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SECTION 1
INTRODUCTION

The Arc-WorldLite 50 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 Arc-WorldLite 50 features a Motoman SV3X arc welding robot and XRC robot controller with menu-driven arc welding application software, complete welding package, stationary weld table, 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 Arc-WorldLite 50 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 Arc-WorldLite 50 system.

SECTION 3 - DESCRIPTION OF EQUIPMENT
Provides a detailed description of the major components of the Arc-WorldLite 50 system. This section also includes a table of component specifications.

SECTION 4 - INSTALLATION
Provides instructions for set up and installation of the Arc-WorldLite 50 system.

SECTION 5 - OPERATION
Provides instructions for basic operation of the Arc-WorldLite 50 system. This section provides procedures for start-up, loading, normal operation, fault recovery, and shutdown.

SECTION 6 - MAINTENANCE
Contains a table listing periodic maintenance requirements for the components of the Arc-WorldLite 50 cell.
1.2 **System Overview**

The Arc-WorldLite 50 provides a complete arc welding solution in a standardized configuration. The system is designed around a Motoman SV3X arc welding robot with XRC controller, and includes a complete welding package. A stationary weld table with protective operator door provides easy operator access to parts, and a safe welding environment. 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 Arc-WorldLite 50 cell.

1.2.1 **System Layout**

The robot manipulator, XRC controller and welding power source, all share a common base for ease of installation and to help maintain proper alignment between components. The Arc-WorldLite 50 cell is fully enclosed by sheet metal and weld curtains to protect the operator. All operator controls are accessible from outside the enclosure.

1.2.2 **Major Components**

The Arc-WorldLite 50 includes the following major components:

- Motoman SV3X manipulator and XRC controller
- Stationary weld table
- Operator station
- Welding equipment, including the following:
  - Welding power source
  - Torch (water-cooled or air-cooled)
  - Wire feeder
  - Torch mount
- Safety equipment, including the following:
  - Protective arc screen
  - Customer actuated Emergency Stops
  - Software defined Interference Cubes

1.2.3 **Optional Equipment**

The following optional equipment is available for use with the Arc-WorldLite 50:

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

Figure 1-1  System Layout

FRONT VIEW

REAR VIEW

WORLDLITE
BY MOTOMAN

ROBOT

WIRE FEEDER

WIRE CASSETTE

POWER DISCONNECT

110 VOLT OUTLET

POWER SOURCE

SAFETY FENCE

OPERATOR STATION

XRC CONTROLLER

OPERATOR STATION

FRONT VIEW

Figure 1-1  System Layout

MOTO MAN

1-3  Arc-WorldLite 50 System Manual
1.3 Reference to Other Documentation
For additional information refer to the following:
- Motoman SV3X Manipulator Manual (P/N 139067-1)
- 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 (SV3X)
- Application Type (welding)
- System Type (Arc-WorldLite 50)
- Software Version (3.74)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)
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: 313/994-6088
FAX: 313/994-3338

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 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 **SV3X Robot Description**

The Motoman SV3X robot and Xtra Robotic Controller (XRC) represent state-of-the-art technology in robotics today. The six-axis SV3X robot has a payload of 3 kg (6.6 lbs). It features a 1,019 mm (40.1 in.) vertical reach and has a relative positioning accuracy of ± 0.03 mm (0.001 in.).

The SV3X robot can reach below its own base as well as behind itself. The SV3X can also be mounted in floor, wall, or ceiling configurations with few hardware modifications. For more information, refer to the manipulator manual that came with your system.

3.2 **XRC Controller**

The XRC robotic controller (see Figure 3-1) coordinates the operation of the Arc-WorldLite 50 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](image)

**Servo On Ready**
The SERVO ON READY push button turns servo power ON. The switch lights when servo power is on. In TEACH mode, the SERVO ON READY push button 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 and TEACH) 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.

**Remote**
This push button disables the playback panel and enables servo power to be applied if play mode is set and positioner door is up.

**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).

**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.
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 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. The following paragraphs describe the operator station controls.

![Figure 3-6 Operator Station](image)

3.3.1 Cycle Start

**WARNING!**

The operation of the CYCLE START palm button 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 CYCLE START push button, located at the top of the operator station, completes the CYCLE START circuit when the operator presses this button. The operator door closes and the robot moves to the appropriate station. The following is an example of typical operation:

The CYCLE START push button is activated, sending a signal to the XRC to close the operator door. Switches located on the operator door verify the operator door is closed, applies servo power, starts the job, and enables the robot to enter the work area and perform the assigned job.
3.3.2 Emergency Stop (E-STOP)

The operator station E-STOP button is connected in series with the system Emergency Stop circuit. Pressing the E-STOP button interrupts this circuit and stops all system operation. Brakes are applied to the robot and all servo power is removed from the system. All door motion commands are cancelled.

**NOTE:** The air operated safety door may continue to move after an E-STOP occurs until cylinder air pressure equalizes.

3.3.3 Door Status

The lower door push button opens the positioner door when pressed. This allows the operator to open the positioner door when needed.

3.4 Stationary Weld Table

The Arc-WorldLite 50 features a weld table with a door that protects the operator from arc radiation, weld splatter, and physical contact with the robot arm. When the robot is finished working, the door lowers, giving the operator access to unload and reload parts from the fixture.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part/Fixture Rating</td>
<td>453.6 kg (1,000 lbs)</td>
</tr>
<tr>
<td>Temperature Operating Range</td>
<td>4-43°C (40-110˚F)</td>
</tr>
<tr>
<td>Humidity (maximum)</td>
<td>Non-condensing 10-90% relative humidity</td>
</tr>
<tr>
<td>Door Cycle Speed</td>
<td>3 - 4 seconds (approximate)</td>
</tr>
<tr>
<td>Air Pressure Requirements</td>
<td>0.04 cmm at 620.5 kPa (1.5 scfm at 90 psi) typical</td>
</tr>
<tr>
<td>Arc Shield</td>
<td>A single vertically actuated sheet metal screen for arc radiation protection between operator and robot area.</td>
</tr>
<tr>
<td>Welding Current Rating</td>
<td>600 amperes at 100% duty cycle</td>
</tr>
</tbody>
</table>

**NOTE:** In high humidity areas, use surface protection to prevent corrosion of the tooling plate.

3.4.1 Arc Shields

**WARNING!**

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

Two separate arc screens are used on the Arc-WorldLite 50. The first is the metal arc screens on the front and sides of the weld table. These screens block arc radiation and sparks from the welding operation. The material used to cover the back of the robotic cell acts as the second arc screen. This material reduces the amount of ultra-violet radiation that escapes from the robotic cell.
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 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 Power Sources](image_url)
Mobility
The steel base that supports the power source for the Arc-WorldLite 50 system is mobile. Four casters enable the power source to be wheeled away from the welding cell for ease of service and installation.

To remove the power source, remove the two bolts that fasten the base to the welding cell. The cross member that stabilizes the frame must also be removed before the power source is wheeled out.

3.5.2 PWF Wire Feeder
The wire feeder is located on the back of the equipment frame. 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 Arc-WorldLite 50 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 Arc-WorldLite 50 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 Shields

**WARNING!**
Although the arc curtain blocks dangerous arc radiation, never look directly at the arc without protective eye wear!

Two separate arc screens are used on the Arc-WorldLite 50. The first is the metal arc screen on the front of the weld table. These screens block arc radiation and sparks from the welding operation. The material used to cover the back of the 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 Arc-WorldLite 50 system encloses the entire robotic cell. It forms a physical barrier preventing entry into the robot envelope during automatic operation.

3.6.3 Emergency Stops (E-STOPS)

In addition to the safety features described above, the Arc-WorldLite 50 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.

3.6.4 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. For detailed information about the operation of the ENABLE switch, refer to the XRC section in the manipulator manual that came with your system.

3.6.5 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 Gate Interlock Error. 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.

In TEACH mode, power to the table is removed if the cell door is open. In order to sweep the table in teach, the door must be closed.
3.6.6 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 the 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:

\[ R1 = SOUT \#081 - 104 \]

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 your XRC manipulator for basic interference cube setup.

3.6.7 Brake Release Control

**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.
SECTION 4
INSTALLATION

The Arc-WorldLite 50 system can be installed easily in just a short time by one or two workers. 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 Arc-WorldLite 50 is not a task for the novice. The Arc-WorldLite 50 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 Arc-WorldLite 50 is included with the system. 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)

4.1.2 List of Tools Required
- Safety glasses
- Face shields
- Gloves
- Level
- Rachet with 3/4-in. socket
- Adjustable wrench set
- Hammer drill with appropriate concrete bits
- Phillips and flat screwdrivers
- Hammer
- Socket set
- Forklift and/or overhead crane
- Air-impact gun with 3/4-in. socket
- Open-end wrench set
- Two socket-head (Allen)
- Wrench sets (standard and metric)
4.2 Site Preparation

To prepare your site, proceed as follows:

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

   **NOTE:** 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.

   ![Figure 4-1 Area Needed for Installation](image)

4.3 Installing the Arc-WorldLite 50 Common Base

The Arc-WorldLite 50 is shipped completely assembled on a wooden shipping skid. To install the Arc-WorldLite 50 common base, proceed as follows:

1. Unbolt Arc-WorldLite 50 common base from wooden shipping skid using a 3/4-in. socket (see Figure 4-2).

   **WARNING!**

   The robot/positioner common base weighs 1724 kg (3800 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, remove Arc-WorldLite 50 common base from the skid.
3. Place Arc-WorldLite 50 common base in position (see Figure 4-1).
4. Carefully remove protective plastic wrapping from all system components.
5. Inspect all system components, for shipping damage.

   **NOTE:** If damage is found, notify shipper immediately.
4.3.1 Removing the Shipping Brackets

**CAUTION!**
Shipping brackets must be removed before operation. Failure to do so will result in damage to the robot drive mechanisms.

Three yellow brackets (see Figure 4-3) 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 system is in place, remove all shipping brackets.
4.4 **Leveling and Securing the Cell**

After everything is in position, the equipment should be leveled and then secured to the floor. The lag bolts are shipped in the accessories box. Refer to your Motoman Robot manipulator manual for floor loading requirements. To level and secure the equipment, proceed as follows:

1. Level cell base by adjusting leveling bolts (see Figure 4-4).
2. Insert a 1/2-in. concrete drill bit through center of the leveling bolts and drill holes for lag bolts.
3. Vacuum concrete dust from holes.
4. Using lag bolts supplied, lag Arc-WorldLite 50 common base to floor.

![Location of Leveling Bolts](image)

**Figure 4-4  Location of Leveling Bolts**

4.5 **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.

⚠️ **CAUTION!**

*Route wires and cables away from hazardous work areas to avoid wire breakage and unnecessary interruption of cell operation.*

4.5.1 **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 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.

4.5.2 Connecting the Water Circulator (Optional)

If your system uses the water cooled welding torch, it is necessary to connect the Motoman water circulator. To connect the water circulator, proceed as follows:

1. Connect two water hoses from weld torch to connections on water circulator marked WATER-IN and WATER-OUT (see Figure 4-5).

CAUTION!

- Use only the antifreeze provided by Motoman. Automotive antifreeze contains stop-leak additives that will clog small torch water-cooling ports and damage gaskets in pump.
- Do not fill water circulator past fill line. Damage to water circulator could occur.

2. Fill water circulator tank with antifreeze coolant provided (P/N 131224-1). Do not fill water circulator past fill line.
3. Plug power cable into electrical outlet on back of power source, or the 110 Volt AC (10 Amp.) outlet.
4.6 Connecting the Gas/Air Services

The gas and air hoses for the Arc-WorldLite 100 are already connected when the unit is shipped. Gas and air services must be completed after the cell has been secured to the floor. The gas and air connections are located in the back of the cell above the power box (see Figure 4-6).
4.7 **Connecting the Power**

After all of the system components have been properly installed, power must be connected to the main disconnect.

4.8 **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, proceed as follows:

1. Check that all three yellow shipping brackets have been removed from robot (see Section 4.3.1).
2. Check that cell door is closed and latched.
3. Check that all cable connections are tight.
4. Check air line connections to optional torch tender and wire cutter.
5. Check that welding power source is set correctly (see welding power source vendor's manual).
6. Verify that incoming line power matches the input power specified on the sticker on the front of the XRC.

Your Arc-WorldLite 50 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.

7. Check all system E-STOPS (pendant, operator station, break a ways, playback panel).
8. Check system Hold buttons.

4.9 **Installation of Tooling and Fixtures**

Your Arc-WorldLite 50 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:

- Door goes up and down.
SECTION 5
OPERATION

The Arc-WorldLite 50 is a fully integrated robotic GMAW welding cell. After production parts have been loaded onto the weld table, the operator door closes, servo power is applied allowing the robot to safely process the parts. The robot welds the parts and returns to the home position, the operator door opens removing servo power allowing the operator to safely remove the welded parts and load new production parts.

This section provides operation instructions for the Arc-WorldLite 50 system. Operation procedures include the following:

- Programming (Section 5.1)
- Daily Operation (Section 5.2)
- Fault 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 Hot Line, at (937) 847-3200 (see Section 1.4).

5.1.1 I/O Assignment

The Arc-WorldLite 50 has dedicated input and output capabilities. For more information on user and dedicated I/O, refer to the XRC Concurrent I/O Parameters Manual (P/N 142102-1). The Arc-WorldLite 50 has the following user inputs and outputs (see Table 5-1 and Table 5-2).
5.2 Daily Operation

The following is the typical sequence of operation for the Arc-WorldLite 50 cell after start-up:

NOTE: By default, the operator door rests in the down position to permit parts loading. This condition occurs only when the robot is in the Home position (Cube 24) and CYCLE START has not been activated.

1. Load System with production parts.
2. Press CYCLE START button on operator station. Operator door rises, servo power is applied and robot begins welding.
3. When robot finishes welding, it returns to home position and operator door lowers, servo power is removed allowing the operator to unload parts.

5.2.1 Start-Up

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

1. Turn on main power disconnect for cell.
2. Set MAIN POWER switch on XRC to ON.
3. Set INPUT POWER switch on welding power source to ON.
4. Open regulator valve on welding gas supply.
5. Open air supply valve.
6. Press TEACH mode button on XRC playback box.
7. Place robot in home position (Cube 24).

---

Table 5-1  XRC User Inputs

<table>
<thead>
<tr>
<th>Input</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN#001</td>
<td>CYCLE START STATION A</td>
</tr>
<tr>
<td>IN#002</td>
<td>LOWER DOOR</td>
</tr>
<tr>
<td>IN#003</td>
<td>DOOR CLOSED STATION A</td>
</tr>
<tr>
<td>IN#004</td>
<td>NOT USED</td>
</tr>
<tr>
<td>IN#005</td>
<td>NOT USED</td>
</tr>
<tr>
<td>IN#006</td>
<td>NOT USED</td>
</tr>
<tr>
<td>IN#007-IN#016</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>

Table 5-2  XRC User Outputs

<table>
<thead>
<tr>
<th>Input</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT#001</td>
<td>LOWER DOOR</td>
</tr>
<tr>
<td>OUT#002</td>
<td>RAISE DOOR</td>
</tr>
<tr>
<td>OUT#003-OUT#016</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>
5.2.2 Robot Home Position

To move the robot to the home position (Cube 24), proceed as follows:

1. Press TEACH mode button on XRC playback box.
2. Press SELECT on programming pendant.
3. Press SEL JOB (F4).
4. Using cursor keys, move cursor to R1home job and press ENTER. R1home job appears in display screen.
5. Turn servo power on by pressing SERVO ON push button on playback box.
6. Press ENABLE function key on programming pendant.
7. Use TEST START and FWD buttons on programming pendant to jog robot to home (Cube 24) position.

5.2.3 Starting the Master Job

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

1. Press SELECT key on programming pendant.
2. Press SEL JOB (F4). Job list appears on display screen.
4. Make sure cursor is at top of the job.
5. Press PLAY mode button on XRC playback box. Job playback operation is enabled.
6. Press REMOTE button on playback box.
7. Pressing cycle start at the table will close the door and start the welding job.

The Arc-WorldLite 50 cell is now ready for operation.

5.2.4 Shutdown

Use the following procedure to shut down the Arc-WorldLite 50 cell after operation is complete:

1. Make sure robot is in home position (Cube 24).
2. Turn off robot servo power by pressing E-STOP button on operator station, programming pendant, or playback box.
3. Press TEACH mode button on playback box.
4. Set controller Main Power switch to OFF position.
5. Set main power disconnect switch to OFF position.

The Arc-WorldLite 50 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. Different types of alarms and errors are described below.

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 an E-STOP button on the operator station, programming pendant, or playback box.
- Actuating the shock sensor on torch mount.

To restart the system after an E-STOP condition occurs, proceed as follows:

1. Clear E-STOP condition by performing any of following actions that apply:
   - Release the E-STOP button on the operator station, programming pendant, or XRC playback box.
   - Clear Shock Sensor condition (see Section 5.3.3).

2. Job Continuation
   a) If job execution can continue from the last programmed point without further E-STOPs, PLAY mode and REMOTE mode must be set and then the operator door must be cycled.
   b) If robot must be manually taught to avoid further collisions, depress the TEACH and SERVO ON push buttons to manually jog the robot to home position before resuming play mode operation.

The Arc-WorldLite 50 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.


The Arc-WorldLite 50 cell is now ready to continue operation.
SECTION 6
MAINTENANCE

6.1 Periodic Maintenance

For periodic maintenance procedures and schedules for the SV3X robot and the XRC controller, refer to the manipulator manual that came with your system.

Table 6-1 provides a list of periodic maintenance to be performed on the Arc-WorldLite 50 cell. Keep in mind that the maintenance intervals given serve as guidelines only. You should adjust the frequency of maintenance to suit your specific work conditions.

**CAUTION!**

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

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Component</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>Water circulator (water-cooled torch application only)</td>
<td>Check the fluid in the water circulator. Add fluid as required. Use only distilled water and approved antifreeze (Motoman P/N 131224-1).</td>
</tr>
<tr>
<td>Daily</td>
<td>Air filter/regulator for water (high-humidity environments)</td>
<td>Inspect left glass cylinder for water. If water is present, loosen the valve at the bottom of the cylinder to expel any moisture.</td>
</tr>
<tr>
<td>Weekly</td>
<td>Positioner Air filter/regulator oil level</td>
<td>Inspect right glass cylinder and transparent neck on the top of the regulator. If oil falls below half, add oil.</td>
</tr>
</tbody>
</table>
6.2 **Fuse and Circuit Breaker Protection**

Tables 6-2 and 6-3 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 with the controller.

![Warning Icon]

**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.

Abbreviations:

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

**Table 6-2 Universal Welding Interface (UWI) Fuses**

<table>
<thead>
<tr>
<th>Device</th>
<th>Rating</th>
<th>Part#</th>
<th>Location</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>8A 250V</td>
<td>On KXA motor speed control</td>
<td>Limits damage from shorts or component breakdowns in DC power supply module.</td>
<td></td>
</tr>
<tr>
<td>FU1</td>
<td>4A 250V</td>
<td>Wickman 19374K-4A</td>
<td>On interface board</td>
<td>Protects 115V circuit.</td>
</tr>
<tr>
<td>FU2</td>
<td>0.25A 125V</td>
<td>Wickman 19303K-250A</td>
<td>On interface board</td>
<td>Protects shock sensor circuit.</td>
</tr>
<tr>
<td>FU3</td>
<td>0.5A 125V</td>
<td>Wickman 19303K-500A</td>
<td>On interface board</td>
<td>Protects 24V circuit.</td>
</tr>
</tbody>
</table>

**Table 6-3 MotoArc 450 CV Fuses and Circuit Breaker**

<table>
<thead>
<tr>
<th>Device</th>
<th>Rating</th>
<th>Part#</th>
<th>Location</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB1</td>
<td>10A</td>
<td>203627-7</td>
<td>Upper rear panel</td>
<td>Protects 115V circuit.</td>
</tr>
<tr>
<td>CB2</td>
<td>10A</td>
<td>203627-7</td>
<td>Upper rear panel</td>
<td>Protects 24V circuit.</td>
</tr>
<tr>
<td>F1</td>
<td>0.5 A</td>
<td>W-11166-11</td>
<td>On contactor box</td>
<td>Protects contactor circuit.</td>
</tr>
</tbody>
</table>
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