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NOTES
Chapter 1
Introduction

1.1 About This Document

This System Manual provides an overview of the complete Motoman Modular ArcWorld® C-200/500 system. For detailed information on any specific system component listed in this document, please refer to the documentation package that is included with your Modular ArcWorld® C-200/500 system (refer to Section 1.3).

Note: This manual documents a standard Motoman system. If your system is custom or modified, please use this manual in conjunction with the drawings, schematics, and parts listing (Bill of Material) for your specific system. The drawings, schematics, and parts listing are included in the documentation package supplied with your Motoman system.

This System Manual contains the following chapters –

CHAPTER 1 - INTRODUCTION
This chapter introduces the Modular ArcWorld® C-200/500 System Manual, provides an overview of the Modular ArcWorld® C-200/500 system, lists reference documents that are included with the documentation package, and provides Motoman Customer Support contact information.

CHAPTER 2 - SAFETY
This chapter provides general information regarding the safe installation, maintenance, and operation of the Modular ArcWorld® C-200/500 system.

CHAPTER 3 - EQUIPMENT DESCRIPTION
This chapter describes the major components of the Modular ArcWorld® C-200/500 system.

CHAPTER 4 - INSTALLATION
This chapter provides installation instructions for Modular ArcWorld® C-200/500 system components.

CHAPTER 5 - OPERATION
This chapter provides an overview of Modular ArcWorld® C-200/500 system operation – start-up, loading, normal operations, fault recovery, and system shutdown.

CHAPTER 6 - MAINTENANCE
This chapter provides a listing of preventive maintenance suggestions for certain components of the Modular ArcWorld® C-200/500 system.
APPENDIX A - ANCHORING

This appendix gives foundation and anchoring suggestions for Modular ArcWorld® C-200/500 system anchoring.

1.2 System Overview

The Modular ArcWorld® C-200/500 system provides a complete arc welding solution in a standardized configuration (see Figure 1). The system is designed around a Motoman SSA2000 robot, an NX100 controller, welding power source, and two workstations; Station 1 and Station 2 and can contain any combination of the following: MHTH-300 kg positioner, MHTH-600 kg positioner, MHTH-900 kg positioner, MHT-500 kg positioner, MTH900-500TR Tilt/Rotate, and stationary table kit. The maximum tooling diameter for the positioners is 1,100 mm.

The Modular ArcWorld® C-200/500 system features a total safety environment that meets or exceeds the requirements of the ANSI/RIA R15.06 standard, and is designed to safeguard both personnel and equipment. Heavy-gauge wire mesh safety fencing prevents unintended entry of personnel into the work cell while it is in operation. Arc curtains cover the wire mesh fencing to block ultraviolet light that would otherwise radiate from the work cell during welding operations. An interlocked access door, at the rear of the work cell, provides convenient access to the torch reamer option, while providing a safety interlock to disable all equipment should the access door be opened while the robots are active. A safety light curtain system provides a “sensing field” in front of each station to protect the operator from positioner movement. In addition, a cylindrical physical barrier is mounted on the robot to limit operator access to the robot to one opening. The physical barrier is mounted on the robot using existing mounting points. Maximum robot travel is also physically limited by an S-axis “hard stop” at the base of the robot.

Figure 1  Overview and Component Location – Modular ArcWorld® C-200/500 System
1.2.1 System Layout

All components of the Modular ArcWorld® C-200/500 system are mount to the common cell assembly base. Heavy-gauge, wire mesh safety fencing is provided for installation at the customer’s location. The NX100-DRC controller assembly and both welding power sources are located outside of the work cell. All system controls, including those on the Programming Pendant, NX100-DRC controller assembly, welding power supplies, and Operator Station are safely accessible from outside the Modular ArcWorld® C-200/500 work cell (see Figure 1 for location of these components).

1.2.2 Major Components

The Modular ArcWorld® C-200/500 system includes the following major components –

- Motoman SSA2000 manipulator (robot)
- NX100 controller
- Positioner Kit (two)
  - MHHT-300/600/900
  - MHT-500
  - MHHT900-500TR Tilt/Rotate
  - Stationary Table
- External Axis Kits (one) - Not required with Stationary Tables
  - NX100 Single External Axis Kit
  - NX100 Dual External Axis Kit
  - NX100 Dual External Axis Kit with Single Skyhook
  - NX100 Triple External Axis Kit
  - NX100 Quad External Axis Kit - the optional Common Equipment Table is required
- Operator Station
- Programming Pendant
- Welding equipment –
  - Welding power supply
  - Welding torch (air-cooled – standard; water-cooled – optional)
  - Wire feeder
  - Applicable welding interface
  - Torch mount
- Safety equipment –
  - Heavy gauge, wire-mesh safety fencing
  - Heavy gauge arc curtains
  - Interlocked safety light curtain system
  - Interlocked work cell entry door
  - Rollup door for each station
1.2.3 **Optional Welding Equipment**

The following optional welding equipment is available for use with the Modular ArcWorld® C-200/500 system –

- Torch cleaner
- Wire cutter
- Water-cooled torch (w/ coolant circulator)
- Bulk wire dereeler, 454 kg
- ComArc™ (seam tracking)
- TouchSense™ (starting point detection)
- ToolSight® (auto verification of correct torch alignment)

1.3 **Reference Documentation**

For additional information on individual Modular ArcWorld® C-200/500 components, refer to the following documentation that is included with your Modular ArcWorld® C-200/500 system –

- Motoman SS-A2000 Manipulator Manual (P/N 153599-1)
- Motoman NX100 Controller Manual (P/N 149201-1)
- Motoman NX100 Maintenance Manual (P/N 150133-1)
- Motoman NX100 Operator's Manual for Arc Welding (P/N 149235-1)
- Motoman NX100 Concurrent I/O Parameter Manual (P/N 149230-1)
- Motoman NX100 Independent/Coordinated Control Function Manual (P/N 149648-1)
- Motoman MHTH Headstock Instructions Manual (P/N 152568-1)
- Motoman INFORM User's Manual (P/N 150078-1)
- Motoman HyperFeed II with MWII HyperFeed II EA with MW II System Manual (P/N 151116-1)
- Vendor manuals for system components not manufactured by Motoman

1.4 **Customer Support Information**

If you need assistance with any aspect of your Modular ArcWorld® C-200/500 system, please contact Motoman Customer Support at the following 24-hour telephone number –

937. 847. 3200

For routine technical inquiries, you can also contact Motoman Customer Support at the following e-mail address –

techsupport@motoman.com

When using e-mail to contact Motoman Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

*Note: Use e-mail for routine inquiries, only. If you have an urgent or emergency need for service, replacement parts, or information, please contact Motoman Customer Support at the telephone number shown above.*
Please have the following information ready before you call –

- **System**: Modular ArcWorld® C-200/500
- **Robots**: SSA2000
- **Controller**: NX100
- **Positioner Kit**:
  - MHHTH-300
  - MHHTH-600
  - MHHTH-900
  - MHT-500
  - MHHTH-900-500TR Tilt/Rotate
- **Primary Application**: Arc welding
- **Software Version**: Access this information on the Programming Pendant display screen by selecting MAIN MENU → SYSTEM INFO → VERSION
- **Robot Serial Number**: Located on data plate of each robot
- **Robot Sales Order Number**: Located on data plate of NX100
- **Warranty ID Code**: Located on back of the Programming Pendant
NOTES
Chapter 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 (ANSI/RIA R15.06-1999). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the robot system. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the robot cell. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE ROBOT SYSTEM!

We recommend approved Motoman training courses for all personnel involved with the operation, programming, or repair of the robot system. This training is designed to familiarize personnel with the safe and correct operation of the robot 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, Operation, and Maintenance Safety (Section 2.6)

### 2.2 Important Advisory Information

Throughout this manual you will find advisory paragraphs (denoted by graphic symbols and bold typeface). All of these (except “NOTE”) direct the reader's attention to information and procedures that are essential to the safety of personnel or protection of equipment.

The type of information contained in the various advisories is described below. These are listed here in descending order of importance to the safety of personnel and protection of equipment.

**DANGER!**
Information appearing under the DANGER caption concerns the protection of personnel from an 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 that can be 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 R15.06-1999, section 4.2.5, Sources of Energy, 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 R15.06-1999 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 equipment is provided as standard:

• Safety fences and barriers
• Light curtains and/or safety mats
• Door interlocks
• Emergency stop palm buttons located on operator station, robot controller, and programming pendant

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 R15.06-1999 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, Operation, and 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. 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 program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

• 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 all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
• Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
• Check the E-Stop button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
• Back up all programs and jobs onto suitable media before 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.
• Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. 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.
• The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. 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 and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.
• Check and test any new or modified program at low speed for at least one full cycle.
• This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

• Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

• Use proper replacement parts.

• 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).
NOTES
Chapter 3

Equipment Description

3.1 Robot Description

The Modular ArcWorld® C-200/500 system uses a Motoman SSA2000 “Super Speed” arc welding robot to reduce welding cycle time and enhance productivity. The SSA2000 robot has a payload capability of 3 kg, a reach of 1390 mm, and features a repeatability accuracy of ±0.08 mm. The SSA2000 robot has an integrated through-the-arm torch cabling, which eliminates cable interference, simplifies programming and reduces cable wear. The T-axis (Twist) can rotate the welding torch ±200 degree without cable interference.

For additional information on the Motoman SSA2000 robot, please refer to the SSA2000 Manipulator Manual included with your Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).

3.2 NX100 Controller

The NX100 robotic controller, shown in NX100 Controller, features a Windows® CE programming pendant with color touch screen, high-speed processing, built-in Ethernet, and a robust PC architecture. The NX100 easily handles multiple tasks and can control up to four robots (up to 36 axes, including robots and external axes), and I/O devices. Advanced Robot Motion (ARM) control provides high-performance path accuracy and vibration control.

The NX100 coordinates the operation of the Modular ArcWorld® C-200/500 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 main logic functions, servo control, program and constant data memory, and power distribution. For more information, refer to the controller manual that came with your system. The NX100 controller features an embedded real-time operating system (RTOS) and is programmed with the Motoman INFORM programming language.
Chapter 3 Equipment Description

3.3 Programming Pendant

The Programming Pendant (see Figure 3) provides the primary means of programmer/operator interaction with the Modular ArcWorld® C-200/500 system. The pendant features the Windows® CE operating system and displays information on a 6½ in., color LCD, touch-screen display. The pendant also incorporates a CompactFlash® card slot for program backups. The Programming Pendant provides icon-driven system programming. It also features a menu-driven interface to simplify operator interaction with the robots. Most operator controls are located on the Programming Pendant. By using the Programming Pendant, the operator can teach robot motion; perform programming, editing, maintenance, and diagnostic functions. For detailed information on the pendant programming keys, programming functions, and display functions, refer to the NX100 Operator’s Manual for Arc Welding included with your Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).
Note: The Programming Pendant LCD touch screen display features a “screen saver” that causes the screen to go dark after a few minutes of inactivity. Press any key to restore screen.

Note: Operator Station “enable” or “disable” is accomplished with the Programming Pendant MODE SELECT SWITCH. To transfer control of the Modular ArcWorld® C-200/500 system to the Operator Station, set the Programming Pendant MODE SELECT SWITCH to REMOTE.
3.4 Operator Station

The Operator Station (see Figure 4) is mounted on a panel between the two safety roll-up doors. See Figure 1 for location of the Operator Station in relation to other components of the Modular ArcWorld® C-200/500 system.

![Operator Station Controls](Image)

3.4.1 Operator Station Function – Cycle Start/Cycle Latched

**WARNING!**

The operation of the CYCLE START/CYCLE LATCHED button is dependent on the structure of the Master Job. Any alteration of the Master Job could result in injury to personnel or damage to equipment.

Pushing the green CYCLE START/CYCLE LATCHED push button, located on the Operator Station, initiates a positioner cycle if the robot is in the Home (Safe) position. If the CYCLE START/CYCLE LATCHED button is pressed while the robot is still welding, or otherwise not in the Home (Safe) position, the CYCLE START/CYCLE LATCHED command is “latched” (stored in) in the NX100 controller circuitry. When the robot returns to the Home (Safe) position, the “latched” CYCLE START/CYCLE LATCHED command is automatically executed in the second station. Circuitry in the NX100 controller prevents the positioner from continuously cycling, should the operator depress and hold the CYCLE START/CYCLE LATCHED push button.
3.4.2 **Operator Station Function – Emergency Stop (E-Stop)**

Pressing the Operator Station E-Stop push button initiates an emergency stop (E-Stop). Refer to Section 3.7.2 for a discussion of the E-stop function, and procedures for recovering the Modular ArcWorld® C-200/500 system from the emergency stop (E-Stop) condition.

3.4.3 **Operator Station Function – Positioner Auto/Manual**

The POSITIONER AUTO/MANUAL selector switch is used to select AUTO or MANUAL mode for the positioner. When the selector switch is in the AUTO position, the robot welds parts immediately after the positioner rotates. In MANUAL mode, the positioner rotates but the robot does not weld parts until the operator selects AUTO mode.

*Note: The POSITIONER AUTO/MANUAL command depends upon the structure of the Master Job.*

3.4.4 **Operator Station Function – Joystick (Optional)**

The Joystick controls positioner rotation and user defined load positions. Moving the joystick to the right (FWD) indexes the operator tooling in a clockwise direction at 30-degree intervals. Moving the joystick to the left (REV) indexes the operator tooling in a counter-clockwise direction at 30-degree intervals. Moving the joystick forward (HOME) moves the positioner headstock to zero degrees (home position).

3.5 **Positioner Kits**

3.5.1 **MHTH-300/600/900**

Each of these Motoman positioners have a 110 mm diameter thru-hole to allow cables, pneumatics and/or hydraulic lines and none require a tailstock or MotoMount. The load capacity corresponds to the model number: MHTH-300 capacity is 300 kg and indexes 180 degrees in 1.4 seconds, MHTH-600 is 600 kg and indexes 180 degrees in 2.1 seconds, and the MHTH-900 has the capacity of 900 kg and indexes 180 degrees in 2.9 seconds. This load capacity is 152 mm from the center of rotation and the overhang load capacity is 1578 kg at 500 mm from the face plate.

For additional positioner information (including an illustrated parts list, lifting and leveling instructions, load capabilities, and dimensions), refer to the MHTH Headstock Instructions Manual that is included with your Modular ArcWorld® C-200/500 system documentation (refer to Section 1.3).

*Note: The customer shall supply all tooling and fixtures for the Positioner Kits.*

*Note: Motoman recommends application of a corrosion/rust preventive compound to tooling and fixtures located in a high-humidity environment.*
3.6 **Welding Equipment**

In its standard configuration, the Modular ArcWorld® C-200/500 system includes a welding power source, wire feeder, torch, and torch mount for the robot. Optional welding equipment is available for the Modular ArcWorld® C-200/500 system (refer to Section 1.2.3). Optional welding equipment may be included with your Modular ArcWorld® C-200/500 system shipment.

3.6.1 **Welding Power Sources**

Motoman offers various brands and types of welding power sources. The actual brand and type of welding power source supplied with the Modular ArcWorld® C-200/500 system depends on the customer’s specific application and preference. For specific information on the welding power sources supplied with your Modular ArcWorld® C-200/500 system, refer to the welding power source vendor manual that is included with your system (refer to Section 1.3).

3.6.2 **HyperFeed II Wire Feeder**

A welding wire feeder is mounted on the upper arm (U-Axis) of the robot. The wire feeder is the “4-roll” type and provides reliable wire feeding at rates up to 750 in. per minute (ipm). Interchangeable feed rolls are used to accommodate different wire gauges and wire types. For additional information on how the wire feeder is mounted to the robots upper arm, including allowable load and installation position, refer to the *HyperFeed II with MWII HyperFeed II EA with MW II System Manual* that is included with your Modular ArcWorld® C-200/500 system (refer to Section 1.3).

3.6.3 **GMAW Torch**

The Modular ArcWorld® C-200/500 system uses either an air-cooled or a water-cooled robotic/automatic GMAW torch. The heavy-duty torch is designed for a quick replacement and a minimum of robot reprogramming. The GMAW torch is installed at the end of the robot wrist flange. For applications that use the optional water-cooled torch, the Modular ArcWorld® C-200/500 system includes a water circulator kit for the robot.

A torch mount on the robot, protects the robot, work piece, fixture, and positioner. It provides multi-directional impact detection. Any torch impact (collision) triggers a system E-Stop condition (refer to Section 3.7.2).

For additional information on the torch and mount that are supplied with your system, refer to the documentation that is included with your Modular ArcWorld® C-200/500 system (refer to Section 1.3).
3.7 Safety Features

The Modular ArcWorld® C-200/500 system features Motoman’s Total Safety Environment. The system incorporates a practical level of safeguarding to satisfy most plant conditions. If the customer complies with all standard safety precautions, the safety equipment helps to ensure safe operation of the robot work cell.

Note: Modular ArcWorld® C-200/500 safety features are independent of program logic. All safeguards are “hard wired” and provide protection that is independent of any software program. System safeguards do not depend upon a programmer correctly inputting an instruction in the operating program.

Note: Modular ArcWorld® C-200/500 system safeguards are interfaced with normally closed (NC) “fail-to-safe” switch contacts. These components will stop work cell operation if they are disconnected or damaged.

Note: Users are responsible for determining that the safeguards provided with the Modular ArcWorld® C-200/500 system are adequate for their plant conditions. Users must also ensure that all safeguards are maintained in working order.

3.7.1 Welding Arc Protection

One by-product of the welding arc is an intense level of ultraviolet light. The ultraviolet light radiates outwardly (equal strength in all directions) from the weld point whenever an arc is established. If not blocked, the radiated ultraviolet light can present a health risk to personnel near the welding arc.

The Modular ArcWorld® C-200/500 system is self-contained system. The cell assembly comes with two roll-up doors with a door opening of 1,200 mm, a robot safety enclosure, gate interlock on the back side of the cell for the torch reamer option, and light curtains interconnected by a safety PLC to provide control-reliable safeguarding. The robot safety enclosure is a cylindrical physical barrier that limits operator access to the robot to one opening. Safety light curtains are built into the base at each station to detect if, the operator is in the work zone (see Figure 1).

WARNING!
Although safety fence arc curtains block the radiation of ultraviolet light, never look directly at the welding arc without protective eye wear.

Just as the safety roll-up doors protect the operator from the ultraviolet light radiation and sparks, the arc curtains protect personnel who are near the work cell.
3.7.2 Emergency Stop (E-Stop)

E-Stop is a primary safety feature of the Modular ArcWorld® C-200/500 system. A work cell access door interlock, a safety light curtain system, robot welding torch impact (collision) detection circuitry (refer to Section 3.6.3), and E-Stop push buttons can all trigger an E-Stop condition. An E-Stop condition immediately de-energizes the control system and activates the robot braking system (refer to Section 3.7.4). The E-Stop push buttons are used for an intentional shutdown of the Modular ArcWorld® C-200/500 system, and are installed at the following locations:

- Programming Pendant
- NX100 controller
- Operator Station

To resume operation after an E-Stop system shutdown, the operator must clear and reset the action that caused the E-Stop condition (refer to Section 5.3.2).

3.7.3 Programming Pendant ENABLE Switch

The ENABLE switch is part of the Programming Pendant, and provides a safety feature that controls servo power while the system is in TEACH mode (see Figure 3 and Figure 5). When pressed in, this switch allows the operator to enable servo power. However, should the operator release the switch or grasp it too tightly, servo power is immediately disabled, thus preventing further robot movement. For detailed information about the operation of the ENABLE switch, refer to the NX100 Operator’s Manual for Arc Welding that is included with your Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).

![Programming Pendant ENABLE Switch](image-url)

**Figure 5** Programming Pendant ENABLE Switch – Location and Operation
3.7.4 **Emergency Braking System**

The robot incorporates a braking system that protects personnel from injury and prevents equipment damage if servo power is disabled. Upon loss of servo power, the brake system activates to hold all robot axes in place. The brake system incorporates a feature that allows the operator to release the brake of a specific robot axis upon loss of servo power. Brake release is accomplished with the Programming Pendant (refer to Section 5.3.4).

3.7.5 **Interlocked Work Cell Door**

A redundant circuit safety interlock is installed on the sliding work cell access door (see Figure 1). Opening the work cell access door while the robot is in PLAY mode triggers an E-Stop condition (refer to Section 3.7.2).
NOTES
Chapter 4
Installation

CAUTION!
The Modular ArcWorld® C-200/500 system should be installed by qualified personnel who are familiar with the installation and set-up of a robotic system.

CAUTION!
Handle all system components with care. The Modular ArcWorld® C-200/500 system is not extremely fragile, but it is a sophisticated robotic system that can be damaged by rough handling.

Note: The customer shall supply all anchoring hardware for the Modular ArcWorld® C-200/500 system. Please refer to Appendix A of this document for suggested anchoring hardware and foundation specifications.

Two to three qualified technicians can install the Modular ArcWorld® C-200/500 system in a reasonable amount of time. Always comply with established safety procedures throughout the installation process (refer to Chapter 2).

4.1 Required Materials

All system components and most of the materials and fasteners needed for installation of the Modular ArcWorld® C-200/500 system are included with shipment from the factory. However, the customer must supply some required items and installation tools (refer to Section 4.1.1 and Section 4.1.2).

4.1.1 Customer-Supplied Items

• Shielding gas for the welding torches
• Local electrical service
• Earth ground wires for the robots and the NX100 controller assembly
• Earth ground rods and/or buried copper sheeting (quantity and placement depth as required to achieve specified resistance-to-ground reading of 100 ohms or less)
• Chemical (optional) to increase conductivity of soil in the vicinity of the earth ground system
• Welding wire
• Clean, dry air supply (for torch tender or wire cutter options) –
  • Flow Rate  0.425 m³/min (15 cfm)
  • Pressure  620 kPa (gage), 90 psi (gage)
• Forklift
• Special anchor bolts and drill bits (refer to Appendix A for suggested anchoring hardware)

4.1.2 Recommended List of Hand Tools and Equipment

• Safety glasses
• Face shield
• Gloves (heavy-duty leather recommended)
• Level (short and long)
• Ratchet Handle (with 3/4 in. hex socket)
• Adjustable wrench (large and small)
• Hammer drill with appropriate concrete bits
• Phillips and flat-blade screwdrivers
• Hammer (dead-blow and steel)
• Hammer (non-marring)
• Socket set (SAE and Metric)
• Air-impact gun (with 3/4 in. hex socket)
• Open-end wrench set (SAE and Metric)
• “Allen” wrench set (SAE and metric)

4.2 Site Preparation

WARNING!
During installation planning, allow sufficient room for access to the work cell door and system components that are exterior to the work cell. Failure to observe this warning could result in injury to personnel during system operation and maintenance.

To prepare your site, proceed as follows –

1. Clear floor space and overhead area needed for the Modular ArcWorld® C-200/500 system (see Figure 6 and Figure 7). Allow an additional 1.2 - 1.5 m on all sides of the work cell to provide the clearance needed for installation.

2. Gather all customer-supplied items and required tools (refer to Section 4.1).
Figure 6  Modular ArcWorld® C-200/500 – Installation Dimensions and Component Locations (Plan View)

Figure 7  Modular ArcWorld® C-200/500 – Installation Dimensions and Component Locations (Elevation View)
4.3 **Removal of System from Shipping Skids**

The Modular ArcWorld® C-200/500 is attached to a wooden shipping skid at the factory, prior to shipment to the customer. The customer is responsible for removing the shipping skids and inspecting the components for shipping damage.

*Note: Notify your shipping contractor if you notice any shipping damage.*

1. Unbolt the Modular ArcWorld® C-200/500 from its shipping skid using a ¾-in. hex socket (see Figure 8).

![Figure 8](image)

**Figure 8** Removal of Typical Shipping Bolt

**WARNING!**

The Modular ArcWorld® C-200/500 weighs approximately 5200 kg. Ensure that your forklift is rated to safely handle this load.

2. Place the tongs of the forklift under the yellow shipping brackets protruding from under the Access Door Opening (see Figure 1).

3. Slowly move the Modular ArcWorld® C-200/500 to its installation location.

4. Remove the yellow shipping brackets and its hardware and store in a safe location for reuse if the Modular ArcWorld® C-200/500 were to be moved to another location.

5. Discard and recycle the shipping skids and other shipping material.
4.4 **System Installation**

Ensure the Modular ArcWorld® C-200/500 is complete and verify the correct amount of floor space is available for installation. Motoman recommends that the system be set in place prior to anchoring the system to the foundation.

4.4.1 **Anchoring and Leveling**

Refer to Figure 9 for the four (4) locations of the lag bolts to anchor the Modular ArcWorld® C-200/500 system to the foundation. Once the system is anchored, install an angle guard, supplied with the Modular ArcWorld® C-200/500 (see Figure 1) on each side of the robot riser.

To reduce the “rocking” or to level the system adjust any of the six (6) Leveling Bolts (see Figure 9).

**WARNING!**

Wear protective eye wear during the anchoring process. Failure to observe this warning could result in eye injury for the installation technician.

1. After positioning the system, insert a drill bit through the center of each levelling bolt and drill a hole into the foundation to accept an anchor bolt (refer to Appendix A for foundation and anchoring suggestions).

2. Use compressed air to remove all concrete dust from each drilled hole.

3. Anchor the system to the foundation with suitable anchor bolts (refer to Appendix A for foundation and anchoring suggestions).

4. If required, level a system adjusting levelling bolts (see Figure 9 insert).

![Figure 9 Lagging and Leveling Locations](image)
4.4.2 Cable Boom

The cable boom is shipped in a stowage position. Loosen the two bolts on the cable boom and pull the rail straight up until you see the line on the cable boom. Then tighten the bolts (see Figure 10).

![Figure 10 Cable Boom Installation](image)

4.5 Removal of Robot Shipping Bracket

**CAUTION!**
Remove the shipping bracket from the robot prior to power-up or operation. Operation of a robot, without first removing the shipping bracket, can damage the robot drive components.

A bracket is installed on the robot at the factory to prevent undesired movement during shipping (see Figure 11). The bracket is painted bright yellow for easy location and identification. The bracket secures the lower arm of the robot to the S-axis housing. In addition, the bracket provides the correct attachment points for a hoisting sling, should a robot need to be lifted or moved. Upon bracket removal, be sure to keep the brackets and attaching hardware in a secure location, should they be needed in the future.

![Figure 11 Robot Shipping Bracket](image)
4.6 **Cable Connections**

The Modular ArcWorld® C-200/500 system components are completely connected and anchored in their correct locations. All cables and connectors are labelled to ensure correct connection to the mating connectors on the applicable system component.

4.7 **Safety / Operation Check**

Before installing the tooling and fixtures for your application, take a few minutes to perform the following safety/operation check –

1. Ensure that the shipping bracket is removed from the robot (refer to Section 4.5).
2. Ensure that the work cell sliding access door is closed and that the door interlock is engaged.
3. Verify the correct settings for the welding power sources (refer to the welding power source documentation that is included with your Modular ArcWorld® C-200/500 system).
4. Verify that local electrical service complies with the power requirements for your Modular ArcWorld® C-200/500 system.

**CAUTION!**
The Modular ArcWorld® C-200/500 system is now ready for power-up. Qualified, trained personnel, who are familiar with this system, should perform the power-up sequence.

5. Rotate the POWER ON-OFF Switch on NX100 controller to ON (see Figure 2).

**WARNING!**
Before operating the robot, verify that each E-Stop push button disables servo power when activated (pushed in). Each E-Stop push button must immediately stop robot and positioner movement when activated (pushed in).

6. Check for correct operation of all E-Stop push buttons (refer to Section 3.7.4).
7. Check for correct operation of the system HOLD button on the Programming Pendant.
8. Check for correct action of the work cell access door safety interlock.
9. Remove power from the Modular ArcWorld® C-200/500 system after completion of the safety / operation check.

4.8 **Installation of Tooling and Fixtures**

The Modular ArcWorld® C-200/500 system is now ready for attachment of tooling fixtures to the positioner kits. Motoman recommends that you assign this task to personnel who are familiar with Modular ArcWorld® C-200/500 system operation and set-up. After installation of tooling fixtures, test the positioner kit for correct operation.

**Note:** All tooling and fixtures for the positioner kit shall be supplied by the customer.

**Note:** Motoman recommends application of a corrosion/rust preventive compound to tooling and fixtures located in a high-humidity environment.
Chapter 5
Operation

CAUTION!
The customer is responsible for providing trained operators to run the equipment. The customer is also responsible for making sure that the equipment is operated in accordance with the ANSI/RIA R15.06-1999 Robot Safety standard, as well as any other local or state standards.

This chapter provides a brief overview of the operating procedures and precautions for your Modular ArcWorld® C-200/500 system. For more detailed operating information, refer to specific component manuals that are part of the Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).

The Modular ArcWorld® C-200/500 system is a fully integrated robotic GMAW welding cell.

The SSA2000 robot welds parts in Station 1 of the two positioner kit while the operator loads Station 2 with parts to be welded. When the robot completes the welding program in Station 1, it returns to the Home (Safe) position. The operator can then initiate a CYCLE START/CYCLE LATCHED for Station 2 from the Operator Station for the new set of parts in Station 2. This moves the robot to Station 2 and the welding processes continues. The operator moves into Station 1 replaces the completed welded parts with part for another welding cycle.

Note: The customer shall supply all tooling fixtures for the positioner.

5.1 Programming

The operation of the Modular ArcWorld® C-200/500 system is programming dependent. The following operating instructions are based on one possible configuration for this system. Your system configuration and job structure may differ slightly from that presented here; however, basic operation will be the same. For additional programming procedures and information, refer to the NX100 controller documentation that is included with your Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).
Any changes made to your system configuration or job structure will alter the operation of the system. Motoman recommends that you DO NOT modify the original jobs and system configuration of your Modular ArcWorld® C-200/500 system. If you determine a need to modify the original jobs and system configuration, make any modifications to a copy of the original. Keep the original as a backup. Do not modify the original. Modifications must be performed by trained and experienced personnel who are familiar with the operation of the Modular ArcWorld® C-200/500 system. If you have questions concerning the configuration of your system, please contact Motoman 24 hour Customer Support (refer to Section 1.4).

5.2 Daily Operation

The procedures below represent the typical operating sequence from power up to shutdown. Your basic operating procedures may vary depending on your situation.

- Perform Start-Up procedures (refer to Section 5.2.1).
- Move robot to Home position (refer to Section 5.2.2).
- Select Master job (refer to Section 5.2.3).
- Perform Operation cycle (refer to Section 5.2.4).
- Perform Shutdown procedures (refer to Section 5.2.5)

5.2.1 Start-Up

To start up the Modular ArcWorld® C-200/500 work cell from a power-off condition, proceed as follows –

1. Rotate the NX100 controller POWER ON-OFF switch to ON (see Figure 2).
2. Set POWER ON-OFF switch on the welding power source to ON (ON-OFF indicator lamp on the welding power source will illuminate).
3. Open regulator valve on welding gas supply.
4. Make sure that the work cell access doors are closed and door safety interlock engaged.
5. Make sure all E-Stop push buttons are released. E-Stop push buttons are installed at the following locations –
   - Programming Pendant
   - NX100 controller
   - Operator Station
7. Place robot in Home position (refer to Section 5.2.2).
5.2.2 Robot Home Position

To move the robot to the Home position –
1. Select TEACH mode on the Programming Pendant.
2. Select MAIN MENU on Programming Pendant touch screen.
4. Select SELECT JOB on Programming Pendant touch screen (a job list appears on the screen).
5. Use the navigation cursor key to move the cursor to R1 SAFE job and press SELECT (the job appears on the display screen).
6. Turn servo power ON by pressing SERVO ON and holding in the ENABLE switch.
7. Use the FWD button on Programming Pendant to jog robot to Home position.

5.2.3 Master Job

With the system powered up and in TEACH mode, call up the Master Job –
1. Select JOB on Programming Pendant touch screen.
2. Select CTRL MASTER on Programming Pendant touch screen. Press SELECT twice to activate the Master Job.
3. Select PLAY mode on Programming Pendant and press the PLAY ENABLE button on the NX100 controller door (job playback operation is enabled). See Figure 2 for location of the PLAY ENABLE button on the controller.
4. Press SERVO ON button on the Programming Pendant.
5. Press START button on Programming Pendant (the Master Job cycles, waiting for a CYCLE START/CYCLE LATCHED input from Operator Station).
6. Transfer control to the Operator Station by selecting REMOTE on the Programming Pendant MODE SELECT SWITCH.

The Modular ArcWorld® C-200/500 work cell is now ready for operation.

5.2.4 Operation Cycle

The following is the typical sequence of operation for the Modular ArcWorld® C-200/500 work cell after start-up –
1. Operator loads the fixture, on station 1, with parts to be welded.
2. Operator steps out of safety zone created by the safety roll-up doors, and moves to the Operator Station.
3. Operator presses the green CYCLE START/CYCLE LATCHED button (station 1 side) on Operator Station. The safety roll-up door closes and the robot moves into the workcell 1 to perform the welding program.
4. While the robot is welding, the operator moves into station 2 and starts loading the next group of parts to be welded.

Note: If the safety roll-up door is not open press the CYCLE START/CYCLE LATCHED button, station 2 side to open.

5. When the welding program in station 1 is complete the robot returns to the HOME (Safe) position, the safety roll-up door will automatically open.

6. When station 2 is ready the operator steps out of the safety zone created by the safety roll-up doors, and moves to the Operator Station and presses the CYCLE START/CYCLE LATCHED button (station 2 side) on the Operator Station. The safety roll-up door closes and the robot moves into the workcell two to perform the welding program.

Note: If the robot is still welding in the opposite welding cell when the CYCLE START/CYCLE LATCHED button is pressed the robot will finish and then proceed to the other cell automatically (see Section 3.4.1).

7. The operator then moves into station 1 and removes the welded part and replaces them with non welded parts and the process continues.

5.2.5 Shutdown

Use the following procedure to perform a normal shut down of the Modular ArcWorld® C-200/500 system –

1. Make sure the robot is in Home position.

2. Turn off system servo power by pressing the E-Stop button on Operator Station or Programming Pendant.

3. Select TEACH mode on the Programming Pendant.

4. Rotate NX100 controller POWER ON-OFF switch to OFF (see Figure 2).

5. Set welding power source POWER ON-OFF switches to OFF.


The Modular ArcWorld® C-200/500 system is now shut down.
5.3  System Recovery

When a system error or alarm occurs, you must clear the error or alarm to return the system to normal operation. The paragraphs below describe the different types of alarms and errors you may encounter, and how to clear them.

5.3.1 Alarms and Errors

Alarms and errors will stop the program. There are three levels –

- Error Messages
- Minor Alarms
- Major Alarms

For more detailed information on alarm and error recovery, refer to the NX100 controller and EA-Series robot documentation that is included with your Modular ArcWorld® C-200/500 documentation package (refer to Section 1.3).

5.3.1.1 Error Messages

Error messages are usually the result of simple, easily-cleared operation errors. The following is one example –

- Pressing the START button when the robot are not in PLAY mode

Clear errors of this type by pressing the CANCEL button on the Programming Pendant.

5.3.1.2 Minor Alarms

Minor alarms usually involve programming errors. Clear alarms of this type by pressing the CANCEL button on the Programming Pendant.

5.3.1.3 Major Alarms

Clear alarms of this type by cycling the NX100 controller in accordance with the following steps –

1. Rotate the NX100 POWER ON-OFF switch to OFF (see Figure 2).
2. Allow the NX100 POWER ON-OFF switch to remain in the OFF position for approximately 10 seconds.
3. Rotate the NX100 POWER ON-OFF switch back to ON.
5.3.2 E-Stop Recovery

An E-Stop (emergency stop) condition is triggered by any of the following conditions –

- An E-Stop push button switch is activated
- A work cell access door is opened while the robot is not in TEACH mode
- The light curtain system is tripped
- A welding torch collision triggers a shock sensor output (refer to Section 5.3.3)

If an E-Stop condition is triggered, restart the Modular ArcWorld® C-200/500 system as follows –

**CAUTION!**

If an E-Stop condition occurs while the positioner is rotating, the positioner will complete the rotation when the Modular ArcWorld® C-200/500 system is restarted.

1. Press the SERVO ON button on the Programming Pendant.
2. Select REMOTE mode on the Programming Pendant MODE SELECT SWITCH to transfer control of the system to the Operator Station.
3. Press the green CYCLE START/CYCLE LATCHED button on the Operator Station.

The Modular ArcWorld® C-200/500 system is now ready to continue operation.

5.3.3 Shock Sensor Recovery

The Modular ArcWorld® C-200/500 welding package includes a Motoman gun mount for each EA-series robot. This mount is designed to protect the torch from damage in case of an impact (collision). A slight deflection of the torch activates a SHOCK SENSOR signal that triggers a system E-Stop condition. To clear the E-Stop condition, you must override the shock sensor and move the robot clear of the impact.

Refer to the following procedures to override the shock sensor –

**CAUTION!**

Always reactivate the Shock Sensor before continuing system operation. The robot can be damaged if the Shock Sensor Override Switch remains in the “Override” position.

1. Press MAIN MENU on the Programming Pendant.
2. Use the Programming Pendant CURSOR KEY to select the ROBOT icon, then press SELECT.
3. Use the Programming Pendant CURSOR KEY to select OVERRUN-S.SENSOR, then press the SELECT key.
4. Select RELEASE to release the shock sensor.
5. Turn servo power ON (depress and hold the Programming Pendant ENABLE switch in the middle position while pressing the SERVO ON / READY push button).
6. Move the robot clear of impact position.

The Modular ArcWorld® C-200/500 system is now ready to continue operation.
5.3.4 Brake Release

The robot braking system is designed to protect the robot and other system components from damage in the event of a system/robot failure or loss of drive power. If a system/robot failure or loss of drive power occurs, you must release the brakes on the affected robot in order to move it.

To release the brakes, proceed as follows –

**WARNING!**

Always support the robot axis to be released BEFORE you release it. Without adequate robot axis support, brake release could cause personal injury or machine damage.

1. On the Programming Pendant, select TEACH mode and turn servo power OFF.
2. Select ROBOT on the pendant display (touch) screen.
3. Select the BRAKE RELEASE option.
4. Use the CURSOR key to select desired robot axis for release.
5. Press and hold the pendant ENABLE switch in its middle position (see Figure 3 and Figure 5), while pressing the INTERLOCK key and the SELECT key.
6. The brake for the selected axis will release.
NOTES
Chapter 6
Maintenance

Assign Modular ArcWorld® C-200/500 system maintenance to technicians who are trained in the operation and repair of a robotic system (preferably the Modular ArcWorld® C-200/500 system). Be sure to read and understand the documentation for a particular component before doing any type of maintenance on that component.

Maintenance intervals given in this chapter are recommendations, only. Adjust the frequency and level of maintenance to suit your specific equipment schedules and shop environment.

Maintenance procedures and schedules for individual components of the system are given in the component manuals supplied with the Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).

Table 1 Periodic Maintenance

<table>
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<tr>
<th>FREQUENCY</th>
<th>COMPONENT</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>Water Circulator (optional) (see NOTE below)</td>
<td>Check level of coolant / antifreeze. If necessary, add a mixture of Motoman coolant / antifreeze (P/N 131224-1) and distilled water. Mix antifreeze and distilled water in proportions shown on the antifreeze container.</td>
</tr>
<tr>
<td>Daily</td>
<td>All safeguard items – work cell door interlock, E-Stop push buttons, safety light curtains, arc curtains, etc.</td>
<td>Check physical condition of safeguard item and ensure that the safeguard item is working correctly.</td>
</tr>
<tr>
<td>On Condition</td>
<td>Modular ArcWorld® C-200/500</td>
<td>Remove accumulated dirt, grease, and debris from inside and outside the work cell.</td>
</tr>
<tr>
<td>Every 6 Months</td>
<td>Common Base Common Equipment Table (Opt.)</td>
<td>Check integrity and security of anchor hardware in accordance with HILTI® documentation. Check torque of hold-down nuts in accordance with HILTI® documentation (refer to Appendix A).</td>
</tr>
</tbody>
</table>

NOTE If your system uses a water-cooled torch, use only Motoman-specified antifreeze. Typical automotive antifreeze contains additives that can clog the small cooling parts in the torch, and can damage sealing gaskets in the water circulator pump.
Appendix A

Anchoring

The customer shall determine all anchoring and foundation requirements, and supply the appropriate anchoring hardware and foundation for a particular system installation. Table A.1 gives anchoring and foundation suggestions.

Table A.1  Suggested Anchor, Floor Plate, and Foundation Specifications

<table>
<thead>
<tr>
<th>SYSTEM EQUIPMENT</th>
<th>MINIMUM HILTI® ANCHOR ROD DIA / TYPE</th>
<th>MINIMUM FLOOR PLATE</th>
<th>MINIMUM FOUNDATION</th>
</tr>
</thead>
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<tr>
<td>ROBOTS HP3JC, HP3, HP3C, HP3CL, HP3XF, HP5, HP5C</td>
<td>1/2&quot; HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>380 mm (15 in.)</td>
<td>381 mm (15.0 in.) Length</td>
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<tr>
<td></td>
<td></td>
<td>380 mm (15 in.)</td>
<td>Width</td>
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<td></td>
<td></td>
<td>19 mm (0.7 in.)</td>
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<tr>
<td></td>
<td></td>
<td>381 mm (15.0 in.) Width</td>
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<tr>
<td></td>
<td></td>
<td>76 mm (3.0 in.)</td>
<td>Thick</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4000 psi Reinforced Concrete</td>
<td></td>
</tr>
<tr>
<td>ROBOTS UP6, UP20, UP20-6, EA1400, EA1900</td>
<td>5/8&quot; HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>600 mm (24 in.)</td>
<td>762 mm (30.0 in.) Length</td>
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<td></td>
<td></td>
<td>600 mm (24 in.)</td>
<td>Width</td>
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<td></td>
<td></td>
<td>38.1 mm (1.5 in.)</td>
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<tr>
<td></td>
<td></td>
<td>762 mm (30.0 in.) Width</td>
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<tr>
<td></td>
<td></td>
<td>178 mm (7.0 in.)</td>
<td>Thick</td>
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<td></td>
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<td>4000 psi Reinforced Concrete</td>
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<tr>
<td>ROBOTS HP6, HP6S, HP6R, HP20, HP20-6, EA1400N, EA1900N, DX1350N, SSA2000, SSF2000</td>
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<td>4000 psi Reinforced Concrete</td>
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<tr>
<td>ROBOTS UP20M, UP50 SP80 (Note 2)</td>
<td>7/8&quot; HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>900 mm (35.4 in.)</td>
<td>1524 mm (60.0 in.) Length</td>
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<td></td>
<td>50.8 mm (2.0 in.)</td>
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<td>1524 mm (60.0 in.) Width</td>
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<td>4000 psi Reinforced Concrete</td>
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<tr>
<td>ROBOTS UP120, UP130, UP165, SP100, SP160, SP250 SP400 (Note 2)</td>
<td>7/8&quot; HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>1200 mm (47.2 in.)</td>
<td>1828 mm (72.0 in.) Length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1200 mm (47.2 in.)</td>
<td>Width</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50.8 mm (2.0 in.)</td>
<td>Thick</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1828 mm (72.0 in.) Width</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>229 mm (9.0 in.)</td>
<td>Thick</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4000 psi Reinforced Concrete</td>
<td></td>
</tr>
</tbody>
</table>
Table A.1  Suggested Anchor, Floor Plate, and Foundation Specifications (Continued)

<table>
<thead>
<tr>
<th>SYSTEM EQUIPMENT</th>
<th>MINIMUM HILTI® ANCHOR ROD DIA / TYPE</th>
<th>MINIMUM FLOOR PLATE</th>
<th>MINIMUM FOUNDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBOTS HP165, HP165N-100, HP165R, ES165RN, ES165N-100, EPL100, EPL160 (Note 2)</td>
<td>7/8” HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>1200 mm (47.2 in.) Length 1200 mm (47.2 in.) Width 50.8 mm (2.0 in.) Thick</td>
<td>1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS UP200</td>
<td>7/8” HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>1200 mm (47.2 in.) Length 1200 mm (47.2 in.) Width 50.8 mm (2.0 in.) Thick</td>
<td>1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS HP200, ES200N, HP200T, HP200RN, ES200RN, EPL300 (Note 2)</td>
<td>7/8” HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>1200 mm (47.2 in.) Length 1200 mm (47.2 in.) Width 50.8 mm (2.0 in.) Thick</td>
<td>1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS UP350, UP500, SK300X</td>
<td>7/8” HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>1500 mm (59.1 in.) Length 1500 mm (59.1 in.) Width 50.8 mm (2.0 in.) Thick</td>
<td>1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS HP350, HP350-200, HP500, HP600, EPL450, EPL500 (Note 2)</td>
<td>7/8” HVA Chemical Anchor (Note 3) (Note 5) (Note 6)</td>
<td>1500 mm (59.1 in.) Length 1500 mm (59.1 in.) Width 50.8 mm (2.0 in.) Thick</td>
<td>1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>POSITIONER Rotary Turntable Type</td>
<td>5/8” HVA Chemical Anchor (Note 3) (Note 6)</td>
<td>Not Applicable</td>
<td>Refer to Applicable Positioner Manual</td>
</tr>
<tr>
<td>POSITIONER “Ferris wheel” type with headstock and tailstock (HS/TS)</td>
<td>7/8” HVA Chemical Anchor (Note 3) (Note 6)</td>
<td>Not Applicable</td>
<td>Refer to Applicable Positioner Manual</td>
</tr>
</tbody>
</table>
Table A.1  Suggested Anchor, Floor Plate, and Foundation Specifications (Continued)

<table>
<thead>
<tr>
<th>SYSTEM EQUIPMENT</th>
<th>MINIMUM HILTI® ANCHOR ROD DIA / TYPE</th>
<th>MINIMUM FLOOR PLATE</th>
<th>MINIMUM FOUNDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIPHERAL EQUIPMENT</td>
<td>1/2&quot; Kwik Bolt II Expansion Anchor (Note 4) (Note 6)</td>
<td>Not Applicable</td>
<td>3&quot; min thickness or 1.3 Embedment Depth (whichever is larger), 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>WORK CELL FENCE POSTS</td>
<td>3/8&quot; Kwik Bolt II Expansion Anchor (Note 4) (Note 6)</td>
<td>Not Applicable</td>
<td>3&quot; min thickness or 1.3 Embedment Depth (whichever is larger), 4000 psi Reinforced Concrete</td>
</tr>
</tbody>
</table>

Notes –

(1) Minimum robot lagging requirements are based on *Maximum Repulsion Forces and Hilti® Anchor Design Program* (v3.3b).
(2) SP and EPL series robots require base plates and/or risers to be level to ± 2°. Grout if necessary.
(3) Reference source: *Hilti® Product Technical Guide* (Section 4.2.1) for hardware specifications or equivalent.
(4) Reference source: *Hilti® Product Technical Guide* (Section 4.3.3) for hardware specifications or equivalent.
(5) Cast-in anchors are specified in some robot manuals. The Hilti® HVA Chemical Anchors listed in this table can be substituted for the cast-in anchors.
(6) Refer to *Hilti® Product Technical Guide* for suggestions on the correct size and type of drill bit to use with each anchor type.

**Contact Information –**

1-800-879-8000 (USA) [http://us.hilti.com](http://us.hilti.com)
1-800-363-4458 (CAN) [http://ca.hilti.com](http://ca.hilti.com)
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