

Motoman

Barrier Assembly Manual

Part Number: 147500-1CD
Revision: 0

MOTOMAN
a YASKAWA company

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

COMPLETE OUR ONLINE SURVEY

Motoman is committed to total customer satisfaction! Please give us your feedback on the technical manuals you received with your Motoman robotic solution.

To participate, go to the following website:

<http://www.motoman.com/forms/techpubs.asp>

The information contained within this document is the proprietary property of Motoman, Inc., and may not be copied, reproduced or transmitted to other parties without the expressed written authorization of Motoman, Inc.

©2007 by MOTOMAN
All Rights Reserved

Because we are constantly improving our products, we reserve the right to change specifications without notice. MOTOMAN is a registered trademark of YASKAWA Electric Manufacturing.

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
LIST OF FIGURES.....	iii
LIST OF TABLES.....	iii
1 INTRODUCTION	
1.1 About this Document.....	1-1
1.2 System Overview.....	1-2
1.2.1 System Layout.....	1-2
1.3 Customer Service Information.....	1-2
2 SAFETY	
2.1 Introduction.....	2-1
2.2 Standard Conventions.....	2-2
2.3 General Safeguarding Tips.....	2-3
2.4 Safety Devices.....	2-3
2.5 Installation Safety.....	2-4
2.6 Programming Safety.....	2-4
2.7 Operation Safety.....	2-5
2.8 Maintenance Safety.....	2-6
3 EQUIPMENT DESCRIPTION	
3.1 Barrier Assembly.....	3-1
3.1.1 Motor Drive.....	3-1
3.1.2 Chain/Sprocket System.....	3-1
4 INSTALLATION	
4.1 Materials Required.....	4-1
4.1.1 Customer-Supplied Items.....	4-1
4.1.2 List of Tools.....	4-1
4.2 Installing Barrier Assembly.....	4-2
4.2.1 Site Preparation.....	4-2
4.2.2 Unpack and Install.....	4-2
4.3 Barrier Assembly Install.....	4-3
4.3.1 Retrofit Usage.....	4-3
4.3.2 Positioner Shipping/Alignments Bolts Removal.....	4-3
4.3.3 Floor Mount.....	4-4
4.4 Conducting a Safety/Operation Check.....	4-4
5 OPERATION	
5.1 DC Motor Controller Board.....	5-1
5.1.1 Sequence of Operation.....	5-1
5.2 Door Operation.....	5-2

<u>Section</u>	<u>Page</u>
6 MAINTENANCE	
6.1 Spare Parts	5-1
6.2 Motor	5-1
6.3 Maintenance Schedule	5-2
6.3.1 Barrier Assembly	5-2
6.4 Troubleshooting.....	5-2
6.4.1 Barrier Assembly	5-2
6.5 Chain/Sprocket System.....	5-2
6.5.1 Spring Tensioner Assembly	5-4
6.5.2 Taper Locks	5-5
6.5.3 Remove Chain	5-6
6.5.4 Install Chain	5-6
6.5.5 Door Attachment/Adjustment	5-7
6.5.6 Limit Switch Replacement	5-8
6.5.7 Limit Switch Position Adjustment	5-9
A ILLUSTRATED PARTS LIST	
A.1 Introduction.....	A-1
INDEX	

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
Figure 1-1	System Layout.....	1-2
Figure 3-1	Chain/Sprocket System Components.....	3-2
Figure 4-1	Unbolting Equipment.....	4-2
Figure 4-2	Location of Positioner Shipping/Alignment Bolts.....	4-3
Figure 4-3	Leveling Bolts.....	4-4
Figure 5-1	Wiring Diagram.....	5-1
Figure 6-1	Chain/Sprocket System.....	5-3
Figure 6-2	Spring Tensioner Install.....	5-4
Figure 6-3	Mounting.....	5-5
Figure 6-4	Dismounting.....	5-6
Figure 6-5	Stop-Nut Gap.....	5-7
Figure 6-6	Shipping/Alignment Bolts.....	5-7
Figure 6-7	Limit Switch Replacement.....	5-8
Figure 6-8	Limit Switch/Mounting Plate Orientation.....	5-9
Figure A-1	Barrier Assembly Components.....	A-4
Figure A-2	Panel Components.....	A-6
Figure A-3	Spring Tensioner Components.....	A-8
Figure A-4	Door Assembly Components.....	A-10
Figure A-5	Motor Drive Components.....	A-12

LIST OF TABLES

<u>Table</u>		<u>Page</u>
Table 5-1	Pin Connection Chart.....	5-2
Table 6-1	Recommended Spare Parts.....	5-1
Table 6-2	Maintenance Schedule.....	5-2
Table 6-3	Troubleshooting.....	5-2
Table A-1	Parts List – Barrier Assembly Components.....	A-5
Table A-2	Parts List – Panel Components.....	A-7
Table A-3	Parts List – Spring Tensioner Components.....	A-9
Table A-4	Parts List – Door Assembly Components.....	A-11
Table A-5	Parts List – Motor Drive Components.....	A-13

NOTES

SECTION 1

INTRODUCTION

1.1 About this Document

This manual provides general information about the Barrier Assembly. Standard widths for the Barrier Assembly are 1.2 and 1.6 meters. However, this manual can be used with any custom width barriers Motoman has produced. This manual contains the following sections:

SECTION 1 - INTRODUCTION

This section provides general information about the Barrier Assembly, the components, a list of reference documents, and customer service information.

SECTION 2 - SAFETY

This section provides information regarding the safe use and operation of the Barrier Assembly positioners.

SECTION 3 - DESCRIPTION OF EQUIPMENT

This section provides detailed descriptions of the major components of Barrier Assembly positioners. This section also includes component specifications.

SECTION 4 - INSTALLATION

This section provides instructions for installing the Barrier Assembly.

SECTION 5 - TOOLING RECOMMENDATIONS

This section provides guide lines for customer-supplied tooling design.

SECTION 6 - MAINTENANCE

This section provides instructions for maintaining the Barrier Assembly positioner.

APPENDIX A

Appendix A provides an illustrated parts lists with exploded views for Barrier Assembly components.

1.2 System Overview

The Barrier Assembly work station is an important part of an arc welding cell. It protects the operator from the active cell area while providing a solid and safe structure to support parts for the arc welding process. A door is raised and lowered to provide access to production parts inside the positioner. Access through the cell door to the positioner is permitted after the welding cycle is complete.

1.2.1 System Layout

The barrier assembly interacts with the controller to activate the cell door. Safety features are in place on the barrier station to prevent accidents and protect the cell operator during emergencies. The cell door protects the user 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.

Use of multiple barrier assemblies require a spanner plate for proper positioning with the robot arm. Figure 1-1 illustrates the barrier assembly.

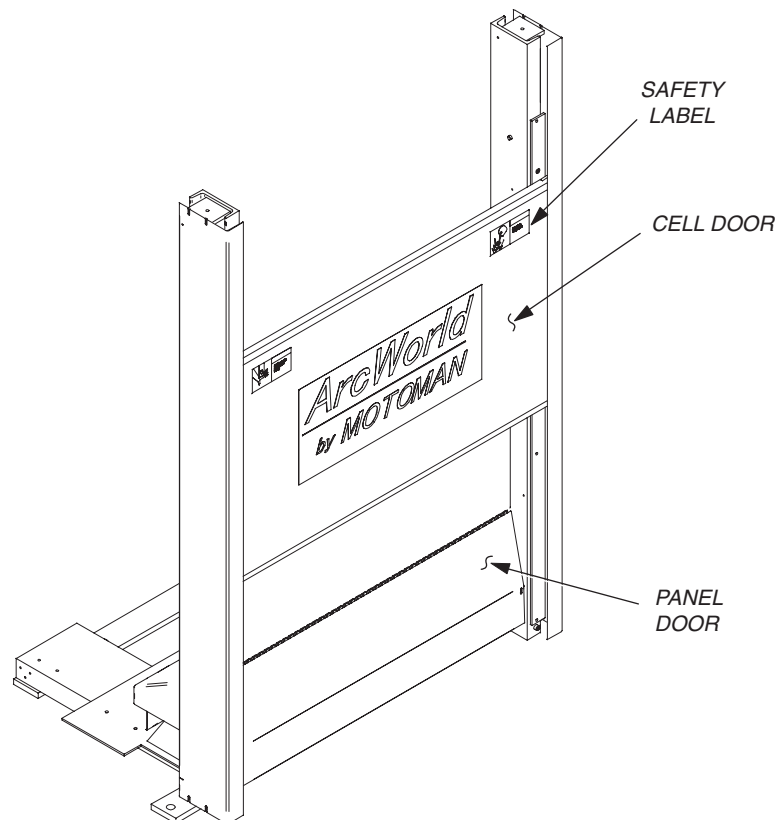


Figure 1-1 System Layout

1.3 Customer Service Information

If you need technical assistance, contact the Motoman service staff at 937.847.3200. Please have the following information ready before you call:

- Product (cell assembly and barrier)
- Serial Number

SECTION 2

SAFETY

2.1 Introduction

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

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

Robotic Industries Association

900 Victors Way

P.O. Box 3724

Ann Arbor, Michigan 48106

TEL: (734) 994-6088

FAX: (734) 994-3338

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

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

This safety section addresses the following:

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

2.2 *Standard Conventions*

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

- DANGER
- WARNING
- CAUTION
- NOTE

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



DANGER!

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



WARNING!

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



CAUTION!

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

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

2.3 *General Safeguarding Tips*

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

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

2.4 *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

Each barrier is built to support the combined weight of tooling fixtures, processed parts, and cell door motion. The barrier is also designed to withstand the dynamic forces generated from the positioner.

3.1 Barrier Assembly

The design of the barrier assembly allows for smooth operation of the positioner door. The door is raised/lowered with an electric motor and chain/sprocket system. The electric motor receives signal from the controller when the cycle start button is pressed.

The chain/sprocket drive, the motor, and the arc-screen door are all synchronized with one another to keep the system consistent and straight. A spring-tensioner keeps proper tension on the chain even after it becomes worn.

3.1.1 Motor Drive

The drive component of the system is a DC (direct current) electric motor. The motor includes a worm-gear reducer and does not require maintenance.

3.1.2 Chain/Sprocket System

The door is mechanically actuated with two #35 roller, self-lubricating, chain/sprocket systems. Both sprocket systems are driven by a jack-shaft rod that is controlled mechanically by an electric motor and a normally-on brake.

In-position Switch

Movement of the door is stopped when either the door-up or down switch is depressed has been pressed. These switches are interlocked with the cell safe guarding that activates the light curtain. Located at the top and bottom of barrier post, this switch is activated when the door opens and closes.

When pushed in, the limit switch also signals the controller (through logic or user-defined logic) to instantly stop the motor and apply brakes to the jack shaft. The limit switch is activated by an actuator plate that is fastened to the chain and the top and bottom of the door.

Counter-weight

To offset the weight of the door during cycles, a steel counter-weight is positioned inline with each chain assembly. This reduces the work-load on the motor.

Adjustments

This system has several chain adjustments that are used for chain/sprocket installation. After installation a spring tensioner is used to keep proper tension on the chain.

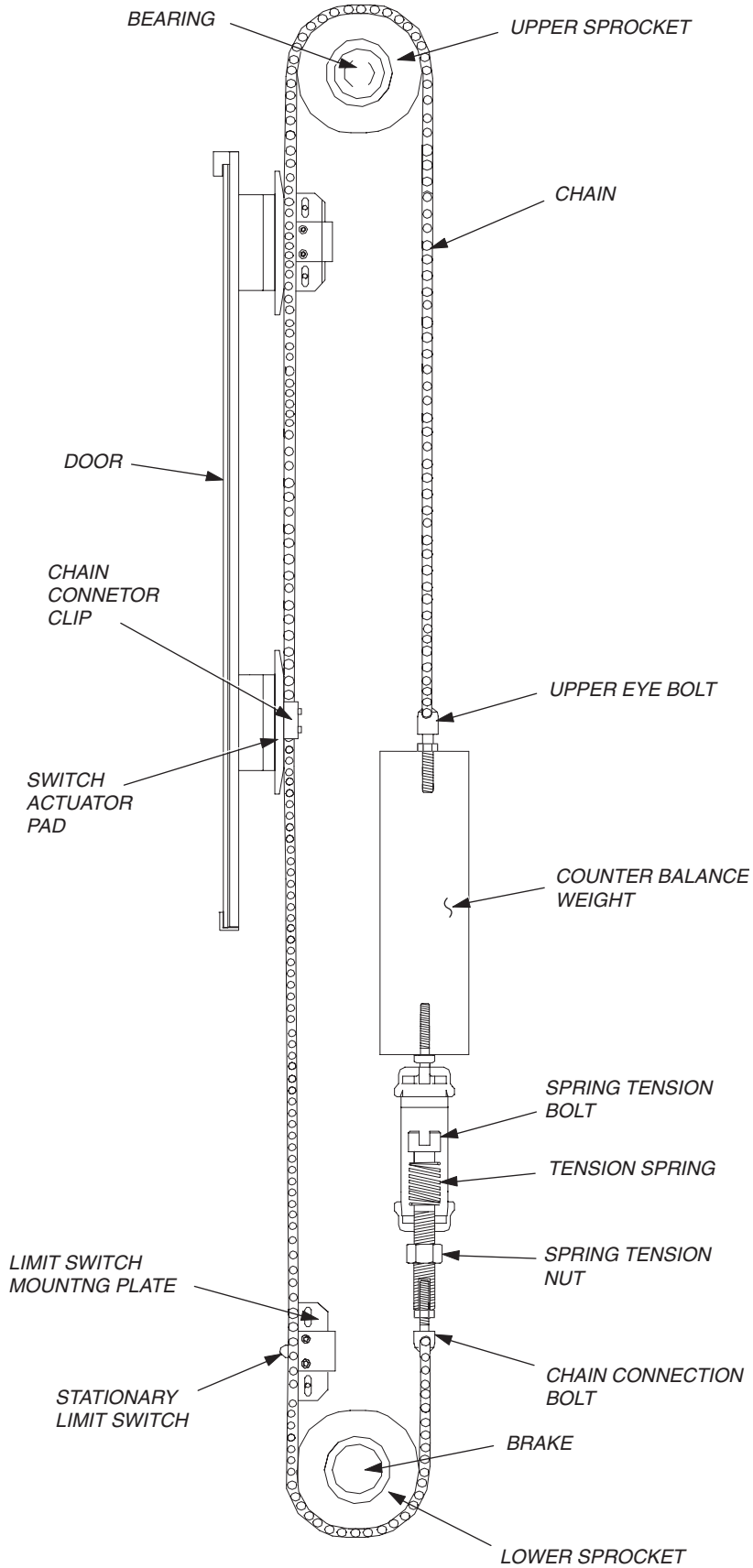


Figure 3-1 Chain/Sprocket System Components

Door

The chain activated door has a hollow core and is made of an aluminum composite material. It allows the operator access to the cell and protects from arc radiation.

The door is fastened to both chains using two chain connector clips. When the door is raised and lowered, the actuator plates trigger the in-position switch which stops the door.

Using friction reducing liners, the actuator plates are the only part of the door assembly to contact the frame of the barrier. This quiets the door.

Control Board

The motor controller is a single board, pulse width modulated, variable frequency, motor control using armature voltage for feedback. The controller has a motor reversing circuit as well as acceleration and deceleration ramp circuits. A 4 amp, MDL fuse provides over current protection.

NOTES

SECTION 4

INSTALLATION



CAUTION!

Installation of the Barrier Assembly positioners is not a task for the novice. These components are not fragile, but should still be handled with care. Rough handling can damage system electronic components.

Installation of the Barrier Assembly 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.

4.1 *Materials Required*

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

4.1.1 *Customer-Supplied Items*

- Servo motion control unit
- Incoming power supply
- Two earth ground cables with two earth ground stakes

4.1.2 *List of Tools*

- Safety glasses
- Level
- Adjustable wrench set
- Hammer drill with appropriate concrete bits
- Forklift and/or overhead crane
- Open-end wrench set
- Wrench sets (standard and metric)

4.2 *Installing Barrier Assembly*

4.2.1 *Site Preparation*

Each barrier assembly should be firmly mounted on a machine base or foundation rigid enough to withstand the static and dynamic forces.

4.2.2 *Unpack and Install*

The barrier assembly is shipped on a wood shipping skid. To install the barrier assembly, proceed as follows:



WARNING!

The barrier assembly weighs 382 kg (843 lbs). Be sure that your lifting device is capable of handling this much weight or damage to the equipment or injury to personnel can result.

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

NOTE: *If any equipment is damaged, notify the shipper immediately.*

3. Unbolt equipment from wooden shipping skid (see Figure 4-1).

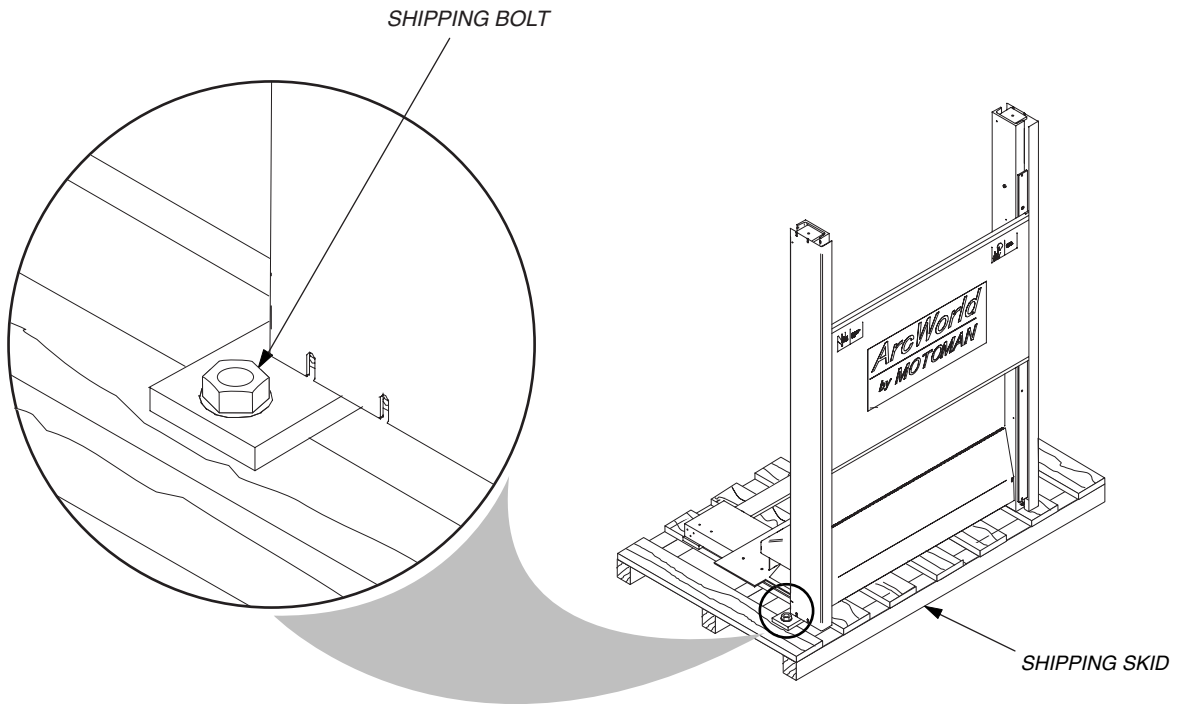


Figure 4-1 Unbolting Equipment

4.3 Barrier Assembly Install

The barrier assembly is delivered assembled and ready to install. The system is pre calibrated with no programming required.

4.3.1 Retrofit Usage

Use the following installation procedures if the barrier assembly was purchased for a retrofit application.

Preparation

Successful installation requires the barrier assembly be firmly mounted to the floor of common base.

Unpack

The barrier assembly is shipped on a shipping skid. Carefully remove plastic wrapping from components and inspect them for shipping damage.

NOTE: *If any equipment is damaged, notify the shipper immediately.*

4.3.2 Positioner Shipping/Alignments Bolts Removal



CAUTION!

Failure to remove the positioner shipping/alignment bolts before operating the Barrier Assembly will result in a blown fuse and possible damage to equipment.

For shipping purposes, a yellow-capped shipping/alignment bolt (see Figure 4-2) is inserted through both front posts of each positioner (four bolts total), and fastened to the counterbalance. Each bolt secures the counterbalance and the rest of the chain assembly to prevent the door from opening. **These two bolts must be removed before operation of the barrier assembly.**

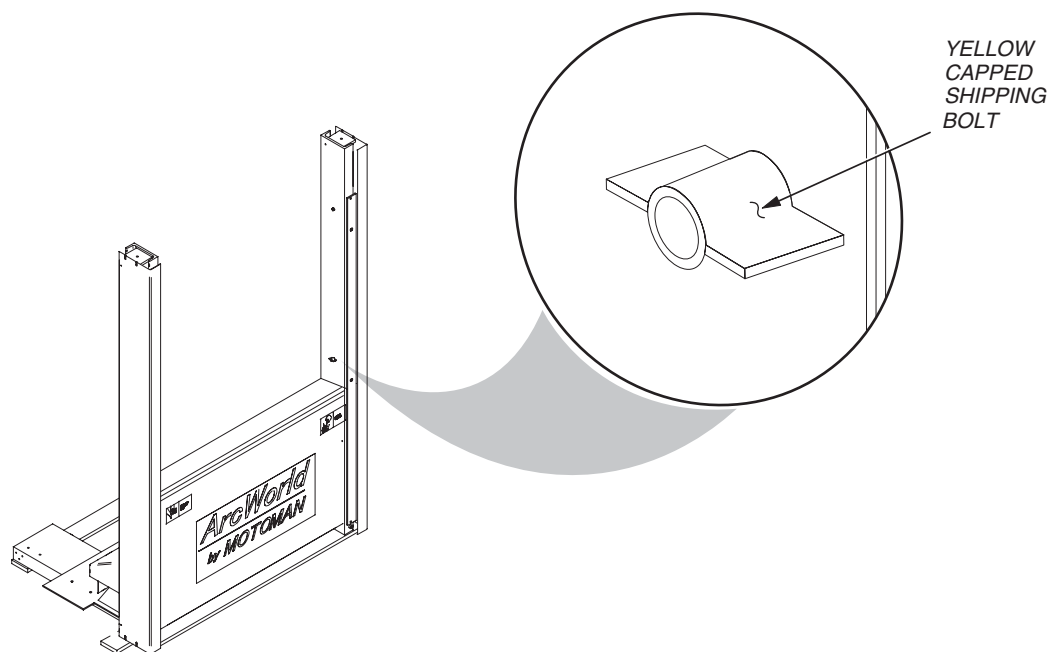


Figure 4-2 Location of Positioner Shipping/Alignment Bolts

4.3.3 Floor Mount

After the barrier assembly is in position, level and secure it to the floor. To level and secure the equipment, proceed as follows:

1. Level barrier assembly by adjusting leveling bolts (see Figure 4-3).

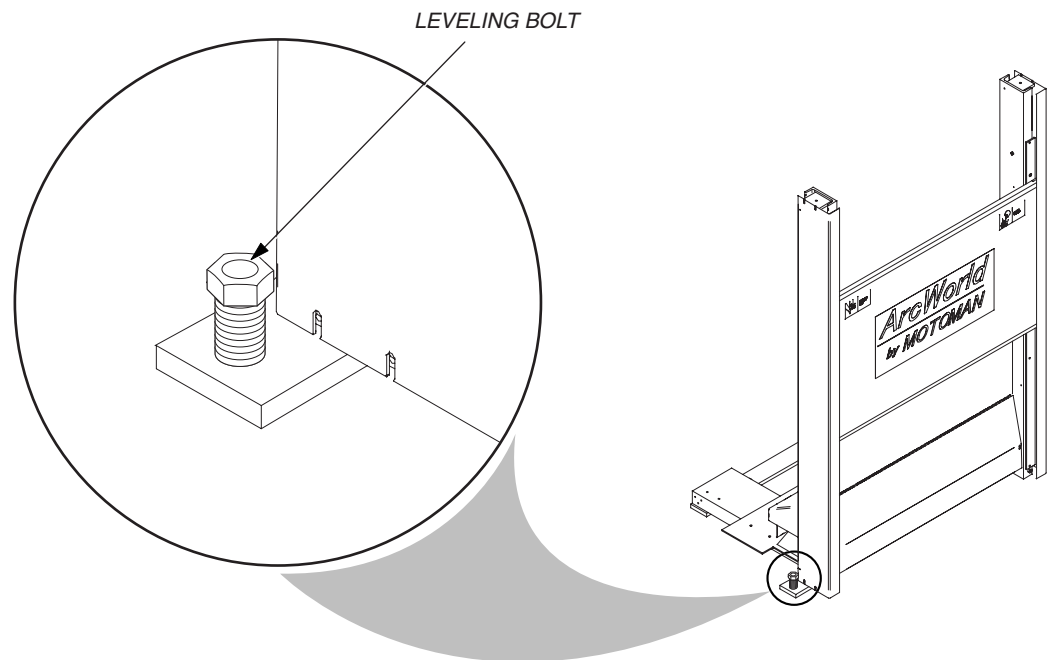


Figure 4-3 Leveling Bolts

2. Insert a 1/2-inch concrete drill bit through center of leveling bolts and drill holes for lag bolts.
3. Vacuum concrete dust from holes.
4. Lag barrier assembly to floor.

4.4 Conducting a Safety/Operation Check

Before operating either Barrier Assembly system, take a few minutes to perform a safety/operation check. To perform a safety/operation check, proceed as follows:

1. Check that all cable connections are tight.
2. Verify the headstock and tailstock are level and parallel.

SECTION 5

OPERATION

The basic function of the barrier assembly is to open/close the door while safely shielding the operator from the robotic cell. Safety features are in place to eliminate harm to the operator and/or the barrier assembly.

5.1 DC Motor Controller Board

Operation of the system is controlled by the motor control assembly board.

5.1.1 Sequence of Operation

1. Set motor direction TB2-7 and TB2-8
2. Enable motor TB2-5 TB2-6.
3. Monitor in-position switch for location.
4. Turn off motor enable.

For wiring and pin connection detail see Figure 5-1 and Table 5-1.

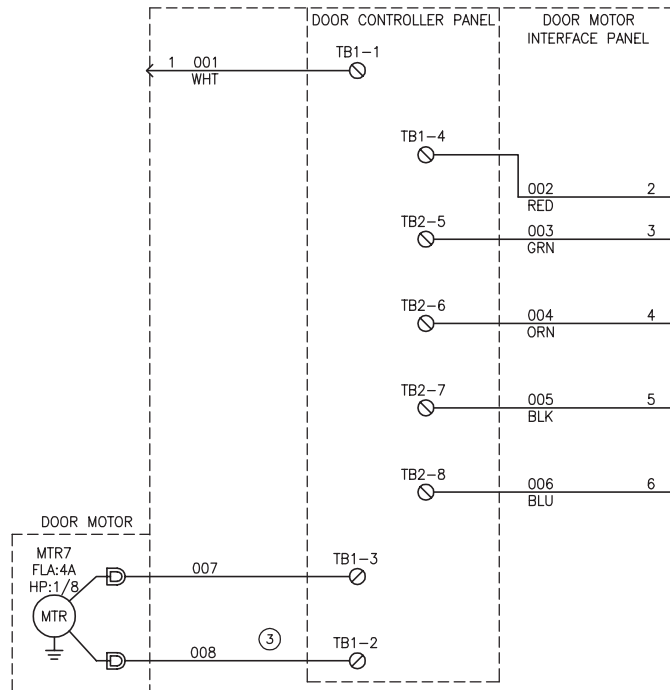


Figure 5-1 Wiring Diagram

Table 5-1 Pin Connection Chart

<i>Terminal</i>	<i>Description</i>
TB1-1	+24 VDC
TB1-2	M+
TB1-3	M-
TB1-4	0 VDC
TB2-1	+15 VDC
TB2-2	+24 VDC
TB2-3	Ref
TB2-4	Com
TB2-5	Motor Enable
TB2-6	Motor Enable
TB2-7	Motor Direction
TB2-8	Motor Direction

5.2 *Door Operation*

The door is driven by an electric motor coupled with a chain sprocket assembly. In-position limit switches are set inline with the door path and chain to actuate the brake for stopping. Hard-stop bolts are in place on top of each side post to physically prevent excessive door travel.

SECTION 6

MAINTENANCE

Maintenance of the Barrier Assembly components should be performed only by authorized personnel who are familiar with the design and construction of this positioner. 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.



WARNING!

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

6.1 Spare Parts

When a part malfunctions, it is helpful to have replacement parts in stock for quick replacement. Table 6-1 lists the recommended spare parts with Motoman part numbers. Motoman recommends the following parts be kept on hand:

Table 6-1 Recommended Spare Parts

<i>Component</i>	<i>Component Name</i>	<i>Recommended Quantity</i>
146734-1	Board Assy, Motor Control	1
147249-1	Brake	1
130293-1	Fuse, MDL, 4 Amp	5
143963-1	Switch, Limit	1
146908-2	Block, Guide, Door	4

6.2 Motor

The motor has no wear parts (i.e. brushes), so a simple daily inspection is sufficient. *Do not disassemble the motor.* Contact the Motoman Service Department at (937) 847-3200 when replacement becomes necessary.

6.3 *Maintenance Schedule*

See Table 6-2 for the periodic maintenance schedule.

Table 6-2 Maintenance Schedule

<i>Inspection Item</i>	<i>Frequency</i>	<i>Inspection Operation</i>
Physical damage	Daily	Check for physical damage; this indicates a load collision and is evidence of misuse.
Excessive or unusual noise	Daily	Listen for grinding, excessive or irregular noise. Contact Motoman Service Department at (937) 847-3200.
Cleaning	As required	Clean with dry cloth or compressed air.
146908-1 Block, Guide, Door	500,000 cycles	Replace

6.4 *Troubleshooting*

See Table 6-3 for the troubleshooting procedures.

Table 6-3 Troubleshooting

<i>Symptom</i>	<i>Probable Cause</i>	<i>Corrective Action</i>
Motor does not start	Power is OFF	Turn power ON.
	Blown Fuse	Check fuse and replace if necessary.
	Overload	Reduce load or reduce unbalanced load.
	Loose connection	Check all wire connections.
	Incorrect wiring	Check that system has been wired correctly.
	Motor loosely mounted	Tighten mounting bolts.
Unusual noise	Doors misaligned	Realign doors.

6.5 *Chain/Sprocket System*

The chain/sprocket system contains low-wear and self-lubricated parts that make the system virtually maintenance free. See Figure 6-6 for system components.

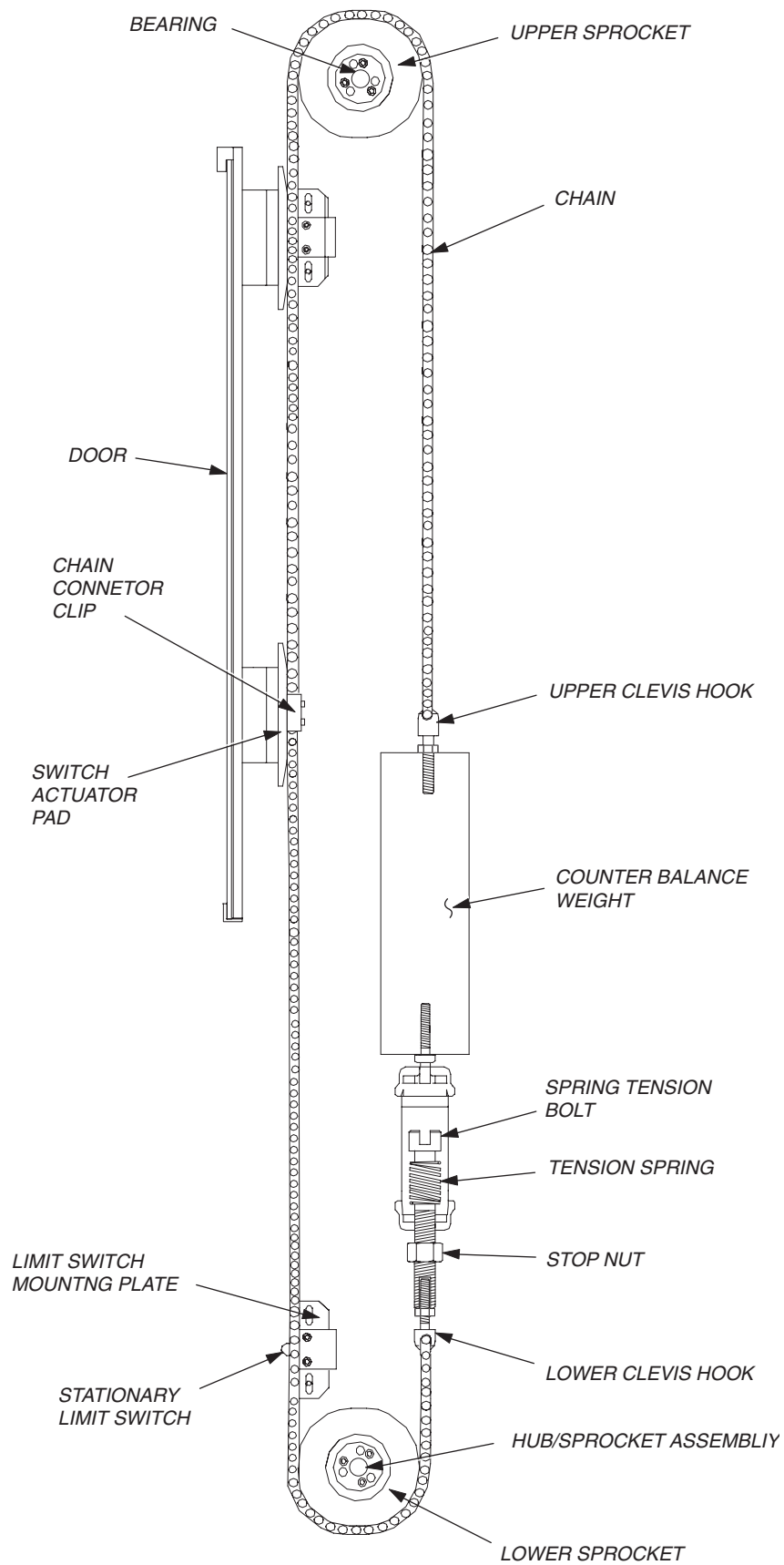


Figure 6-1 Chain/Sprocket System

Before servicing the Chain/Sprocket assembly, the side rails on the barrier must be removed.

6.5.1 Spring Tensioner Assembly

Use Figure 6-2 to install counter weight components. Before starting assembly, secure counter weight to barrier post.

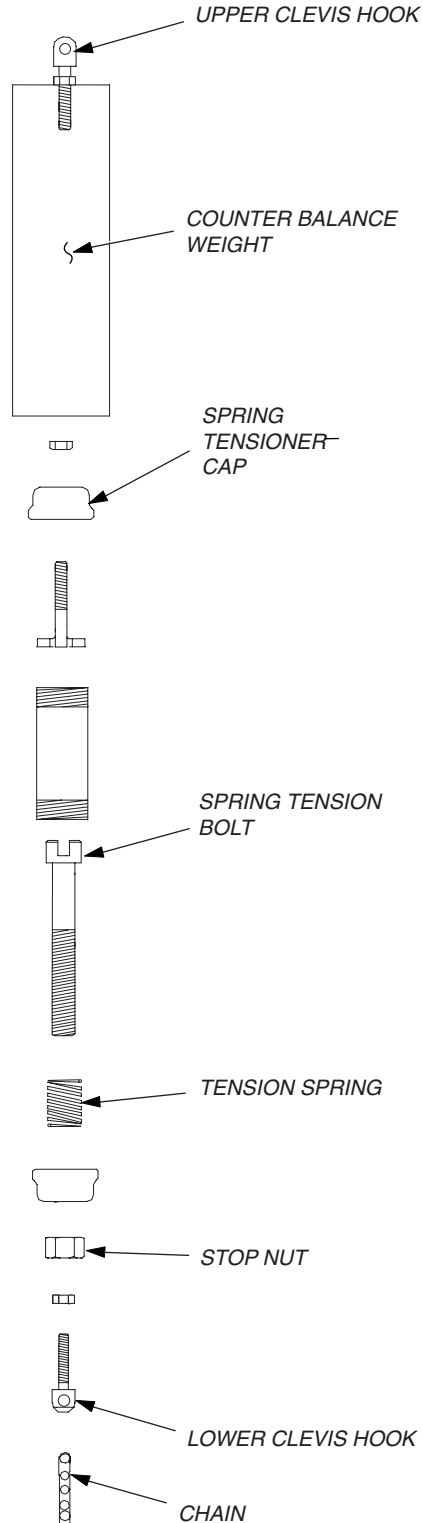


Figure 6-2 Spring Tensioner Install

6.5.2 Taper Locks

Mounting



CAUTION!

- *Caution A* – To ensure proper installation of QD bushing, be sure cone surfaces are free of paint, grease and dirt (see Figure 6-2 and Figure 6-3).
- *Caution B* – To ensure proper installation of QD bushing, tighten pull-up bolts alternately and evenly per bolt torque given (see Figure 6-2 and Figure 6-3).
- *Caution C* – To ensure proper installation of QD bushing, never close gap between sprocket and flange of QD bushing (see Figure 6-2 and Figure 6-3).



CAUTION!

Use of anti-seize lubricant on tapered cone surfaces when mounting sprocket voids all warranties.

1. Assemble sprocket with bolts inserted (but not tightened) through DRILLED holes in bushing flange into TAPPED holes in sprocket.
2. With key in shaft keys seat, slide assembly into approximate position on shaft with flange end of bushing away from bearing.
3. Position QD bushing on shaft.
4. Tighten pull-up bolts alternately and evenly to 3.6 N•m (2.6 lbf-ft.). Do not use extensions on wrench handles. There should be a gap between the face of the sprocket hub and the flange of the QD bushing to insure a satisfactory cone grip and press fit. **THIS GAP MUST NOT BE CLOSED** (see Figure 6-3).

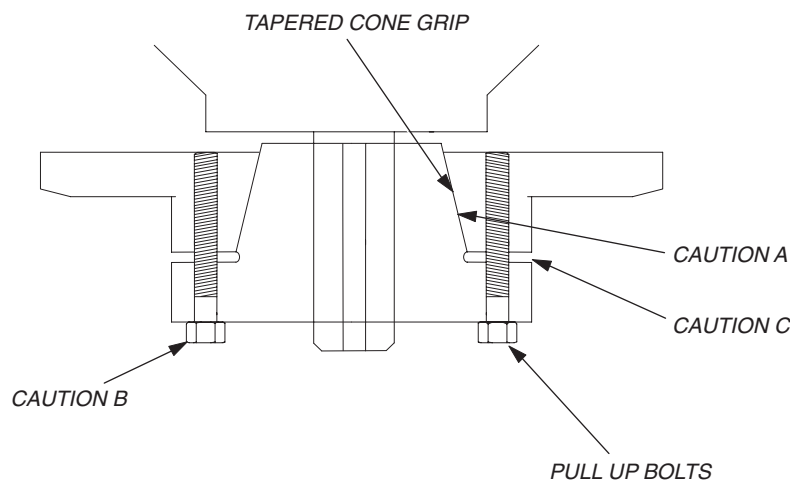


Figure 6-3 Mounting

Dismounting

1. Remove pull-up bolts (see Figure 6-4) and screw them into TAPPED holes in bushing flange and against hub of sprocket to break cone grip.
2. Loosen set screw in bushing flange and slide QD bushing from shaft.

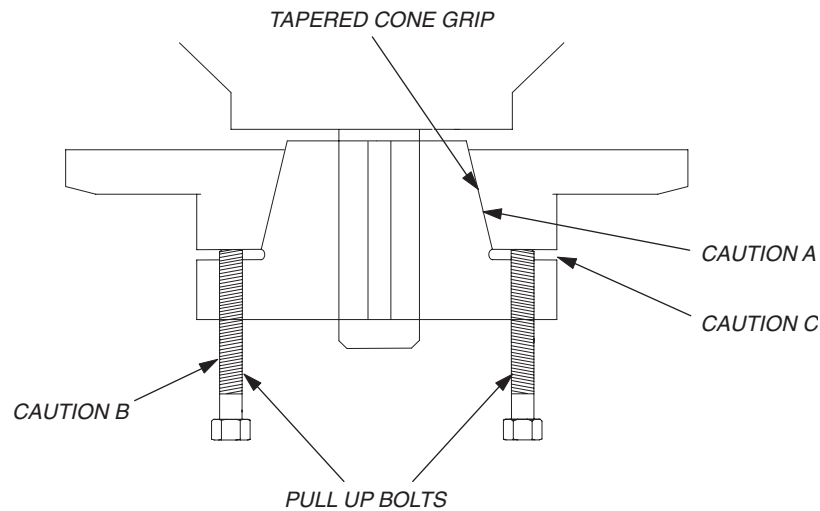


Figure 6-4 Dismounting

6.5.3 Remove Chain

1. Secure counter weight to the side post of the barrier assembly with the shipping/alignment bolts (see Figure 6-6).
2. Loosen the hub/sprocket assembly (see Section 6.5.2).
3. Remove spring pressure by loosening the stop nut.
4. Detach master links.
5. Detach chain from door.
6. Remove chain.

6.5.4 Install Chain

1. Attach chain to top of counter weight with master link
2. Route chain over upper sprocket and under drive sprocket.
3. Attach chain to spring tensioner with master link.
4. Check for 3 - 5 mm gap (see Figure 6-5) and that the chain will not jump sprocket.

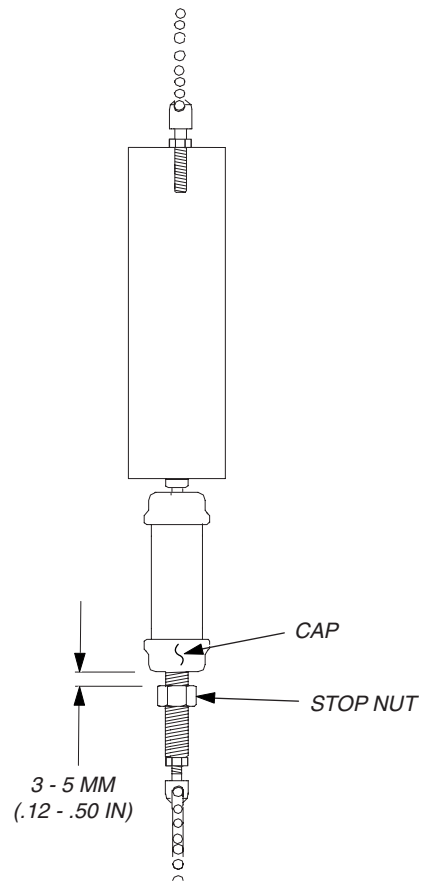


Figure 6-5 Stop-Nut Gap

6.5.5 Door Attachment/Adjustment

Before attempting to attach or adjust door, make sure both counter weights are secured with shipping bolts (see Figure 6-6).

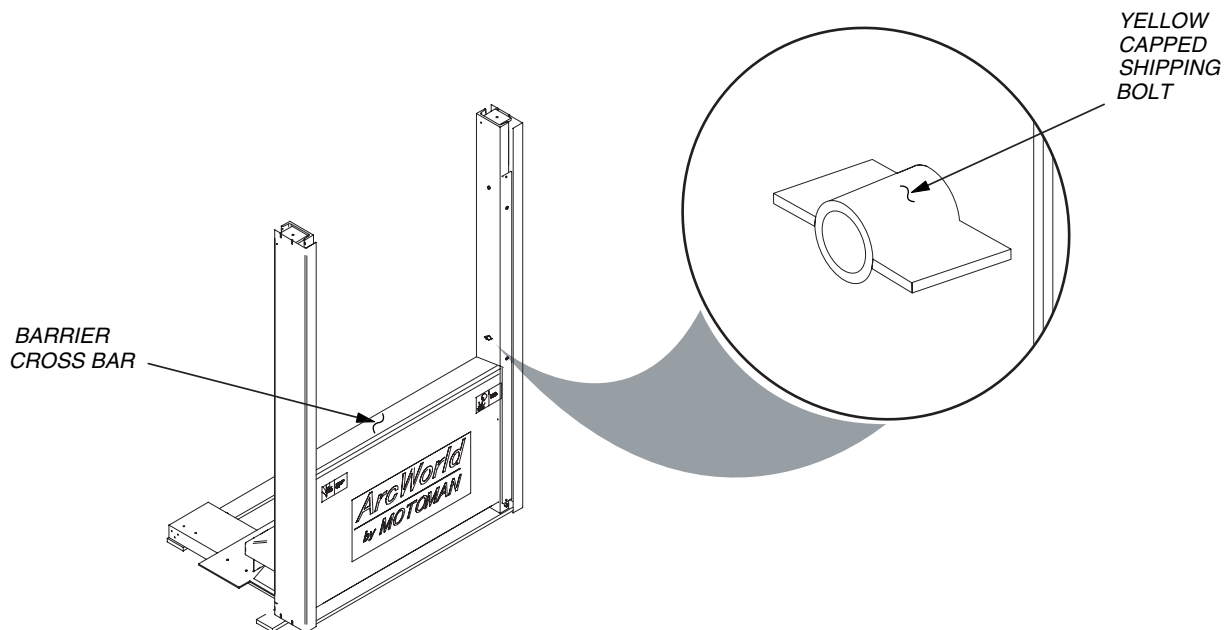


Figure 6-6 Shipping/Alignment Bolts

Door Assemble

1. Install guide blocks to left side of door assembly.
2. Slide door assembly onto left guide rail.
3. Rest door assembly on base/floor.
4. Install guide blocks to right side of door assembly.



CAUTION!

Door must be free of binding during motion. Binding of the system causes undue stress on system components.

5. Slide door assembly to the upper position then to lower position to check for binding of guides. If there is binding, adjust rail position on frame.

Door Attach/Adjust to Chain Drive

1. Block bottom of door up 406.4 mm (16 inches) from floor/base.
2. Attach right hand chain to door with clip on lower switch actuator. If chain and mounting holes are not aligned, adjust position of chain with upper and lower clevis on weight assembly.
3. Attach left hand chain to door with clip on upper switch actuator. If chain and mounting holes are not aligned, adjust position of chain with upper and lower clevis on weight assembly.

If replacing both chains, repeat each step for the opposite side.

4. Tighten the hub/sprocket assembly to shaft end (see Section 6.5.2).
5. Repeat the above steps for the other chain assembly.
6. Attach the side rails back onto the barrier sides.

6.5.6 Limit Switch Replacement

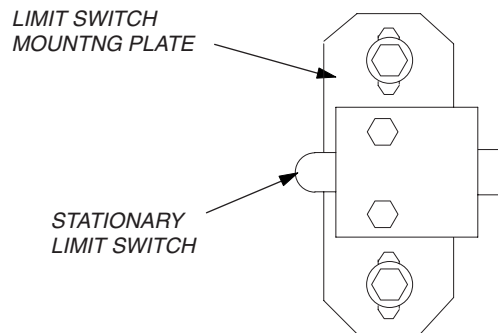


Figure 6-7 Limit Switch Replacement

The limit switch is on the recommended list of spares for the barrier assembly. To replace the limit switch proceed as follows:

1. Shut down the cell and power off.
2. Remove the side post panel.
3. Detach cable from limit switch.
4. Unbolt the limit switch from limit switch mounting plate.

NOTE: *The limit switch mounting plate does not need to be removed to replace the limit switch.*

If the mounting plate is removed, see Figure 6-8 for installation orientation.

As shown in Figure 6-8, the center lines for the limit switch and limit switch mounting plate do not overlap. Be aware of this orientation when assembling the new limit switch and limit switch mounting plate to the barrier post.

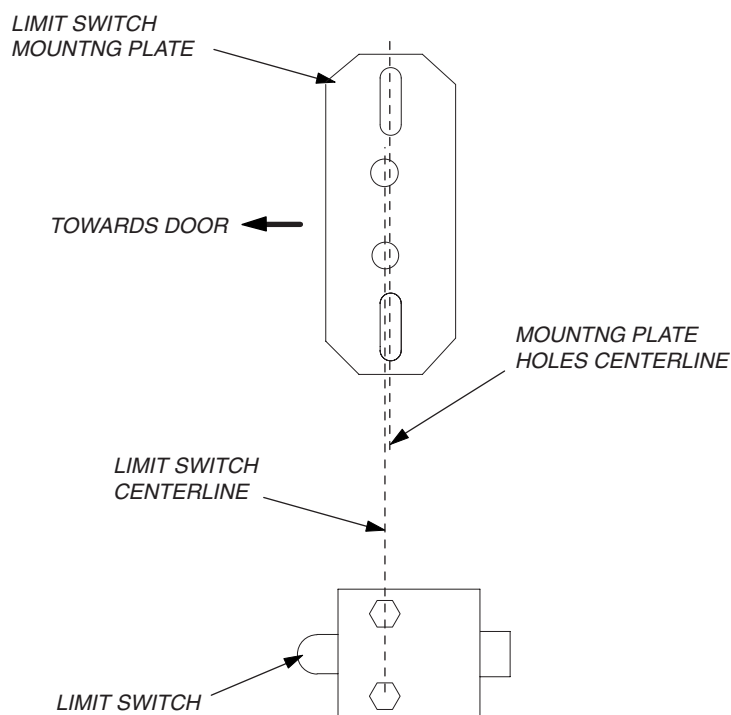


Figure 6-8 Limit Switch/Mounting Plate Orientation

5. Replace limit switch and connect cable.

6.5.7 Limit Switch Position Adjustment

When the door cycles up and down, it must actuate the limit switches to stop. If the limit switch needs adjusted, proceed as follows:

1. Shut power off to the barrier assembly.
2. Grasp the limit switch and hold.
3. Loosen – do not take out – the two bolts that fasten the limit switch mounting plate to the barrier post.
4. Slide the limit switch assembly up or down as needed.
5. Tighten the two bolts.

NOTES

APPENDIX A

ILLUSTRATED PARTS LIST

A.1 Introduction

A.1.1 General

The Illustrated Parts List identifies, describes, and illustrates detail parts of the main assemblies for the Barrier Assembly Manual positioner manufactured by Motoman.

A.1.2 Purpose

This list provides parts identification and descriptive information for use in provisioning, requesting, purchasing, storing, and issuing spare parts.

A.1.3 Arrangement

Appendix A is arranged as follows:

- Appendix A.1 – Introduction
- Appendix A.2 – Illustrated Parts List

A.1.4 Explanation of Parts List

Contents

The parts list contains a breakdown of the equipment into detail parts. All parts of the equipment are listed except the following:

1. Standard hardware items (attaching parts) such as nuts, screws, washers, etc., which are available commercially.
2. Bulk items such as wire, cable, sleeving, tubing, etc., which are also commercially available.
3. Permanently attached parts which lose their identity by being welded, soldered, riveted, etc., to other parts, or assemblies.

Parts List Form

This form is divided into four columns as follows:

1. “Figure - Item Number” Column

This Figure column lists the figure number of the illustration applicable to a particular parts list and also identifies each part in the list by an item number. These item numbers also appear on the illustration. Each item number on the illustration is connected to the part to which it pertains by a leader line and arrow. Thus, the figure and item numbering system ties the parts list to the illustrations and vice versa

2. “Motoman Part Number” Column

All part numbers appearing in this column are Motoman part numbers.

3. “Description” Column

The item nomenclature appears in this column.

4. “QTY” Column

This column indicates the quantity of parts required for an assembly or subassembly in which the part appears. This column does not necessarily reflect the total used in the complete end item.

A.2 Parts List

A.2.1 Explanation of Parts List Arrangement

The parts list is arranged so that the illustration will appear on left-hand page and the applicable parts list will appear on the opposite right-hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

A.2.2 Symbols and Abbreviations

The following is a list of symbols and abbreviations used in the parts list.

- amp – ampere
- AC – alternating current
- cyl – cylinder
- DC – direct current
- fig – figure
- hex – hexagon
- ID – inside diameter
- in– inch
- m – meter
- mm – millimeter
- No– number
- psi – pounds per square inch
- v – voltage

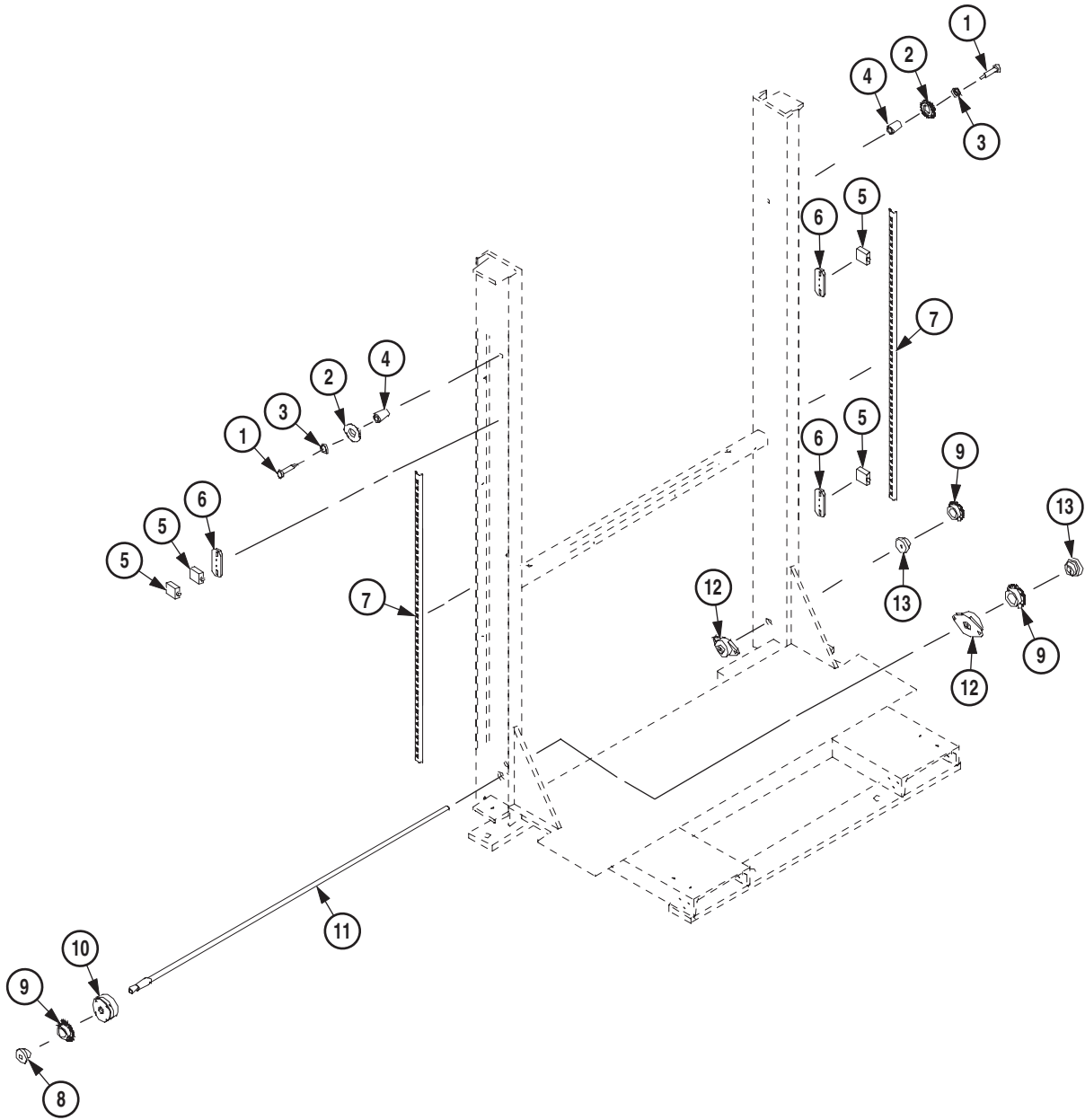


Figure A-1 Barrier Assembly Components

Table A-1 Parts List – Barrier Assembly Components

<i>Figure A-1 Item Number</i>	<i>Motoman Part Number</i>	<i>Description</i>	<i>QT Y</i>
	146406-()	BARRIER ASSY, SAFETY	
1	NA	SCREW, SHOULDER, M20 X 50 MM LONG	2
2	146563-1	SPROCKET, ALTERED, MOTOR OUTPUT	3
3	146439-1	SPACER, PULLEY	2
4	138653-1	BEARING, BALL, SINGLE ROW	2
5	143963-1	SWITCH, LIMIT, MINIATURE	4
6	146442-1	PLATE, MTG, LIMIT SWITCH	3
7	146232-1	RAIL, DIN, 35 MM	2
8	146699-2	BUSHING, 3/4" TAPERLOCK	1
9	146404-1	SPROCKET, #35 X 20 TOOTH	3
10	147249-1	BRAKE	1
11	146413-1	SHAFT, TIMING, DOOR, 5/8" DIA.	1
12	146700-1	FLANGE, 5/8" DIAMETER	2
13	146699-1	BUSHING, BEARING, 5/8" TAPERLOCK	2
NS	NA	CHAIN, #35 ROLLER X 120" LENGTH	2

NA = Not Applicable

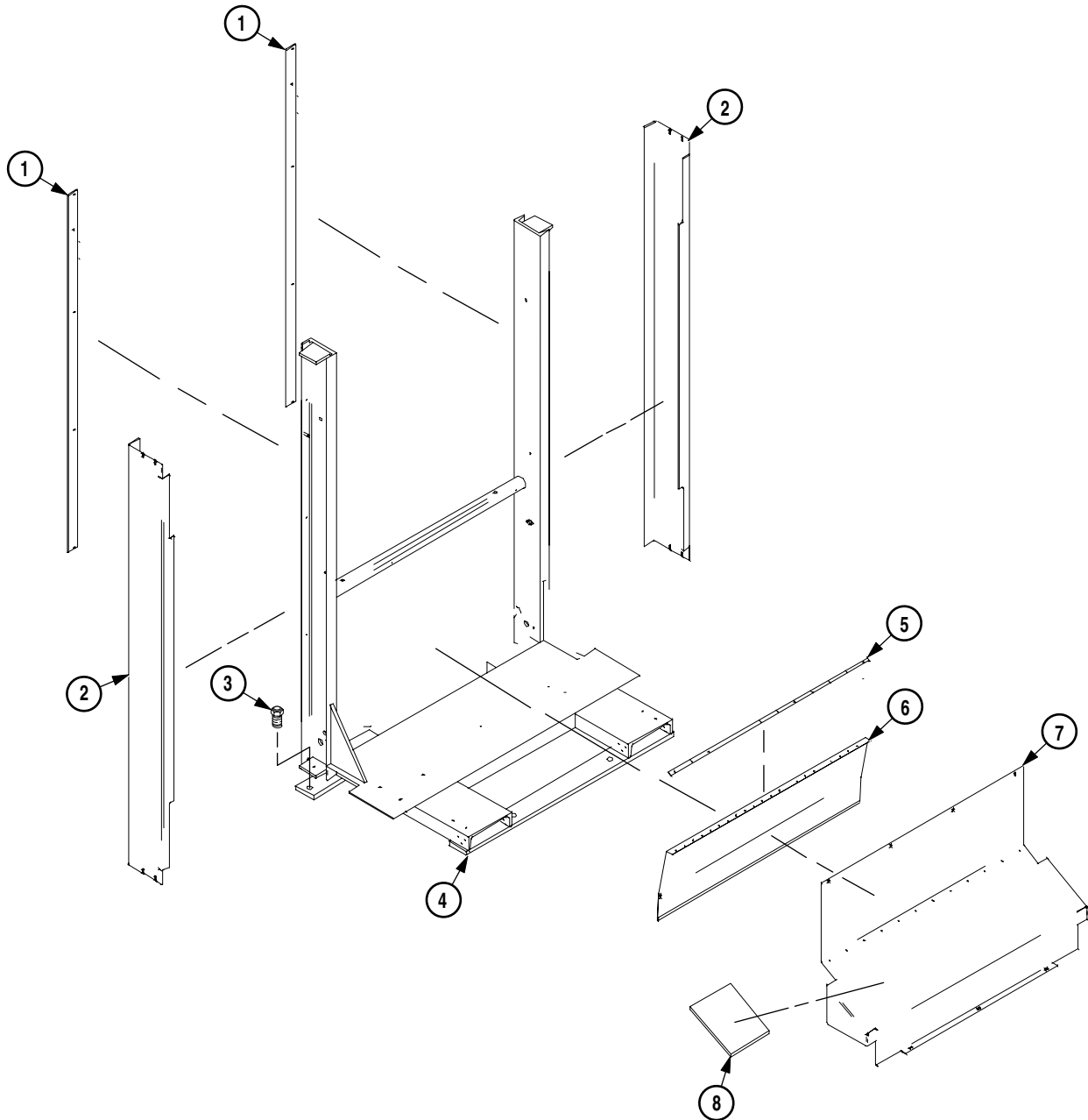


Figure A-2 Panel Components

Table A-2 Parts List – Panel Components

<i>Figure A-2 Item Number</i>	<i>Motoman Part Number</i>	<i>Description</i>	<i>QT Y</i>
1	146400-1	GUIDE, DOOR	2
2	146455-1	GUARD, SIDE	2
3	140784-1	SCREW, LEVELING, M30 X 3.5 X 80	4
4	146409-1	FRAME, WELDMENT, BARRIER	1
5	147252-1	SPACER, HINGE	1
6	146440-1	COVER, FRONT	1
7	146451-1	GUARD, DRIVE	1
8	146734-1	BOARD ASSY, MOTOR CONTROL	1

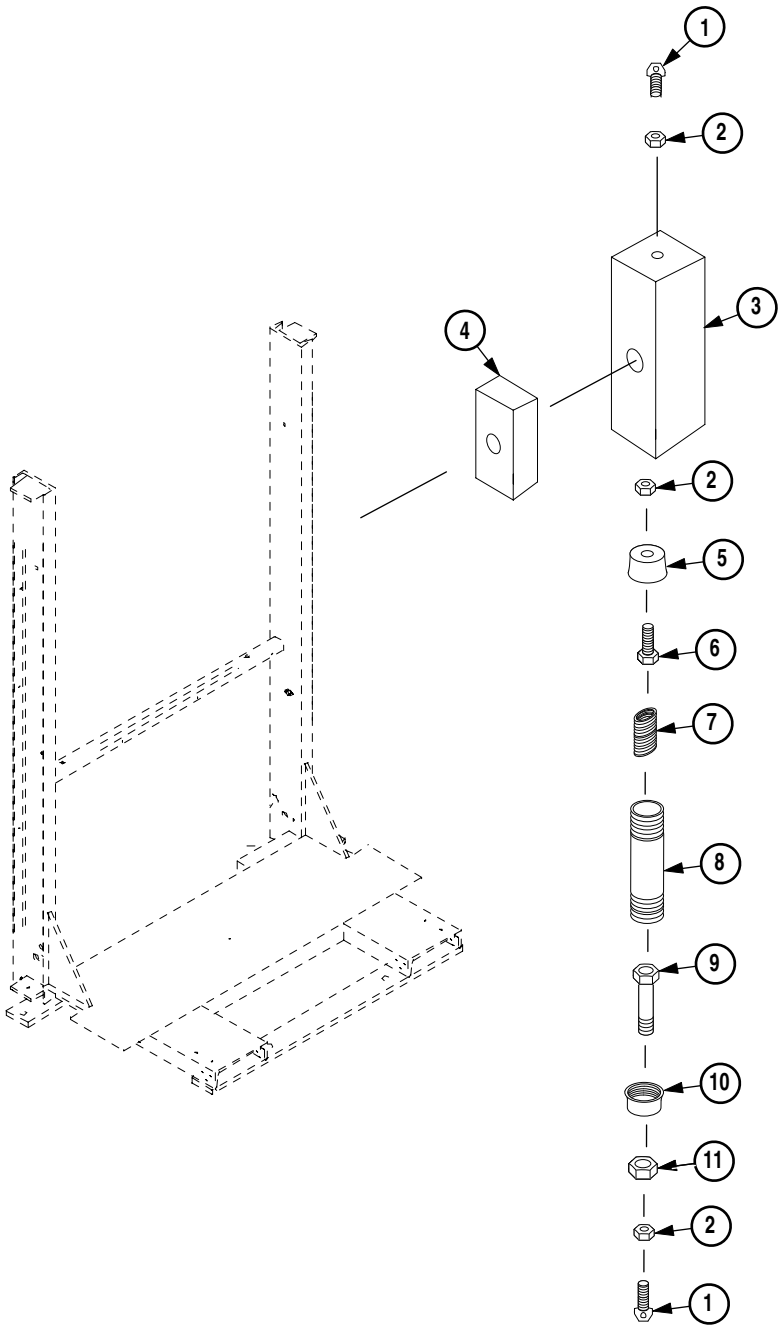


Figure A-3 Spring Tensioner Components

Table A-3 Parts List – Spring Tensioner Components

<i>Figure A-3 Item Number</i>	<i>Motoman Part Number</i>	<i>Description</i>	<i>QT Y</i>
1	146565-1	BOLT, SWING, M6	4
2	NA	NUT, HEX, M6, ZP	6
3	146412-1 146412-2	WEIGHT, COUNTER (146412-1 is for the 1.2 m unit, 146412-2 is for the 1.6 m unit)	2
4	146408-1	PAD, SHIPPING, COUNTERWEIGHT	2
5	146912-1	CAP, PIPE, MODIFIED, M12 DIA.	2
6	NA	SCREW, SHC, M6X25	2
7	146915-1	SPRING, COMPRESSION	2
8	146913-1	FITTING, NIPPLE, PIPE, BRASS	2
9	146910-1	SCREW MODIFIED	2
10	146911-1	CAP, PIPE, MODIFIED, M6 DIA.	2
11	NA	NUT, LOCK, M12, ELASTIC STOP	2

NA = Not Applicable

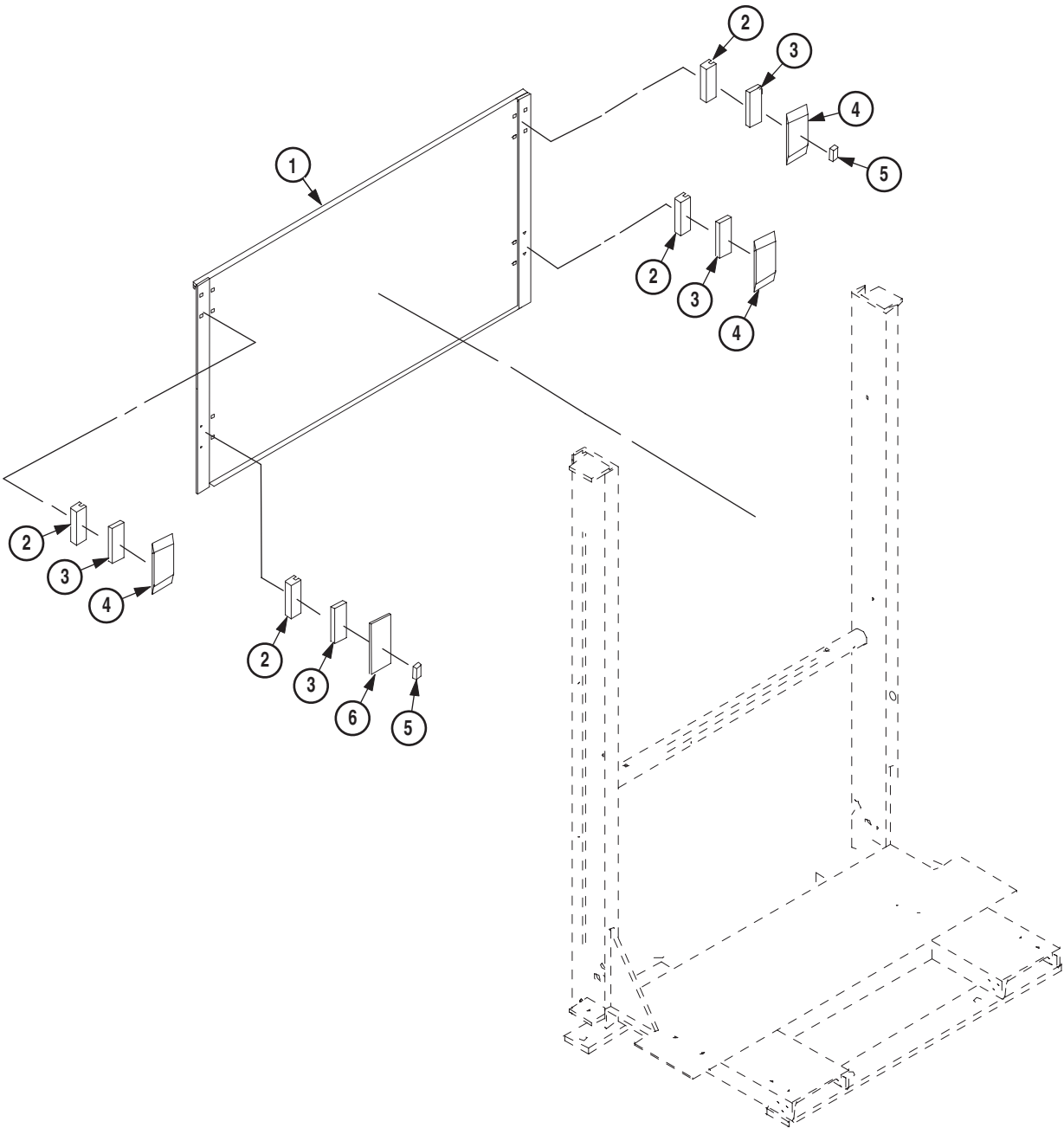


Figure A-4 Door Assembly Components

Table A-4 Parts List – Door Assembly Components

<i>Figure A-4 Item Number</i>	<i>Motoman Part Number</i>	<i>Description</i>	<i>QT Y</i>
1	146411-1 146411-2	SCREEN ASSY, ARC (146411-1 is for the 1.2 m unit, 146411-2 is for the 1.6 m unit)	1
2	146908-2	BLOCK, GUIDE, DOOR	4
3	146399-1	SPACER, GUIDE, DOOR	4
4	146443-1	PLATE, ACTUATOR, LIMIT SWITCH	3
5	146454-1	CLIP, CHAIN CONNECTION	2
6	146693-1	PLATE, NUT, DOOR BUSHING	1

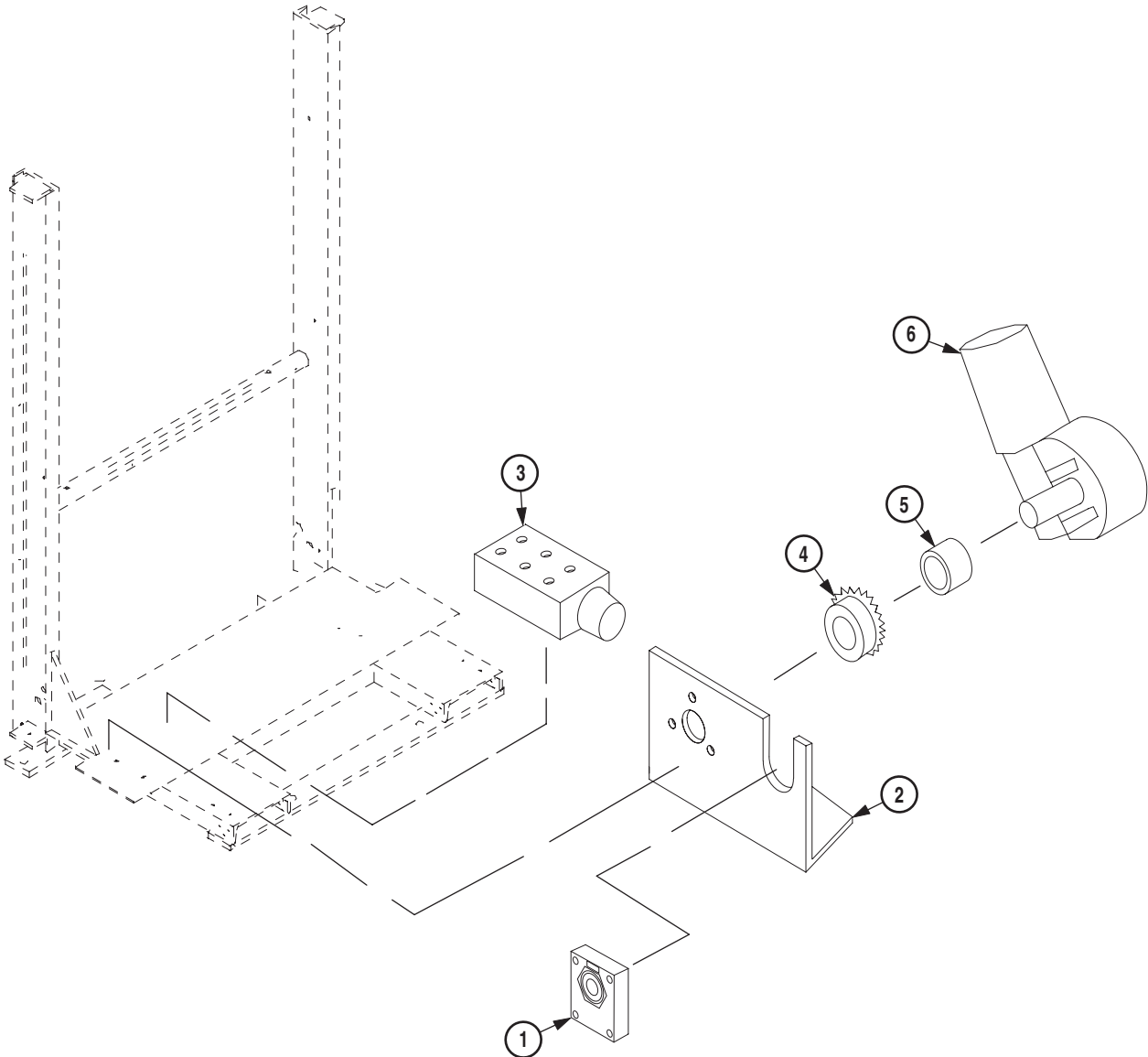


Figure A-5 Motor Drive Components

Table A-5 Parts List – Motor Drive Components

<i>Figure A-5 Item Number</i>	<i>Motoman Part Number</i>	<i>Description</i>	<i>QT Y</i>
1	146810-1	PANEL, ASSY, MOTOR, CONTROL	1
2	146401-1	BRACKET, MTG, MOTOR	1
3	706917-1	MODULE, J-BOX, 8-PORT, EURO	1
4	146563-1	SPROCKET, ALTERED, MOTOR OUTPUT	1
5	146564-1	INSERT, SHAFT ADAPTER	1
6	146398-1	MOTOR, DC, PERMMAG, W/WORM REDUCER	1
NS	NA	CHAIN, #35 ROLLER X 18 3/4 L	1

NA = Not Applicable

NS = Not Shown

NOTES

INDEX

A

About This Document, 1-1

ANSI/RIA, 2-1

C

Customer Service Information, 1-2

E

Equipment Description, 3-1

G

General Safeguarding Tips, 2-3

I

Installation, 4-1

Customer-Supplied Items, 4-1

List of Tools, 4-1

Materials Required, 4-1

Preparation, 4-3

Site Preparation, 4-2

Installation Safety, 2-4

Installing the Barrier Assembly, 4-2

Introduction, 1-1

M

Maintenance, 5-1

Maintenance Safety, 2-6

Maintenance Schedule, 5-2

O

Operation, 5-1

Operation Safety, 2-5

P

Programming Safety, 2-4

R

Robotic Industries Association, 2-1

S

Safety, 2-1

Safety Devices, 2-3

Site Preparation, 4-2, 4-3

Standard Conventions, 2-2

System Layout, 1-2

System Overview, 1-2

T

Troubleshooting, 5-2

INDEX