ROBO CYLINDER

ROBO Cylinder
Slider Type

RCS2 Actuators

Motor Straight Type (Coupling Type): SA4C, SA5C SA6C, SA7C, SS7C and SS8C
Motor Straight Type (Built-in Type): SA4D, SA5D and SA6D
Motor Reversing Type: SA4R, SA5R, SA6R, SA7R, SS7R and SS8R

RCS2CR Actuators, Clean room Specification

Motor Straight Type (Coupling Type): SA4C, SA5C, SA6C, SA7C, SS7C and SS8C
Motor Straight Type (Built-in Type): SA5D and SA6D

Operating Manual

Second Edition

IAI America, Inc.

ROBO CYLINDER	Note	

Greasing Actuators of Cleanroom Specification

For ROBO Cylinder actuators of cleanroom specification, use grease of low-dust-raising type for cleanroom applications.
The grease specified in the maintenance/inspection sections of the Operating Manual is for actuators of standard specification.
Using the grease for the standard actuators on the cleanroom actuators may generate dust.

Recommended grease: C Grease by Kuroda Precision Industries Ltd.

C Grease by Kuroda Precision Industries is applied to the cleanroom actuators before shipment from IAI.

Safety Precautions (Please read before using the product.)

Before installing, operating, maintaining or inspecting this product, please peruse this operating manual as well as the operating manuals and other related documentations for all equipment and peripheral devices connected to this product in order to ensure the correct use of this product and connected equipment/devices. Those performing installation, operation, maintenance and inspection of the product must have sufficient knowledge of the relevant equipment and their safety. The precautions provided below are designed to help you use the product safely and avoid bodily injury and/or property damage.

In this operating manual, safety precautions are classified as “Danger,” “Warning,” “Caution” and “Note,” according to the degree of risk.

⚠ Danger	Failure to observe the instruction will result in an imminent danger leading to death or serious injury.
⚠ Warning	Failure to observe the instruction may result in death or serious injury.
⚠ Caution	Failure to observe the instruction may result in injury or property damage.
ⓘ Note	The user should take heed of this information to ensure the proper use of the product, although failure to do so will not result in injury.

It should be noted that the instructions under the ⚠ Caution and ⓘ Note headings may also lead to serious consequences, if unheeded, depending on the situation.
All instructions contained herein provide vital information for ensuring safety. Please read the contents carefully and handle the product with due caution.
Please keep this operating manual in a convenient place for quick reference whenever needed, and also make sure that the manual will get to the end-user.

⚠ Danger

[General]

- Do not use this product for the following applications:
  1. Medical equipment used to maintain, control or otherwise affect human life or physical health
  2. Mechanisms and machinery designed for the purpose of moving or transporting people
  3. Important safety parts of machinery

  This product has not been planned or designed for applications requiring high levels of safety. Use of this product in such applications may jeopardize the safety of human life. The warranty covers only the product as it is delivered.

[Installation]

- Do not use this product in a place exposed to ignitable, inflammable or explosive substances. The product may ignite, burn or explode.
- When installing the product, be sure to securely support and affix it (including the work). Failure to do so may cause the product to tip over, drop or malfunction, resulting in injury.

- Avoid using the product in a place where the main unit or controller may come in contact with water or oil droplets.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Doing so may result in fire.

[Operation]

- Do not enter the machine's range of operation while the product is operating or standing by. The actuator may move suddenly, causing injury.
- Do not pour water onto the product. Spraying water over the product, washing it with water or using it in water may cause the product to malfunction, resulting in injury, electric shock, fire, etc.

[Maintenance, Inspection, Repair]

- Never modify the product. Unauthorized modification may cause the product to malfunction, resulting in injury, electric shock, fire, etc.
- Do not disassemble and reassemble the components relating to the basic structure of the product or its performance and function. Doing so may result in injury, electric shock, fire, etc.

⚠ Warning

[General]

- Do not use the product outside the specifications. Using the product outside the specifications may cause it to fail, stop functioning or sustain damage. It may also significantly reduce the service life of the product. In particular, observe the maximum loading capacity and speed.

[Installation]

- If the machine will stop in the case of system problem such as emergency stop or power failure, design a safety circuit or other device that will prevent equipment damage or injury.
- Before supplying power to and operating the product, always check the operation area of the equipment to ensure safety. Supplying power to the product carelessly may cause electric shock or injury due to contact with the moving parts.
- Wire the product correctly by referring to the operation manual. Securely connect the cables and connectors so that they will not be disconnected or come loose. Failure to do so may cause the product to malfunction or cause fire.

[Operation]

- Before operating the moving parts of the product by hand (for the purpose of manual positioning, etc.), confirm that the servo is turned off (using the teaching pendant). Failure to observe this instruction may result in injury.
- Do not scratch the cables. Scratching, forcibly bending, pulling, winding, crushing with heavy object or pinching a cable may cause it to leak current or lose continuity, resulting in fire, electric shock, malfunction, etc.
- Turn off the power to the product in the event of power failure. Failure to do so may cause the product to suddenly start moving when the power is restored, thus resulting in injury or product damage.
- If the product is generating heat, smoke or a strange smell, turn off the power immediately. Continuing to use the product may result in product damage or fire.
- If noise or abnormally high vibration is detected, stop the operation immediately. Continuing to use the product may result in product damage, malfunction due to damage, runaway machine, etc.
- If any of the product's protective functions (alarms) has actuated, turn off the power immediately. Continuing to use the product may result in injury due to product malfunction, or cause product breakdown or damage. After the power has been cut off, identify and remove the cause of the problem, and then reconnect the power.
- Do not step on the product, use it as a footstool or place any object on it. You may slip and fall or the product may tip over or drop, resulting in injury. Malfunction, runaway product, etc., may also result due to product breakdown or damage.

[Maintenance, Inspection, Repair]

- Before commencing maintenance/inspection, servicing, replacement or any other work on the product, be sure to completely cut off the power supply to the product. Also take heed of the following precautions:
    1. Put up a sign bearing “WORK IN PROGRESS. DO NOT TURN ON POWER” or other warning statement to that effect, to prevent a bystander from accidentally turning on the power.
    2. If multiple operators work together to perform maintenance/inspection work, the operators should always give verbal cues to one another to ensure safety before turning on/off the power or moving any axis.

[Disposal]

- Do not throw the product into flames. The product may explode or toxic gases may generate.

⚠ Caution

[Installation]

- Do not use the product in a place exposed to direct sunlight (ultraviolet ray), dusty place or place where air contains salt or iron powder, humid place, or in any ambience where the product may come in contact with organic solvent, hydraulic oil containing phosphate ester, etc. If used in theses places/ambiences, the product may lose its function over a short period of time or suffer rapid performance deterioration, or the service life of the product may be reduced.
- Do not use the product in an ambience where it may come in contact with corrosive gases (sulfuric acid, hydrochloric acid, etc.). The product may lose its strength due to rust.
- Provide sufficient shielding measures if the product is used in any of the following places. If proper measures are not taken, the product may malfunction:
    1. Place where large current or strong magnetic field generates
    2. Place where arc discharge occurs due to welding work, etc.
    3. Place where noise generates due to electrostatic, etc.
    4. Place where the product may come in contact with radiation
- Do not install the product in a place subject to vibration or shock.
- Provide an emergency stop device in an easily accessible position so the device can be immediately actuated should danger occur during operation. Failure to do so may result in injury.
- Provide sufficient maintenance space when installing the product. If sufficient space is not available, daily inspection, maintenance and other necessary work cannot be carried out, resulting in system shutdown or product damage.
- When transporting or installing the product, support the product using a lift or suspension equipment or carry it with multiple operators working together, and exercise due caution to ensure safety.
- When installing the product, do not hold the moving parts or cables of the product. Doing so may result in injury.
- Use IAI’s genuine cables to connect the actuator and controller. Also use IAI’s genuine components for the actuator, controller, teaching pendant, etc.
- The brake mechanism is designed to prevent the slider from dropping upon turning off the power when the actuator is installed vertically. Do not use the brake mechanism as a safety brake.
- When installing, adjusting or carrying out any other work on the actuator, put up a sign bearing “WORK IN PROGRESS. DO NOT TURN ON POWER” or other warning statement to that effect, to prevent the product from being powered on accidentally. If the power is turned on accidentally, injury may result due to electric shock or sudden movement of the actuator.

[Operation]

- Turn on the power to individual equipment one by one, starting from the equipment at the highest level in the system hierarchy. Failure to do so may cause the product to start suddenly, resulting in injury or product damage.
- Do not insert a finger or object in the openings in the product. It may cause fire, electric shock or injury.
- Do not step on the product, use it as a footstool or place any object on it. It may cause scoring, dents or deformation of the driving part, resulting in product damage, unintended stopping due to damage, or performance drop.

[Maintenance, Inspection, Repair]

- Wear protective goggles when applying grease to the actuator. Failure to do so may result in eye inflammation due to spattered grease.

Note

[Installation]

- If the product is used in a vertical setup, be sure to use the vertical specification (with brake).
- Protection covers or other guards must be provided for the moving parts of the equipment to avoid direct contact with the operators.
- Do not configure a control circuit that will cause the work to drop in case of power failure. Configure a control circuit that will prevent the table or work from dropping when the power to the machine is cut off or an emergency stop is actuated.
- The following conditions must be met in order to improve the straightness of the table movement and ensure the smooth movement of the ball screw and linear guides:
    1. Flatness of the mounting surface must be within 0.05 mm.
    2. The mounting surface area must be large enough to ensure the rigidity of the actuator.

[Installation, Operation, Maintenance]

- When handling the product, wear protective gloves, protective goggles, safety shoes or other necessary gear to ensure safety.

[Maintenance, Inspection, Repair]

- When performing maintenance, apply the specified grease to the guides and ball screw. Pay special attention not to let fluoride grease mix with lithium grease. The machine may be damaged due to poor lubrication, increased resistance, etc.

[Disposal]

- When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.

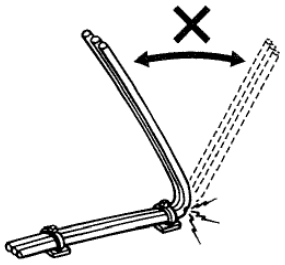
Others

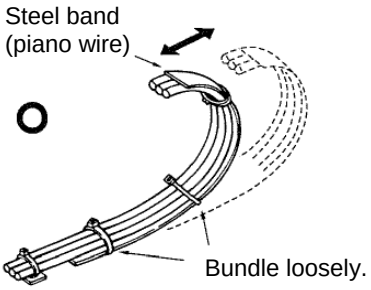
- IAI shall not be liable whatsoever for any loss or damage arising from a failure to observe the items specified in “Safety Precautions.”

Prohibited Handling of Cables

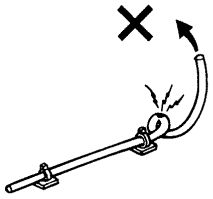
When designing an application system using IAI's actuators and controllers, incorrect wiring or connection of each cable may cause unexpected problems such as a disconnected cable or poor contact, or even a runaway system. This section explains prohibited handling of cables. Read the information carefully to connect the cables properly.

1. Do not let the cable flex at a single point.

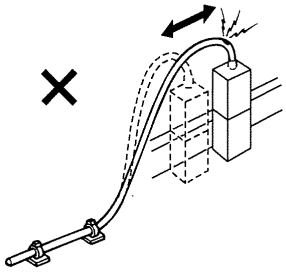




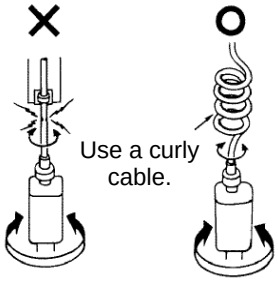
2. Do not let the cable bend, kink or twist.



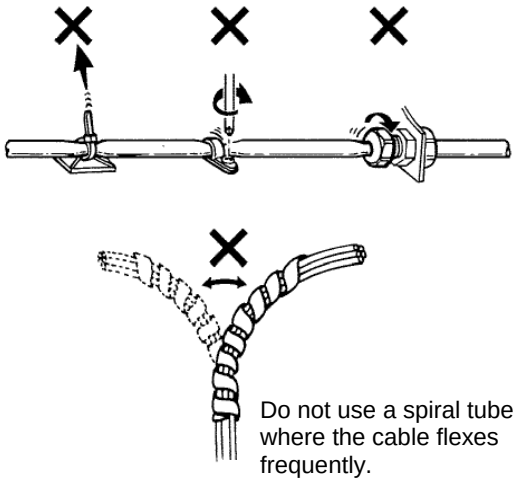
3. Do not pull the cable with a strong force.



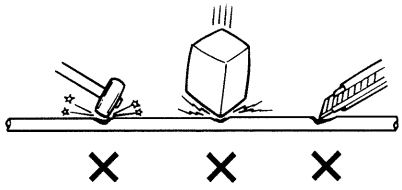
4. Do not let the cable receive a turning force at a single point.



5. When fixing the cable, provide a moderate slack and do not tension it too tight.

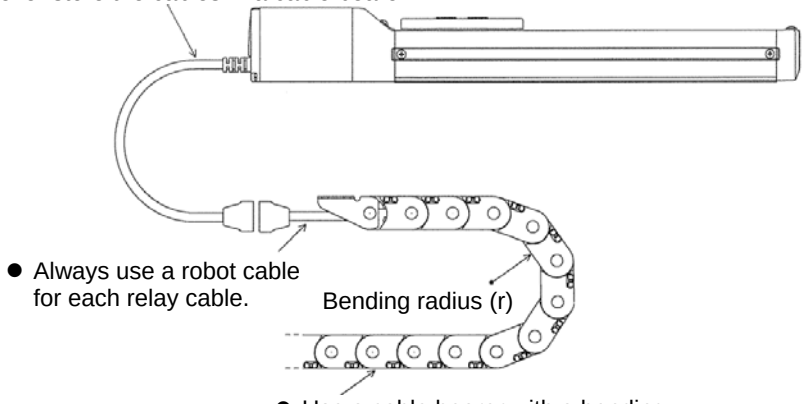


6. Do not pinch, drop a heavy object onto or cut the cable.

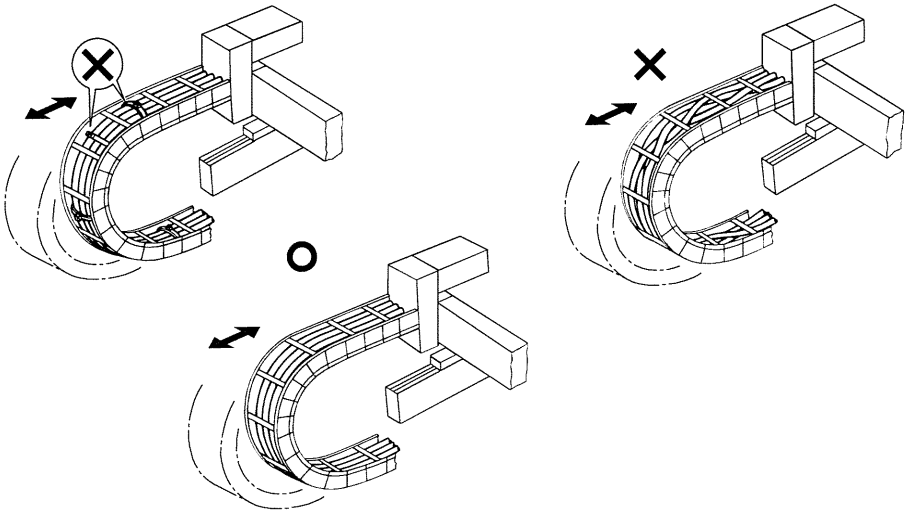


7. Notes on using cable bearers

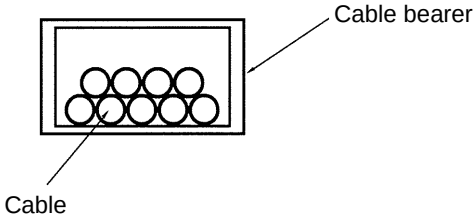
- The supplied cables are not robot cables. Accordingly, never store the cables in a cable bearer.



- Do not let the cable get tangled or kinked in a cable bearer or flexible tube. When bundling the cable, keep a certain degree of flexibility (so that the cable will not become too taut when bent).



- Do not cause the cables to occupy more than 60% of the space in the cable bearer.



- Do not lay signal lines together with circuit lines that create a strong electric field.

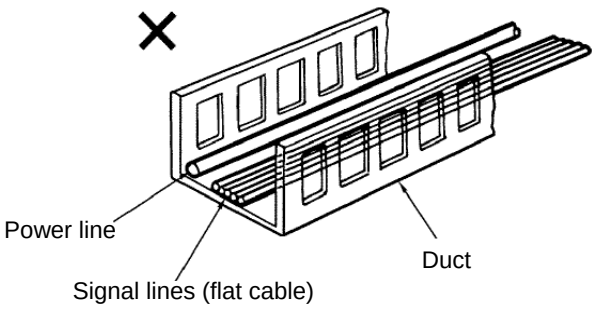


Table of Contents

1. Foreword

Thank you for purchasing an IAI product.
This manual explains the structure, correct operation and maintenance of the actuator.
Please read this manual carefully before using the product.
For more complete information on operating the actuator, please also refer to the controller operating manual.

2. Safety Precautions

2.1 Basic Operating Instructions

- Please do not attempt to use or operate the actuator in any manner not indicated in this manual or the controller manual.
- Please be sure to use only the cable provided by IAI to connect the actuator and controller.
- Please do not allow people within the moving range of the unit when it is in operation or when the power is ON since this is dangerous.

2.2 Maintenance and Inspection

- When doing maintenance and inspection work, always shut down the controller power first.
- When doing inspection, make sure that no one can inadvertently turn the power ON.
- Make sure that a sign indicating work in progress is clearly visible.
- If several persons are working, be sure to watch out for each other's safety. In particular, check before turning power ON or OFF and let others know if you are doing work involving axis movement.

(Note)
- The content of this manual is subject to change without notice for the purpose of improvement.
- This manual was created with utmost attention to accuracy. Should you find any error, however, or if you have any question, please contact IAI.

3. Warranty

3.1 Warranty Period

Warranty period shall be either of the following periods whichever ends first:

- **18 months after shipment from our factory**
- **12 months after delivery to a specified location**
- **2500 hours of operation time**

3.2 Scope of Warranty

If a breakdown occurs within the period specified above and is due to the manufacturer's error, we will repair the unit at no cost. However, the following items are not covered by this warranty.

- Faded paint or other changes that occur naturally over time.
- Consumable components that wear out with use (stainless sheet, etc.).
- Unit seems to be noisy or similar impressions that do not affect machinery performance.
- Damage resulting from improper handling by the user or lack of proper maintenance.
- Any alterations made by other than IAI or its representatives.
- Breakdowns caused by using controllers made by other manufacturers.
- Any damages caused by fire and other natural disasters or accidents.

The warranty pertains to the purchased product itself and does not cover any damages that might arise from a breakdown of the supplied product.
Any repairs will be done at our factory. Even if the product is still covered under the warranty period, we will assess a separate charge for sending technicians to the customer's site.

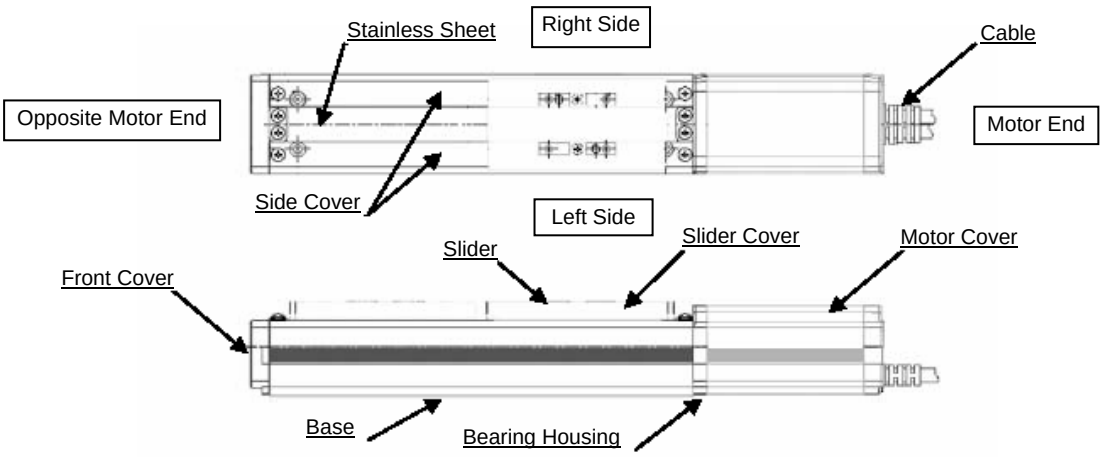
4. Names of the Parts

The names of the actuator parts are indicated below.

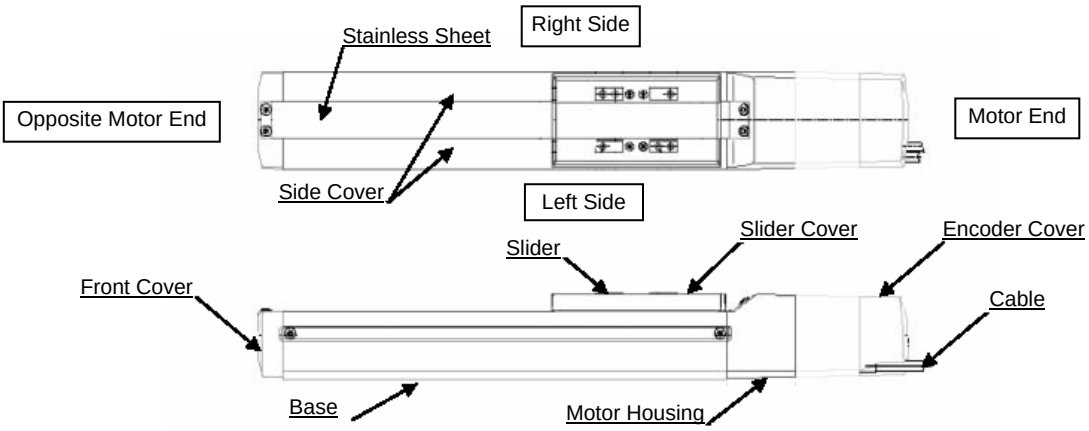
The left and right sides are indicated by looking at the actuator from the motor end with the actuator set down horizontally. Front end means the side opposite the motor end.

4.1 Motor Straight Type (Standard) RCS2

- Coupling Type (SA4C, SA5C, SA6C),

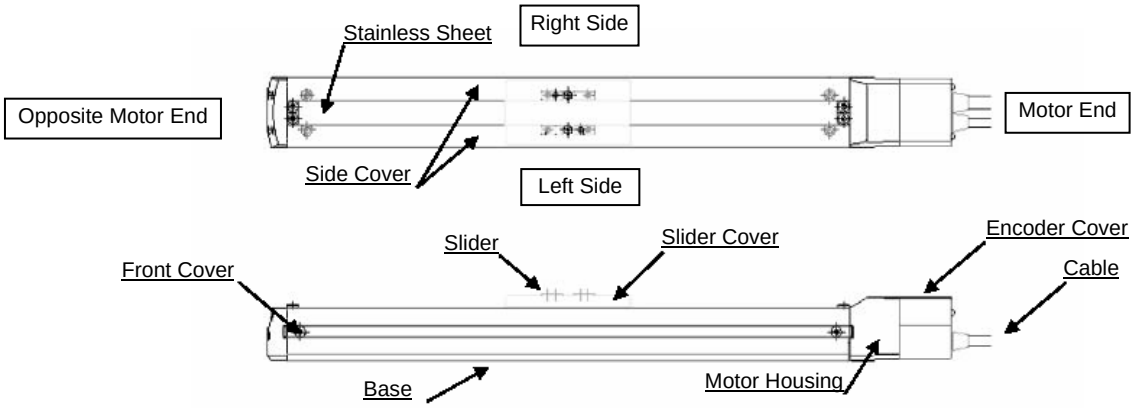


- Coupling Type (SA7C, SS7C, SS8C),



Caution:	The cable directly connected to the actuator is not robot cable even when ordered with robot cable option. When designing, please be sure not to give repeated bending loads to this cable. The robot cable is applicable only to the connecting cables.

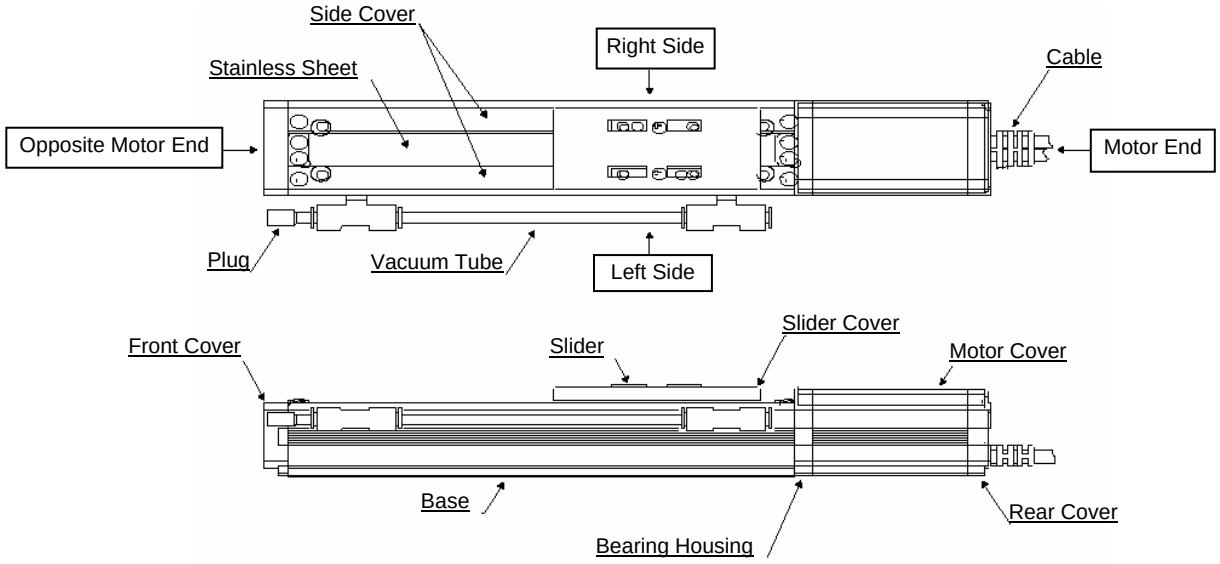
- Built-in Type (SA4D, SA5D, SA6D)



Caution:	The cable directly connected to the actuator is not robot cable even when ordered with robot cable option. When designing, please be sure not to give repeated bending loads to this cable. The robot cable is applicable only to the connecting cables.

4.2 Motor Straight Type (Cleanroom Specification) RCS2CR

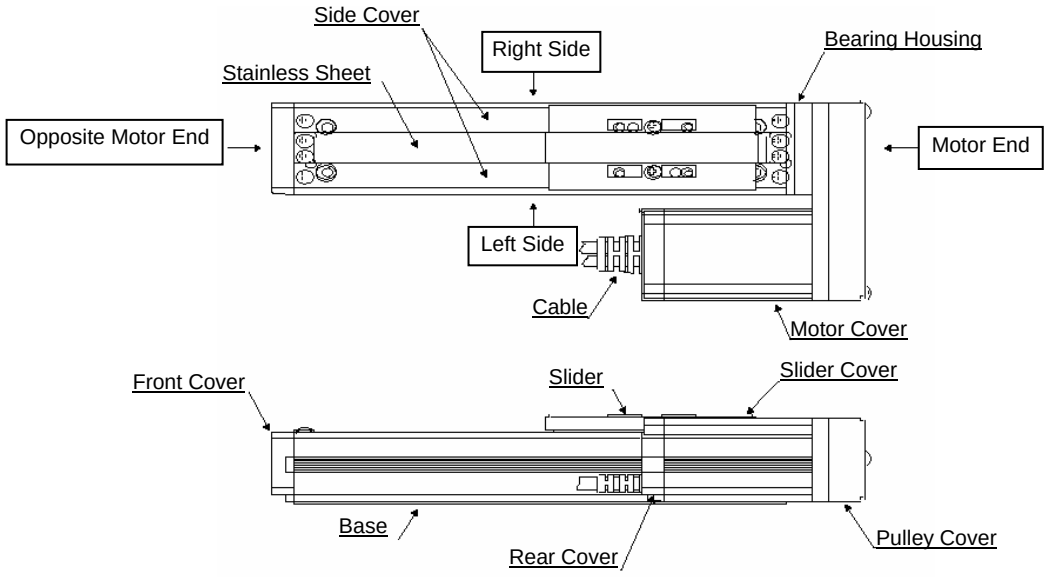
- Coupling Type (SA4C, SA5C, SA6C, SA7C, SS7C, SS8C), Built-in Type (SA5D, SA6D)



Caution:	The cable directly connected to the actuator is not robot cable even when ordered with robot cable option. When designing, please be sure not to give repeated bending loads to this cable. The robot cable is applicable only to the connecting cables.

4.3 Motor Reversing Type RCS2

- SA4R, SA5R, SA6R, SA7R, SS7R, SS8R



Caution:	The cable directly connected to the actuator is not robot cable even when ordered with robot cable option. When designing, please be sure not to give repeated bending loads to this cable. The robot cable is applicable only to the connecting cables.

5. Transporting and Handling

5.1 Handling the Actuator

5.1.1 Handling the Packed Unit

Unless otherwise specified, each actuator (axis) is shipped individually.
Please take care that the shipping box is not dropped or subjected to strong impact during transport.

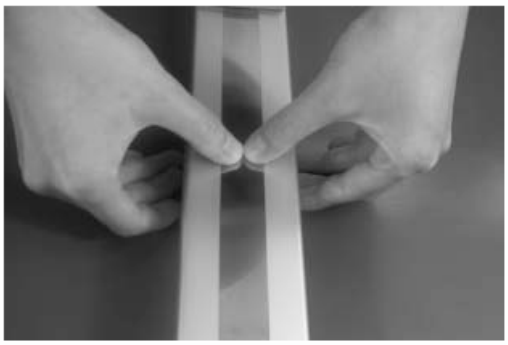
- The operator should not carry heavy shipping boxes by themselves.
- If the shipping box is left standing, it should be in a horizontal position.
- Do not climb on top of the shipping box.
- Do not place heavy objects on top of the shipping box.

5.1.2 Handling the Actuator After It is Unpacked

Lift the actuator up by the base to remove it from the packing.

- When carrying the actuator, take care not to bump it. Take particular care with the front cover and motor cover.
- Do not exert excessive force on any part of the actuator.
- Be careful not to cause the cables to receive a tensile force.
- Note on handling the stainless sheet
  The stainless sheet is designed very thin (thickness: Approx. 0.1 mm) in order to ensure flexibility. Therefore, the stainless sheet is easily dented or scratched. Once dented or scratched, the stainless sheet may break during use.

⚠ Warning: Do not press the sheet directly with hands.



* Please refer to Section 4 above for the names of the actuator parts.

5.2 Handling the Actuator Assembly

Pay attention to the following instructions when transporting an assembly of actuator axes.

5.2.1 Condition of Shipment from IAI (Assembled)

The actuators you have ordered are assembled at IAI, after which the assembly receives a shipping inspection and is shipped in an outer frame with skids.

The assembly is packed with the sliders securely affixed so that they will not move unexpectedly during transportation. In the case of a combined unit, the actuator ends are secured to prevent swinging due to external vibration.

- The package is not designed with special considerations for protection against impact due to dropping or collision, so please handle the package with care. Also, do not place any heavy object on the outer frame, as it is not strong enough to withstand loads.
- When suspending the package using ropes, etc., pass the ropes from underneath the reinforcement frames at the bottom of the skids. When lifting with a forklift, also place the forks underneath the skids.
- Set down the package carefully so as not to apply impact to the assembly or cause it to bounce.

After unpacking, handle the actuator assembly correctly by observing the instructions given below.

5.2.2 Handling after Assembly with Peripheral Equipment

When transporting the actuators that have been assembled with peripheral equipment either at IAI or on your site, observe the instructions given below.

- Secure each slider to prevent unexpected movement during transportation.
- If any actuator end is protruding, secure it to prevent swinging due to external vibration.
- If the actuator ends are not secured, do not apply any impact force exceeding 0.3 G during transportation.
- When suspending the actuator-assembled peripheral equipment using ropes, etc., make sure the ropes do not contact the actuators directly.
- Pass the ropes over appropriate cushion materials, and make sure the loads from the ropes will be received by the base of each actuator.
- Secure the end of the Y-axis using a separate rope to maintain the axis in a stable horizontal position. At this time, be careful not to apply loads on the screw cover.
- Be careful not to allow the brackets, covers and connector box of each actuator to receive loads. Also protect the cables from pinching or excessive deformation.

6. Operating and Storage Environment

6.1 Operating Environment

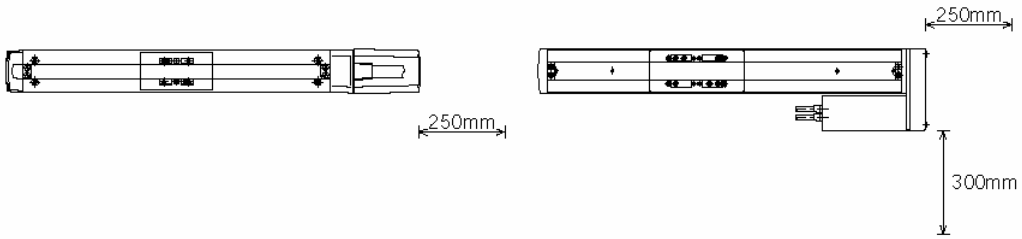
The actuator should be set up in an environment, which meets the following criteria:

- Avoid direct sunlight.
- Avoid radiant heat from strong heat sources such as a furnace.
- Ambient temperature should be 0 ~ 40°C.
- The humidity should be less than 85% and there should be no condensation.
- Avoid exposure to corrosive or combustible gases.
- The area should have very little dust and be suitable for normal assembly operations.
- Avoid exposure to oil mist or fluids used in cutting.
- The unit should not be subject to impacts or vibrations.
- Avoid extreme electromagnetic waves, ultraviolet rays and radiation.
- This product is not intended to be used in a chemical environment.

In general, the environment should be one in which an operator can work without protective gear.

Work space needed for maintenance/inspection

[Motor straight type] [Motor reversing type]



6.2 Storage Environment

The storage environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored for a long period of time. Unless there are special instructions, we do not include moisture absorption agents when shipping the unit. If you are storing the unit where condensation might occur, then you must treat the entire package or treat the unit itself after it is unpacked to prevent condensation. The unit can withstand up to 60°C during a short storage interval but only up to 50°C if the storage period is longer than one month.

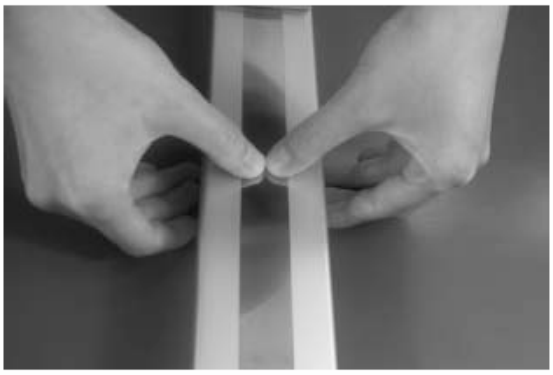
7. Installation

Notes on Installation

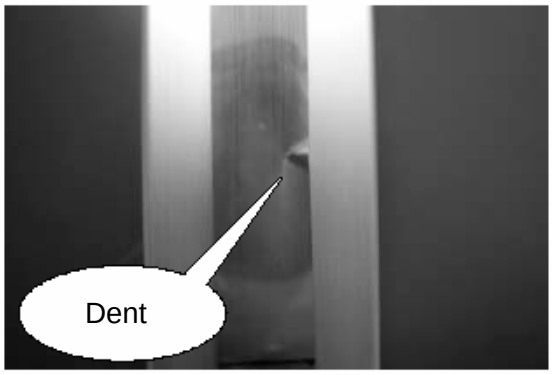
The stainless sheet is designed very thin (thickness: approx. 0.1 mm) in order to ensure flexibility. Therefore, the stainless sheet is easily dented or scratched. Once dented or scratched, the stainless sheet may break during use.

When installing the stainless sheet, pay attention to the following points:

1. Do not press the sheet directly with hands



2. Protect the sheet from dents by paying attention not to drop tools and works onto the sheet.



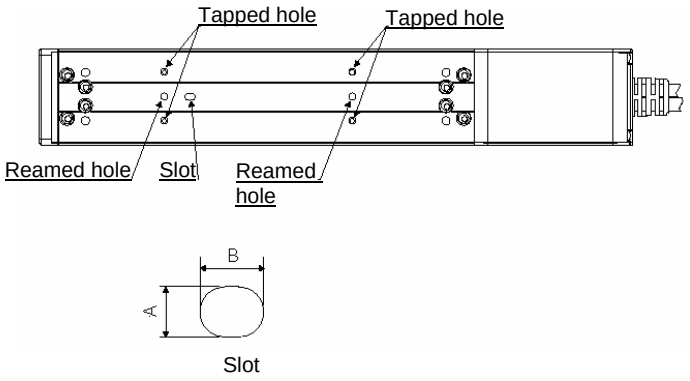
3. Do not allow powder dust or iron powder to generate around the stainless sheet.
   If generation of powder dust/iron powder cannot be fully prevented, wipe the stainless sheet after the operation to remove all particles attached to the sheet.
   If the actuator is operated with the stainless sheet carrying foreign particles, the particles may enter the slider and damage the sheet or cause the sheet to deform, lift or present other problems.
   The stainless sheet is held in place by means of magnets. If ambient air contains iron powder or other magnetic substances, they may attach to the magnets and cause problems. Pay attention to the surrounding environment and take appropriate measures, if necessary.

7.1 Installing the Main Body

Mount the actuator to a machined surface or one of comparable precision.

The side faces and lower surface of the base run parallel with the guides. When traveling precision is required, use these as the reference planes for mounting. Take note that the available mounting methods are different for each actuator type.

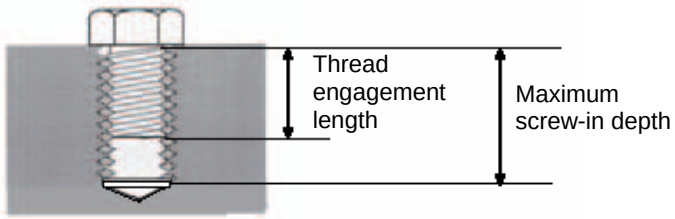
7.1.1 Using the Tapped Holes at Back of the Base



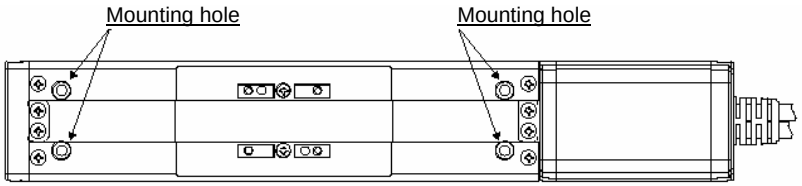
Tapped holes are provided on the back of the base for mounting the actuator. Install the actuator using these tapped holes. The sizes and effective depths of tapped holes are listed below. Be careful not to let the ends of bolts project from the holes. If necessary, use the additional reamed holes that are provided for positioning purpose.
(Two reamed holes are provided, one on the motor side and the other on the counter-motor side. One slot is provided on the counter-motor side.)

Type	Tap size	Maximum screw-in depth	Minimum thread engagement length	Reamed hole	Slot
SA4C, D, R	M3	5 mm	3 mm	∅3H7, depth 5 mm or less	A: 3H7, B: 4, depth 5 mm or less
SA5C, D, R	M4	7 mm	4 mm	∅4H7, depth 5 mm or less	A: 4H7, B: 5, depth 5 mm or less
SA6C, R	M5	8 mm	5 mm	∅4H7, depth 5 mm or less	A: 4H7, B: 5, depth 5 mm or less
SA6D	M5	8 mm	5 mm	∅4H7, depth 5 mm or less	A: 4H7, B: 5, depth 5 mm or less
SA7C, R	M5	9 mm	5 mm	-	-
SS7C, R	M5	8 mm	5 mm	-	-
SS8C, R	M8	10 mm	8 mm	-	-

Caution: When the actuator uses an aluminum base
If the thread engagement length between the mounting screw and tapped hole is no more than five-eighths the maximum screw-in depth of the tapped hole, tighten the screw to approx. 70 to 80% of the specified torque.



7.1.2 Using the Mounting Holes on Top of the Base (SA4 of 200 mm or Shorter Strokes/SA5 of 300 mm or Shorter Strokes)



Four through holes (two on the motor side and two on the counter-motor side) are provided in the base for installing the actuator on its top face. Use these mounting holes to install the actuator.
When installing the actuator using these mounting holes alone, take heed of the following points:

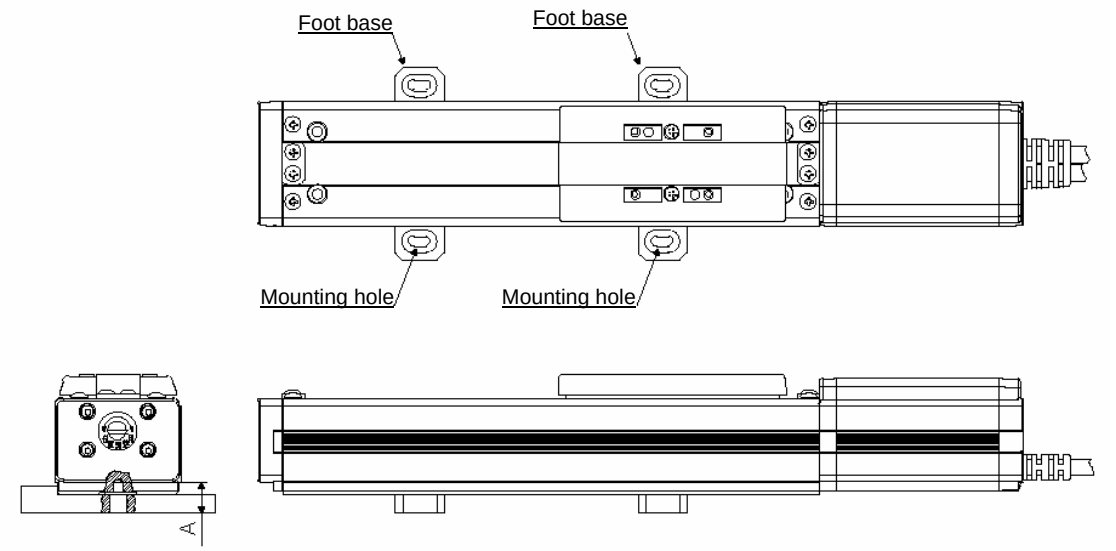
1. SA4: Applicable to models of 200 mm or shorter strokes only
2. SA5: Applicable to models of 300 mm or shorter strokes only
3. SA6: Mounting holes are not provided.

If any model other than those specified in 1 and 2 (longer stroke) is installed using the mounting holes alone, the base may deform and the slider may slide abnormally, generate noise or present other problems.

As for mounting bolts, use hexagon socket-head bolts conforming to the applicable specification in the table below in accordance with the machine frame material.
If necessary, the reamed holes/slot explained in 7.1.1 can be used as positioning pin holes.

Type	Mating material is steel	Mating material is aluminum
SA4	M3, length 35 mm or more	
SA5	M4, length 40 mm or more	M4, length 45 mm or more

7.1.3 Using Foot Bases (Optional)



By using foot bases (optional), the actuator can be installed on its top face using the mounting holes in the foot bases.
Foot bases provide an effective means for installing the SA4 models of strokes exceeding 200 mm, S5A models of strokes exceeding 300 mm, or all SA6 models.
As for mounting bolts, use hexagon socket-head bolts and flat washers conforming to the applicable specification in the table below in accordance with the machine frame material.
If necessary, the reamed holes/slot explained in 7.1.1 can be used as positioning pin holes.
The depth of reamed holes/slot must conform to dimension A. (Dimension A considers the foot base thickness.)

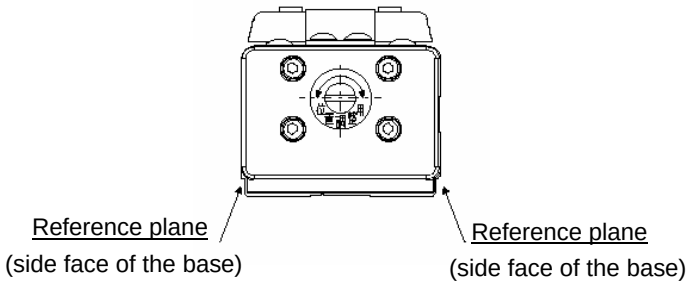
Type	Mating material is steel	Mating material is aluminum	Flat washer	Dimension A
SA4	M4, length 8 mm or more	M4, length 12 mm or more	Nominal diameter 4	12 mm
SA5	M4, length 8 mm or more	M4, length 12 mm or more	Nominal diameter 4	13 mm
SA6	M5, length 10 mm or more	M5, length 15 mm or more	Nominal diameter 5	14 mm

7.2 Mounting Surface

- The mounting table should have sufficient rigidity to avoid generating vibration.
- The surface where the actuator will be mounted should be machined or be equally level and the flatness tolerance between the actuator and the table should be within ± 0.05 mm.
- Provide enough space around the actuator to permit maintenance work to be done.

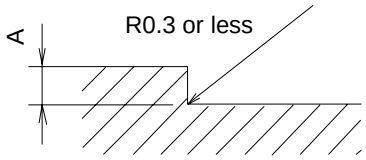
7.2.1 Using Side Faces of the Base as Reference Planes

- The side and bottom faces of the actuator base provide the reference planes for slider travel.
- When precision is required, use these surfaces as the reference planes for mounting.



Caution:	As shown above, the side faces of the base provide the reference planes for slider travel. When precision is required, use these surfaces as the reference planes for mounting.

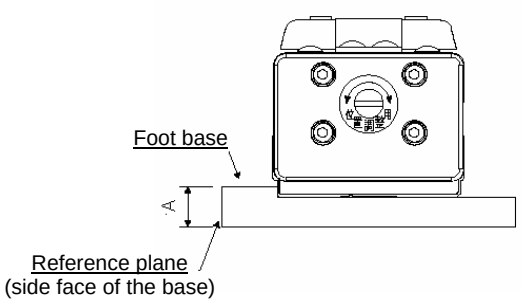
When using the base as the reference planes for mounting the actuator to the machine frame, follow the machining dimensions shown below.



Type	Dimension A
SA4	2 ~ 3 mm
SA5	2 ~ 4.5 mm
SA6	2 ~ 4.5 mm
SA7	2 ~ 5.5 mm
SS7	2 ~ 4 mm
SS8	2 ~ 4.5 mm

7.2.2 Using Side Faces of the Foot Base as Reference Planes (If Equipped with Optional Foot Bases)

- The side faces of the foot base provide the reference planes for slider travel.
- When precision is required, use these surfaces as the reference planes for mounting.



Type	Dimension A
SA4	9.5 mm
SA5	11 mm
SA6	12 mm

7.3 Clamp Screws

- The male screws for mounting the base should be M3 for SA4, M4 for SA5, M5 for SA6/SA7/SS7, and M8 for SS8. (Use hexagon socket-head bolts).
- For the bolts, we recommend high strength bolts of ISO-10.9 or higher.
- When using a foot base to attach to a mounting table, use the special washer made for high strength bolts that comes with the actuator if the bolt is M8 or larger. This is unnecessary for M6 or smaller bolts. Do not use a common spring washer.

- The recommended screw torque is given below.

Screw nominal diameter	Screw Torque	
	When the bolt seating surface is steel	When the bolt seating surface is aluminum
M3	1.5 N·m (0.15 kgf-m)	0.8 N·m (0.08 kgf-m)
M4	3.6 N·m (0.38 kgf-m)	1.8 N·m (0.23 kgf-m)
M5	7.3 N·m (0.77 kgf-m)	3.4 N·m (0.44 kgf-m)
M8	30.0 N·m (3.19 kgf-m)	11.5 N·m (1.43 kgf-m)

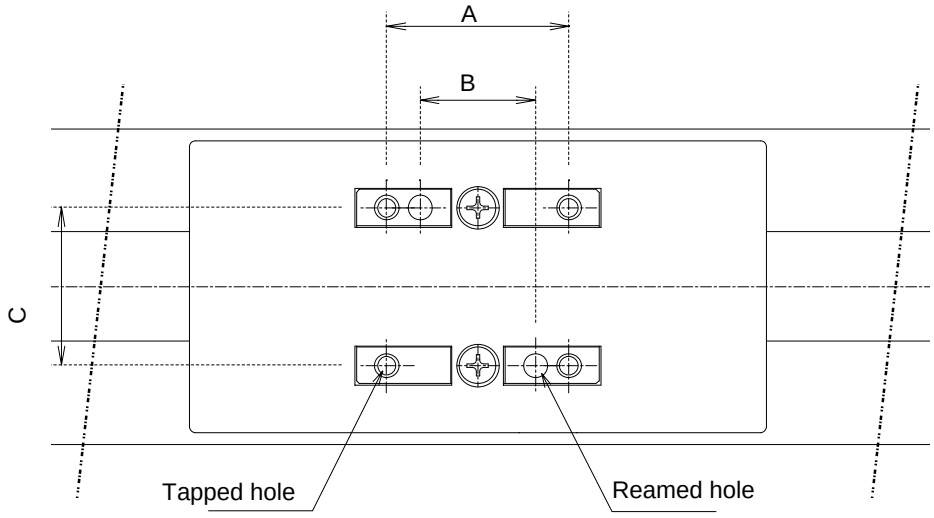
7.4 Installing the load to the Slider

7.4.1 Using the Slider

- Tapped holes are provided on the slider for installing the load. The method of clamping varies according to how to mount the main body.
- In case of moving actuator instead of slider, use the same tapped holes on the slider.
- Please use two reamed holes on the slider when repeatability of mounting and dismounting is required. When fine adjustment of the squareness is necessary, use only one reamed hole to allow adjustment.

Sizes and depths of tapped holes and reamed holes on slider

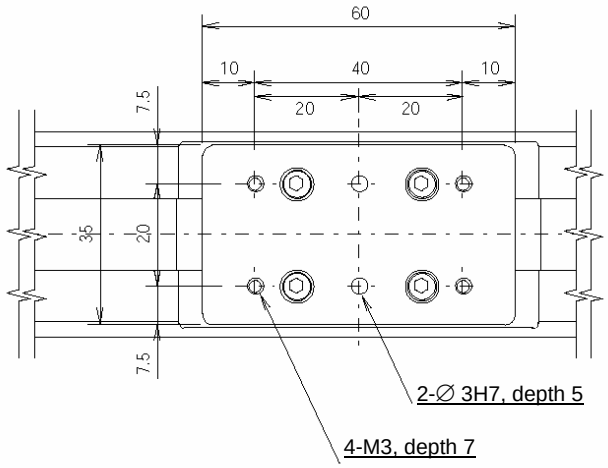
Model	Tap size	Depth of thread	A	B	C	Hole size
SA4	M3	7 mm	24 mm	16 mm	20 mm	∅3 H7, depth 5 mm
SA5	M4	9 mm	30 mm	19 mm	26 mm	∅4 H7, depth 6 mm
SA6	M5	9 mm	50 mm	32 mm	31 mm	∅5 H7, depth 6 mm
SA7	M5	10 mm	50 mm	32 mm	39 mm	∅5 H7, depth 10 mm
SS7	M5	10 mm	50 mm	32 mm	32 mm	∅5 H7, depth 10 mm
SS8	M8	10 mm	75 mm	45 mm	45 mm	∅8 H7, depth 10 mm



Caution: When installing the load, do not let adhesives, paints or other viscous substances attach the stainless sheet. Also, avoid applying a concentrated force that will dent the sheet. It may cause the slider to malfunction or damage the sheet.

7.4.2 Using a Slider Spacer (Optional) (Optional for SA4 Type)

For the SA4 type, a slider spacer is available as an option.
The figure below shows the positions of load-mounting holes in actuators with a slider spacer.



8. Wiring Cable

- In an application where the cable cannot be anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable as large radial wire duct to limit the load on the cable.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length.
- The cables supplied with the actuator offer excellent flexibility, but they are not robot cables. If the cables are to be stored in a movable cable duct (cable bearer, etc.), use robot cables.

For cable modification, please contact IAI.

9. Maximum Speed

The maximum speed of the actuator is limited to prevent resonance of the ball screw shaft and also in consideration of the restrictions on motor speed.
Observe the maximum speed limits specified below.

Strokes and maximum speed limits (unit: mm/sec)

		Stroke (mm)															
Type	Lead	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1000
SA4	2.5mm	165															
	5mm	330															
	10mm	665															
SA5	3mm	200									190						
	6mm	400									380						
	12mm	800									760						
SA6	3mm	200									190	160	135				
	6mm	400									380	320	270				
	12mm	800									760	640	540				
SA7	4mm	200												160	120		
	8mm	400												320	240		
	16mm	800												640	480		
SS7	4mm	200												160	120		
	8mm	400												320	240		
	16mm	800												640	480		
SS8	10mm	500												480	380	310	265
	20mm	1000												960	765	625	515

Caution: If the maximum speed limit is exceeded, noise may increase or vibration may occur due to resonance of the ball screw shaft, in which case the service life of the actuator may be significantly reduced.
If multiple actuators are used together, with each actuator operating independently, create programs where each actuator does not exceed the applicable maximum speed (see the table above). If operations of multiple actuators are synchronized, programs should be based on the lowest maximum speed among the combined actuators.
Create appropriate program by checking the maximum speed of each actuator.

10. Load on the Actuator

Do not exceed the load shown in the load specification column. Please make note of the slider moment, allowable overhang length and the load weight.

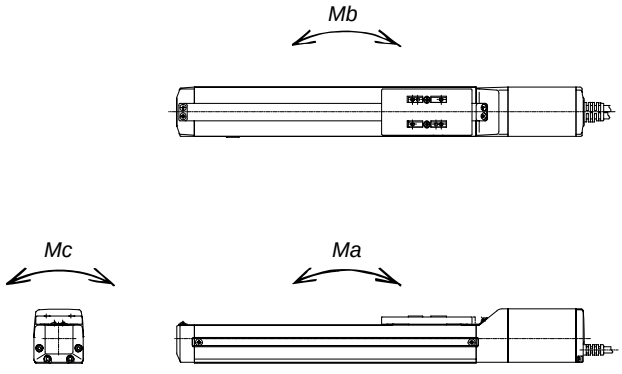
Load moments

Model	Ma	Mb	Mc
SA4	2.7 N·m (0.27 kgf-m)	3.9 N·m (0.4 kgf-m)	6.8 N·m (0.7 kgf-m)
SA5	4.9 N·m (0.5 kgf-m)	6.8 N·m (0.7 kgf-m)	11.7 N·m (1.2 kgf-m)
SA6	8.9 N·m (0.9 kgf-m)	12.7 N·m (1.3 kgf-m)	18.6 N·m (1.9 kgf-m)
SA7	13.9 N·m (1.41 kgf-m)	19.9 N·m (2 kgf-m)	38.3 N·m (3.9 kgf-m)
SS7	14.7 N·m (1.49 kgf-m)	14.7 N·m (1.49 kgf-m)	33.3 N·m (3.39 kgf-m)
SS8	36.3 N·m (3.7 kgf-m)	36.3 N·m (3.7 kgf-m)	77.4 N·m (7.89 kgf-m)

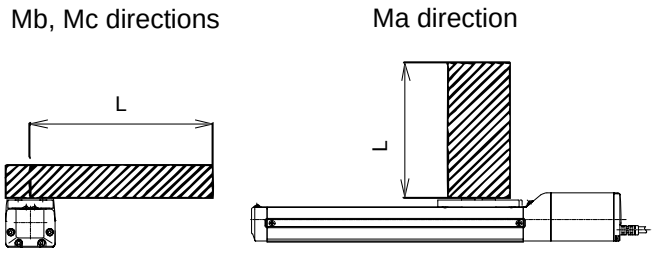
Allowable overhang lengths

Model	Ma direction	Mb direction	Mc direction
SA4	120 mm or less	120 mm or less	120 mm or less
SA5	150 mm or less	150 mm or less	150 mm or less
SA6	220 mm or less	220 mm or less	220 mm or less
SA7	230 mm or less	230 mm or less	230 mm or less
SS7	300 mm or less	300 mm or less	300 mm or less
SS8	450 mm or less	450 mm or less	450 mm or less

- The allowable overhang lengths are based on a configuration where the center of gravity of the load mounted on the actuator corresponds to the center of the overhang length.

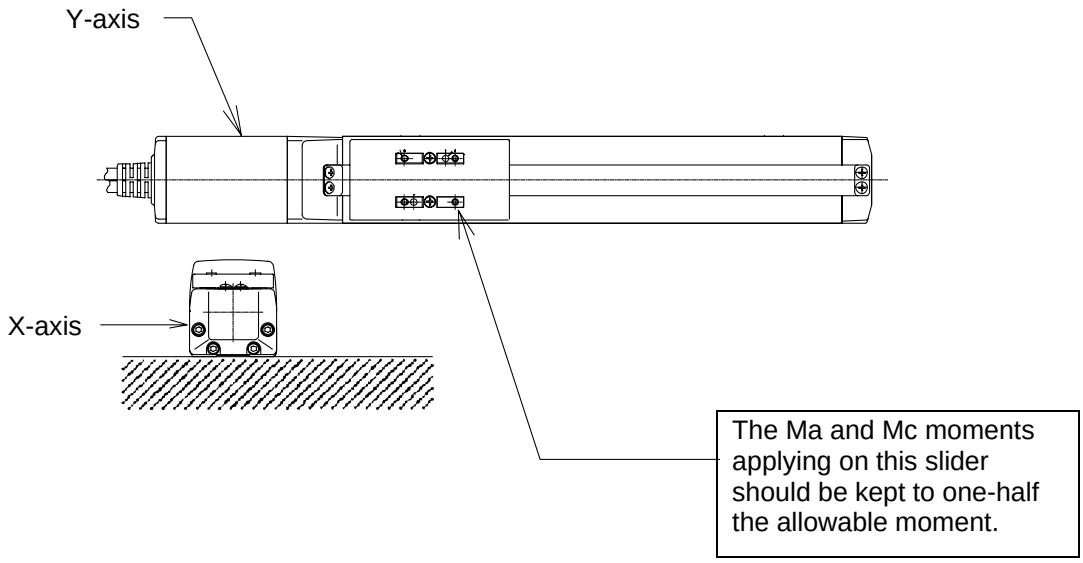


Directions of moment forces



Directions of allowable overhangs

The body of the base warps easily when the actuator is used as the Y-axis in an X-Y overhang setup. In this case, use the actuator so that the Ma and Mc moments are kept to one-half the allowable moment or less (see the figure below).



Caution:	Allowing the slider to receive an excessive load moment will shorten the service life of the guides. If the allowable overhang length is exceeded, vibration may generate or the service life of the guides may be reduced.

11. Notes on Actuators with a Switch (Optional)

On actuators with a switch, the switch is stored inside the actuator body. (The switch can be accessed by removing the side covers.)

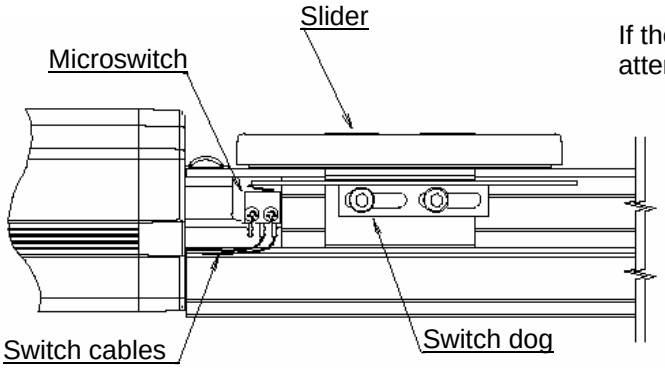
Microswitch and switch dog are adjusted to the optimal positions before shipment.
Do not loosen the mounting screws or bend the switch dog.
If the mounting screws are loosened or switch dog is bent, the optimal positions will be lost and the switch may not demonstrate its intended function.

Do not increase the homing speed beyond the default factory setting.
If the homing speed is increased beyond the default, the switch may be damaged.

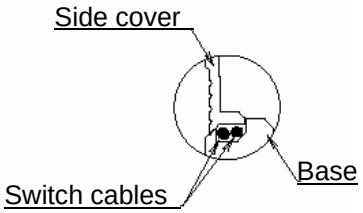
Do not move the slider toward the mechanical end from the home position other than during homing.
If the actuator is moved manually or at high speed by jogging, etc., and the switch dog contacts the microswitch as a result, the switch may be damaged.
When moving the slider manually toward the mechanical end during motor replacement, etc., move the slider slowly.

When changing the home direction after shipment (such as when a need arises to move the factory-set home position to the opposite side due to a specification change, etc.), the microswitch position and switch dog must be readjusted.
Should you require such adjustment, contact the IAI sales office near you.

If the side covers were removed for maintenance, etc., be careful not to pinch the switch cables when reinstalling the covers.
In particular, pay attention when the home is set on the opposite side, because the switch cables are stored in the space between a side cover and the base.

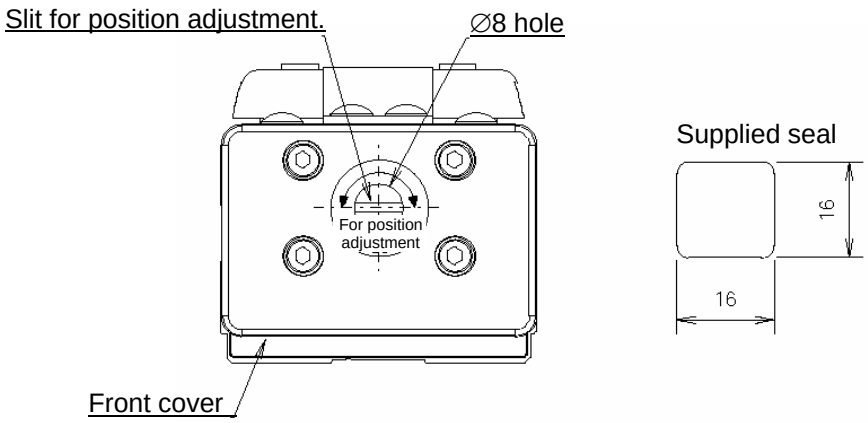


If the home is set on the opposite side, pay attention to the storage of switch cables.



12. Slit for Position Adjustment

A hole is provided in the front cover on the counter-motor side, with a slit machined on the ball screw shaft.
Use this slit if you want to fine-tune the slider position (for direct teaching, etc.).
Insert a screwdriver with an outer diameter of ∅8 mm or less into the slit, and turn the driver.



Caution:	Be sure to operate the slit when the servo is off. Do not insert a finger or object in this hole while the slider is moving, as it is very dangerous. While the slit is not in use, attach the supplied seal or equivalent to cover the hole. If the hole remains exposed, a finger or object may enter accidentally, creating a very dangerous situation. With the cleanroom specification, leaving this hole open may cause dust and other particles inside the actuator to escape through the hole and affect the cleanliness of the operating room.

13. Cleanroom Specification

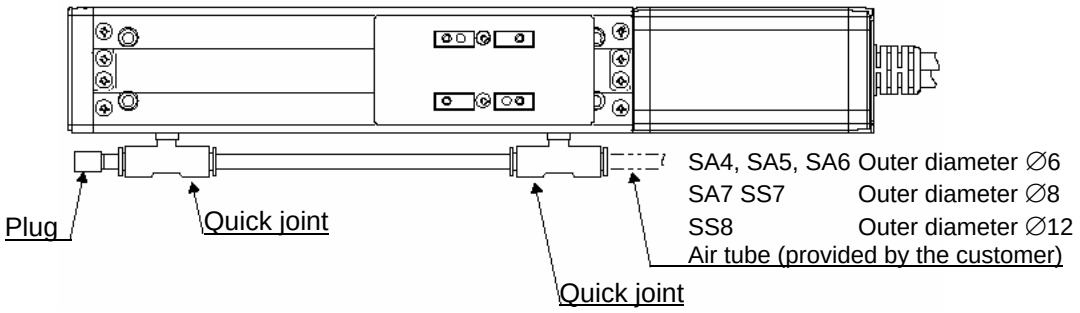
13.1 Suction Rate

Air inside the actuator must be suctioned to ensure that the actuator operates in conformance with the requirements of cleanliness class 10.
Provide an air tube and connect it to a quick joint (outer diameter ∅6) provided at the suction section, and connect the other end of the tube to a vacuum pump, blower, ejector, etc., to suction at an applicable flow rate as specified below.

Lead	Recommended suction rate
2.5 mm/3 mm	15 Nl/min
5 mm/6 mm	30 Nl/min
10 mm/12 mm/16 mm	50 Nl/min
10 mm (SS8)	40 Nl/min
20 mm	80 Nl/min

13.2 Suction Joint

Remove the plug from either quick joint and insert an air tube to suction air from either the motor side or counter-motor side.
Remember to cover the unused joint with a plug.



14. Maintenance

14.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

The schedule is set assuming eight hours of operation a day. When the operation time is long such as 24-hour operation, shorten the maintenance intervals as needed.

	Visual inspection	Check interior	Grease supply
Start of operation	○		
After 1 month of operation	○		
After 6 months of operation	○	○	
After 1 year of operation	○	○	○
Every 6 months thereafter	○		
Every 1 year	○	○	○

14.2 Visual Inspection of the Machine Exterior

Check the following items when carrying out visual inspection.

Body	Loose mounting bolts?
Cables	Damage to cables or connection to connector box?
Stainless sheet	Damage or foreign deposit?
General	Unusual noise or vibrations?

14.3 Cleaning

- Clean the exterior as needed.
- Wipe off dirt with a soft cloth.
- Do not use strong compressed air on the actuator as this may force dust into the crevices.
- Do not use petroleum-based solvent on plastic parts or painted surfaces.
- If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth, and wipe gently.

14.4 Interior Inspection

Turn off the power, remove the side covers, and then visually inspect the interior.
Check the following items during interior inspection.

Body	Loose mounting bolts?
Guides	Lubrication appropriate? Soiling?
Ball screw	Lubrication appropriate? Soiling?

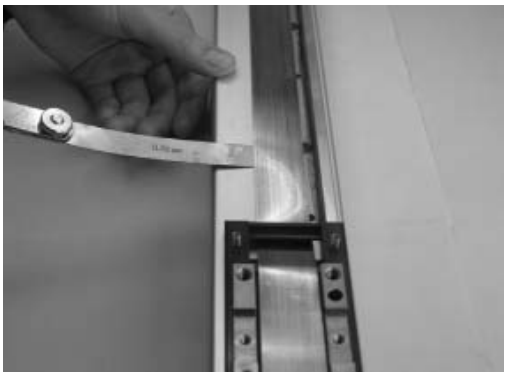
How to inspect the interior:

1) Remove both side covers.
   Use an Allen wrench of 1.5 mm across flats.

Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the traveling surface appears shiny.

2) If the grease becomes dirty and dull or if the grease has worn away due to extended operating time, lubricate the parts after cleaning them.

3) When the inspection/maintenance work is complete, install the side covers.
   Tightening torque: Thin-head screw M3 x 6 – 87.2 N-cm (8.90 kgf-cm)



When installing the side covers, do not let them contact the end faces of the stainless sheet. It may damage or bend the stainless sheet, causing the sheet to deteriorate or wear quickly. To prevent this problem, insert a shim (approx. 0.1 to 0.2 mm) between the sheet and each cover to provide an allowance, and gently push in the cover.

Caution:
- When checking the interior, be careful not to bend or scratch the stainless sheet. Wear protective gloves when handling the stainless sheet, because it has sharp edges that may cause accidental cuts.
  The front cover is supporting the ball screw; so do not disassemble the front cover.
  If the front cover is misaligned, the shaft centers may become offset, thus increasing the traveling resistance, reducing the service life of each part, or generating noise.
- If the actuator is equipped with a microswitch (optional), carefully install the side covers so that the switch cables are not pinched.

14.5 Internal Cleaning

- Wipe off dirt with a soft cloth.
- Do not use strong compressed air on the actuator as this may force dust into the crevices.
- Do not use petroleum-based solvent, neutral detergent or alcohol.

Caution:	Do not use flushing oil, molybdenum grease or anti-rust lubricant. When grease is soiled with large amounts of foreign substances, wipe off the dirty grease and then apply new grease.

14.6 Lubricating the Guides and Ball Screw

14.6.1 Other than Cleanroom Specification

(1) What Grease to Use on the Guides

The following grease is used when we ship the unit.

Idemitsu Kosan	Daphne Eponex Grease No.2

Other companies also sell a grease similar to this. If ordering from another maker, give the name of this product and request something comparable. Comparable products include the following:

Showa Shell Oil	Albania Grease No. 2
Mobil Oil	Mobilux 2

(2) What Grease to Use on the Ball Screw

The following grease is used when we ship the unit.
This grease offers excellent properties such as low heat generation, and is suitable for lubricating ball screws.

Kyodo Yushi	Multemp LRL3

⚠ Warning:	Never use any fluorine-based grease. It will cause a chemical reaction when mixed with a lithium-based grease and may cause damage to the actuator.

14.6.2 Cleanroom Specification

(1) What grease to use on the guide and ball screw

The following grease is used when we ship the unit.
This grease is of low-dust-raising type.

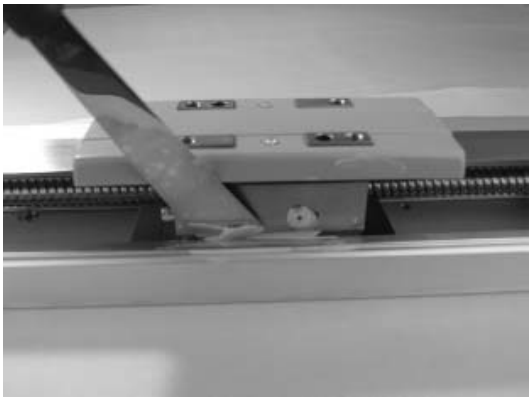
Kuroda Precision Industries	C Grease

Caution: Never use grease for the standard specification. It may allow dust to generate.

⚠ Warning: Never use any fluorine-based grease. It will cause a chemical reaction when mixed with a lithium-based grease and may cause damage to the actuator.

14.6.3 How to Apply Grease

1) When greasing the guide, use a spatula or grease applicator to squeeze or inject grease into the space between the slider and base, and then move the slider back and forth several times to let the grease spread evenly.
   Apply grease on the guides on both sides.
   Remove excess grease.



2) When greasing the ball screw, clean the ball screw, apply grease using a finger, and then move the slider back and forth several times to let the grease spread evenly.
   At this time, be careful not to deform the stainless sheet by accidentally touching the sheet.
   Remove excess grease.

3) Install the side covers.
   Tightening torque: Thin-head screw M3 x 6 – 87.2 N·cm (8.90 kgf-cm)
   Refer to 3) in 14.4, “Interior Inspection,” for notes on installing the side covers.

Caution:	If the actuator is equipped with a microswitch (optional), carefully install the side covers so that the switch cables are not pinched.

14.7 Replacing/Adjusting the Stainless Sheet

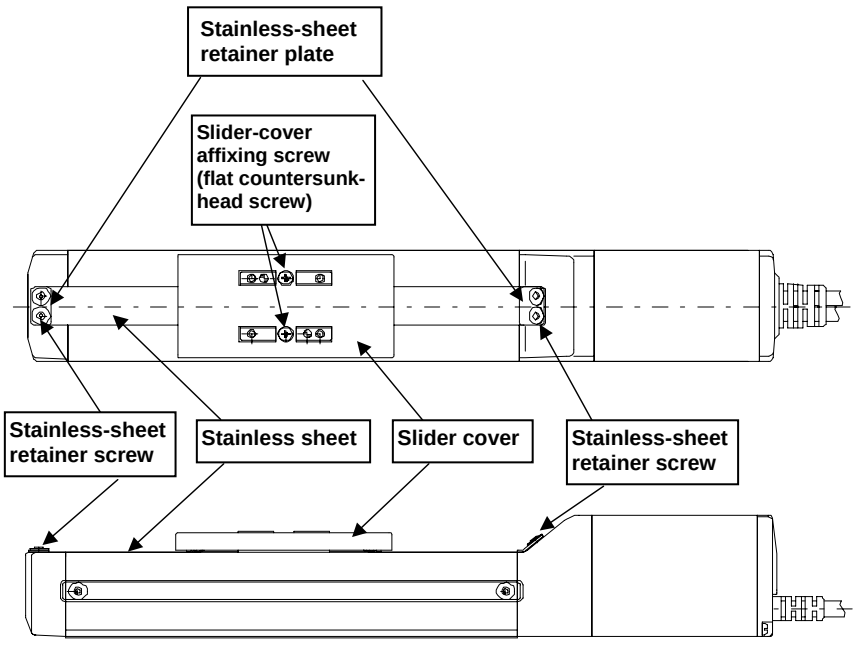
[Items Required for Replacement]

- Replacement stainless sheet
- Clearance-checking tool (a regular slider cover with holes)
  (This tool is available from IAI's Sales Engineering Section. If you are replacing the stainless sheet, please contact us to make a rental arrangement or purchase the tool.)
- Allen wrench set • Phillips screwdriver • Measure

[Note on Stainless Sheet Tension]

Deterioration and wear of the stainless sheet is affected by its tension.
If the stainless sheet is too tight, excessive clearances will be created between the sheet and slider covers and the sheet may undergo a fatigue failure.
If the stainless sheet is too loose, the sheet will contact the back of the slider covers and generate shaving.
Therefore, use a dedicated adjustment tool to properly adjust the tension of the stainless sheet so that the clearances between the stainless sheet and slider covers conform to the specified dimension.

[Name of Each Part]

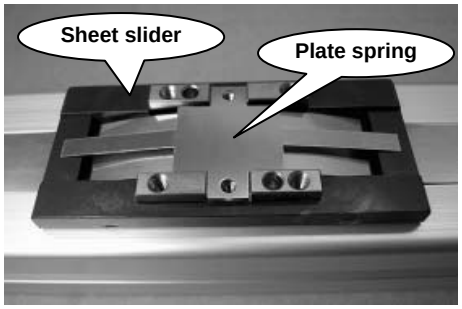


[Procedure]

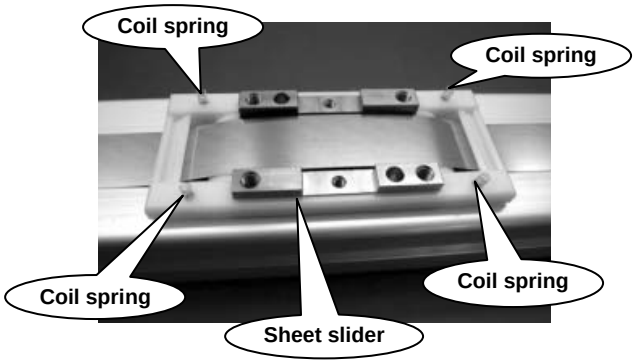
1) Remove the slider-cover affixing screws and remove the covers.
   After the slider covers have been removed

   [1] Standard specification (slider structure)

   - RCS2-SA4/SA5

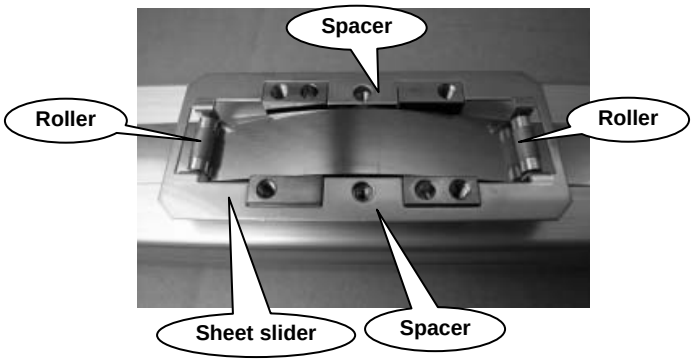


   - RCS2-SA6/SA7/SS7/SS8



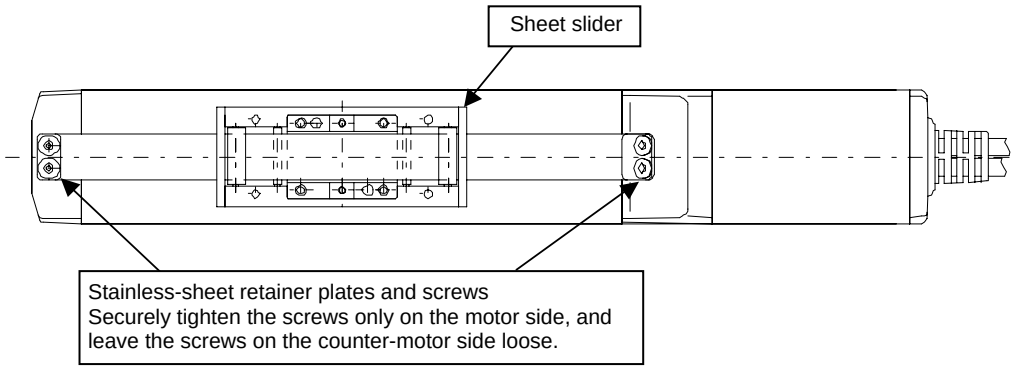
   [2] Cleanroom specification (roller structure)

   - RCS2CR-SA4/SA5/SA6/SA7/SS7/SS8

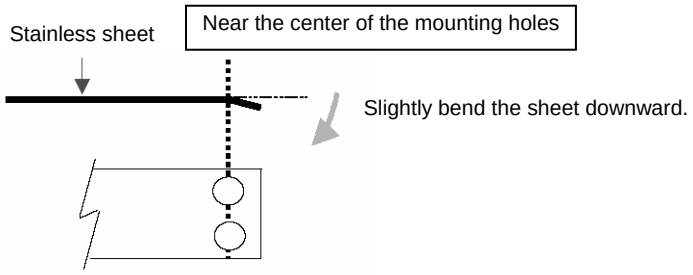


Caution:	Remove the slider covers slowly and gently. If the actuator is installed on the ceiling or oriented vertically or horizontally on side, place a plastic bag, etc., underneath the slider covers so as not to lose the coil springs and spacers in case they drop off.

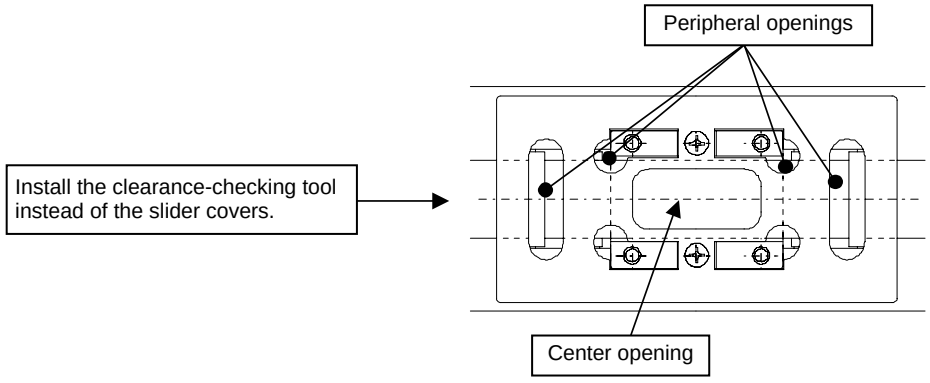
2) Remove the stainless-sheet retainer screws on both sides and pull out the stainless sheet.
3) Guide a new stainless sheet into the slider.
4) Hold the stainless sheet in place, and affix the retainer plates and screws.
   At this time, securely tighten the screws only on the motor side, and leave the screws on the counter-motor side loose.



- How to prevent the stainless sheet from lifting
  Slightly bend the stainless sheet downward near the center of the mounting holes so that the sheet can be held securely.

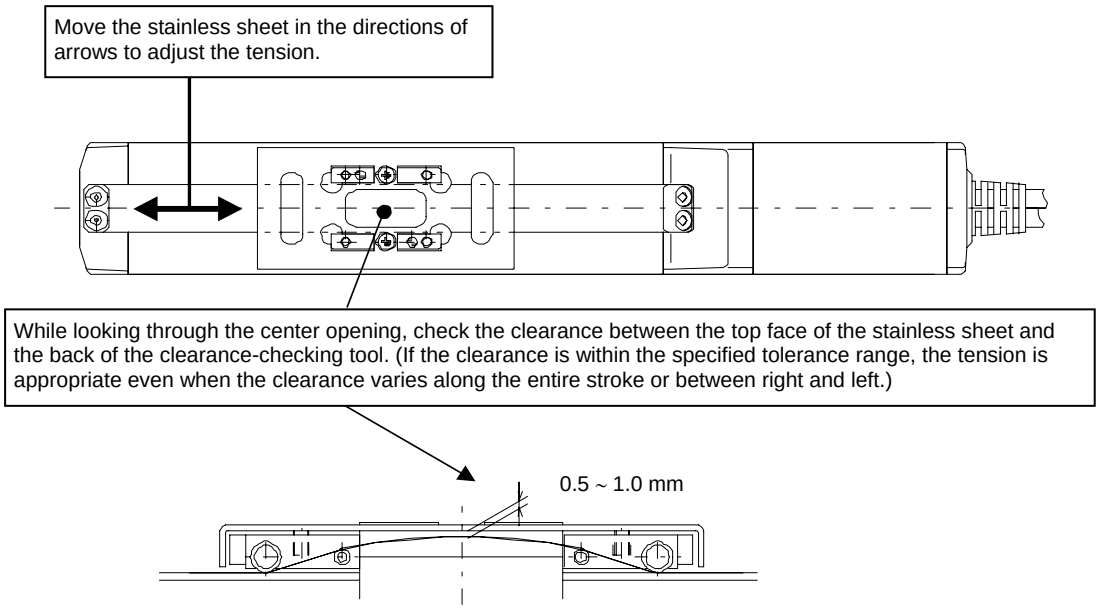


5) Install the clearance-checking tool.



6) Adjust the tension of the stainless sheet.

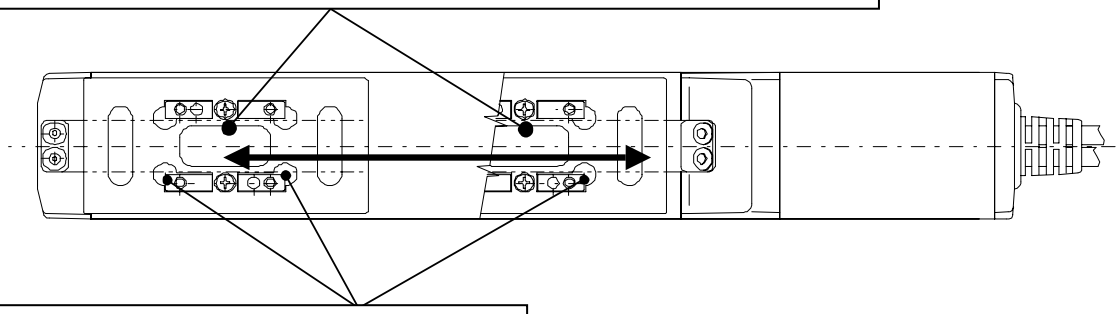
[1] While looking through the center opening in the clearance-checking tool, move the stainless sheet on the loose end in the directions of arrows until the clearance between the top face of the stainless sheet and the back of the clearance-checking tool falls within the specified range.



[2] When the stainless sheet has been properly positioned, tighten the screws on the loose end to a level that the stainless sheet no longer moves.

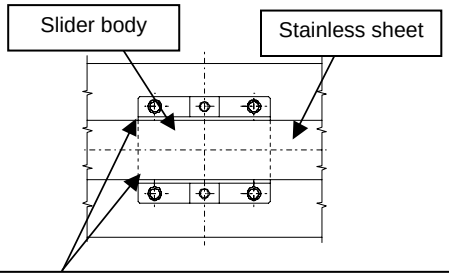
[3] Move the slider and check the tension of the stainless sheet along the entire stroke.

Checkpoint 1:
Check if the clearance between the top face of the stainless sheet and the back of the clearance-checking tool falls within the specified range along the entire stroke.



Checkpoint 2:
Look through the peripheral openings and confirm that the stainless sheet edges do not contact the slider body.
Move the slider back and forth at least three times over the entire stroke to ensure the edges do not contact the slider.
The sheet may move during the slider strokes, but slight movement is acceptable as long as the offset does not increase and the sheet does not contact the slider.
If the stainless sheet contacts the slider, repeat the adjustment from [1].

The stainless sheet is not perfectly straight, but it bends to right and left slightly.
It is impossible to adjust the right and left clearances perfectly uniform.
Slight variation in clearance in the stroke direction or between right and left is acceptable, as long as the stainless sheet edges do not contact the slider body over the entire stroke.

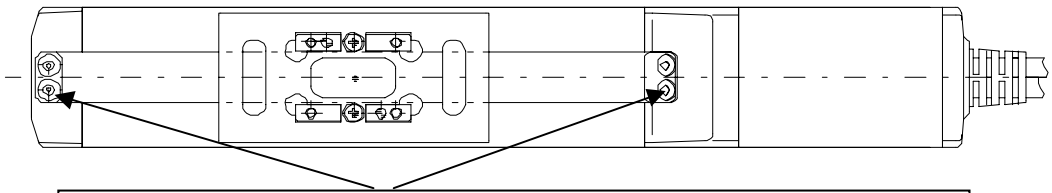


Clearances between stainless sheet edges and slider body

If the conditions in Checkpoints 1 and 2 are not satisfied, loosen the screws and readjust the position and tension of the stainless sheet again from [1].

Note) If the condition in Checkpoint 2 cannot be met after the readjustment, try installing the stainless sheet in the reverse direction or placing it upside down. If the stainless sheet is still not adjusted properly, replace it with a new sheet.

[4] When proper clearances are obtained between the slider body and stainless sheet and an absence of contact between the two is confirmed, tighten the two screws on the loose end alternately, and then finally tighten all screws to a uniform torque to securely affix the stainless sheet. If the screws are not tightened uniformly, the sheet may meander or lift.



Apply additional torque to the screws on both ends until the stainless sheet no longer moves.
Tightening torque: 87.2 N-cm (8.90 kgf-cm) [Reference value]

[5] Remove the clearance-checking tool and install the slider covers.
Note) Again, pay attention not to lose the coil springs and spacers.

14.8 Reduction Belt [Motor Reversing Type]

14.8.1 Inspecting the Belt

Remove the pulley cover and visually inspect the belt.
Durability of the reduction belt is affected significantly by the operating condition, and there is no standard guideline as to when the belt should be replaced.
Generally, the belt is designed to withstand several millions of flexing loads.
As a practical guideline, replace the reduction belt when any of the conditions listed below is observed:

- The teeth and end faces of the belt have worn significantly.
- The belt has swollen due to deposits of oil, etc.
- Cracks and other damages are found on the teeth or back of the belt.
- The belt has broken.

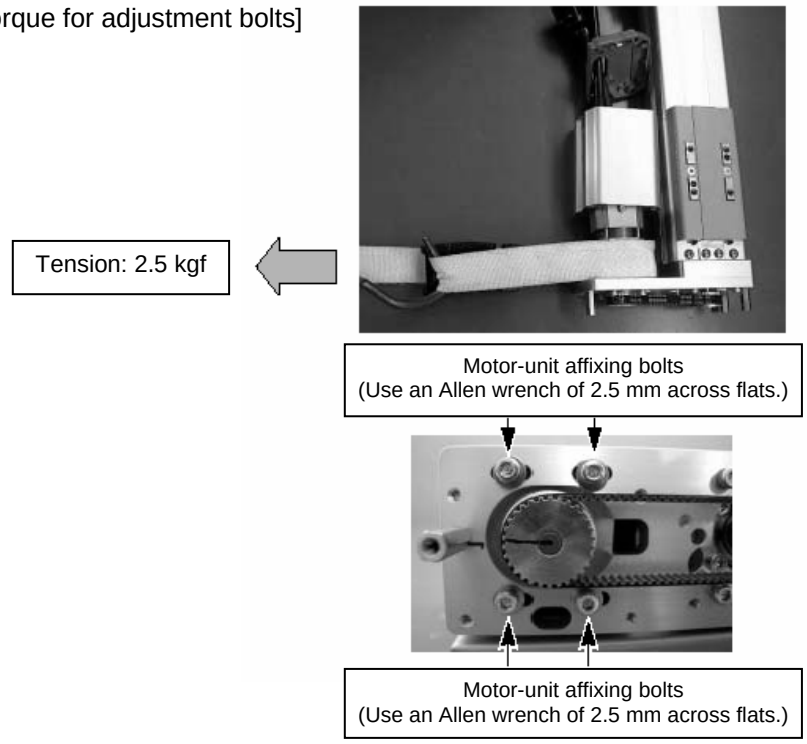
14.8.2 Applicable Belt

- SA4 - 60S2M160R Rubber, cleanroom type (Bando Chemical Industries) 6 mm wide
- SA5 - 60S2M180R Rubber, cleanroom type (Bando Chemical Industries) 6 mm wide
- SA6 - 60S2M190R Rubber, cleanroom type (Bando Chemical Industries) 6 mm wide
- SA7 - 150S3M255U (Bando Chemical Industries) 15 mm wide
- SS7 - S3M222 (Bando Chemical Industries) 6 mm wide
- SS8 - P3M264 (Tsubakimoto Chain) 10 mm wide

14.8.3 Adjusting the Belt Tension (SA4R, SA5R, SA6R)

Remove the pulley cover and motor-end cover, and loosen the four motor affixing bolts.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the motor-unit affixing bolts.

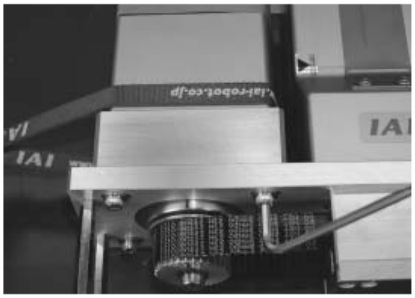
[Recommended tightening torque for adjustment bolts]
162 N-cm (16.5 kgf-cm)



14.8.4 Adjusting the Belt Tension (SA7R)

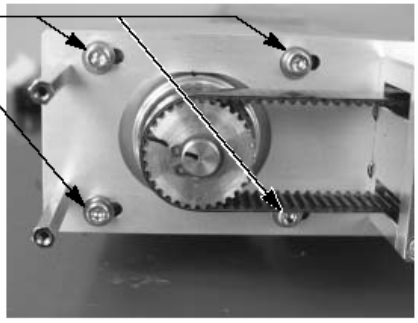
Remove the pulley cover, loosen the four tension adjustment bolts, tension the belt by moving the motor to the left, and tighten the tension adjustment bolts.

[Recommended tightening torque for adjustment bolts]
(M4) 377N-cm (38 kgf-cm)



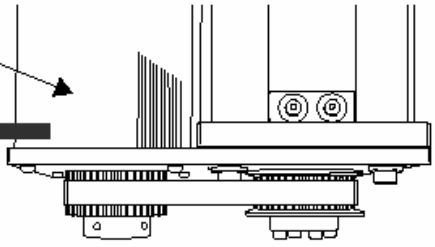
Tension: 8 kgf ± 0.3 kgf

Tension adjustment bolts M4x20 (4 pcs)
Use an Allen wrench of 3 mm across flats.
Tightening torque 377 N-cm (38 kgf-cm)

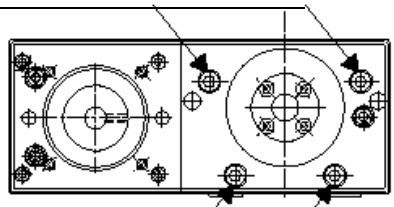


14.8.5 Adjusting the Belt Tension (SS7R, SS8R)

Remove the pulley cover, loosen the four tension adjustment bolts, tension the belt by moving the motor to the left, and tighten the tension adjustment bolts.



Tension adjustment bolts (2 pcs)
SS7R: Use an Allen wrench of 3 mm across flats.
Tightening torque 377 N-cm (38 kgf-cm)
SS8R: Use an Allen wrench of 4 mm across flats.
Tightening torque 763 N-cm (78 kgf-cm)



Tension adjustment bolts (2 pcs)
Use an Allen wrench of 3 mm across flats.
Tightening torque 377 N-cm (38 kgf-cm)

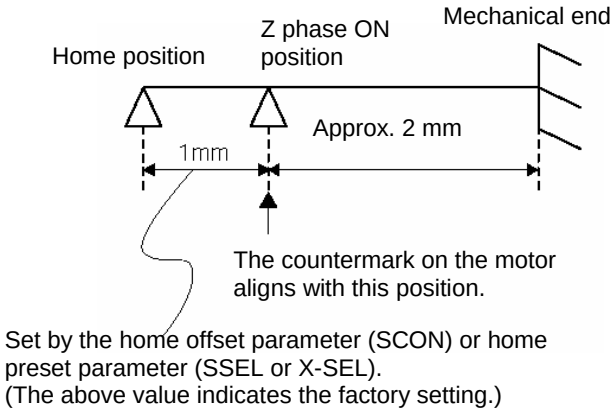
14.8.6 Replacing the Belt of the Motor Reversing Type (SA4R, SA5R, SA6R)

[Items Required for Replacement]

- Replacement belt
- Allen wrenches
- Phillips screwdriver
- Tension gauge (capable of tensioning to 7 kgf or greater)
- Strong string, looped (or long tie-band)
- Scale
- Oil-based marker pen
- PC or teaching pendant

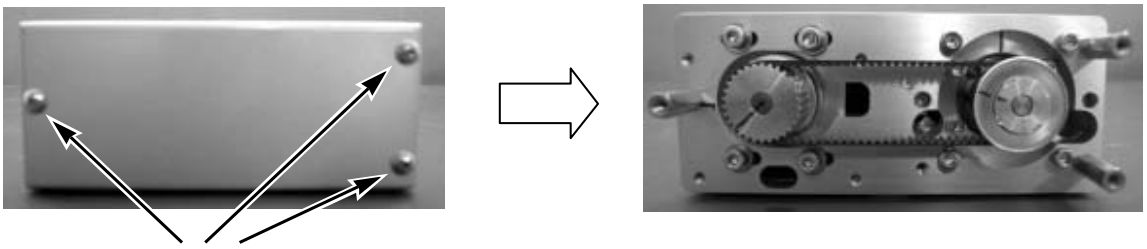
[Overview of Replacement]

1) Move the slider to a position where Z phase turns on (home position) (2 mm from the mechanical end). In this position, loosen the motor-unit affixing bolts and replace the belt.
2) Restore the home position.
   Affix the slider at a position 2 mm from the mechanical end on the home side, pass the belt, and adjust the belt to the specified tension.
3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.



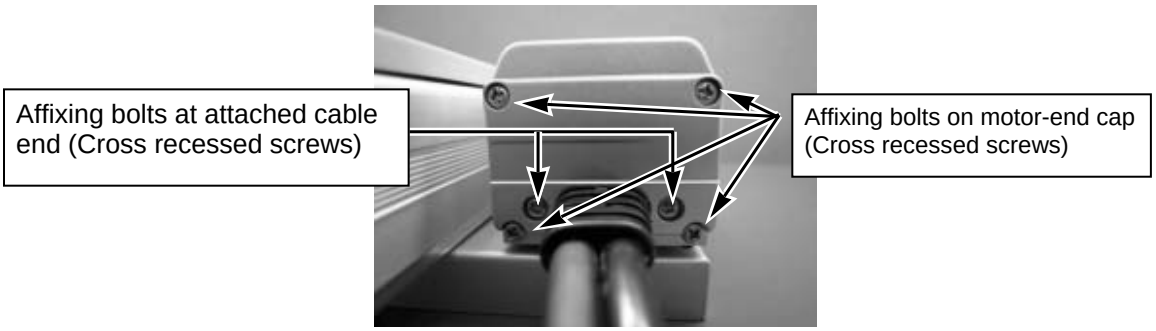
[Procedure]

1) Remove the pulley cover using a Phillips screwdriver.

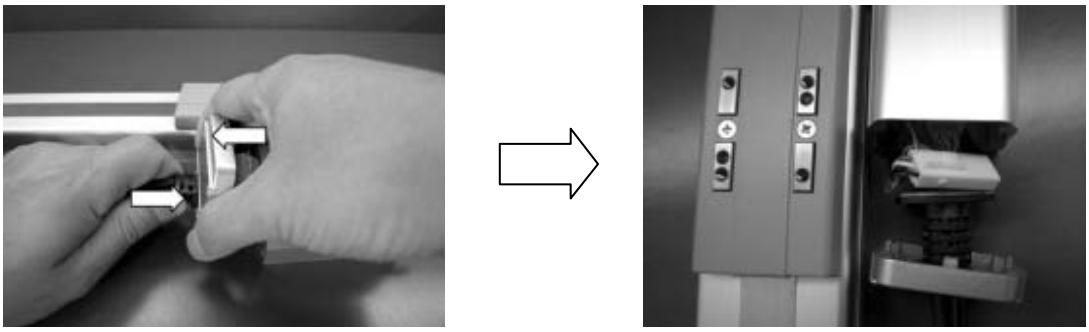


Cross recessed screws: M3

2) Use a Phillips screwdriver to remove the bolts affixing the motor-end cap and attached cables.



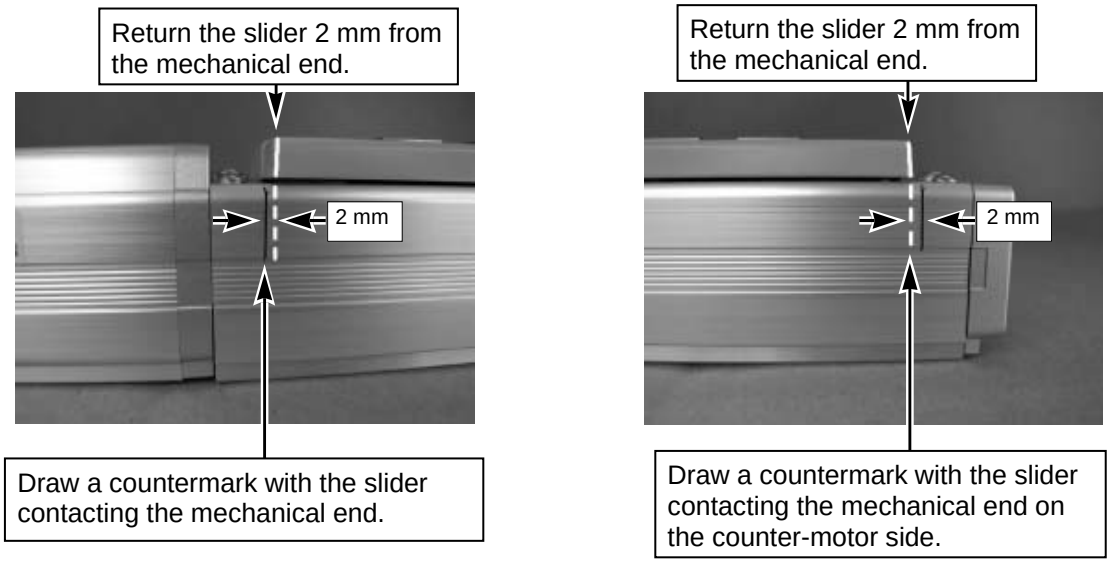
3) Pull out the motor-end cap.



Push in the cable end while pulling out the motor-end cap.

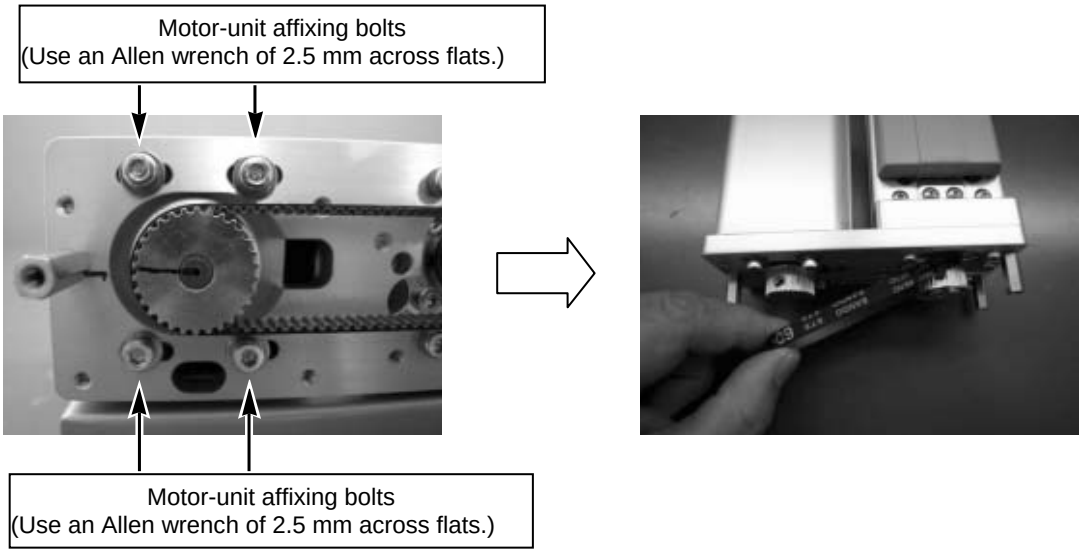
4) Pull out the motor-end cover to expose the motor.

5) Move the slider to a position where Z phase turns on (home position).
On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2 mm from the mechanical end.



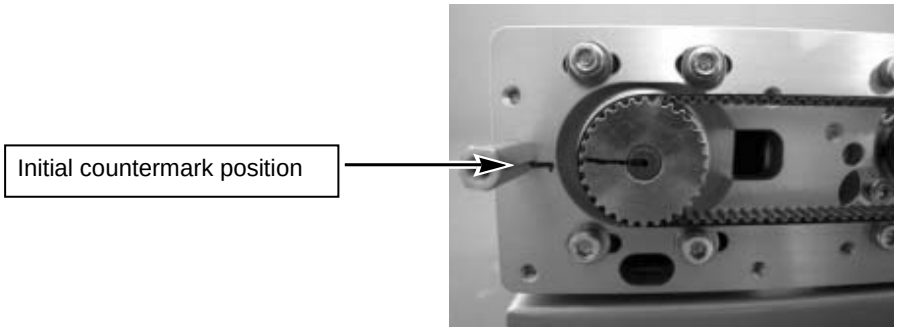
⚠ Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly.
Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers or damage the load.

6) Loosen the motor-unit affixing bolts using an Allen wrench of 2.5 mm across flats. Slide the motor, and loosen and remove the belt.

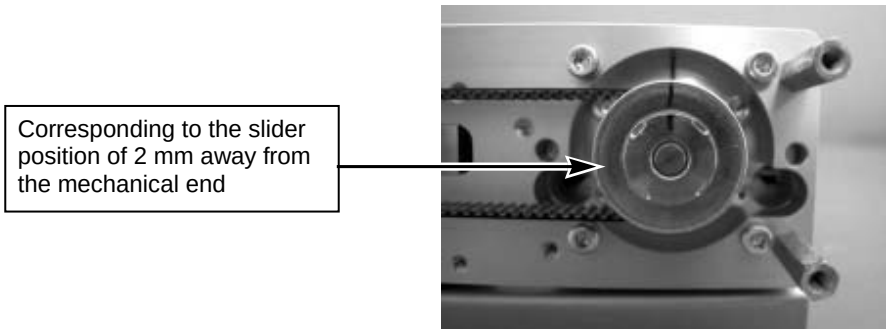


7) Check the following points before restoring the home position:
   - The motor side should be aligned with the initial countermark. If the position is offset, adjust it to achieve proper alignment.
   - The ball-screw side should be in a location corresponding to the slide position of 2 mm away from the mechanical end.

   After the check, attach a new belt while holding the pulleys on both sides in position.



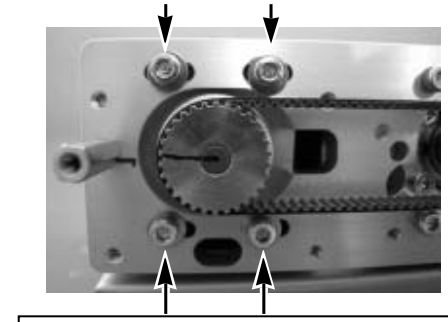
Motor side



Ball-screw side

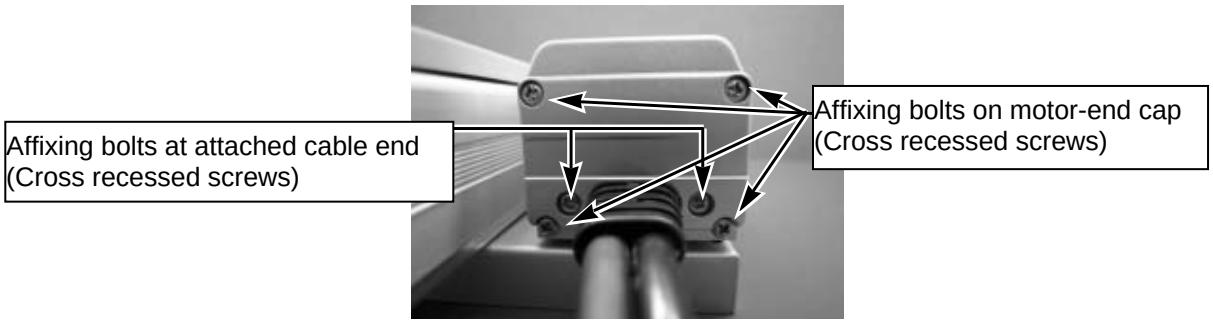
8) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the motor-unit affixing bolts.

[Recommended tightening torque for adjustment bolts]
162 N-cm (16.5 kgf-cm)

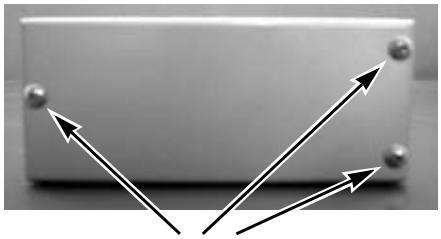


9) Insert the motor-end cover and cap.

10) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



11) Use a Phillips screwdriver to securely tighten the affixing bolts for pulley cover.



Cross recessed screws: M3

12) Connect a PC or teaching pendant to the controller to perform homing. (If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

14.8.7 Replacing the Belt of the Motor Reversing Type (SA7R)

[Items Required for Replacement]

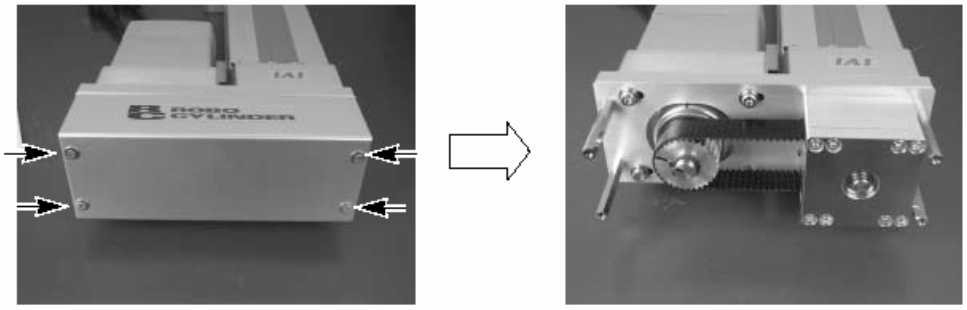
- Replacement belt
- Allen wrenches
- Tension gauge (capable of tensioning to 8 kgf or greater)
- Strong string, looped (or long tie-band)
- PC or teaching pendant

[Overview of Replacement]

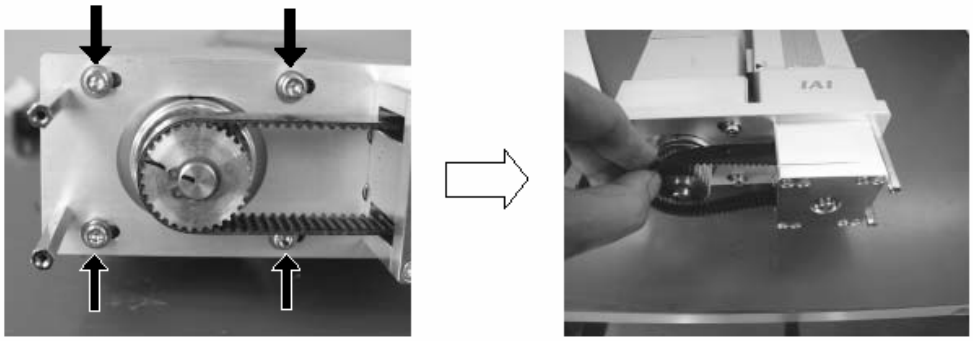
1) Loosen the tension adjustment bolts and replace the belt.
2) Restore the home position.
   Press the slider against the mechanical end on the home side, and move the motor shaft away from the countermark by the specified distance. With the slider and motor shaft affixed in these positions, adjust the belt to the specified tension.
3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.

[Procedure]

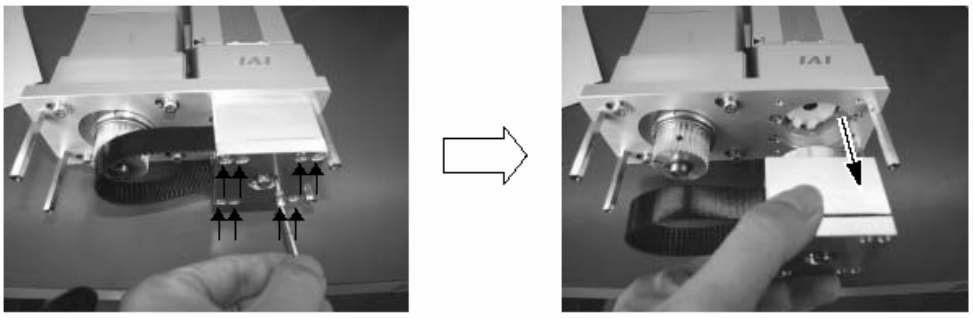
1) Move the slider from the home position toward the mechanical end and check the rotating direction of the motor. (This check is necessary, because the rotating direction of the motor is different on actuators whose home is set on the opposite side.)
   - Remove the pulley cover.
     (Remove the three thin-head mounting screws using an Allen wrench.)



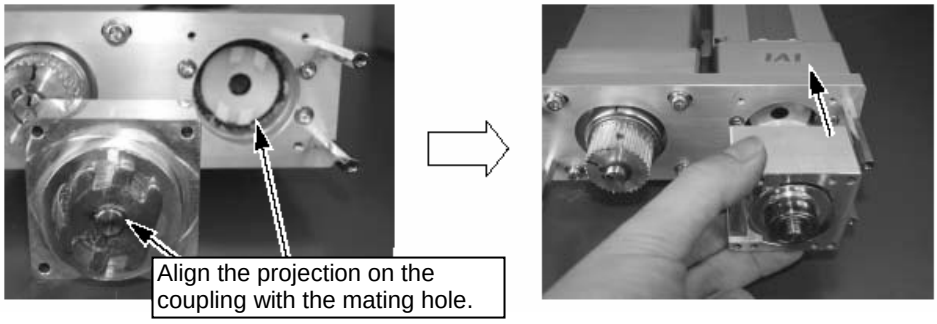
2) Loosen the four tension adjustment bolts and move the motor bracket to slacken the belt.



3) Remove the eight bolts affixing the pulley cap and pulley housing, and remove the belt.



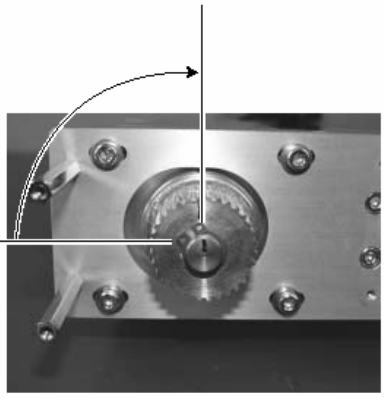
4) Install the pulley housing.
(Install the pulley housing by making sure the angle of the projection on the coupling matches the angle of the mating hole.)



5) Make the adjustment to restore the home position.
- Press the slider against the mechanical end on the home side and affix the slider in this position.
- Turn the motor shaft away from the countermark by the specified distance in the direction of returning to the mechanical end (the direction checked earlier).

Example: When the return angle is 90 degrees →

Initial countermark position



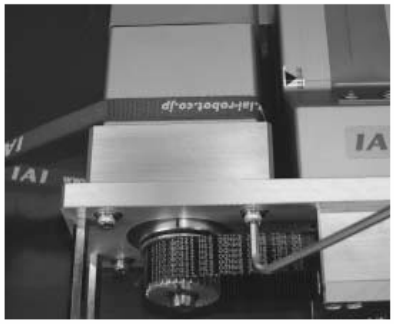
Type	Return angle from countermark position
SA7R-4	180 degrees
SA7R-8	90 degrees
SA7R-16	45 degrees

6) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the adjustment bolts.

[Recommenced tightening torque for adjustment bolts] (M4) 377 N-cm (38 kgf-cm)

Caution: Carefully tighten them to the specified torque by making sure the pulleys on both sides do not move.

Tension: 8 kgf ± 0.3 kgf



7) Install the pulley cover.
Tighten the four thin-head screws (M3x6) using an Allen wrench of 1.5 mm across flats.

8) Perform homing using a PC or teaching pendant.
(If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

14.8.8 Replacing the Belt of the Motor Reversing Type (SS7R, SS8R)

[Items Required for Replacement]

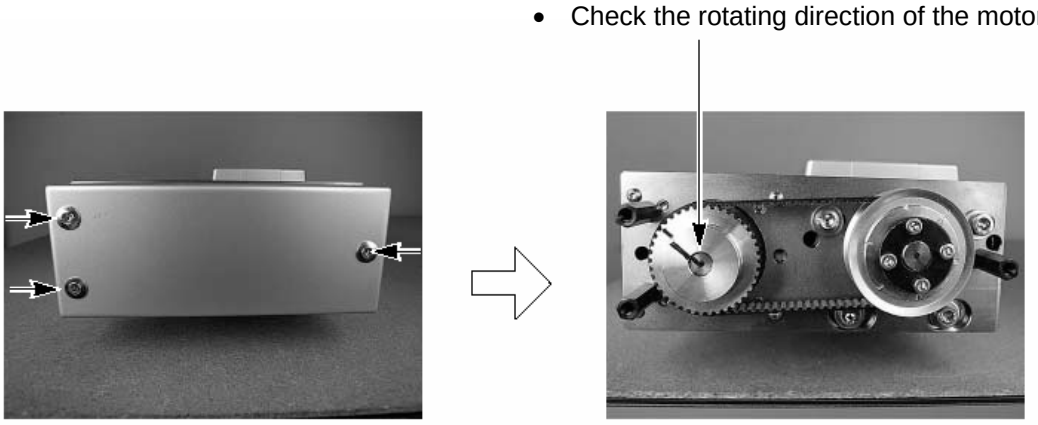
- Replacement belt
- Allen wrenches
- Tension gauge (capable of tensioning to 7 kgf or greater)
- Strong string, looped (or long tie-band)
- PC or teaching pendant

[Overview of Replacement]

1) Loosen the tension adjustment bolts and replace the belt.
2) Restore the home position.
   Press the slider against the mechanical end on the home side, and move the motor shaft away from the countermark by the specified distance. With the slider and motor shaft affixed in these positions, adjust the belt to the specified tension.
3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.

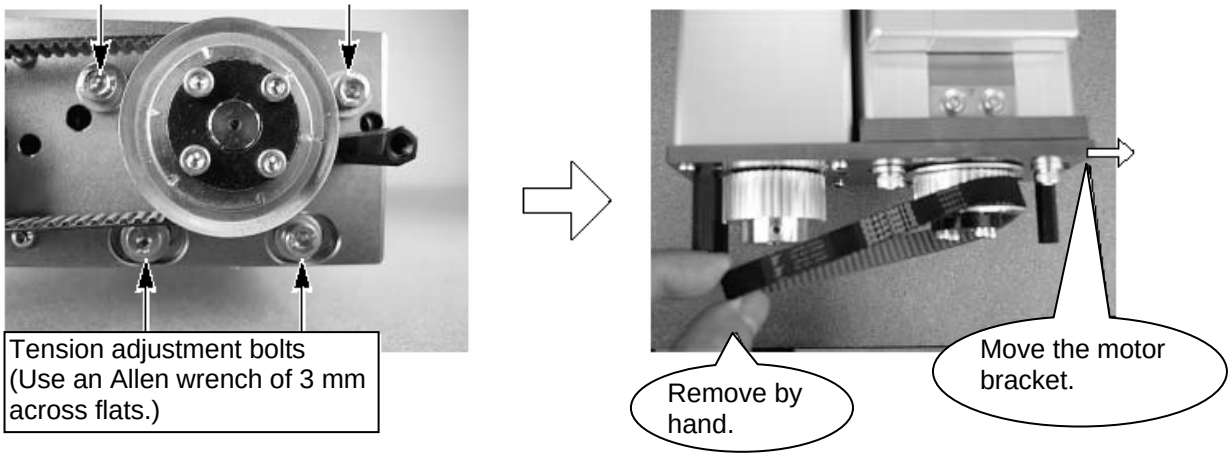
[Procedure]

1) Move the slider from the home position toward the mechanical end and check the rotating direction of the motor. (This check is necessary, because the rotating direction of the motor is different on actuators whose home is set on the opposite side.)
   - Remove the pulley cover.
     (Remove the three thin-head mounting screws using an Allen wrench of 1.5 mm across flats for SS7R and of 2 mm across flats for SS8R.)



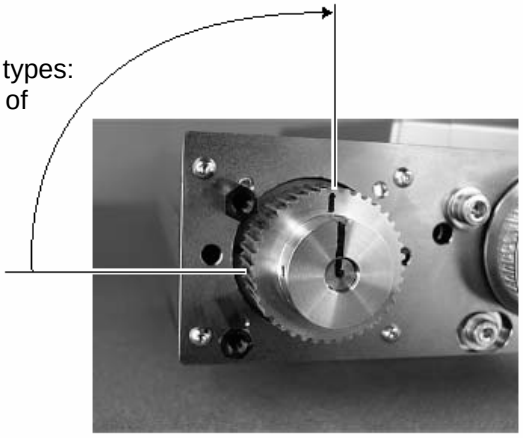
2) Loosen the tension adjustment bolts and move the motor bracket to slacken and remove the belt.

Tension adjustment bolts
(Use an Allen wrench of 3 mm across flats for SS7R and of 4 mm across flats for SS8R.)



3) Make the adjustment to restore the home position.
- Press the slider against the mechanical end on the home side and affix the slider in this position.
- Turn the motor shaft away from the countermark by the specified distance in the direction of returning to the mechanical end (the direction checked earlier).

Example for SS7R-12/SS8R-10 types:
Turn 90 degrees in the direction of returning to the mechanical end (standard home specification).



Type	Return angle from countermark position
SS7R-12 (high speed)	90 degrees
SS7R-6 (medium speed)	180 degrees
SS8R-20 (high speed)	45 degrees
SS8R-10 (medium speed)	90 degrees

- Pass the new belt by making sure the pulleys on both sides do not move.

4) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the adjustment bolts.
Recommenced tightening torque for adjustment bolts
SS7R: 2 upper bolts (M4) 377 N-cm (38 kgf-cm) SS8R: 2 upper bolts (M5) 763 N-cm (78 kgf-cm)
2 lower bolts (M4) 377 N-cm (38 kgf-cm) 2 lower bolts (M4) 377 N-cm (38 kgf-cm)

Caution: Carefully tighten them to the specified torque by making sure the pulleys on both sides do not move.

Tension: SS7R: 6.7 kgf
SS8R: 6.9 kgf

5) Install the pulley cover.
With SS7R, tighten the three thin-head screws (M3x6) using an Allen wrench of 1.5 mm across flats.
With SS8R, tighten the three thin-head screws (M4x6) using an Allen wrench of 2 mm across flats.

6) Perform homing using a PC or teaching pendant.
(If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

14.9 Replacing the Motor

14.9.1 Replacing the Motor of the Motor Straight Type (Coupling Type): SA4C, SA5C, SA6C

[Items Required for Replacement]

- Replacement motor
- Allen wrenches
- Scale
- Grease
- Coupling (with screws)
- Phillips screwdriver
- Oil-based marker pen

Other than cleanroom specification

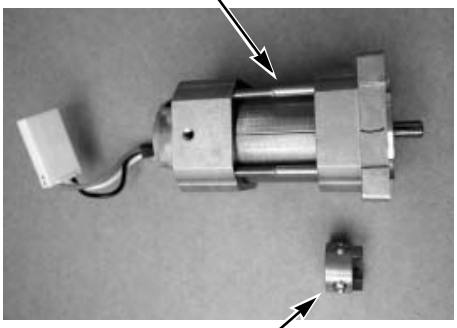
Idemitsu Kosan	Daphne Eponex Grease No.2

Cleanroom specification

Kuroda Precision Industries	C Grease

- PC or teaching pendant

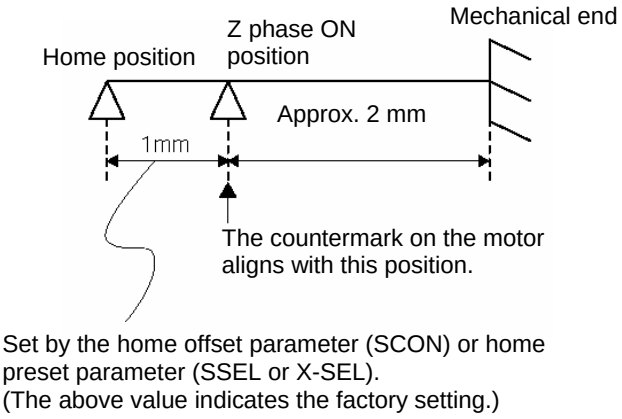
Example: Replacement motor (IAI encoder)



Caution:	When replacing the motor, handle the replacement motor with due care. The actuator has been shipped with the encode adjusted to an optimal position, so do not crush the encoder unit. It may displace the encoder, thus impairing proper actuator operation.

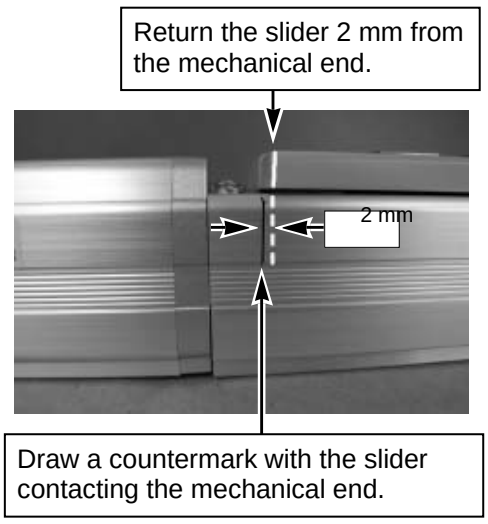
[Overview of Replacement]

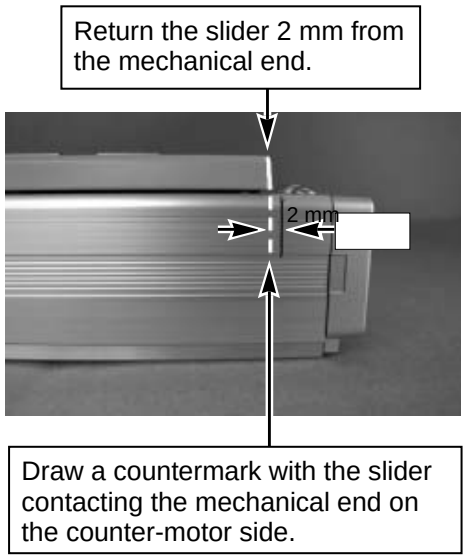
1) Move the slider to a position where Z phase turns on (home position) (2 mm from the mechanical end). Replace the motor in this position.
2) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.



[Procedure]

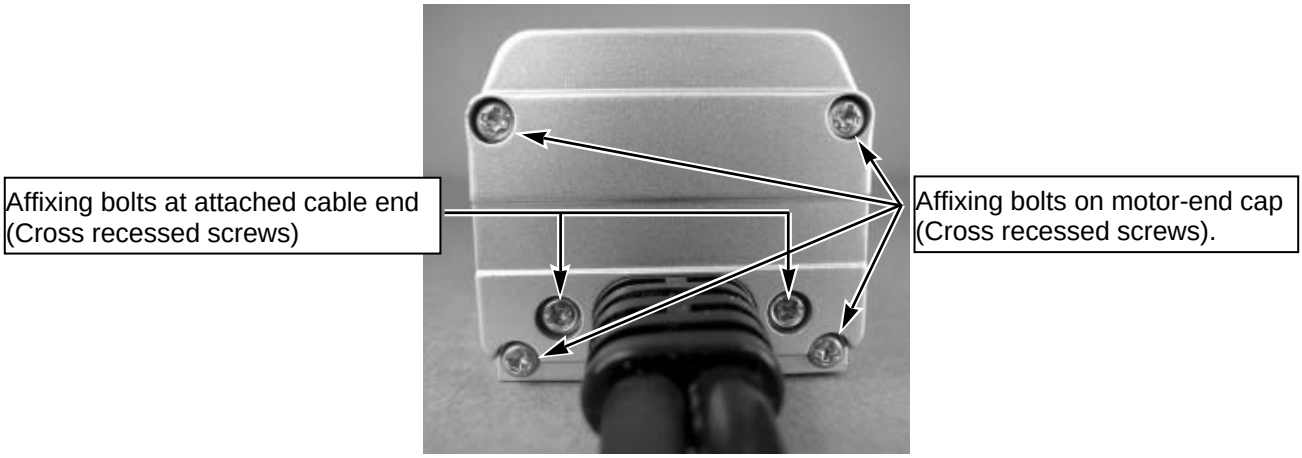
1) Move the slider to a position where Z phase turns on (home position).
   On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2 mm from the mechanical end.



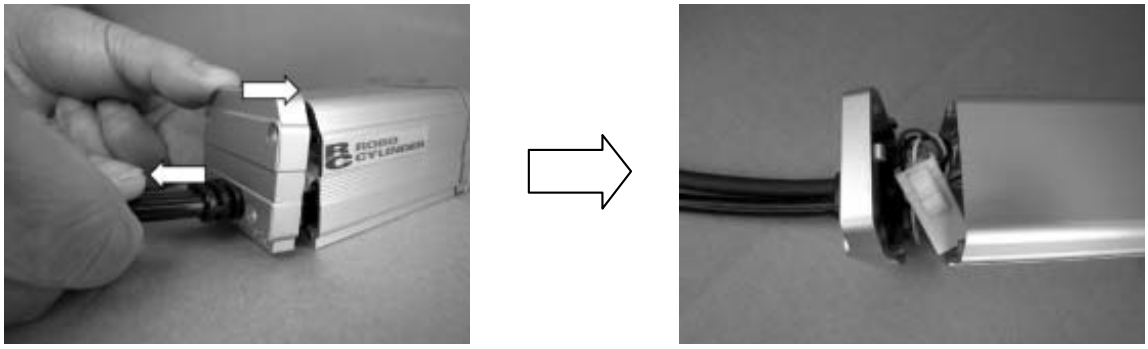


> ⚠ Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly.
> Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers or damage the load.

2) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.

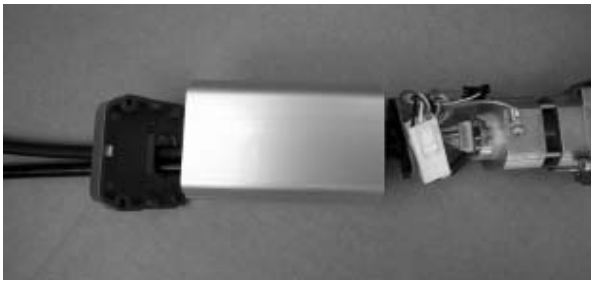


3) Pull out the motor-end cap.

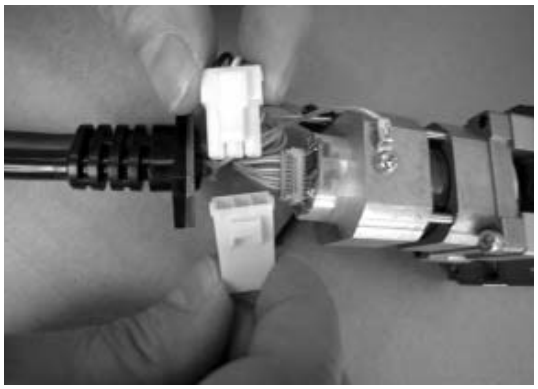


Push in the cable end while pulling out the motor-end cap.

4) Pull out the motor-end cover to expose the motor.



5) Detach the attached cables.
   - Pull out the motor connector.



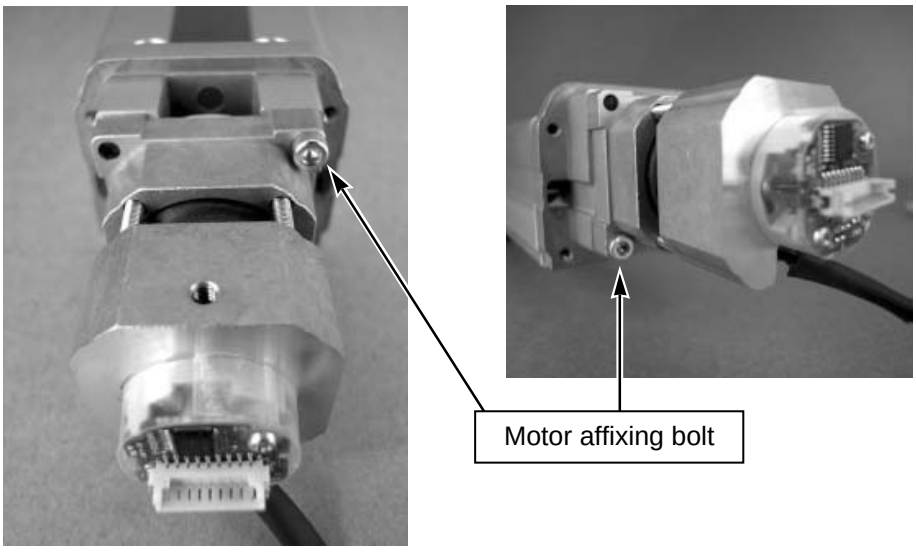
   - If the actuator has a brake, also detach the brake connector.

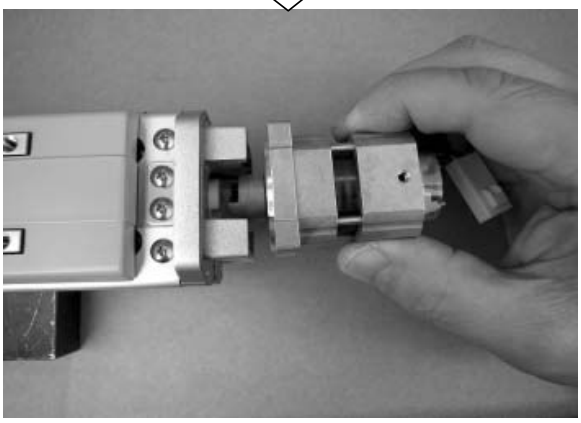
   - Remove the grounding wire using a Phillips screwdriver.

   - While holding the motor with one hand, pull out the encoder cable.
     (The photograph bellow shows the motor (IAI encoder).)

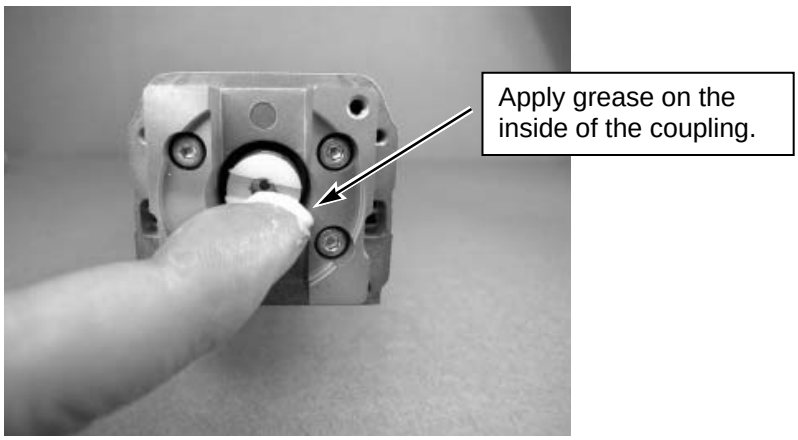
6) Detach the attached cables.

7) Take out the motor.
   - Remove the two motor affixing bolts using an Allen wrench of 2.5 mm across flats.

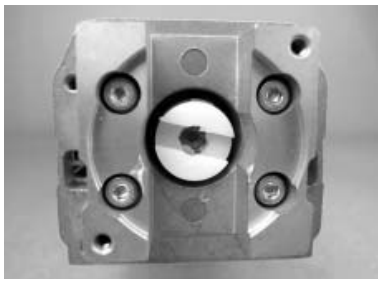




8) Apply grease on the actuator coupling.



9) Insert the replacement coupling (with screws) by aligning it with the current orientation of the actuator coupling.

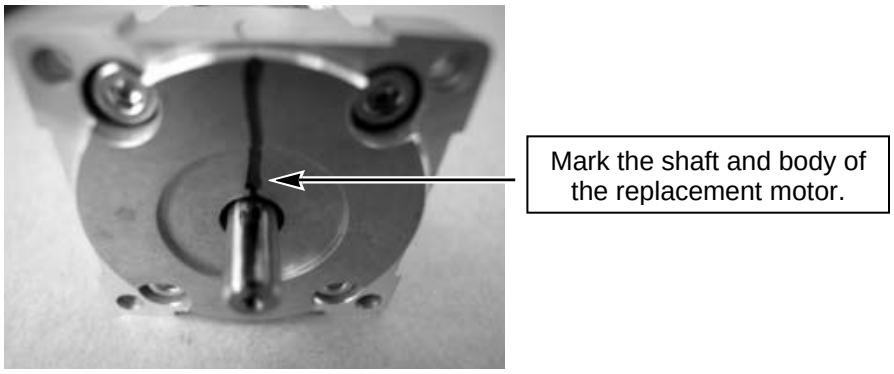


Coupling on actuator side

Inserting the coupling (with screws)

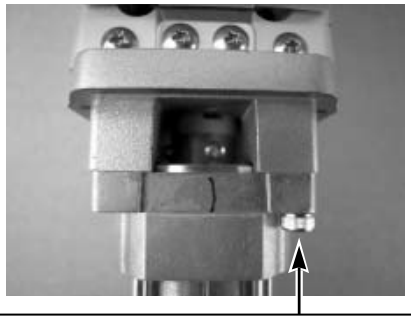
Inserted coupling (with screws)

10) Mark the shaft and body of the replacement motor to prevent the motor shaft position from deviating.



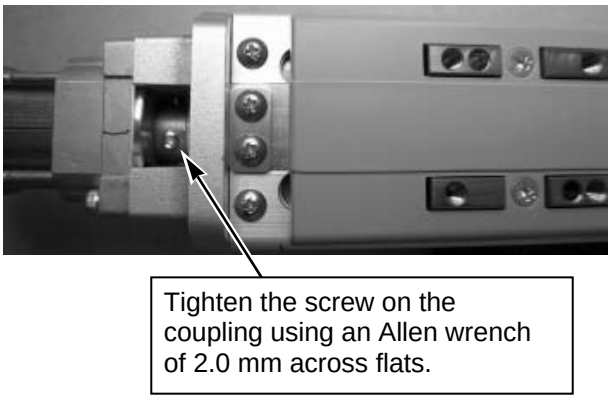
11) Insert the replacement motor into the actuator coupling, and secure with two motor affixing bolts.

Insert the replacement motor.

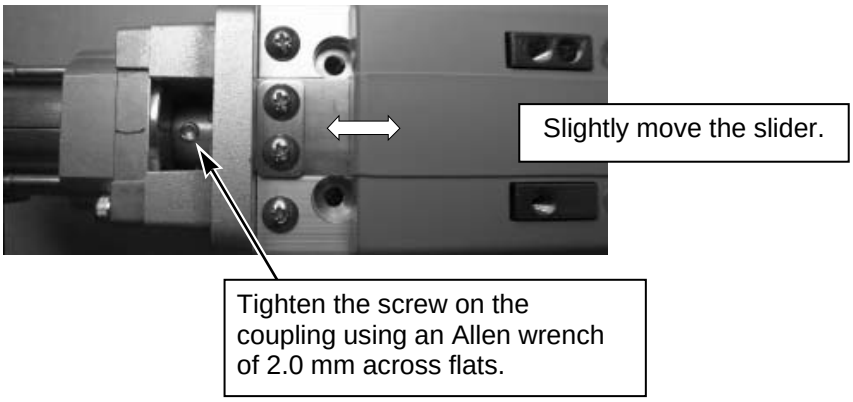


Tighten two bolts at top and bottom using an Allen wrench of 2.5 mm across flats.

12) Tighten the screw on the coupling.



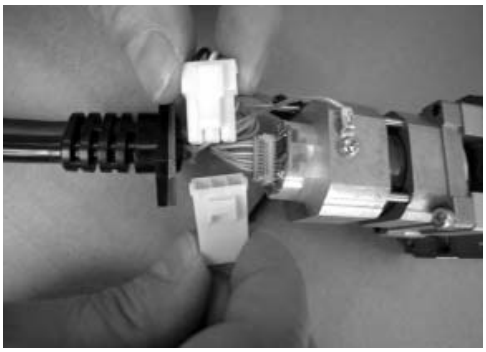
13) Slightly move the slider to expose the second screw on the coupling, and tighten the screw in the same manner.



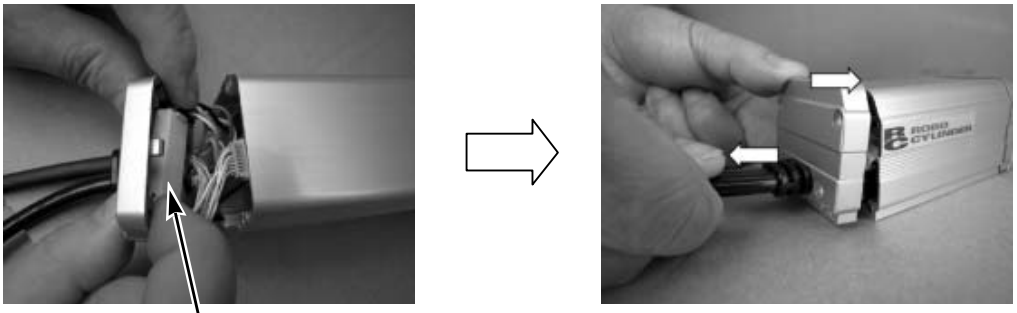
14) Install the attached cables.
- While holding the motor with one hand, insert the encoder cable. (The photograph bellow shows the motor (IAI encoder).)

- Install a grounding wire using a Phillips driver.

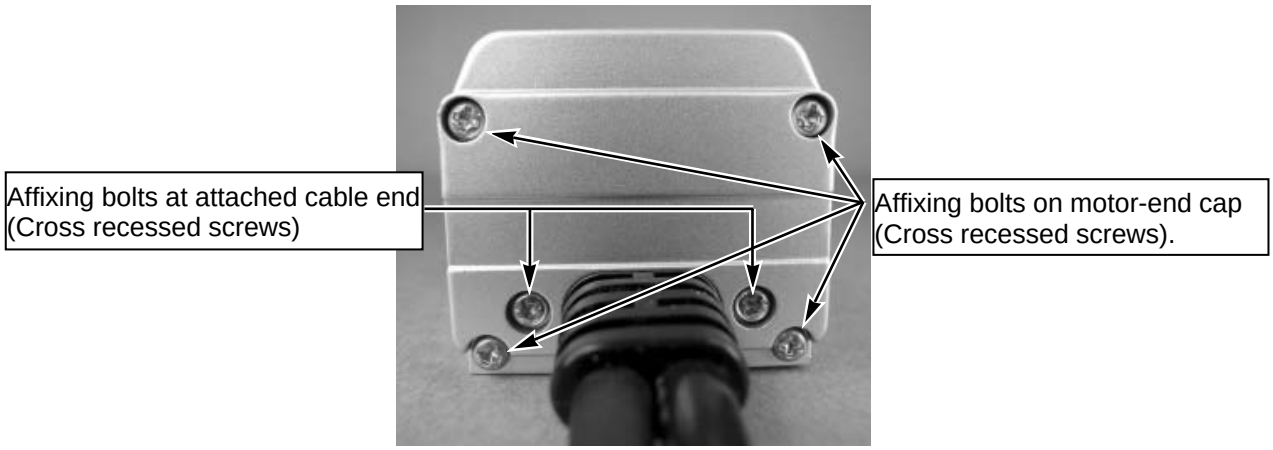
- Plug the cables into the motor.



15) Insert the motor-end cover and cap.
Store the connector inside the motor-end cap.



16) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



17) Connect a PC or teaching pendant to the controller to perform homing. (If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

14.9.2 Replacing the Motor of the Motor Straight Type (Coupling Type): SS7C, SS8C

● SS7C Type

[Items Required for Replacement]

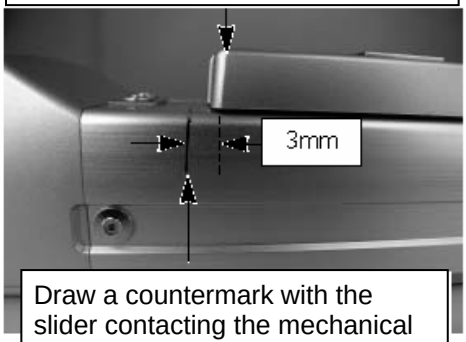
- Replacement motor unit (with a coupling preinstalled on the motor shaft; see the photograph on the right)
  Note: Never remove the coupling.
- Allen wrenches • Scale • Oil-based marker pen

[Procedure]

1) Move the slider to a position where Z phase turns on (reference home position).
   On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 3 mm from the mechanical end.

[Standard specification]

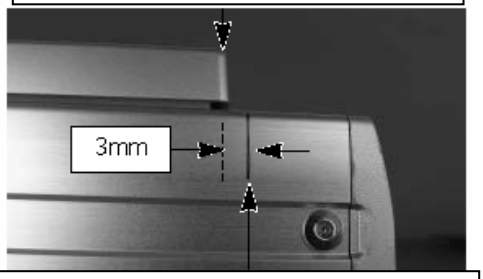
Return the slider 3 mm from the mechanical end.



Draw a countermark with the slider contacting the mechanical end.

[Specification with home set on opposite side]

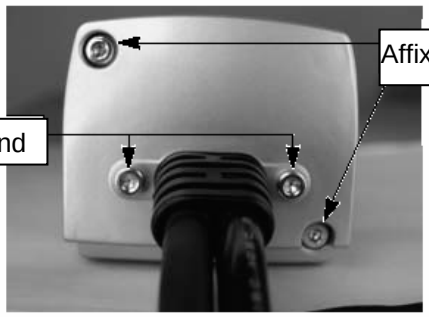
Return the slider 3 mm from the mechanical end.



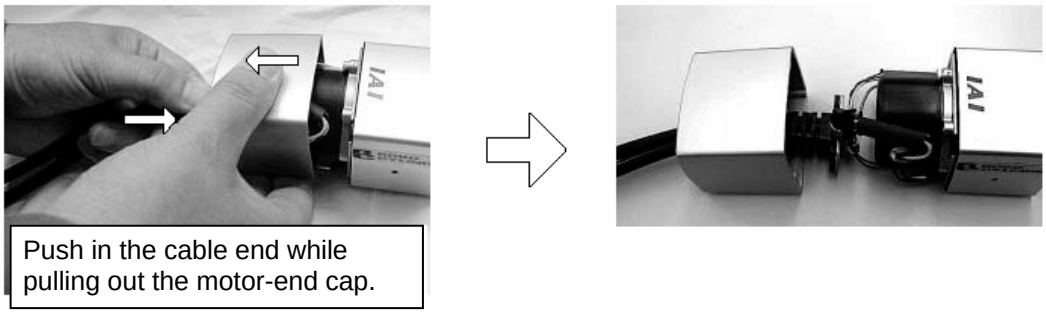
Draw a countermark with the slider contacting the mechanical end on the counter-motor side.

⚠ Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly.
Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers or damage the load.

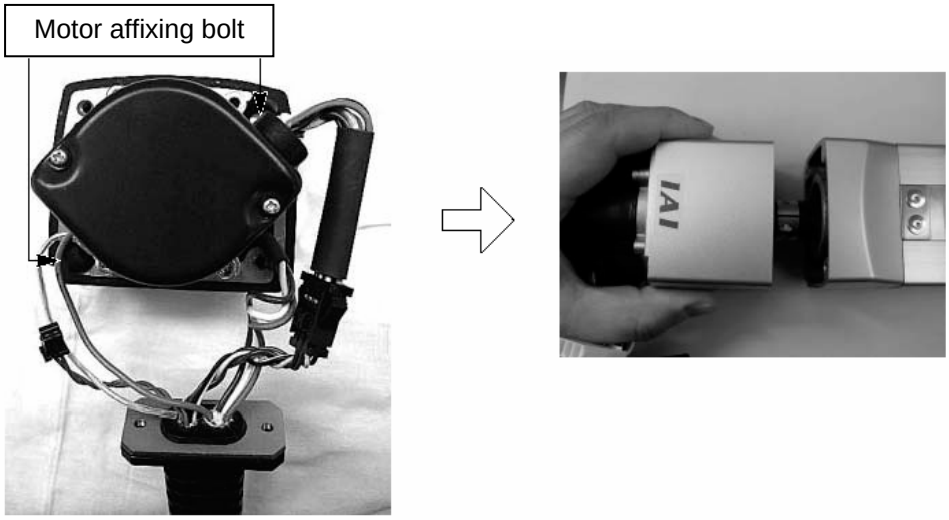
2) Using an Allen wrench of 2.5 mm across flats, remove the bolts affixing the motor-end cap and attached cables.



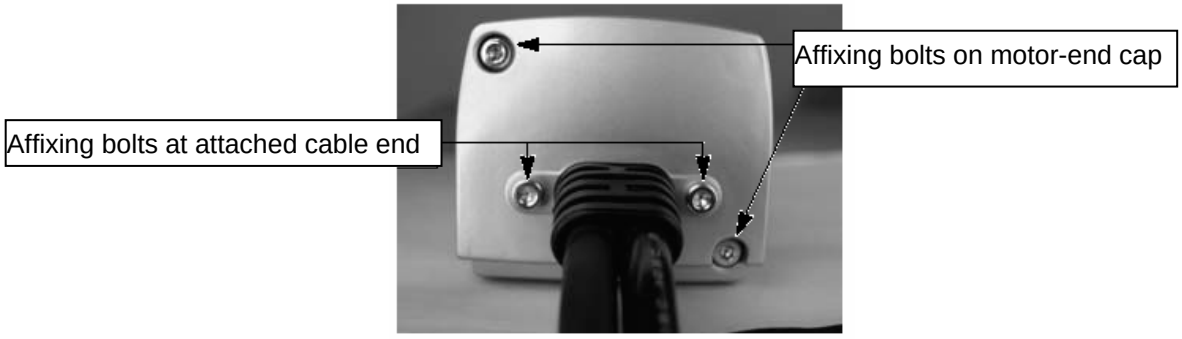
3) Pull out the motor-end cap.



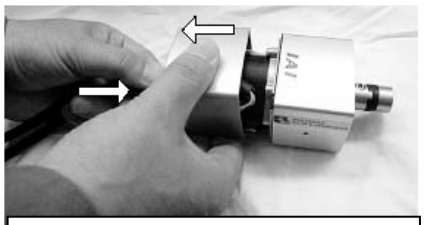
4) Remove the motor.
Remove the two motor affixing bolts using an Allen wrench of 3 mm across flats.



5) Using an Allen wrench of 2.5 mm across flats, remove the bolts affixing the end cap and attached cables on the replacement motor unit.

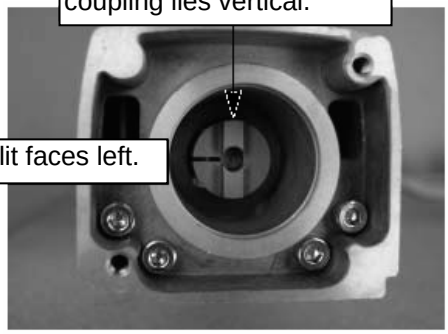


6) Pull out the motor-end cap.

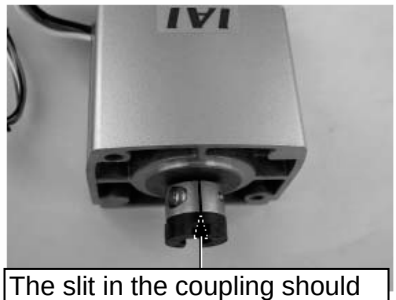


Push in the cable end while pulling out the motor-end cap.

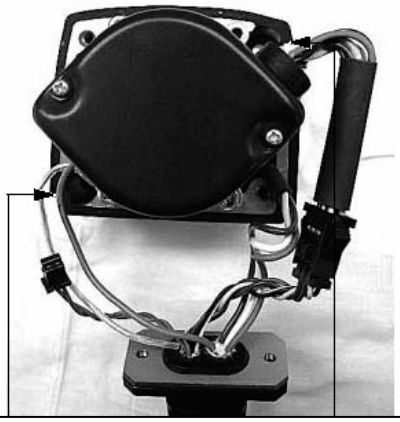
7) Align the coupling position on the actuator side.
Fine-adjust the coupling position until the projection on the coupling lies vertical, with the slit facing left.



8) Position the new motor so that the slit in the coupling points to the 12 o'clock position, and install the motor in this condition by engaging its coupling with the coupling on the actuator side.

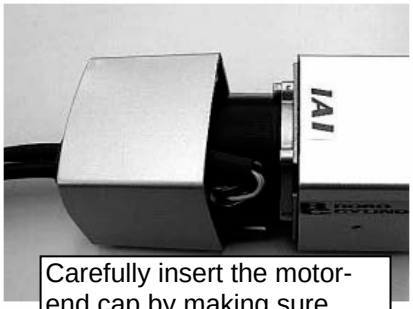


The slit in the coupling should point to the 12 o'clock position.

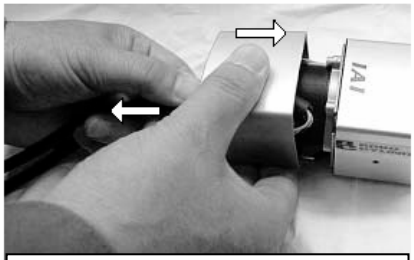


Using an Allen wrench of 3 mm across flats, uniformly tighten the two hexagon socket-head bolts (M4x25) affixing the motor to secure the motor.
Tightening torque: 176 N-cm (18.0 kgf-cm)

9) Install the motor-end cap.
   - Carefully push in the motor-end cap by making sure the cables are not pinched.



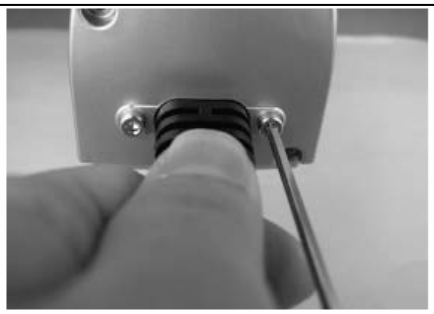
Carefully insert the motor-end cap by making sure cables are not pinched



Pull out the cable end while pushing in the motor-end cap.

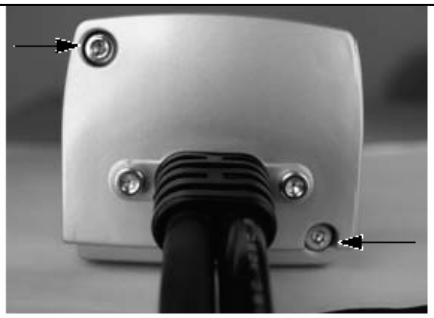
- Tighten the bolts while securely holding the cable end by hand.

Uniformly tighten the two hexagon socket-head bolts (M3x8) using an Allen wrench of 2.5 mm across flats.



- Affix the motor-end cap.

Uniformly tighten the two hexagon socket-head bolts (M3x50) using an Allen wrench of 2.5 mm across flats.
Tightening torque: 83 N-cm (8.47 kgf-cm)



10) Correct the position deviation.

[Incremental encoder]

[1] Check the home position.
Turn on the controller power.
Use the PC software or teaching pendant to perform homing to check the home position. Repeat homing several times to confirm that the actuator returns to the same position every time.

[2] Check the amount of position deviation.
The home position may have shifted slightly after the motor replacement.
To check the amount of position deviation, select a desired position number appropriate for checking the deviation after the motor replacement, perform positioning to the selected position, and measure the amount of deviation.

[3] Correct the deviation.
If there is a deviation from the initial home position, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."

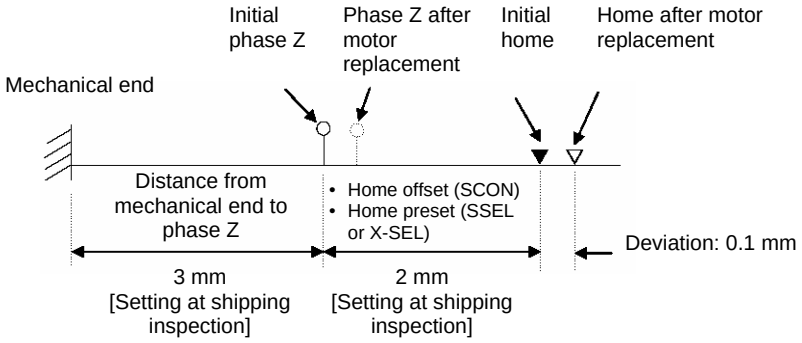
[Absolute encoder]

[1] Check the home position.
Turn on the controller power.
When the controller is turned on for the first time after the motor has been replaced, a battery voltage low alarm should generate. Reset this alarm.
Next, use the PC software or teaching pendant to perform homing, and then perform an absolutes reset.
Thereafter, repeat homing several times to confirm that the actuator returns to the same position every time.

[2] Check the amount of position deviation.
The home position may have shifted slightly after the motor replacement.
To check the amount of position deviation, select a desired position number appropriate for checking the deviation after the motor replacement, perform positioning to the selected position, and measure the amount of deviation.

[3] Correct the deviation.
If there is a deviation from the initial home position, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
After either parameter has been changed, perform homing and then carry out an absolute reset.

[Correction example of home offset (SCON) and home preset (SSEL or X-SEL)]



If, after the motor replacement, the home position became deviated by 0.1 mm in the direction of moving away from the mechanical end, decrease the value in Parameter No. 22, "Home offset" by 0.1 mm, in the case of a SCON controller, to adjust the home back to the initial home position. With a SSEL controller or X-SEL controller, decrease the value in Axis-specific Parameter No. 12, "Home preset" by 0.1 mm. (In either case, the parameter value is changed from 2 mm to 1.9 mm.)

● SS8C Type

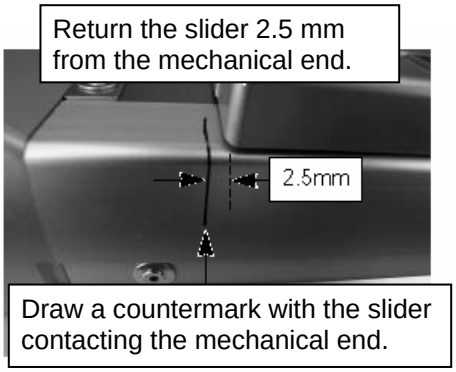
[Items Required for Replacement]

- Replacement motor (with a coupling preinstalled on the motor shaft; see the photograph on the right)
  Note: Never remove the coupling.
- Allen wrenches • Scale • Oil-based marker pen

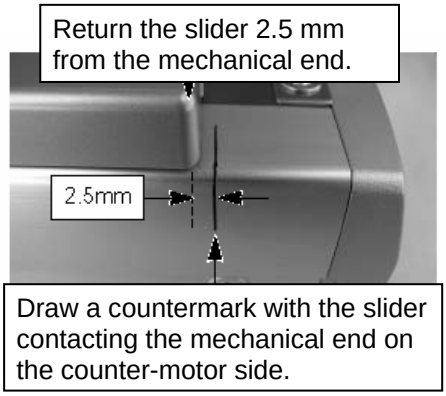
[Procedure]

1) Move the slider to a position where Z phase turns on (reference home position).
   On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2.5 mm from the mechanical end.

[Standard specification]



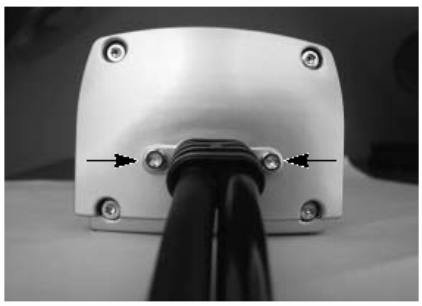
[Specification with home set on opposite side]



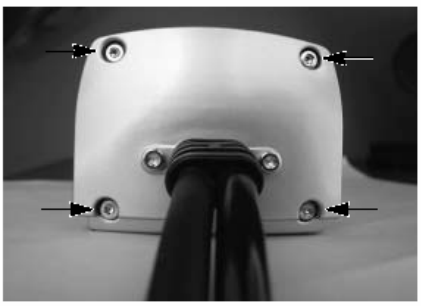
⚠ Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly.
Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers or damage the load.

2) Using an Allen wrench of 2.5 mm across flats, remove the bolts affixing the motor-end cap and attached cables.

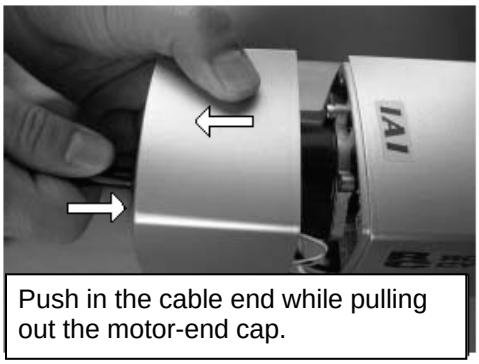
- Affixing bolts at attached cable end



- Affixing bolts on motor-end cap



3) Pull out the motor-end cap.



Push in the cable end while pulling out the motor-end cap.

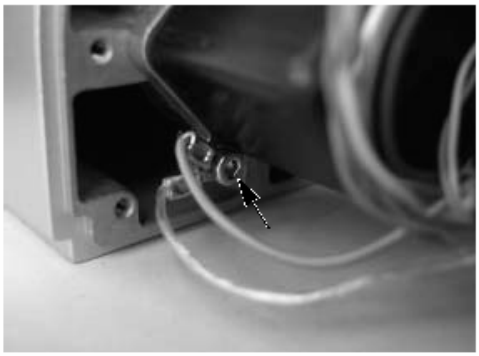
4) Remove the attached cables.

- Pull out the motor connector.

- Pull out the encoder connector.

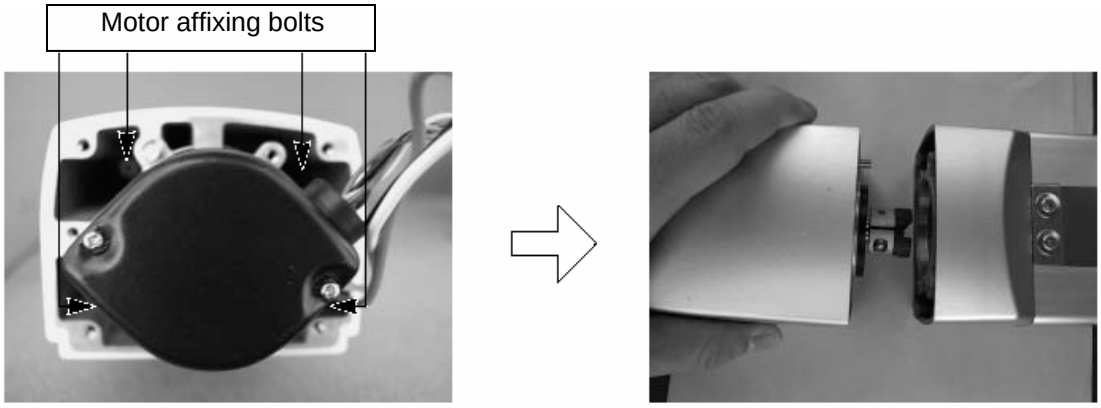
* If the actuator is equipped with a brake, pull out the brake connector.

- Remove the bolts affixing the grounding and shield wires using an Allen wrench of 2.5 mm across flats.

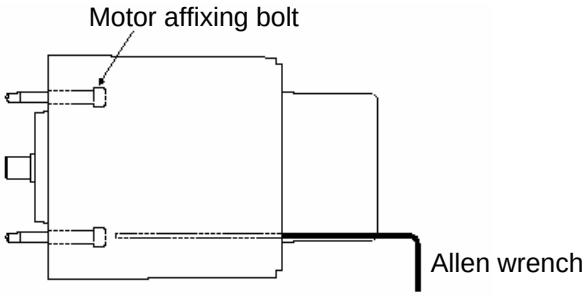


- Remove the attached cables.

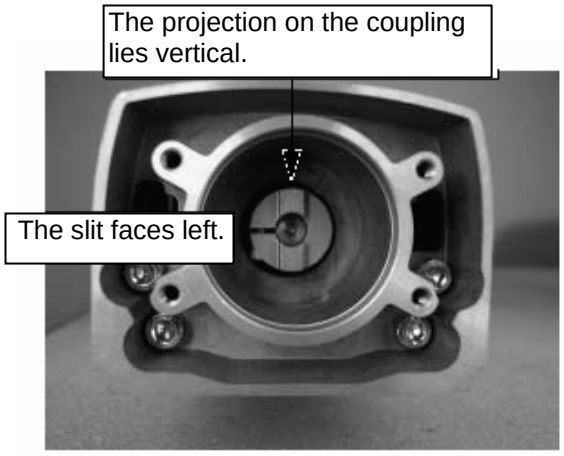
5) Remove the motor.
Remove the four motor affixing bolts using an Allen wrench of 3 mm across flats.



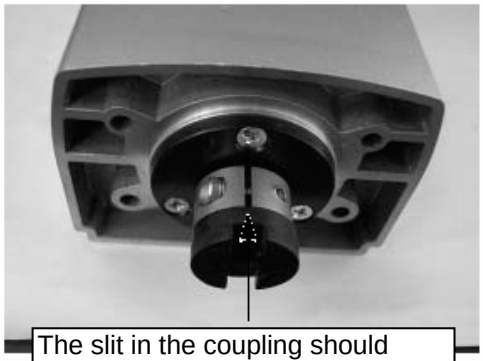
[Structure of 150-watt type]



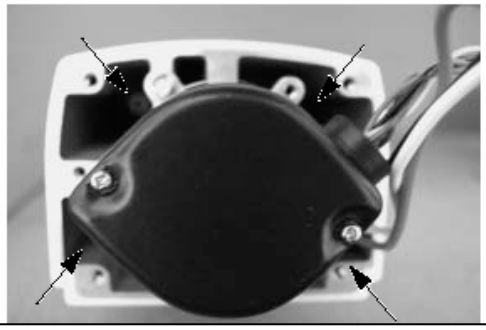
6) Align the coupling position on the actuator side.
Fine-adjust the coupling position until the projection on the coupling lies vertical, with the slit facing left.



7) Position the new motor so that the slit in the coupling points to the 12 o'clock position, and install the motor in this condition by engaging its coupling with the coupling on the actuator side.

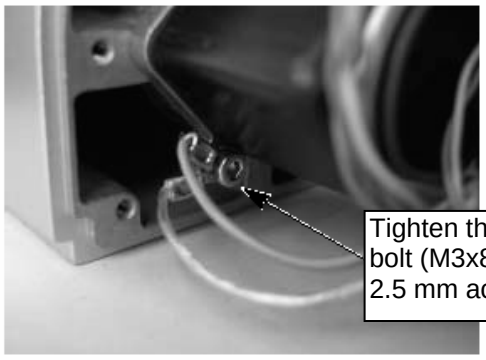


The slit in the coupling should point to the 12 o'clock position.



Using an Allen wrench of 3 mm across flats, uniformly tighten the four hexagon socket-head bolts (M4x25) affixing the motor to secure the motor.
Tightening torque: 176 N-cm (18.0 kgf-cm)

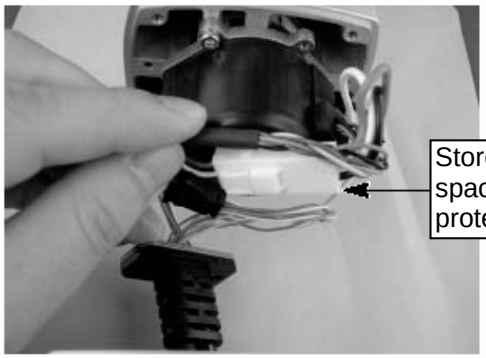
8) Affix the grounding and shield wires for the attached cables.



Tighten the hexagon socket-head bolt (M3x8) using an Allen wrench of 2.5 mm across flats.

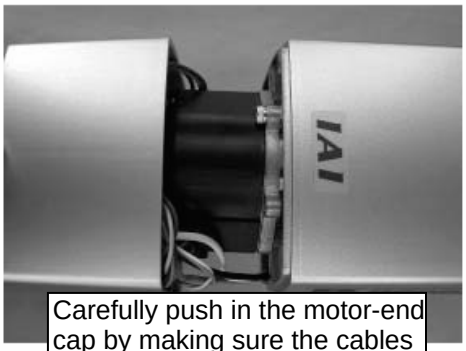
9) Connect the relay connectors (for the motor, encoder and brake).

- Store the motor connector into the space at the rear of the encoder protection cap above the cap.

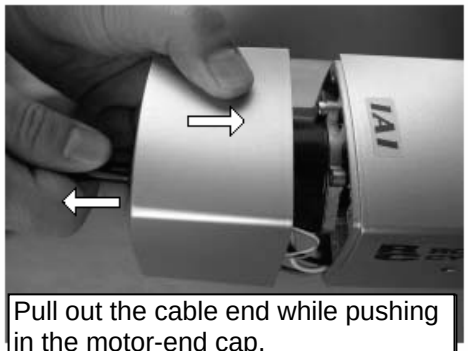


Store the motor connector into the space at the rear of the encoder protection cap above the cap.

10) Install the motor-end cap.
- Carefully push in the motor-end cap by making sure the cables are not pinched.



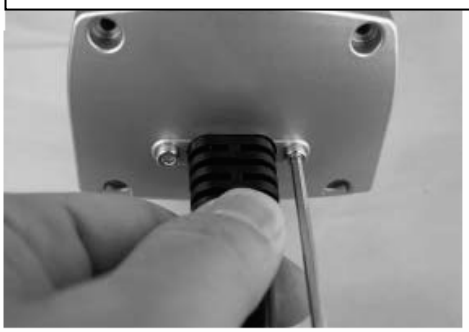
Carefully push in the motor-end cap by making sure the cables are not pinched.



Pull out the cable end while pushing in the motor-end cap.

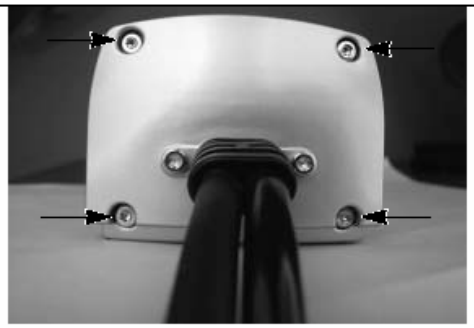
- Tighten the bolts while securely holding the cable end by hand.

Uniformly tighten the two hexagon socket-head bolts (M3x8) using an Allen wrench of 2.5 mm across flats.



- Affix the motor-end cap.

Uniformly tighten the two hexagon socket-head bolts (M3x50) using an Allen wrench of 2.5 mm across flats.
Tightening torque: 83 N-cm (8.47 kgf-cm)



11) Correct the position deviation.

[Incremental encoder]

[1] Check the home position.
Turn on the controller power.
Use the PC software or teaching pendant to perform homing to check the home position. Repeat homing several times to confirm that the actuator returns to the same position every time.

[2] Check the amount of position deviation.
The home position may have shifted slightly after the motor replacement.
To check the amount of position deviation, select a desired position number appropriate for checking the deviation after the motor replacement, perform positioning to the selected position, and measure the amount of deviation.

[3] Correct the deviation.
If there is a deviation from the initial home position, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."

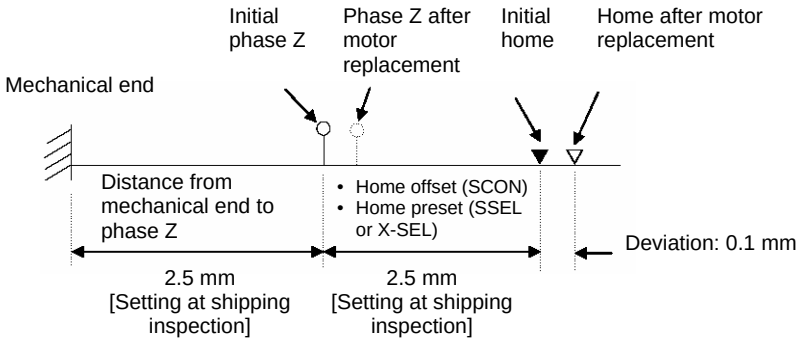
[Absolute encoder]

[1] Check the home position.
Turn on the controller power.
When the controller is turned on for the first time after the motor has been replaced, a battery voltage low alarm should generate. Reset this alarm.
Next, use the PC software or teaching pendant to perform homing, and then perform an absolutes reset.
Thereafter, repeat homing several times to confirm that the actuator returns to the same position every time.

[2] Check the amount of position deviation.
The home position may have shifted slightly after the motor replacement.
To check the amount of position deviation, select a desired position number appropriate for checking the deviation after the motor replacement, perform positioning to the selected position, and measure the amount of deviation.

[3] Correct the deviation.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
After either parameter has been changed, perform homing and then carry out an absolute reset.

[Correction example of home offset (SCON) and home preset (SSEL or X-SEL)]

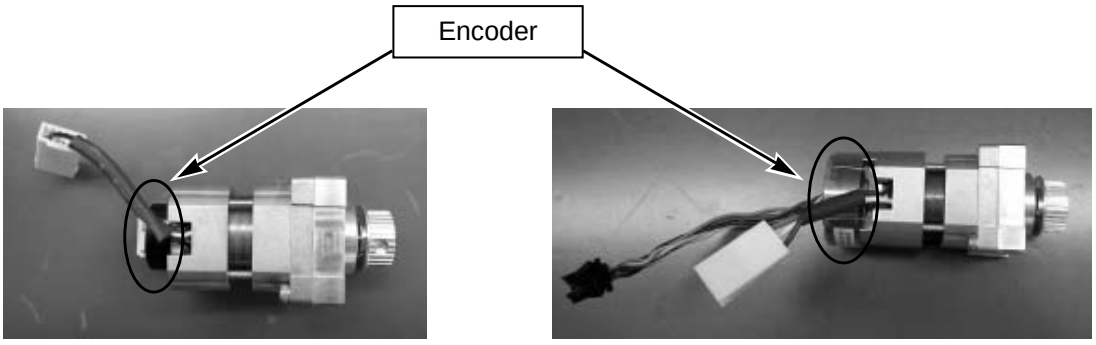


If, after the motor replacement, the home position became deviated by 0.1 mm in the direction of moving away from the mechanical end, decrease the value in Parameter No. 22, "Home offset" by 0.1 mm, in the case of a SCON controller, to adjust the home back to the initial home position. With a SSEL controller or X-SEL controller, decrease the value in Axis-specific Parameter No. 12, "Home preset" by 0.1 mm. (In either case, the parameter value is changed from 2.5 mm to 2.4 mm.)

14.9.3 Replacing the Motor of the Motor Reversing Type: SA4R, SA5R, SA6R

[Items Required for Replacement]

- Replacement motor
- Allen wrenches
- Phillips screwdriver
- Tension gauge (capable of tensioning to 7 kgf or greater)
- Strong string, looped (or long tie-band)
- Scale
- Oil-based marker pen
- PC or teaching pendant



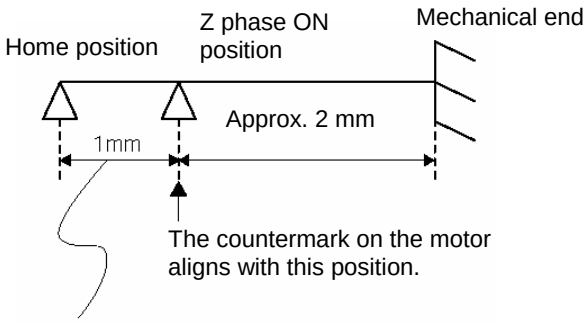
Replacement motor (IAI encoder)

Replacement motor (Tamagawa encoder)

Caution:	When replacing the motor, handle the replacement motor with due care. The actuator has been shipped with the encode adjusted to an optimal position, so do not crush the encoder unit. It may displace the encoder, thus impairing proper actuator operation.

[Overview of Replacement]

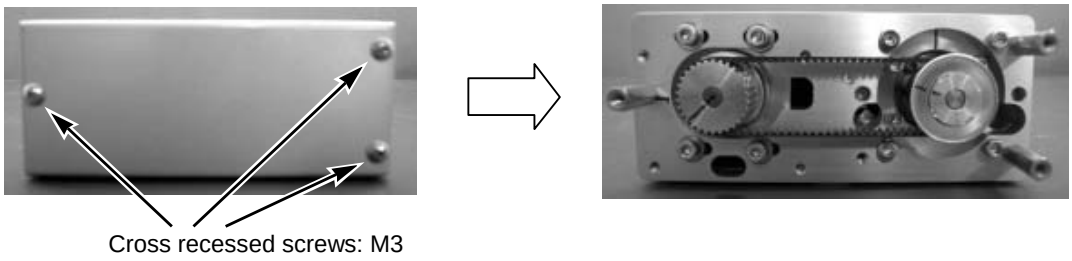
1) Loosen the motor-unit affixing bolts to remove the belt, and replace the motor.
2) Restore the home position.
   Affix the slider at a position 2 mm from the mechanical end on the home side, pass the belt, and adjust the belt to the specified tension.
3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.



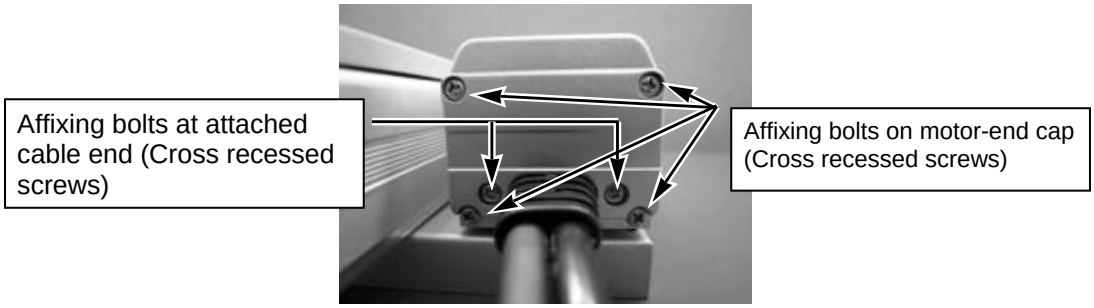
Set by the home offset parameter (SCON) or home preset parameter (SSEL or X-SEL).
(The above value indicates the factory setting.)

[Procedure]

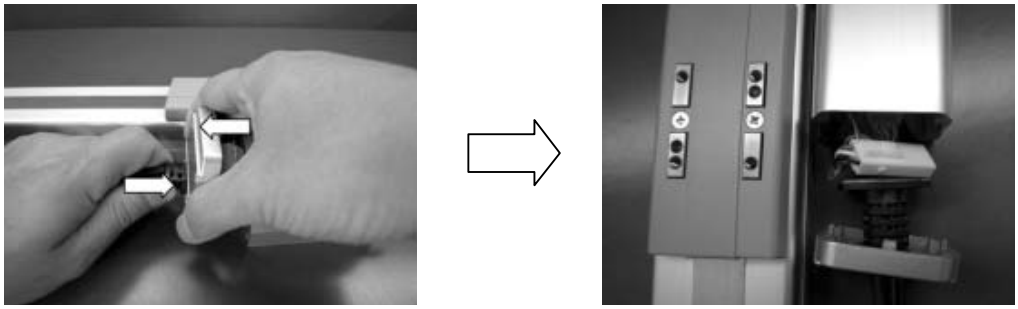
1) Remove the pulley cover using a Phillips screwdriver.



2) Use a Phillips screwdriver to remove the bolts affixing the motor-end cap and attached cables.



3) Pull out the motor-end cap.

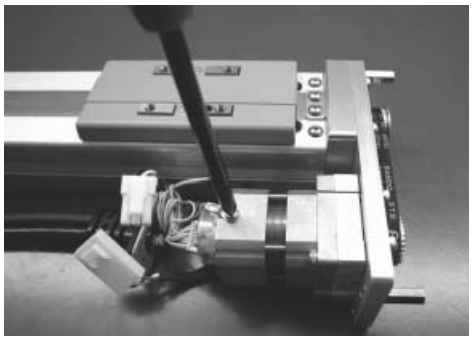


4) Pull out the motor-end cover to expose the motor.

5) Detach the attached cables.
   - Pull out the motor connector.

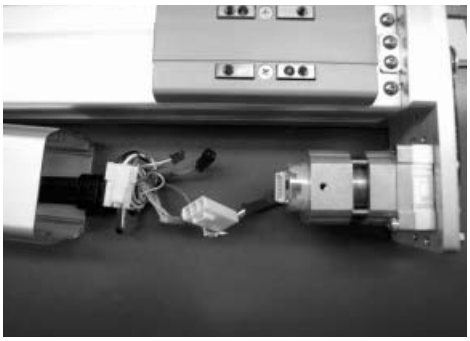
   - If the actuator has a brake, also detach the brake connector.

- Remove the grounding wire using a Phillips screwdriver.

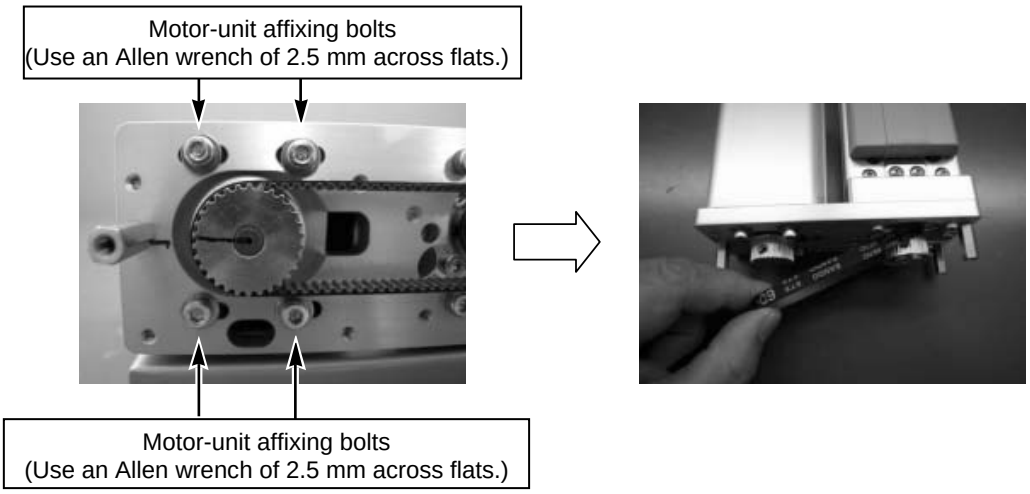


- While holding the motor with one hand, pull out the encoder cable.
  (The photograph bellow shows the motor (IAI encoder).)

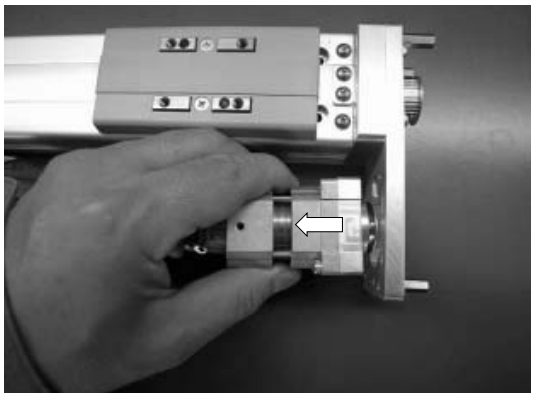
6) Detach the attached cables.



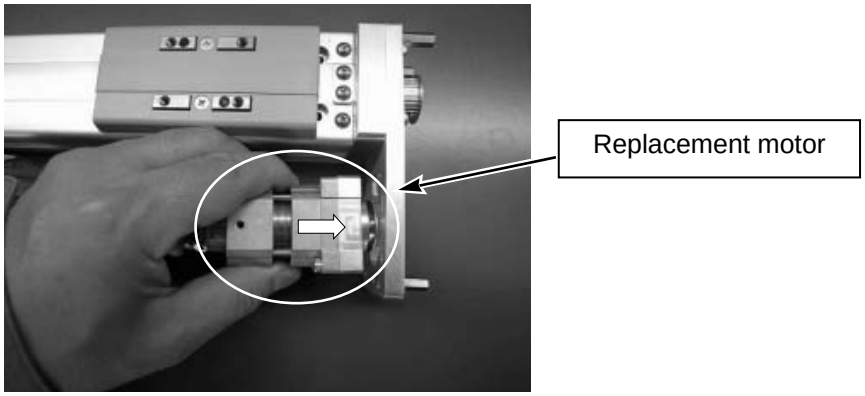
7) Loosen the motor-unit affixing bolts using an Allen wrench of 2.5 mm across flats. Slide the motor, and loosen and remove the belt. After the belt has been removed, remove the motor-unit affixing bolts.



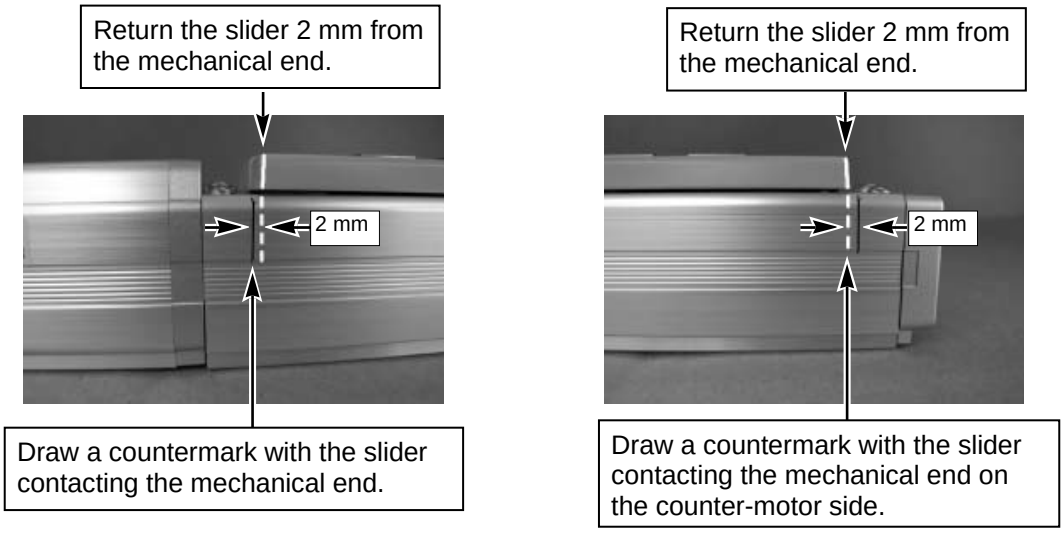
8) Take out the motor.



9) Install the replacement motor. Loosely tighten the motor-unit affixing bolts.



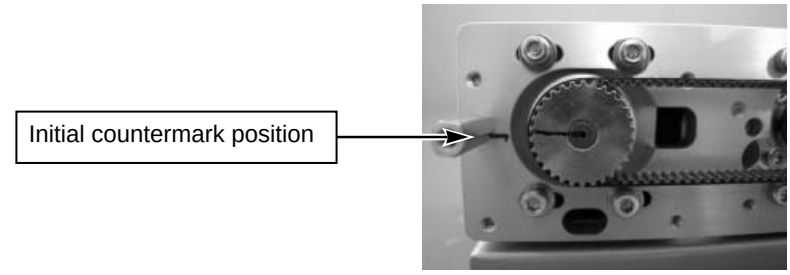
10) Move the slider to a position where Z phase turns on (home position).
On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2 mm from the mechanical end.



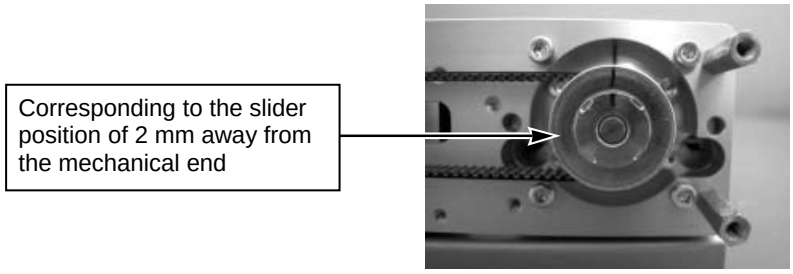
Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly.
Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers or damage the load.

11) Check the following points before restoring the home position:
- The motor side should be aligned with the initial countermark. If the position is offset, adjust it to achieve proper alignment.
- The ball-screw side should be in a location corresponding to the slide position of 2 mm away from the mechanical end.

After the check, attach a new belt while holding the pulleys on both sides in position.



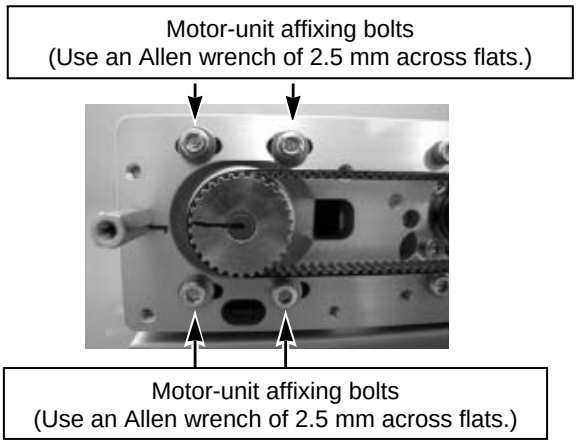
Motor side



Ball-screw side

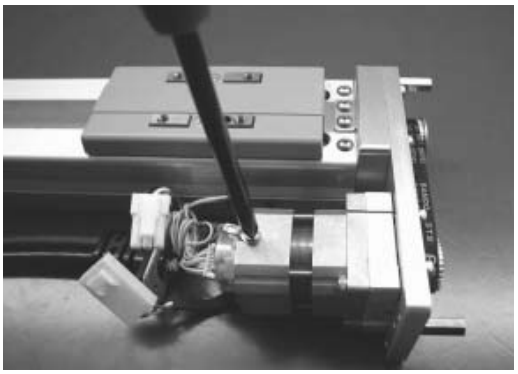
12) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the motor-unit affixing bolts.

[Recommended tightening torque for adjustment bolts]
162 N-cm (16.5 kgf-cm)

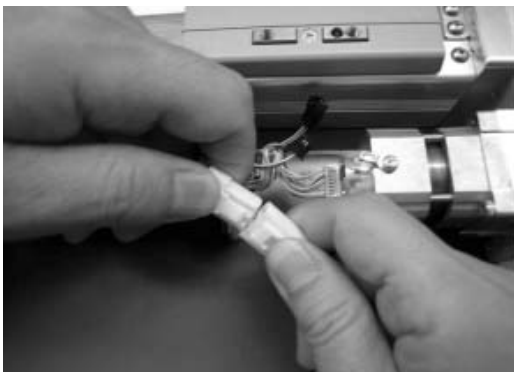


13) Install the attached cables.
- While holding the motor with one hand, insert the encoder cable.
  (The photograph bellow shows the motor (IAI encoder).)

- Install a grounding wire using a Phillips driver.



- Plug the cables into the motor.

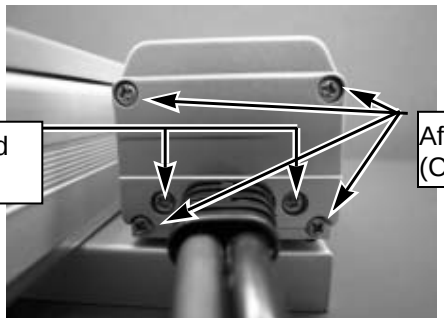


- If the actuator has a brake, also plug in the brake connector.

14) Insert the motor-end cover and cap.

Pull out the cable end while pushing in the motor-end cap.

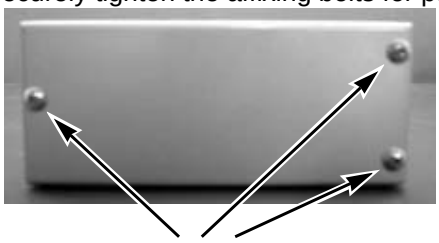
15) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



Affixing bolts at attached cable end (Cross recessed screws)

Affixing bolts on motor-end cap (Cross recessed screws).

16) Use a Phillips screwdriver to securely tighten the affixing bolts for pulley cover.



Cross recessed screws: M3

17) Connect a PC or teaching pendant to the controller to perform homing. (If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

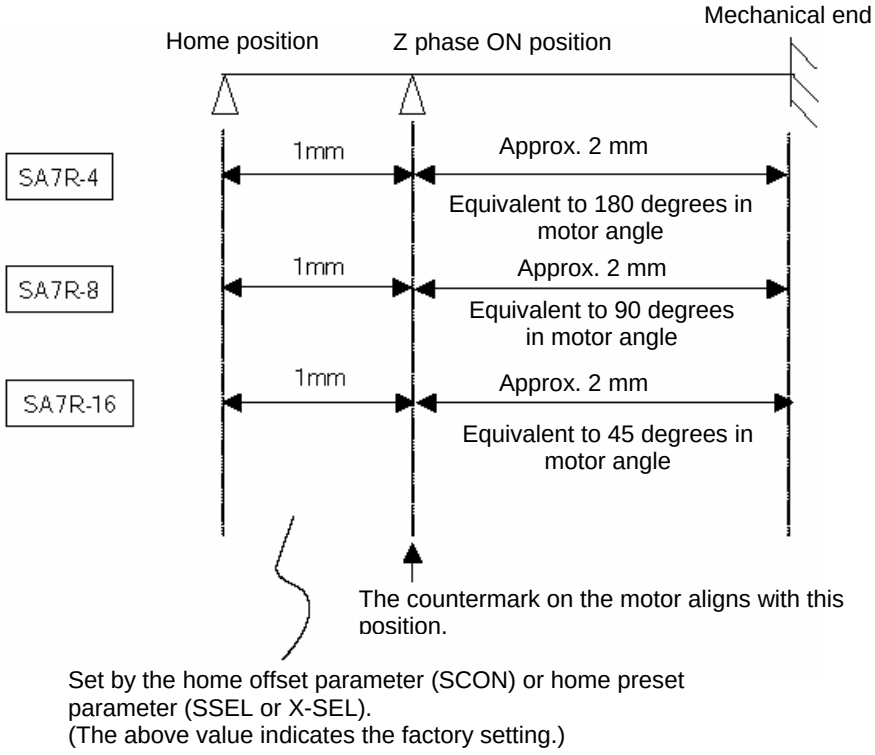
14.9.4 Replacing the Motor of the Motor Reversing Type: SA7R

[Items Required for Replacement]

- Replacement motor with pulley (See the photograph on the right) (Confirm that the motor has a countermark.)
- PC or teaching pendant
- Tension gauge (capable of tensioning to 8 kgf or greater)
- Strong string, looped (or long tie-band)
- Allen wrenches
- Phillips screwdrivers
- 5.5-mm spanner wrench or needle-nose pliers

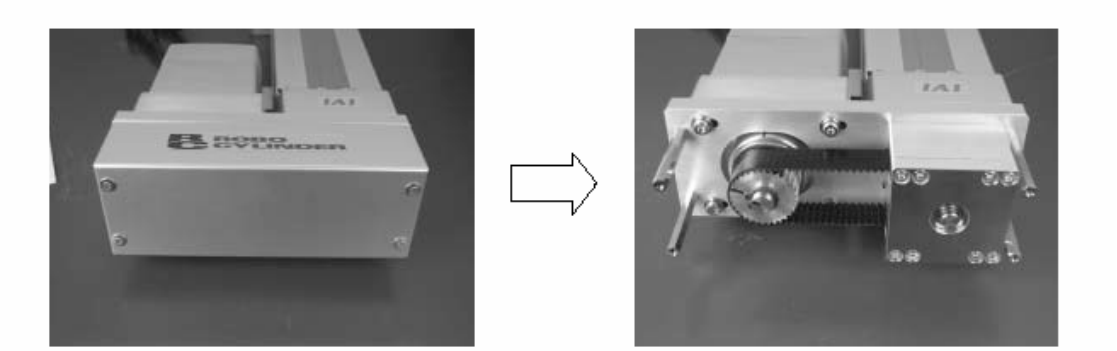
[Overview of Replacement]

1) Remove the belt and replace the motor.
2) Restore the home position.
   Press the slider against the mechanical end on the home side, and move the motor shaft away from the countermark by the specified distance. With the slider and motor shaft affixed in these positions, adjust the belt to the specified tension.
3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.

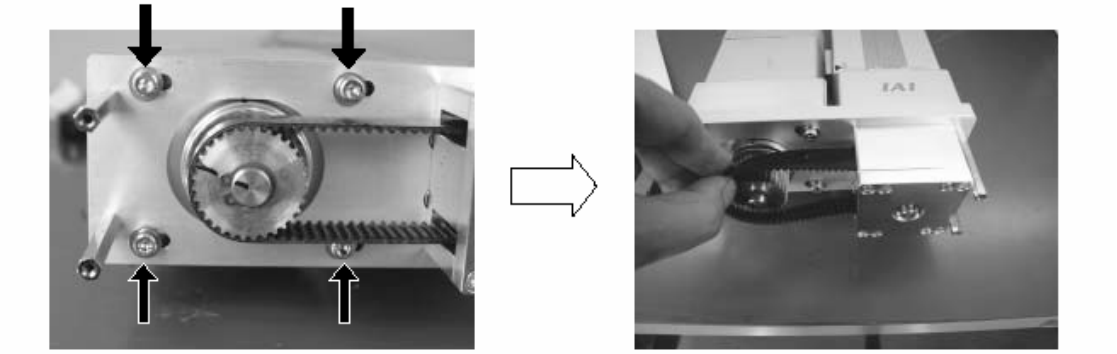


[Procedure]

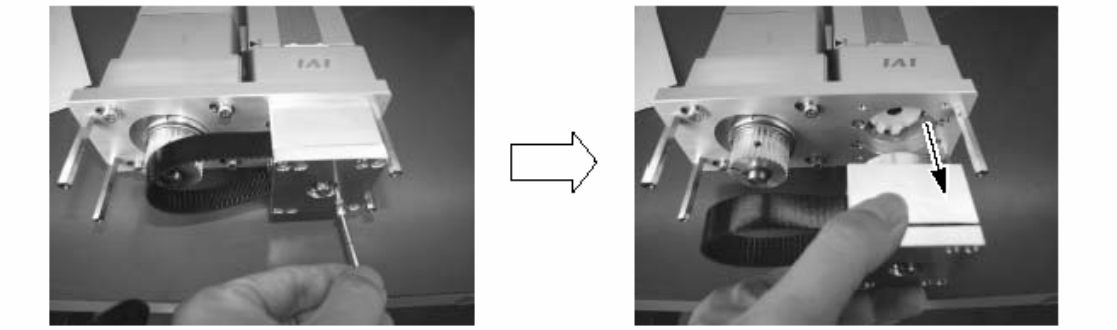
1) Move the slider from the home position toward the mechanical end and check the rotating direction of the motor. (This check is necessary, because the rotating direction of the motor is different on actuators whose home is set on the opposite side.)
   - Remove the pulley cover.
     (Remove the four thin-head mounting screws using an Allen wrench.)



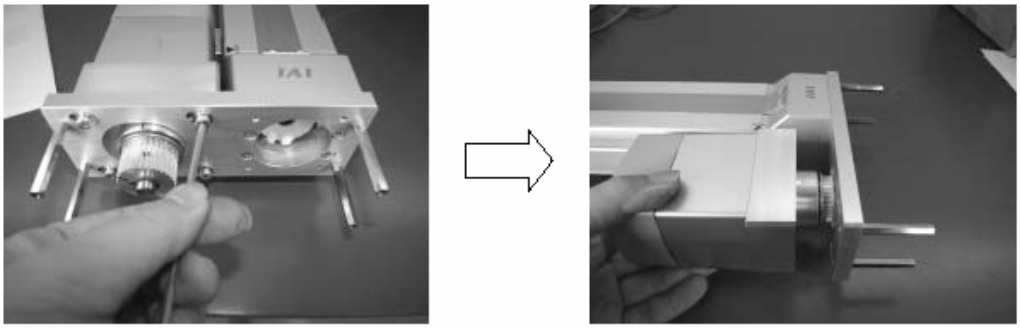
2) Loosen the four tension adjustment bolts and move the motor bracket to slacken the belt.



3) Remove the affixing the pulley cap and pulley housing, and remove the belt.

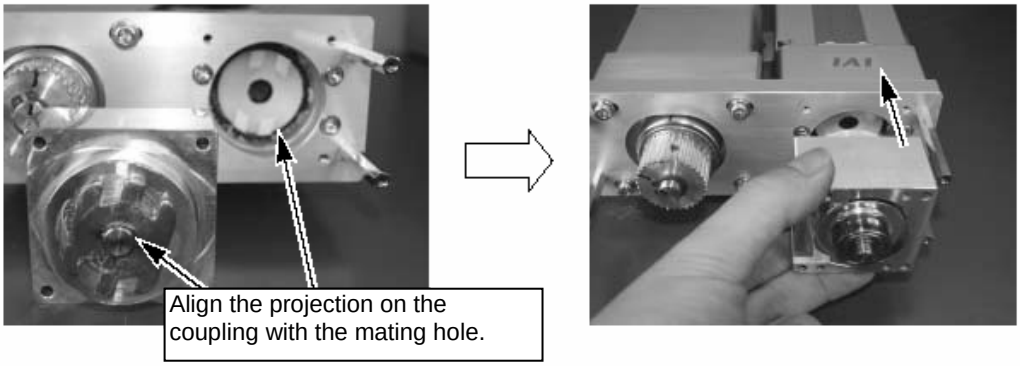


4) Remove the motor.
Remove the four hexagon socket-head bolts using an Allen wrench.



5) Install the new motor.
Loosely affix the four hexagon socket-head bolts (M4x20) using an Allen wrench of 3 mm across flats.

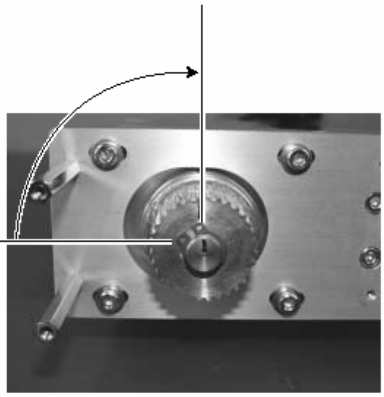
6) Install the pulley housing.
(Install the pulley housing by making sure the angle of the projection on the coupling matches the angle of the mating hole.)



7) Make the adjustment to restore the home position.
- Press the slider against the mechanical end on the home side and affix the slider in this position.
- Turn the motor shaft away from the countermark by the specified distance in the direction of returning to the mechanical end (the direction checked earlier).

Example: When the return angle is 90 degrees →

Initial countermark position



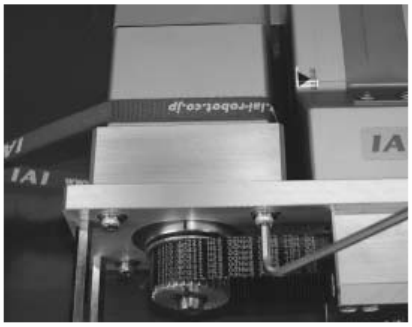
Type	Return angle from countermark position
SA7R-4	180 degrees
SA7R-8	90 degrees
SA7R-16	45 degrees

8) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the adjustment bolts.

[Recommenced tightening torque for adjustment bolts] (M4) 377 N-cm (38 kgf-cm)

Caution: Carefully tighten them to the specified torque by making sure the pulleys on both sides do not move.

Tension: 8 kgf ± 0.3 kgf



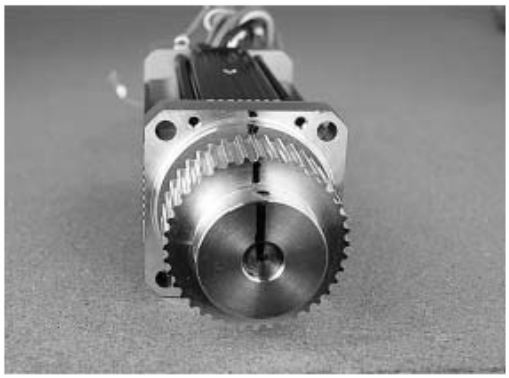
9) Install the pulley cover.
Tighten the four thin-head screws (M3x6) using an Allen wrench of 1.5 mm across flats.

10) Perform homing using a PC or teaching pendant.
(If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

14.9.5 Replacing the Motor of the Motor Reversing Type: SS7R, SS8R

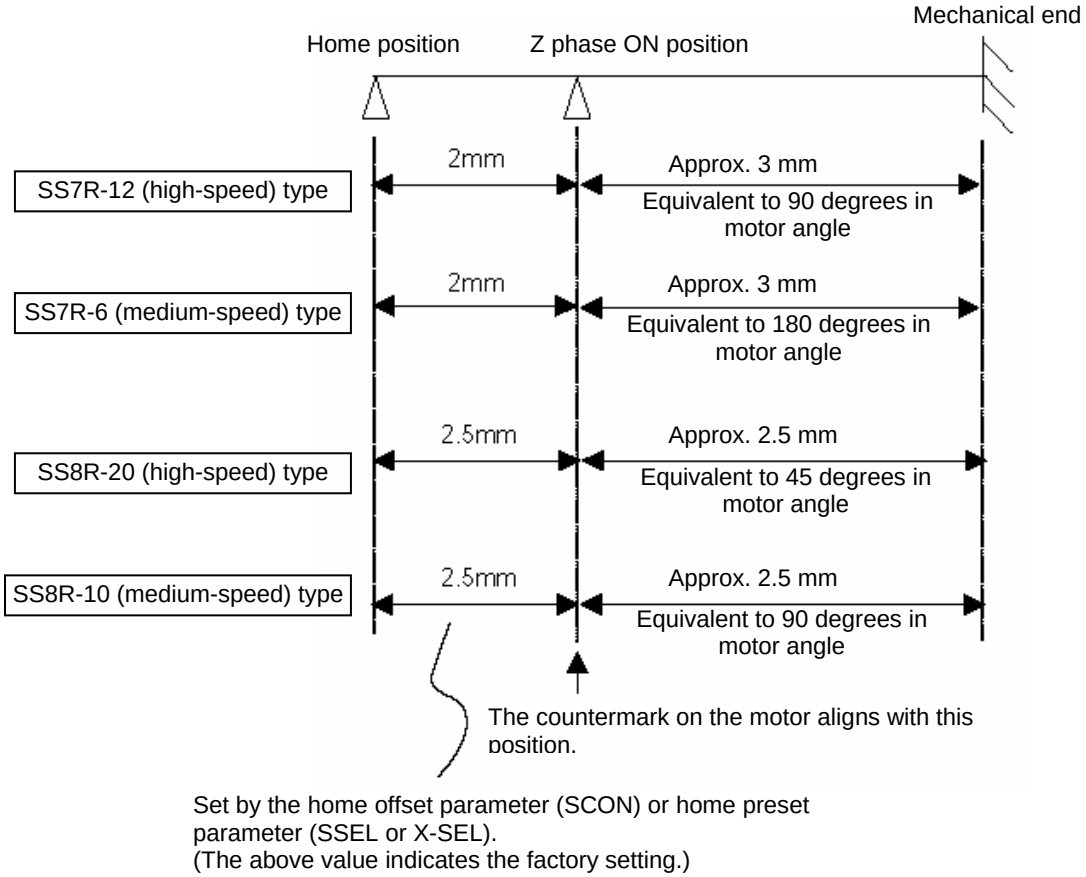
[Items Required for Replacement]

- Replacement motor with pulley (See the photograph on the right) (Confirm that the motor has a countermark.)
- PC or teaching pendant
- Tension gauge (capable of tensioning to 7 kgf or greater)
- Strong string, looped (or long tie-band)
- Allen wrenches
- Phillips screwdrivers
- 5.5-mm spanner wrench or needle-nose pliers



[Overview of Replacement]

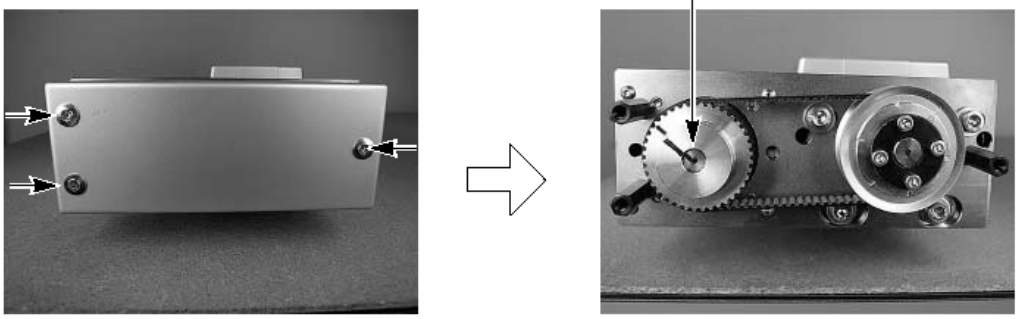
1) Remove the belt and replace the motor.
2) Restore the home position.
   Press the slider against the mechanical end on the home side, and move the motor shaft away from the countermark by the specified distance. With the slider and motor shaft affixed in these positions, adjust the belt to the specified tension.
3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position. If there is a deviation, adjust the home offset in the case of a SCON controller. With a SSEL controller of X-SEL controller, adjust the home preset.



Set by the home offset parameter (SCON) or home preset parameter (SSEL or X-SEL).
(The above value indicates the factory setting.)

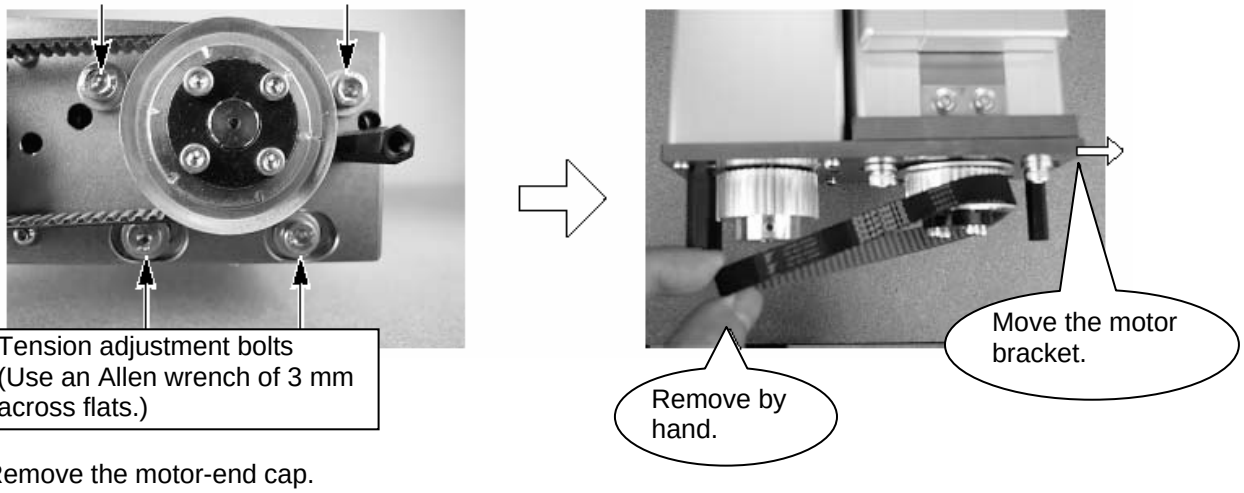
[Procedure]

1) Move the slider from the home position toward the mechanical end and check the rotating direction of the motor. (This check is necessary, because the rotating direction of the motor is different on actuators whose home is set on the opposite side.)
   - Remove the pulley cover.
     (Remove the three thin-head mounting screws using an Allen wrench of 1.5 mm across flats for SS7R and of 2 mm across flats for SS8R.)
   - Check the rotating direction of the motor shaft.

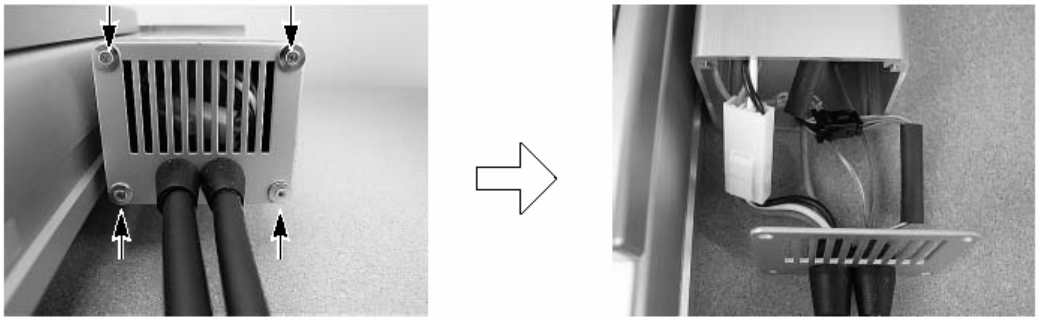


2) Loosen the tension adjustment bolts and move the motor bracket to slacken and remove the belt.

Tension adjustment bolts
(Use an Allen wrench of 3 mm across flats for SS7R and of 4 mm across flats for SS8R.)



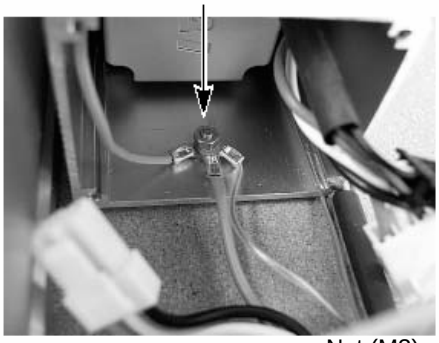
3) Remove the motor-end cap.
   (Remove the four thin-head screws using an Allen wrench of 1.5 mm across flats.)

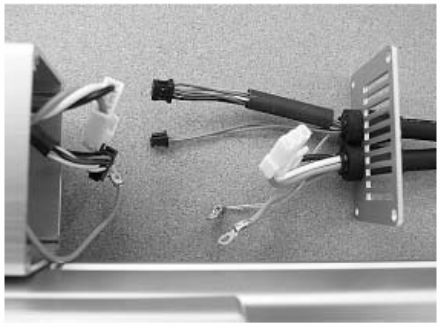


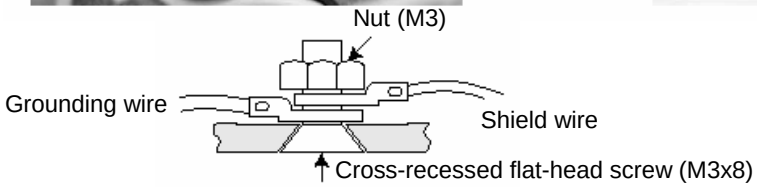
4) Pull out the relay connectors for the attached cables.
   - Motor connector
   - Encoder connector

   - If the actuator is equipped with a brake, also remove the brake connector.

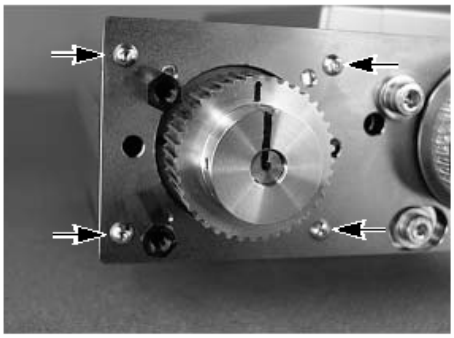
5) Remove the grounding and shield wires, and separate the attached cables.
   - Loosen the nut using a Phillips screwdriver and a 5.5-mm spanner wrench (or needle-nose pliers).

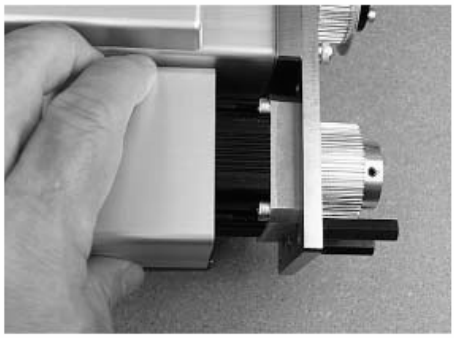




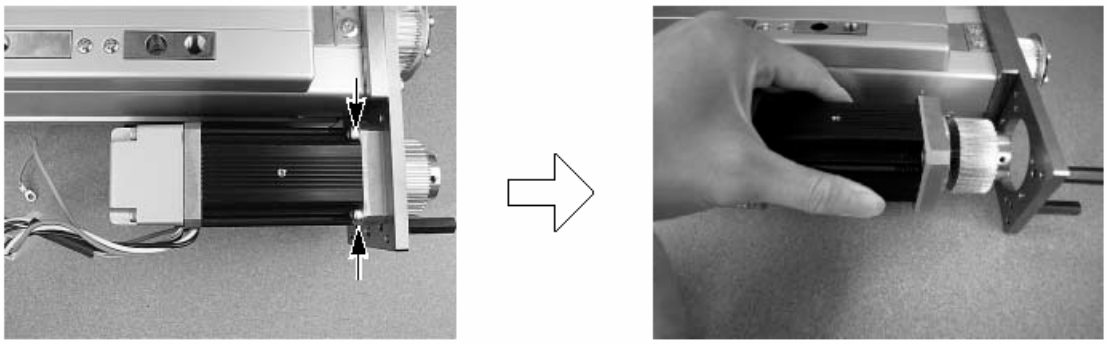


6) Remove the motor cover.
   Remove the four hexagon socket-head button bolts using an Allen wrench of 2 mm across flats.





7) Remove the motor.
Remove the four hexagon socket-head bolts using an Allen wrench of 3 mm across flats.



8) Install the new motor.
Tighten the four hexagon socket-head bolts (M4x15) uniformly using an Allen wrench of 3 mm across flats.

Recommended tightening torque: 176 N-m (18 kgf-cm)

9) Install the motor cover.
Tighten the four hexagon socket-head button bolts (M3x12) using an Allen wrench of 2 mm across flats.

10) Connect the relay connectors for the attached cables, grounding wires etc., back to their original conditions.
- Affix the two grounding wires and one shield wire using the flat-head screw and nut.
- Connect the relay connectors.

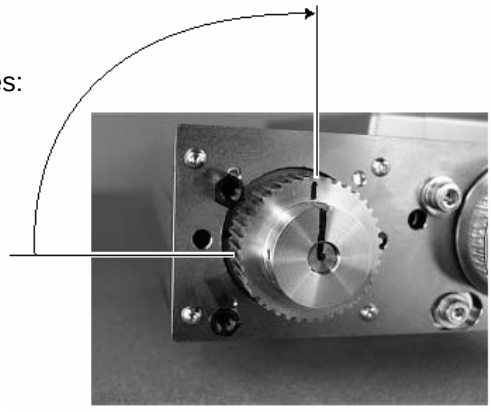
11) Install the motor-end cap.
Tighten the four thin-head screws (M3x6) using an Allen wrench of 1.5 mm across flats.

Caution: Check the storage of cables carefully to make sure the cables are not pinched.

12) Make the adjustment to restore the home position.
- Press the slider against the mechanical end on the home side and affix the slider in this position.
- Turn the motor shaft away from the countermark by the specified distance in the direction of returning to the mechanical end (the direction checked earlier).

Example for SS7R-12/SS8R-10 types:
Turn 90 degrees in the direction of returning to the mechanical end (standard home specification).

Initial countermark position



Type	Return angle from countermark position
SS7R-12 (high speed)	90 degrees
SS7R-6 (medium speed)	180 degrees
SS8R-20 (high speed)	45 degrees
SS8R-10 (medium speed)	90 degrees

- Pass the new belt by making sure the pulleys on both sides do not move.

13) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the adjustment bolts.
Recommenced tightening torque for adjustment bolts
SS7R: 2 upper bolts (M4) 377 N-cm (38 kgf-cm) SS8R: 2 upper bolts (M5) 763 N-cm (78 kgf-cm)
2 lower bolts (M4) 377 N-cm (38 kgf-cm) 2 lower bolts (M4) 377 N-cm (38 kgf-cm)

Caution: Carefully tighten them to the specified torque by making sure the pulleys on both sides do not move.

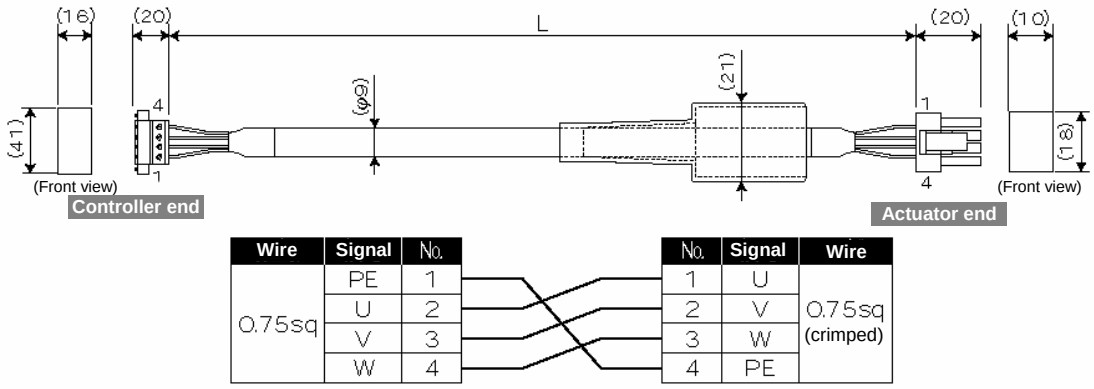
Tension: SSR: 6.7 kgf
SMR: 6.9 kgf

14) Install the pulley cover.
With SS7R, tighten the three thin-head screws (M3x6) using an Allen wrench of 1.5 mm across flats.
With SS8R, tighten the three thin-head screws (M4x6) using an Allen wrench of 2 mm across flats.

15) Perform homing using a PC or teaching pendant.
(If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position.
If there is a deviation, adjust Parameter No. 22, "Home offset" in the case of a SCON controller. With a SSEL controller or X-SEL controller, adjust Axis-specific Parameter No. 12, "Home preset."
If the actuator is of absolute encoder specification, perform homing and then carry out an absolute reset after either parameter has been changed.

15. Cable Drawings

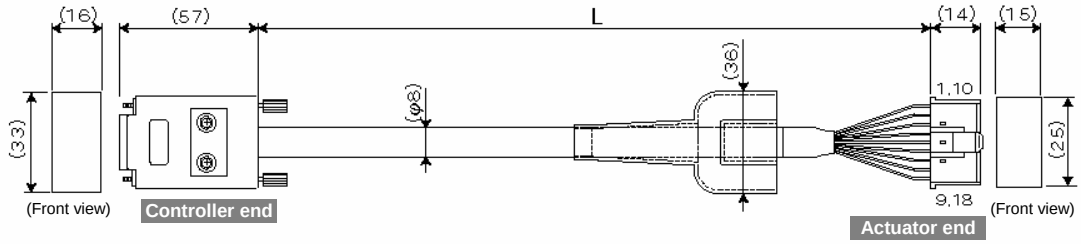
[1] Motor cable/motor robot cable
Model: CB-RCC-MA□□□/CB-RCC-MA□□□-RB



Wire	Signal	No.
0.75sq	PE	1
	U	2
	V	3
	W	4

No.	Signal	Wire
1	U	0.75sq (crimped)
2	V	
3	W	
4	PE	

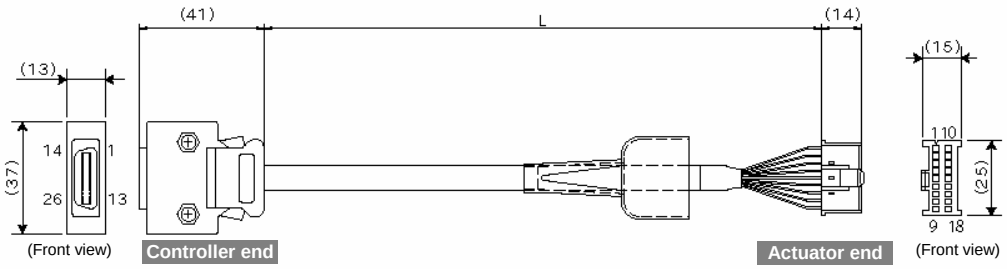
[2] Encoder cable/encoder robot cable (for X-SEL-J/K)
Model: CB-RCBC-PA□□□/CB-RCBC-PA□□□-RB



Wire	Signal	No.
0.15sq (crimped)	A/U	1
	$\overline{A/U}$	2
	B/V	3
	$\overline{B/V}$	4
	Z/W	5
	$\overline{Z/W}$	6
	SD	7
	$\overline{SD}$	8
	BAT+	9
	BAT−	10
	VCC	11
	GND	12
	BK−	13
	BK+	14
	—	15
Clamp the shield to the hood.		
Drain wire and braided shield wire		

No.	Signal	Wire
1	A/U	0.15sq (crimped)
2	$\overline{A/U}$	
3	B/V	
4	$\overline{B/V}$	
5	Z/W	
6	$\overline{Z/W}$	
7	—	
8	—	
9	FG	
10	SD	
11	$\overline{SD}$	
12	BAT+	
13	BAT−	
14	VCC	
15	GND	
16	—	
17	BK−	
18	BK+	

[3] Encoder cable/encoder robot cable (for SCON, SSEL and X-SEL-P/Q)
Model: CB-RCS2-PA□□□/CB-X2-PA□□□



Wire	Color	Signal	No.
	—	—	10
	—	—	11
	—	E24V	12
	Gray/white	OV	13
	Brown/White	LS	26
	—	CLEEP	25
	—	OT	24
	—	RSV	23
	—	—	9
AWG26 (soldered)	—	—	18
	—	—	19
	Pink	A+	1
	Purple	A-	2
	White	B+	3
	Blue/red	B-	4
	Orange/white	Z+	5
	Green/white	Z-	6
	Blue	SRD+	7
	Orange	SRD-	8
	Black	BAT+	14
	Yellow	BAT−	15
	Green	VCC	16
	Brown	GND	17
	Gray	BKR-	20
	Red	BKR+	21
	—	—	22

Clamp the shield to the hood.
Note 3

Note 4

Note 1

Drain wire and braided shield wire

Note 2

No.	Signal	Color	Wire
1	A	Pink	AWG26 (crimped)
2	$\overline{A}$	Purple	
3	B	White	
4	$\overline{B}$	Blue/red	
5	Z	Orange/white	
6	$\overline{Z}$	Green/white	
7	LS+	Brown/white	
8	—	—	
9	FG	Drain	
10	SD	Blue	
11	$\overline{SD}$	Orange	
12	BAT+	Black	
13	BAT−	Yellow	
14	VCC	Green	
15	GND	Brown	
16	LS-	Gray/white	
17	BK−	Gray	
18	BK+	Red	

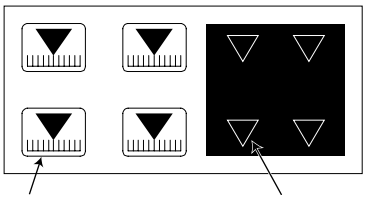
Appendix

How to use the home mark

- Please affix these marks to the actuator as home markers as needed.

Contents of sticker

Home mark sticker



x 1 sheet

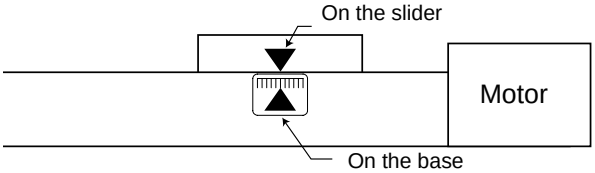
Home mark scale x 4 Home mark x 4
(Scale: 1 mm graduation mark, 10 mm width)

- Peel off the marks from the base sheet.

Note 1. Every mark has sticky back.
2. Remove smear and stain from the surface.
3. Avoid label or nameplate as a marking location.

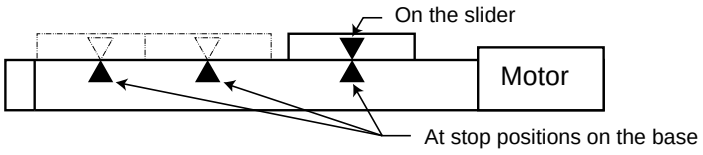
Example of Use

[1] Used as home position



- Place the marks when the actuator is stopped at home position.

[2] Used as stop positions



Catalog No.: RCS2 MJ3654-2A-Mar 2007-1

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