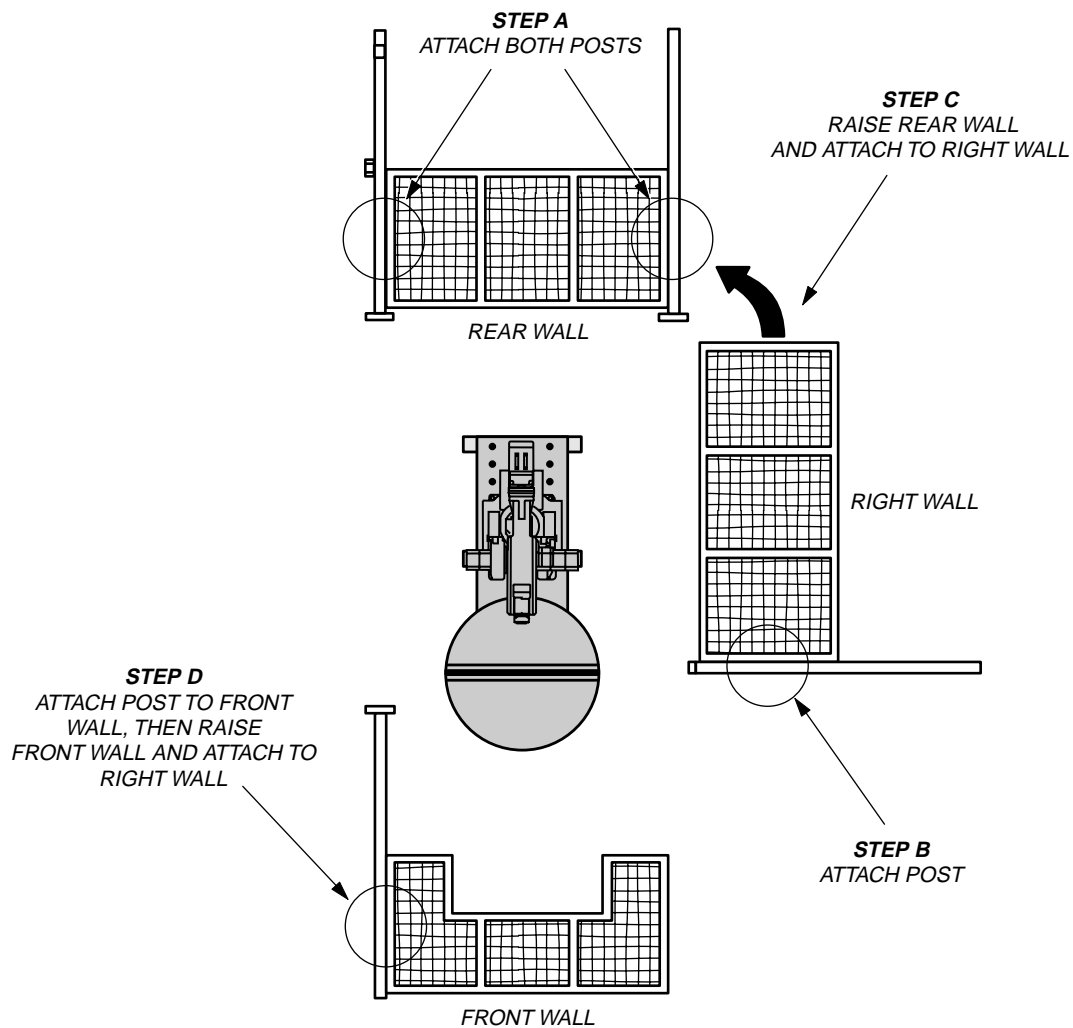


Figure 4-8 Assembling the Fence Walls

7. Raise front wall and center it carefully over positioner (see Figure 4-10).

NOTE: Make sure the positioner table extends 76.2 cm (30 in.) in front of the fence and align with the metal arc screen.

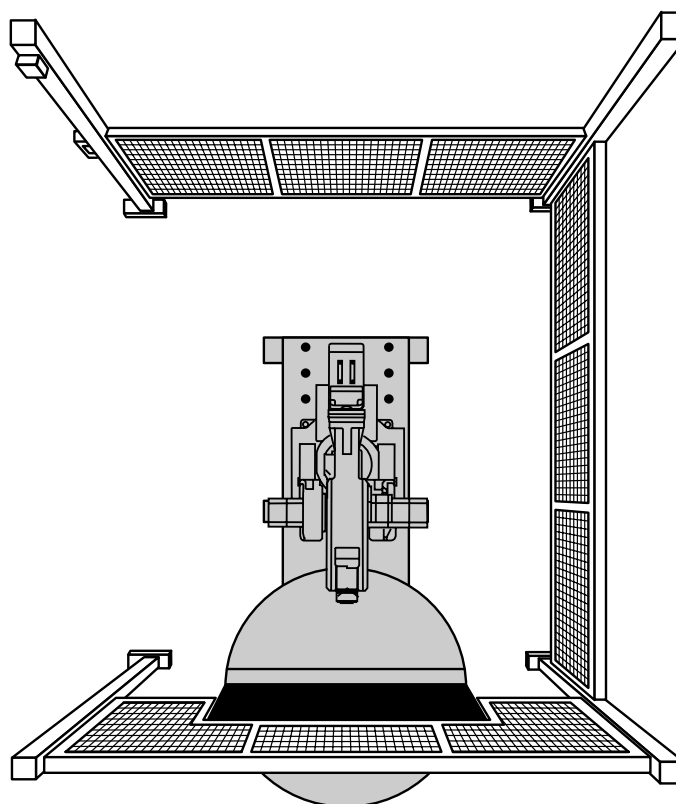


Figure 4-9 Centering the Front Wall Over the Positioner

8. Clamp front wall to positioner arc screen with large C-clamps, using two pieces of wood as buffers to protect surface of screen (see Figure 4-11).

NOTE:

The clamps will hold the wall in place while you install the rest of the cell.

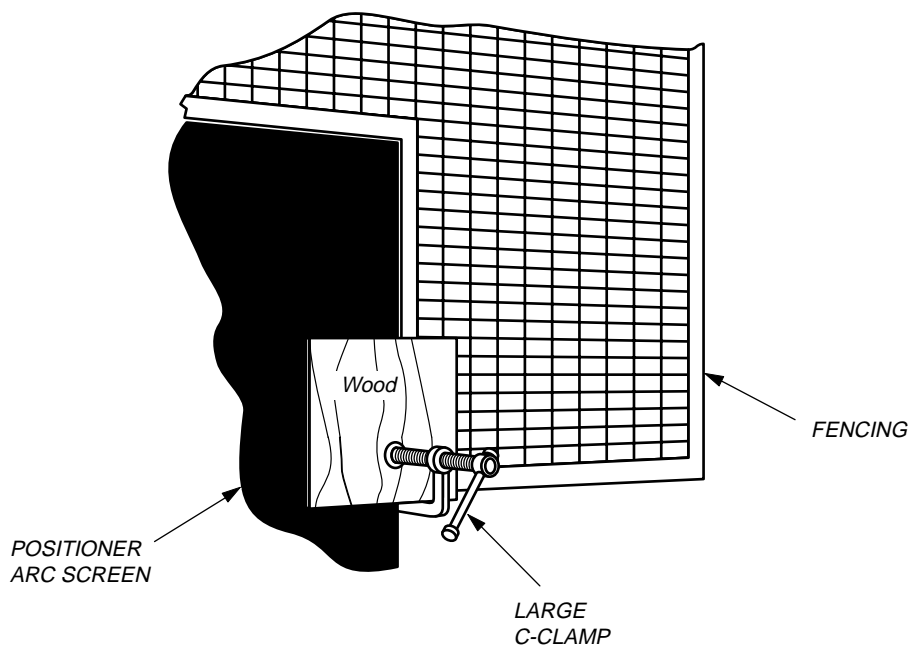


Figure 4-10 Wall Clamped to Positioner Arc Screen with C-Clamps

9. Connect a fence post to end of bottom section of left wall (see Figure 4-12).
10. Raise left wall and bolt to post on front fence wall.

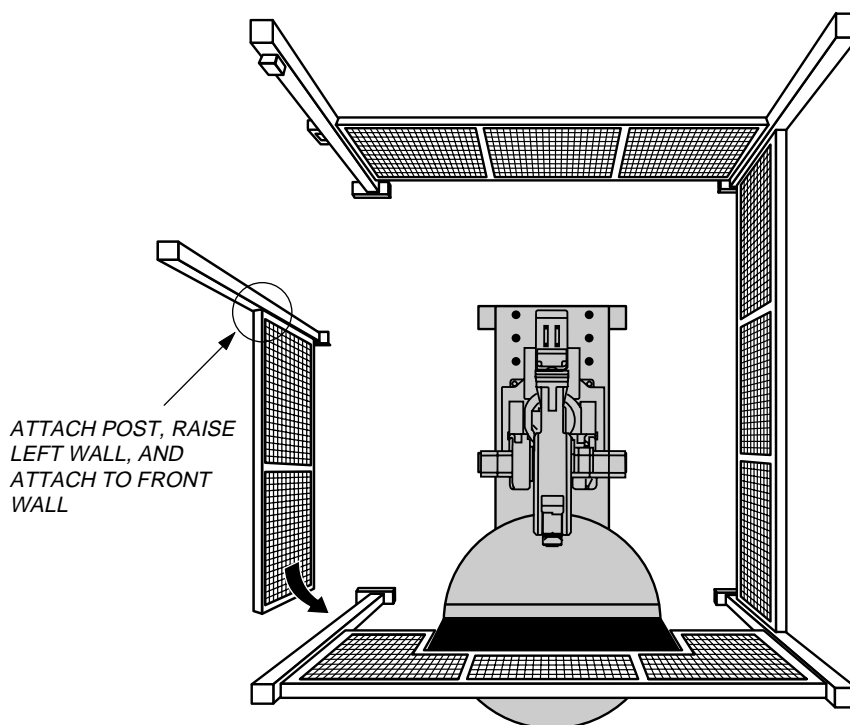


Figure 4-11 Installing the Left Wall

11. Install top door rail across door opening, using clamps provided (see Figure 4-13).

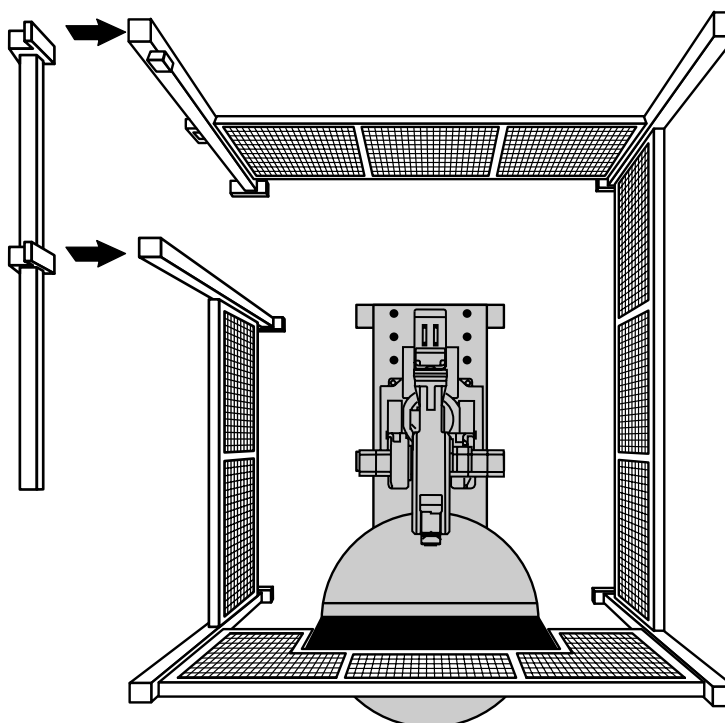


Figure 4-12 Installing the Top Door Rail

12. Install top section of left wall by bolting it to bottom section and both posts (see Figure 4-14).

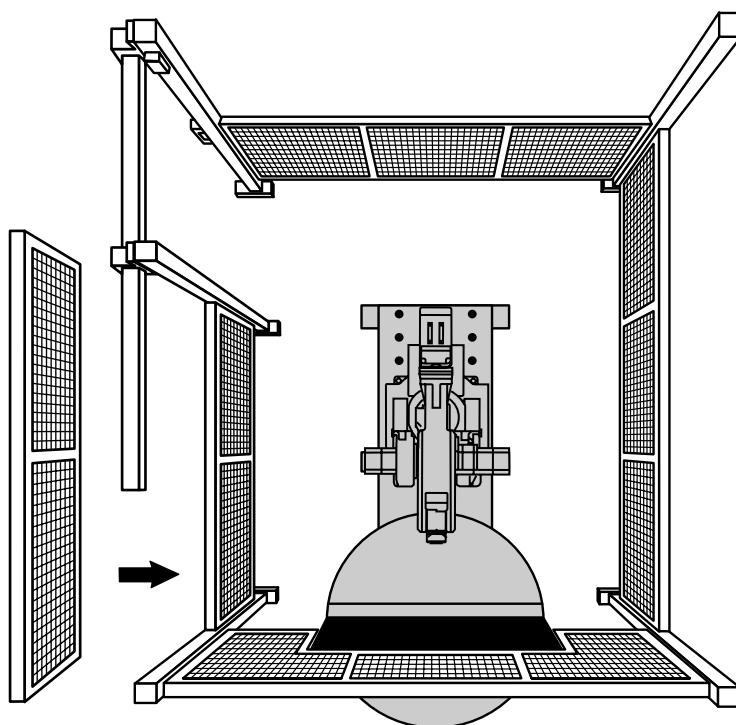


Figure 4-13 Installing the Top Section of the Left Wall

13. Raise cell door and slide it into position on door rail.
14. Close door and install remaining door rail clamp (see Figure 4-15).
15. Install stop bolt and tighten clamp.

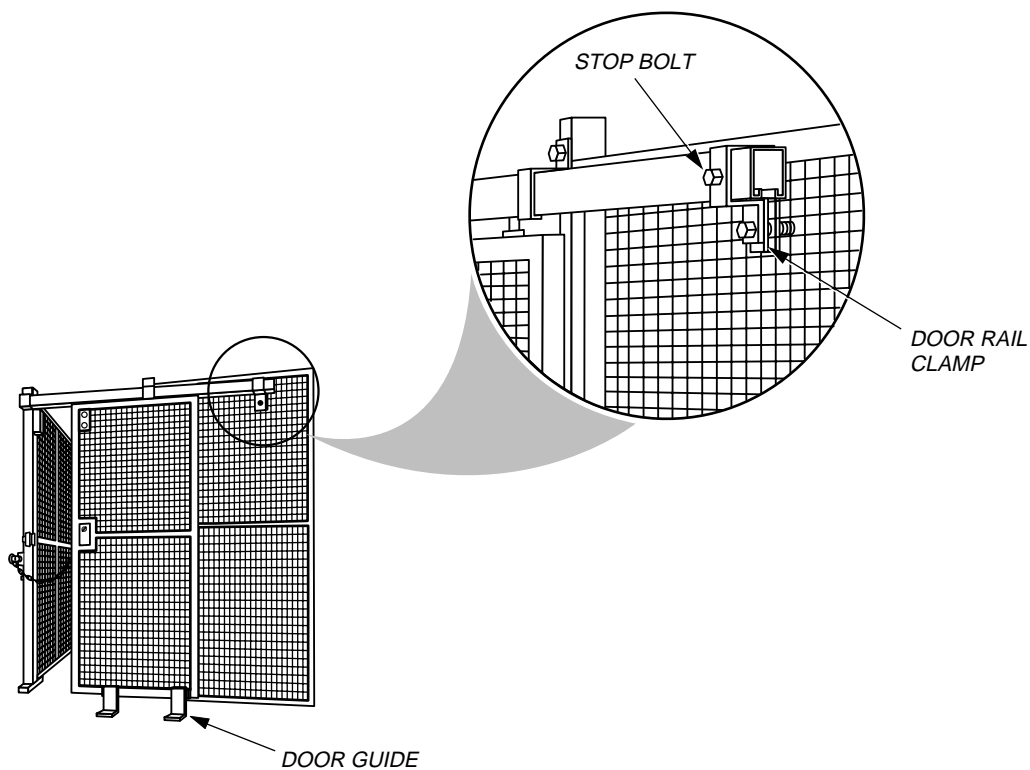


Figure 4-14 Installing Final Door Rail Clamp

16. Bolt top section of rear wall to bottom section and both end posts.

17. Bolt top section of right wall to bottom section and both end posts.
18. Remove C-clamps from metal arc screen.
19. Put bottom sections of front wall in place on both sides of positioner table.
20. Bolt bottom sections of front wall to top section and end posts.
21. Adjust door hangers until latching mechanism latches firmly and securely.
22. Ensure cell walls are square.
23. Ensure front wall is centered over positioner table.
24. Ensure there is 1.27 cm (0.5 in.) clearance on either side of metal arc screen.
25. Once fence sections are positioned correctly, insert appropriate size concrete drill bit through center of fence wall feet and drill holes for lag bolts in floor at locations shown in Figure 4-16.
26. Vacuum concrete dust from holes.
27. Lag cell walls to floor.

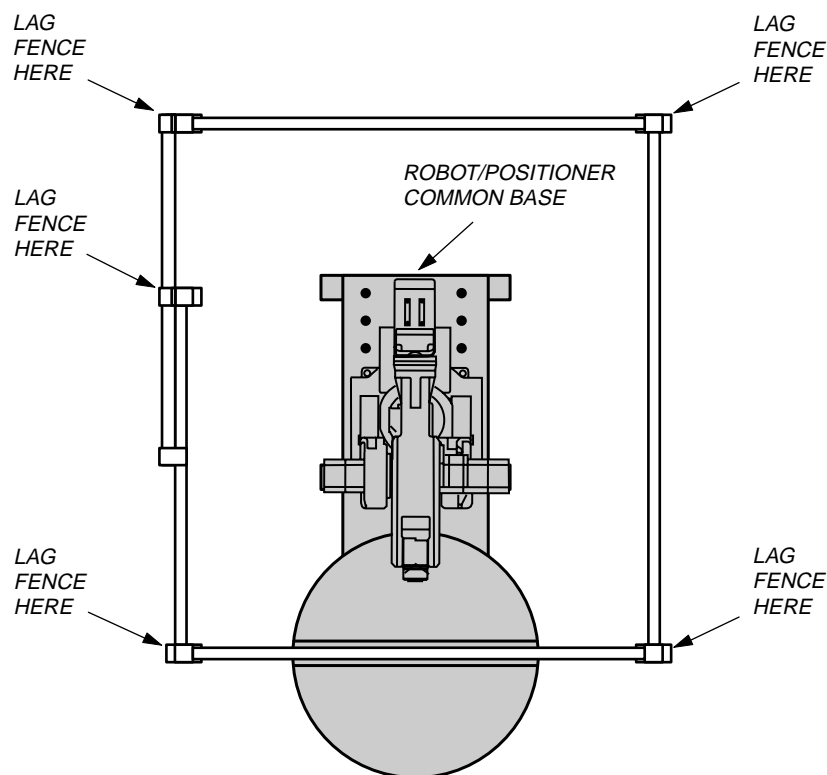


Figure 4-15 Lagging Cell Walls to Floor

28. Use bottom cell door guides (see Figure 4-15) as templates to mark location of two mounting holes.
29. Remove bottom cell door guides.
30. Using a concrete drill bit, drill holes in floor at marked locations for door guides.
31. Vacuum concrete dust from holes.
32. Position cell door guides.
33. Using lag bolts supplied, lag cell door guides to floor to ensure smooth door operation.

4.6 Installing the Arc Curtains

Once the cell walls are fully assembled and lagged to the floor, they must be covered with the arc curtains. The arc curtains are shipped in an accessories box. To install the arc curtains, proceed as follows:



DANGER!

Do not install the arc curtains until after the cell walls have been lagged to the floor. Unsecured cell walls can fall and injure personnel and damage equipment.

1. Unfold arc curtains and install one piece on inside of each cell wall, using supplied wire ties and eyelets in curtain material (see Figure 4-17).

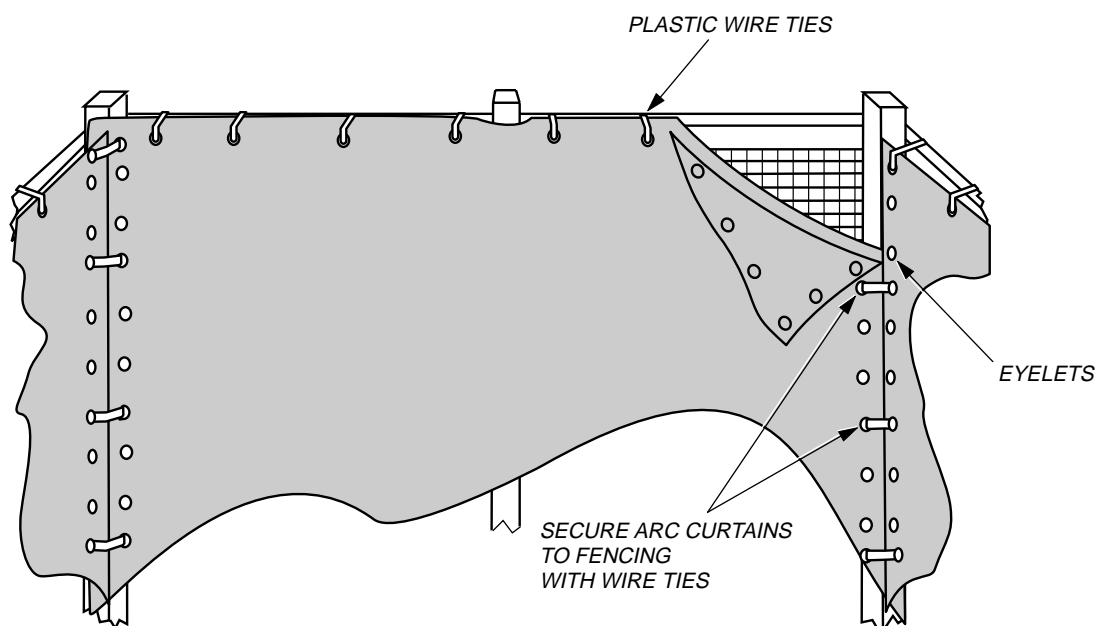


Figure 4-16 Securing the Arc Curtains

NOTE: The arc curtains have been pre-cut to match the cell walls. Each arc curtain bag contains documentation that includes the arc screen's dimensions. If necessary, these dimensions can be used to match each curtain to the correct cell wall.

2. Make sure there are no gaps between arc curtains.
3. Install door panel safety curtain on outside of door panel, using supplied wire ties and eyelets in curtain material.

4.7 Installing the Auxiliary Equipment Common Base

The auxiliary equipment common (AEC) base contains the XRC controller and the welding power source with disconnect. It may also include the optional water circulator and/or the Com-Arc III. The AEC base is shipped on a separate wooden shipping skid. The accessories box is secured to the top of the welding power source. To install the AEC base, proceed as follows:

1. Unbolt the AEC base from the wooden shipping skid by removing the four shipping bolts using a 3/4-in. deep well socket (see Figure 4-18).

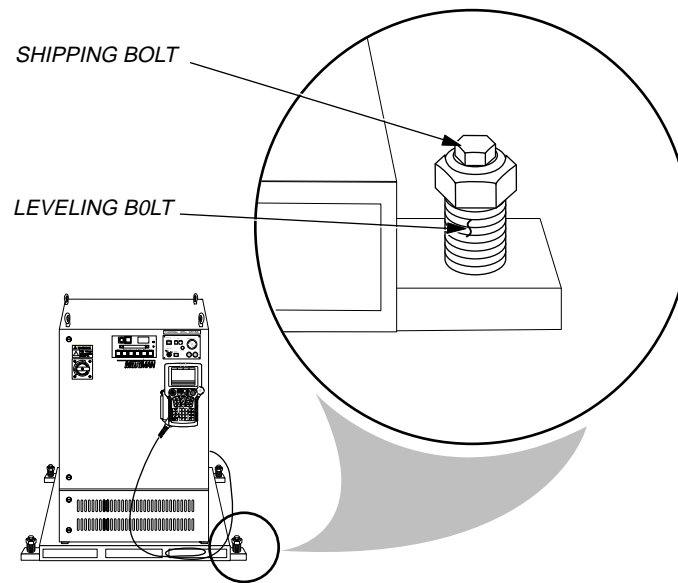


Figure 4-17 Unbolting the Auxiliary Equipment Common (AEC) Base



WARNING!

The AEC base weighs 680 kg (1500 lbs). Be sure that your crane or forklift is capable of handling this much weight or damage to the equipment or injury to personnel can result.

2. Using a forklift, lift base and remove from wooden shipping skid.
3. Place AEC base approximately 0.6 m (2 ft) behind ArcWorld III-1000 cell (see Figure 4-19).
4. Carefully remove protective plastic wrapping and cardboard from AEC base.
5. Remove accessories boxes from welding power source and set safely aside.
6. Inspect AEC base components for shipping damage.

NOTE: *If damage is found, notify shipper immediately.*

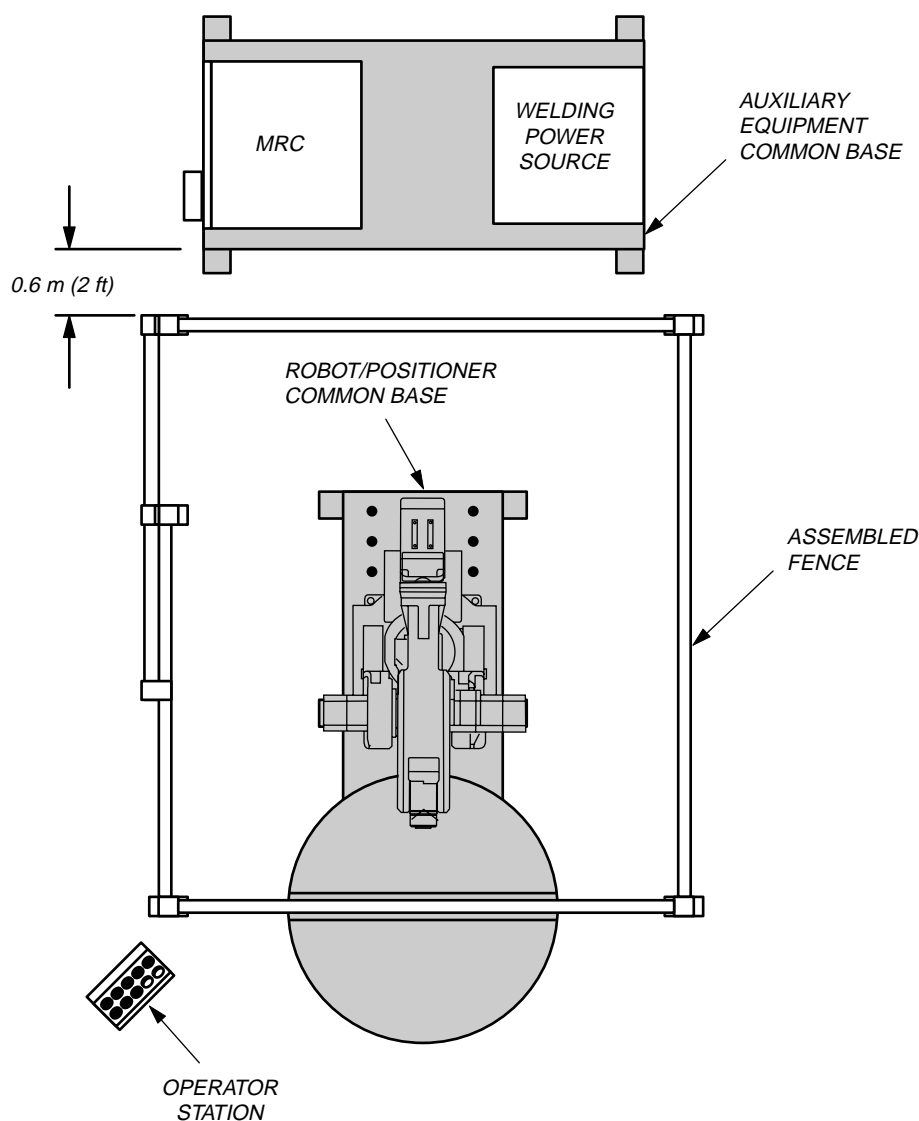


Figure 4-18 Location of the Auxiliary Equipment Common (AEC) Base

4.8 Installing the Operator Station

To install the operator station, proceed as follows:

1. Unload operator station.
2. Carefully remove protective plastic wrapping from operator station.
3. Inspect operator station for shipping damage.

NOTE:

If damage is found, notify the shipper immediately.

4. Place operator station outside fence to front of positioner (see Figure 4-19).
5. Insert 1/4 in. concrete drill bit through center of lag holes in operator station and drill holes for lag bolts.
6. Vacuum concrete dust from holes.
7. Lag operator station to floor.

4.9 **Installing the Safety Mats**

Safety mats require special handling to prevent damage to the internal electrode assembly. Grasp the mat by its long edges and lift, while causing a slight bow down the length of the mat (see Figure 4-19). This prevents the mat from kinking lengthwise. Place the mat cord and junction box on top of the mat during handling to reduce tripping hazards. To install the safety mats, proceed as follows:

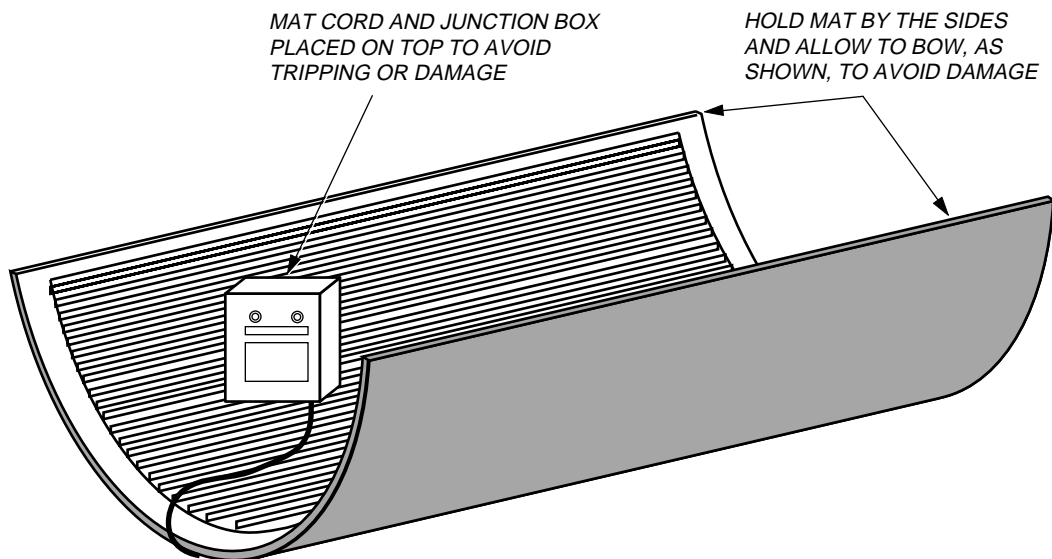


Figure 4-19 Handling a Safety Mat



CAUTION!

Mats are susceptible to edge damage and damage from bending. Be careful not to impact the edges or corners of the mats. Do not attempt to lift large mats without help.

A T-shaped aluminum extrusion, called the active joiner, is used to abut two safety mats together to increase sensitivity. On the extrusion there are adhesive strips that bond to each mat so that debris will not accumulate under the mats. At least three of the outside edges of the mat layout will need perimeter anchoring trim to hold the mats in place.

To install the safety mats, proceed as follows:

Prepare Safety Mats

To prepare the mats for installation with the active joiner proceed as follows:

1. Vacuum or sweep floor surface where mat will be mounted to ensure surface is flat, smooth, and free of debris.
2. Use a sharp utility knife and a straight edge to remove the lock lip from both mats at the point they will join one another. **Only remove the lip from the mat on the side that is joining another mat** (see Figure 4-21).

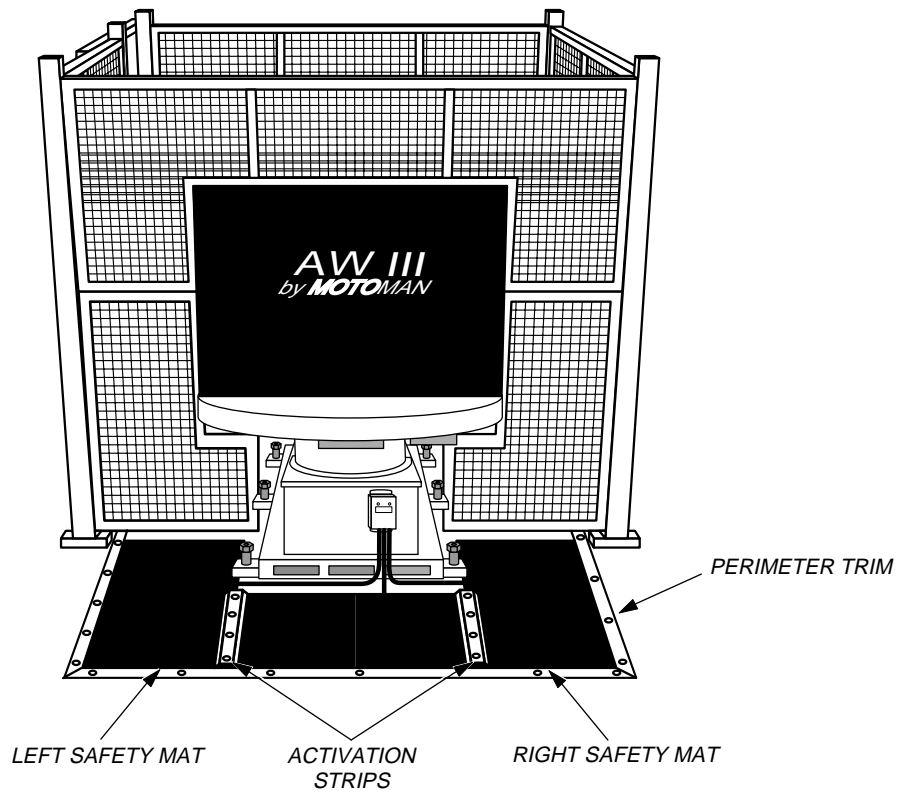


Figure 4-20 Placement of the Positioner Safety Mats

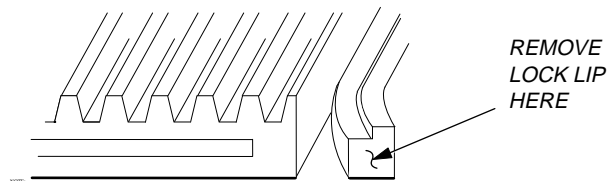


Figure 4-21 Lip Lock Removal

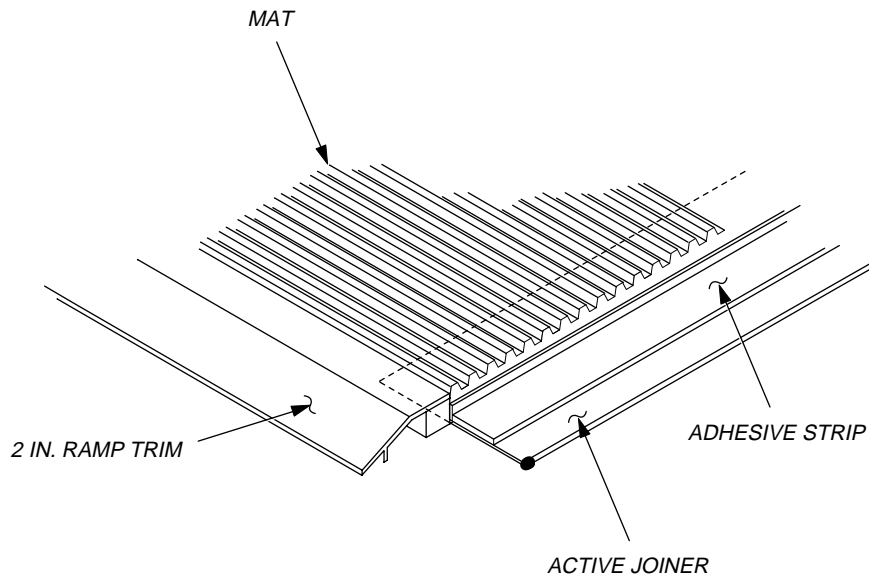


Figure 4-22 Safety Mat Assembly

Set up

After the lock lips have been removed on adjoining mat ends, do a trial run. Location of safety mat must be in front of positioner with back perimeter trim even with fence ends (see Figure 4-22).

1. Put the safety mats, active joiner strips, and perimeter anchoring trim together in the desired configuration.
2. Once proper fit is ensured, expose one adhesive strip and secure the active joiner to one of the mats.
3. Expose the other adhesive strip and put the second mat in place.
4. Repeat this process until all mats using the active joiner are joined together.

NOTE:

- *The active joiner should be positioned up to the mat's dimensional edge, just inside the lock lip.*

Finish installation

Once the trial run is complete and the mat is adhered to active joiner, the rest of the assembly can be anchored.

1. Using hardware provided, bolt safety mat junction box to front of positioner.
2. Place safety mat perimeter trim in position.

NOTE:

For the perimeter trim, use a 1/4-in. drill bit.

3. Holding perimeter trim securely in place, drill 2.54 cm (1 in.) deep through pre-drilled holes into floor.
4. Remove perimeter trim.
5. Remove any debris that may be underneath mat.
6. Reposition perimeter trim.
7. Insert appropriate anchors into holes for perimeter trim.
8. Insert #10 x 1-1/4-in. screws into perimeter trim, and tighten screws until they hold mat securely.

4.10 **Leveling and Securing the Equipment**

After everything is in position, level the equipment and secure it to the floor. The lag bolts are shipped in the accessories box. To level and secure the equipment, proceed as follows:

1. Level robot/positioner base by adjusting leveling bolts (see Figure 4-22).
2. Insert 1/2-in. concrete drill bit through center of leveling bolts and drill holes for lag bolts.
3. Vacuum concrete dust from holes.
4. Lag robot/positioner common base to floor.

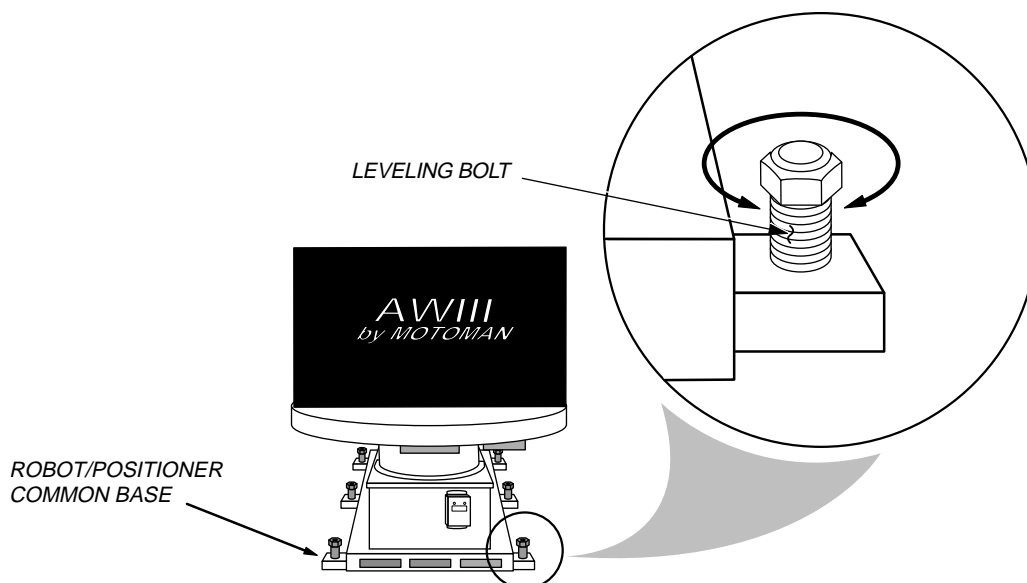


Figure 4-23 Leveling Bolts

5. Level AEC base by adjusting leveling bolts (see Figure 4-23).
6. Insert a 1/2-in. concrete drill bit through center of leveling bolts and drill holes for lag bolts.
7. Lag AEC base to floor.

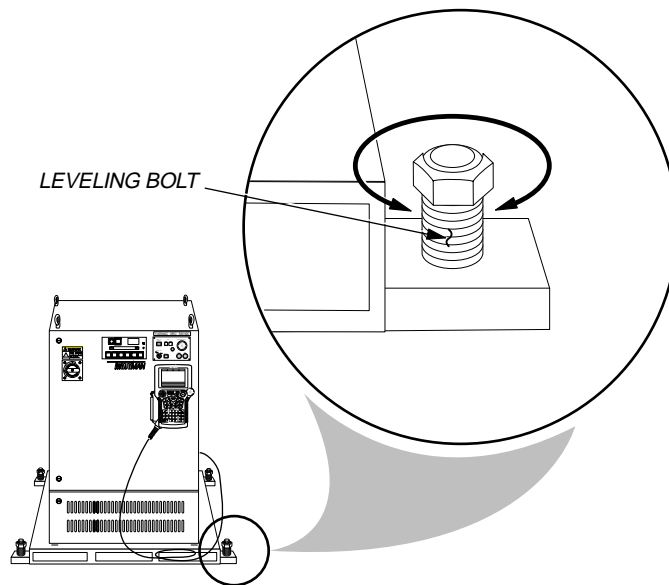


Figure 4-24 Auxiliary Equipment Common (AEC) Base Leveling Bolts

4.11 **Connecting the Cables**

After components are level and securely in place, the cables should be unwrapped from around the equipment and laid out according to the cable diagram included in the system drawing package. Each cable connection is clearly identified for ease of installation.

4.11.1 **Connecting the Earth Ground**

The robot and the XRC must each be connected to an earth ground. An earth ground is a ground in which the equipment is connected to a ground stake driven into the earth. The ground stake must be driven a minimum of eight feet into the earth, and the earth must be treated with chemicals in order to reduce resistance to the ground stake. Deeper ground stakes may be required depending on area soil conditions. A maximum of 100 ohms ground resistance is recommended. To ground the robot and the XRC, proceed as follows:



WARNING!

- ***If proper earth grounds cannot be provided, do not use the equipment! Serious injury or death can occur.***
- ***Do not place the MIG system within 50 feet of other sources of noise (i.e., GTAW arc starters, plasma cutters, induction furnaces, high-power-resistance spot welders, dielectric heaters, etc.). Equipment that generates impulse or high-frequency noise can cause unexpected equipment operation and failure, which can result in serious injury or death.***

NOTE:

If the robot and the XRC are within 15 feet of each other, a common earth ground may be used. Otherwise, separate earth grounds must be used.

1. Connect one end of the robot earth ground cable to lug marked EARTH GROUND on bottom back of robot.
2. Connect other end of robot earth ground cable to earth ground stake.
3. Connect one end of second earth ground cable to common ground bus bar inside XRC.
4. Connect other end of second earth ground cable to earth ground stake.

4.11.2 Connecting the XRC Controller

To connect the XRC controller to the robot, proceed as follows:

1. Unpack two large black manipulator cables from XRC controller, and route to back of robot.
1. Carefully engaging connectors, connect two large black cables (labeled 1BC and 2BC) on XRC to 1BC and 2BC connections on back of robot (see Figure 4-25).

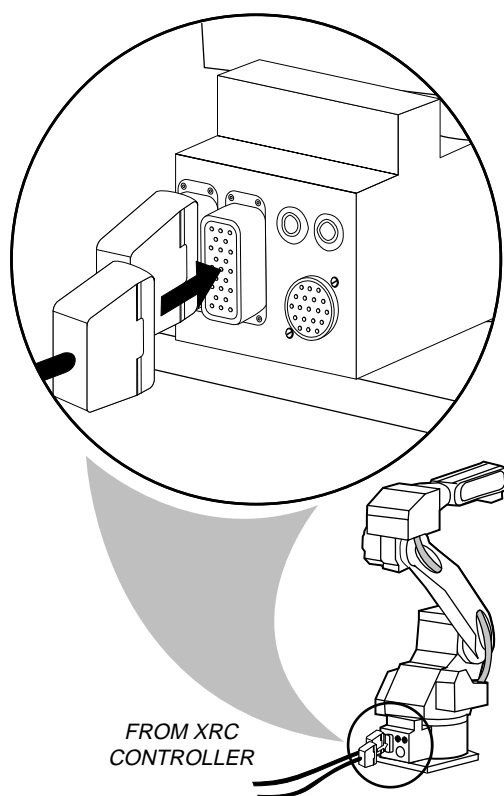


Figure 4-25 Robot Cables and Hoses Connecting the XRC to the Robot

4.11.3 **Connecting the Water Circulator (Option)**

To connect the water circulator, proceed as follows:

1. Plug water circulator into AC plug on back of welding power source.



CAUTION!

Use only the antifreeze provided by Motoman. Automotive anti-freeze contains stop-leak additives that will clog the small torch water-cooling ports and damage the pump gaskets.

- **Do not fill the water circulator past its fill line. Damage to the water circulator could occur.**

2. Fill water circulator tank with antifreeze/coolant provided (P/N 131224-1). Do not fill water circulator past the fill line.

4.11.4 **Connecting the System Interface Box**

The system interface box is mounted on the back of the system fencing. To connect the system interface box, proceed as follows:

1. Locate and unpack Door Switch cables and connect to sides of interface box.
2. Unpack safety mat cable and connect between safety mat junction box and interface box.
3. Unpack operator station cable and connect to interface box.
4. Unpack positioner cables from interface box and connect to XRC cabinet.

4.12 **Connecting the Power**

After all of the system components have been properly installed, connect the power to the ArcWorld III-1000. To connect incoming power to the ArcWorld III-1000, proceed as follows:



DANGER!

Power should be connected only by a qualified electrician. Electrical and grounding connections must comply with applicable portions of the national electrical code and/or local electrical codes.

1. Install 3-phase power wiring to circuit breaker located inside left wall of XRC cabinet. Table 4-1 shows size and type of wire needed.
2. Tighten screws to the torque indicated in Table 4-1.
3. Install an M5 lug on incoming ground wire.
4. Terminate ground wire to frame ground stud with hardware provided.

NOTE:

The ArcWorld III-1000 is configured for three-phase 460/480V AC, unless other voltage was requested. If other voltage is required for your plant, you must make the necessary modifications to the transformer. For more information, refer to the manipulator manual that came with your system.

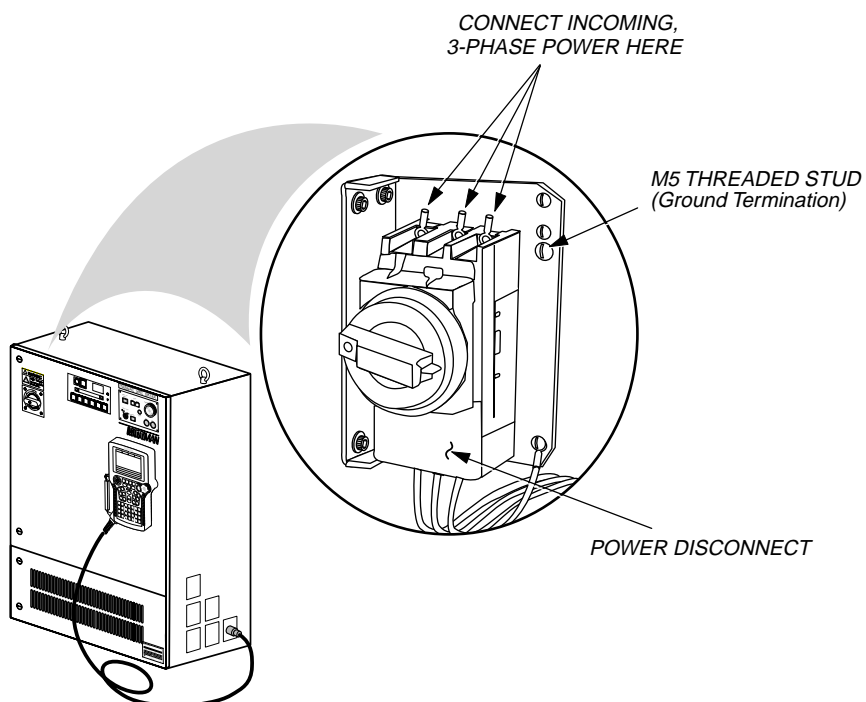


Figure 4-26 Incoming Power Connections

Table 4-1 Incoming Power Specifications (Decal)

Lug Data	60/75° C wire
Catalog No.	TCAL14
Wire Size	#14-7 Copper #12-8 Aluminum
Torque	#14-7, 4.0 N•m (35 lb-in.)

4.13 **Conducting a Safety/Operation Check**

Before installing the tooling and fixtures for your application, take a few minutes to perform a safety/operation check. To conduct a safety/operation check:

1. Check that all three yellow shipping brackets have been removed from robot (see Section 4.3.2).
2. Be sure safety mats are placed correctly.
3. Check cell door is closed and latched.
4. Check all cable connections are tight.
5. Check air line connections to positioner air line regulator and to optional torch tender and wire cutter.
6. Be sure welding power source is set correctly (see welding power source vendor's manual).
7. Verify incoming line power matches input power specified on sticker on front of XRC.

Your ArcWorld III-1000 is now ready for power-up. The ArcWorld system should be operated only by personnel who have received operator training from Motoman and who are familiar with the operation of this Motoman robot model. Turn the main power ON, and continue the safety/operation check.

8. Check all system E-STOPS (pendant, operator-station, breakaways, playback panel).
9. Check system Hold buttons.

4.14 **Installation of Tooling and Fixtures**



WARNING!

When loading fixturing and/or tooling weighing over 90.7 kg(200 lbs) per side, the arcscreen must be removed and the fixturing loaded on the robot side. Do Not sweep the positioner to load the robot side!

Your ArcWorld III-1000 system is now ready for the installation of tooling and fixtures for your application. Installation of tooling and fixtures should be performed by personnel who are familiar with the operation of this system. Tooling and fixtures are supplied by the customer. After tooling is installed, test the positioner for proper operation:

- Verify that the air line FRL is set for 620.5 kPa (90 psi).
- Positioner achieves full sweep time (4 to 8 seconds, depending on positioner).

SECTION 5

OPERATION

The ArcWorld III-1000 is a fully integrated robotic GMAW welding cell. The robot welds on one side of the turntable positioner while the operator loads the opposite side with parts. Once the robot is finished with its process, it returns to the Safe position. The operator sweeps the turntable, enabling the robot to start welding on the next part. Operation of the ArcWorld III-1000 will differ if your system includes the Continuous Rotation kit. Refer to the Continuous Rotation Supplemental for more information before operating this system.

This section provides operation instructions for the ArcWorld III-1000 system. Operation procedures include the following:

- Programming (Section 5.1)
- Daily Operation (Section 5.2)
- System Recovery (Section 5.3)

5.1 Programming

The operation of this system is programming dependent. The operating instructions included in this section are based on one possible configuration of this system. Your system configuration and job structure may differ slightly from that presented here, however basic operation will be the same.

Any changes made to your system configuration and/or job structure will alter the operation of this cell. Motoman recommends you do not modify the original jobs and system configuration that came with your system. If modifications need to be made, they should be made to copies of these jobs and not to the originals. Modifications should only be performed by personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman system. If you have questions concerning the configuration of your system please contact the 24 hour Service Hotline, at (937) 847-3200 (see Section 1.4).

5.1.1 I/O Assignment

The ArcWorld III-1000 uses the following user and dedicated inputs and outputs (see Tables 5-1 and 5-2).

XRC Dedicated Inputs XRC Dedicated Outputs

- | | |
|---------------------------|--------------------|
| • Servo On | • Servo Power ON |
| • External Job Start | • TEACH mode |
| • Alarm Reset | • Cube 1 |
| • REMOTE mode ON | • Alarm Occurrence |
| • Hold | |
| • External Emergency Stop | |

For more information on user and dedicated I/O's, refer to the XRC User Functions & I/O Structure Manual (P/N 132331-1).

Table 5-1 XRC User Inputs

Input	Assignment
IN#001	CYCLE START
IN#002	AUTO/MANUAL
IN#003	AT SIDE A
IN#004	AT SIDE B
IN#005	MAT ACTIVE
IN#006-#016	NOT USED

Table 5-2 XRC User Outputs

Output	Assignment
OUT#001	STATION READY
OUT#002 - #003	NOT USED
OUT#004	WIRE CUTTER (OPTION)
OUT#005 -#016	NOT USED

5.1.2 Sweeping the Positioner

NOTE: *In order to sweep the positioner, the robot must be in the Safe position in Cube 1.*

MANUAL mode allows you to sweep the positioner without activating the robot. Parts can be loaded onto the fixture to achieve the most efficient configuration and then swept into the welding zone, *before* teaching the robot a series of moves. To sweep Side A or Side B of the positioner into the robot's welding zone, proceed as follows:

1. Place robot in Safe position (see Section 5.2.2).
2. Set the op-station POSITIONER switch to MANUAL mode and start Master Control job (see Section 5.2.3). Normally robot will not move out of Safe position when POSITIONER switch is in MANUAL. (This depends on job structure.)

NOTE: *Cycle Start latching is not operative in Manual mode.*

3. Press CYCLE START palm buttons on operator station. Positioner sweeps each time CYCLE START buttons are pressed.

When table sweeps Side A into position, the positioner provides an input to ?IN #3 "AT SIDE A." When this input is turned on, robot Output #1 should be turned off.

NOTE: *The Cube function is a software feature that turns on an output when the robot tool center point is within established boundaries. If the robot moves outside of Cube 1, the output is lost and the positioner will not sweep. The cube position is factory set to be clear of the positioner. For more information on basic cube setup, refer to Appendix A.*

5.2 **Daily Operation**

The following is the typical sequence of operation for the ArcWorld III-1000 cell after start-up:

1. Load fixture on operator side of positioner table with parts to be welded.
2. Press both CYCLE START palm buttons on operator station. STATION READY light comes on and positioner sweeps, placing unwelded parts in robot work area. The robot then begins welding parts.
3. While robot is welding, load operator side.
4. Press both CYCLE START palm buttons on operator station; CYCLE LATCHED light comes on. When robot is finished welding, it returns to Safe position (Cube 1) and positioner sweeps, returning welded parts outside cell and placing newly loaded, unwelded parts in robot work area.
5. Unload welded parts from the fixture.

NOTE: Before sweeping at first power up, make sure the correct job has been loaded.

5.2.1 **Start-Up**

To start up cell from a Power-Off condition, proceed as follows:

1. Set MAIN POWER switch on XRC to ON.
2. Turn ON welding power source disconnect.
3. Set INPUT POWER switch on welding power source to ON; power source pilot light turns on.
4. Open regulator valve on welding gas supply.
5. Make sure the enclosure door is closed and the safety plug is connected.
6. Disable operator station.
7. Make sure E-STOP buttons on playback box, programming pendant, and operator station are released.
8. Press TEACH mode button on XRC playback panel; indicator light turns on.
9. Place robot in Safe or Home position (Cube 1).

5.2.2 **Robot Safe (Cube 1) Position**

To move the robot to the Safe position (Cube 1):

1. Press TEACH mode button on XRC playback panel.
2. Press TOP MENU on programming pendant.
3. Select JOB icon using cursor keys and press SELECT.
4. Cursor to SELECT JOB and press SELECT key.
5. Using cursor keys, move cursor to Cube 1 job and press SELECT. Cube 1 job appears on display screen.
6. Turn servo power ON by pressing SERVO ON, pressing TEACH LOCK and holding in ENABLE switch.
7. Use INTERLOCK and FWD buttons on programming pendant to jog robot to Safe (Cube 1) position.

5.2.3 Starting the Master Job

With the system powered up and in TEACH mode, call up the Master job:

1. Press TOP MENU key on programming pendant.
2. Select JOB icon using cursor keys and press SELECT.
3. Cursor to SELECT JOB and press SELECT key. Job list appears on display screen.
4. Using cursor keys, move cursor to Master job and press SELECT. Master job appears on display screen.
5. Make sure both enclosure doors are closed and securely latched.
6. Press PLAY mode button on XRC playback panel. Job playback operation is enabled.
7. Press SERVO ON button on playback panel.
8. Reset positioner by simultaneously pressing RESET and right CYCLE START buttons on operator station.
9. Place ENABLE/DISABLE switch on operator station in ENABLE position. XRC is placed in REMOTE mode and system control is transferred to operator station.
10. Press MASTER JOB START button on operator station. The Master job cycles, waiting for a Cycle Start input from operator station.

The ArcWorld III-1000 cell is now ready for operation.

5.2.4 Shutdown

Use the following procedure to shut down the ArcWorld III-1000 cell after operation is complete:

1. Make sure robot is in Safe position (Cube 1).
2. Turn off system servo power by pressing E-STOP button on operator station, programming pendant, or playback panel.
3. Press TEACH mode button on playback panel.
4. Set controller Main Power switch to OFF position.
5. Set Main Power switch on welding power source to OFF position.
6. Close regulator valve on welding gas supply.

The ArcWorld III-1000 cell is now shut down.

5.3 System Recovery

Under certain conditions you will be required to clear an alarm or error. Clearing an alarm or error requires different operator actions depending on the type. The paragraphs below describe the different types of alarms and errors you may encounter and how to remedy them when you do.

5.3.1 Alarms and Errors

Alarms and errors will cause the program to stop. There are three levels of alarms and errors: Error Messages, Minor Alarms, and Major Alarms. For more detailed information about alarm recovery, refer to manipulator manual that came with your system.

Error Messages

These are simple errors such as pressing the START button when the robot is not in PLAY mode, or enabling the programming pendant without the servo power being live. Errors like these are cleared by pressing the CANCEL button on the programming pendant.

Minor Alarms

Minor alarms are usually programming errors. Minor alarms might occur if a circle has been programmed with fewer than three circular points, etc. These alarms are cleared by pressing the RESET (F5) soft key on the programming pendant.

Major Alarms

Major alarms are hardware failures. Major alarms might occur because of a servo tracking error or an abnormal speed and are usually associated with crashes. To clear these alarms, you must turn off the controller and then turn it on again.

5.3.2 E-STOP Recovery

An E-STOP can occur under any of the following conditions:

- Pressing the E-STOP button on the op-station, the programming pendant, or the playback box.
- Opening the sliding door on the robot enclosure or removing the safety plug when the robot is not in TEACH mode.
- Stepping on the safety mat when the MHS-250-PR positioner is sweeping.
- Actuating the shock sensor on the torch mount.
- Loss of air system pressure.

To restart the ArcWorld III-1000 cell after an E-STOP condition occurs, follow the procedure below.

1. To clear E-STOP condition, perform any of the following actions that apply:
 - Release E-STOP button on operator station, programming pendant, or XRC playback panel.
 - Close sliding door and connect safety plug.
 - Step off safety mat.
 - Clear Shock Sensor condition (refer to Section 5.3.3).

***CAUTION!***

If an emergency stop condition occurs while the positioner is sweeping, the positioner will continue the sweep when system is reinitialized.

2. Press SERVO ON button on operator station, programming pendant, or playback panel.
3. Press RESET button and right CYCLE START button on operator station to initialize system.
4. Ensure operator station is enabled.
5. Press MASTER JOB START button on operator station.

The ArcWorld III-1000 cell is now ready to continue operation.

5.3.3 Shock Sensor Recovery

The ArcWorld welding package includes a Motoman gun mount. This mount is designed to protect the torch from damage in case of a crash. A slight deflection of the torch activates a SHOCK SENSOR message, which triggers an E-STOP condition. To clear the E-STOP condition, you must override the shock sensor and move the robot clear of the impact. To override the shock sensor, proceed as follows:



CAUTION!

It is possible to crash the robot with the Shock Sensor Override Switch left in the "Override" position. Always remember to reactivate the Shock Sensor before continuing system operation.

1. Press TOP MENU on programming pendant.
2. Select ROBOT icon using cursor keys and press SELECT.
3. Cursor to OVERRUN-S.SENSOR and press SELECT key.
4. Select RELEASE to release shock sensor.
5. Turn servo power ON by holding ENABLE switch on the programming pendant and pressing SERVO ON.

NOTE: TEACH LOCK must be ON to turn servo power on in TEACH mode.

6. Move manipulator clear of impact position.

The ArcWorld III-1000 cell is now ready to continue operation.

5.3.4 Using the Brake Release

The brake release control panel is located on front of the XRC. Each axis brake is controlled by an individual axis buttons. Simultaneously pressing the ENABLE button and one of these axis buttons releases the indicated axis. To release the brakes, proceed as follows:

1. Press E-STOP button on programming pendant, playback panel, or operator station, to be sure servo power is OFF.
2. Provide adequate support for axis to be released. Support should withstand payload of robot and approximate weight of axis. Listed below are weights support should be able to hold:

SK6 21 pounds

SK16 55 pounds



WARNING!

Releasing brakes could cause personal injury or machine damage. Always support the axis to be released BEFORE you release it.

3. Release specific axis brake by pressing and holding corresponding axis button and ENABLE button at same time.

NOTE: You must hold both the axis and ENABLE buttons down for the axis to remain released. Releasing either button will automatically lock the brakes again.

SECTION 6

MAINTENANCE

6.1 Periodic Maintenance

Table 6-1 provides periodic maintenance items and intervals for the ArcWorld III-1000 cell. Keep in mind that the maintenance intervals serve as guidelines only. You should adjust the frequency of maintenance to suit your specific work conditions.

For periodic maintenance procedures and schedules for the individual components of your ArcWorld III-1000, refer to the manipulator and additional manuals that came with your system.



CAUTION!

Use only the antifreeze provided by Motoman. Automotive antifreezes contain stop-leak additives that will clog small torch water-cooling ports and damage gaskets in water circulator pump.

Table 6-1 Periodic Maintenance

Frequency	Component	Procedure
Daily	Water Circulator (Water-cooled Torch Application only)	Check the fluid in the water circulator. Add fluid as required. Use only distilled water and approved antifreeze (Motoman P/N 131224-1).
Monthly	Positioner Nylon Ground Insulator	Check ground insulator for signs of electrical breakdown (melting). Replace the insulator as required.
<ul style="list-style-type: none"> • 1,000H • 6,000H • 12,000H 	Positioner Axis Motor Connectors	Check for loose connections. Tighten if necessary.
<ul style="list-style-type: none"> • 6,000H 	Positioner Axis Speed Reducer and Gear	Grease at 6,000H with Molywhite RE No. 00 (see Sec. 6.2.1).
<ul style="list-style-type: none"> • 12,000H 	Positioner Axis Speed Reducer and Gear	Replace grease at 12,000H with Molywhite RE No. 00 (see Sec. 6.2.2).
<ul style="list-style-type: none"> • 6,000H • 12,000H 	Limit Switch Dog for Positioner Axis	Check for damage and looseness. Tighten and check the dog movement.

H=Hours of Operation

6.2 MR1500S Positioner Maintenance Procedures

The following procedures should be performed only as needed. Read through the instructions completely before performing any maintenance procedure. Be sure that you understand the procedure, have the proper tools, and observe all applicable safety precautions.

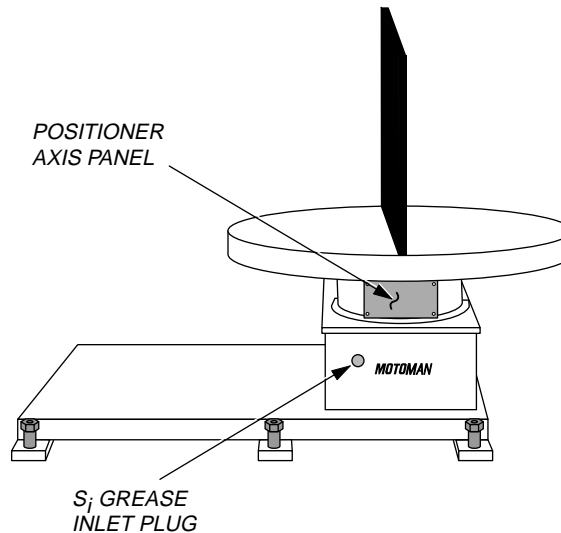


Figure 6-1 ArcWorld III-1000 (MR1500S) Positioner



WARNING!

- **Ensure that servo power is off before performing the following procedures. Observe standard lockout/tagout practices.**
- **Spilled grease is very slippery. Clean up spilled grease immediately to avoid injury to personnel.**

6.2.1 Positioner Axis Lubrication

After 6,000 hours of operation, add grease according to the following procedure:

1. Remove positioner axis panel and Si grease inlet plug (see Figure 6-1) to gain access to Si grease nipple (Zerk).
2. Remove SO exhaust filter before adding any grease (see Figure 6-2). If grease is added with exhaust filter still in place, grease will enter motor and cause damage.
3. Use a grease gun to inject Molywhite RE No. 00 grease into Si grease nipple (Zerk). Use 1,200 cc of grease for first application and 600 cc for successive applications.
4. Move positioner axis for 30 minutes to discharge extra grease.
5. Wipe SO exhaust port with clean cloth and install filter.
6. Lubricate positioner axis at regular intervals, alternating with grease replacement procedure below.

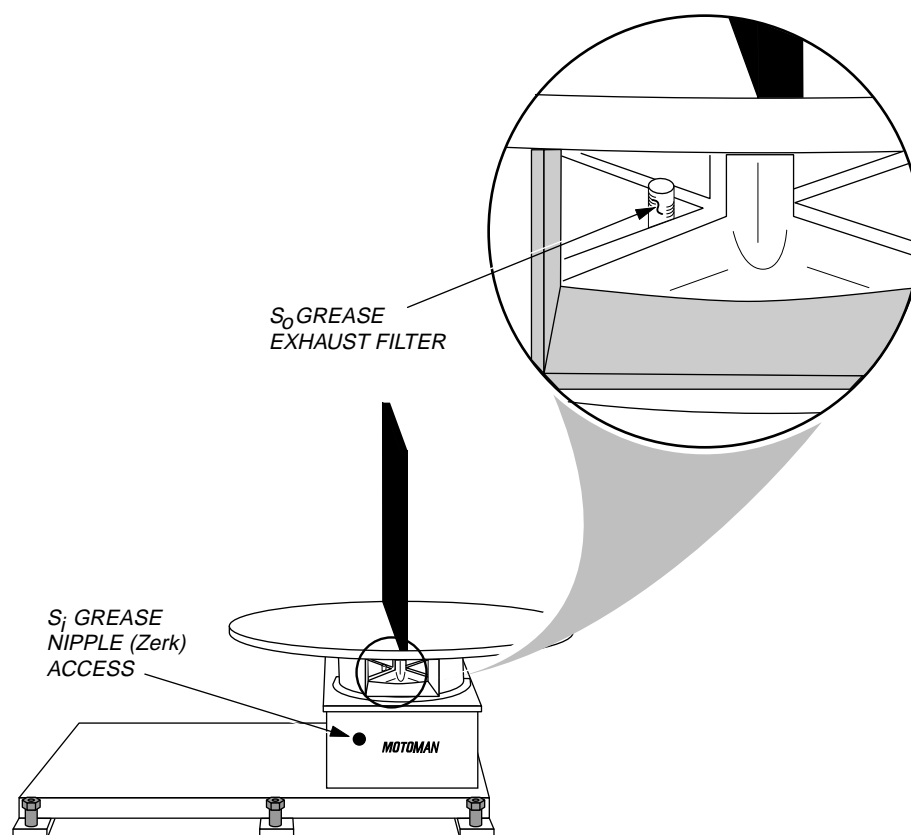


Figure 6-2 Positioner Lubrication

6.2.2 Grease Replacement

After 12,000 hours of operation, replace the grease in the positioner axis according to the following procedure:

1. Remove positioner axis panel and S_i grease inlet plug (see Figure 6-1) to gain access to S_i grease nipple (Zerk).
2. Remove S_o exhaust filter before adding any grease (see Figure 6-2). If grease is added with exhaust filter still in place, grease will enter motor and cause damage.
3. Insert a foot long pipe with a 90° elbow fitting into S_o exhaust port to route old grease away from positioner and into an appropriate size bucket.
4. Use a grease gun to inject 3,000 cc of Molywhite RE No. 00 grease into S_i grease nipple (Zerk). The new grease will replace and push out old.
5. Grease replacement is complete when new grease appears from S_o exhaust port. The new grease will appear a different, cleaner color from old.
6. Remove pipe from S_o exhaust port.
7. Move positioner axis for 30 minutes to discharge extra grease.
8. Wipe S_o exhaust port with a cloth and install filter.
9. Replace grease at regular intervals, alternating with positioner lubrication procedure above.

6.2.3 Cross Roller Bearings Lubrication

After 6,000 and 12,000 hours of operation, add grease according to the following procedure:

1. Remove exhaust plug for air flow (see Figure 6-3).
2. Use a grease gun to inject 100 cc of Alvania EP #2 grease into SC grease nipple (Zerk).
3. Install plug.
4. Repeat procedure at regular intervals.

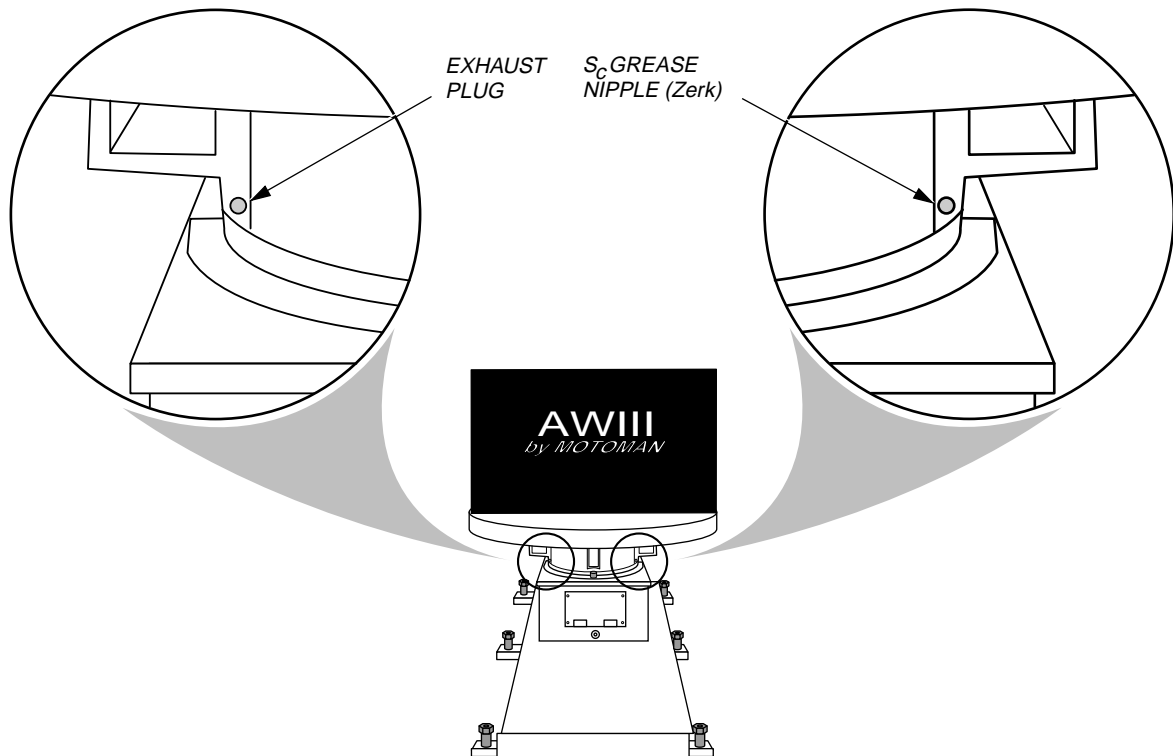


Figure 6-3 Greasing the Cross Roller Bearings

6.3 Fuse and Circuit Breaker Protection



WARNING!

Replace fuses with those of the same type and rating. Replacement with fuses of higher amperage rating or lower voltage will damage the robot controller and/or auxiliary equipment, necessitating costly replacement.

Tables 6-2 through 6-4 give the locations of fuses and circuit breakers that are significant to the operation of the total system. In most cases, spare fuses are placed in the accessory bag that came with the controller.

Abbreviations:

- CB — designates circuit breaker
- F, FU, or 101FU — designates fuse

Table 6-2 MotoArc 450 CV Fuses and Circuit Breaker

Designator	Rating	Part #	Location	Purpose
CB1	10A 115V	203627-7	Upper rear panel	Protects 115V circuit.
CB2	10A 24V	203627-7	Upper rear panel	Protects 24V circuit.
F1	0.5A	W-11166-11	On contactor box	Protects contactor circuit.

Table 6-3 Universal Welding Interface (UWI) Fuses

Designator	Rating	Part #	Location	Purpose
F1	8A 250V		On KXA motor speed control	Limits damage from shorts or component breakdowns in DC power supply module.
FU1	4A 250V	Wickman 19374K-4A	On interface board	Protects 115V circuit.
FU2	0.25A 125V	Wickman 19303K-250A	On interface board	Protects shock sensor circuit.
FU3	0.5A 125V	Wickman 19303K-500A	On interface board	Protects 24V circuit.
Fuse	1A 250V	TD-1	Front of Com-Arc box	Protects 200V circuit.

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