MOTOMAN-MFL15D-875/-1600
INSTRUCTIONS

TYPE:
YR-MFL015D-A00 (875ST, MOTOMAN-MFL15D-875)
YR-MFL015D-A20 (1600ST, MOTOMAN-MFL15D-1600)

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS
MOTOMAN-MFL15D-875/-1600 INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

The DX200 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 179394-1CD
Revision: 0
MANDATORY

- This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MFL15D for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator.

- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 Instructions before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.

- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.

- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

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

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
**Notes for Safe Operation**

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-MS165.

In this manual, the Notes for Safe Operation are classified as "DANGER", "WARNING", "CAUTION", "MANDATORY", or "PROHIBITED".

- **DANGER**
  
  Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **WARNING**
  
  Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **CAUTION**
  
  Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

- **MANDATORY**
  
  Always be sure to follow explicitly the items listed under this heading.

- **PROHIBITED**
  
  Must never be performed.

Even items described as "CAUTION" may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

---

**Note**

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "DANGER", "WARNING" and "CAUTION".

---

**DANGER**

- Maintenance and inspection must be performed by specified personnel.

  Failure to observe this caution may result in electric shock or injury.

- For disassembly or repair, contact your YASKAWA representative.

- Do not remove the motor, and do not release the brake.

  Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.
WARNING

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Fig. : Emergency Stop Button

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the power for the DX200.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX200 and the programming pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
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<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
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Description of the Operation Procedure

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
Explanation of Warning Labels

The following warning labels are attached to the manipulator.
Always follow the warnings on the labels.
Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

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**WARNING**

Do not enter robot work area.

**WARNING**

Moving parts may cause injury.
Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.

• Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.

• The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

• In accordance with ANSI/RIA R15.06-2012, 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).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the users 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 R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this 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 barriers
• Door interlocks
• Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment 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.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment 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 the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.
- Some operations require a standard passwords and some require special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- 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 equipment. All connections must be made within the standard voltage and current ratings of the equipment.
**Maintenance Safety**

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

**Summary of Warning Information**

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.
Customer Support Information

If you need assistance with any aspect of your MFL15D-875/-1600 system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

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

techsupport@motoman.com

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

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

- System: MFL15D-875/-1600
- Primary Application: ___________________________
- Controller: DX200
- Software Version: Access this information on the Programming Pendant’s LCD display screen by selecting (MAIN MENU) - (SYSTEM INFO) - (VERSION)
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the DX200 controller data plate
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1 Receiving

1.1 Checking Package Contents

When the package arrives, check the contents for the following standard items (Any additional options ordered should be checked as well.):

- Manipulator
- DX200
- Programming pendant
- Manipulator cables between the DX200 and the manipulator
- Accessories (Refer to Fig. 2-3(a) "MFL15D-875 Thick Washer (delivered with the manipulator) and Cap Mounting Positions" and Fig. 2-3(b) "MFL15D-1600 Thick Washer (delivered with the manipulator) and Cap Mounting Positions")

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagon socket head cap screw M16</td>
<td>4</td>
</tr>
<tr>
<td>with anti-corrosive treatment (length: 50 mm)</td>
<td></td>
</tr>
<tr>
<td>Spring washer M16 with anti-corrosive treatment</td>
<td>4</td>
</tr>
<tr>
<td>Flat washer M16 (thickness: 5 mm, nickel-plated)</td>
<td>4</td>
</tr>
<tr>
<td>Cap CP-30-BC-12</td>
<td>9</td>
</tr>
<tr>
<td>Grease zerk PT1/8</td>
<td>6</td>
</tr>
</tbody>
</table>

CAUTION

- Confirm that the manipulator and the DX200 have the same order number. Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform as expected and cause injury or damage.

Accessories Quantity

Hexagon socket head cap screw M16 with anti-corrosive treatment (length: 50 mm) 4
Spring washer M16 with anti-corrosive treatment 4
Flat washer M16 (thickness: 5 mm, nickel-plated) 4
Cap CP-30-BC-12 9
Grease zerk PT1/8 6
1.2 Checking the Order Number

Check that the order number of the manipulator corresponds to the DX200. The order number is located on a label as shown below.

Fig. 1-1: Location of Order Number Labels

THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE SAME ORDER NUMBER.

ORDER No.

Check that the manipulator and the DX200 have the same order number.

(a) DX200 (Front View)  (b) Manipulator (Top View)

1.3 Precautions on Unpacking

Unpack the equipment in a clean room. If in any place other than a clean room, unpack the manipulator after removing dust with an air blower.

Operating the manipulator in an environmental clean room of a lower class may lower the cleanliness class of the manipulator.

NOTE
2 Transporting

2.1 Transporting Method

2.1.1 Using a Crane

As a rule, when removing the manipulator from the package and moving it, a crane should be used. The manipulator should be lifted using a four-leg bridie sling threaded through attached eyebolts. Be sure the manipulator is fixed with the shipping bolts and brackets before transporting, and lift it in the posture as shown in Fig. 2-1(a) "Transporting Position MFL15D-875" and Fig. 2-1(b) "Transporting Position MFL15D-1600".

CAUTION

- Sling and crane or forklift operations must be performed by authorized personnel only.
- Avoid excessive vibration or shock during transportation.

Failure to observe this caution may result in injury or damage. The system consists of precision components: failure to observe this caution may adversely affect performance.
2 Transporting

2.1 Transporting Method

Fig. 2-1(a): Transporting Position MFL15D-875

Eyebolt M16 (Delivered with the manipulator)

Fig. 2-1(b): Transporting Position MFL15D-1600

Eyebolt M16 (Delivered with the manipulator)
2 Transports

2.1 Transporting Method

2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with shipping bolts and brackets as shown in Fig. 2-2 “Using a Forklift”. Insert forks under the pallet and lift the manipulator with the pallet. The pallet must be strong enough to support the manipulator. Transport the manipulator slowly in order to avoid overturning or slippage.

- Check that the eyebolts are securely fastened.
- The mass of the manipulator is approximately 420 kg (MFL15D-875) and 610 kg (MFL15D-1600) with shipping bolts and brackets included. Use a wire rope strong enough to withstand the mass.
- Attached eyebolts are designed to support the manipulator mass. Do not use them for anything other than transporting the manipulator.
- Avoid external force on the arm or motor unit in transporting the manipulator. Use caution when using transporting equipment other than a crane or a forklift, to avoid injury.

![Fig. 2-2: Using a Forklift](image-url)
2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets to protect the mechanical part of the manipulator from external force during the transportation. (Refer to Fig. 2-1(a) “Transporting Position MFL15D-875” and Fig. 2-1(b) “Transporting Position MFL15D-1600”.)

The shipping bolts and brackets are painted yellow.

Before turning ON the power, check to be sure that all the shipping bolts and brackets have been removed. The shipping bolts and brackets then must be stored for future use, in the event that the manipulator must be moved again.

After removing the shipping bolts and brackets, the unpainted surfaces and tapped holes must be protected with the washers and caps as shown in Fig. 2-3(a) “MFL15D-875 Thick Washer (delivered with the manipulator) and Cap Mounting Positions” and Fig. 2-3(b) “MFL15D-1600 Thick Washer (delivered with the manipulator) and Cap Mounting Positions”.

Fig. 2-3(a): MFL15D-875 Thick Washer (delivered with the manipulator) and Cap Mounting Positions
2 Transporting
2.2 Shipping Bolts and Brackets

Fig. 2-3(b): MFL15D-1600
Thick Washer (delivered with the manipulator) and Cap Mounting Positions

Flat washer M12 (2 washers) (Thickness: 5mm) (Nickel-plated)

Flat washer M12 (3 washers) (Thickness: 5mm) (Nickel-plated)
3 Installation

WARNING

- Install the safeguarding. Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the manipulator's tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or DX200 when the arm is fully extended. Failure to observe this warning may result in injury or damage.
- Do not start the manipulator or even turn ON the power before it is firmly anchored. The manipulator may overturn and cause injury or damage.

CAUTION

- Do not install or operate a manipulator that is damaged or lacks parts. Failure to observe this caution may cause injury or damage.
- Before turning ON the power, check to be sure that the shipping bolts and brackets are removed. Failure to observe this caution may result in damage to the driving parts.
3 Installation

3.1 Installation of Safeguarding

To insure safety, be sure to install the safeguarding. It prevents unforeseen accidents with personnel and damage to equipment. The following is quoted for your information and guidance.

Responsibility for Safeguarding [ISO 10218]
The user of a manipulator or robot system shall ensure that the safeguarding is provided and used in accordance with Sections 6, 7, and 8 of this standard. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

3.2 Mounting Procedures for Manipulator Base

The manipulator should be firmly mounted on a base or foundation strong enough to support the manipulator and withstand reaction forces during acceleration and deceleration.

Construct a solid foundation with the appropriate thickness to withstand maximum reaction forces of the manipulator as shown in Table 3-1 “Maximum Reaction Forces of the Manipulator”.

The flatness for installation must be kept at 0.5 mm or less: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities. Mount the manipulator base as shown in section 3.2.1 “When the Manipulator and Mounting Fixture Are Installed on a Common Base” or section 3.2.2 “When the Manipulator Is Mounted Directly on the Floor”.

Table 3-1: Maximum Reaction Forces of the Manipulator

<table>
<thead>
<tr>
<th></th>
<th>Maximum torque in horizontal rotation (S-axis moving direction)</th>
<th>Maximum torque in vertical rotation (U-axis moving direction)</th>
</tr>
</thead>
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<tr>
<td></td>
<td>500 N•m (51 kgf•m)</td>
<td>MFL15D-875: 2000 N•m (204 kgf•m) MFL15D-1600: 5100 N•m (520 kgf•m)</td>
</tr>
</tbody>
</table>
3.2 Mounting Procedures for Manipulator Base

3.2.1 When the Manipulator and Mounting Fixture Are Installed on a Common Base

The common base should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. The recommended thickness of the common base is 40 mm or more, and an M16 or larger size is recommended for an anchor bolt.

There are four mounting holes on the manipulator base. Fix the manipulator securely with the hexagon socket head cap screws M16 (60 mm long recommended). Tighten the screws and anchor bolts securely so that they will not work loose during operation.

See Fig. 3-1 “Mounting on the Common Base” for the method.
3.2 Mounting Procedures for Manipulator Base

3.2.2 When the Manipulator Is Mounted Directly on the Floor

The floor should be strong enough to support the manipulator. Construct a solid foundation with the appropriate thickness to withstand maximum reaction forces of the manipulator. As a rough standard, if a concrete thickness (floor) is 150 mm or more, the manipulator base can be fixed directly on the floor with anchor bolts M16. Before mounting the manipulator, however, check that the floor is level and that all cracks, etc. are repaired.

A non-concrete floor or a floor less than 150 mm thick is insufficient for installation, even if the floor is concrete.

Fig. 3-2: Direct Mounting on the Floor
3 Installation

3.3 Installation Method

The MOTOMAN-MFL15D-875/-1600 are floor-mounted types.

3.4 Location

The MOTOMAN-MFL15D series manipulators are used in the clean room. It is required to satisfy the undermentioned environmental conditions:

- 15 to +35°C (ambient temperature; during the operation)
- 20 to 80%RH (no moisture, non-condensing)
- Free from water
- Free from corrosive gases or liquid, or explosive gases
- Free from excessive impact or vibration (vibration acceleration: 4.9 m/s² (0.5 G) or less)
- Free from large electrical noise (plasma)
- The flatness for installation is 0.5 mm or less

3.5 Required Maintenance Space

When installing the manipulator, reserve some space for maintenance around the manipulator as shown in Fig. 3-3(a) "Maintenance Space (MFL15D-875)" and Fig. 3-3(b) "Maintenance Space (MFL15D-1600)". (When connecting the power cables, also refer to Fig. 3-3(a) and Fig. 3-3(b).)
3. Installation
3.5 Required Maintenance Space

Fig. 3-3(a): Maintenance Space (MFL15D-875)

Fig. 3-3(b): Maintenance Space (MFL15D-1600)
4 Wiring

WARNING

• Ground resistance must be 100 Ω or less.
  Failure to observe this warning may result in fire or electric shock.
• Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)
  Failure to observe this warning may result in fire or electric shock.

CAUTION

• Wiring must be performed by authorized or certified personnel.
  Failure to observe this caution may result in fire or electric shock.
• Do not cover the manipulator cables or allow them to tangle when laying the cables from the manipulator to the DX200. Keep the cables as straight as possible.
  Failure to observe this caution may result in burns by disturbing the heat release of the cables.
4.1 Grounding

Follow local regulations for grounding line size. The recommended grounding wire size is 5.5 mm² or more. Refer to Fig. 4-1 “Grounding Method” to connect the ground line directly to the manipulator.

- Do not use this line sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or cable trays are used for cable laying, ground in accordance with Electric Equipment Technical Standards.

Fig. 4-1: Grounding Method

4.2 Manipulator Cable Connection

There are two manipulator cables; an encoder cable for detection (1BC) and a power cable (2BC). (Refer to Fig. 4-2 “Manipulator Cables”.) Connect these cables to the manipulator base connectors and the DX200, respectively.

For the connection method, refer to Fig. 4-3(a) “Manipulator Cable Connection (Manipulator Side)” and Fig. 4-3(b) “Manipulator Cable Connection (DX200 Side)”.

4.2.1 Connection to the Manipulator

Verify the numbers on both the manipulator cables and the manipulator base connectors, then connect the cables to the manipulator in the order of 2BC and 1BC. After inserting the cables, depress each lever until it clicks.
4.2 Manipulator Cable Connection

4.2.2 Connection to the DX200

Remove the cover at the bottom of a side of the DX200. Pass the cables 1BC and 2BC through each cable inlet, and tighten screws.

Connect the cables to the board in the order of 2BC and 1BC. Be sure to verify the numbers on both the cables and board connectors before connection. After the connection, tighten attached screws on 1BC connector with Phillips screwdriver for fall prevention.

Fig. 4-2: Manipulator Cables
4 Wiring

4.2 Manipulator Cable Connection

Fig. 4-3(a): Manipulator Cable Connection (Manipulator Side)

Fig. 4-3(b): Manipulator Cable Connection (DX200 Side)
4.2 Manipulator Cable Connection

4.2.3 Cable Laying

PROHIBITED

- For cable laying, avoid coiling or looping the manipulator cables (encoder and power cables) even if the cable length is too long. Failure to observe this caution may result in cable burnt due to heat generation in the power cable.

When you place the encoder and power cables in a cable duct, put them separately in the cable duct with compartment or in separate cable ducts.

When you do not use a cable duct, lay down the encoder and power cables with keeping one cable away from the other cable. The distance between the encoder cable and the power cable should be 50 mm or more as a rough standard.
## 5 Basic Specifications

### 5.1 Basic Specifications

**Table 5-1: Basic Specifications**

<table>
<thead>
<tr>
<th>Name(^1)</th>
<th>MOTOMAN-MFL15D-875</th>
<th>MOTOMAN-MFL15D-1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>YR-MFL015D-A00</td>
<td>YR-MFL015D-A20</td>
</tr>
<tr>
<td>Configuration</td>
<td>Horizontally Articulated</td>
<td>Horizontally Articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Payload</td>
<td>15 kg/arm</td>
<td>15 kg/arm</td>
</tr>
<tr>
<td>Repeatability(^2)</td>
<td>±0.2 mm</td>
<td>±0.2 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis (upper/lower)</td>
<td>875 mm</td>
<td>1600 mm</td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>-305° to +35°</td>
<td>-305° to +35°</td>
</tr>
<tr>
<td>L and R-axes (horizontal)</td>
<td>-1080 mm to +1080 mm</td>
<td>-1080 mm to +1080 mm</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>700 mm/s, max</td>
<td>600 mm/s, max</td>
</tr>
<tr>
<td>S-axis</td>
<td>3.93 rad/s (225°/s)</td>
<td>3.93 rad/s (225°/s)</td>
</tr>
<tr>
<td>L and R-axes</td>
<td>1800 mm/s, max</td>
<td>1800 mm/s, max</td>
</tr>
<tr>
<td>Allowable Moment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L and R-axes</td>
<td>30.0 N•m (3.0 kgf•m)</td>
<td>30.0 N•m (3.0 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²/4)(^3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L and R-axes</td>
<td>2.6 kg•m²</td>
<td>2.6 kg•m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>400 kg</td>
<td>590 kg</td>
</tr>
<tr>
<td>Standard Painting Color</td>
<td>Munsell value N9.5 or equivalent</td>
<td></td>
</tr>
<tr>
<td>Cleanliness Class</td>
<td>Class 4 (ISO standard)</td>
<td></td>
</tr>
</tbody>
</table>

#### Ambient Conditions

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>15 to 35°C</td>
<td>15 to 35°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH (at a constant temperature)</td>
<td>20 to 80% RH (at a constant temperature)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>4.9 m/s² (0.5 G) or less</td>
<td>4.9 m/s² (0.5 G) or less</td>
</tr>
</tbody>
</table>

Others:  
- Free from corrosive gas or liquid, or explosive gas.  
- Free from water or dust.  
- Free from excessive electrical noise (plasma).  
- Flatness of 0.5 mm or less for installation surface.

### Power Capacity

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 kVA</td>
<td>3.0 kVA</td>
</tr>
</tbody>
</table>

---

\(^1\) SI units are used in this table. However, gravitational unit is used in ( ).

\(^2\) Conformed to ISO9283.

\(^3\) Refer to section 6.1 “Allowable Wrist Load” for details on the allowable moment and inertia.
5.2 Manipulator Clean Specifications

The manipulator conforms to ISO cleanliness class 4\(^1\).

1 Under the condition that the manipulator is in the downflow of 0.4 m/s or more in a vertically rectified state. The parts higher than the wrist flange are applicable.

5.3 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes
5.4 Manipulator Base Dimensions

Fig. 5-2(a): Manipulator Base Dimensions (MFL15D-875)

Fig. 5-2(b): Manipulator Base Dimensions (MFL15D-1600)
5.5 Dimensions and Working Envelope

Fig. 5-3(a): Dimensions and Working Envelope (MFL15D-875)

Turning axis (S-axis) center of rotation
5.5 Dimensions and Working Envelope

Fig. 5-3(b): Dimensions and Working Envelope (MFL15D-1600)

[Diagram showing dimensions and working envelope with labeled parts such as turning axis (S-axis) center of rotation and specific measurements.]
5.6 Limitations of the Movement of the S-, U-Axes

The manipulator limits the movement of the S- and U-axes according to the position of the R- or L-axis. Basically, for high-speed movement of the S- and U-axes, move these axes after moving the R- and L-axes to the home position (0 pulse position) or behind the home position where the pulse is negative.

If either the R- or L-axis is ahead of the home position where the pulse is positive, the S- and U-axes cannot move faster than the specified speed limit. The following alarm occurs if an attempt is made to use a move instruction to move the axes faster than the speed limit:

Alarm 4617: SU IMPOSSIBLE MOVE (L/R POS) [1]

The S- and U-axes cannot move if both the R- and L-axis are ahead of the home position. The following alarm occurs if an attempt is made to use a move instruction to move the S- or U-axis:

Alarm 4617: SU IMPOSSIBLE MOVE (L/R POS) [2]

If any of the above alarms occur, add another teaching position before the move instruction where the alarm has occurred, change the teaching position immediately before the instruction, or return the R- and L-axes to the home position.
### 5.6 Limitations of the Movement of the S-, U-Axes

<table>
<thead>
<tr>
<th>R- and L-axes posture</th>
<th>S- and U-axes movement</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="R- and L-axes posture" /></td>
<td>• No limitation</td>
</tr>
</tbody>
</table>
| ![R- and L-axes posture](image2) | • Enabled at a speed lower than the speed limit.  
  • Alarm occurs at a speed exceeding the speed limit.  
  <In playback operation, forward/backward operation, or test run>  
  4617: SU IMPOSSIBLE MOVE (L/R POS) [1]  
  <In axis operation>  
  Special soft limit: MAX [ ] |
| ![R- and L-axes posture](image3) | |
| ![R- and L-axes posture](image4) | |
5.7 Limitations on the L- and R-Axis Movement

The MOTOMAN-MFL15D limits the movement of either the L- or R-axis according to the position of the other. (e.g. The movement of the L-axis is limited according to the position of the R-axis, and vice versa.)

To move either the L- or R-axis, move first the other axis backward from the limited position. Then start moving the L- or R-axis from the position.

The following alarm occurs if an attempt is made to execute a move instruction to move the L- or R-axis beyond the limited position when the other axis is in the “+” direction from the limited position.

<At playback operation, forward/backward operation, or test run>
Alarm 4617: SU-Axes MOTION IMPOSSIBILITY (LR-Axes pose error) [Decimal Data]

<At axis operation>
Alarm 4421: SPECIAL SOFTLIMIT (MAX.) Robot/Station [Axis Data]
## Basic Specifications

### 5.7 Limitations on the L- and R-Axis Movement

<table>
<thead>
<tr>
<th>L/R-axis posture</th>
<th>L/R-axis movement</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td>• Either the L- or R-axis can be moved without limitations when the other axis is in the backward position from the limited position.</td>
</tr>
<tr>
<td><img src="image2" alt="Diagram" /></td>
<td>• The L-axis cannot be moved when the R-axis is in the “+” direction from the limited position.</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td>• The R-axis cannot be moved when the L-axis is in the “+” direction from the limited position.</td>
</tr>
</tbody>
</table>
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 15 kg/arm. If force is applied to the wrist instead of the load, force on the R- and L-axes should be within the value shown in Table 6-1 “Allowable Moment and Inertia”. Contact your YASKAWA representative for further information or assistance.

Table 6-1: Allowable Moment and Inertia

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N•m (kgf•m)¹</th>
<th>Inertia kg•m² (GD²/4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R- and L-axes</td>
<td>30.0 (3.0)</td>
<td>2.6</td>
</tr>
</tbody>
</table>

¹ (): Gravitational unit
6.2 Wrist Flange

The wrist flange dimension is shown in Fig. 6-1 "Wrist Flange".

In order to see the alignment mark, it is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside of the attachment must be 8 mm or less.

Fig. 6-1: Wrist Flange

Details of L-axis Flange

Details of R-axis Flange
7 System Application

7.1 Internal User I/O Wiring Harness and Air Lines

Internal user I/O wiring harness (0.2 mm² x 12 wires each for R- and L-axes) and air lines (2 lines each for R- and L-axes) are used in the manipulator for the drives of the peripheral devices mounted on the upper arm as shown in Fig. 7-1 “Internal User I/O Wiring Harness and Air Lines”.

The connector pins (1 to 12) are assigned as shown in Fig. 7-2 “Detailed Drawing of Connector Pin Numbers”.

Wiring must be performed by user.

- The allowable current for cables: 3 A or less for each cable
  (The total current value for pins 1 to 12 must be 30 A or less.)
- The maximum pressure for the air line: 490 kPa (5 kgf/cm²) or less
  (Inside diameter: 2.5 mm; 2 lines)
7 System Application
7.1 Internal User I/O Wiring Harness and Air Lines

Fig. 7-1: Internal User I/O Wiring Harness and Air Lines

View A: L-axis Connector Details
Section B-B
BCL (for internal user I/O wiring harness):
HR10A-10R-12S (socket connector)
Prepare pin connector HR10A-10P-12P (Optional)
(Cables and air tubes for the handling application are also optional)
Air supply inlet (2 inlets): Taped hole PT1/8 (with pipe plug)
Left side: Port L-1, Right side: Port L-2

View C: R-axis Connector Details
Section D-D
BCR (for internal user I/O wiring harness):
HR10A-10R-12S (socket connector)
Prepare pin connector HR10A-10P-12P
(Cables and air tubes for the handling application are also optional)
Air inlet (4 inlets): PT1/8 with a pipe plug

Connector for internal user I/O wiring harness
(Cables are also optional; 2 connections):
JL05-2A20-29P (with a cap)
Prepare socket connector JL05-6A20-29SC.
The same numbered pins (1 to 12) of the two connectors are connected with a single lead wire of 0.2 mm².
8  Electrical Equipment Specification

8.1 Location of Broken-Belt Detection Sensors

The broken-belt detection sensors are installed only on the U-axis. Refer to Fig. 8-1 “Location of the Broken-Belt Detection Sensor”.

Fig. 8-1: Location of the Broken-Belt Detection Sensor

If a message for a broken belt appears, remove the cover on the U-arm, and check if the belt is broken. If this message appears, take the same corrective action as for an overrun recovery as described in the DX200 Operator’s Manual.

Replace the broken belt promptly in the event that the belt is broken.
8.2 Internal Connections

High reliability connectors which can be easily removed and put back are used with each connector part. For the number and location of connectors, refer to Fig. 8-2 “Locations and Numbers of Connectors”. Refer to the figures from Fig. 8-5(a) “Internal Connection Diagram (MFL15D-875)”; Fig. 8-5(b) “Internal Connection Diagram (MFL15D-875)”; Fig. 8-5(c) “Internal Connection Diagram (MFL15D-1600)” and Fig. 8-5(d) “Internal Connection Diagram (MFL15D-1600)” for the internal connections between the inside of the manipulator and the DX200.

Fig. 8-2: Locations and Numbers of Connectors

| Connector for internal user I/O wiring harness on connector base | JL05-2A20-29P (JL05-6A20-29SC: Optional) 1) |
| Connector for internal user I/O wiring harness on R- and L-axes | HR10A-10R-12S (HR10A-10P-13P: Optional) 1) |

1 Including cables, connectors on the other ends are optional.
Fig. 8-5(a): Internal Connection Diagram (MFL15D-875)
Fig. 8-5(b): Internal Connection Diagram (MFL15D-875)
Fig. 8-5(d): Internal Connection Diagram (MFL15D-1600)
9 Maintenance and Inspection

9.1 Inspection Schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels. Conduct periodical inspections according to the inspection schedule in Table 9-1 “Inspection Items”.

In Table 9-1, the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized of the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel. Only specified personnel are to do inspection work.

![DANGER]
- Maintenance and inspection must be performed by specified personnel.
- For disassembly or repair, contact your YASKAWA representative.
- Do not remove the motor, and do not release the brake.

Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

![WARNING]
- Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

Failure to observe this warning may result in electric shock or injury.

![CAUTION]
- The battery pack must be connected before removing detection connector when maintenance and inspection.

Failure to observe this caution may result in the loss of home position data.

- The inspection interval must be based on the servo power supply ON time.
- For axes which are used very frequently (in handling applications, etc.), it is recommended that inspections be conducted at shorter intervals. Consult with your YASKAWA representative.

9-1 HW1483905
## Table 9-1: Inspection Items (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Items 1)</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td></td>
<td></td>
<td>Specified Person</td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td>Licensee</td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td>Service Company</td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Alignment mark</td>
<td>Visual</td>
<td>Check alignment mark accordance and damage at the home position. Also check for nameplate damage. Be sure nameplate is securely attached.</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>2 External lead</td>
<td>Visual</td>
<td>Check for wear, damage and deterioration of leads.</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>3 Working area and whole exterior of manipulator</td>
<td>Visual</td>
<td>Clean the dust and the surface. Check for damage, outside cracks, and grease leakage. 2)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>4 Manipulator base mounting bolts</td>
<td>Spanner wrench</td>
<td>Tighten loose bolts.</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>5 Cover mounting screws</td>
<td>Phillips screwdriver, wrench</td>
<td>Tighten loose screws.</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>6 Connector base</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>7 U-, S-, L- and R-axes timing belt</td>
<td>Manual</td>
<td>Check for belt tension and wear.</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>8 Internal user I/O wiring harness and air line (for axes)</td>
<td>Visual, multimeter</td>
<td>Check for conduction between the main connected of connector base and intermediate connector with manually shaking the wire. Check for wear of protective spring. 3)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>9 Internal user I/O wiring harness and air line</td>
<td></td>
<td>Replace. 4)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>10 Battery pack in manipulator</td>
<td></td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 24000 H.</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

1) Replace. 2) Replace. 3) Replace. 4)
### Table 9-1: Inspection Items (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>R- and L-axes speed reducers</td>
<td>![image]</td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease (6000H cycle). See section 9.3.3 “Grease Replenishment/Exchange for R-, L-Axes Speed Reducers”. Exchange grease (12000H cycle). See section 9.3.3. (only for ![image], ![image]).</td>
<td>![image]</td>
</tr>
<tr>
<td>U-axis cross roller bearing</td>
<td>![image]</td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease (6000H cycle). See section 9.3.4 “Grease Replenishment for U-Axis Cross Roller Bearing”.</td>
<td>![image]</td>
</tr>
<tr>
<td>Overhaul</td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 9-1: Inspection Parts and Inspection Numbers

Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Molywhite RE No. 00</td>
<td>U-axis speed reducer</td>
</tr>
<tr>
<td>2</td>
<td>Molywhite RE No. 00</td>
<td>S-axis speed reducer</td>
</tr>
<tr>
<td>3</td>
<td>Molywhite RE No. 00</td>
<td>L-axis speed reducer</td>
</tr>
<tr>
<td>4</td>
<td>Harmonic Grease SK-1A</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Molywhite RE No. 00</td>
<td>R-axis speed reducer</td>
</tr>
<tr>
<td>6</td>
<td>Harmonic Grease SK-1A</td>
<td></td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in Table 9-1 “Inspection Items”.
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

Two battery packs are mounted on the position indicated in Fig. 9-2 "Battery Pack Location". If a battery alarm occurs in the DX200, replace the battery pack according to the following procedure:

**Fig. 9-2: Battery Pack Location**

**Fig. 9-3: Battery Pack Connection**
9 Maintenance and Inspection
9.2 Notes on Maintenance Procedures

1. Turn OFF the DX200 main power supply.
2. Remove the plate fixing screws and the plate on the connector base, then pull the battery pack out to replace it with the new one.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack to the unoccupied connector on the board.
5. Remove the old battery pack from the board.

6. Mount the new battery pack to the holder.
7. Reinstall the plate.

**NOTE**
Remove the old battery pack after connecting the new one so that the encoder absolute data does not disappear.

**NOTE**
Do not allow plate to pinch the cables when reinstalling the plate.
9.3 Grease Exchange Procedures

Make sure to follow the instructions listed below when exchanging grease. Failure to observe the following notes may result in damage to a motor and a speed reducer.

- If grease is added without removing the plug, grease will leak inside the motor or an oil seal of the speed reducer will come off, resulting in damage to the motor and speed reducer. Make sure to remove the plug before the grease injection.
- When attaching a joint and a hose to the grease exhaust port, make sure to use the hose whose inside diameter is 5 mm or more with the length of 100 mm or less. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.
- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.
9.3.1 Grease Replenishment/Exchange for U-Axis Speed Reducer

Fig. 9-4: U-Axis Speed Reducer

Ua: Grease inlet
Hexagon socket head plug PT1/8

Ua: Grease exhaust port
Hexagon socket head plug PT1/8
9.3 Grease Exchange Procedures

**Grease Replenishment**
(Refer to Fig. 9-4 "U-Axis Speed Reducer").

Replenish grease following the procedures below.

1. Remove the hexagon socket head plugs PT1/8 on the Uo grease exhaust ports and the Ui grease inlets.

   **NOTE**
   If grease is added without removing the hexagon socket head plugs PT1/8, the internal pressure will increase and may cause a damage.

   Never fail to remove the hexagon socket head plugs PT1/8 before the grease injection.

2. Install grease zerks A-PT1/8 on the Ui grease inlets, then inject grease.

3. Move the U-axis for a few minutes to discharge excess grease.

4. Reinstall the hexagon socket head plugs PT1/8 on the Ui grease inlets and the Uo grease exhaust ports. Apply ThreeBond 1206C to the thread parts. (Refer to Table 10-1 “Spare Parts for the MOTOMAN-MFL15D-875 (YR-MFL015D-A00).”)

**Grease Exchange**
(Refer to Fig. 9-4.)

1. Remove the hexagon socket head plugs PT1/8 on the Uo grease exhaust ports and the Ui grease inlets.

   **NOTE**
   If grease is added without removing the hexagon socket head plugs PT1/8, the internal pressure will increase and may cause a damage.

   Never fail to remove the hexagon socket head plugs PT1/8 before the grease injection.

2. Install grease zerks A-PT1/8 on the Ui grease inlets, then inject grease.

3. The grease exchange is complete when the old grease is drained off and the new grease appears in the Uo grease exhaust ports. (The new grease can be distinguished from the old grease by color.)

4. Move the U-axis for a few minutes to discharge excess grease.

5. Wipe off the exhausted grease with a cloth, and reinstall the hexagon socket head plugs PT1/8 on the Ui grease inlets and the Uo grease exhaust ports. Apply ThreeBond 1206C to the thread parts.
9.3.2 Grease Replenishment/Exchange for S-Axis Speed Reducer

Fig. 9-5: S-Axis Speed Reducer (After the Cover Removal)

- **Grease Replenishment**
  
  (Refer to Fig. 9-5 "S-Axis Speed Reducer (After the Cover Removal)."

  1. Posture the R- and L-axes as shown in Fig. 9-5.
  2. Remove the hexagon socket head plugs PT1/8 on the So grease exhaust port and the Si grease inlet.

- **Note**
  
  If grease is added without removing the hexagon socket head plugs PT1/8, the internal pressure will increase and may cause a damage.

  Never fail to remove the hexagon socket head plugs PT1/8 before the grease injection.
3. Install grease zerk A-PT1/8 on the Si grease inlet, then inject grease.

4. Move the S-axis for a few minutes to discharge excess grease.

5. Wipe off the exhausted grease with a cloth, and reinstall the hexagon socket head plugs PT1/8 on the Si grease inlet and the So grease exhaust port. Apply ThreeBond 1206C to the thread parts.

**Grease Exchange**

(Remark to Fig. 9-5 “S-Axis Speed Reducer (After the Cover Removal)”)

1. Posture the R- and L-axes as shown in Fig. 9-5.

2. Remove the hexagon socket head plugs PT1/8 on the So grease exhaust port and the Si grease inlet.

3. Install grease zerk A-PT1/8 on the Si grease inlet, then inject grease.

   **Grease Exchange**

   If grease is added without removing the hexagon socket head plugs PT1/8, the internal pressure will increase and may cause a damage.

   Never fail to remove the hexagon socket head plugs PT1/8 before the grease injection.

4. The grease exchange is complete when the old grease is drained off and the new grease appears in the So grease exhaust port. (The new grease can be distinguished from the old grease by color.)

5. Move the S-axis for a few minutes to discharge excess grease.

6. Wipe off the exhausted grease with a cloth, and reinstall the hexagon socket head plugs PT1/8 on the Si grease inlet and the So grease exhaust port. Apply ThreeBond 1206C to the thread parts.
9.3.3 Grease Replenishment/Exchange for R-, L-Axes Speed Reducers

Fig. 9-6(a): R-, L-Axes Speed Reducers

Fig. 9-6(b): R-, L-Axes Speed Reducers (A, B, and C Part)
Grease Exchange Procedures

9.3 Grease Exchange Procedures

For A and B Part

1. Posture the R- and L-axes as shown in Fig. 9-6(a).
2. Remove the hexagon socket head plugs PT1/8 on the exhaust ports Ro and Lo and the grease inlets Ri and Li.
3. Install grease zerks A-PT1/8 on the respective Ri and Li grease inlets, then inject grease into the respective Ri and Li grease inlets.
4. Move the R- and L-axis for a few minutes to discharge excess grease.
5. Wipe off the exhausted grease with a cloth, and reinstall the hexagon socket head plugs PT1/8 on the grease inlets Ri and Li and the grease exhaust ports Ro and Lo. Apply ThreeBond 1206C to the thread parts.

For C Part

1. Posture the R- and L-axes as shown in Fig. 9-6(a).
2. Remove the hexagon socket head plugs PT1/8 on the grease exhaust ports Ro and Lo and the grease inlets Ri and Li.
3. Install grease zerks A-PT1/8 on the respective Ri and Li grease inlets, then inject grease into the respective Ri and Li grease inlets.
4. Move the R- and L-axis for a few minutes to discharge excess grease.
5. Wipe off the exhausted grease with a cloth, and reinstall the hexagon socket head plugs PT1/8 on the grease inlets Ri and Li and the grease exhaust ports Ro and Lo. Apply ThreeBond 1206C to the thread parts.

Grease Type: Harmonic Grease SK-1A
Amount of Grease: Approx. 4 g
Air Supply Pressure of Grease Pump: 0.3 MPa or less
Use a manual grease gun.

Grease Type: Molywhite RE No.00
Amount of Grease: Approx. 30 g (Approx. 60 g for 1st supply)
Air Supply Pressure of Grease Pump: 0.3 MPa or less
Grease Injection Rate: 8 g or less
Grease Exchange
(Refer to Fig. 9-6(a) “R-, L-Axes Speed Reducers”.)
(Note: Grease exchange of R-, L-axes speed reducers is necessary only for section B shown in Fig. 9-6(b) “R-, L-Axes Speed Reducers (A, B, and C Part)”.)

1. Posture the R- and L-axes as shown in Fig. 9-6(a).

2. Remove the hexagon socket head plugs PT1/8 on the grease exhaust ports Ro and Lo and the grease inlets Ri and Li.

3. Install grease zerks A-PT1/8 on the respective Ri and Li grease inlets, then inject grease into the respective Ri and Li grease inlets.

4. The grease exchange is complete when the old grease is drained off and the new grease appears in the Ro and Lo grease exhaust ports. (The new grease can be distinguished from the old grease by color.)

5. Move the R- and L-axis for a few minutes to discharge excess grease.

6. Wipe off the exhausted grease with a cloth, and reinstall the hexagon socket head plugs PT1/8 on the grease inlets Ri and Li and the grease exhaust ports Ro and Lo. Apply ThreeBond 1206C to the thread parts.

**NOTE**
If grease is added without removing the hexagon socket head plugs PT1/8, the internal pressure will increase and may cause a damage.

Never fail to remove the hexagon socket head plugs PT1/8 before the grease injection.

| Grease Type: Molywhite RE No.00 |
| Amount of Grease: Approx. 120 g |
| Air Supply Pressure of Grease Pump: 0.3 MPa or less |
| Grease Injection Rate: 8 g or less |
9.3.4 Grease Replenishment for U-Axis Cross Roller Bearing

Fig. 9-7: U-Axis Cross Roller Bearing

1. Remove the hexagon socket head plugs PT1/8 on the Uco exhaust port and the Uci grease inlet.
2. Install grease zerk A-PT1/8 on the Uci grease inlet, then inject grease. (Refer to Fig. 9-7 “U-Axis Cross Roller Bearing”)

   - Cross roller bearing
   - Link
   - Uco: Exhaust port
   - Uci: Grease inlet
   - Hexagon socket head plug PT1/8

3. Reinstall the hexagon socket head plug PT1/8 on the Uco exhaust port. Apply ThreeBond 1206C to the thread parts.
4. Reinstall the hexagon socket head plug PT1/8 on the Uci grease inlet. Apply ThreeBond 1206C to the thread parts.

**NOTE**

- Grease is not exhausted from the Uco exhaust port. Do not inject excessive grease.

Grease Type: Alvania EP Grease 2
Amount of Grease: 8 g (16 g for 1st supply)
Use a manual grease gun
9.3.5 Notes on Maintenance

- **Inspecting Broken-Belt Detection Sensor**
  Remove the cover and check if any foreign matter adheres to the projector or the photo-detector of the broken-belt detection sensor. If any dirt or dust is found, wipe the part with cleaning wipes.

*Fig. 9-8: Broken-Belt Detection Sensor*
### Battery Pack Connection

Before removing the encoder connector (with CAUTION label), connect the battery pack referring to the following figures.

**Fig. 9-9(a): Encoder Connector Diagram (for U-Axis)**

- Motor power connector
- Encoder connector
- Battery pack HW9470917-A
- Connector for battery back-up

**Fig. 9-9(b): Encoder Connector Diagram (for S-, L-, and R-Axes)**

- Motor
- Encoder
- Power connector
- Motor cable, etc.
- Power connector
- Connection
- Battery pack

**CAUTION**

Connect battery to encoder to save the data before removing connector.
10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the manipulator. The spare parts lists for the MOTOMAN-MFL15D (YR-MFL015D-A00/A20) are shown below.

For preparing lead wires for internal wiring, etc., check the serial number and contact your YASKAWA representative.

Product performance cannot be guaranteed when using spare parts from any company other than YASKAWA. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts
- Rank B: Parts for which replacement may be necessary as a result of frequent operation
- Rank C: Drive unit

To replace parts in Rank B or Rank C, be sure to contact your YASKAWA representative.

### Table 10-1: Spare Parts for the MOTOMAN-MFL15D-875 (YR-MFL015D-A00)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1</td>
<td>Grease</td>
<td>Molywhite</td>
<td>RE No. 00</td>
<td>YASKAWA</td>
<td>16 kg</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A 2</td>
<td>Grease</td>
<td>Harmonic grease SK-1A</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5 kg</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 3</td>
<td>Grease</td>
<td>Alvania EP grease 2</td>
<td>Showa Oil Co., Ltd.</td>
<td>16 kg</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 4</td>
<td>Liquid gasket</td>
<td>Three Bond 1206 C</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 5</td>
<td>Battery pack</td>
<td>HW9470917-A</td>
<td>Three Bond Co., Ltd.</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 6</td>
<td>Battery pack</td>
<td>HW0470360-A</td>
<td>YASKAWA</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>B 7</td>
<td>U-axis timing belt</td>
<td>100S5M1270</td>
<td>Mitsubishi Belting Limited</td>
<td>2</td>
<td>2</td>
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<td>100S5M575</td>
<td>Mitsubishi Belting Limited</td>
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<tr>
<td>B 9</td>
<td>R-, L-axes timing belt</td>
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<td>2 each</td>
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<tr>
<td>B 10</td>
<td>Replacement kit for U-axis (lower part) speed reducer</td>
<td>Y005C-MFL015DA00U1</td>
<td>YASKAWA</td>
<td>1</td>
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<tr>
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<tr>
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<td>1</td>
<td>1</td>
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**Recommended Spare Parts**

Table 10-1: Spare Parts for the MOTOMAN-MFL15D-875 (YR-MFL015D-A00)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per Unit</th>
<th>Remarks</th>
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<tr>
<td>B 13</td>
<td>Y005C-MFL015DA00L1</td>
<td>Replacement kit for L-, R-axes (shoulder part) speed reducer</td>
<td>YASKAWA</td>
<td>1</td>
<td>2</td>
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<td>B 14</td>
<td>Y005C-MFL015DA00L2</td>
<td>Replacement kit for L-, R-axes (elbow part) speed reducer</td>
<td>YASKAWA</td>
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<tr>
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<td>Y005C-MFL015DA00L3</td>
<td>Replacement kit for L-, R-axes (end part) speed reducer</td>
<td>YASKAWA</td>
<td>1</td>
<td>2</td>
<td></td>
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<tr>
<td>B 16</td>
<td>HW1172543-Z HW0174743-A</td>
<td>Internal cable</td>
<td>YASKAWA</td>
<td>1 each</td>
<td>1 each</td>
<td>Between the box and U-arm, between U-arm and the casing</td>
</tr>
<tr>
<td>B 17</td>
<td>HW1372398-A HW0373537-A HW0373537-B HW0373536-C HW0373536-D</td>
<td>Internal cable</td>
<td>YASKAWA</td>
<td>1 each</td>
<td>1 each</td>
<td></td>
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<td>B 18</td>
<td>HW1271492-Z</td>
<td>Internal cable</td>
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<td>1</td>
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<td>Between the box and U-axis motor</td>
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<td>YASKAWA</td>
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<td>1 each</td>
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<td>HW0472239-Z</td>
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<td>YASKAWA</td>
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<td>C 21</td>
<td>HW0382156-A (SGMR8-13A2A-YR1*)</td>
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<td>YASKAWA</td>
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<td>C 22</td>
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<td>AC servomotor for S-axis</td>
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<tr>
<td>C 23</td>
<td>HW0382152-A (SGMPH-02A2A-YR1*)</td>
<td>AC servomotor for R-, L-axes</td>
<td>YASKAWA</td>
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<tr>
<td>Rank</td>
<td>Parts No.</td>
<td>Name</td>
<td>Type</td>
<td>Manufacturer</td>
<td>Qty. per Unit</td>
<td>Remarks</td>
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<tr>
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<tr>
<td>B</td>
<td>19</td>
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<td>HW1372333-C</td>
<td>YASKAWA</td>
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Table 10-2: Spare Parts for the MOTOMAN-MFL15D-1600 (YR-MFL015D-A20)

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<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per Unit</th>
<th>Remarks</th>
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<tr>
<td>B</td>
<td>20</td>
<td>Connector base box</td>
<td>HW0472239-Z</td>
<td>YASKAWA</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>C</td>
<td>21</td>
<td>AC servomotor for U-axis</td>
<td>HW0382198-A (SGMRS-30A2A-YR1*)</td>
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<tr>
<td>C</td>
<td>22</td>
<td>AC servomotor for S-axis</td>
<td>HW0383251-A (SGMPH-04A2A-YR2*)</td>
<td>YASKAWA</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>23</td>
<td>AC servomotor for R-, L-axes</td>
<td>HW0382152-A (SGMPH-02A2A-YR1*)</td>
<td>YASKAWA</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
MOTOMAN-MFL15D-875/-1600 INSTRUCTIONS

Specifications are subject to change without notice for ongoing product modifications and improvements.

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MANUAL NO.
HW1483905