

Motoman

MR300 Positioner Manual

Part Number: 147585-1CD
Revision 0

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a YASKAWA company

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SECTION 1

INTRODUCTION

1.1 About this Document

This manual provides installation and maintenance information on the MR300 positioner, and contains the following sections:

SECTION 1 - INTRODUCTION

This section provides general information about the MR300 positioner, a list of reference documents, and customer service information.

SECTION 2 - SAFETY

This section provides information regarding the safe use and operation of the MR300 positioner.

SECTION 3 - DESCRIPTION OF EQUIPMENT

This section provides detailed descriptions of the major components of the MR300 positioner. It also includes a table, listing component specifications.

SECTION 4 - INSTALLATION

This section provides instructions for installing the positioner.

SECTION 5 - TOOLING RECOMMENDATIONS

This section provides guidelines for customer-supplied tooling design.

SECTION 6 - MAINTENANCE

This section provides detailed instructions for maintaining each MR300 positioner.

APPENDIX

Appendix A provides exploded views and illustrated parts lists for the MR300.

1.2 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 (MR300)
- Serial Number

1.3 System Overview

The MR300 rotary positioner's reciprocating motion sweeps a circular turntable from the operator's loading zone, into the robot's work zone, and back to the operator's zone again.

The MR300 can be mounted in any orientation the welding/handling application might require. The standard configuration includes an AC motor, a high-ratio gear reducer, table top, and housing. It also includes integral position switches.

The positioner is controlled by a Yaskawa-manufactured inverter drive.

1.3.1 System Layout

An arc screen divides the table top in half, providing two semicircular work areas labeled SIDE A and SIDE B. See Figure 1-1. When SIDE A is in the robot's work zone, SIDE B is facing the operator and is ready to be loaded or unloaded with parts. Loading fixtures are supplied by the customer.

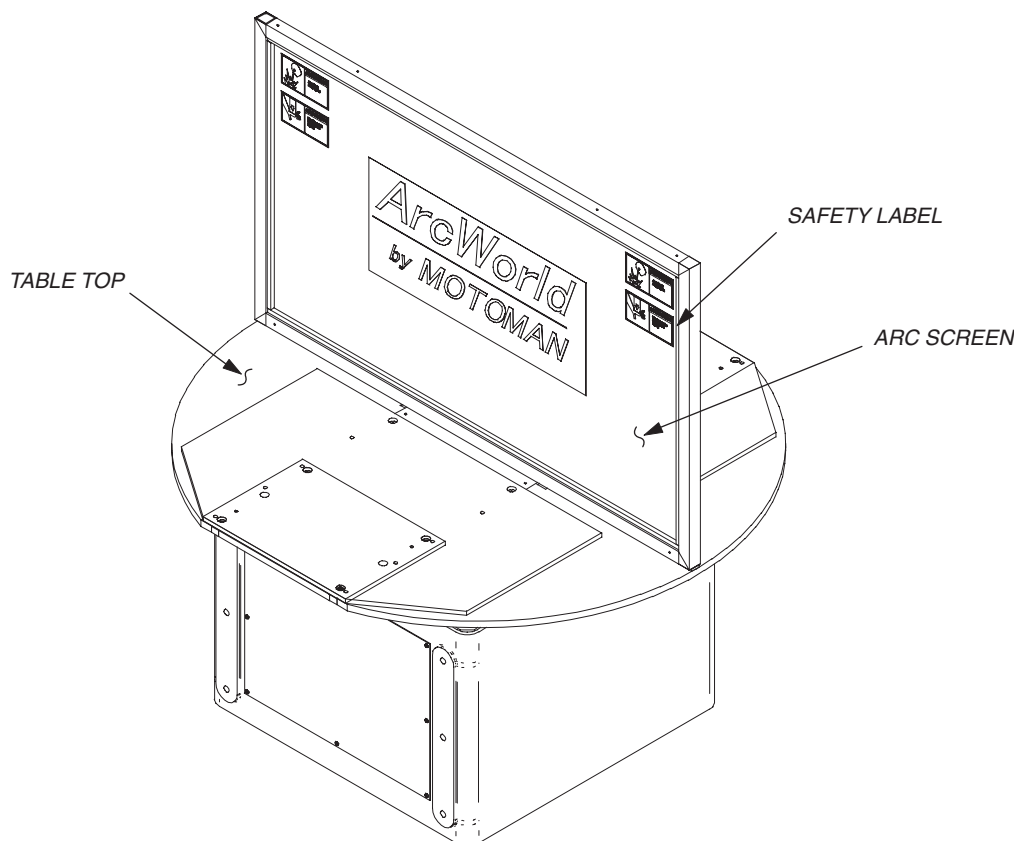


Figure 1-1 System Layout

1.3.2 System Identification

Each MR300 positioner has an identification label, located at the base, that contains specifications for the positioner (see Figure 1-2).



Figure 1-2 Identification Label

The MR300 positioner is available in the following system configurations:

- 147141-1 MR300, 1524 mm (60 in.) diameter table, dual-channel
- 1220 mm (48 in.) diameter table and 1828 mm (72 in.) diameter table are available as options

NOTES

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

3.1 MR300 Rotary Positioner

The MR300 is a high-speed, AC motor driven positioner that features a 300-kg (600-lb) capacity per side. The sweep time for a 180-degree rotation is 4.0 seconds when fully loaded. The standard table top is 1524 mm (60 in.) in diameter. See Figure 3-1.

The MR300 rotary positioner consists of an AC motor plus gear reducer. Position switches are included as a standard feature.

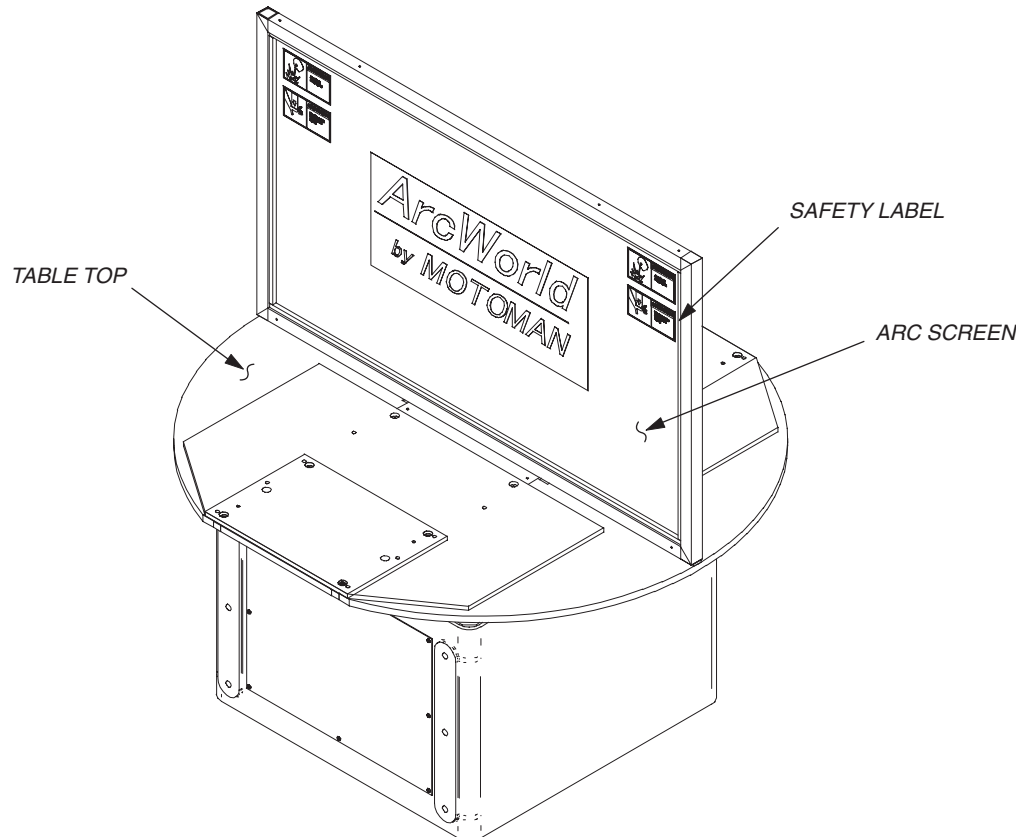


Figure 3-1 MR300 Positioner

3.1.1 System Specifications

Table 3-1 lists the MR300 specifications.

Table 3-1 MR300 Specifications

Rated Load (per side)	300 kgf
Standard Table Diameter	1525 mm/60 in.
Table Center Through Hole	130 mm/5.12 in.
Base to Table Height	772 mm/30.3 in.
180-Degree Sweep Time	4 sec

3.1.2 Arc Shield



WARNING!

Do not operate this equipment unless the arc screen is in place. Damage to eyes may occur!

The Motoman MR300 positioner's arc screen spans the width of the positioner table and visually separates the loading zone from the welding zone. This screen acts as a shield to protect the operator from the arc radiation and sparks produced by the welding operation. Do not operate this equipment in a welding application unless the arc screen is in place.

3.1.3 Inverter Drive

The MR300's inverter motor drive (G5) coordinates positioner functions while communicating with the controller. The G5 is factory-programmed and password-protected with set variables. User-definable variables (parameters) are available that are not password protected. Please refer to the accompanying inverter motor drive G5 manual to change these variables.

SECTION 4

INSTALLATION

Installation of the MR300 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

- 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 sets (standard and metric)

4.2 Site Preparation

To prepare your site, proceed as follows:

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

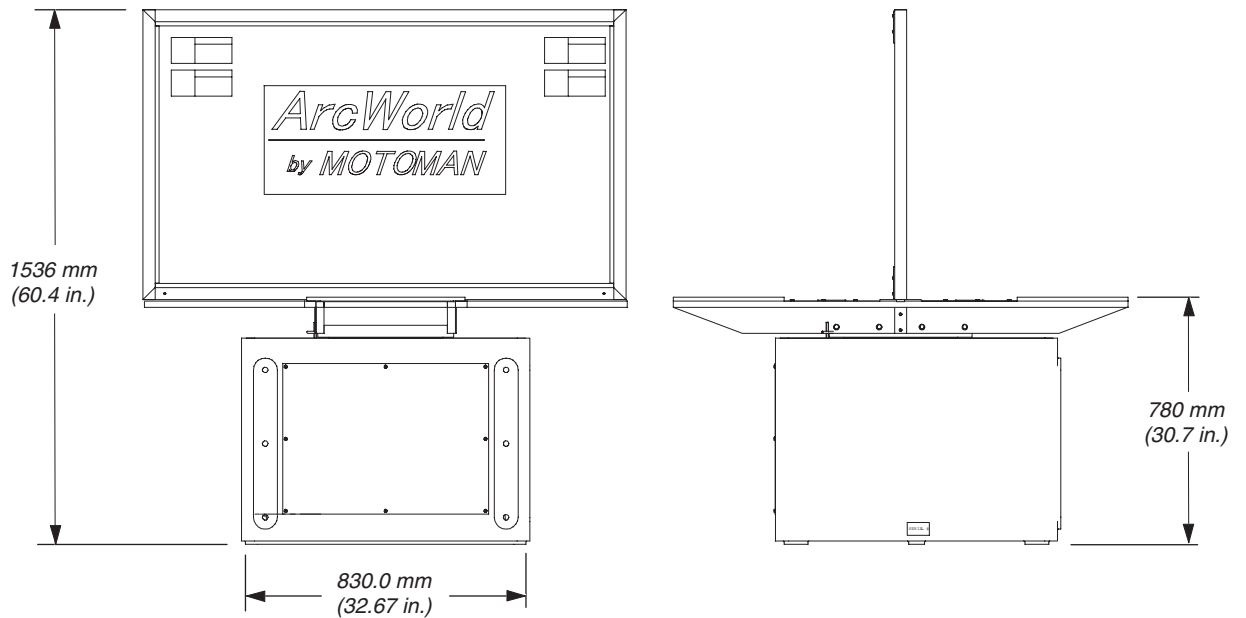


Figure 4-1 Area Needed for Installation

2. Gather all customer-supplied items and required tools listed in Section 4.1.

4.2.1 Mounting Hole Pattern

Use the mounting hole pattern in Figure 4-2 to accurately position the MR300 positioner on a mounting base. If mounting directly to the floor, use the optional mounting plate, Motoman PN 147328-1, and level using four M30 leveling bolts. Refer to Figure 4-3 for optional mounting plate hole pattern.

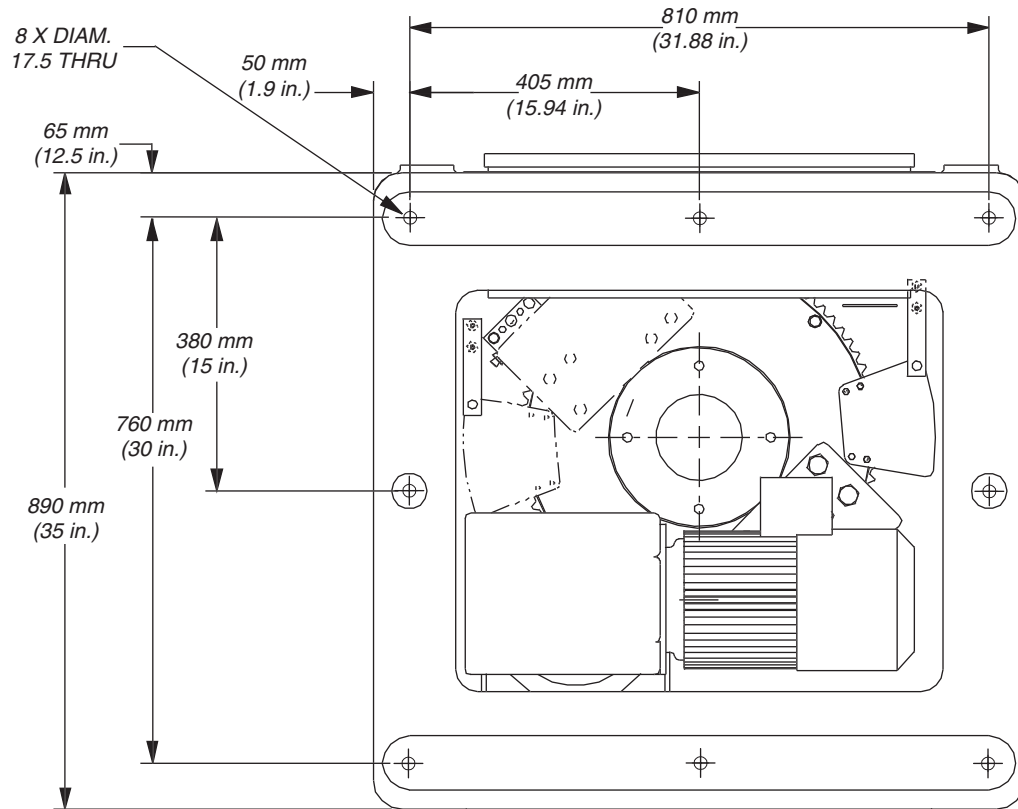


Figure 4-2 Mounting Base Hole Pattern

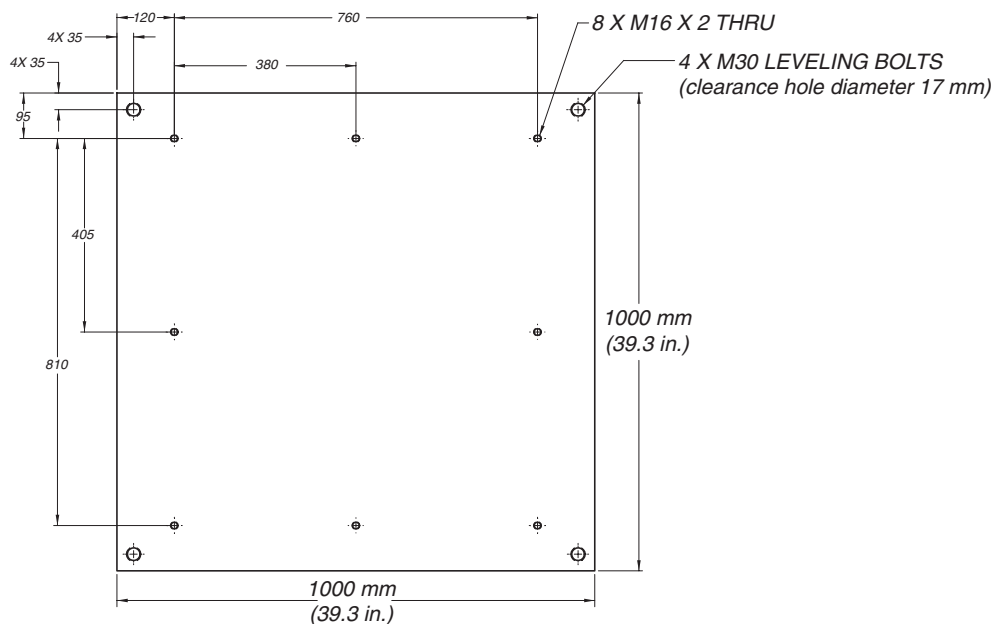


Figure 4-3 Optional Floor Mounting Hole Pattern

4.3 **Installing the MR300 Drive Assembly**

The MR300 table must be firmly mounted on a machine base or on a foundation rigid enough to support its static and dynamic forces.

4.3.1 **Unpack and Install**

The positioner table is shipped on a wood shipping pallet. To install the table, proceed as follows:



WARNING!

The MR300 positioner (147141-1) weighs 1050 kg (2,315 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 system.
2. Inspect system for shipping damage.

NOTE:

If any equipment is damaged, notify the shipper immediately.

3. To access the shipping bolts, unbolt interface box from the front of the positioner base.
4. Unbolt rear base cover. The positioner base is bolted to the shipping pallet at the four inside corners. See mounting hole pattern in Figure 4-2 for location of corner bolt holes.
5. Unbolt positioner base from wood shipping pallet (four places) using a 3/4-inch socket wrench.
6. Insert two eye bolts (four total) on each side of the arc screen. Use the four bolts that are closest to the arc screen.
7. Attach chains from lifting device to the eye bolts and raise the table from wood shipping pallet.
8. Place table in position.
9. Remove chains and eye bolts.

4.3.2 Connecting the Cables

Do not connect any cables until after the drive assembly is securely in place.

Connection to Motoman Controller

Two sets of cables lead from the controller to the positioner: an I/O cable and a power cable. These cables are routed through the back of the interface box and steadied with a gland plate. Connect these cables to the interface panel.

- I/O Cables – One ribbon cable and two spares
 - a) The I/O ribbon cable fastens to the PC Interference Board.
 - b) Securely tie the spare wires out of the way.
- Power Cables – Three black cables and one green cable
 - a) The three black cables connect to the fuse holder block labeled 2, 4, and 6. See system drawings.
 - b) The green cable connects to the ground lug on the interface panel.

When the MR300 table is delivered with a Motoman robot, connections between the two have been made at the factory. See separate schematics and/or documentation specific to your system.

Ground Cables

Fasten the ground cable in the center hole of the table, underneath the table frame. When installing, make sure that the cable can flex during table rotation.

4.4 Conducting a Safety/Operation Check

Before operating the MR300 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. Check that the tooling is properly attached to table.
3. Make sure all loose components are removed from table.

NOTES

SECTION 5

TOOLING RECOMMENDATIONS

5.1 Installation of Tooling Fixtures

Installation of application-specific tooling should be performed by personnel who are familiar with the operation of this system. Tooling is supplied by the customer.

Customer-supplied tooling must be designed to fit the table top mounting holes. See Figure 5-1 for MR300 1524-mm (60-in) table mounting hole pattern. Two optional fixture plates are available: PN146175-1 (350 X 500 mm) and PN146175-2 (650 X 1000 mm).



CAUTION!

Do not install tooling on the positioner shield assemblies (PN 146176-1) or damage to the table top may result. The shield assemblies are not structural and should not be used to support tooling.

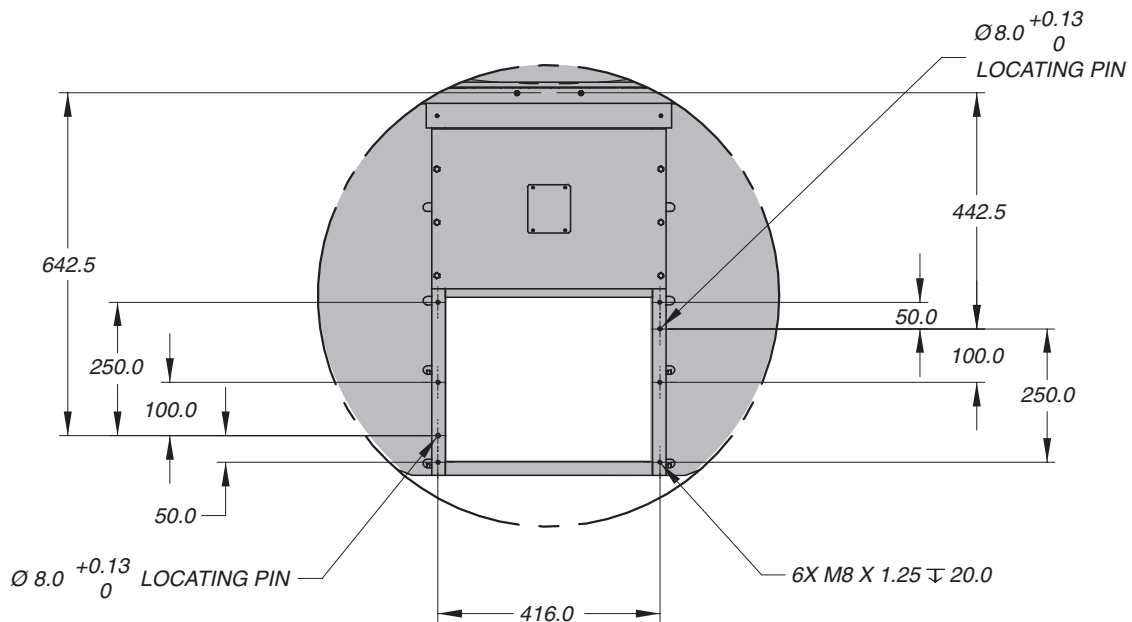


Figure 5-1 Fixture Mounting Holes – 1524 mm (60 in.) Table

NOTES

SECTION 6

MAINTENANCE

Maintenance of the MR300 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.



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:



WARNING!

Always use Motoman spare parts when servicing your positioner. Using non-Motoman parts may void your warranty and may result in machine malfunction, machine damage, or injury to personnel.

Table 6-1 Recommended Spare Parts

<i>Part Name</i>	<i>Motoman Part Number</i>	<i>Recommended Qty</i>
Proximity Switch, Dual Channel	130137-7	1
Control Card	139485-2	3
Fuse	133653-3	1
Limit Switch	143963-1	1
Grease	133174-1	1

6.2 Ordering Parts

When ordering spare parts, always state:

- Machine type (Positioner)
- Machine Name (MR300)
- Motoman Part No.
- Part name
- Number of parts

Send your order to: Customer Service
 Motoman
 805 Liberty Lane
 West Carrollton, Oh 45449
 Telephone:(937) 847-3200
 Telefax:(937) 847-3211

6.3 Drive Motor

The AC drive motor is brushless. The inspection schedule for the motor is shown in the table below. *Do not disassemble the motor.* Contact the Motoman Service Department at (937) 847-3200 when overhaul becomes necessary.

6.4 Maintenance Schedule

6.4.1 MR300 Positioners

Table 6-2 Maintenance Schedule

Inspection Item	Frequency	Inspection Operation
Physical damage	Daily	Check for physical damage from a load collision or 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.
Lubrication – gears	500 hours	If the cycle time is shorter than 2 minutes, grease every 15,000 indexes
Positioner Axis Motor Connectors	<ul style="list-style-type: none"> • 1,000 hours • 6,000 hours • 12,000 hours 	Check for loose connections. Tighten if necessary.
Positioner Axis Speed Reducer and Gear	6,000 hours	Grease with Molywhite RE No. 00.
Positioner Axis Speed Reducer and Gear	12,000 hours	Replace grease with Molywhite RE No. 00.

6.5 Troubleshooting

6.5.1 MR300 Positioners

Table 6-3 Troubleshooting

Symptom	Probable Cause	Corrective Action
Motor does not start	Loose connection	Check all wire connections.
	Incorrect wiring	Check that system has been wired correctly.
	Overload	Reduce load and recheck. Repeat until problem stops.
Unstable operation	Incorrect wiring	Inspect and correct wiring across motor terminals L1, L2, L3, and PE.
Motor overheats	Excessive ambient temperature	Reduce ambient temperature below 40° 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	Reduce load and recheck. Repeat until problem stops.
Unusual noise	Motor loosely mounted	Tighten mounting bolts.
	Noisy bearing	Check alignment, noise of bearing, lubrication. Call Motoman Service.

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 MR300 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

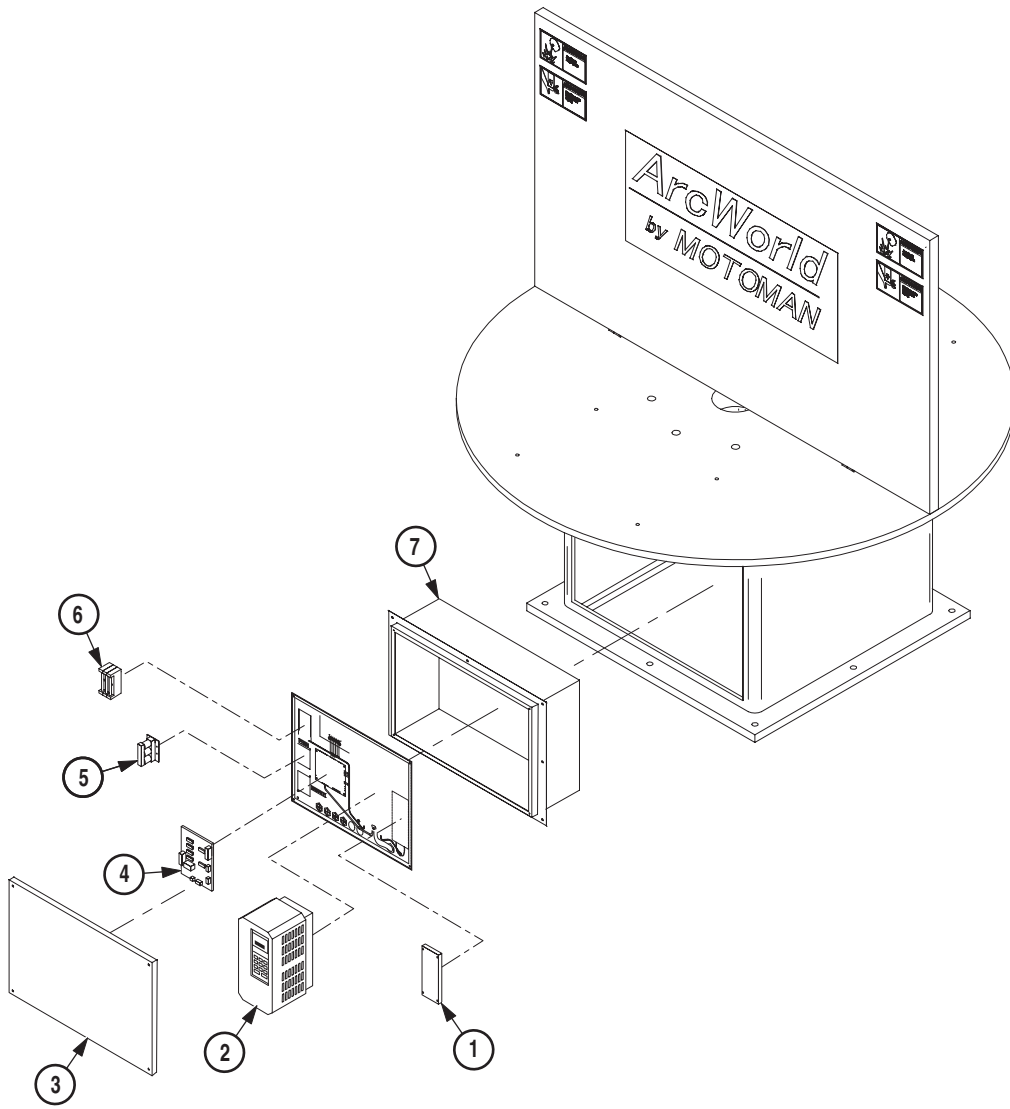


Figure A-1 Interface Box

Table A-1 Parts List – Interface Box Components

Figure A-1 Item Number	Motoman Part Number	Description	QTY
1	144460-1	RESISTOR, 250W, 5%, 50 OHM	1
2	136023-1	DRIVE, W/CRANE	1
3	140793-1	ENCLOSURE, COVER	1
5	139497-1	REACTOR, 2HP	1
6	133651-1	FUSE, HOLDER, BLOCK	1
6	133652-1	FUSE, HOLDER, PULLER	3
6	133653-3	FUSE, ADAPTER, 10 AMP	3
7	140792-1	ENCLOSURE, INTERFACE	1
4	139485-3	BOARD, PC, INTERFACE, DUAL CHANNEL	1

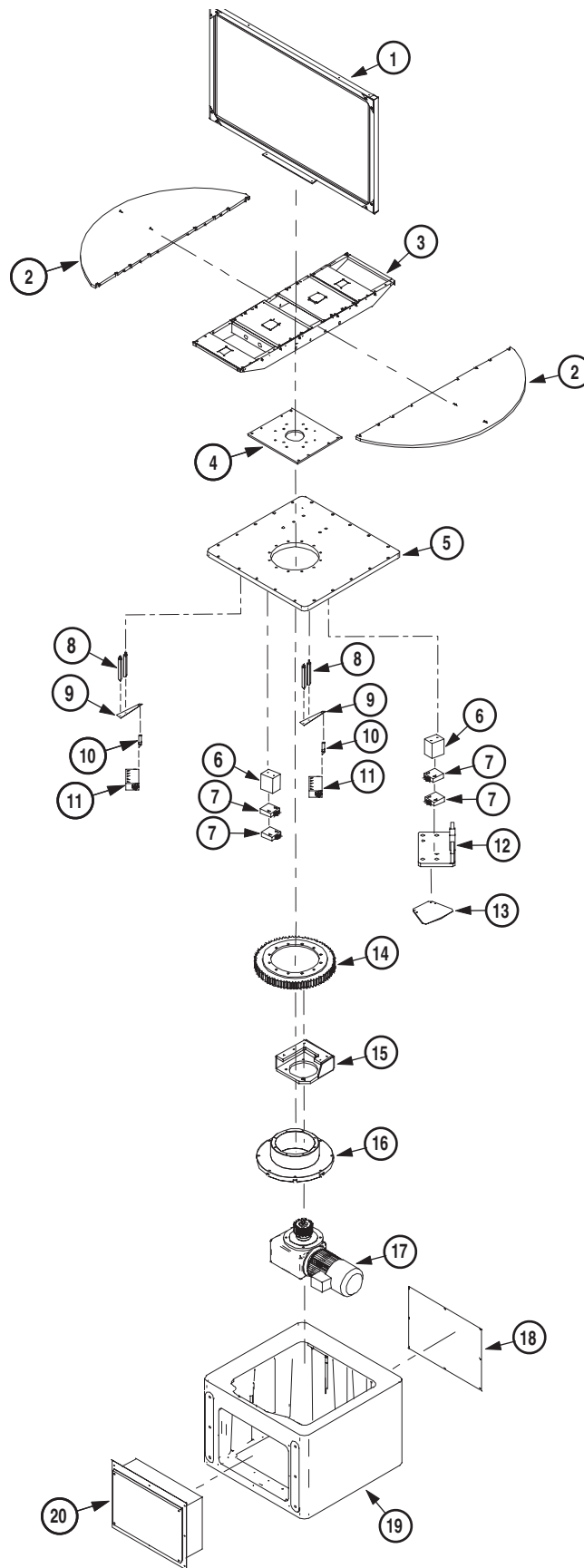


Figure A-2 MR300 Exploded View

Table A-2 Parts List – Common Table Components

Figure A-2 Item Number	Motoman Part Number	Description	QTY
1	146710-1	SCREEN, ASSY, POSITIONER	1
2	146176-1	SHIELD ASSY, POSITIONER	2
3	146174-1	FRAME, TABLE, POSITONER, ROTARY	1
4	147201-1	PLATE, MTG, TABLE	1
5	147142-1	TABLE, MR300, TYPE II	1
6	147148-1	BLOCK, MOUNTING, LIMIT SWITCH	2
7	143963-1	SWITCH, LIMIT, MINIATURE	4
8	147314-1	SPACER, BRACKET, PROXIMITY SWITCH	4
9	147147-1	PLATE, MOUNTING, PROXIMITY SWITCH	2
10	130137-7	SENSOR, PROXIMITY	2
11	147150-1	SHOCK ABSORBER ASSEMBLY	2
12	147145-1	STOP, POSITIONER, MR300HD	1
13	147149-1	PLATE, TARGET, PROXIMITY SWITCH	1
14	140786-1	BEARING, SLEWING, EXTERNAL	1
15	147144-1	BRACKET, MTG, DRIVE MOTOR	1
16	147143-1	POST, MTG, DRIVE GEAR	1
17	146197-1	GEAR MOTOR ASSY, MR300, CASTING	1
18	146365-2	COVER, BASE, CASTING	1
19	146197-1	BASE, CASTING, TURNTABLE	1
20	140789-3	INTERFACE ASSY	1

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