Procedures described in this maintenance manual should be carried out by the person who took the maintenance-relevant trainings offered by YASKAWA. Do NOT distribute this maintenance manual to other than above mentioned. Read this manual thoroughly together with "MOTOPOS-D700F POSITIONER INSTRUCTIONS".

MOTOPOS INSTRUCTIONS

Please have the following information available when contacting Yaskawa Customer Support:
- System
- Primary Application
- Software Version (Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})
- Robot Serial Number (Located on robot data plate)
- Robot Sales Order Number (Located on controller data plate)
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Introduction

**DANGER**

- This maintenance manual is intended to explain mainly on the mechanical part of the MOTOPOS 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 MOTOPOS. Any matter not described in this manual must be regarded as “prohibited” or “improper”.
- General items related to safety are listed in the Section 1: Safety of the YRC1000 instructions. To ensure correct and safe operation, carefully read the YRC1000 instructions before reading this manual.

**CAUTION**

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place 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 is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

**NOTICE**

- 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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOPOS and the YRC1000.

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

**DANGER**
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

**CAUTION**
Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

**NOTICE**
NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

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

- 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 table of the MOTOPOS.

WARNING

- 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.
Before operating the MOTOPOS, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

- Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
- Disconnect the safety plug of the safety fence.

(when in the play mode or in the remote mode)

If operation of the MOTOPOS cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button

Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the MOTOPOS, which may result in personal injury.

Fig. : Release of Emergency Stop

Observe the following precautions when performing a teaching operation within the operating range of the MOTOPOS:

- Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
- View the MOTOPOS from the front whenever possible.
- Always follow the predetermined operating procedure.
- Always keep in mind emergency response measures against the unexpected movement of the MOTOPOS toward a person.
- Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the MOTOPOS, which may result in personal injury.

- Confirm that no person is present in the operating range of the MOTOPOS and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the MOTOPOS by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the operating range of the MOTOPOS during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the MOTOPOS.
Introduction

Definition of Terms Used Often in This Manual

The MOTOPOS is the positioner for the YASKAWA industrial robot. The MOTOPOS usually consists of MOTOPOS positioner unit, a controller unit, a programming pendant, and power cables.
In this manual, the equipment is defined as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>YRC1000 controller</td>
<td>YRC1000</td>
</tr>
<tr>
<td>YRC1000 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between MOTOPOS and the YRC1000</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

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 MOTOPOS. Always follow the warnings on the labels. Also, an identification label with important information is placed on the body of the MOTOPOS. Prior to operating the MOTOPOS, confirm the contents.

Nameplate:

<table>
<thead>
<tr>
<th>YASKAWA</th>
<th>MODEL: MOTOPOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAYLOAD kg</td>
<td>MASS kg</td>
</tr>
<tr>
<td>ORDER NO.</td>
<td>DATE</td>
</tr>
<tr>
<td>SERIAL NO.</td>
<td></td>
</tr>
<tr>
<td>YASKAWA ELECTRIC CORPORATION</td>
<td></td>
</tr>
<tr>
<td>2-1 Kurosakishirushi, Yahatanishi-ku, Kitakyushu 806-0004, Japan</td>
<td></td>
</tr>
<tr>
<td>MADE IN JAPAN</td>
<td></td>
</tr>
</tbody>
</table>

WARNING label A:

![Collision hazard]

Collision hazard
Can cause severe injury. Keep away from the robot during automatic operation.

WARNING label B:

![Crush hazard]

Crush hazard
Can cause severe injury. Keep clear of all moving parts.
2 Notes for Maintenance

If disconnecting the connector for the motor encoder, the home position data will disappear. Also, if disconnecting the battery pack which is connected to the internal wiring harness, the home position will disappear. When the replacement of the battery pack is required, refer to chapter 8.2.1 “Battery Pack Replacement” in “MOTOPOS-D700F POSITIONER INSTRUCTIONS (HS1480656)” . And if the home position disappears, refer to chapter 3 “Home Position Return”.

Fig. 2-1: Motor Diagram

![Motor Diagram](image-url)
3 Home Position Return

Reset the home position of the MOTOPOS if the home position is cleared or deviated. The YRC1000 stores the position data of the job program (hereinafter called JOB) as the pulse number from the home position of each axis. Thus, by precisely resetting the home position, the JOB which is used before resetting can be used without correction. The home-position return must be performed when one of the following cases occurs:

- The motor or absolute encoder is replaced.
- Stored memory is cleared due to the run-out of the internal battery.
- A main part such as a speed reducer is replaced or disassembled and reassembled.

3.1 Types of Methods for Home Position Return

This section explains the types of methods for home position return in detail.

- **Using a Teaching Point for Setting the Home Position**
  As a preparation, create the standard position for home position adjustment under normal operating conditions. After the replacement of the motor, etc., move the MOTOPOS to the created position to adjust the deviation.

  < Preparation/Creating a check-point >

  Before motor replacement, create a standard position (hereinafter called the check-point) for home position adjustment after the replacement. The check-point must satisfy the conditions below. Furthermore, create the JOB so that the manipulator safely moves to the check-point from the standby position. (The JOB created in this manner will be hereinafter called the check-JOB.)

  ① The position should not be deviated by turning the power ON or OFF, or lowering air pressure.

  ② Use pointed jigs to create the position so that the deviation is easily found. Keep a distance as long as possible from the rotational center of the replacing axis.

- **Using Keys**
  The method for adjusting the home position by using keys.

- **Using Encoder Backup Error Recovery Function**
  If the stored memory is cleared due to the run-out of the internal battery and the “Encoder Backup Error” alarm occurs, run the “Backup Alarm Restoration” software on the programming pendant. This function cannot be used when the motor or absolute encoder is replaced.
3 Home Position Return

3.1 Types of Methods for Home Position Return

Table of Suitable Methods for Home Position Return

Suitable methods to return the home position for each case are shown in Table 3-1 “Table of Suitable Methods for Home Position Return”.

Table 3-1: Table of Suitable Methods for Home Position Return

<table>
<thead>
<tr>
<th>Method</th>
<th>Case</th>
<th>Replacement of motor or encoder</th>
<th>Run-out of internal battery</th>
<th>Replacing a main part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching point</td>
<td>High</td>
<td>N/A</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Key</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
</tr>
<tr>
<td>Encoder backup error</td>
<td>N/A</td>
<td>High</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Accuracy of home position return is categorized as follows:
High, Mid, N/A (not applicable)

3.1.1 Home Position Return by Using a Teaching Point

Home Position Adjustment
Move the axis to the position where the key slot of the table and frame are matched. Only for the axis whose motor was replaced, by using the home position key, perform the home position calibration and register the temporary home position.
(For more information, refer to “YRC1000 INSTRUCTIONS (RE-CTO-A221)”.)

Move the axis to the check-point by the check-JOB. (Be careful when moving the axis so that the manipulator does not interfere with jigs.) Move only the axis whose motor was replaced to correct the deviation from the check-point created before calibration.

Display the position screen (COMMAND POSITION).
Determine the deviation amount (the difference between the current value and the command value), and then move the replaced axis to the pulse position equivalent to the deviation amount using the position screen.
3 Home Position Return
3.1 Types of Methods for Home Position Return

At this position, perform the home position calibration only for the axis whose motor was replaced. (For more information, refer to “YRC1000 INSTRUCTIONS (RE-CTO-A221)”.

Move the axis again to the check-point by the check-JOB. Check if the axis is at the check-point created before the operation. (If it is deviated, repeat the adjustment procedures.)

Perform an operation check by using the JOB used before motor replacement. If no problem is found, write down the modified home position data (ABSO data) and the date in the label on the inside of the YRC1000.

3.1.2 Home Position Return by Using Keys

Move the axis to the position where the key slots of the table and frame are matched. By using the home-position key, perform the home position calibration only for the axis which is need to be calibrated. (For details, refer to “YRC1000 INSTRUCTIONS (RE-CTO-A221)”.

3.1.3 Home Position Return by Using Encoder Backup Error Recovery Function

For details on the encoder backup error recovery function, refer to “YRC1000 INSTRUCTIONS (RE-CTO-A221)".
4 Disassembly/Reassembly of the Motor

4.1 Disassembly and Reassembly of the Tilt-Axis (S1) Motor

Refer to fig. 4-1 “Disassembly & Reassembly of the Tilt-Axis (S1) Motor”.

**Disassembly**
1. Turn OFF the MOTOPOS controller power supply.
2. Unscrew the hexagon socket head cap screws, and remove the cover.
3. Connect the backup battery if it is necessary to save the home position data. (Refer to chapter 2 “Notes for Maintenance”.)
4. Disconnect the connector (for the encoder and the power) which is connected to the motor.
5. Unscrew the hexagon socket head cap screws, and remove the motor from the motor base. At this time, be careful not to damage the oil sealing in the motor base.
6. Remove the retaining ring, remove the input gear and the shaft from the bolt, and the bolt from the motor, and then remove the shaft and the key.

**Reassembly**
1. Mount the key and the shaft to the motor. Apply LOCTITE 242 to the thread part of the bolt and tighten it with the tightening torque shown in table 4-1 “Tilt-Axis Motor Parts Checklist”. At this time, apply ThreeBond 1206C to the root of the matching surface between the shaft and the motor.
2. Mount the shaft, the input gear, and then the retaining ring.
3. Mount the motor to the motor base. At this time, be careful not to damage the oil sealing in the motor base.
4. Tighten the hexagon socket head cap screws with the tightening torque shown in table 4-1.
5. Mount the connector (for the encoder and the power) of the internal wiring harness to the motor.
6. Replenish grease. Refer to chapter 8.2.2 “Grease Replenishment/Exchange for Speed Reducer” in “MOTOPOS-D700F POSITIONER INSTRUCTIONS” (HS1480656).
7. Disconnect the backup battery connected in step 3 of the disassembly process.
4. Disassembly/Reassembly of the Motor

4.1 Disassembly and Reassembly of the Tilt-Axis (S1) Motor

8. Mount the cover② by using the hexagon socket head cap screws①. And tighten them with the tightening torque shown in Table 4-1 “Tilt-Axis Motor Parts Checklist”.

9. Turn ON the MOTOPOS controller power supply.

### Table 4-1: Tilt-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Hexagon socket head cap screw M5 (length: 20 mm)</td>
<td>4 each</td>
<td>Tightening torque 6 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2L-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Motor cover HS1301461-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Tilt-axis motor SGM7G-37APK-YR1#</td>
<td>1</td>
<td>HW1385397-A</td>
</tr>
<tr>
<td>④</td>
<td>Hexagon socket head cap screw M12 (length: 35 mm)</td>
<td>4 each</td>
<td>Tightening torque 84 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Bolt HW9481363-A</td>
<td>1 each</td>
<td>Tightening torque 40 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2L-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Retaining ring STW-12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Input gear HS0481844-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>Shaft HW9481343-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑨</td>
<td>Shaft HS0481845-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑩</td>
<td>Key (delivered with the motor)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
4 Disassembly/Reassembly of the Motor
4.1 Disassembly and Reassembly of the Tilt-Axis (S1) Motor

Fig. 4-1: Disassembly & Reassembly of the Tilt-Axis (S1) Motor
4.2 Disassembly and Reassembly of Rotation-Axis (S2) Motor

Refer to fig. 4-2 “Disassembly & Reassembly of the Rotation-Axis (S2) Motor”.

**NOTE**
- When replacing a motor, the backup battery does not need to be connected.
- Remove old sealing bond on each part completely before reassembly.

**Disassembly**

1. Turn OFF the MOTOPOS controller power supply.

2. Unscrew the hexagon socket head cap screws, and remove the cover.

3. Connect the backup battery if it is necessary to save the home position data. (Refer to chapter 2 “Notes for Maintenance”.)

4. Disconnect the connector (for the encoder and the power) which is connected to the motor.

5. Unscrew the hexagon socket head cap screws, and remove the motor from the motor base. At this time, be careful not to damage the oil sealing in the motor base.

6. Unscrew the hexagon socket head cap screw, and then remove the washer, the input gear, the key, and the shaft from the motor.

**Reassembly**

1. Mount the shaft, the key, the input gear and the washer to the motor. Apply LOCTITE 242 to the thread part of the hexagon socket head cap screw and tighten it with the tightening torque shown in table 4-2 “Rotation-Axis Motor Parts Checklist”. At this time, apply ThreeBond 1206C to the root of the matching surface between the motor and the shaft.

2. Mount the motor to the motor base. At this time, be careful not to damage the oil sealing in the motor base.

3. Tighten the hexagon socket head cap screws with the tightening torque shown in table 4-2.

4. Mount the connector (for the encoder and the power) of the internal wiring harness to the motor.

5. Replenish grease. Refer to chapter 8.2.2 “Grease Replenishment/Exchange for Speed Reducer” in “MOTOPOS-D700F POSITIONER INSTRUCTIONS (HS1480656)”.

6. Disconnect the backup battery connected in step 3 of the disassembly process.

7. Mount the cover by using the hexagon socket head cap screws. And tighten them with the tightening torque shown in table 4-2.

8. Turn ON the MOTOPOS controller power supply.
4 Disassembly/Reassembly of the Motor
4.2 Disassembly and Reassembly of Rotation-Axis (S2) Motor

Table 4-2: Rotation-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hexagon socket head cap screw M6 (length: 25 mm)</td>
<td>10</td>
<td>Tightening torque 10 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2L-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Motor cover HS1301462-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor cover HS1301463-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rotation-axis motor SGM7G-13APK-YR1#</td>
<td>1</td>
<td>HW1385395-A</td>
</tr>
<tr>
<td>4</td>
<td>Hexagon socket head cap screw M8 (length: 25 mm)</td>
<td>4</td>
<td>Tightening torque 24.5 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2L-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M6 (length: 15 mm)</td>
<td>1</td>
<td>Tightening torque 16.5 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2L-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Washer HS9405096-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Input gear HS1401064-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Key (delivered with the motor)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Shaft HS1401065-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4-2: Disassembly & Reassembly of the Rotation-Axis (S2) Motor
5 Disassembly/Reassembly of Speed Reducer

5.1 Disassembly and Reassembly of the Tilt-Axis (S1) Speed Reducer

Refer to fig. 5-1 “Disassembly & Reassembly of the Tilt-Axis (S1) Speed Reducer”.

**Disassembly**
1. Turn OFF the MOTOPOS controller power supply.
2. Remove the motor by referring to chapter 4.1 “Disassembly and Reassembly of the Tilt-Axis (S1) Motor”.
3. Unscrew the hexagon socket head cap screws and .
4. Pull out the M-base , and then make the spacer contact with the frame.
5. Secure the spacer to the frame by using two hexagon socket head cap screws temporarily.
6. Unscrew the hexagon socket head cap screws .
7. Remove the M-base and the spacer from the speed reducer.
8. Remove the O-ring from the speed reducer.

**Reassembly**
1. Mount the O-ring to the speed reducer.
2. Mount the speed reducer to M-base after confirming its position.
3. Mount the spacer to the speed reducer. At this time, apply ThreeBond 1206C to the matching surface between the speed reducer and the spacer. Tighten the hexagon socket head cap screws with the tightening torque shown in table 5-1 “Tilt-Axis Motor Parts Checklist”.

**NOTE**
Remove old sealing from each part completely before assembling.

**DANGER**
For this procedure, contact your YASKAWA representative described in the back cover.
If the tilt-axis motor is removed, the frame of the rotation axis (S2) rotates and is fallen.
Before removing the motor, support the frame side of the rotation axis (S2) by using the chain block, etc. to avoid it from falling down.

Refer to chapter 2 “Notes for Maintenance”, chapter 3 “Home Position Return”, chapter 6 “Grease Replenishment for Replacement of Speed Reducer”.

Remove old sealing from each part completely before assembling.

Refer to fig. 5-1 “Disassembly & Reassembly of the Tilt-Axis (S1) Speed Reducer”.

NOTE
Remove old sealing from each part completely before assembling.

DANGER
For this procedure, contact your YASKAWA representative described in the back cover.
If the tilt-axis motor is removed, the frame of the rotation axis (S2) rotates and is fallen.
Before removing the motor, support the frame side of the rotation axis (S2) by using the chain block, etc. to avoid it from falling down.

Refer to fig. 5-1 “Disassembly & Reassembly of the Tilt-Axis (S1) Speed Reducer”.

**Disassembly**
1. Turn OFF the MOTOPOS controller power supply.
2. Remove the motor by referring to chapter 4.1 “Disassembly and Reassembly of the Tilt-Axis (S1) Motor”.
3. Unscrew the hexagon socket head cap screws and .
4. Pull out the M-base , and then make the spacer contact with the frame.
5. Secure the spacer to the frame by using two hexagon socket head cap screws temporarily.
6. Unscrew the hexagon socket head cap screws .
7. Remove the M-base and the spacer from the speed reducer.
8. Remove the O-ring from the speed reducer.

**Reassembly**
1. Mount the O-ring to the speed reducer.
2. Mount the speed reducer to M-base after confirming its position.
3. Mount the spacer to the speed reducer. At this time, apply ThreeBond 1206C to the matching surface between the speed reducer and the spacer. Tighten the hexagon socket head cap screws with the tightening torque shown in table 5-1 “Tilt-Axis Motor Parts Checklist”.

**NOTE**
Remove old sealing from each part completely before assembling.

**DANGER**
For this procedure, contact your YASKAWA representative described in the back cover.
If the tilt-axis motor is removed, the frame of the rotation axis (S2) rotates and is fallen.
Before removing the motor, support the frame side of the rotation axis (S2) by using the chain block, etc. to avoid it from falling down.
5 Disassembly/Reassembly of Speed Reducer
5.1 Disassembly and Reassembly of the Tilt-Axis (S1) Speed Reducer

4. Unscrew two hexagon socket head cap screws① which secured the spacer④ temporarily.

5. Mount the speed reducer⑤ and M-base③ to the frame simultaneously. And then tighten the hexagon socket head cap screws② with the tightening torque shown in table 5-1 “Tilt-Axis Motor Parts Checklist”.

6. Mount the spacer④ to the frame of the rotation axis. And then tighten the hexagon socket head cap screws① with the tightening torque shown in table 5-1.

7. Mount the motor by referring to chapter 4.1 “Disassembly and Reassembly of the Tilt-Axis (S1) Motor”.

8. Turn ON the MOTOPOS controller power supply.
Table 5-1: Tilt-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Hexagon socket head cap screw M12 (length: 35 mm)</td>
<td>16</td>
<td>each</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-12</td>
<td></td>
<td>Tightening torque 142 N•m</td>
</tr>
<tr>
<td>②</td>
<td>Hexagon socket head cap screw M12 (length: 110 mm)</td>
<td>15</td>
<td>each</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-12</td>
<td></td>
<td>Tightening torque 142 N•m</td>
</tr>
<tr>
<td>③</td>
<td>M-base HS1301460-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Spacer HS1300788-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon socket head cap screw M12 (length: 30 mm)</td>
<td>21</td>
<td>each</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-12</td>
<td></td>
<td>Tightening torque 142 N•m</td>
</tr>
<tr>
<td>⑥</td>
<td>Speed reducer HS0382070-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>O-ring AS (ARP) 566-272</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5-1: Disassembly & Reassembly of the Tilt-Axis (S1) Speed Reducer

![Diagram of the Tilt-Axis (S1) Speed Reducer]
5.2 Disassembly and Reassembly of the Rotation-Axis (S2) Speed Reducer

**Disassembly**

1. Turn OFF the MOTOPOS controller power supply.
2. Unscrew the hexagon socket head cap screws, and remove the table from the speed reducer.
3. Unscrew the hexagon socket head cap screws, and remove the shaft from the speed reducer. At this time, be careful not to damage the oil sealing in the frame. Remove the O-ring from the shaft.
4. Unscrew the hexagon socket head cap screws, remove the speed reducer from its frame by using the tapped hole M10, and then remove the O-ring from the speed reducer.

**Reassembly**

1. Wipe the old grease in the frame by using a cloth.
2. Mount the O-ring to speed reducer. And mount the speed reducer to the frame, then tighten the hexagon socket head cap screws with the tightening torque shown in table 5-2 “Rotation-Axis Motor Parts Checklist”.
3. Mount the O-ring to the shaft, and then mount the shaft to the speed reducer, then tighten the hexagon socket head cap screws with the tightening torque shown in table 5-2. At this time, be careful not to damage the oil sealing in the frame.
4. Mount the seal cap (2 places).
5. Mount the table to the speed reducer, and then tighten the hexagon socket head cap screws with the tightening torque shown in table 5-2.
6. Replenish grease. Refer to chapter 6 “Grease Replenishment for Replacement of Speed Reducer”.
7. Turn ON the MOTOPOS controller power supply.
Table 5-2: Rotation-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hexagon socket head cap screw M12 (length: 35 mm) GT washer GT-LH12</td>
<td>9</td>
<td>Tightening torque 142 N•m</td>
</tr>
<tr>
<td>2</td>
<td>Table HS1300602-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Speed reducer HW0384526-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hexagon socket head cap screw M6 (length: 15 mm) Conical spring washer 2L-6</td>
<td>6</td>
<td>Tightening torque 10 N•m</td>
</tr>
<tr>
<td>5</td>
<td>Shaft HS9302803-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>O-ring CO0546A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hexagon socket head cap screw M10 (length: 90 mm) Conical spring washer 2L-10</td>
<td>14</td>
<td>Tightening torque 82 N•m</td>
</tr>
<tr>
<td>8</td>
<td>O-ring AS (ARP) 568-173</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Seal cap SC10-4</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5-2: Disassembly & Reassembly of the Rotation-Axis (S2) Speed Reduce
6 Grease Replenishment for Replacement of Speed Reducer

Fig. 6-1: Recommended Posture for Grease Replenishment and Grease Inlet/Exhaust Port

This chapter explains the grease-replenishment procedures for replacing the S1-axis speed reducer. For other regular grease-exchange for maintenance, refer to the procedures described in "MOTOPOS-D700F POSITIONER INSTRUCTIONS (HS1480656)".
6.1 Notes on Grease Exchange Procedures

Make sure to follow the instructions listed below at grease replenishment/exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

- If grease is injected without removing the plug from the grease exhaust port, the grease will leak inside a motor, or an oil seal of a speed reducer will come off. Make sure to remove the plug or it may result in a failure. Also, when using a tube, the length must be 150 mm or shorter and the inside diameter must be 6 mm or longer. If the tube is too long, the exhaust resistance at the tube part is increased, and the inner pressure of the grease bath is raised. It may result in coming off of an oil seal.

- Make sure to use a grease pump to inject grease. Set the grease injection rate to 7 g/s or less. (Air supply pressure to the grease pump: 0.3 MPa or less (rough standard))

- When using extrusion air for discharging the grease, set air supply pressure at 0.025 MPa or less. If the air supply pressure is higher than above mentioned value, an oil seal of a speed reducer will come off, and it may result in a failure.

- When using extrusion air for discharging grease, grease may be vigorously discharged from the exhaust port. Perform an operation such as using a tube at the grease exhaust port to pour into an appropriate container.

- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

- After injecting grease, discharge the specified amount of grease. If insufficient, the inner pressure is raised during the operation, and grease may leak. When discharged too much, the speed reducer is not lubricated sufficiently during the operation, and it may cause the early failure of the speed reducer.

- When filling/exchanging grease, the grease may flow out from the grease inlet or the grease exhaust port. Prepare a container to receive the grease and a waste cloth to wipe the grease in advance.
6 Grease Replenishment for Replacement of Speed Reducer
6.2 Grease Exchange Procedure of the Rotation Axis (S2)

6.2 Grease Exchange Procedure of the Rotation Axis (S2)

For the tilt axis (S1), perform the usual maintenance procedures. Refer to “MOTOPOS-D700F POSITIONER INSTRUCTIONS (HS1480656)”.

1. Remove the plug from grease exhaust port.

2. Install a grease zerk A-PT3/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)

3. Inject the grease through the grease inlet by using a grease gun.
   - Grease type: Molywhite RE No. 00
   - Recommended grease lubricator: Powerlube P3C (made by Macnaught)
   - Air supply pressure of grease pump: 0.3 MPa or less (approx.)
   - Speed of grease injection: 7 g/s or less
     (For example, if grease is supplied from the lubricator at 2 times/s, set the amount to 3.5 g/time or less)
   - Amount of grease: 1420 g (1632 cc) (approx.)

4. The old grease is discharged from the grease exhaust port. At this time, stop injection when the mixture of the old grease and the new grease in an equal ratio is seen.

5. Discharge the specified amount of grease from the grease inlet or grease exhaust port. In order to discharge the specified amount of grease, receive the discharged grease by using a container, and then measure the weight of the discharged grease by weighing the container till the amount reaches to the specified amount. Use one of the following methods to discharge grease.
   - Amount of discharged grease: 142 to 213 g
     Method 1: Extruding grease by air from the grease exhaust port
       (1) Connect the joint and the hose to the grease inlet.
       (2) Connect the regulator to the grease exhaust port.
       (3) Inject air from the grease exhaust port to extrude grease by air.
         (Extrusion air pressure: 0.025 MPa or less)
     Method 2: Suctioning grease out
       (1) Keep the inlet open and insert the tube into the exhaust port.
       (2) Discharge grease by suctioning grease out of the exhaust port.
         (Suction pressure: 0.025 MPa or less)

6. For the axis where grease is exchanged, perform a playback operation indicated in table 6-1 “Running-In Operation for Each Axis” for running-in the speed reducer with grease. At this time, grease may be discharged during the operation. Remove the grease zerk from the grease inlet, and clean and degrease the tap part and the thread part of the plug. Apply liquid gasket to the thread part of the plug. Tighten the plug on the grease inlet with the tightening torque of 5 N•m (0.5 kgf•m). Use R1/8 Plug (JIS B 0203) (speed reducer’s accessory) for the inlet. Also, discharge the excess grease in order not to increase the inner pressure of the speed reducer. Attach a bag to receive grease such as indicated in fig. 6-2 “Grease Receiving Bag (Rough Standard)”, and then perform the running-in operation.
7. Wipe the discharged grease with a cloth. Before installing the plug, clean and degrease the tap part and the thread part of the plug. Apply liquid gasket to the thread part of the plug. Tighten the plug on the grease exhaust port by using the tightening torque 23 N•m(2.3 kgf•m).

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Running-in operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation angle</td>
</tr>
<tr>
<td>S1-axis</td>
<td>±90°</td>
</tr>
</tbody>
</table>

**Table 6-1: Running-In Operation for Each Axis**

**Fig. 6-2: Grease Receiving Bag (Rough Standard)**

Grease receiving bag
Cut one corner to remove air.
To prevent grease from scattering from the cut corner, cover the receiving bag with a plastic bag etc. without being sealed.

Bond for fixing a grease receiving bag

Tube (inside dia.: 6 mm or more)

Union (inside dia.: 6 mm or more)
R3/8
7 Battery Pack Replacement

For the explanations of this chapter, refer to “MOTOPOS-D700F POSITIONER INSTRUCTIONS (HS1480656)".
8  Grounding Unit Replacement

For the explanations of this chapter, refer to "MOTOPOS-D700F POSITIONER INSTRUCTIONS (HS1480656)".