

**Motoman NX100 Controller**

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**MDC-2300M  
Drop Center  
Positioner Manual**

Part Number: 150840-1CD  
Revision: 1

**YASKAWA**

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## Chapter 1

# Introduction

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### 1.1 About This Document

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

#### **SECTION 1 - INTRODUCTION**

This section provides general information about the MDC-2300M Drop Center positioner and its components, options, equipment specifications, a list of reference documents, and customer service information.

#### **SECTION 2 - SAFETY**

This section provides information regarding the safe use and operation of the MDC-2300M Drop Center positioner.

#### **SECTION 3 - INSTALLATION**

This section provides instructions for set up and installation of the MDC-2300M Drop Center positioner.

#### **SECTION 4 - OPERATION**

This section provides instructions for basic operation of the MDC-2300M Drop Center positioner. This section also provides procedures for start-up, normal operation, fault recovery, and shutdown.

#### **SECTION 5 - MAINTENANCE**

This section contains a table listing periodic maintenance requirements for the components of the MDC-2300M Drop Center positioner.

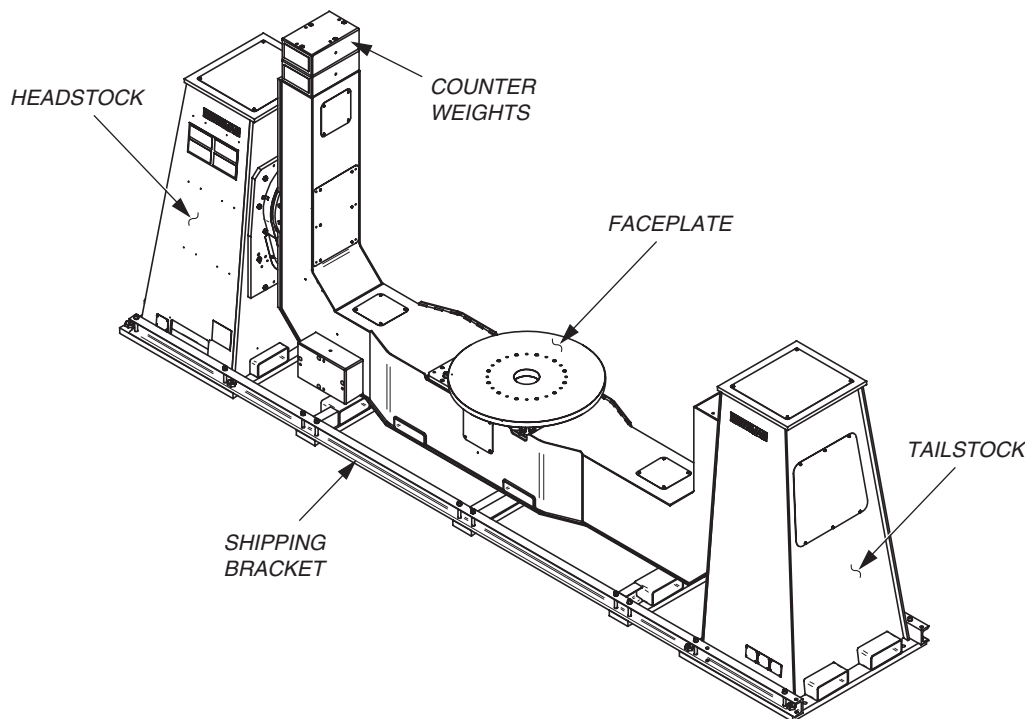
#### **APPENDIX A - ILLUSTRATED PARTS LIST**

Appendix B provides exploded views and illustrated parts lists for the MDC-2300M Drop Center positioner.

## 1.2 Overview

The MDC-2300M is a two servo axis tilt/rotate positioner with a maximum payload of 2,300 kg. The maximum tooling sweep diameter is 3,000 mm. The main axis rotation is limited to  $\pm 35$  degree sweep when the tooling is at the maximum diameter and  $\pm 145$  degrees when the tooling diameter is 2,200 mm or smaller due to the counterweight. If the mass and center of gravity of the tooling are within the specifications shown in the chart below, one of the two counterweights can be removed. This allows clearance for the main axis to sweep  $\pm 179$  degrees. The tooling axis can rotate continuously or be indexed. The main axis and tooling axis can move independently or with coordinated motion with each other and with the robot. The positioner has a 150 mm thru-hole in the tooling faceplate to allow airlines, cables or hydraulic lines for clamps, motors, and/or cylinders. The tooling faceplate has ground brushes allowing the current capacity of 1600 amps.

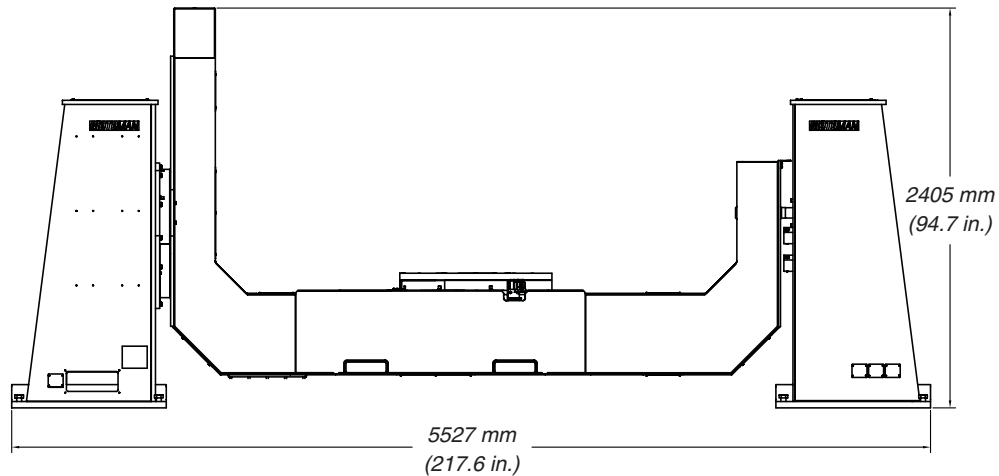
The two servo axes of the positioner are driven by Motoman's standard external axis package. This external axis package is mounted inside the standard NX100 controller. This eliminates the need for a top- or side-mount cabinet. The motors in the positioner are 4.5 kW. The positioner kit includes the positioner, external axis, 5.0-meter cable for motor power, encoder signal, and I/O. Features include a multiple angle load station that allows the user to rotate the load station tooling clockwise and counter clockwise (with a resolution of approximately 2.5 degrees) to improve load station ergonomics and part tacking.



**Figure 1** MDC-2300M Drop Center Positioner and Major Components

## 1.2.1 Layout

Figure 2 shows the layout dimensions for the MDC-2300M Drop Center positioner.



**Figure 2** MSR2S-Series Positioner Layout

## 1.2.2 Specifications

**Table 1** MDC-2300M Drop Center Positioner Specifications

Description	Unit	Specification
Main axis index sweep time @ 180 degrees	sec	7.9
Main axis speed	rpm	4.7
Capacity @ 0 to 650 mm from faceplate	kg	2,300
Tooling axis index time	sec/180 degrees	4.8
Tooling axis speed	rpm	7.4
Maximum fixture diameter	m	3
Maximum fixture height for 180 degree main axis sweep	mm	1,400
Repetitive position accuracy	mm	± 0.1
Welding capacity @ 100% duty cycle	amps	1600
Tooling axis faceplate horizontal load height	mm	814
Tooling axis faceplate thru-hole	mm	150

## 1.3 Reference to Other Documentation

For additional information refer to the following:

- System manual that came with your system
- Motoman Concurrent I/O Manual (P/N 149230-1)
- Vendor manuals for system components not manufactured by Motoman

## 1.4 Customer Service Information

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

- Robot Type (EA1400N, HP20, etc.)
- Application Type (material handling, arc welding, etc.)
- System Type (MDC-2300M Drop Center)
- Software Version (access using TOP MENU > SYSTEM INFO > VERSION > SYSTEM on the programming pendant)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on front door of controller)



## Chapter 2

# Safety

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### 2.1 Introduction

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**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.**

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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 R15.06-1999. 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  
INTERNET: [www.roboticsonline.com](http://www.roboticsonline.com)

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, Operation, and Maintenance Safety (Section 2.6)

## 2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.



### **DANGER!**

Information appearing in a **DANGER** 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 in a **WARNING** 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 in a **CAUTION** 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 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 R15.06-1999, 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

# Installation

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The MDC-2300M Drop Center positioner can be installed easily in just a short time by three workers. The more people involved (within reason), the more quickly installation can be completed. Follow established safety procedures **at all times** throughout the installation process. Failure to use safe work practices can result in damage to the equipment and injury to the workers.



### **CAUTION!**

**INSTALLATION OF THE MDC-2300M DROP CENTER POSITIONER IS NOT A TASK FOR THE NOVICE. THE MDC-2300M DROP CENTER POSITIONER IS NOT FRAGILE, BUT IT IS A SOPHISTICATED MACHINE. HANDLE COMPONENTS WITH CARE. ROUGH HANDLING CAN DAMAGE ELECTRONIC COMPONENTS.**

## 3.1 Materials Required

All hardware necessary for installing the MDC-2300M Drop Center positioner is included. This section identifies customer-supplied items and tools required to complete installation.

### 3.1.1 Customer-Supplied Items

- Suitable floor anchors rated at 4000-kgf working load

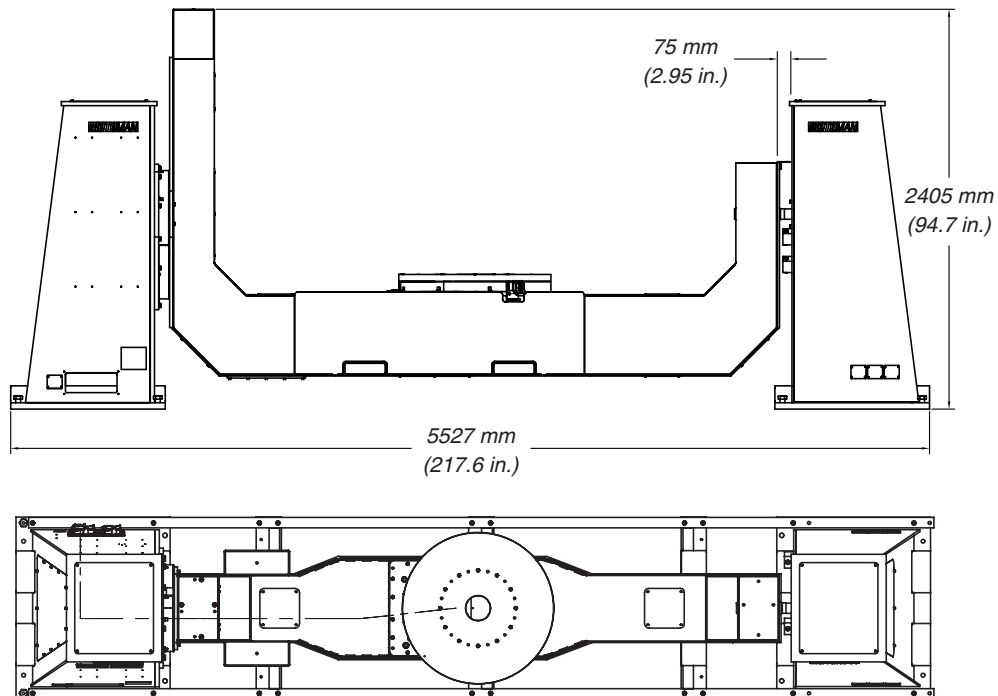
### 3.1.2 List of Tools

- Safety glasses
- Face shields
- Gloves
- Level
- Hammer drill with appropriate concrete bits
- Phillips and flat screwdrivers
- Socket set
- Forklift and/or overhead crane
- Large torque wrench
- Large hex sockets-M14, M17, M19, M24
- Wrench sets (standard and metric)

## 3.2 Site Preparation

All components of the MDC-2300M Drop Center positioner must be firmly mounted on a foundation rigid enough to support its static and dynamic forces. Review drawing package for specifications. To prepare your site, proceed as follows:

1. Clear the floor space needed for the positioner. Refer to Figure 3 for the area needed for installation.
2. Gather all customer-supplied items and required tools listed in Section 3.1.



**Figure 3** Area Needed for Installation



### 3.3 Unpacking the Positioner

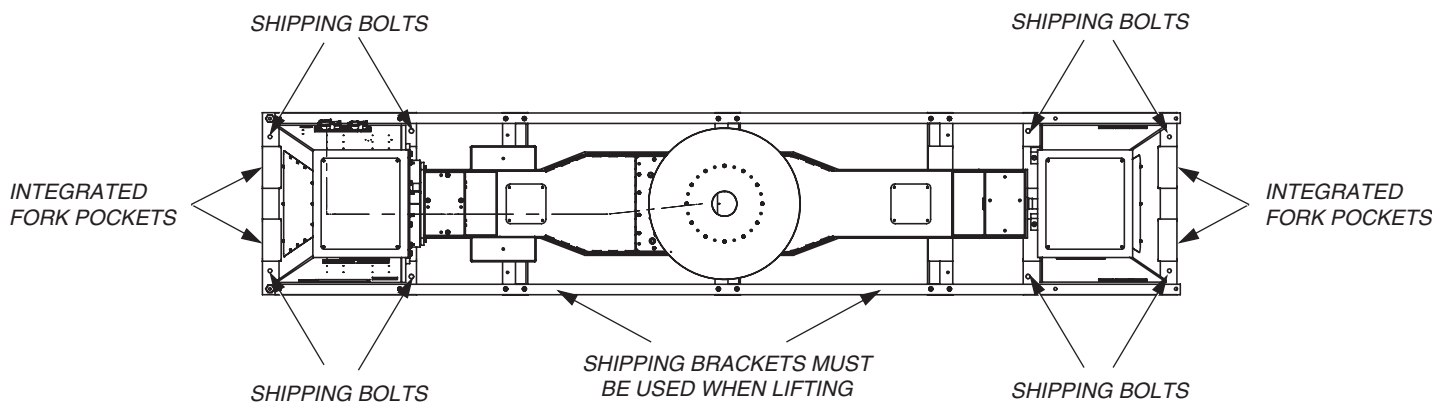
This positioner is shipped individually on a shipping pallet. To unpack the positioner, proceed as follows:

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



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

3. Unbolt positioner from shipping skid. Refer to Figure 4 for location of shipping bolts.



**Figure 4** Location of Shipping Bolts



#### **WARNING!**

**The positioner weighs 3900 kg (8580 lbs). Use two fork lifts and lift from both ends using the integrated fork pockets.**

4. Using two forklifts, lift the positioner from the shipping pallet and place in position on floor. Make sure there is adequate room for tooling installation and part positioning.

### 3.4 Anchoring Positioner Base

The MDC-2300M Drop Center positioner should be firmly mounted on a base plate or foundation rigid enough to support the positioner and withstand repulsion forces. The surface of the floor should be level and even. If it is uneven, grind the swell and flatten the surface.

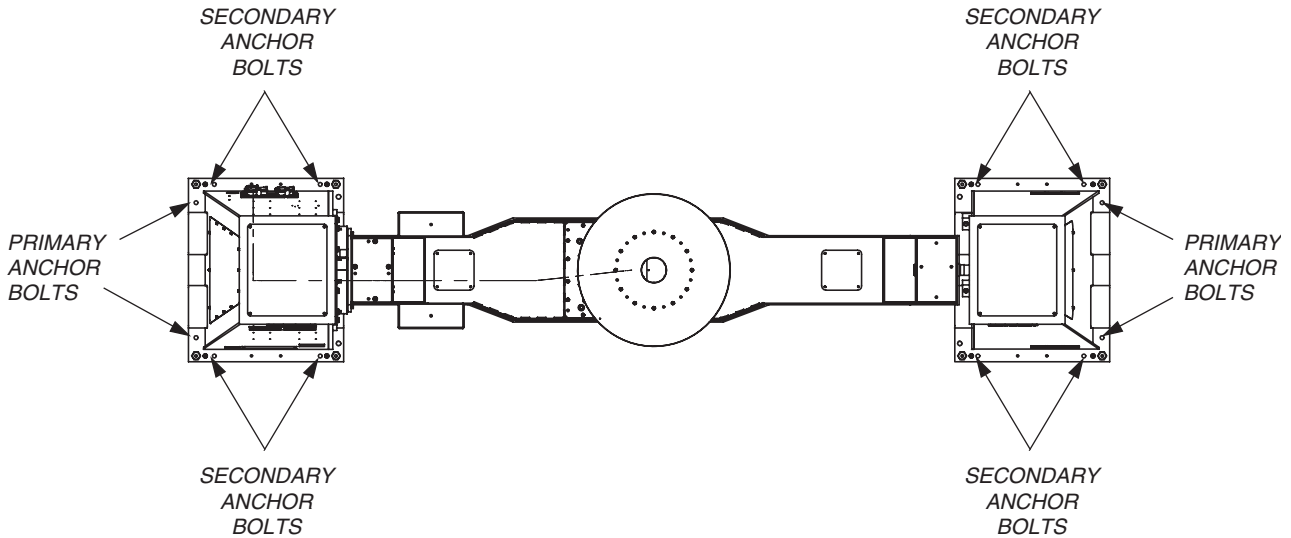
The concrete thickness of the floor must be at least 150 mm.

1. Insert an M20 concrete drill bit through the primary anchor bolt holes on each end of the positioner and drill holes (at least four inches deep into concrete) for anchor bolts.
2. Install the anchors in the concrete per the manufacture's instructions.
3. Anchor primary bolt locations using four M20 or 3/4-inch anchor bolts.



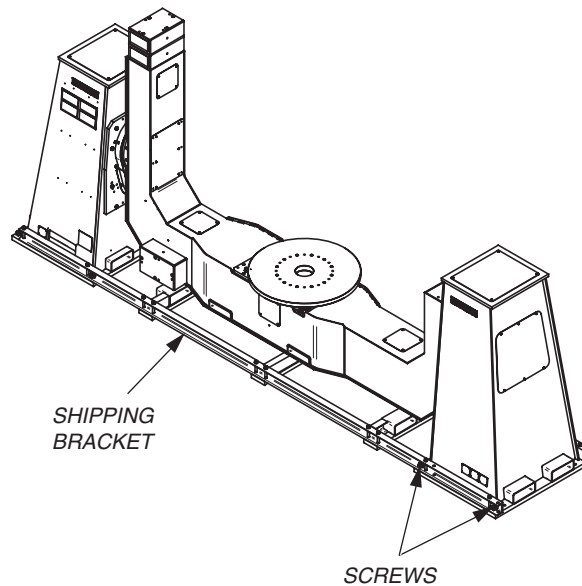
*Note: It is important that both the headstock and tailstock are anchored to the floor prior to the removal of the shipping brackets. This prevents misalignment between the headstock and tailstock.*

4. Screw each leveling bolt down until it just contacts the leveling shim and hand tighten the anchor bolts or nuts.



**Figure 5** Anchor Locations

5. Use an M24 socket/wrench to remove the eight screws securing the shipping bracket to the positioner.



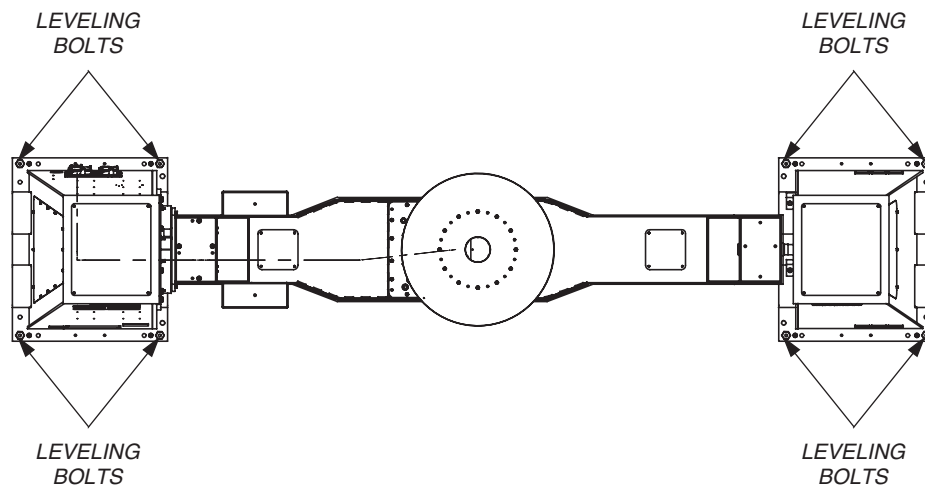
**Figure 6** Positioner Shipping Brackets

6. Remove the shipping brackets.



*Note: Positioner shipping brackets are required to move the positioner. Be sure to keep the shipping brackets for future use.*

7. Insert M20 concrete drill bit through the secondary anchor bolt holes on each end of the positioner and drill holes (at least four inches deep into concrete) for anchor bolts.
8. Anchor the secondary bolt locations using eight M20 or 3/4-inch bolts.
9. Using an M36 socket to turn each leveling bolt, stabilize the positioner.

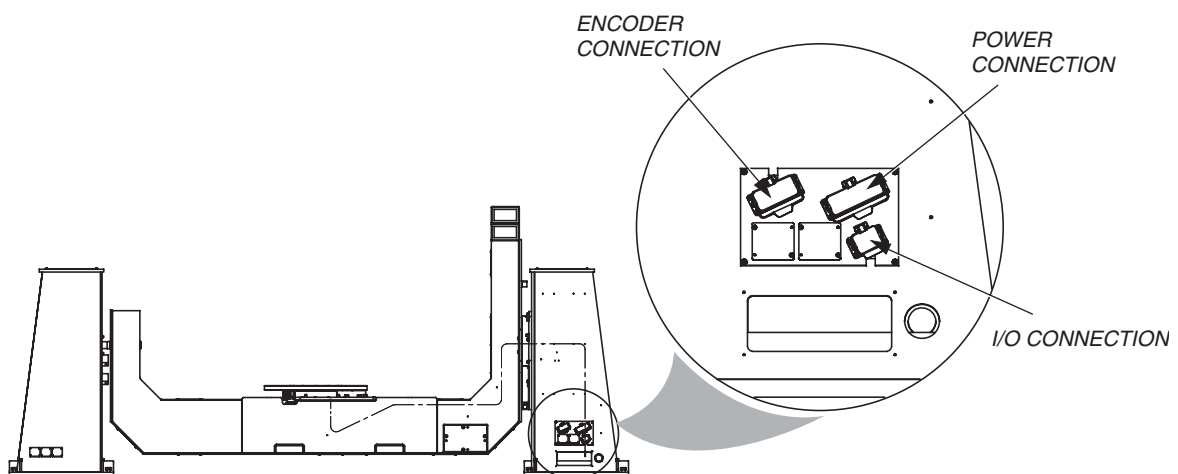


**Figure 7** Leveling Bolts

### 3.5 Connecting to Motoman Controller

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

See separate schematics for electrical connections:



**Figure 8** Positioner Connections

Do not connect the encoder, power, and ground cables until after the positioner is securely in place. When the positioner is delivered with a Motoman robot, connections between the two usually have been made at the factory, or if not, instructions for making connections can be found in the system manual. See separate schematics and/or documentation specific to your system.

Feed weld ground cables (one per power supply) through the weld cable access opening at the base of the positioner. Route cables to ground bar inside the positioner base and attach to ground bar with lug nuts. Remove paint as required from the lug contact surface on the housing.

### 3.6 Conducting a Safety/Operation Check

Before operating the MDC-2300M Drop Center positioner, 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. Check that all component hardware is tight.
3. Check that all safety equipment and protective devices are connected and operational.



**WARNING!**

**Check all safety functions, emergency stop buttons etc. Failure to do so could result in serious personal injury or death.**

**Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) may cause unexpected positioner motion which may result in personal injury or death.**

**If RFI or EMI is suspected, contact an electrical noise consultant.**

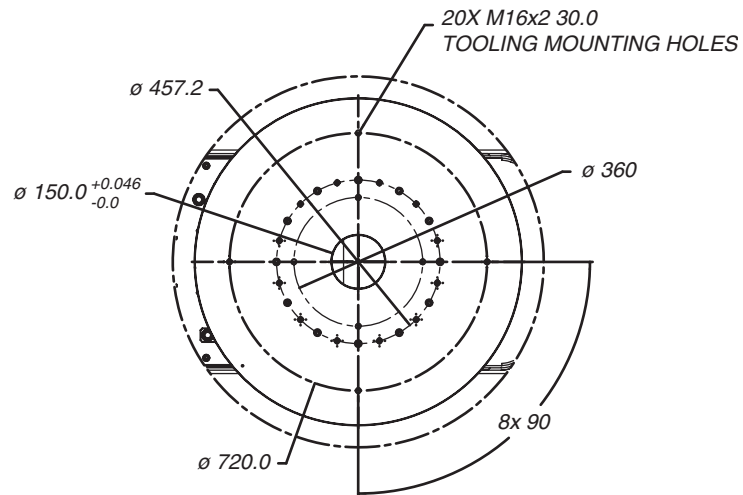
**During operation, check the positioner for excessive vibration, unusual noise etc. If any of these occur, stop immediately by pushing an Emergency Stop button and contact Motoman Service.**

## 3.7 Tooling

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.

### 3.7.1 Mounting Hole Pattern

Any tooling fixture must have the following hole pattern.



**Figure 9** Mounting Hole Pattern

# Notes

## Chapter 4

# Maintenance

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Maintenance of the MDC-2300M Drop Center components should be performed 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.



### **DANGER!**

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

## 4.1 Drive Motor Maintenance

The servo drive motor is virtually maintenance free. If the servo motor is physically damaged due to a load collision or misuse, or if there is grinding or excessive noise, contact Motoman Service Department at (937) 847-3200.



*Note: Maintenance on the motor and reducer are not recommended for field service. The unit should be returned to Motoman for repairs to these components.*

## 4.2 Troubleshooting

Table 6-2 identifies common problems that could occur. To troubleshoot your system, identify the type of problem and look for it in the PROBLEM column. Next to this column is a list of PROBABLE CAUSES and CORRECTIVE ACTIONS.

Be aware that sometimes more than one problem can occur at the same time. After identifying and resolving a problem, test the system thoroughly to make sure no other problems exist.

**Table 2** Troubleshooting

Problem	Probable Cause	Corrective Action
No positioner movement	Loose connection	Check all wire connections.
	Incorrect wiring	Check that system has been wired correctly.
	Overload	Reduce load and re-check. Repeat until problem stops.
Unstable operation	No brake operation	If positioner movement is unstable, check brakes and replace if necessary (see Section 6.7).
	Loose mounting	Check all mounting bolts and tighten as needed.
Motor overheats	Excessive ambient temperature	Reduce ambient temperature below 45° C (104° F). Positioner has an operating range of 0 to 45° C (32 to 113° F).
	Motor surface is dirty	Clean motor surface.
	Motor overloaded	Check motor connections and correct as needed.
Unusual noise	Motor is going bad	Call Motoman service.
	Brakes	Inspect/replace the brake pads (see Section 6.5).

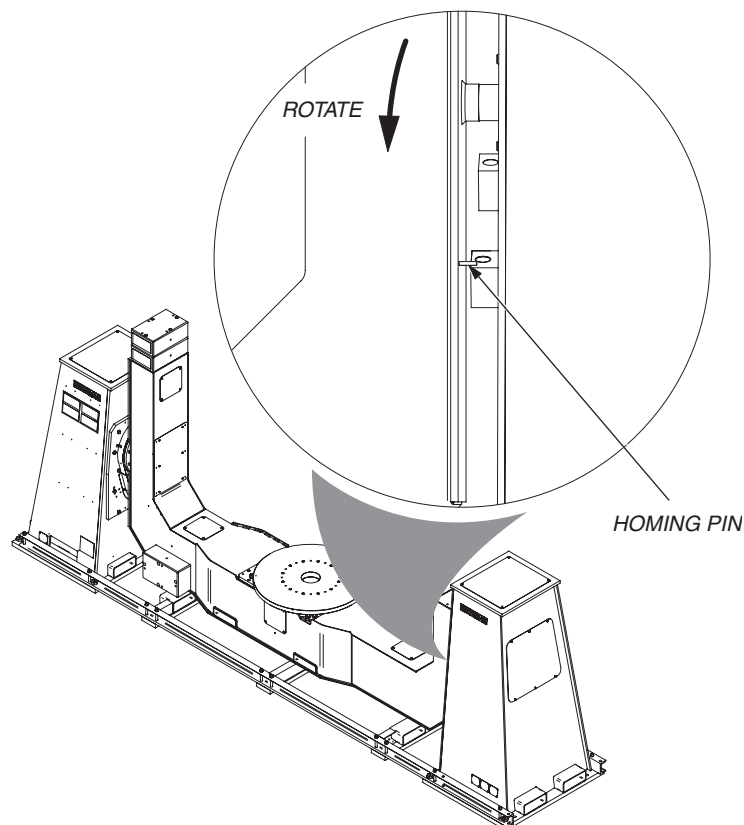


## 4.3 Resetting Home Position

Resetting the MDC-2300M Drop Center axes to Home position is typically done during initial installation or after a servo motor has been serviced. To reset Home position, proceed as follows:

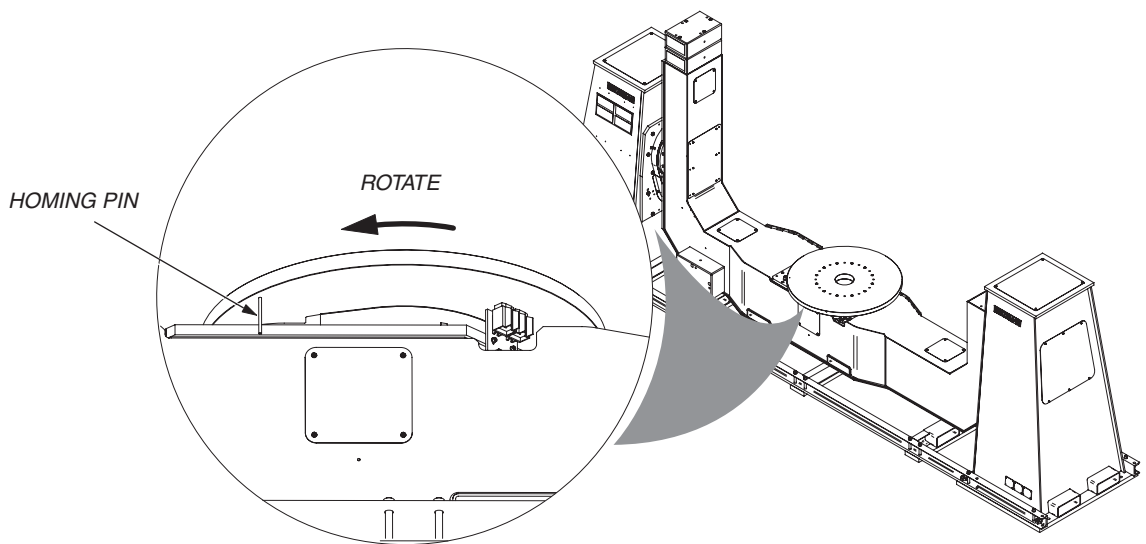
### S1

1. Place robot in TEACH MODE and slowly jog axis until homing pin hole on the main frame is accessible.
2. Install homing pin into homing pin hole in the frame.
3. Jog the S1 axis slowly until homing pin just touches stationary block on the operator's side. If you jog the axis too far, the pin will bend, causing an inaccuracy. Slowly jog the axis in reverse until pin is straight, but still touching the edge of structure.
4. Place the programming pendant in MAINTENANCE MODE.
5. Press the TOP MENU key on the programming pendant.
6. Cursor to ROBOT and press SELECT.
7. Cursor to HOME POSITION and press SELECT.
8. Press the PAGE OVER key to the S1 station (indicated in the top right corner).
9. Make sure the axis is in the position that you want to teach as Home and press SELECT.
10. Cursor to YES and press SELECT. The S1 axis is now reset to zero.
11. Remove the homing pin from the main frame.



## S2

1. Place robot in TEACH MODE and slowly jog axis until homing pin hole on adaptor plate is accessible.
2. Install homing pin into homing pin hole in adaptor plate.
3. Jog the S2 axis slowly until homing pin just touches stationary edge of structure. If you jog the axis too far, the pin will bend, causing an inaccuracy. Slowly jog the axis in reverse until pin is straight, but still touching the edge of structure.
4. Place the programming pendant in MAINTENANCE MODE.
5. Press the TOP MENU key on the programming pendant.
6. Cursor to ROBOT and press SELECT.
7. Cursor to HOME POSITION and press SELECT.
8. Press the PAGE OVER key to the S2 station (indicated in the top right corner).
9. Make sure the axis is in the position that you want to teach as Home and press SELECT.
10. Cursor to YES and press SELECT. The S2 axis is now reset to zero.
11. Remove the homing pin from the adaptor plate.



## 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

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.

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**

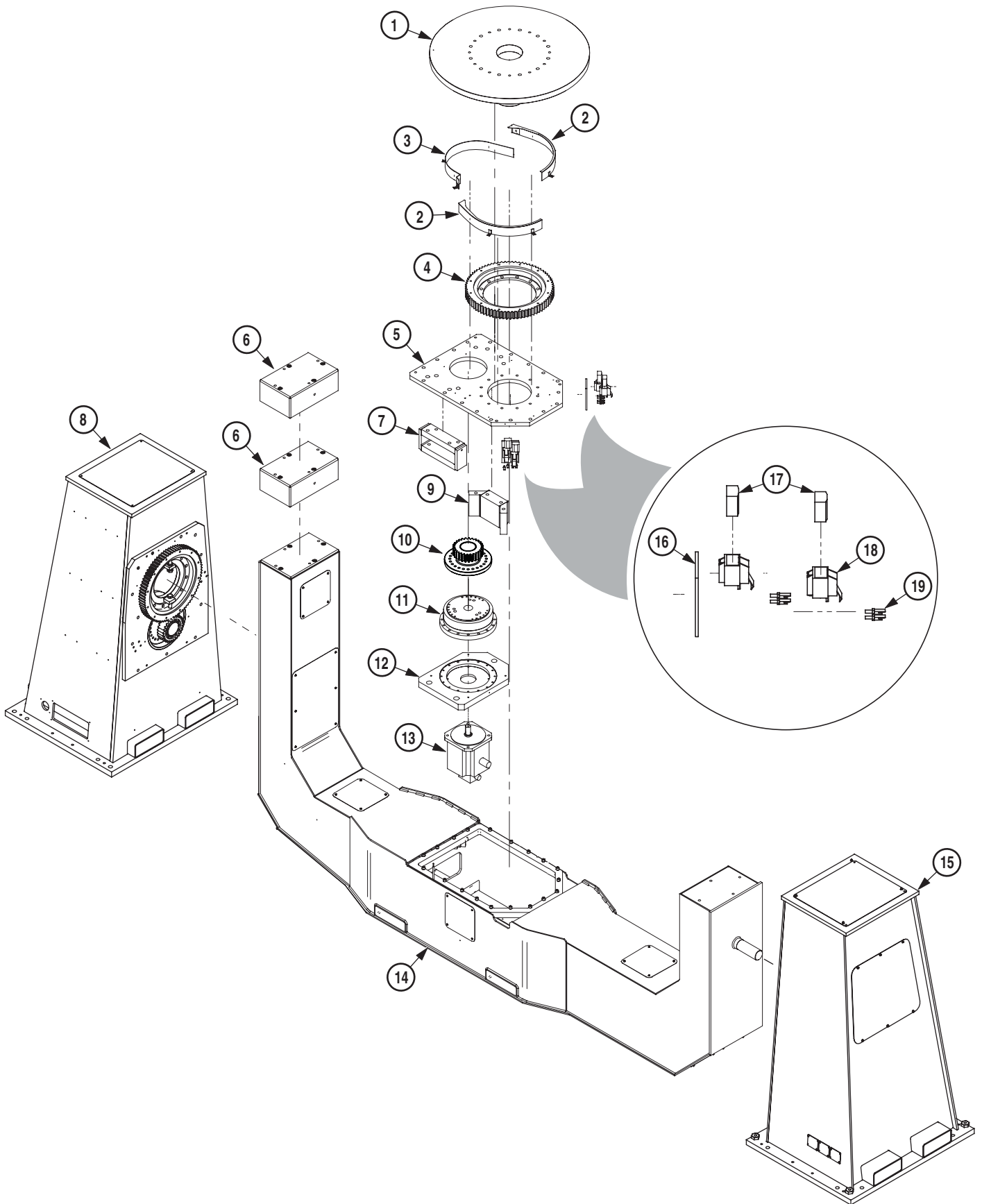
### **A.2.5 Explanation of Parts List Arrangement**

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.2.6 Symbols and Abbreviations**

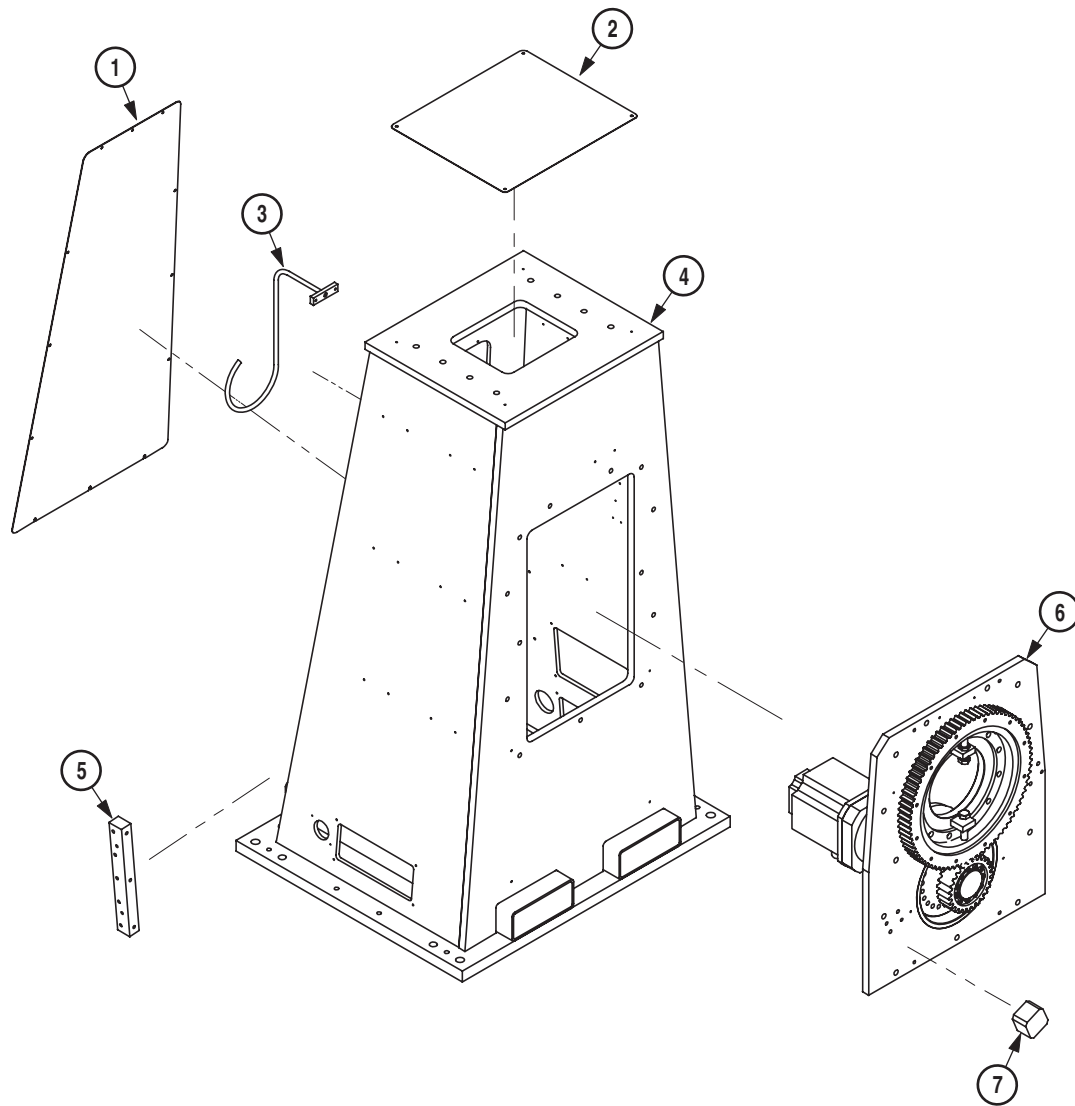
The following is a list of symbols and abbreviations used in the parts list.

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



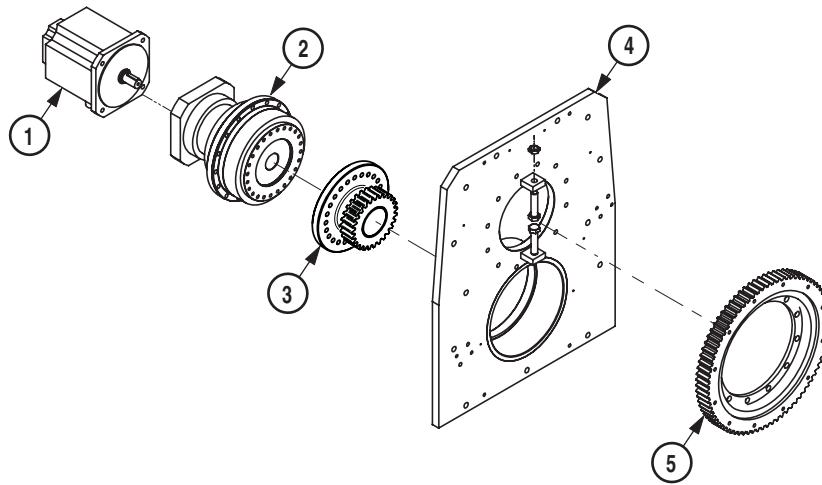
**Table 3** MDC-2300M Drop Center Components

Item Number	Motoman Part Number	Description	QTY
1	150049-1	PLATE	1
2	148813-1	GUARD, DRIVE	2
3	150052-1	GUARD	1
4	140786-2	POSITIONER BEARING WITH GEAR	1
5	150050-1	PLATE	1
6	150121-1	COUNTER WEIGHT	2
7	150053-1	BLOCK SPRING ASSY.	1
8	148708-2	HOUSING ASSY, HEADSTOCK	1
9	150058-1	MOUNT	1
10	150074-2	GEAR ASSY, INPUT, TOOLING	1
11	133917-1	RV320E	1
12	150051-1	PLATE	1
13	142142-1	MOTOR, 4.5 KW	1
14	150115-1	DROPCENTER FRAME WELDMENT ASSY	1
15	148719-1	HOUSING, TAILSTOCK	1
16	150111-1	PLATE, GROUND, BRUSH	2
17	144371-1	BRUSH	4
18	144372-1	BRUSH HOLDER	4
19	144370-1	GROUND LUG	8



**Table 4** Headstock Assembly Components

Item Number	Motoman Part Number	Description	QTY
1	148715-1	COVER, HOUSING, HEADSTOCK	1
2	148716-1	COVER, HOUSING	1
3	149172-1	SUPPORT, CABLE, HANGER	1
4	148709-1	HOUSING, HEADSTOCK	1
5	146909-1	BAR, GROUND	1
6	148710-1	DRIVE, ASSY, MAIN	1
7	150470-1	HARD STOP	1



**Table 5** Main Drive Assembly Components

Item Number	Motoman Part Number	Description	QTY
1	142142-1	MOTOR, 4.5 kW	1
2	148712-1	RD-320E-81	1
3	150074-1	GEAR ASSY, INPUT, MAIN DRIVE	1
4	148711-1	PLATE, MAIN	1
5	140786-2	POSITIONER BEARING W/ GEAR	1



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