

SS Actuator

Operating Manual



Intelligent Actuator, Inc.

This publication was written to assist you in better understanding this part of your IA system. If you require further assistance, please contact IA Technical Support. For Central and East Coast Time Zones, please call our Itasca, IL office at 1-800-944-0333 or FAX 630-467-9912. For Mountain and Pacific Time Zones, please call our Torrance, CA office at 1-800-736-1712 or FAX 310-891-0815; Monday thru Friday from 8:30AM to 5:00PM.



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SS Actuator

1. Foreword

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

2. Safety Precautions

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.

Maintenance and Inspection

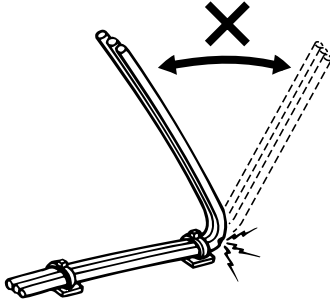
- When doing maintenance and inspection work, always shut down the controller power first.
- When doing inspection, make sure that no one can inadvertently turn the power ON.
- Make sure that a sign indicating work in progress is clearly visible.
- If several persons are working, be sure to watch out 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.

3. Cabling Precautions

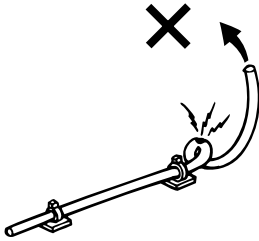
When using the Robo Cylinder actuator and controller to build an application system, it is important to position and lay out the cable correctly. If this is not done, the cable may snap or have a faulty connection that could lead to a variety of problems which in turn could cause the actuator to run out of control. Below, we explain the things not to do to ensure that the cables are connected in the correct fashion.

Ten “Do’s and Don’ts” When Laying Out Cable (Please make sure to observe these rules!)

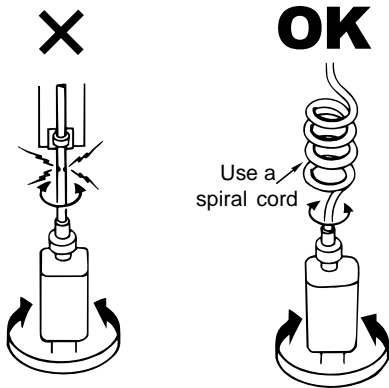
- (1) Make sure there is no excessive bending at one spot.



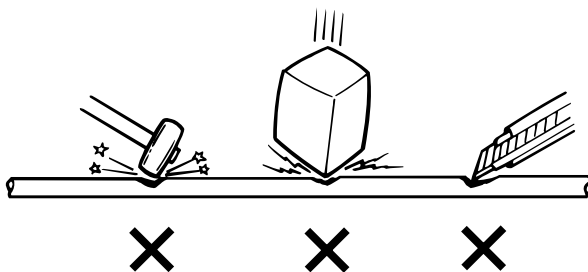
- (2) Do not twist or crease the cable.



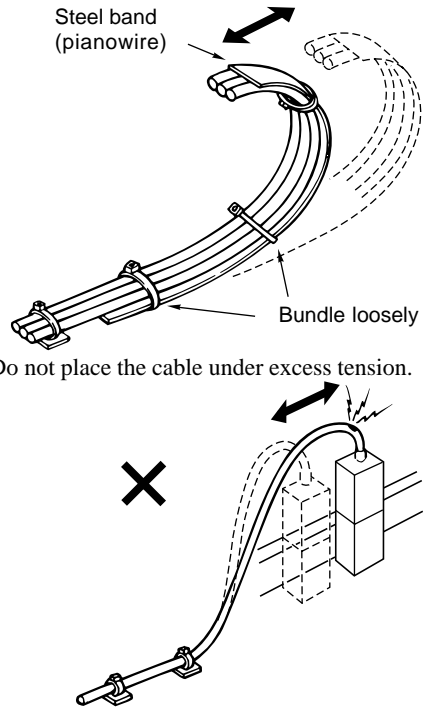
- (3) Do not exert a rotational force at a single spot on the cable.



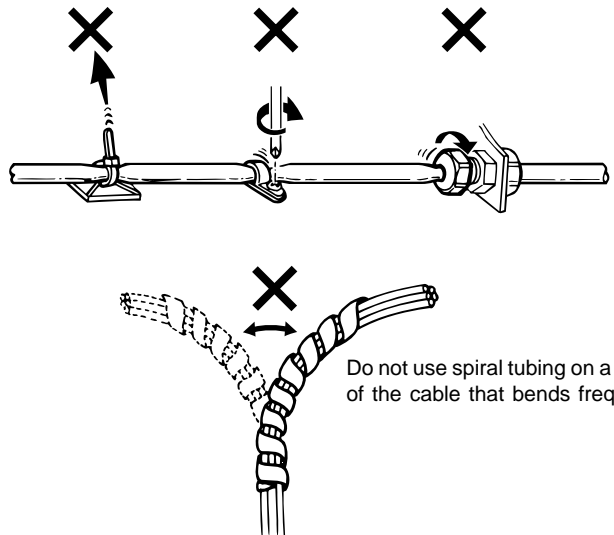
- (4) Do not let the cable be caught in anything, or get dented or cut.



- (5) Do not place the cable under excess tension.



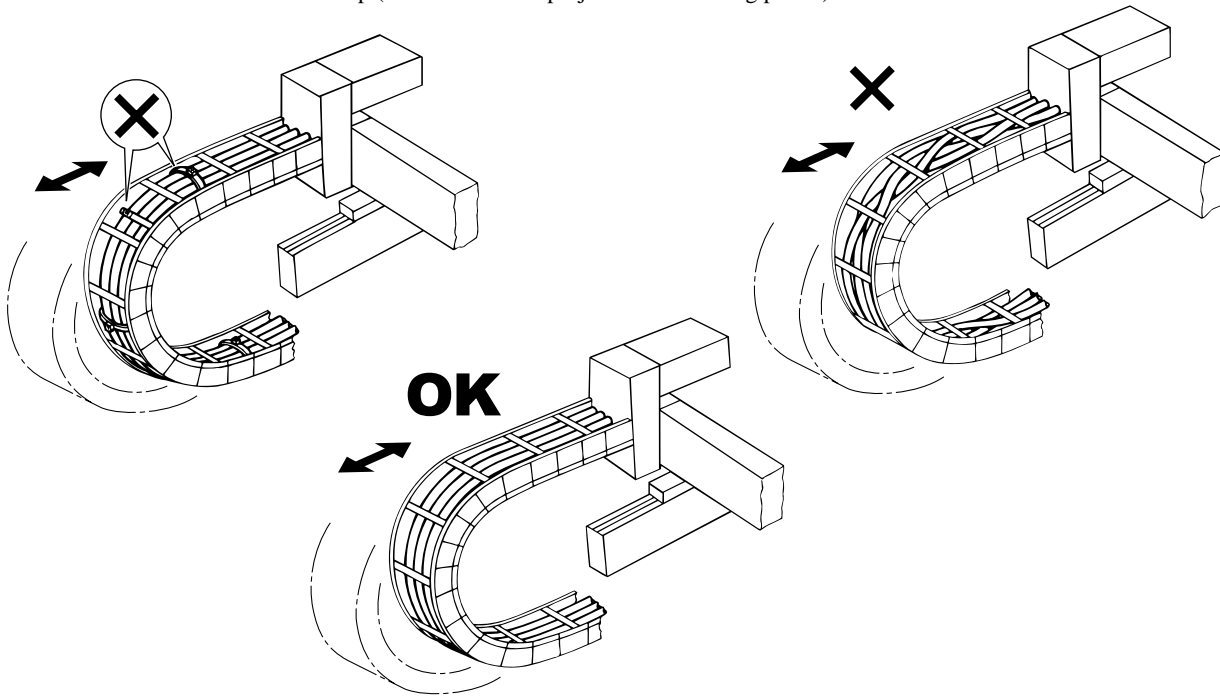
- (6) When affixing the cable, do not clamp it too tightly.



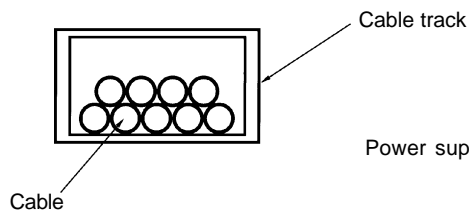
Do not use spiral tubing on a section of the cable that bends frequently.

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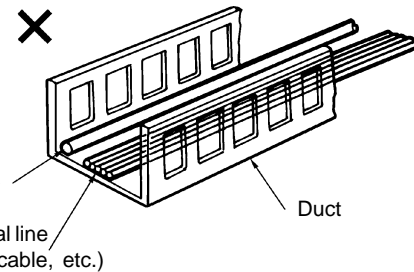
- (7) If placing cable in a cable track or flexible tube then, take sure it does not twist around. Also, make sure the cables have some freedom of movement and are not bunched up (cable should not project out at bending points).



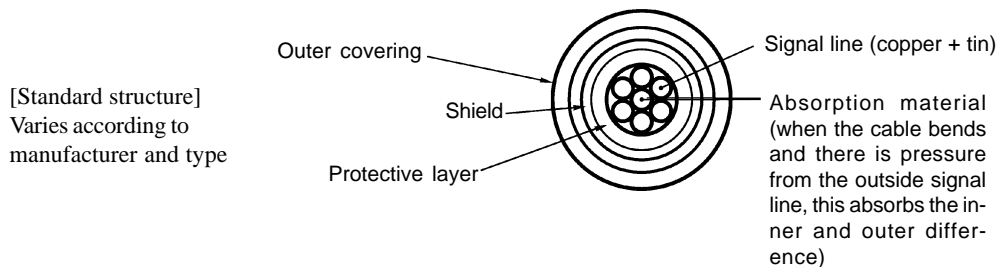
- (8) The amount of cable placed inside a cable track should fill about 60% of the space in the cable track.



- (9) Do not mix the signal line in with a high voltage circuit.



- (10) In a case where the cable will be subject to forced bending, always use robot cable.*

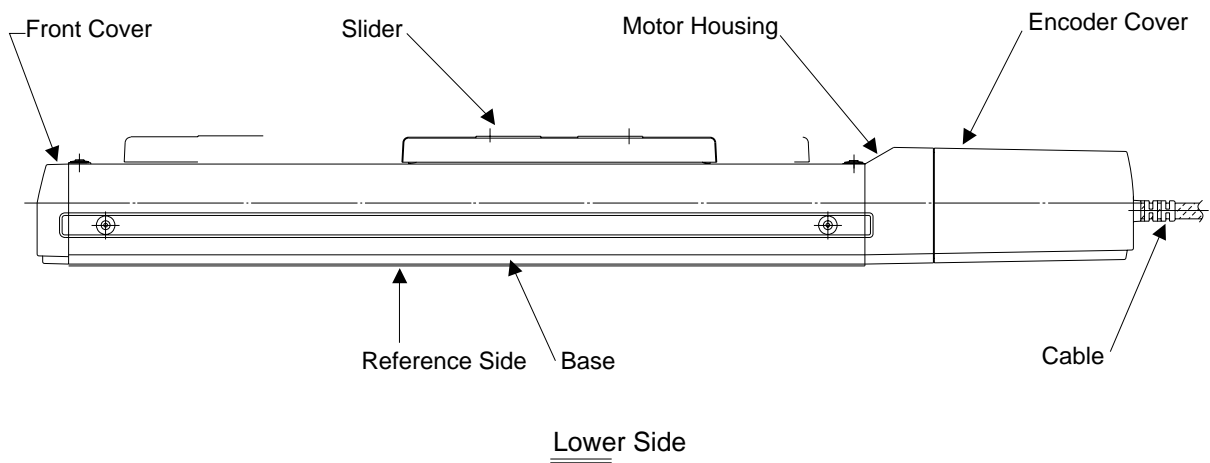
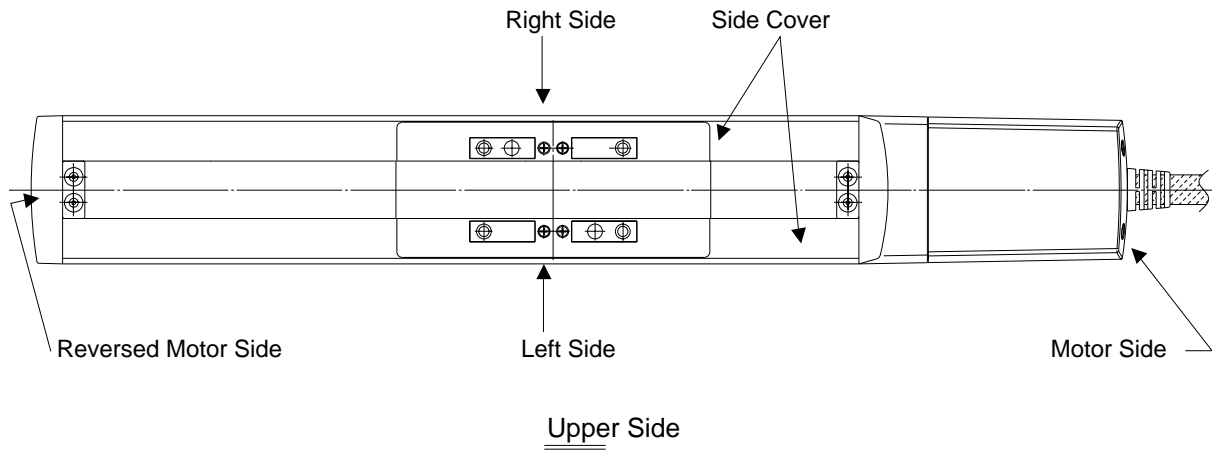


*When to use Robot Cable

When assembling two or three axes and connecting cable to the moving parts, bending weight will be repeatedly applied to the base of the cable. In this case, the cable core is very likely to snap. To prevent this from happening, we strongly recommend the use of robot cable which has greatly improved capacity to withstand bending.

4. Name of the Parts

The name 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.



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5. Transporting and Handling

5.1 Handling the Packed Unit

Unless there are special instructions, the actuator is shipped with each axis packed separately. 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 himself.
- ♦ 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.

5.2 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, motor housing and the motor end cap. Do not carry by the cable.
- ♦ Do not exert excessive force on any part of the actuator. Take particular care with the screw cover and cable.

* Please refer to Section 3 above for the names of the actuator parts.

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 using in cutting.
- ♦ The unit should not be subject to vibrations greater than 0.3G.
- ♦ Avoid extreme electromagnetic waves, ultraviolet rays and radiation.

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

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 packing 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

We'll describe the installation process using a single axis unit.

There are tapped holes for mounting on the back side of the actuator. The tap effective length for base mounting is indicated in the table below. Please make sure that the bolt tip does not overhang.

	Tap Effective Length
SS Small Type	8mm
SS Medium Type	10mm

7.1 Attaching the Slider Carrying the Payload

- 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 0.05mm.
- Provide enough space around the actuator to permit maintenance work to be done.
- The slider travelling plane is the reference plane for the actuator base and the lower surface. When travelling precision is required, use this as the reference plane for mounting.

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 0.05mm.
- Provide enough space around the actuator to permit maintenance work to be done.
- The slider travelling plane is the reference plane for the actuator base and the lower surface. When travelling precision is required, use this as the reference plane for mounting.

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7.3 Clamp Screws

- The screws for mounting the base should be M5 for SS-Small (S) Type, and M8 for the SS-Medium (M) Type (use hexagon sockets).
- For the bolts, we recommend high strength bolts of ISO- 10.9 or higher.
- Make sure the bolt and screw engagement length is the following value or greater:
 - Steel screw → same length as the nominal diameter
 - Aluminum screw → twice as long as the nominal diameter
- When attaching the base 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 to the diagram below.

Screw Nominal Diameter	Clamping Torque	
	When the rod surface is steel	When the rod surface is aluminum
M5	7.7N • m (0.77kgf • m)	4.4N • m (0.44kgf • m)
M6	31.9 • m (31.9kgf • m)	14.3N • m (1.43kgf • m)

8. Connecting the Controller

We will explain the controller wiring for a single axis actuator.

8.1 Standard Wiring Specifications

For a single axis actuator, unless otherwise specified we attach a standard 3 meter cable (5 meter option) to the actuator when we ship the unit. Please attach the cable end directly to the controller.

- Although we use cable that is resistant to bending fatigue, it is not robot cable. Please avoid housing the cable in a wire duct with a small bending radius.
- In an application where the cable cannot be anchored, try to place the cable where it will sag only under its own weight or use dedicated cable hose for large radius wire duct to limit the load on the cable.
- Do not cut the cable to lengthen, shorten, or reconnect it.
- Do not pull on the cable or use excessive force to bend it.

If you wish to alter the cable, please consult with IAI before doing so.

9. 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. The body of the base warps easily when you use the actuator with the Y-axis overhanging. Please use the actuator so that the Ma and Mc moments are less than 1/2 of the rated value.

10. Setting Home Position

10.1 Principle of the Homing Operation

IA performs homing in the following manner.

- ① The moving direction is determined by the parameters set by the homing command.
- ② The software senses the mechanical end in the homing operation.
- ③ The slider reverses direction when this end is reached and the place where the Z phase signal is detected becomes the reference point.
- ④ The slider travels further by an offset amount defined by the parameters and this position becomes home.

10.2 Fine Control of Home Position

The number of motor revolutions from the time the slider hits the stopper to when the Z phase signal is generated is adjusted when the unit is shipped. The standard value of the backing distance when the slider hits the stopper, reverses and then stops at the home position:

Machine Type	Reverse distance from mechanical end (~mm)
SS Small Type	5
SS Medium Type	5

As long as the homing direction is the same, you can make fine adjustments to the home position for each actuator by changing the parameters based on this value. Adjustments are made as follows:

- ① Initiate the homing operation and confirm home.
- ② After that, move to the desired home position, check the difference and adjust the parameters.
You can reset the parameters on the plus side in the advancing direction (minus direction is not allowed).
- ③ If you allow for ample offset amount the movement range is that much more limited. If the offset is greater than 1mm, you will have to reset the stroke soft limit.

10.3 Changing Home Direction

If you change the home direction after the unit is delivered, the move direction parameter must be changed and you may need to adjust the encoder Z-phase so please contact IAI.

- ① Use the standard value set at the time of shipment for the home offset amount.
- ② Initiate the homing operation.
- ③ As described in the preceding section, check to see that the home position is within 5mm from the end.
- ④ If the ball screw lead differs by more than 1/4 cycle, loosen the ball screw feed nut and remove it from the slider, rotate the nut by that amount and then reattach it.
- ⑤ Perform the homing operation, then recheck the offset amount.
- ⑥ If necessary, use the parameters to fine tune the offset.

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11. Maintenance

11.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

Maintenance Checkpoints

	Visual inspection	Check for loose dust shield	Check interior	Lubrication
Start of operation	○			
After 1 month of operation	○	○		
After 6 months of operation	○	○	○	
After 1 year of operation	○	○	○	○
Seminually thereafter	○	○		
Annually thereafter	○	○	○	○

Note 1: The above schedule assumes running time is 8 hours per day. When running time is high such as continuous day and night operation, shorten the maintenance intervals as required.

Note 2: The end cover supports the ball screw so please do not remove it. Do not remove the encoder cover as this contains precision equipment

11.2 Visual Inspection of the Machine Exterior

Check the following when doing the visual inspection.

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

11.3 Cleaning the Exterior

- ① Wipe off dirt with a soft cloth.
- ② Wipe the dust shield gently so that it does not bend.
- ③ Do not use strong compressed air on the actuator as this may force dust into the crevices.
- ④ Do not use petroleum-based solvents on plastic parts or painted surfaces.
- ⑤ If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth and wipe lightly.

11.4 Lubricating the Guide Bearing Block

11.4-1 What Grease to Use

Use lithium grease no.2. When we ship the unit, we use the following grease.

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

11.4-2 How to Lubricate

There are four grease nipples on the slider.

- Remove the screw cover. (Use a 1.5mm hexagonal wrench for the SS Small type, and a 2.0mm wrench for the SS Medium type.
- Squirt the grease in from the grease nipple using a grease gun.
- Repeat for the grease hole on the other side.
- Move the slider back and forth several times by hand.
- Repeat lubrication one more time.
- Wipe off the excess grease.

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11.5 Lubricating the Ball Screw

11.5-1 Ball Screw Grease

When we ship the units, we use the following grease which is specifically for ball screws.

Kyodo Yushi Ball temp LRL3

This product is well suited for ball screws and has excellent properties such as low heat generation. We recommend it when doing maintenance work but for consistency it is all right to use the same grease used for the guide. There is no problem using the two together since both are lithium type grease.

!!WARNING!!

Never use any fluorine based grease. When mixed with a lithium based grease, not only does the grease lose its performance but it can actually damage the actuator.

11.5-2 Lubrication

Clean the screw, then apply grease with your finger and spread it out by moving the slider back and forth. After this, wipe off any excess grease leaking from the nut. Application is done this way because if too much grease is applied, the agitation resistance increases and the ball screw generates heat more easily. Also, when the ball screw rotates, excess grease is splattered on the surrounding areas.

12. Warranty

12.1 Warranty Period

The warranty period is one year after IAI America ships the unit.

12.2 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.
- ♦ 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.

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