

Motoman

MH1600-500TR Positioner

Part Number: 153443-1CD
Revision: 1



Motoman, Incorporated
805 Liberty Lane
West Carrollton, OH 45449
TEL: (937) 847-6200
FAX: (937) 847-6277
24-Hour Service Hotline: (937) 847-3200
www.motoman.com
info@motoman.com

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Chapter 1

Introduction

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 operation of the MH1600-500TR positioner kit. For more detailed information, refer to the manuals listed in Section 1.3. This manual contains the following chapters:

CHAPTER 1 - INTRODUCTION

This section provides general information about the MH1600-500TR positioner and its components, a list of reference documents, and customer support information.

CHAPTER 2 - SAFETY

This section provides information regarding the safe use and operation of the MH1600-500TR positioner.

CHAPTER 3 - INSTALLATION

This section provides instructions for set up and installation of the MH1600-500TR positioner.

CHAPTER 4 - MAINTENANCE

This section contains a table listing periodic maintenance requirements for the components of the MH1600-500TR positioner.

1.2 System Overview

The MH1600-500TR positioner kit features a two-axis positioner rated at 500 kg payload. The MH-1600-500TR provides both tilt and rotation axes for flexible part positioning with the ability to provide coordinated motion with the robot. The tilt/rotate positioner is a combination of the MH1600 and MH500 headstock modules and features integrated weld ground brushes and position switches. The positioner kit includes a dual external axis kit for the Sigma III motors and 7-meter cables. Up to three external axis drives can be mounted inside the controller; therefore, two tilt/rotate positioners will require the addition of an external cabinet.

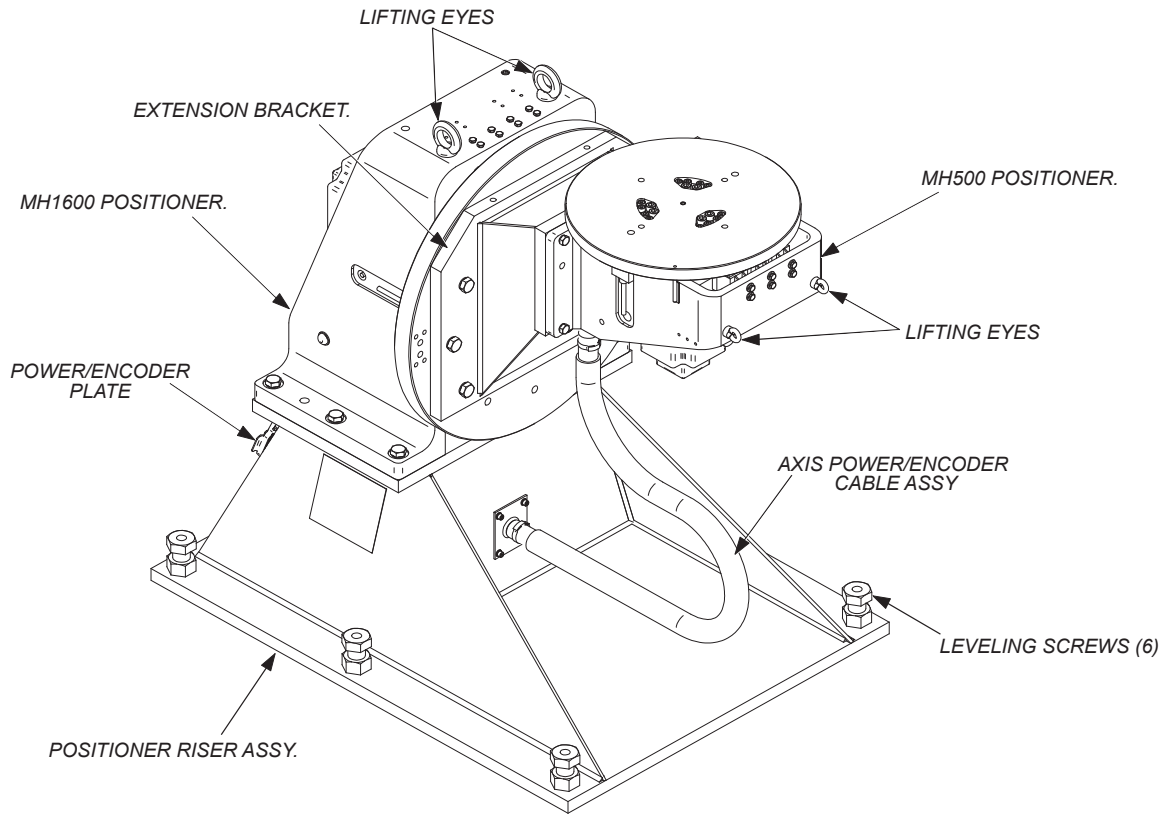


Figure 1 MH1600-500TR System Overview

1.2.1 Specifications

Table 1 MH1600-500TR Specifications

Rated Load	kgf	500
Table Speed	rpm	9.8
180-degree Rotation	sec	3.56
Rated Load CG Off Center	mm	0
Rated Load CG Overhang	mm	100
Rated Load Inertia	kg*m ²	119
Rated Weld Ground (STD/Optional)	A/brush	800/1200
Repeatability	mm/mm	0.00003

1.3 Reference Documentation

For additional information refer to the following:

- Motoman *Manipulator Manual*
- Motoman *MH-Series Sigma III Positioner Manual*
- Motoman *Controller Manual*
- Motoman *Maintenance Manual*
- Motoman *Operator's Manual for Arc Welding*
- Motoman *Concurrent I/O Parameter Manual*
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Support Information

If you need assistance with any aspect of your MH1600-500TR positioner, 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:

- Robot Type
- System Type (MH1600-500TR)
- Software Version (access using MAIN MENU, SYSTEM INFO, VERSION on programming pendant)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on front door of the controller)

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).

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Chapter 3

Installation

Installation of the MH1600-500TR positioner should be performed by personnel who are familiar with this Motoman product. 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.

Due to the variety of installation applications, it is not possible to provide detailed installation instructions for the MH1600-500TR module. However, general installation guidelines are provided. Contact the Motoman Service Staff for help integrating the MH1600-500TR module into your system.



CAUTION!

Installation of the MH1600-500TR is not a task for the novice. The MH1600-500TR is not fragile, but it is a highly sophisticated positioning system. Handle components with care. Rough handling can damage system electronic components.

3.1 Materials Required

This section identifies customer-supplied items and tools required to complete installation.

3.1.1 Customer-Supplied Items

- Incoming power supply to controller - 240/480/575 volts
- Appropriate mounting hardware

3.1.2 List of Tools

- Safety glasses
- Gloves
- Level
- Ratchet with 3/4-in. socket
- Adjustable wrench set
- Phillips and flat screwdrivers
- Socket set
- Forklift and/or overhead crane
- Air-impact gun with 3/4-in. socket
- Open-end wrench set
- Wrench sets (standard and metric)
- 255 N•m (188 ft. lb) torque wrench

3.2 Lifting Instructions

The MH1600-500TR positioner is shipped on a wooden shipping skid. The customer is responsible for removing the positioner from the shipping skid and inspecting for shipping damage. The MH1600-500TR positioner can be moved by forklift or by overhead crane and straps using M16 eyebolts. To install the MH1600-500TR positioner proceed as follows:



DANGER!

Forklift truck operation should be performed only by licensed personnel. Never place any part of your body under a suspended load or move a suspended load over any part of another person's body. Careless handling may result in severe personal injury or death.

1. Carefully remove protective plastic wrapping from positioner.
2. Inspect positioner for shipping damage.



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

3. Unbolt the positioner from the shipping skid using a 3/4-in. socket.



WARNING!

The MH1600-500TR positioner weighs approximately 770 kg. Ensure that your lifting device is rated to safely handle this load.

4. Attach slings from lifting device to the four M16 lifting eyes, refer to Figure 1.
5. Using the lifting device, lift the MH1600-500TR positioner and place in the desired location.

3.2.1 Dimensions

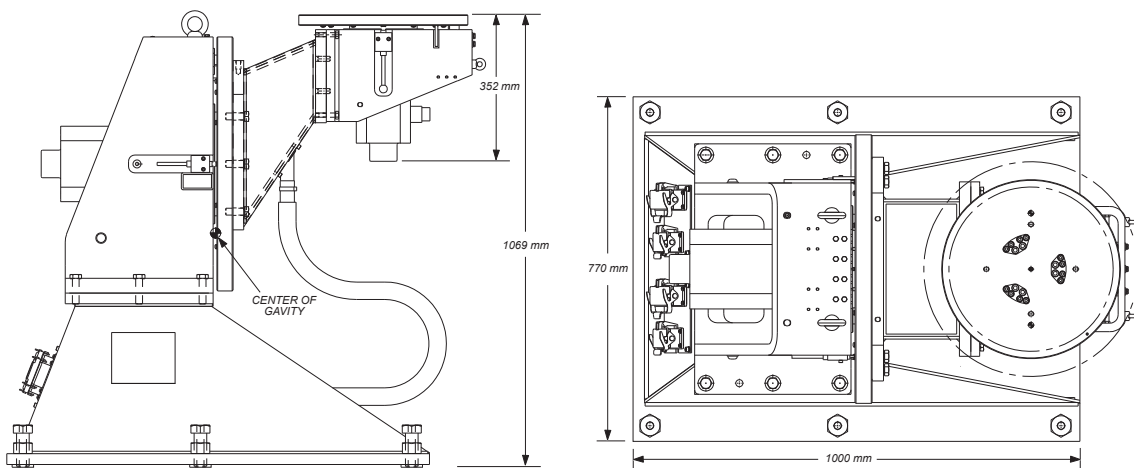


Figure 2 Dimensions

3.2.2 Mounting

The MH1600-500TR positioner should be firmly mounted on a base plate or foundation rigid enough to support the weight and also withstand repulsion forces. The surface should be level and even. If it is uneven, grind the swell and flatten the surface. All floor requirements are application specific and must be determined by the project engineer overseeing the installation.

3.3 Connection to Motoman Controller

Installation and connection to the controller comprises hardware as well as software installation and must be carried out by Motoman Service personnel. When the MH1600-500TR positioner is delivered together with a robot, this installation is complete.

See separate schematics for electrical connections:



WARNING!

Install all electrical cables connecting the MH1600-500TR positioner and electrical supply wiring cables so that there is not possibility of their being walked on or run over. Do not put any object directly on the cables and do not install cables across other cables.

3.3.1 Conducting a Safety/Operation Check

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

1. Check that safeguards have been installed and are adequate for plant conditions per ANSI/RIA R15.06-1999 Robot Safety Standard.
2. Verify that cable connections are tight and system is level and secure.

Your MH1600-500TR positioner is now ready for power-up. This 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.

3. Check all system E-Stops (pendant, operator station, control door).
4. Check system Hold buttons.

3.4 Installation of Tooling and Fixtures

Your MH1600-500TR positioner is now ready for the installation of tooling and fixtures for you 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 module for proper operation.

NOTES

Chapter 4

Maintenance

Maintenance of the MH1600-500TR components should be performed by authorized personnel who are familiar with the design and construction of this product. The following procedures should be performed only as needed. Read through the instructions completely before performing any maintenance procedure. Be sure that you understand the procedure, have the proper tools, and observe all applicable safety precautions.



DANGER!

Ensure power is off before performing the following procedures. Observe standard lockout/tagout practices.

4.1 Ordering Parts

Contact the Motoman service staff at (937) 847-3200 to order spare parts. Please have the following information ready before you call:

- Machine type (Positioner)
- Machine Name (MH1600-500TR)
- Motoman Part No.
- Part(s) name
- Number of parts

Place your order with: Motoman Customer Service
 Telephone (937) 847-3200
 Telefax: (937) 847-3211

For additional information on the MH1600 and MH500 positioners, please refer to the *MH-Series Sigma III Positioner Manual* that is included with your MH1600-500TR system documentation package (refer to Section 1.3).

NOTES

Appendix A

Anchoring

The customer must 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

SYSTEM EQUIPMENT	MINIMUM HILTI® ANCHOR ROD DIA / TYPE	MINIMUM FLOOR PLATE	MINIMUM FOUNDATION
ROBOTS HP3JC, HP3, HP3C, HP3CL, HP3XF, HP5, HP5C	1/2" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	380 mm (15 in.) Length 380 mm (15 in.) Width 19 mm (0.7 in.) Thick	381 mm (15.0 in.) Length 381 mm (15.0 in.) Width 76 mm (3.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS UP6, UP20 UP20-6, EA1400, EA1900	5/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	600 mm (24 in.) Length 600 mm (24 in.) Width 38.1 mm (1.5 in.) Thick	762 mm (30.0 in.) Length 762 mm (30.0 in.) Width 178 mm (7.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS HP6, HP6S, HP6R, HP20, HP20-6, EA1400N, EA1900N, DX1350N	5/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	600 mm (24 in.) Length 600 mm (24 in.) Width 38.1 mm (1.5 in.) Thick	762 mm (30.0 in.) Length 762 mm (30.0 in.) Width 178 mm (7.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS UP20M, UP50 SP80 (Note 2)	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	900 mm (35.4 in.) Length 900 mm (35.4 in.) Width 50.8 mm (2.0 in.) Thick	1524 mm (60.0 in.) Length 1524 mm (60.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS HP50, HP50-20, HP50-35, EPL80 (Note 2)	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	900 mm (35.4 in.) Length 900 mm (35.4 in.) Width 50.8 mm (2.0 in.) Thick	1524 mm (60.0 in.) Length 1524 mm (60.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS UP120,UP130 UP165,SP100 SP160,SP250 SP400 (Note 2)	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	1200 mm (47.2 in.) Length 1200 mm (47.2 in.) Width 50.8 mm (2.0 in.) Thick	1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete

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

SYSTEM EQUIPMENT	MINIMUM HILTI® ANCHOR ROD DIA / TYPE	MINIMUM FLOOR PLATE	MINIMUM FOUNDATION
ROBOTS HP165, HP165N-100, HP165R, ES165RN, ES165N, ES165N-100, EPL100, EPL160 (Note 2)	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	1200 mm (47.2 in.) Length 1200 mm (47.2 in.) Width 50.8 mm (2.0 in.) Thick	1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS UP200	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	1200 mm (47.2 in) Length 1200 mm (47.2 in) Width 50.8 mm (2.0 in) Thick	1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS HP200, ES200N, HP200T, HP200RN, ES200RN, EPL300 (Note 2)	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	1200 mm (47.2 in) Length 1200 mm (47.2 in) Width 50.8 mm (2.0 in) Thick	1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS UP350, UP500, SK300X	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	1500 mm (59.1 in) Length 1500 mm (59.1 in) Width 50.8 mm (2.0 in) Thick	1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
ROBOTS HP350, HP350-200, HP500, HP600, EPL450, EPL500 (Note 2)	7/8" HVA Chemical Anchor (Note 3) (Note 5) (Note 6)	1500 mm (59.1 in) Length 1500 mm (59.1 in) Width 50.8 mm (2.0 in) Thick	1828 mm (72.0 in.) Length 1828 mm (72.0 in.) Width 229 mm (9.0 in.) Thick 4000 psi Reinforced Concrete
POSITIONER Rotary Turntable Type	5/8" HVA Chemical Anchor (Note 3) (Note 6)	Not Applicable	Refer to Applicable Positioner Manual

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

SYSTEM EQUIPMENT	MINIMUM HILTI® ANCHOR ROD DIA / TYPE	MINIMUM FLOOR PLATE	MINIMUM FOUNDATION
POSITIONER "Ferris wheel" type with headstock and tailstock (HS/TS)	7/8" HVA Chemical Anchor (Note 3) (Note 6)	Not Applicable	Refer to Applicable Positioner Manual
PERIPHERAL EQUIPMENT	1/2" Kwik Bolt II Expansion Anchor (Note 4) (Note 6)	Not Applicable	3" min thickness or 1.3 Embedment Depth (whichever is larger), 4000 psi Reinforced Concrete
WORK CELL FENCE POSTS	3/8" Kwik Bolt II Expansion Anchor (Note 4) (Note 6)	Not Applicable	3" min thickness or 1.3 Embedment Depth (whichever is larger), 4000 psi Reinforced Concrete
<p>Notes –</p> <p>(1) Minimum robot lagging requirements are based on <i>Maximum Repulsion Forces and Hilti® Anchor Design Program</i> (v3.3b).</p> <p>(2) SP and EPL series robots require base plates and/or risers to be level to $\pm 2^\circ$. Grout if necessary.</p> <p>(3) Reference source: <i>Hilti® Product Technical Guide</i> (Section 4.2.1) for hardware specifications or equivalent.</p> <p>(4) Reference source: <i>Hilti® Product Technical Guide</i> (Section 4.3.3) for hardware specifications or equivalent.</p> <p>(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.</p> <p>(6) Refer to <i>Hilti® Product Technical Guide</i> for suggestions on the correct size and type of drill bit to use with each anchor type.</p> <p> Contact Information –</p> <p>1-800-879-8000 (USA) http://us.hilti.com</p> <p>1-800-363-4458 (CAN) http://ca.hilti.com</p>			

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