



ROBO Cylinder

RCS3 Loadcell-equipped Rod Type Actuator

Instruction Manual

===== **Third Edition** =====

Equipped with Loadcell: RA4R, RA6R, RA7R, RA8R, RA10R, RA15R, RA20R (LCT included in model code)

Conveyor Type (with no loadcell): RA15R, RA20R (LCT not included in model code)

Please Read Before Use

Thank you for purchasing our product.

This instruction manual explains the handling methods, structure and maintenance of this product, among others, providing the information you need to know to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.

The DVD that comes with the product contains instruction manuals for IAI products. When using the product, refer to the necessary portions of the applicable instruction manual by printing them out or displaying them on a PC.

After reading the instruction manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when necessary.

[Important]

- This instruction manual is original.
- This product is not to be used for any other purpose from what is noted in this instruction manual. IAI shall not be liable whatsoever for any loss or damage arising from the result of using the product for any other purpose from what is noted in the manual.
- The information contained in this instruction manual is subject to change without notice for the purpose of production improvement.
- If you have any question or finding regarding the information contained in this instruction manual, contact our customer center or our sales office near you.
- Using or copying all or a part of this instruction manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

RC ROBO
CYLINDER

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Safety Guide

“Safety Guide” has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	<ul style="list-style-type: none"> • This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. <ol style="list-style-type: none"> 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 (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) • Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. • Do not use it in any of the following environments. <ol style="list-style-type: none"> 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact • For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	<ul style="list-style-type: none"> ● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	<ul style="list-style-type: none"> ● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	<p>(1) Installation of Robot Main Body and Controller, etc.</p> <ul style="list-style-type: none"> ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. <ol style="list-style-type: none"> 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	<p>(2) Cable Wiring</p> <ul style="list-style-type: none"> ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire. <p>(3) Grounding</p> <ul style="list-style-type: none"> ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm² (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).





No.	Operation Description	Description
4	Installation and Start	<p>(4) Safety Measures</p> <ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	<ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>

No.	Operation Description	Description
6	Trial Operation	<ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	<ul style="list-style-type: none"> ● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	<ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the instruction manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. <p>Use in incomplete condition may cause damage to the product or an injury.</p> <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>
9	Modification and Dismantle	<ul style="list-style-type: none"> ● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	<ul style="list-style-type: none"> ● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. <p>The product may burst or generate toxic gases.</p>
11	Other	<ul style="list-style-type: none"> ● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the instruction manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

Caution in Handling

1. Make sure to follow the usage condition, environment and specification range of the product.
In case it is not secured, it may cause a drop in performance or malfunction of the product.
2. Do not attempt to have any handling or operation that is not stated in this Instruction manual.
3. It is recommended to apply our products for the wiring between the actuator and the controller.
4. Do not attempt to establish the settings for the speed and acceleration/deceleration above the allowable range.
An operation with speed and acceleration/deceleration beyond the allowable range may cause an abnormal noise, vibration, malfunction or shortened life.
5. Do not attempt to apply the radial load and the moment load when the actuator is equipped with a loadcell.
Load applied to the direction of rod axis center should only be accepted.
6. The allowable load applied on the end of the rod on the transportation type should be below the allowable range.
Operation with load more than the allowable load on the rod end may cause abnormal noise, vibration and malfunction, which could end up with shortened product life.
7. The load offset distance of the transportation type should be below the allowable range.
Attaching a load with an load offset distance above the allowable range may cause vibration and abnormal noise.
8. If back and forth operations are performed repeatedly in short distance, it may wear out the film of grease.
Continuous back and forth operation within a distance less than 30mm may cause wear of grease. As a reference, have approximately 5 cycles of back and forth operation in a distance more than 50mm in every 5,000 to 10,000 cycles to regenerate the oil film. Keep using the actuator with the grease worn out may cause malfunction. If it is extreme, flaking may occur on the guide or ball screw.
9. Do not attempt to hit the rod to an obstacle in high speed (more than 10mm/s).
It may destroy the actuators.
10. Pressurizing operation speed can be raised up to 50mm/s for actuators equipped with loadcell, however, make sure to conduct searching operation in the pressing program. Be careful of pressurizing operation speed setting as it may increase the overshoot of the load if the pressurizing operation speed is set to a value higher than 10mm/s when "Velocity Control" is used in the pressing program for RA15R and RA20R.
11. Actuators equipped with the loadcell cannot perform force control in the pulling direction.
It performs only in the pressing direction.

12. The duration till pressing complete may become long for actuators equipped with the loadcell.
13. The measurement accuracy of the loadcell in the force control is the repeatability in unit and accuracy to detect the load, and not that which guarantees the accuracy of the absolute values.
14. Make sure to attach the actuator properly by following this instruction manual.
Using the product with the actuator not being certainly retained or affixed may cause abnormal noise, vibration, malfunction or shorten the product life.
15. The minimum velocity available for setting in the pressing program in the servo pressing should be 1mm/s.
Do not attempt to set a value smaller than 1mm/s.

International Standards Compliances

This actuator complies with the following overseas standard.
Refer to Overseas Standard Compliance Manual (ME0287) for more detailed information.

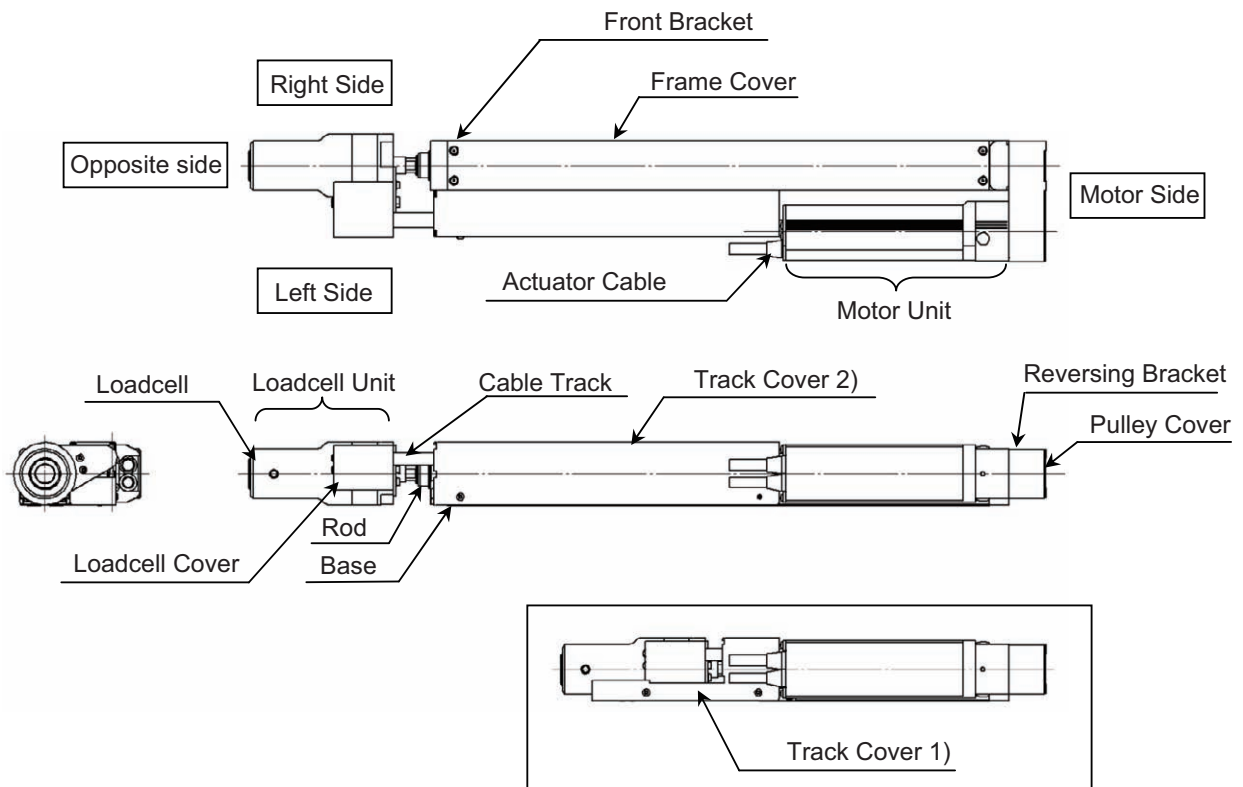
RoHS Directive	CE Marking
○	○ ^(Note1)

(Note 1) RA4R is applicable for option.

Names of the Parts

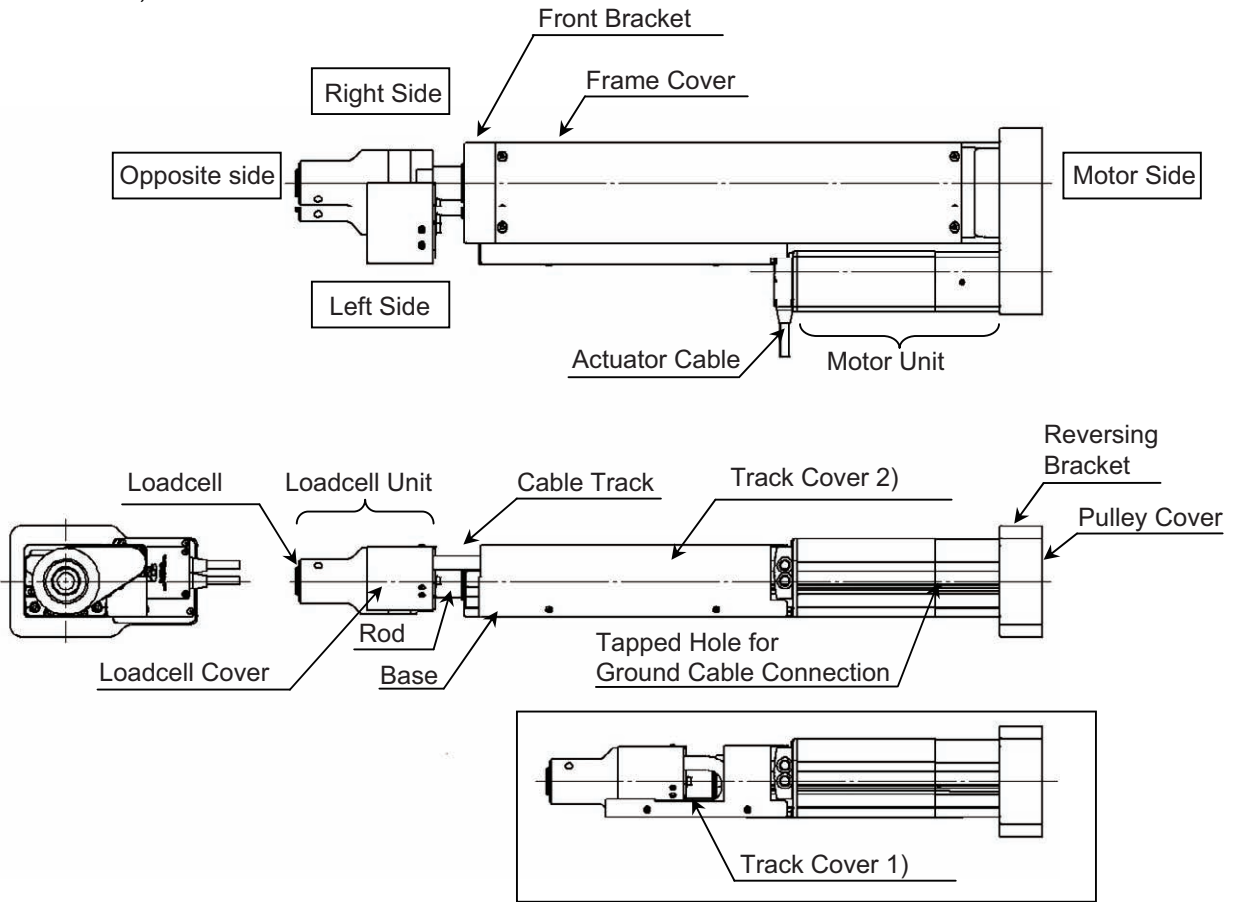
In this Instruction Manual, the left and right sides are indicated by looking at the actuator from the motor end, with the actuator placed horizontally, as shown in the figure below.

1. RA4R



Type	Stroke [mm]	
	Track Cover 1)	Track Cover 2)
RA4R	110 to 310	360 to 410

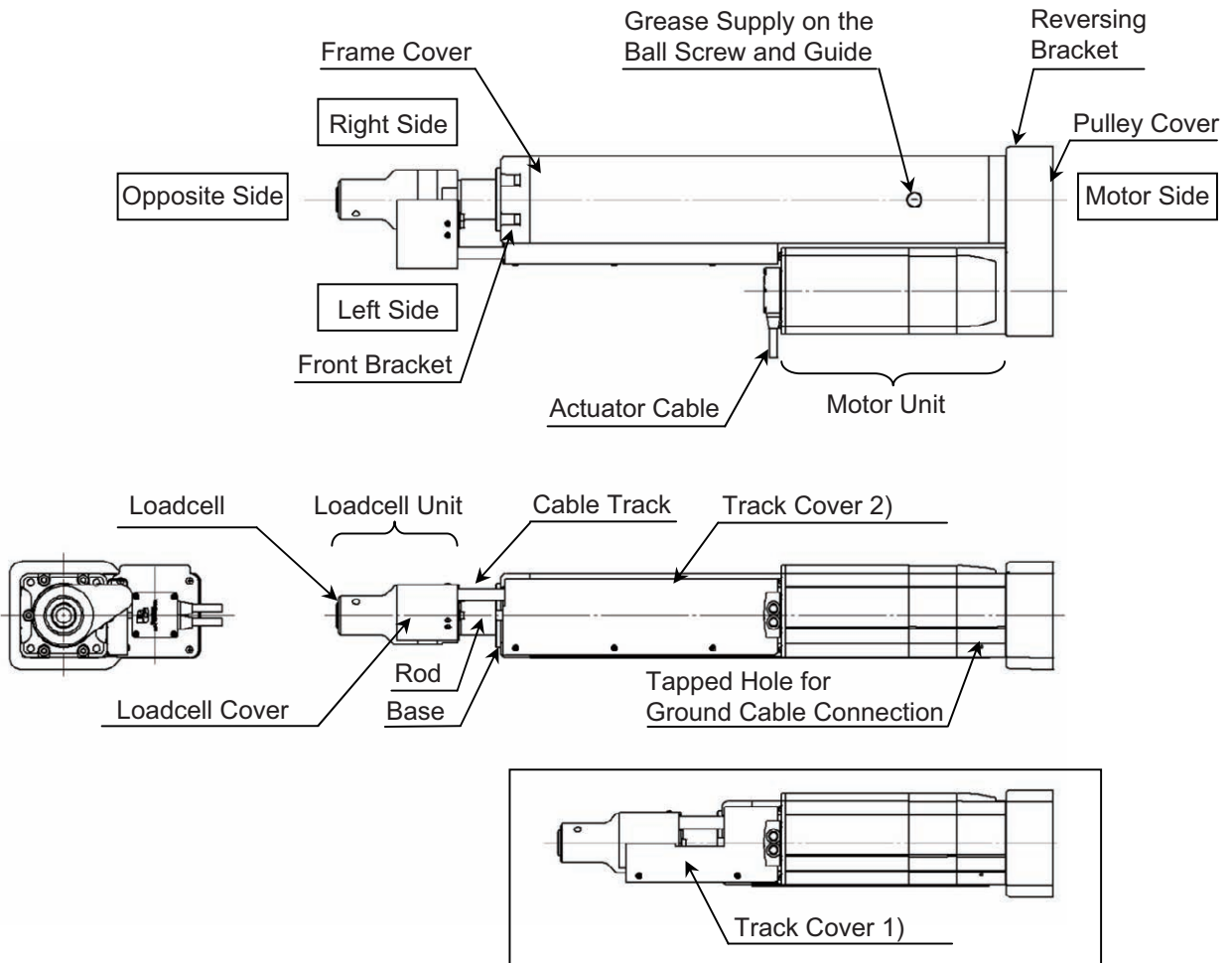
2. RA6R, RA7R



(Note) The profile of the track cover differs depending on the stroke.

Type	Stroke [mm]	
	Track Cover 1)	Track Cover 2)
RA6R	115 to 265	315 to 415
RA7R	120 to 270	320 to 520

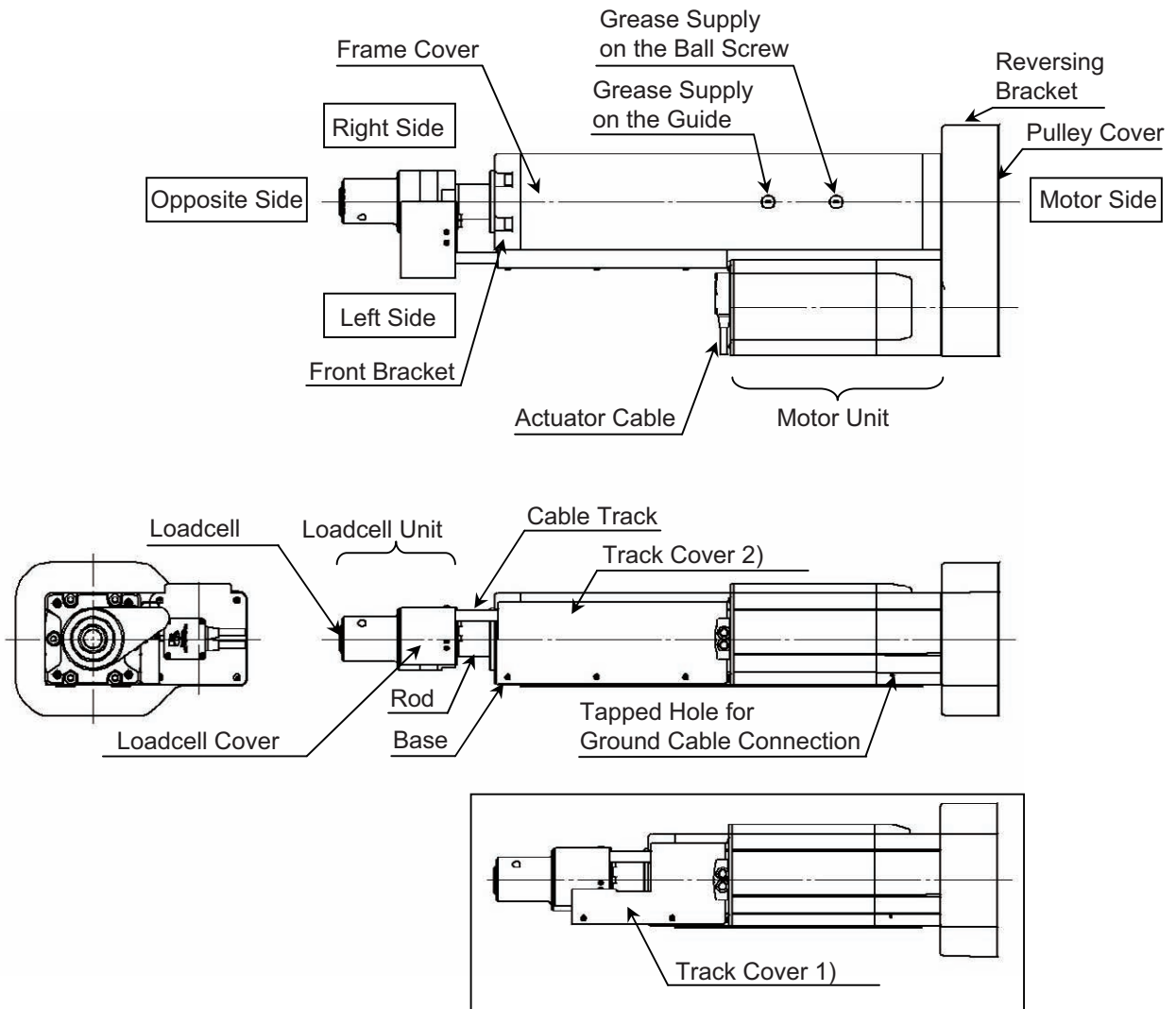
3. RA8R



(Note) The profile of the track cover differs depending on the stroke.

Type	Stroke [mm]	
	Track Cover 1)	Track Cover 2)
RA8R	100 to 250	300 to 500

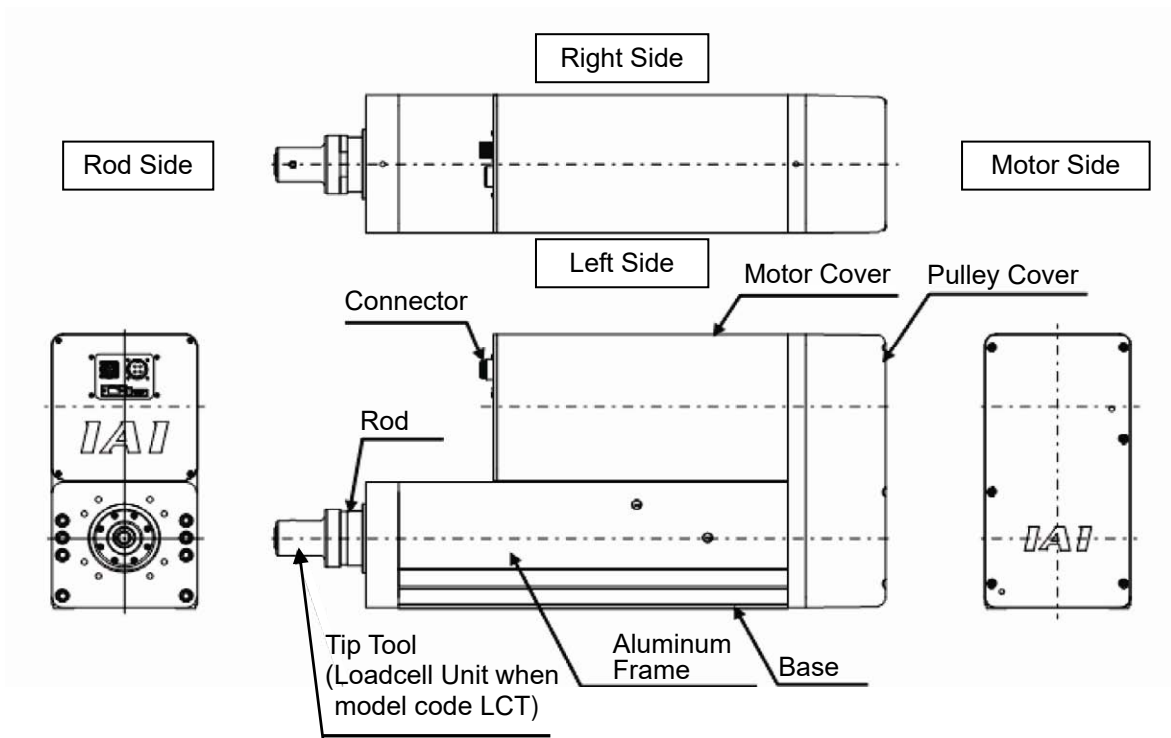
4. RA10R



(Note) The profile of the track cover differs depending on the stroke.

Type	Stroke [mm]	
	Track Cover 1)	Track Cover 2)
RA10R	100 to 200	250 to 500

5. RA15R, RA20R



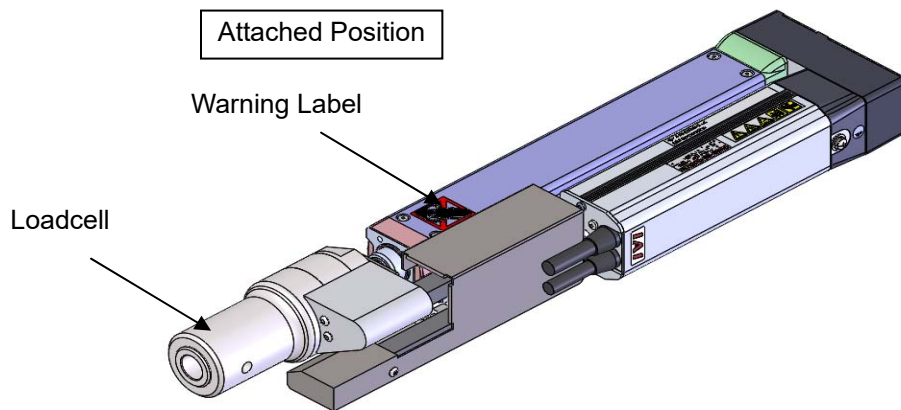
Warning Label

Warning label as shown below is attached on the main body of RCS3-RA4R. Please follow the description on the label in order to use the product safely.

[Warning Label: Do not attempt to apply impact on loadcell]



Please do not attempt to apply impact or crash on the loadcell.
The Loadcell of 200N (RCS3-RA4R) could break down with impact or crash.



1. Specifications Check

1.1 Checking the Product

The standard configuration of this product is comprised of the following parts.
See the component list for the details of the enclosed components. If you find any fault or missing parts, contact your local IAI distributor.

1.1.1 Parts

No.	Name	Model Number	Quantity	Remarks
1	Actuator	Refer to "How to Read the Model Nameplate" and "How to Read the Model Number."	1	
Accessories				
2	Motor • Encoder Cables ^(Note1)		1	
3	First Step Guide		1	
4	Instruction Manual (DVD)		1	
5	Safety Guide		1	

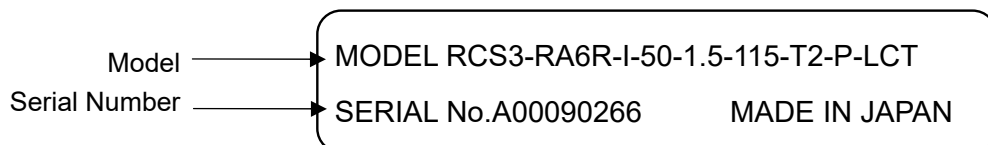
Note1 The motor • encoder cables supplied vary depending on the controller used.
[Refer to 1.5, "Motor • Encoder Cables."]

1.1.2 Related Instruction Manuals for the Each Controller Supported by This Product

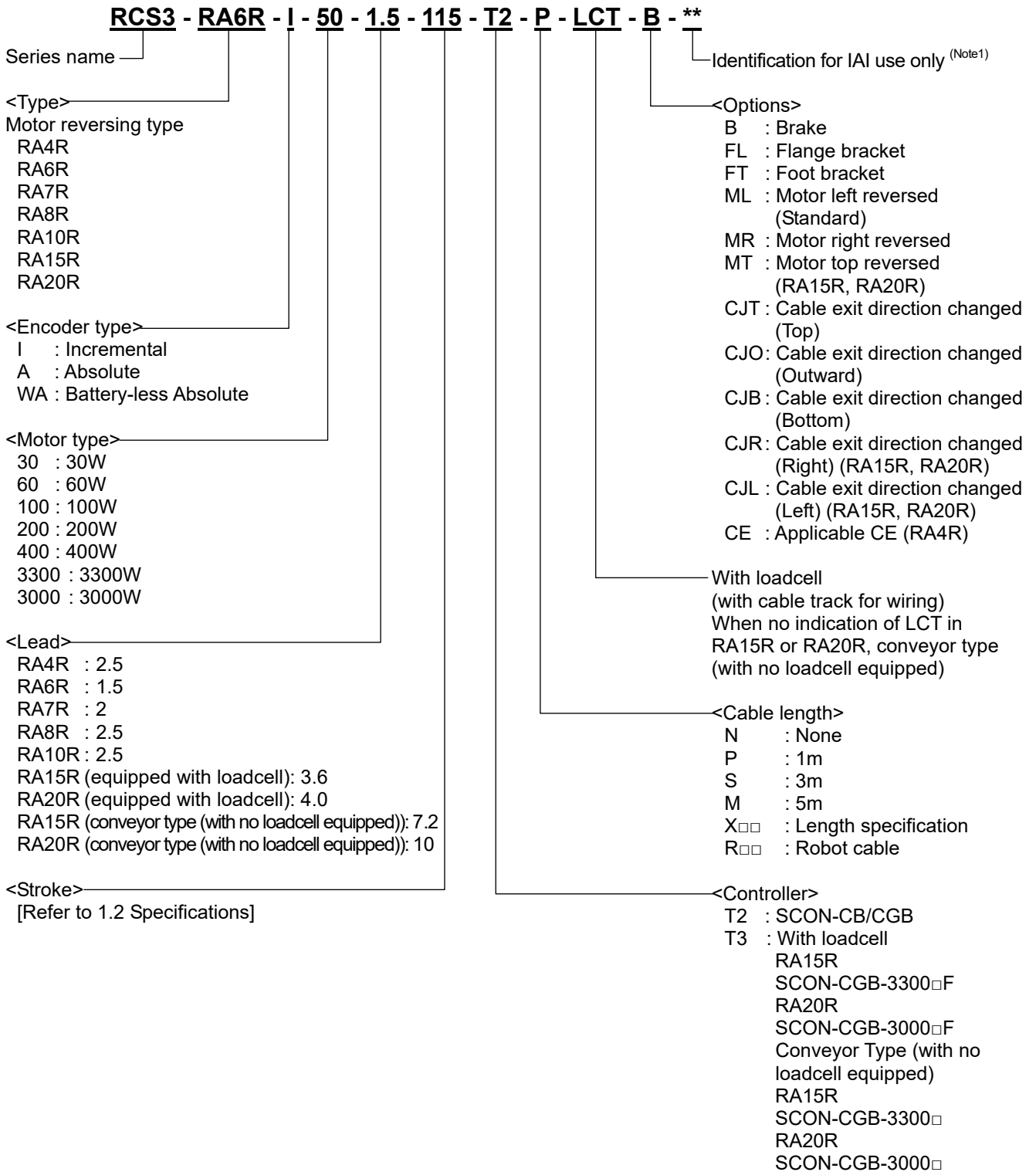
Shown below is a list of the instruction manuals for the controllers related to this product which is recorded in Instruction Manual (DVD).

No.	Name	Control No.
1	Instruction Manual for SCON-CB Controller	ME0340
2	Instruction Manual for RC PC Software RCM-101-MW/RCM-101-USB	ME0155
3	Instruction Manual for Touch Panel Teaching Pendant CON-PTA/PDA/PGA	ME0295
4	Instruction Manual for Touch Panel Teaching Pendant TB-01/01D/01DR Applicable for Position Controller	ME0324

1.1.3 How to Read the Model Nameplate



1.1.4 How to Read the Model Number



Note 1 Identification for IAI use only: It may be displayed for IAI use. It is not a code to show the model type.

1.2 Specifications

1.2.1 Speed

Speed limits [Unit: mm/s]

Size	Motor Type	Lead [mm]	Horizontal/ Vertical	Stroke [mm]									
				110	160	210	260	310	360	410	-	-	
RA4R	30W	2.5	Horizontal	125								-	-
			Vertical	125								-	-
RA6R	60W	1.5	Horizontal	75								-	-
			Vertical	75								-	-
				120	170	220	270	320	370	420	470	520	
RA7R	100W	2	Horizontal	100									
			Vertical	100									
				100	150	200	250	300	350	400	450	500	
RA8R	200W	2.5	Horizontal	125									
			Vertical	125									
				100	150	200	250	300	350	400	450	500	
RA10R	400W	2.5	Horizontal	125									
			Vertical	125									

[Equipped with Loadcell]

Size	Motor Type	Lead [mm]	Horizontal/ Vertical	Stroke [mm]									
				100		200		300		400		500	
RA15R	3300W	3.6	Horizontal	240									
			Vertical	240									
				100		200		300		400		500	
RA20R	3000W	4.0	Horizontal	220									
			Vertical	220									

[Conveyor Type (with no loadcell equipped)]

Size	Motor Type	Lead [mm]	Horizontal/ Vertical	Stroke [mm]				
				100	200	300	400	500
RA15R	3300W	7.2	Horizontal	400				
			Vertical	400				
				100	200	300	400	500
RA20R	3000W	10	Horizontal	400				
			Vertical	400				

1.2.2 Payload

Type	Motor Type	Lead [mm]	Horizontal / Vertical	Payload [kg]	
				Acceleration	RA4R : 0.5G RA6R, RA7R : 0.3G RA8R, RA10R : 0.2G
RA4R	30W	2.5	Horizontal	3	
			Vertical	3	
RA6R	60W	1.5	Horizontal	10	
			Vertical	10	
RA7R	100W	2	Horizontal	10	
			Vertical	10	
RA8R	200W	2.5	Horizontal	10	
			Vertical	10	
RA10R	400W	2.5	Horizontal	15	
			Vertical	15	

[Equipped with Loadcell (New Type): Battery-less Absolute Type]

Type	Motor Type	Lead [mm]	Horizontal / Vertical	Payload [kg]	
				Acceleration	RA10R : 0.2G RA15R, RA20R: 0.1G
RA15R	3300W	3.6	Horizontal	15	
			Vertical (Note 1)	220	
RA20R	3000W	4.0	Horizontal	15	
			Vertical (Note 1)	220	

Note 1 The workpiece weight should be 15kg or less if it is affixed with only the screw at the center hole.

[Equipped with Loadcell (Old Type)]

Type	Motor Type	Lead [mm]	Horizontal / Vertical	Payload [kg]	
				Acceleration	RA10R : 0.2G RA15R, RA20R: 0.1G
RA15R	3300W	3.6	Horizontal	15	
			Vertical	15	
RA20R	3000W	4.0	Horizontal	15	
			Vertical	15	

[Conveyor Type (with no loadcell equipped)]

Type	Motor Type	Lead [mm]	Horizontal / Vertical	Payload [kg]	
				Acceleration	RA15R, RA20R: 0.2G
RA15R	3300W	7.2	Horizontal	700	
			Vertical	400	
RA20R	3000W	10	Horizontal	1000	
			Vertical	600	



Caution: Do not attempt to establish the settings for the acceleration/deceleration above the allowable range. It may cause vibration, malfunction or shortened life. Setting of acceleration/deceleration above the ratings may cause creeping or slippage of the coupling.

1.2.3 Driving System • Position Detector

Type	Motor Type	Lead [mm]	No. of Encoder Pulses	Ball Screw Type		
				Type	Diameter	Accuracy
RA4R	30W	2.5	16384	Rolled	φ8mm	C10
RA6R	60W	1.5		Rolled	φ10mm	C10
RA7R	100W	2.0		Rolled	φ12mm	C10
RA8R	200W	2.5		Rolled	φ16mm	C10
RA10R	400W	2.5		Rolled	φ20mm	C10

[Equipped with Loadcell]

Type	Motor Type	Lead [mm]	No. of Encoder Pulses	Ball Screw Type		
				Type	Diameter	Accuracy
RA15R	3300W	3.6	16384	Grinded	φ36mm	C10
RA20R	3000W	4.0		Grinded	φ40mm	C10

[Conveyor Type (with no loadcell equipped)]

Type	Motor Type	Lead [mm]	No. of Encoder Pulses	Ball Screw Type		
				Type	Diameter	Accuracy
RA15R	3300W	7.2	16384	Grinded	φ36mm	C10
RA20R	3000W	10.0		Grinded	φ40mm	C10

1.2.4 Positioning Precision

Type	Lead [mm]	Item	Tolerance
RA4R	2.5	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less
RA6R	1.5	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less
RA7R	2.0	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less
RA8R	2.5	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less
RA10R	2.5	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less

This is an option already attached when it is shipped out from the factory. It does not include the consideration of time-dependent change as it is used.

[Equipped with Loadcell]

Type	Lead [mm]	Item	Tolerance
RA15R	3.6	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less
RA20R	4.0	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less

This is an option already attached when it is shipped out from the factory. It does not include the consideration of time-dependent change as it is used.

[Conveyor Type (with no loadcell equipped)]

Type	Lead [mm]	Item	Tolerance
RA15R	7.2	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less
RA20R	10.0	Positioning repeatability	±0.01mm
		Lost motion	0.1mm or less

This is an option already attached when it is shipped out from the factory. It does not include the consideration of time-dependent change as it is used.

1.2.5 Loadcell

Tolerance	RA4R	RA6R	RA7R	RA8R
Loadcell System	Strain Gauge			
Rated Capacity [N (kgf)]	200 (20.4)	600 (61)	2000 (204)	2000 (204)
Allowable Overload [%R.C]	200			
Loadcell Total Accuracy [%R.C] <small>(Note 1)</small>	±1			
Dielectric Strength Voltage [V]	DC50V			

Tolerance	RA10R	RA15R	RA20R
Loadcell System	Strain Gauge		
Rated Capacity [N (kgf)]	6000 (612)	50000 (5102)	50000 (5102)
Allowable Overload [%R.C]	200		
Loadcell Total Accuracy [%R.C] <small>(Note 1)</small>	±1		
Dielectric Strength Voltage [V]	DC50V		

* R.C: Rated Capacity

Note 1 The accuracy may become wider than stated due to conditions (stiffness, profile, etc.) of the installed environment, work piece, pressed object and so on.

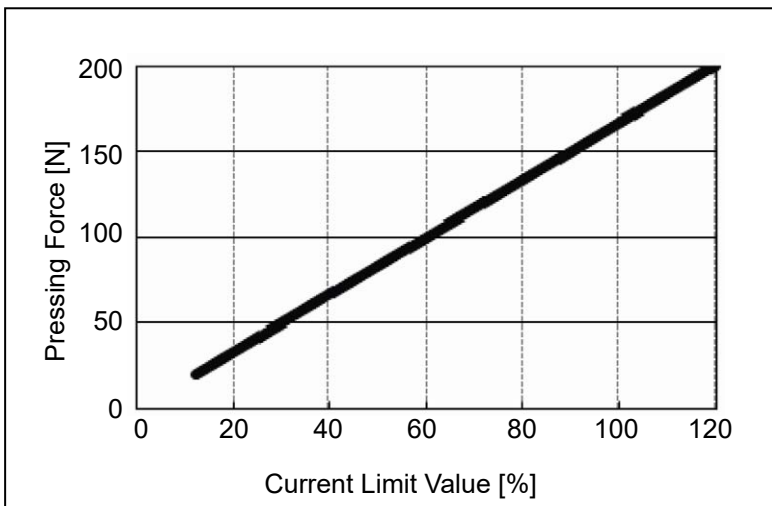
(Note) The frequency of calibration for loadcell differs depending on the condition of use (such as frequency of pressing operation, pressing force, ambient temperature and so on). Please contact IAI for the frequency reference of calibration.
Refer to 5.9 How to Replace Loadcell for how to detach and attach the loadcell when passing to the calibration.

1.2.6 Current Limit Value and Pressing Force

(Note) An actuator equipped with the loadcell is not capable of force control in pulling direction. It performs only in the pressing direction.

[1] RA4R Motor Type 30W Lead 2.5

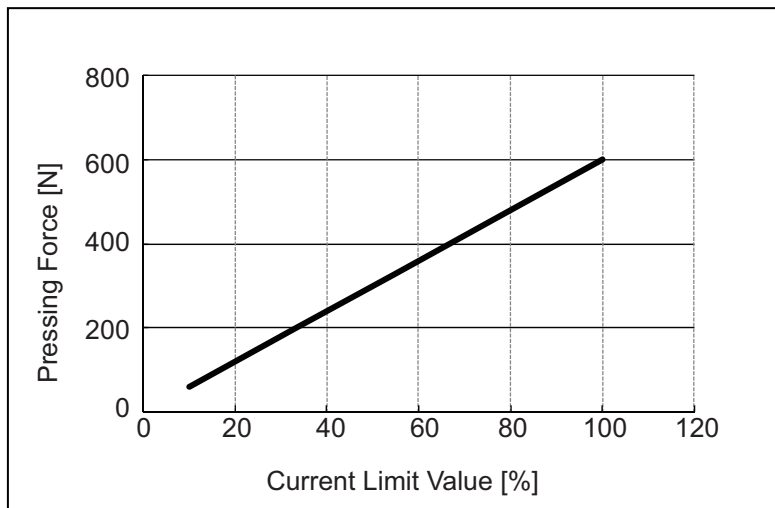
Current Limit Value	Pressing Force [N]
12%	20
20%	33
40%	67
60%	100
80%	133
100%	167
120%	200



- Caution:
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[2] RA6R Motor Type 60W Lead 1.5

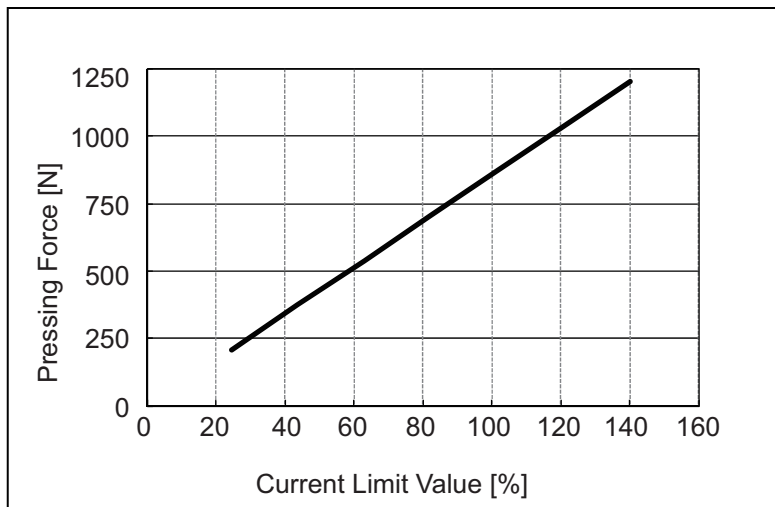
Current Limit Value	Pressing Force [N]
10%	60
20%	120
40%	240
60%	360
80%	480
100%	600



- Caution:
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[3] RA7R Motor Type 100W Lead 2.0

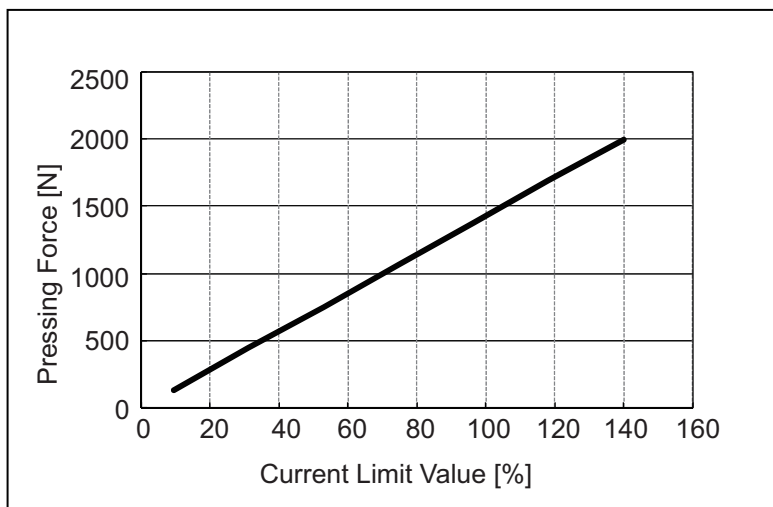
Current Limit Value	Pressing Force [N]
24%	206
40%	343
60%	514
80%	686
100%	857
120%	1029
140%	1200



- ⚠ Caution:**
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[4] RA8R Motor Type 200W Lead 2.5

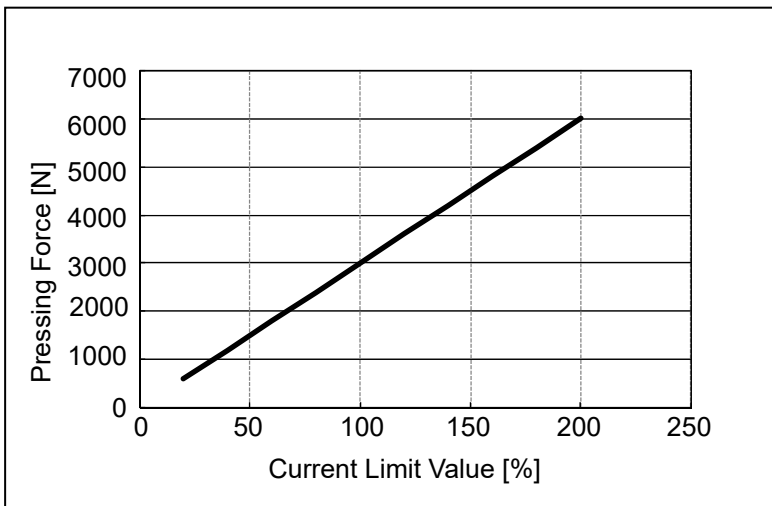
Current Limit Value	Pressing Force [N]
14%	200
20%	286
40%	571
60%	857
80%	1143
100%	1429
120%	1714
140%	2000




- Caution: (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
- (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
- (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
- (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[5] RA10R Motor Type 400W Lead 2.5

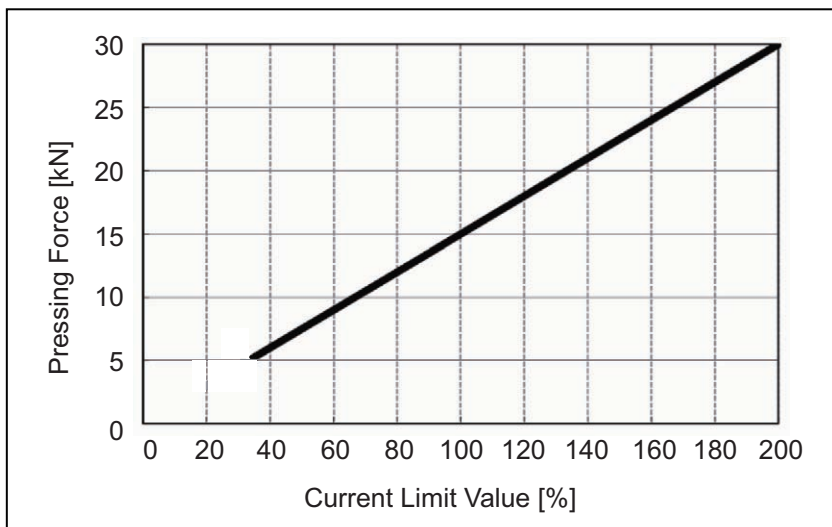
Current Limit Value	Pressing Force [N]
20%	600
40%	1200
60%	1800
80%	2400
100%	3000
120%	3600
140%	4200
160%	4800
180%	5400
200%	6000



-  **Caution:**
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[6] RA15R (Equipped with Loadcell) Motor Type 3300W Lead 3.6

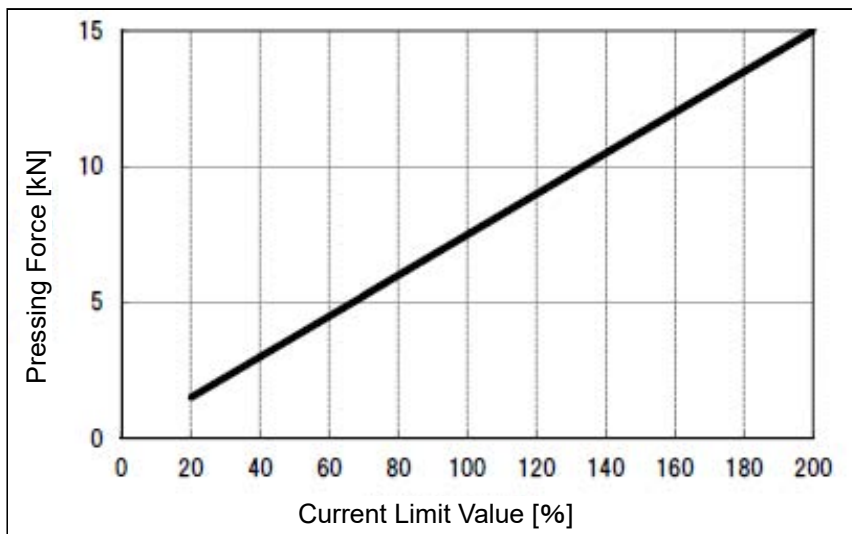
Current Limit Value	Pressing Force [kN]
34%	5.1
40%	6
50%	7.5
60%	9
70%	10.5
90%	13.5
91%	13.65
100%	15
110%	16.5
120%	18
130%	19.5
140%	21
150%	22.5
160%	24
170%	25.5
180%	27
190%	28.5
200%	30



- Caution:**
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[7] RA15R (Conveyor Type (with No Loadcell Equipped)) Motor Type 3300W Lead 7.2

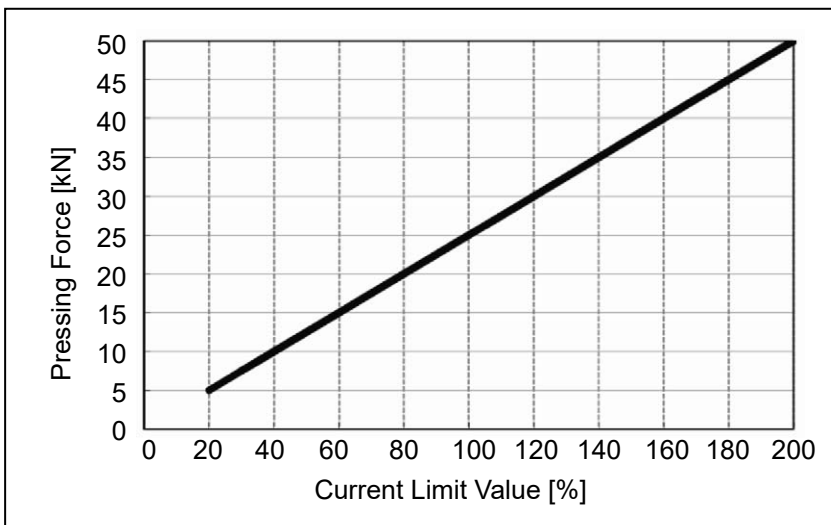
Current Limit Value	Pressing Force [kN]
20%	1.5
70%	5.25
90%	6.75
91%	6.825
100%	7.5
110%	8.25
120%	9
130%	9.75
140%	10.5
150%	11.25
160%	12
170%	12.75
180%	13.5
190%	14.25
200%	15



- ⚠ Caution:**
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[8] RA20R (Equipped with Loadcell) Motor Type 3000W Lead 4.0

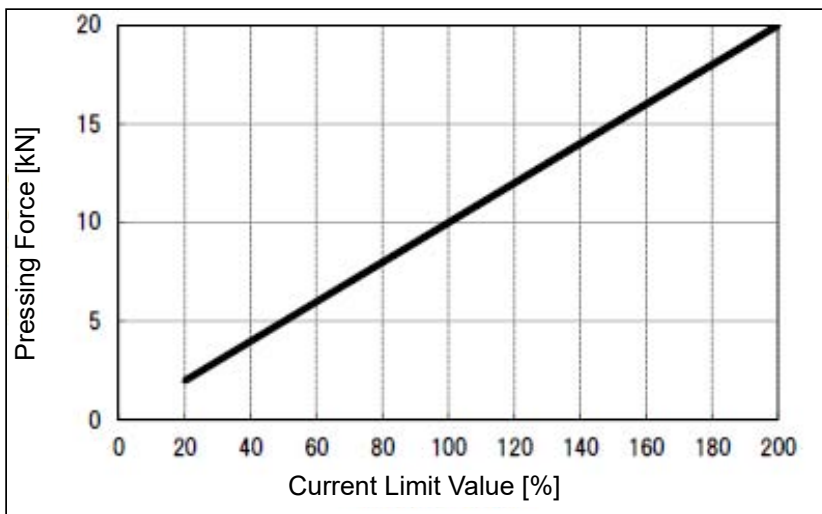
Current Limit Value	Pressing Force [kN]
20%	5
30%	7.5
40%	10
50%	12.5
60%	15
70%	17.5
90%	22.5
91%	22.75
100%	25
110%	27.5
120%	30
130%	32.5
140%	35
150%	37.5
160%	40
170%	42.5
180%	45
190%	47.5
200%	50



- ⚠ Caution:**
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

[9] RA20R (Conveyor Type (with No Loadcell Equipped)) Motor Type 3000W Lead 10.0

Current Limit Value	Pressing Force [kN]
20%	2
70%	7
90%	9
91%	9.1
100%	10
110%	11
120%	12
130%	13
140%	14
150%	15
160%	16
170%	17
180%	18
190%	19
200%	20



- ⚠ Caution:
- (1) The relation of the current limit and the pressing force is a reference when assuming the speed is 10mm/s.
 - (2) Maximum pressing time differs depending on operation. Check the pressing time in 1.3 Operational Condition. Do not conduct pressing longer than the maximum pressing time.
 - (3) Use the product within the range in the graph for the current limit value. Usage above the maximum current limit value shown in the graph is not available. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
 - (4) When the approach speed to the pressing start position (setting in the position table) is 10mm/s or less, pressing will be performed with the approach speed. In such cases, check in advance that the actuator can be used with no problem before omit using.

1.2.7 Rod Non-Rotation Accuracy

RA4R

Item		Stroke						
		110	160	210	260	310	360	410
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0						

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

RA6R

Item		Stroke						
		115	165	215	265	315	365	415
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0						

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

RA7R

Item		Stroke								
		120	170	220	270	320	370	420	470	520
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0								

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

RA8R

Item		Stroke								
		100	150	200	250	300	350	400	450	500
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0								

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

RA10R

Item		Stroke								
		100	150	200	250	300	350	400	450	500
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0								

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

RA15R

Item		Stroke				
		100	200	300	400	500
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0				

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

RA20R

Item		Stroke				
		100	200	300	400	500
Rod Non-Rotation Accuracy <small>(Note 1)</small>	[deg]	0				

(Note 1) It shows the displacement angle in the rod rotational direction at no load.

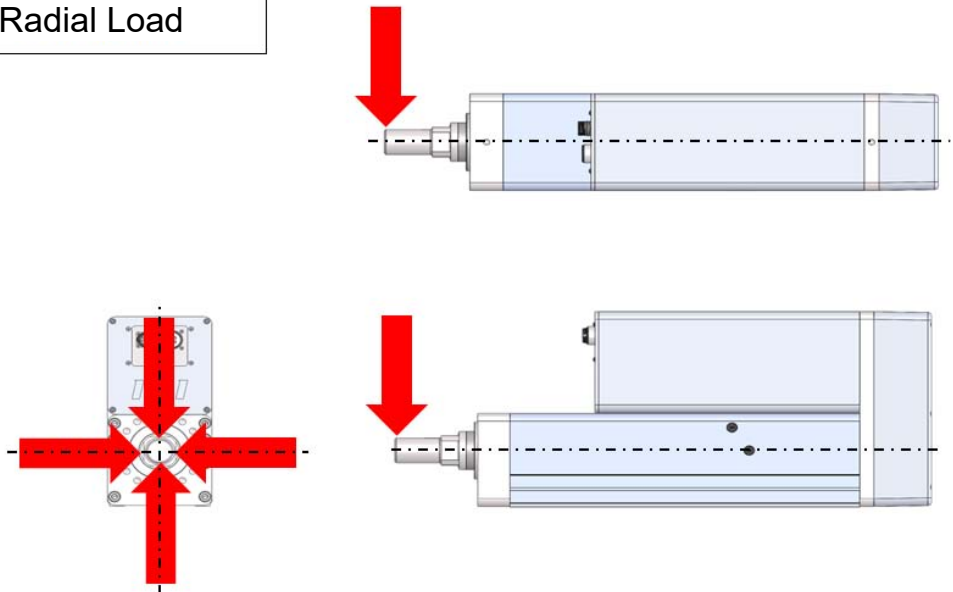
1.2.8 Rod End Allowable Load for RA15R/RA20R (Conveyor Type)

(Note) RCS3-RA15R/RA20R (equipped with the loadcell) cannot accept any radial load or moment load on the loadcell unit.

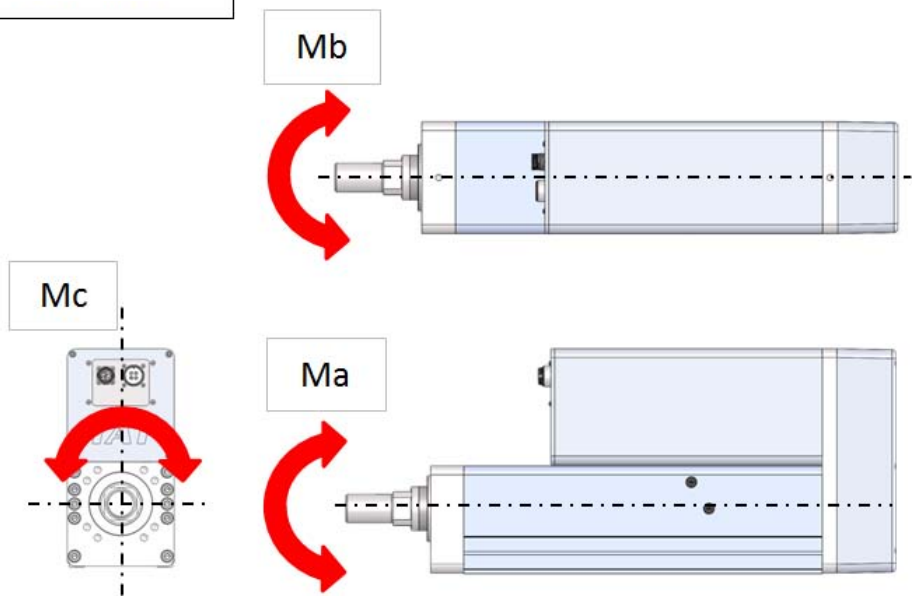
RCS3-RA15R/RA20R are equipped with a built-in linear guide. Therefore, these models are capable for radial load and moment load being applied. However, there is upper limit to the capable load. Make sure to use the product within the range that satisfies the load condition described below.

Applicable load on the rod end with the aid of the built-in linear guide is four types shown below, radial load and moment load in three directions.

Radial Load



Moment Load



It is necessary to satisfy two conditions stated below in order to apply these types of load.
 [Condition 1] Radial load should be at "Allowable Radial Load" (refer to table below) or below
 [Condition 2] The total of applied moment (refer to formula [1]) should be at "Allowable Moment"
 (refer to table below) or below

$$M \geq Ma + Mb + K \times Mc \dots [1]$$

M : Allowable Moment Load (refer to specification table)

Ma : Load Moment (pitching)

Mb : Load Moment (yawing)

Mc : Load Moment (rolling)

K : Equivalent Modulus (RA15R: K=0.36, RA20R: K=0.37)

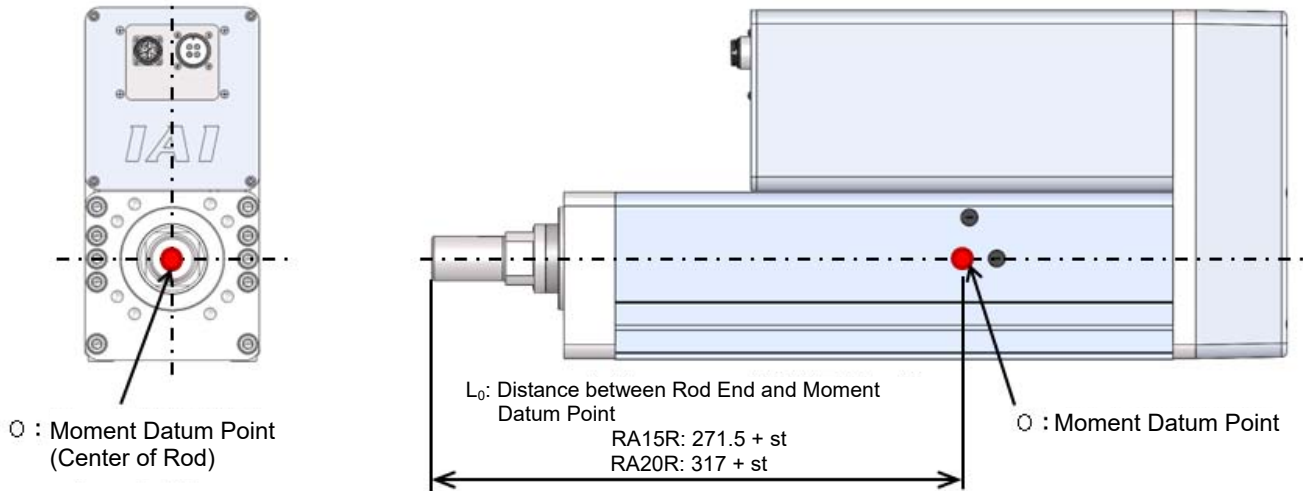
RA15R

Item		Stroke				
		100	200	300	400	500
Allowable Radial Load	N(kgf)	392(40)				
Allowable Moment	N·m	140	135	130	125	120

RA20R

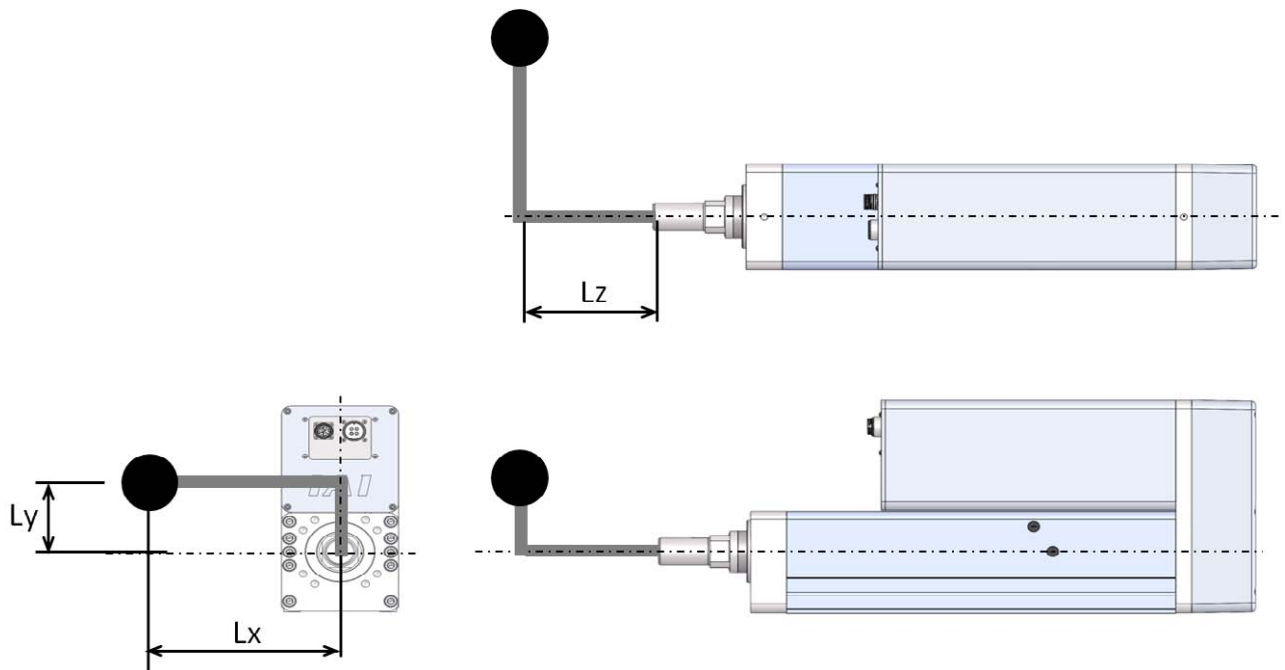
Item		Stroke				
		100	200	300	400	500
Allowable Radial Load	N(kgf)	540(55)				
Allowable Moment	N·m	230	220	210	200	190

[Datum point of moment as shown below]



《Example for Calculation》

Shown below is an example for rod end load calculation.



~ Conditions ~

- Product Type: RCS3-RA15R (300 stroke)
- Installation Posture: Horizontal Installation (Condition of unit being stable)
- Transportable Weight: $m = 15\text{kg}$
- Offset: $Lx = 150\text{mm}$
- Offset: $Ly = 50\text{mm}$
- Offset: $Lz = 100\text{mm}$
- Distance between Rod End and Moment Datum Point: $L0 = 217.5\text{mm} + \text{Stroke } 300\text{mm} = 571.5\text{mm}$
- Acceleration/deceleration speed: $0.2G$
- Equivalent Modulus: $K = 0.36$

[Condition 1] Radial Load $F \leq 392\text{N}$
 $F = mg = 15 \times 9.81 = 147\text{N} \rightarrow \text{OK}$

[Condition 2] Moment $Ma + Mb + K \times Mc \leq 130\text{N}\cdot\text{m}$ (Stroke 300mm)

$$Ma = (Lz + L0) mg + Ly \times m \times 0.2G$$

$$= \{(100 + 571.5)/1000 \times 15 \times 9.8\} + \{50/1000 \times 15 \times 0.2 \times 9.8\} = 100.2\text{N}\cdot\text{m}$$

$$Mb = Lx \times m \times 0.2G = 150/1000 \times 15 \times 0.2 \times 9.8 = 4.4\text{N}\cdot\text{m}$$

$$Mc = Lx \cdot mg = 150/1000 \times 15 \times 9.8 = 22.1\text{N}\cdot\text{m}$$

$$Ma + Mb + K \times Mc = 100.2 + 4.4 + 0.36 \times 22.1 = 112.6\text{N}\cdot\text{m} \rightarrow \text{OK}$$

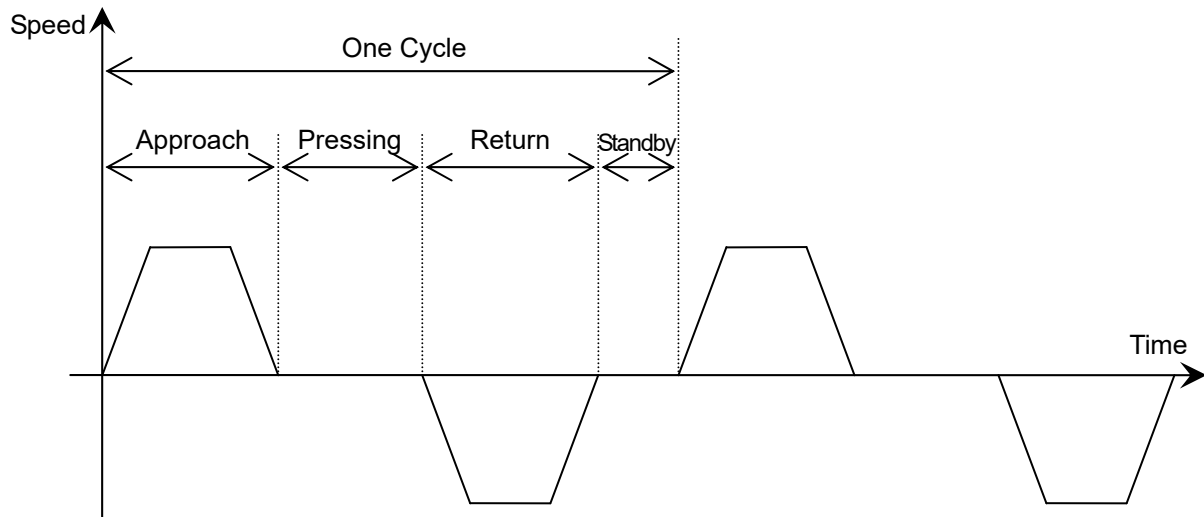
Operation is available as both the conditions 1 and 2 are satisfied.

1.3 Operational Condition

* There is no limit in pressing for RA4R. It is not necessary to check the availability of pressing in operational conditions.

1.3.1 Available Conditions for Operation

Such pattern as shown below is assumed as an operation pattern.



In such operation patterns as when pressing time is long, it may cause heat on the motor, which could cause malfunction of the product. Conduct operation that satisfies all of the conditions below.

- 1) Pressing time should be at the maximum pressing time or below.
[Refer to 1.3.2 Maximum Pressing Time]
- 2) Operation pattern should satisfy the pressing available conditions.
[Refer to 1.3.3 Checking Pressing Available Conditions.]
- 3) Pressing operation in one cycle should be one time.

Regarding 2), it is available to check (1) in graph and (2) by calculation. In a check in the graph, it is available to check the available time for pressing in the worst operational condition. In case any other condition is considered, check by calculation.

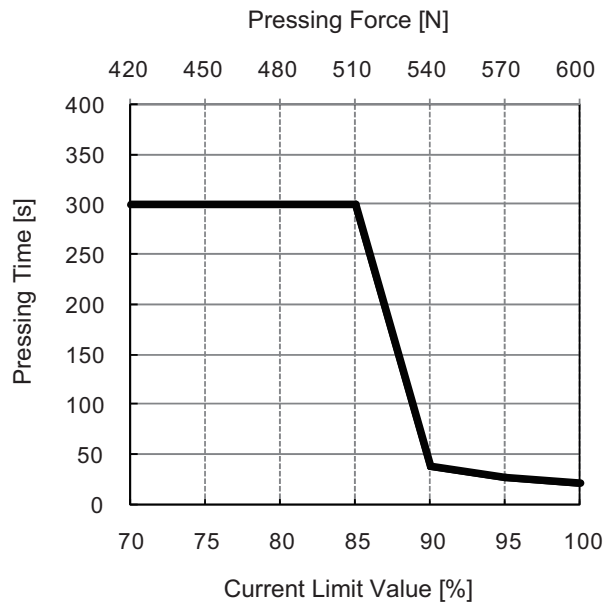
1.3.2 Maximum Pressing Time

* There is no limit in pressing time for RA4R. It is available to have continuous pressing.

The maximum pressing time is as shown below. Continuing pressing for more than this pressing time may cause malfunction.

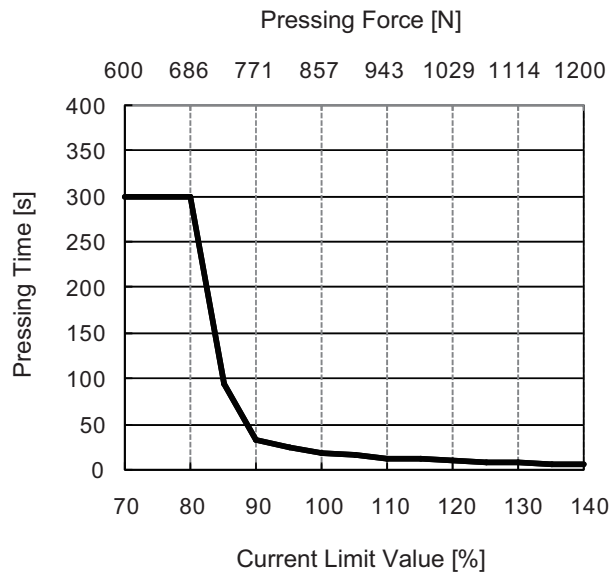
[Maximum Pressing Time of RA6R]

Current Limit Value [%]	Pressing Force [N]	Maximum Pressing Time [s]
70 or less	420 or less	Continuous pressing allowed
85	510	300
90	540	38
95	570	27
100	600	21



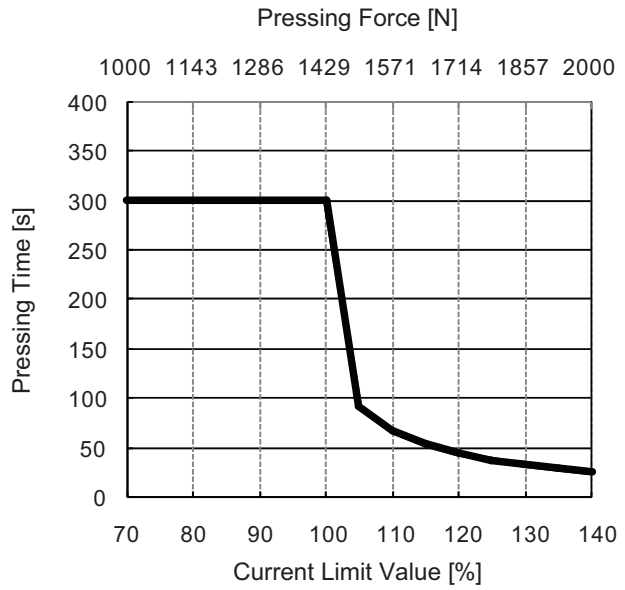
[Maximum Pressing Time of RA7R]

Current Limit Value [%]	Pressing Force [N]	Maximum Pressing Time [s]
70 or less	600 or less	Continuous pressing allowed
80	666	300
85	729	94
90	771	33
95	814	24
100	857	18
105	900	15
110	943	12
115	986	11
120	1029	9
125	1071	8
130	1114	7
135	1157	6
140	1200	5



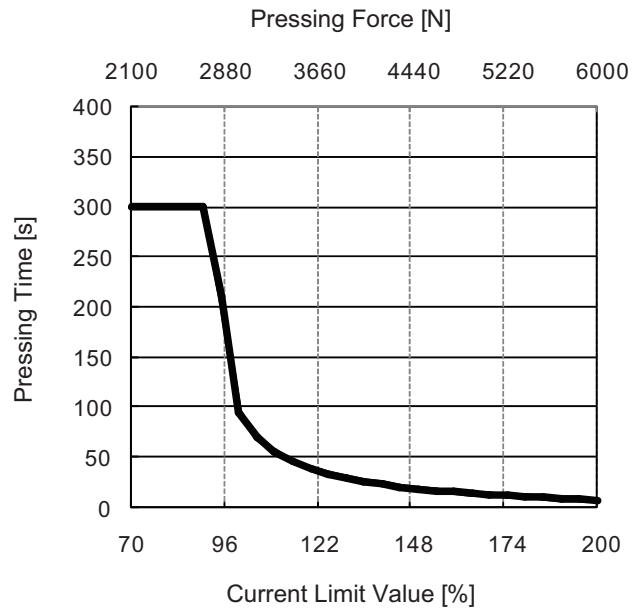
[Maximum Pressing Time of RA8R]

Current Limit Value [%]	Pressing Force [N]	Maximum Pressing Time [s]
70 or less	1000 or less	Continuous pressing allowed
100	1429	300
105	1500	92
110	1571	67
115	1643	54
120	1714	44
125	1786	38
130	1857	33
135	1929	29
140	2000	25



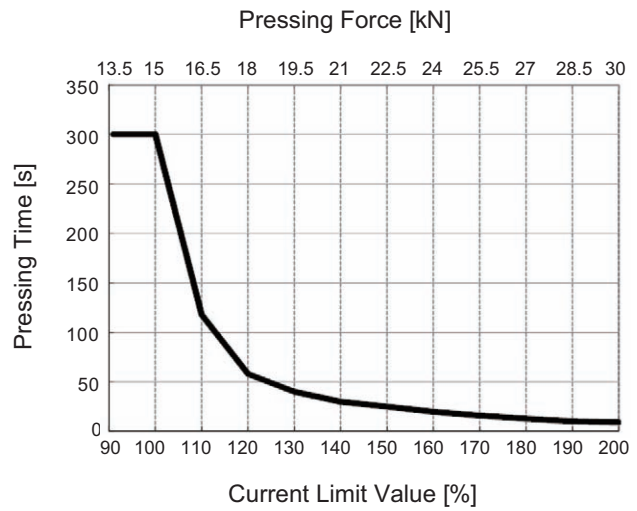
[Maximum Pressing Time of RA10R]

Current Limit Value [%]	Pressing Force [N]	Maximum Pressing Time [s]
70 or less	2100 or less	Continuous pressing allowed
90	2700	300
95	2850	210
100	3000	95
105	3150	70
110	3300	56
115	3450	46
120	3600	39
125	3750	34
130	3900	30
135	4050	26
140	4200	24
145	4350	21
150	4500	19
155	4650	17
160	4800	16
165	4950	14
170	5100	13
175	5250	12
180	5400	11
185	5550	10
190	5700	9
195	5850	9
200	6000	8



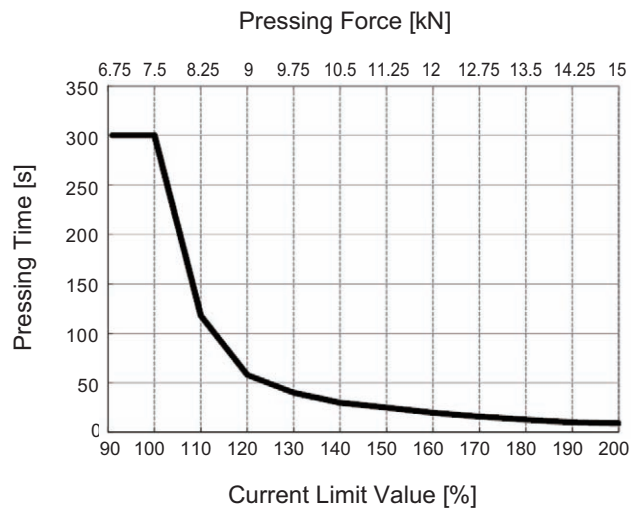
[Maximum Pressing Time of RA15R (Equipped with Loadcell)]

Current Limit Value [%]	Pressing Force [kN]	Maximum Pressing Time [s]
34	5.1	Continuous pressing allowed
90	13.5	Continuous pressing allowed
91	13.65	300
100	15	300
110	16.5	118
120	18	58
130	19.5	40
140	21	30
150	22.5	25
160	24	20
170	25.5	16
180	27	13
190	28.5	10
200	30	9



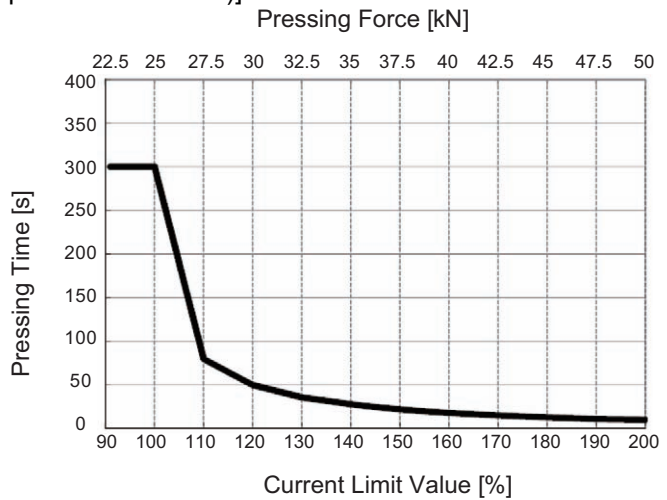
[Maximum Pressing Time of RA15R (Conveyor Type (with no loadcell equipped))]

Current Limit Value [%]	Pressing Force [kN]	Maximum Pressing Time [s]
20	1.5	Continuous pressing allowed
70	5.25	Continuous pressing allowed
90	6.75	Continuous pressing allowed
91	6.825	300
100	7.5	300
110	8.25	118
120	9	58
130	9.75	40
140	10.5	30
150	11.25	25
160	12	20
170	12.75	16
180	13.5	13
190	14.25	10
200	15	9



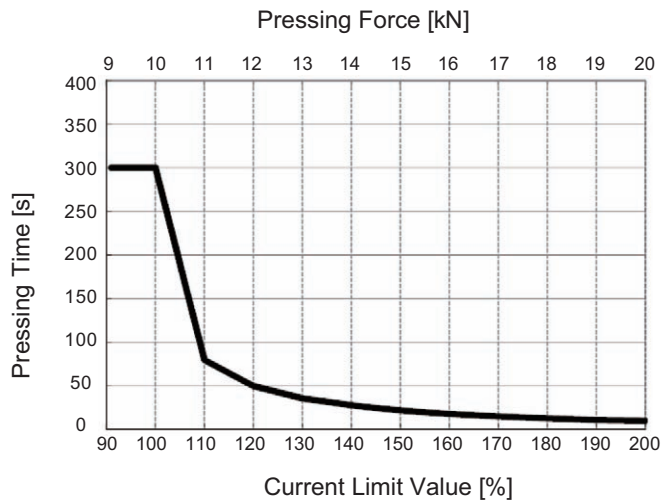
[Maximum Pressing Time of RA20R (Equipped with Loadcell)]

Current Limit Value [%]	Pressing Force [kN]	Maximum Pressing Time [s]
20	5	Continuous pressing allowed
70	17.5	Continuous pressing allowed
90	22.5	Continuous pressing allowed
91	22.75	300
100	25	300
110	27.5	80
120	30	50
130	32.5	36
140	35	28
150	37.5	22
160	40	18
170	42.5	15
180	45	13
190	47.5	11
200	50	10



[Maximum Pressing Time of RA20R (Conveyor Type (with no loadcell equipped))]

Current Limit Value [%]	Pressing Force [kN]	Maximum Pressing Time [s]
20	2	Continuous pressing allowed
70	7	Continuous pressing allowed
90	9	Continuous pressing allowed
91	9.1	300
100	10	300
110	11	80
120	12	50
130	13	36
140	14	28
150	15	22
160	16	18
170	17	15
180	18	13
190	19	11
200	20	10



1.3.3 Checking Available Conditions for Pressing of Actuator Equipped with Loadcell

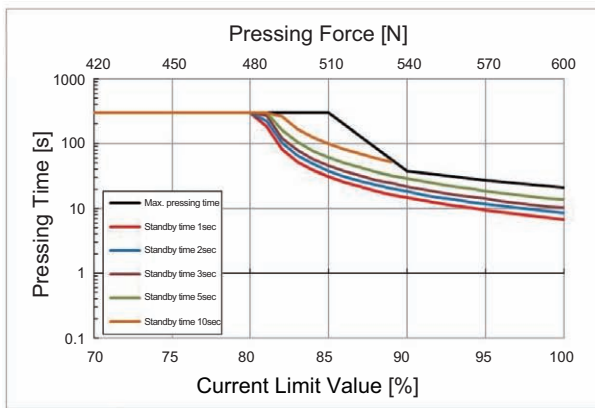
* There is not necessary to check the pressing available conditions for RA4R.

(1) Check in Graphs

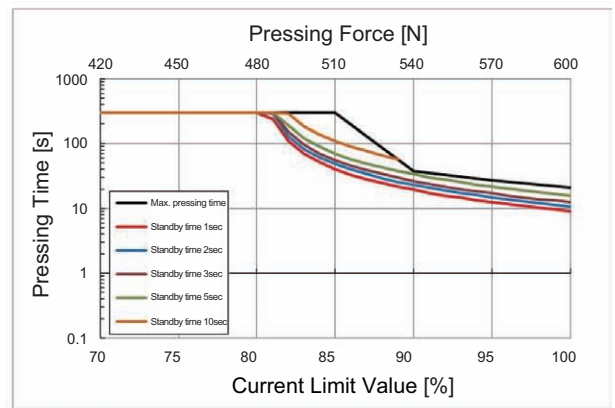
In the check in graphs, confirm the operation is available by the relation between current limit value and pressing time. The graphs below show the time available for pressing in the worst operational condition stated below.

Operation conditions of RA6R, RA7R, RA8R, RA10R	
Installation Posture:	Vertical installation
Approach Distance:	Full stroke
Speed:	Maximum speed
Acceleration/deceleration Speed:	Maximum acceleration/deceleration speed
Load Weight:	Max. weight for vertical transfer

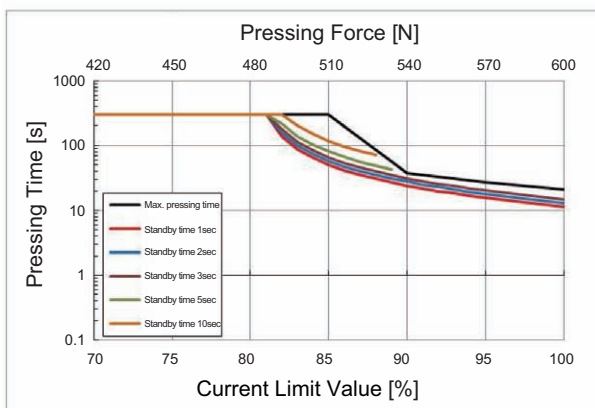
[Relation of Current Limit Value and Pressing Time for RA6R]



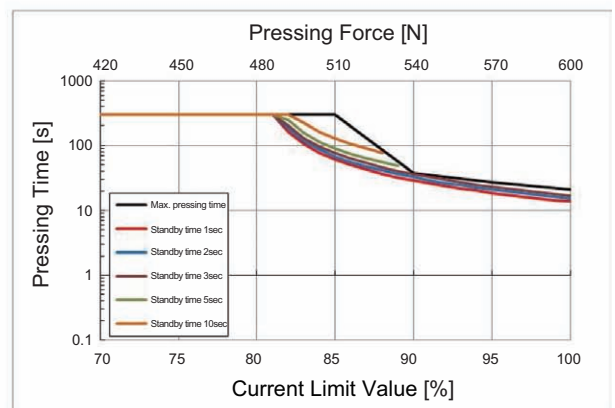
<RA6R 115st>



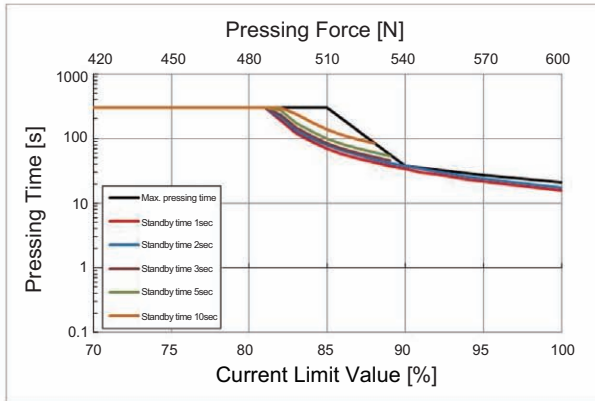
<RA6R 165st>



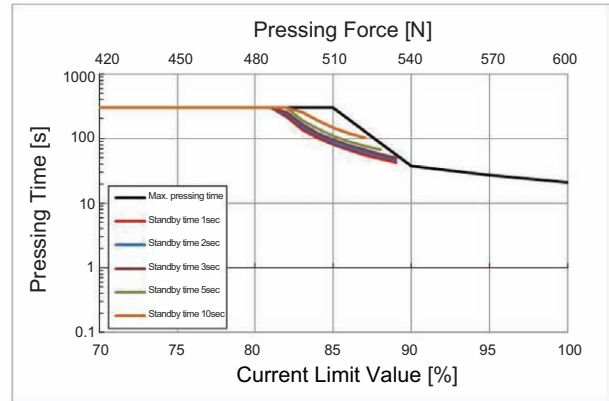
<RA6R 215st>



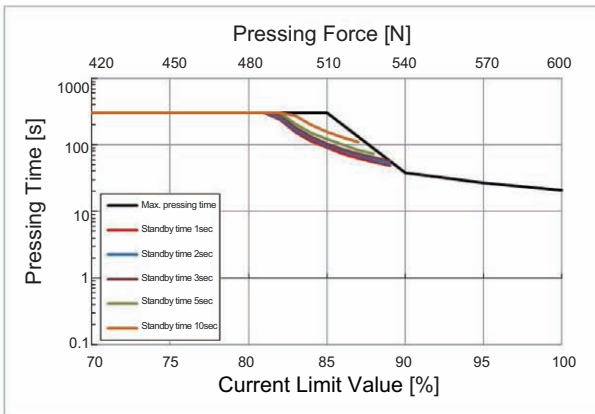
<RA6R 265st>



<RA6R 315st>

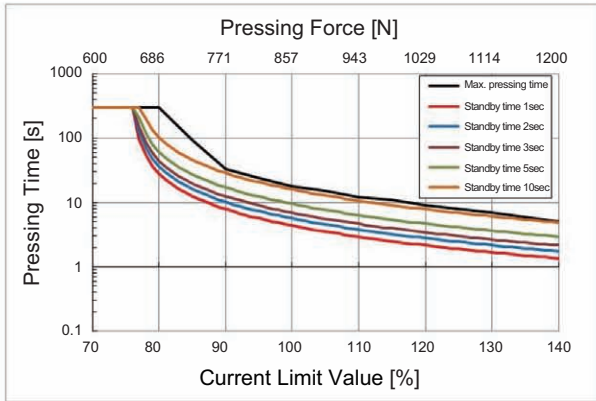


<RA6R 365st>

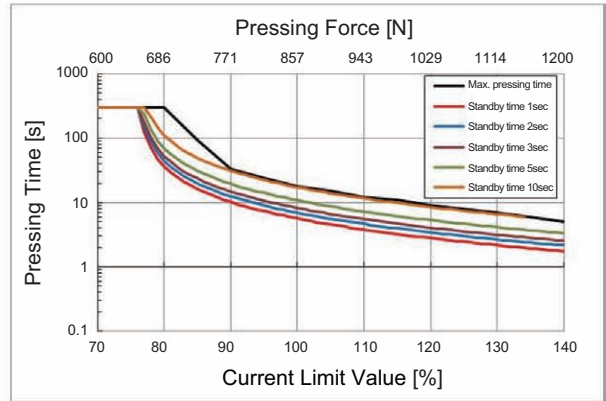


<RA6R 415st>

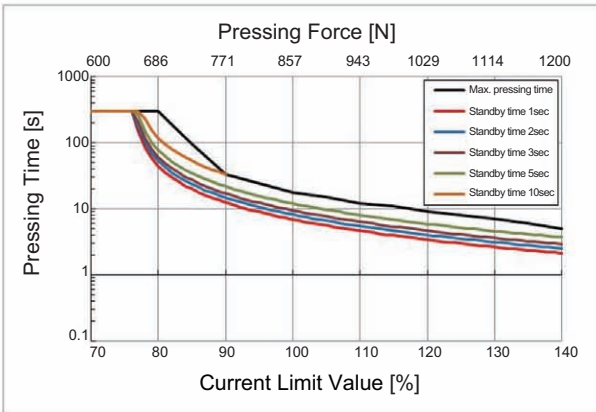
[Relation of Current Limit Value and Pressing Time for RA7R]



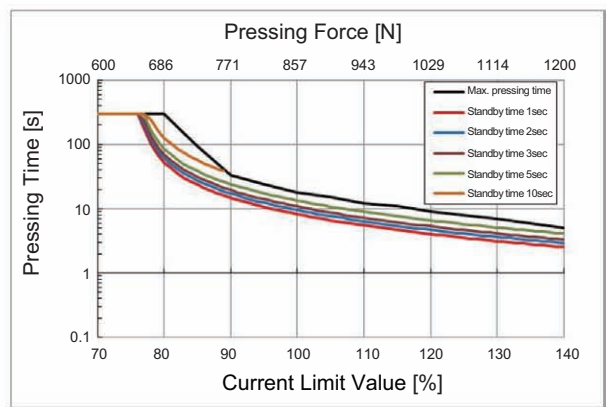
<RA7R 120st>



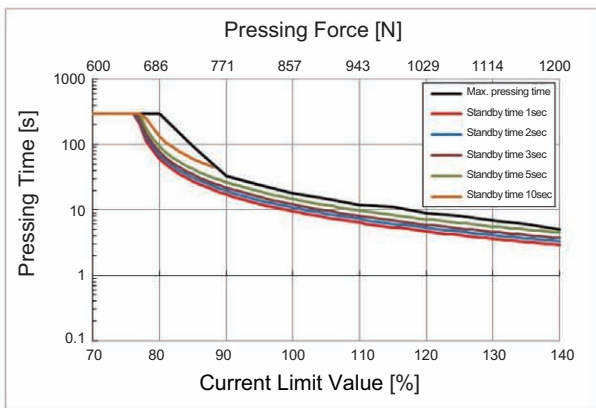
<RA7R 170st>



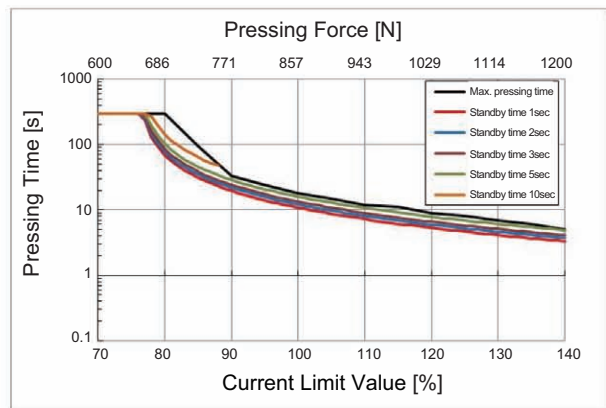
<RA7R 220st>



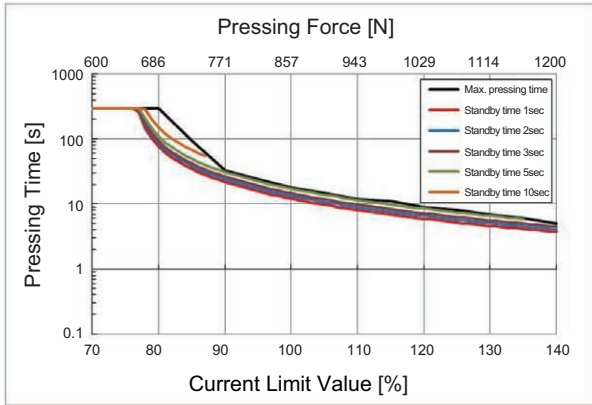
<RA7R 270st>



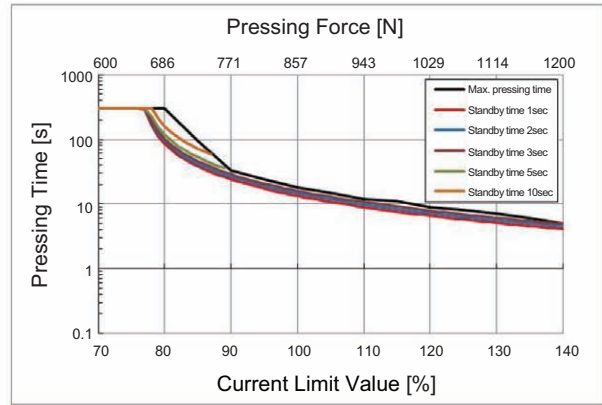
<RA7R 320st>



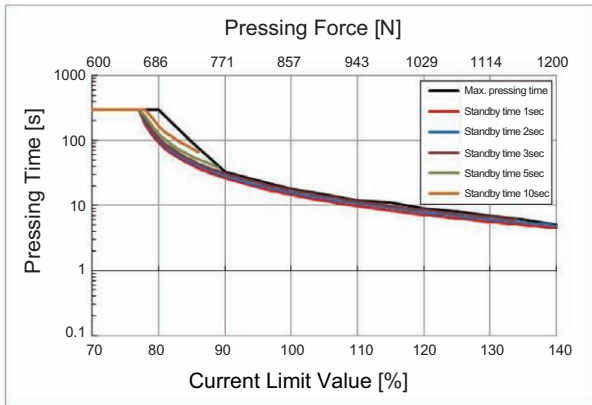
<RA7R 370st>



<RA7R 420st>

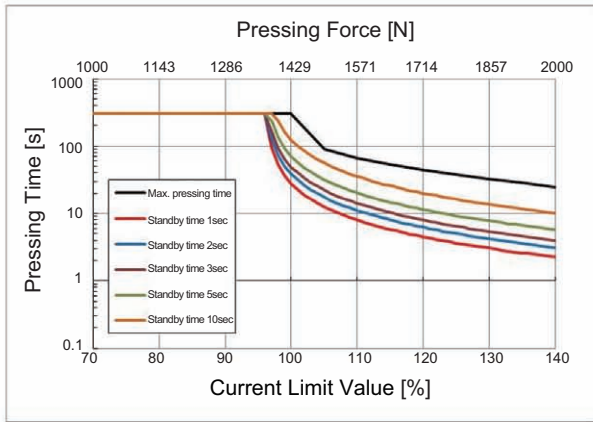


<RA7R 470st>

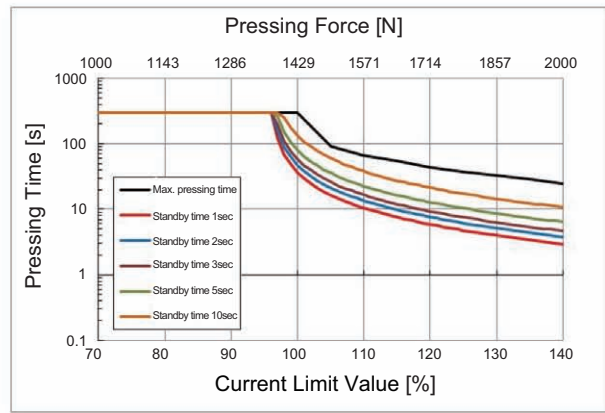


<RA7R 520st>

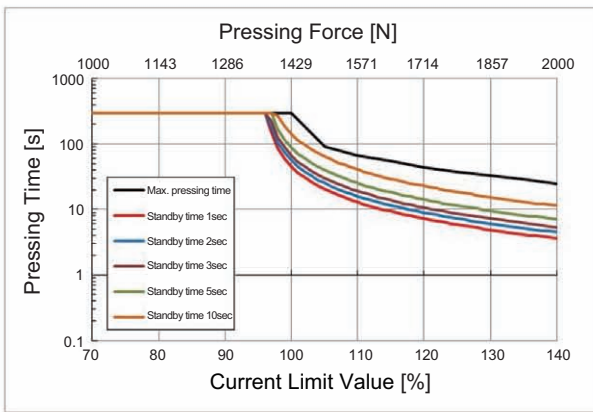
[Relation of Current Limit Value and Pressing Time for RA8R]



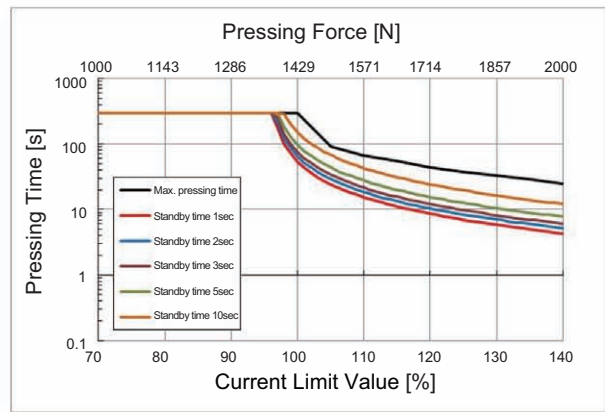
<RA8R 100st>



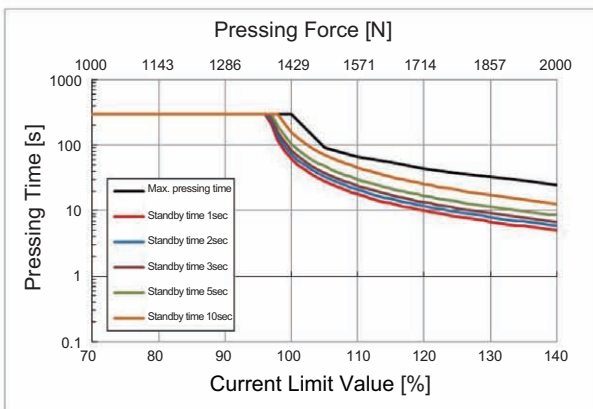
<RA8R 150st>



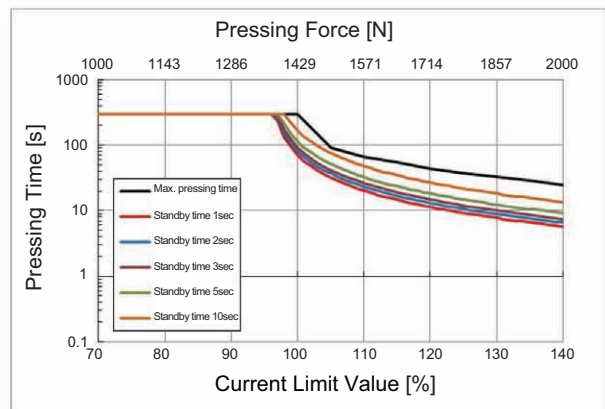
<RA8R 200st>



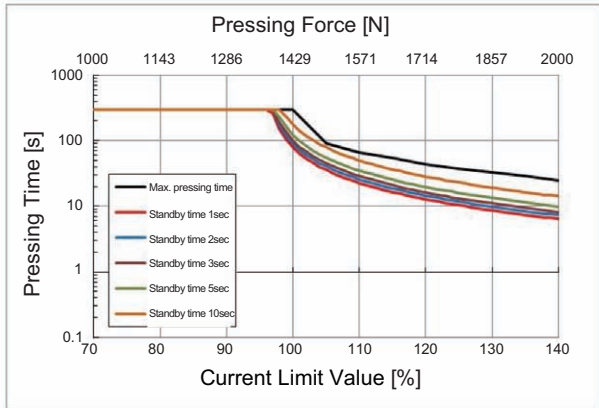
<RA8R 250st>



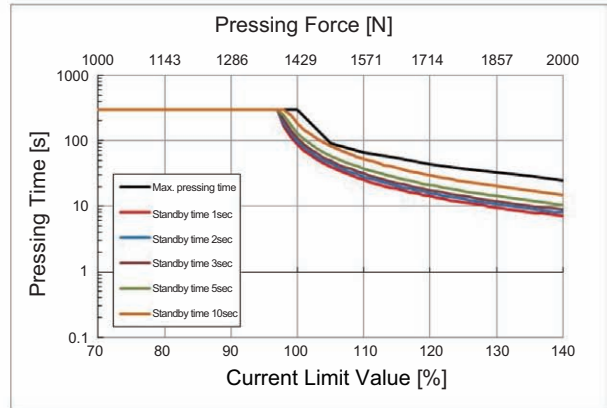
<RA8R 300st>



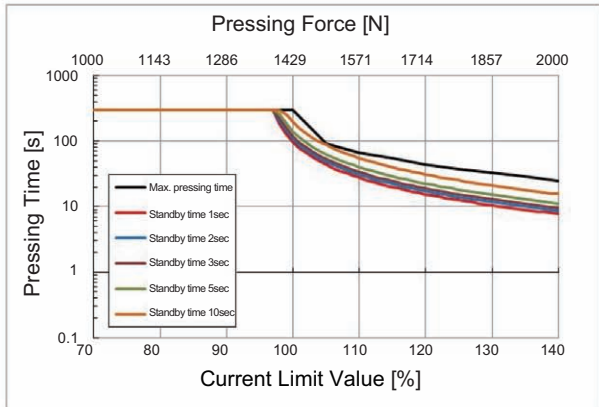
<RA8R 350st>



<RA8R 400st>

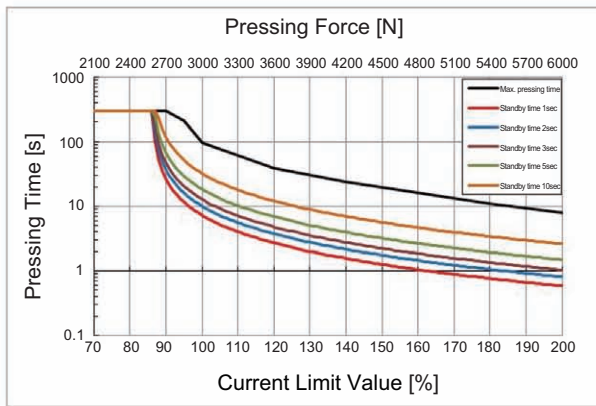


<RA8R 450st>

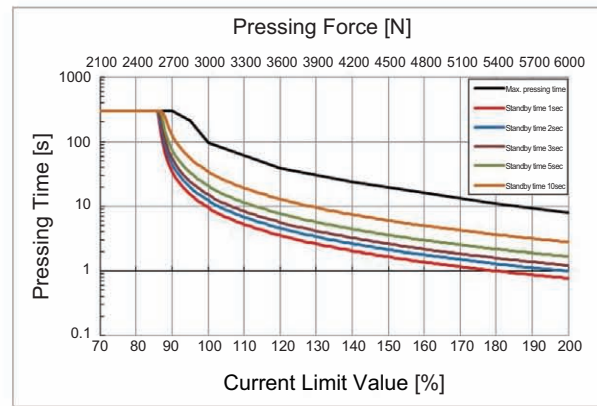


<RA8R 500st>

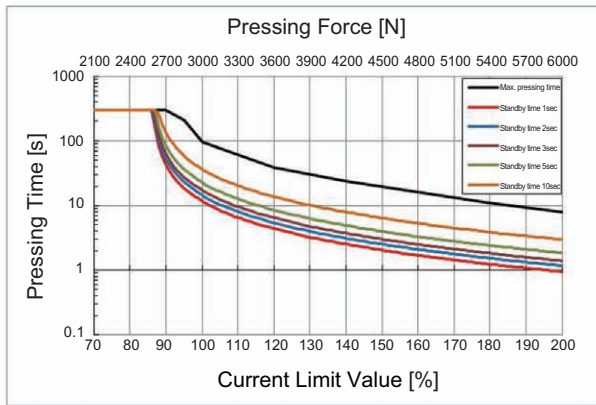
[Relation of Current Limit Value and Pressing Time for RA10R]



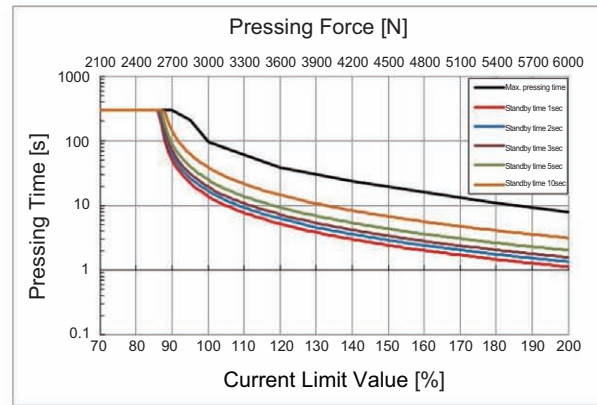
<RA10R 100st>



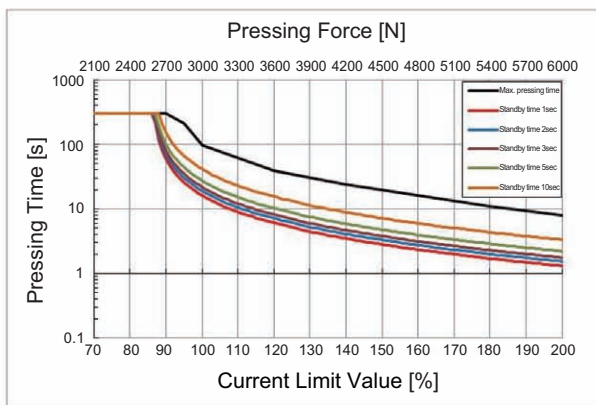
<RA10R 150st>



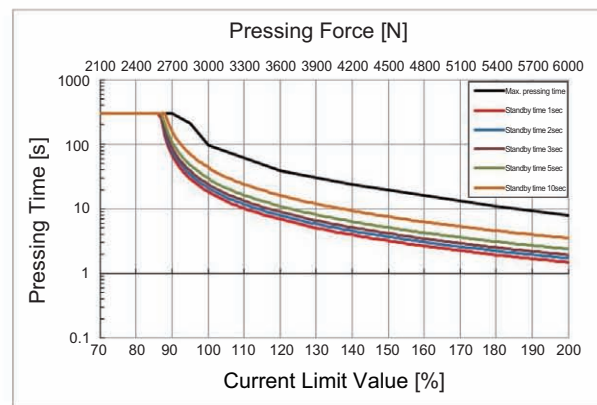
<RA10R 200st>



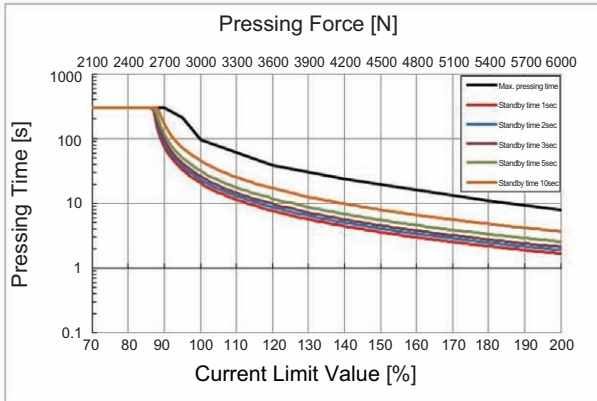
<RA10R 250st>



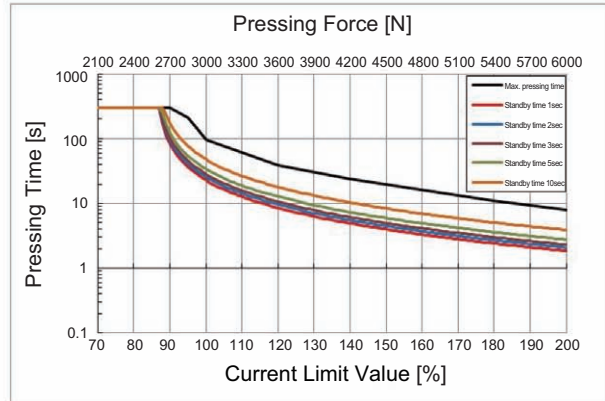
<RA10R 300st>



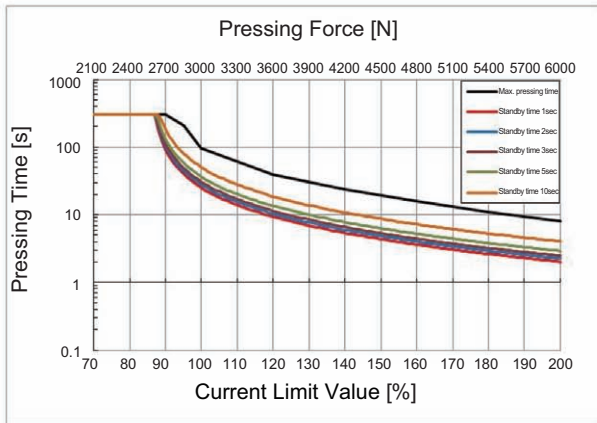
<RA10R 350st>



<RA10R 400st>



<RA10R 450st>



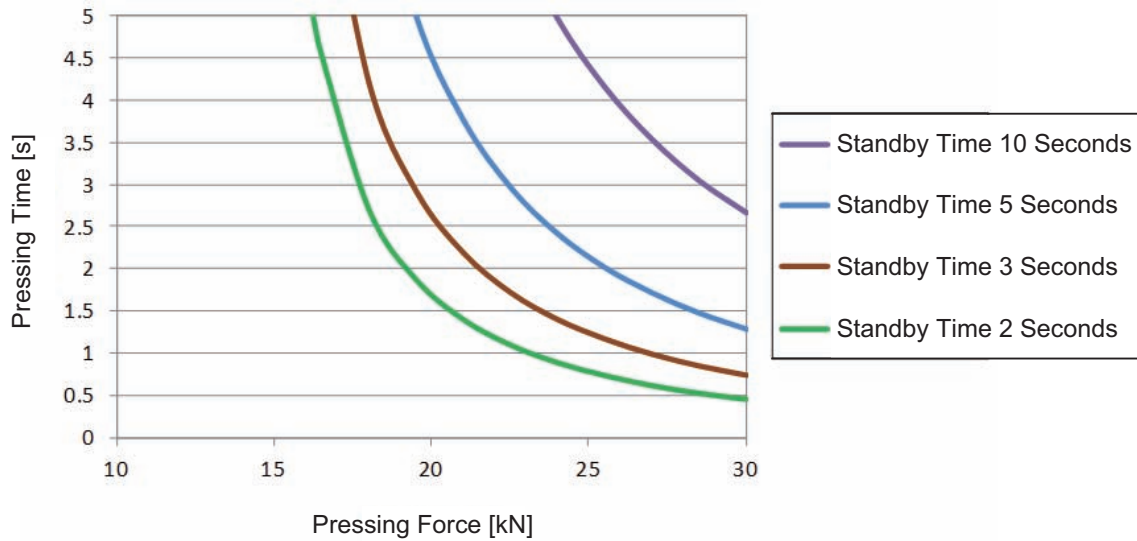
<RA10R 500st>

In the graph, confirm that it is available for operation from the relation between the current limit and the pressing duration.

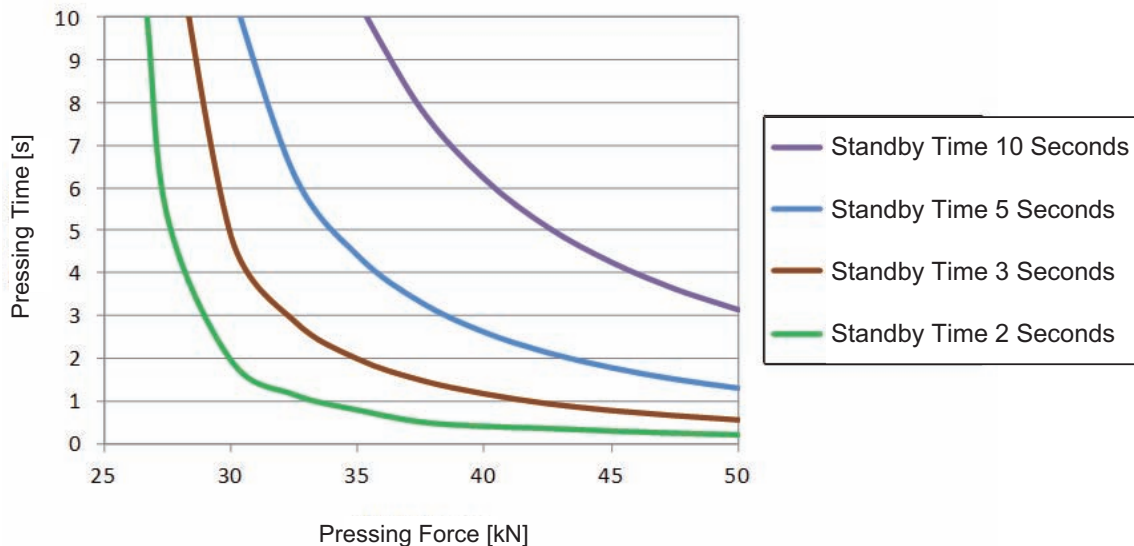
Also, the graph shows the duration available for pressing in the following operation conditions.

Operation conditions of RA15R, RA20R	
Installation Posture:	Vertical installation
Approach Distance:	50mm
Speed:	Maximum speed
Acceleration/deceleration Speed:	Maximum acceleration/deceleration speed
Load Weight:	0kg

[Relation between Standby Time and Pressing Force and Pressing Time of RA15R]



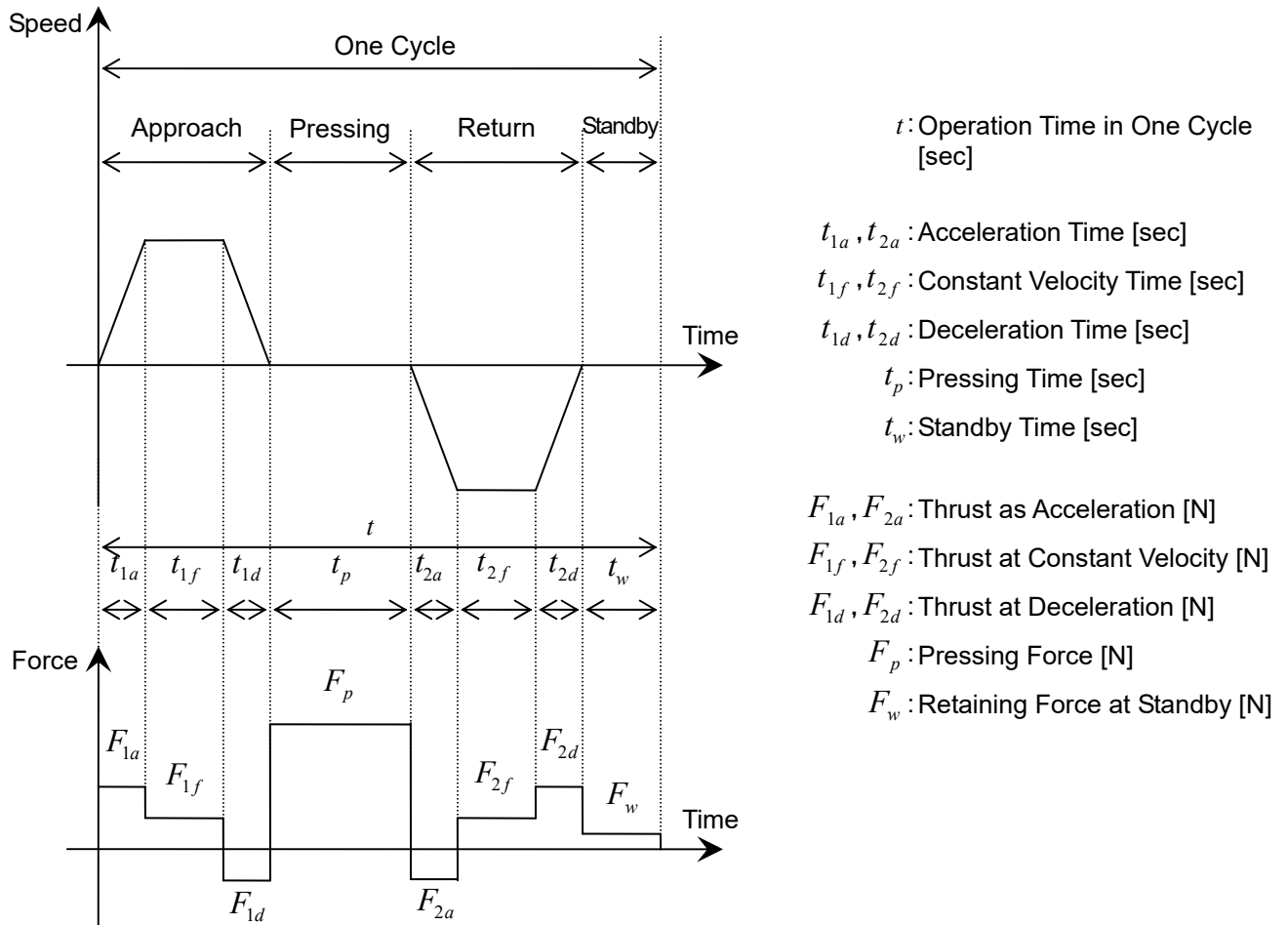
[Relation between Standby Time and Pressing Force and Pressing Time of RA20R]



There may be a possibility that operation is able to be performed even outside the range shown in the graph when it is installed in horizontal orientation or the operation is performed in low speed. Confirm that operation is available based on the check by calculation.

(2) Check by Calculation

Confirm that the continuous operation thrust of one cycle considering the load and duty is less than the continuous operational thrust. Make sure the pressing operation held in one cycle is one time. The operation pattern is as shown below.



At this time, the continuous operational thrust F_t is provided by the formula below.

$$F_t = \sqrt{\frac{\sum_i F_i^2 \cdot t_i}{t}}$$

But,

$$\sum_i F_i^2 \cdot t_i = F_{1a}^2 \cdot t_{1a} + F_{1f}^2 \cdot t_{1f} + F_{1d}^2 \cdot t_{1d} + F_p^2 \cdot t_p + F_{2a}^2 \cdot t_{2a} + F_{2f}^2 \cdot t_{2f} + F_{2d}^2 \cdot t_{2d} + F_w^2 \cdot t_w$$

The thrust F necessary for each operation here can differ depending on the installed posture. Figure out the thrust based on the formulas below.

◎ For RA6R, RA7R, RA8R and RA10R, make judgment by calculating with following formulas.

[For vertical orientation]

$$\text{Thrust downwards at acceleration [N]: } F_{1a} = (M + m) \cdot (9.8 - a)$$

$$\text{Thrust downwards at constant velocity [N]: } F_{1f} = (M + m) \cdot 9.8 + f$$

$$\text{Thrust downwards at deceleration [N]: } F_{1d} = (M + m) \cdot (9.8 + a)$$

$$\text{Thrust upwards at acceleration [N]: } F_{2a} = F_{1d}$$

$$\text{Thrust upwards at constant velocity [N]: } F_{2f} = F_{1f}$$

$$\text{Thrust upwards at deceleration [N]: } F_{2d} = F_{1a}$$

$$\text{Retaining force at standby [N]: } F_w = (M + m) \cdot 9.8$$

[For horizontal orientation and horizontally oriented wall mount]

$$\text{Thrust at acceleration/deceleration [N]: } F_{1a} = F_{1d} = F_{2a} = F_{2d} = (M + m) \cdot a$$

$$\text{Thrust at constant velocity [N]: } F_f = f$$

$$\text{Retaining force at standby [N]: } F_w = 0$$

But,

- M : Weight on movable part [kg]
2.5kg for RA6R, 3.5kg for RA7R, 4kg for RA8R and 5kg for RA10R
- m : Load Weight [kg]
- a : Commanded acceleration/deceleration [m/s^2]
- f : Driving resistance when attaching external guide [N]

Confirm that the calculated continuous operational thrust F_i is less than the continuous operational thrust below. The continuous operational thrust are as shown below.

Type	Continuous Operational Thrust [N]
RA6R	420
RA7R	600
RA8R	1000
RA10R	2100

In case the conditions cannot be satisfied, have counteraction such as to shorten the pressing time or make the standby time longer.

◎ For RA15R and RA20R, make judgment by calculating with following formulas.

[For vertical orientation]

Thrust downwards at acceleration [N]: $F_{1a} = (M + m) \cdot (9.8 - a) + F_s$

Thrust downwards at constant velocity [N]: $F_{1f} = (M + m) \cdot 9.8 + f + F_s$

Thrust downwards at deceleration [N]: $F_{1d} = (M + m) \cdot (9.8 + a) + F_s$

Thrust upwards at acceleration [N]: $F_{2a} = F_{1d}$

Thrust upwards at constant velocity [N]: $F_{2f} = F_{1f}$

Thrust upwards at deceleration [N]: $F_{2d} = F_{1a}$

Retaining force at standby [N]: $F_w = (M + m) \cdot 9.8$

[For horizontal orientation and horizontally oriented wall mount]

Thrust at acceleration/deceleration [N]: $F_{1a} = F_{1d} = F_{2a} = F_{2d} = (M + m) \cdot a + F_s$

Thrust at constant velocity [N]: $F_{1f} = f_{2f} = f + F_s$

Retaining force at standby [N]: $F_w = 0$

But,

M : Weight on movable part [kg]
10kg for RA15R, 18kg for RA20R

m : Load Weight [kg]

a : Commanded acceleration/deceleration [m/s^2]

f : Driving resistance when attaching external guide [N]

F_s : Find the thrust for each speed from the table below and put it in the formula.

RA15R		RA20R	
Speed [mm/s]	Fs [N]	Speed [mm/s]	Fs [N]
0~180	0	0~40	0
181~190	625	41~50	1875
191~200	1250	51~60	3750
201~210	1875	61~70	5625
211~220	2500	71~80	7500
221~230	3125	81~90	9375
231~240	3750	91~100	11250
		101~110	13125
		111~120	15000
		121~130	16875
		131~140	18750
		141~150	20625
		151~160	22500
		161~170	24375
		171~180	26250
		181~220	27500

Next, calculate the average velocity. The average velocity can be figured v_t out with following formula.

$$v_t = \frac{0.5 \cdot v_1 \cdot t_{1a} + v_1 \cdot t_{1f} + 0.5 \cdot v_1 \cdot t_{1d} + 0.5 \cdot v_2 \cdot t_{2a} + v_2 \cdot t_{2f} + 0.5 \cdot v_2 \cdot t_{2d}}{t}$$

v_1 : Velocity at constant speed in approaching motion [mm/s]

v_2 : Velocity at constant speed in returning motion [mm/s]

Next, calculate the final continuous operation thrust F from the continuous operation thrust F_t and the average velocity v_t that have been figured out.

$$F = F_t + v_t \cdot K$$

The coefficient K should be selected from the table below.

Model	Coefficient K
RA15R	150
RA20R	412.5

Confirm that the final continuous operation thrust F figured out is smaller than the allowable continuous operation thrust shown in the table below.

Model	allowable continuous operation thrust [N]
RA15R	13500
RA20R	22500

In case the condition cannot be met, revise the condition such as to shorten the pressing time or to make the standby duration longer.

1.3.4 Checking Duty Conveyor Type (with No Loadcell Equipped)

(1) Check in Graphs

The maximum velocity available for operation will differ depending on the standby time and payload. In the graph, shows the relation of payload and maximum velocity for each duty under the conditions which can be a reference.

Check the graph to see if the operational condition is available.

* Note that the judgement in the graph is just a reference. Have margin to the setting of the operational conditions.

[Duty Ratio]

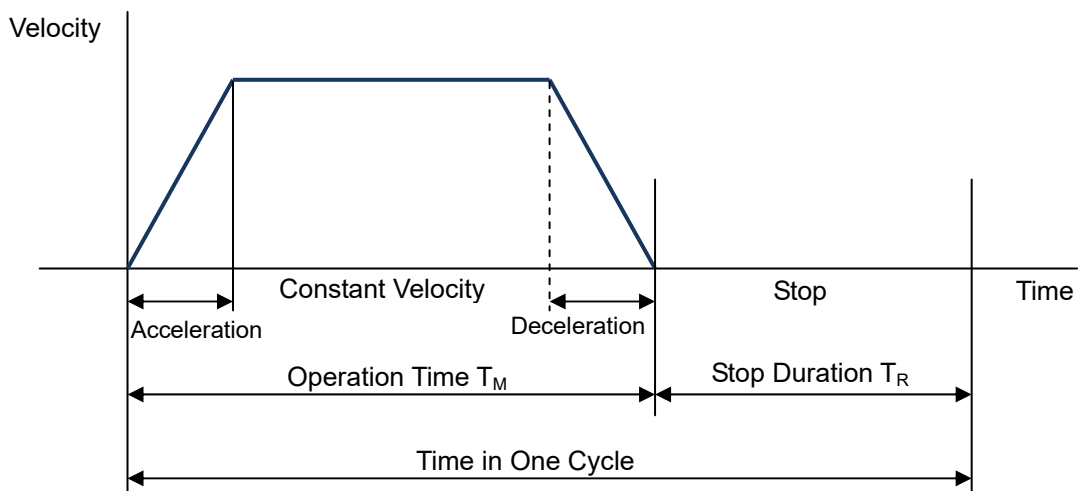
The duty ratio is the ratio of operation expressed in % to show the duration when the actuator is operating in one cycle.

$$D = \frac{T_M}{T_M + T_R} \times 100 [\%]$$

D : Duty

T_M : Operation Time (including the pressing operation)

T_R : Stop Duration



[How to Check]

Check in the applicable graph if the crossing point of the maximum velocity and maximum payload in one cycle is below the line of the calculated duty.

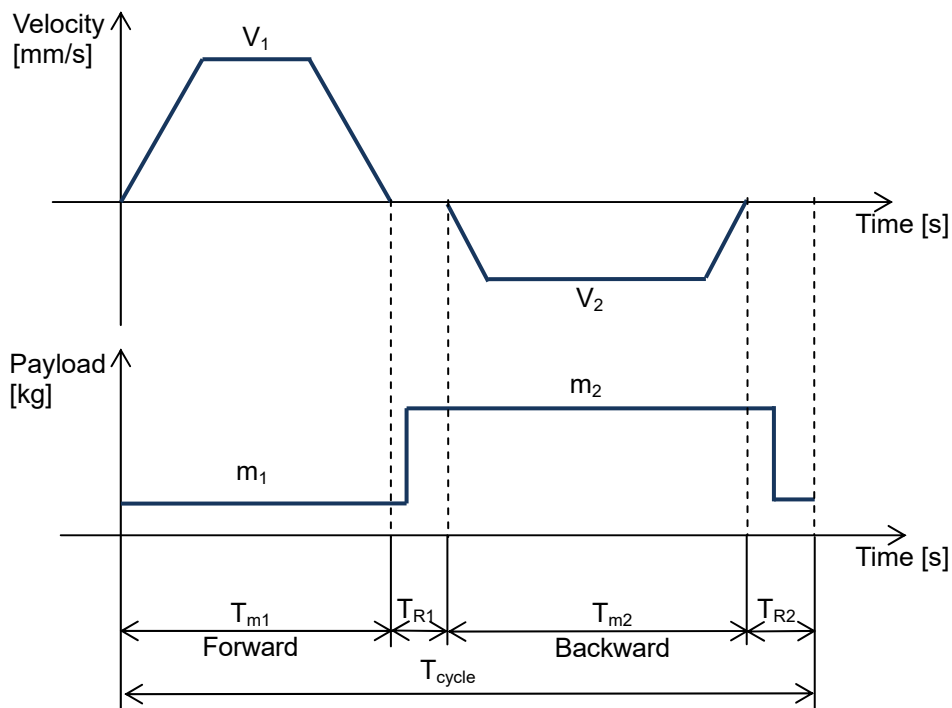
Operation should be available if it is below the line.

The range available for use will differ depending on the number of connected external regenerative resistances.

(e.g.) When payload changes during operation

As the graph shows, if both of the velocity and payload are different on the way forward and backward, make a selection using the maximum values in the operation. It should be V_1 and m_2 in the example below.

* Select the maximum value for the velocity no matter the direction of operation.



In the example above;

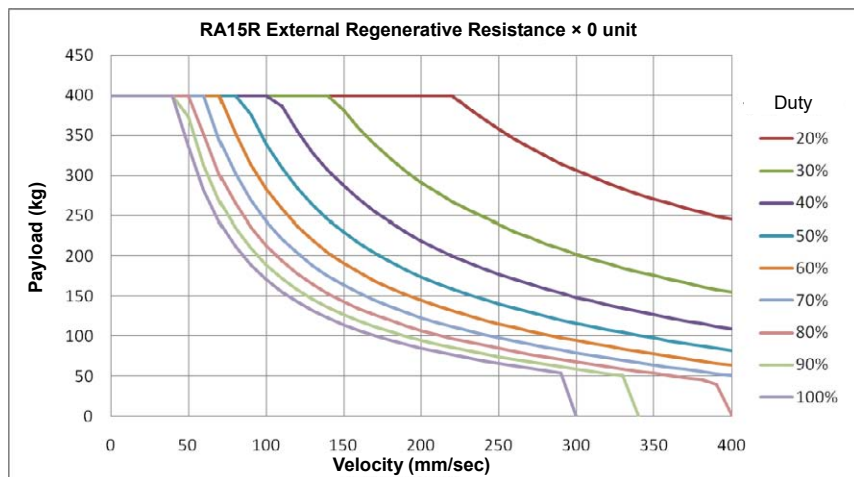
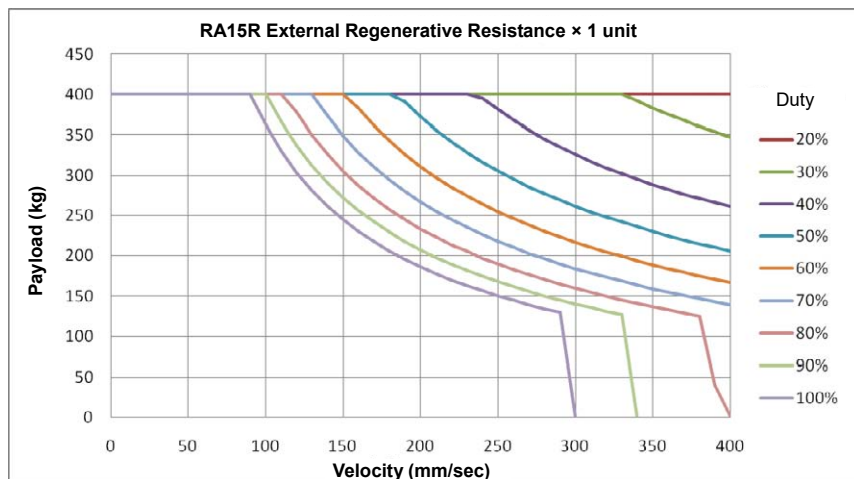
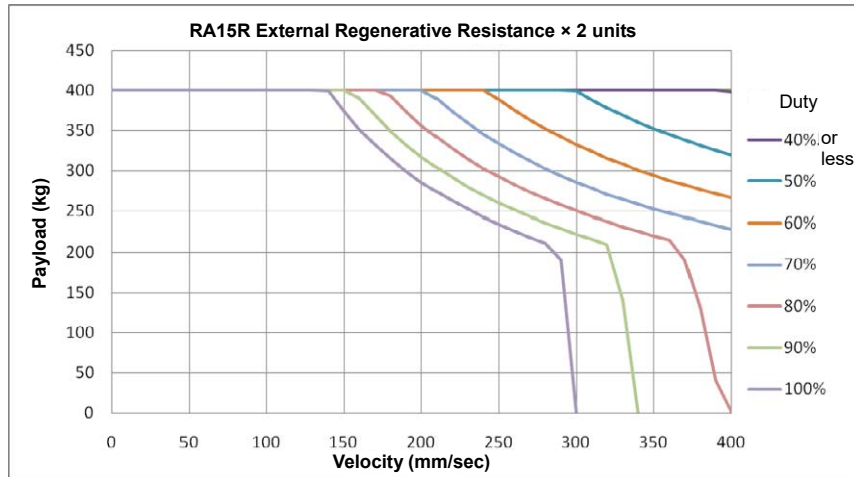
Maximum Velocity: V_1

Maximum Payload: m_2

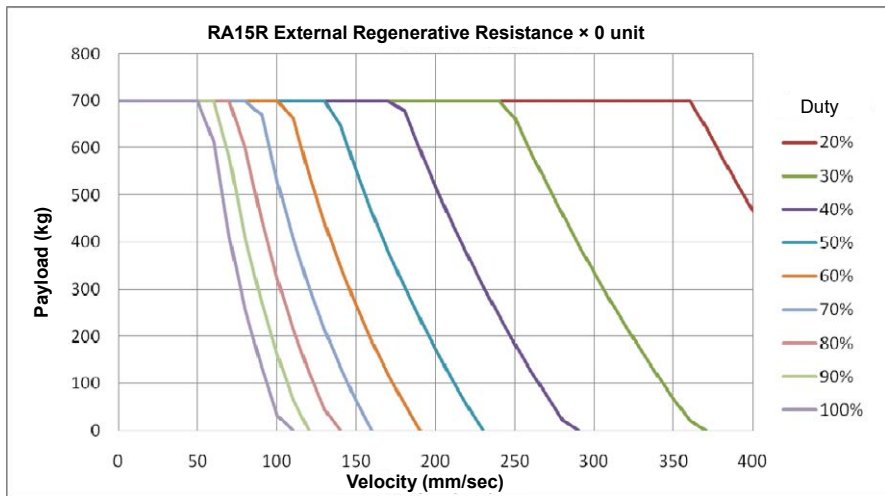
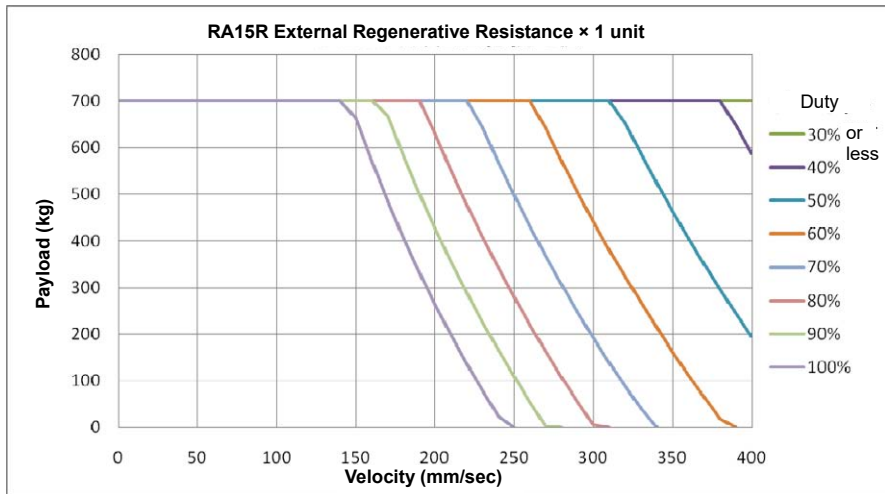
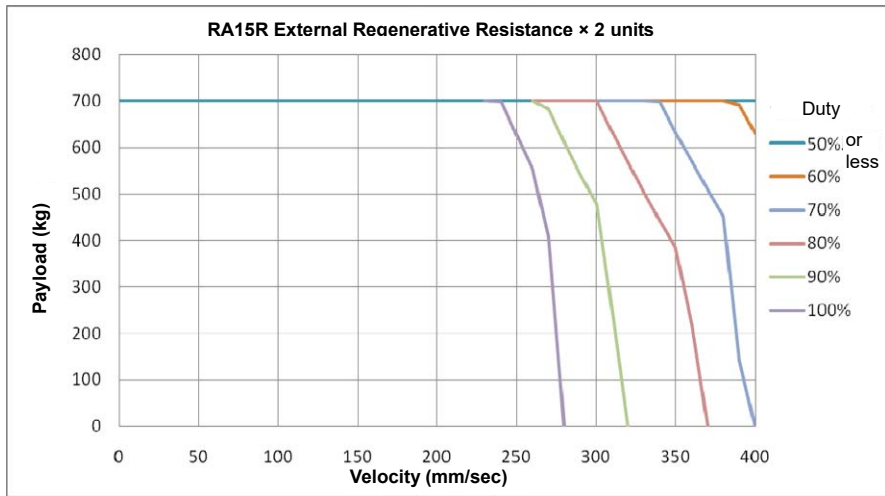
Cycle Time: $T_{cycle} = T_{m1} + T_{R1} + T_{m2} + T_{R2}$

[Relation of Standby Time, Payload and Max. Velocity for RA15R Conveyor Type (with No Loadcell Equipped)]

© Vertical installation

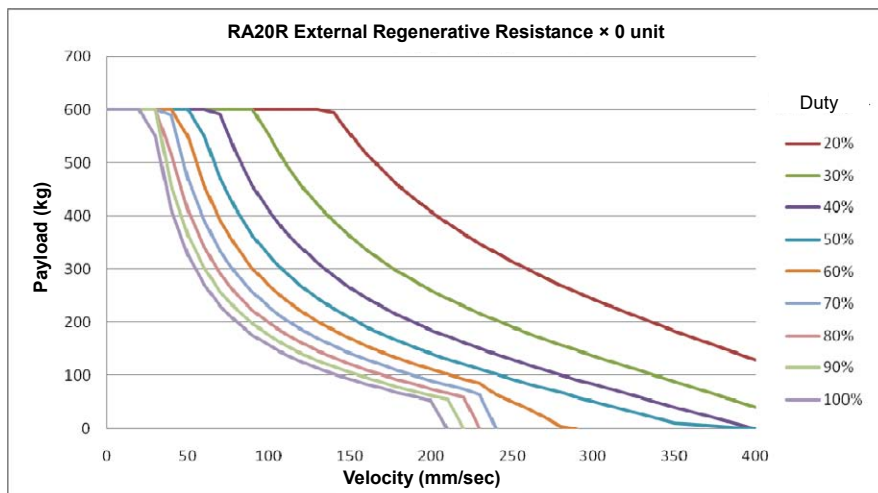
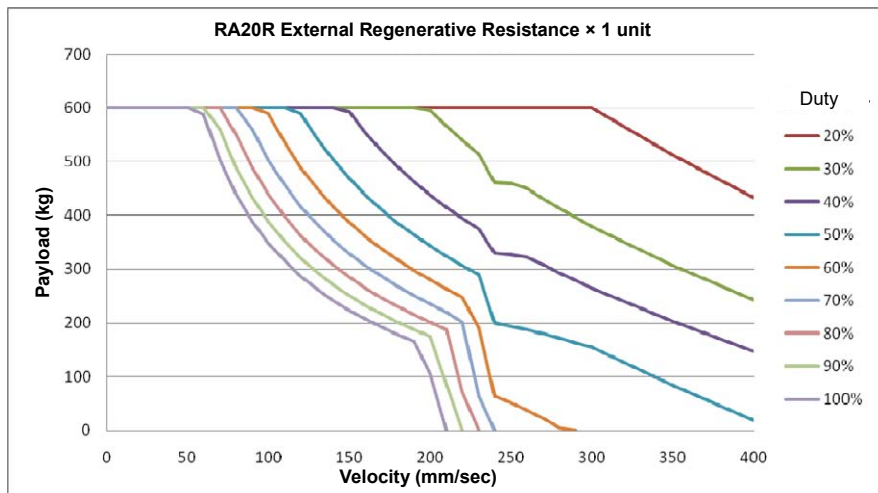
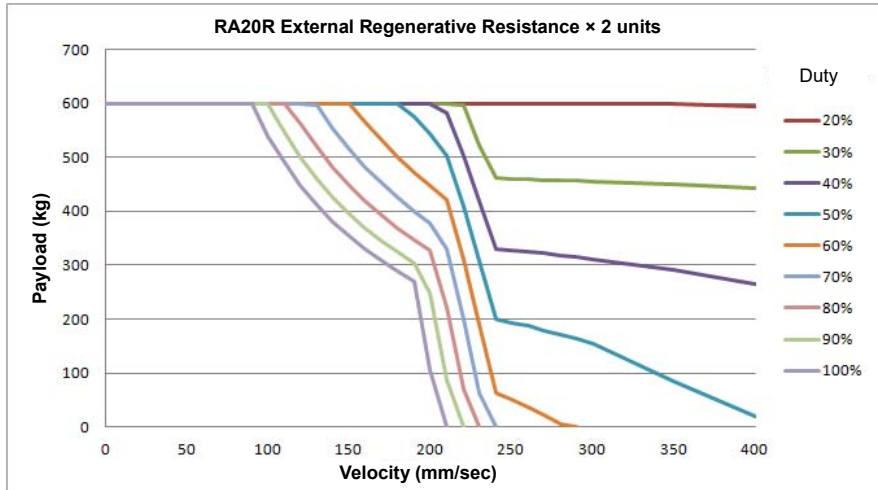


© Horizontal installation

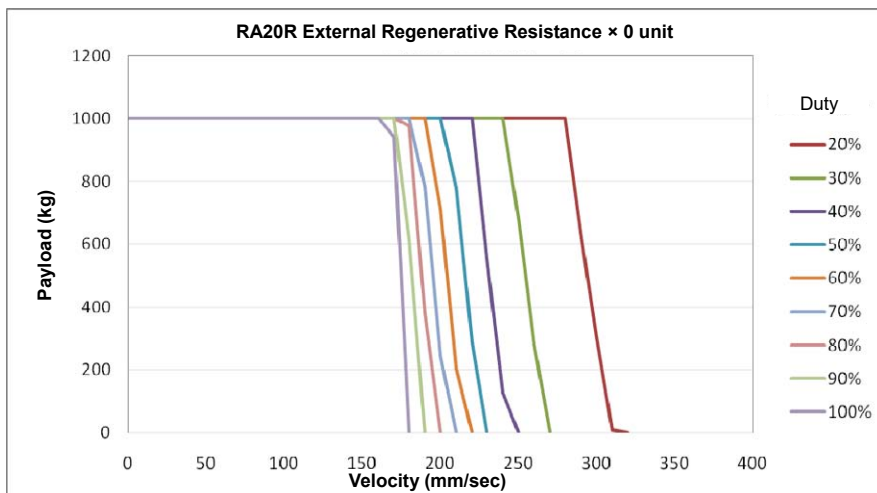
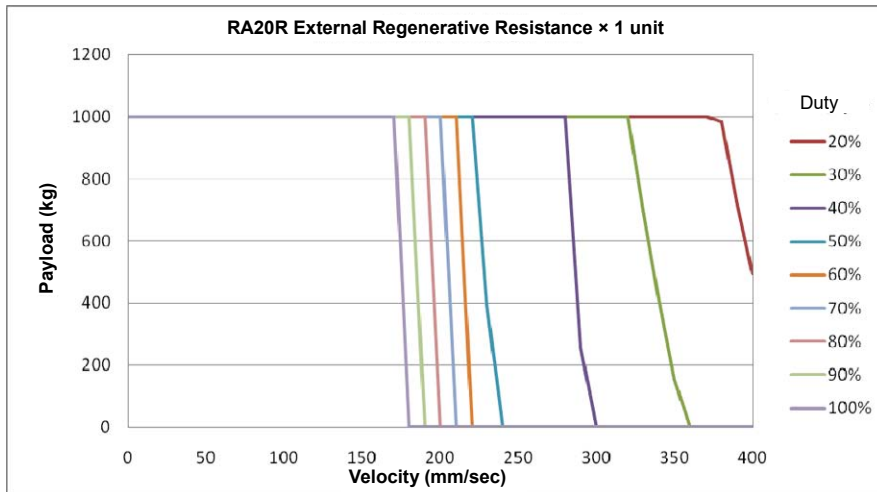
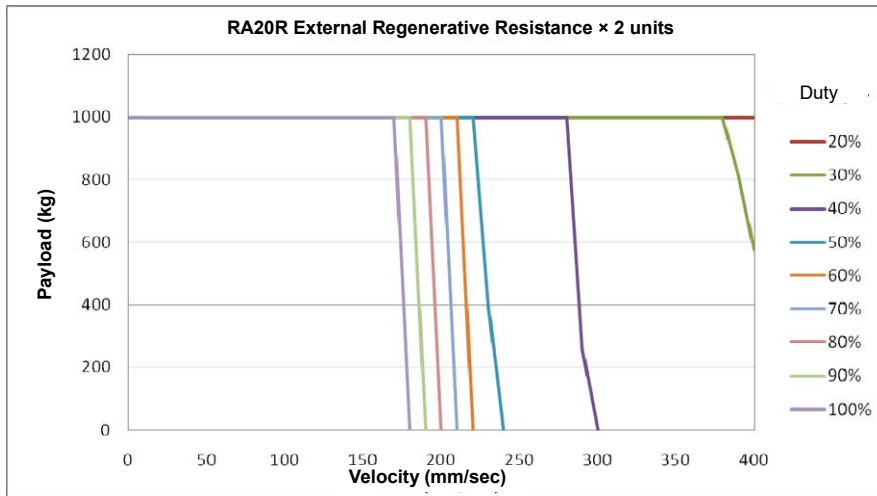


[Relation of Standby Time, Payload and Max. Velocity for RA20R Conveyor Type (with No Loadcell Equipped)]

© Vertical installation



© Horizontal installation



1.4 Options

1.4.1 Brake Type (Model: B)

The brake is a mechanism designed to prevent the rod from dropping on a vertically installed actuator when the power or servo is turned OFF.

Use the brake to prevent the installed load, etc., from being damaged due to the falling rod.

1.4.2 Flange Bracket (Front) (Model: FL)

Application : RA4R, RA6R, RA7R, RA8R, RA10R

This is the flange bracket to attach on the front of the main unit.

[For the dimensions, refer to 2.3.2 Installation of the the Main Unit [4] When using Frange Bracket (Front) (Option).]

(Note) The flange bracket (front) for the actuator equipped with the loadcell cannot be attached in the customers' sites after the product has been delivered.

Indicate FL in the option at the product order if the flange bracket (front) is required.

1.4.3 Foot Bracket (Model: FT)

Application : RA4R, RA6R, RA7R, RA8R, RA10R

This metal part is used for fixing the actuator from the top side using the bolts.

[For the dimensions, refer to 6. External Dimensions]

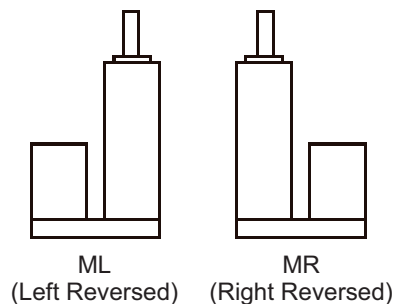
(Note) Foot bracket (FT) option is not available to choose when CJB (bottom) is selected for the cable ejected direction in RA8R with 100mm of stroke, RA10R with 100mm of stroke and RA6R with strokes except for 415mm of stroke.

The reason is the cable interferes with the foot bracket.

1.4.4 Motor Left Reversed, Motor Right Reversed (Model: ML, MR)

Application : RA4R, RA6R, RA7R, RA8R, RA10R

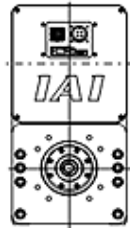
From the view of the motor side, the type with the motor reversed to the left is ML, and the motor reversed to the right is MR.



1.4.5 Motor Top Reversed (Model: MT)

Application : RA15R, RA20R

From the view of the motor side, the type with the motor reversed to the top is MT. There is no motor reversed option other than the motor top reversed MT.

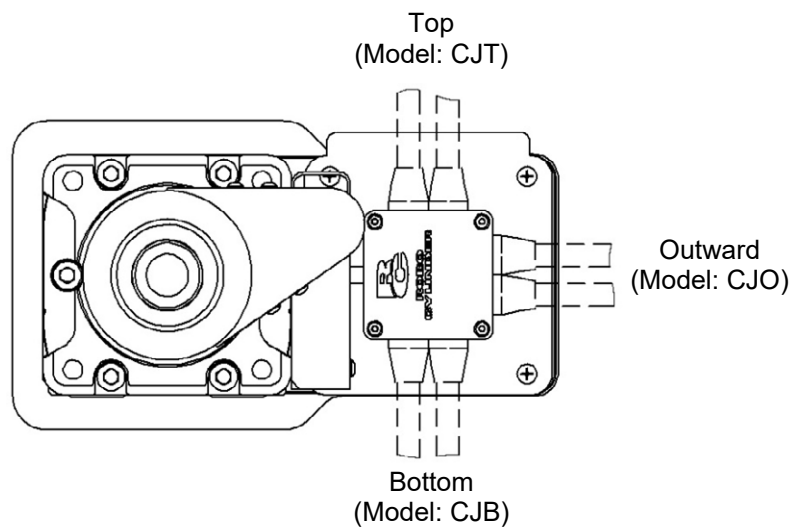


MT
(Motor Top Reversed)

1.4.6 Cable Eject Direction Changed (Model: CJT, CJB, CJO)

Application : RA4R, RA6R, RA7R, RA8R, RA10R

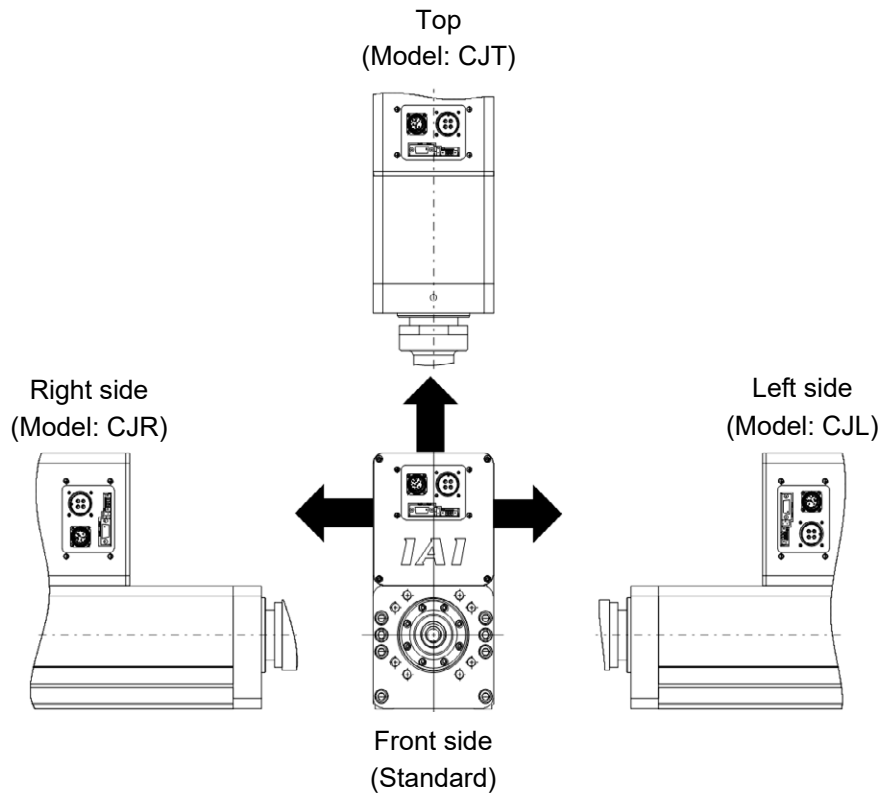
If a change in the cable ejection direction is made, the direction of cable ejection will be changed. There are ejection directions, top (model: CJT), bottom (model: CJB) and outward (model: CJO). However, RA4R is limited to outward (model: CJO) only. It is not available to choose top (model: CJT) or bottom (model: CJB).



1.4.7 Cable Eject Direction Changed (Model: CJT, CJR, CJL)

Application : RA15R and RA20R

The standard is front for the cable ejection direction.
If a change in the cable ejection direction is made, the direction of cable ejection will be changed.
There are ejection directions, top (model: CJT), right side (model: CJR), left side (model: CJL).



1.4.8 Applicable CE (Model: CE)

Application : RA4R

Applicable for CE mark.

1.4.9 Equipped with Loadcell (Model: LCT)

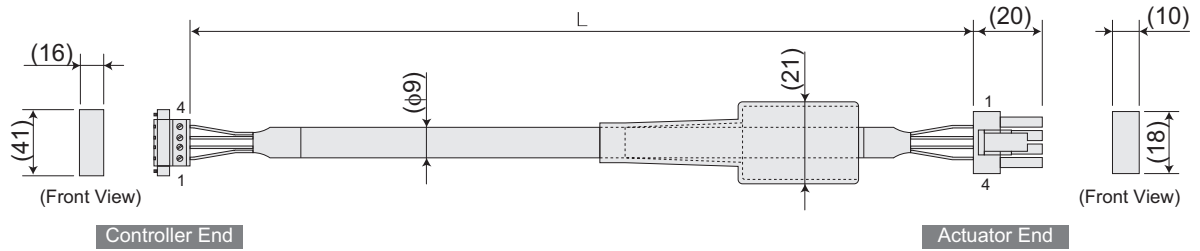
It is an option to make the pressing force stable by equipping a loadcell on the end of the rod.
Force control can be performed if a controller applicable for servo pressing is used.

1.5 Motor • Encoder Cables

1.5.1 Motor Cable/Motor Robot Cable (RA4R, RA6R, RA7R, RA8R and RA10R)

Model: CB-RCC-MA□□□/CB-RCC-MA□□□-RB

□□□ indicates the cable length (L) (Example: 030=3m), Max.30m

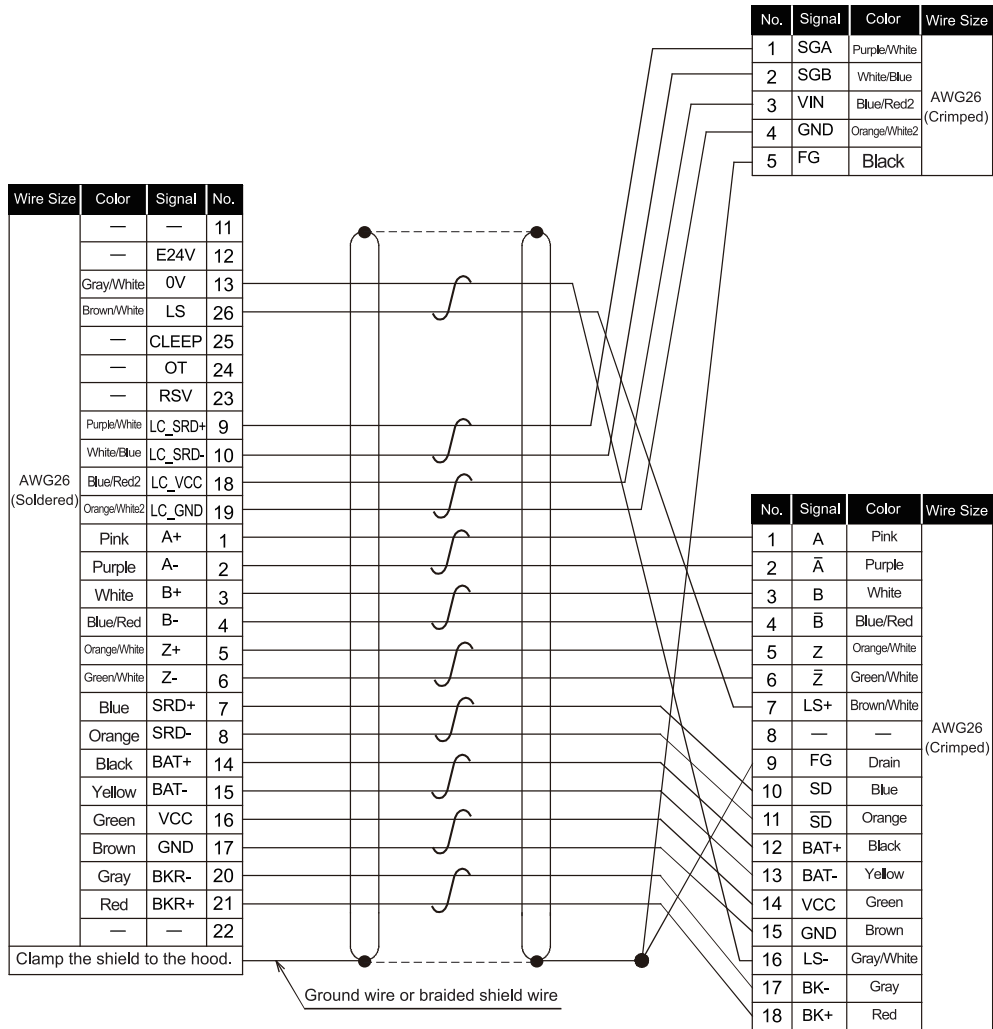
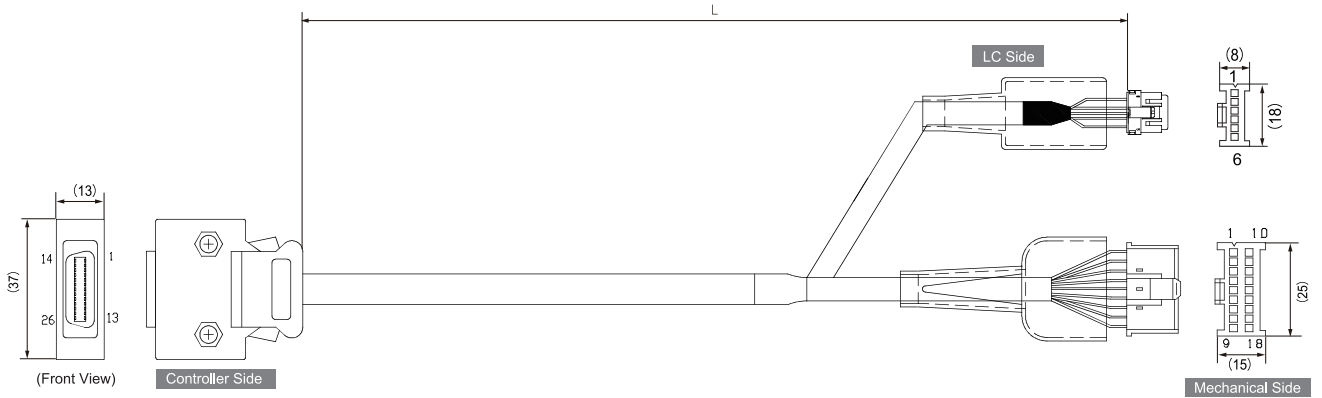


Wire Size	Color	Signal	No.	No.	Signal	Color	Wire Size
0.75sq	Green	PE	1	1	U	Red	0.75sq (Crimped)
	Red	U	2	2	V	White	
	White	V	3	3	W	Black	
	Black	W	4	4	PE	Green	

1.5.2 Encoder Cable (RA4R, RA6R, RA7R, RA8R and RA10R)

Model: CB-RCS2-PLDA□□□

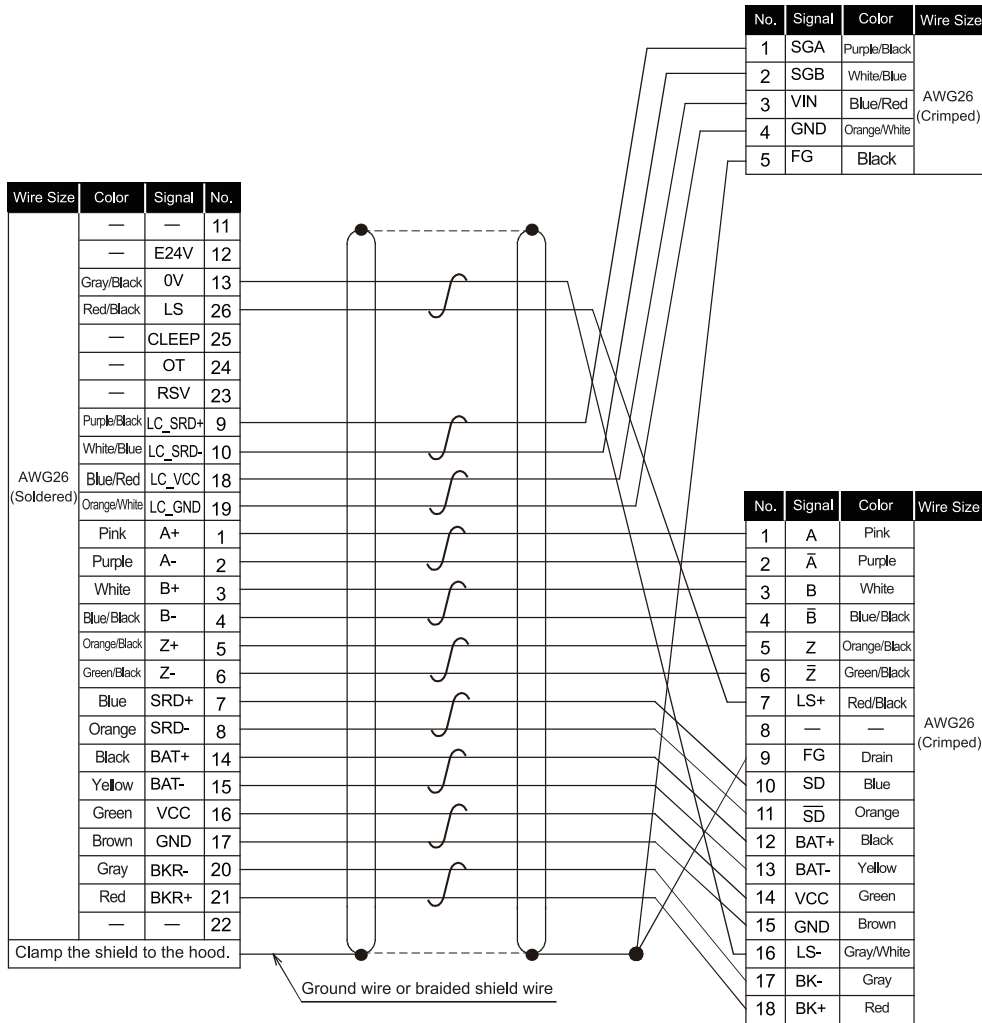
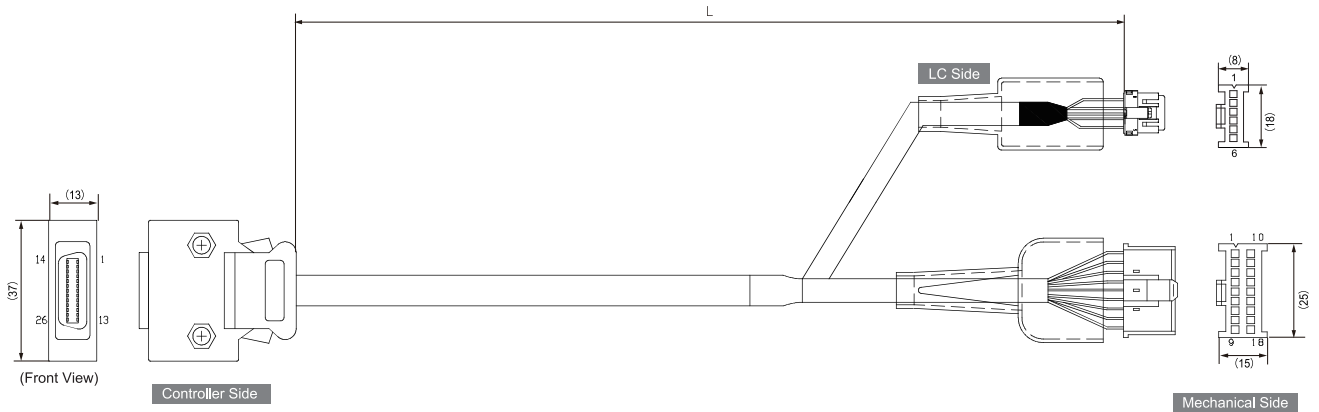
□□□ indicates the cable length (L) (Example: 030=3m), Max.30m



1.5.3 Encoder Robot Cable (RA4R, RA6R, RA7R, RA8R and RA10R)

Model: CB-RCS2-PLDA□□□-RB

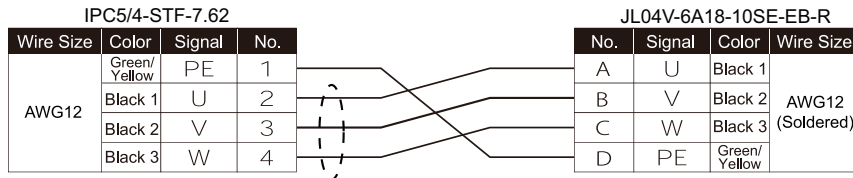
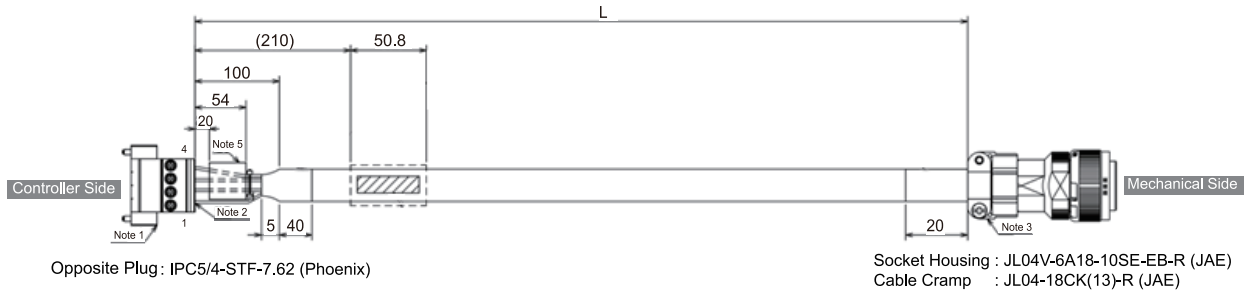
□□□ indicates the cable length (L) (Example: 030=3m), Max.30m



1.5.4 Motor Cable/Motor Robot Cable (RA15R and RA20R)

Model: CB-RCS3-MA□□□-RB

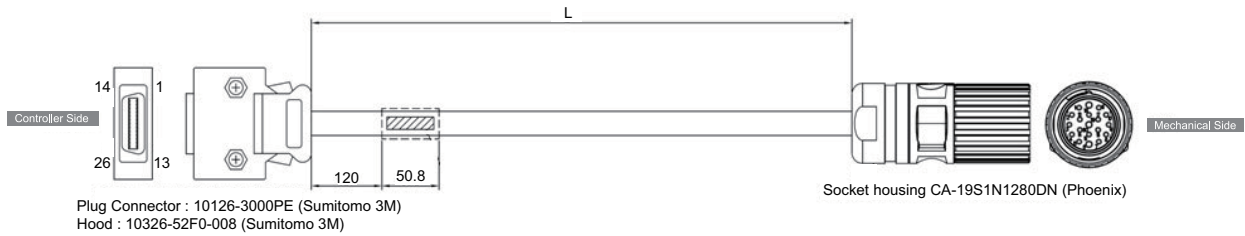
□□□ indicates the cable length (L) (Example: 030=3m), Max.30m



1.5.5 Encoder Cable (RA15R and RA20R)

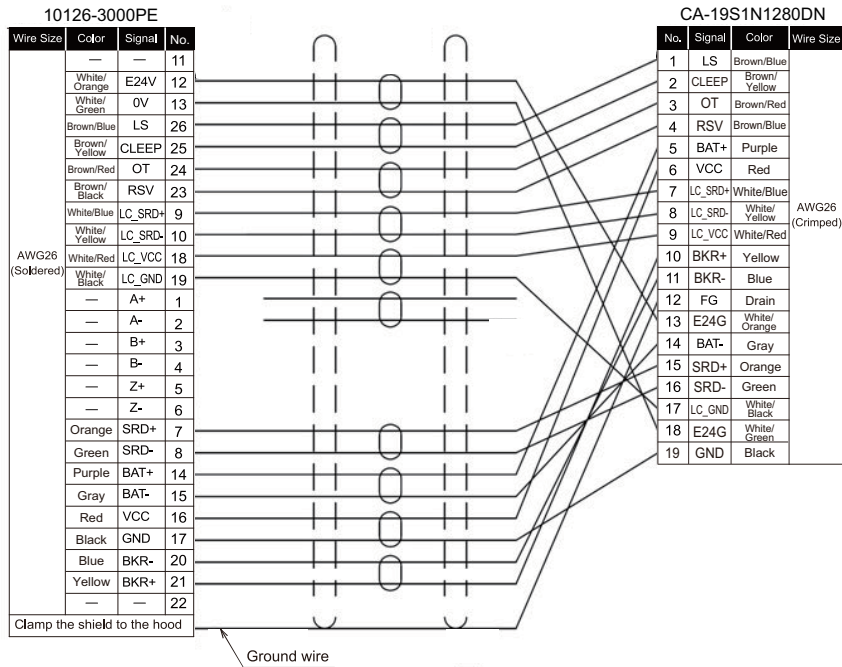
Model: CB-RCS3-PLA□□□-RB

□□□ indicates the cable length (L) (Example: 030=3m), Max.30m



Plug Connector : 10126-3000PE (Sumitomo 3M)
Hood : 10326-52F0-008 (Sumitomo 3M)

Socket housing CA-19S1N1280DN (Phoenix)



2. Installation

2.1 Transportation

[1] Handling of Robot

(1) Handling the Packed Unit

Unless otherwise specified, the actuator is shipped with each axis packaged separately.

- Do not damage or drop. The package is not applied with any special treatment that enables it to resist an impact caused by a drop or crash.
- Transport a heavy package with at least more than two operators. Consider an appropriate method for transportation.
- Keep the unit in horizontal orientation when placing it on the ground or transporting. Follow the instruction if there is any for the packaging condition
- Do not step or sit on the package.
- Do not put any load that may cause a deformation or breakage of the package.

(2) Handling the Actuator After Unpacking


[RA4R, RA6R, RA7R, RA8R and RA10R]

- Do not carry an actuator by motor unit and a track cover area and the cable or attempt to move it by pulling the cable.
- Be careful not to bump the actuator into anything when moving it.
- Hold the body base when transporting the actuator.
- Do not apply an excessive force to each part of the actuator. In particular, prevent the motor unit and rear bracket from receiving an unnecessary force.

Supplement) For the names of each part of the actuator, refer to “Names of the Parts”

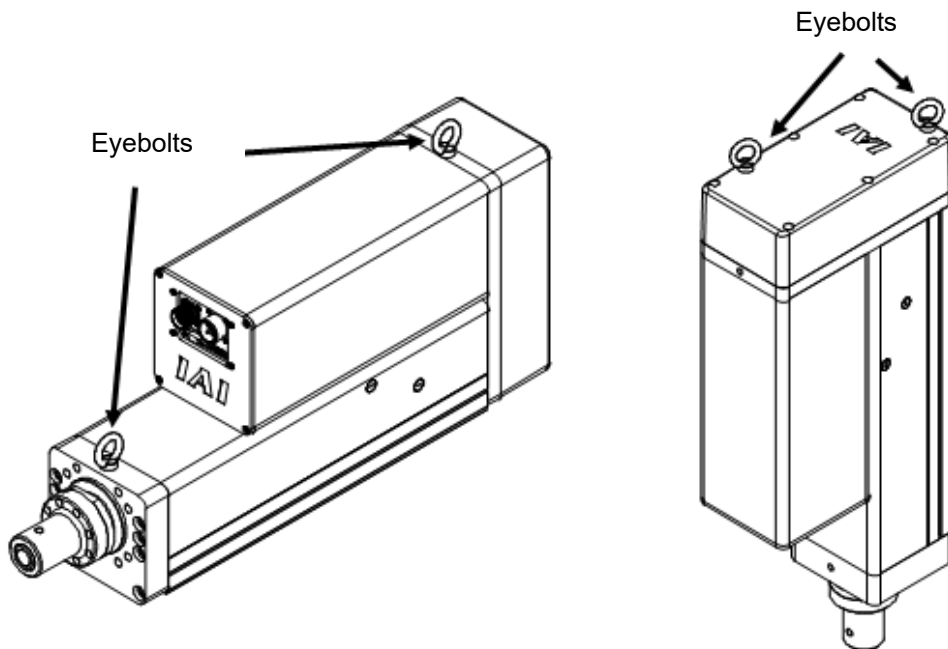
[RA15R and RA20R]

- Attach the enclosed eyebolts on the main body and lift it up on a crane. Do not attempt to lift up only the motor unit or cables. Also, do not attempt to pull out the rod and apply excess force on it.
- Pay attention not to hit the product on anything while hanging up to carry. Especially, avoid damage on the rod and motor unit.
- Do not give any excessive force to any of the sections in the actuator.

 Caution: Do not attempt to lift up the unit by hanging on the rod or motor unit.

Supplement) Refer to “Name of Each Part” for the name of each part on the actuator.

[Eyebolt]
Types M10 (2 pcs)

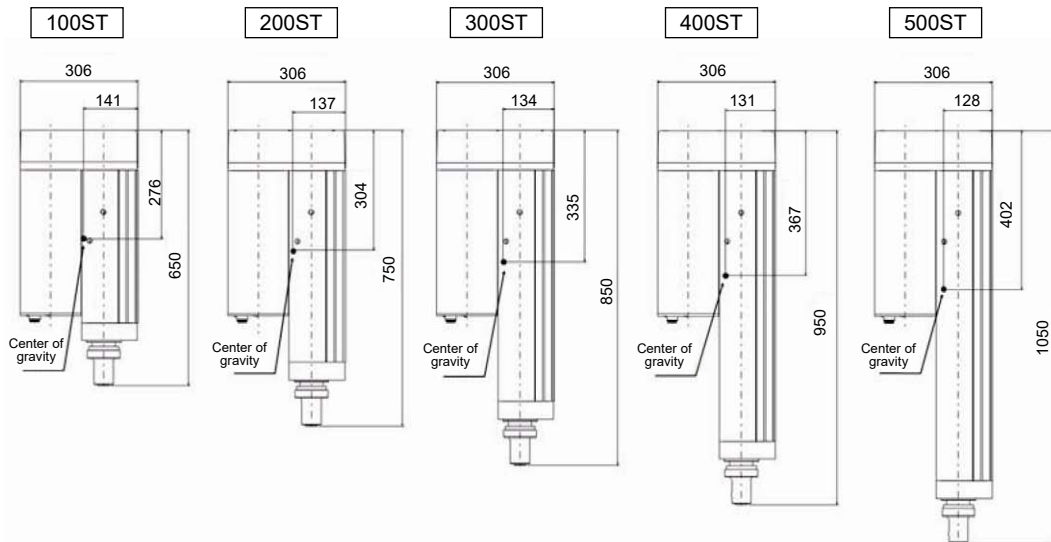


[Center Point of Gravity on Main Body]

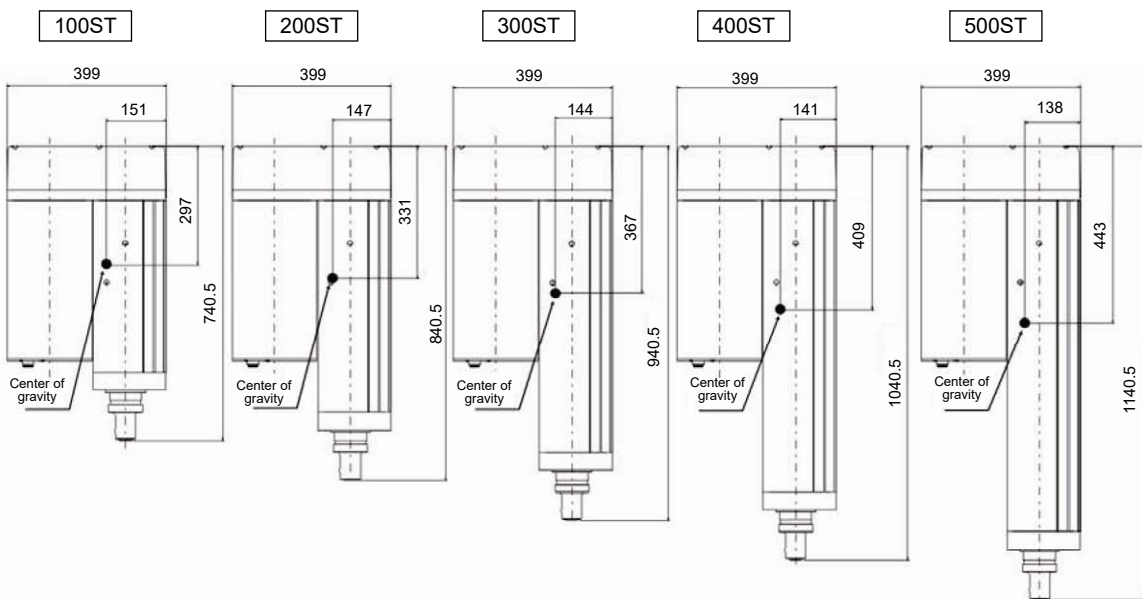
When transporting an actuator, check the mass and the center of gravity of the actuator before lifting up on a crane. Pay attention to the center point of gravity as it differs for each model. The center point of gravity is a reference assuming the rod is placed at the home position.

Stroke [mm]	Mass [kg]			
	RCS3-RA15R (equipped with loadcell)	RCS3-RA15R (Conveyor Type) (with no loadcell equipped)	RCS3-RA20R (equipped with loadcell)	RCS3-RA20R (Conveyor Type) (with no loadcell equipped)
100	61	60	93.3	93.3
200	64.9	63.9	99.6	99.6
300	68.7	67.7	105.8	105.8
400	72.6	71.5	112.1	112.1
500	76.5	75.5	118.4	118.4

1. RCS3-RA15R Center Point of Gravity



2. RCS3-RA20R Center Point of Gravity



[2] Handling in the Assembled Condition

This is the case when the product is delivered from our factory under a condition that it is assembled with other actuators. The combined axes are delivered in a package that the frame is nailed on the lumber base. Fix the rod so that would not accidentally move during transportation. The actuators are also fixed so the tip of it would not shake due to the external vibration.

(1) How to Handle the Package

- Do not hit or drop the package. No special treatment is conducted on this package to endure a drop or impact on it.
- Do not attempt to carry a heavy package with only one worker. Also, have an appropriate method for transportation.
- When hanging up with ropes, support on the reinforcement frame on the bottom of the lumber base. When bringing up the package with a forklift, also support on the bottom of the lumber base.
- Handle with care when putting the package down to avoid impact or bounce.
- Do not step on the package.
- Do not put anything on the package that could deform or damage it.

(2) How to Handle after Unpackaged

- Secure the rods to prevent sudden movement during transport.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up with ropes, have appropriate cushioning to avoid any deformation of the actuator body. Also keep it in stable horizontal orientation. Make a fixture utilizing the attachment holes and the tapped holes on the actuator body if necessary.
- Do not attempt to apply load on the actuators or the connector box. Also pay attention not to pinch cables and bend or deform them forcefully.

[3] Handling in Condition of being assembled in Machinery Equipment (System)

These are some caution notes for when transporting the actuator being assembled in the machinery equipment (system):

- Fix the rod so that it would not move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up the machinery equipment (system) with ropes, do not attempt to apply load on the actuators or the connector box. Also pay attention not to pinch cables and bend or deform them forcefully.

2.2 Installation and Storage • Preservation Environment

[1] Installation Environment

The actuator should be installed in a location other than those specified below.

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

Also provide sufficient work space required for maintenance inspection.

- Where the actuator receives radiant heat from strong heat sources such as heat treatment furnaces
- Where the ambient temperature exceeds the range of 0 to 40°C
- Where the temperature changes rapidly and condensation occurs
- Where the relative humidity exceeds 85% RH
- Where the actuator receives direct sunlight
- Where the actuator is exposed to corrosive or combustible gases
- Where the ambient air contains a large amount of powder dust, salt or iron (at level exceeding what is normally expected in an assembly plant)
- Where the actuator is subject to splashed water, oil (including oil mist or cutting fluid) or chemical solutions
- Where the actuator receives impact or vibration
- Where the altitude is more than 2000m

If the actuator is used in any of the following locations, provide sufficient shielding measures:

- Where noise generates due to static electricity, etc.
- Where the actuator is subject to a strong electric or magnetic field
- Where the actuator is subject to ultraviolet ray or radiation

[2] Storage • Preservation Environment

- The storage and preservation environment should comply with the same standards as those for the installation environment. In particular, when the machine is to be stored for a long time, pay close attention to environmental conditions so that no dew condensation forms.
- Unless specially specified, moisture absorbency protection is not included in the package when the machine is delivered. In the case that the machine is to be stored and preserved in an environment where dew condensation is anticipated, take the condensation preventive measures from outside of the entire package, or directly after opening the package.
- For storage and preservation temperature, the machine withstands temperatures up to 60°C for a short time, but in the case of the storage and preservation period of 1 month or more, control the temperature to 50°C or less.
- Storage and preservation should be performed in the horizontal condition. In the case it is stored in the packaged condition, follow the posture instruction if any displayed on the package.

2.3 How to Install

This chapter explains how to install the actuator on your mechanical system.

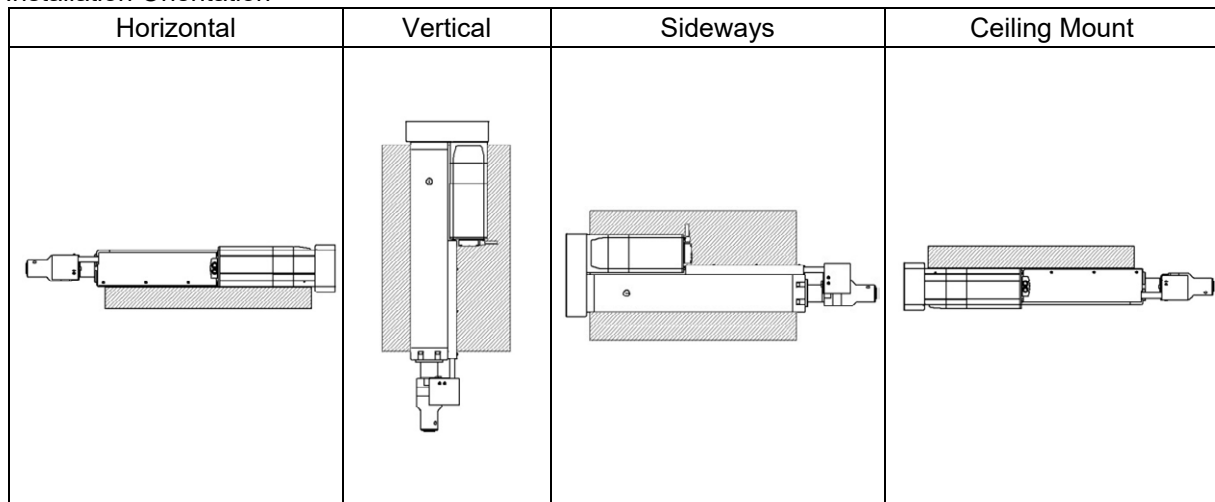
2.3.1 Installation

Follow the information below when installing the actuator, as a rule. Do pay attention to these items (except with custom-order models).

○ : Possible × : Not possible

Type	Horizontal Installation	Vertical Installation	Sideway Installation	Ceiling Mount Installation
RA4R, RA6R, RA7R, RA8R, RA10R	○	○	○	×
RA15R, RA20R (equipped with loadcell)	○	○	×	×
RA15R, RA20R (Conveyor type) (with no loadcell equipped)	○	○	○	○

Installation Orientation



2.3.2 Installation of the Main Unit

The surface to mount the main unit should be a machined surface or a plane that possesses an equivalent accuracy and the flatness should be within 0.05mm/m. Also, the platform should have a structure stiff enough to install the unit so it would not generate vibration or other abnormality.

Also consider enough space necessary for maintenance work such as actuator replacement and inspection.

On the base there is a datum surface prepared for the attachment oblong holes.

On the back side of the actuator, there are attachment tapped holes, through holes (RA6R and RA7R), positioning reamed holes and oblong holes. For the details of the positions and dimensions, check in the appearance drawings. [Refer to 6. "External Dimensions"]

When repeatability in re-attaching is required after it is detached, utilize the reamed holes. Please note, however, that a consideration is necessary such as to use only one point on the motor side of the reamed holes when a fine-tuning such as perpendicularity is required.

[1] Using the Tapped Holes on the Bottom of the Base

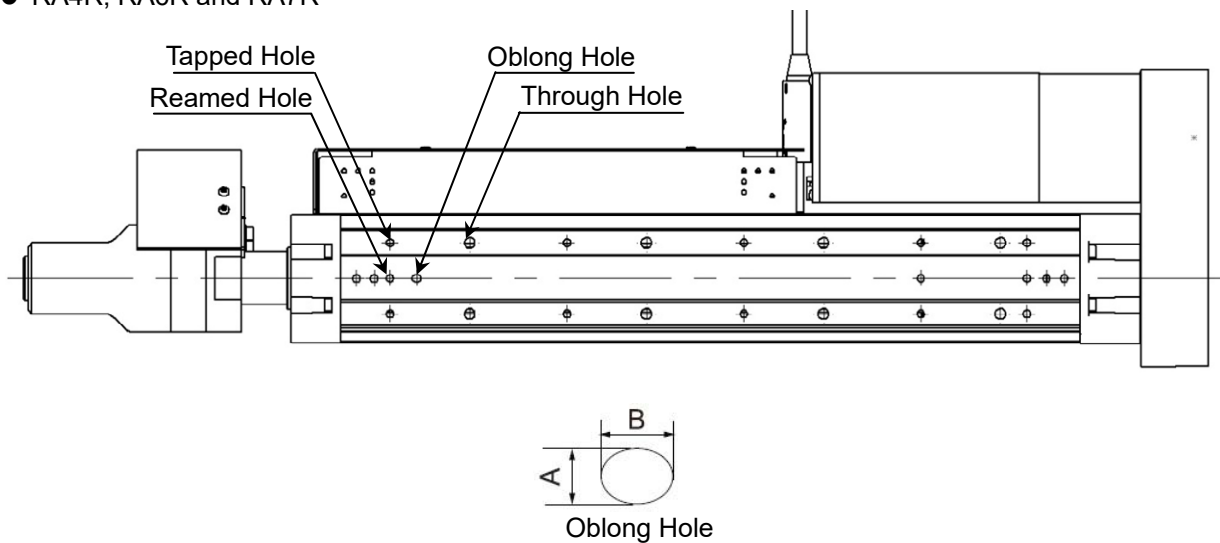
The actuator of RA4R, RA6R, RA7R, RA8R and RA10R has tapped holes for mounting so it can be fixed from the bottom of the base.

(Note that the tapped holes size depends on the model. Please see the diagrams below and 6. "External Dimensions")

Also, there are reamed holes and a oblong hole for positioning pins.

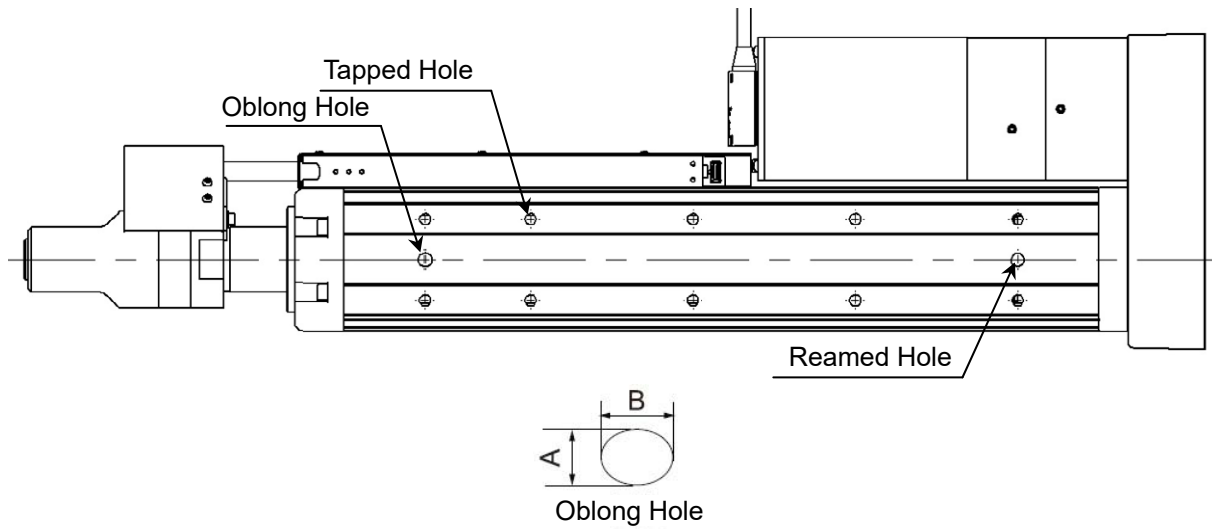
(Note) RA15R and RA20R cannot be fixed on the back surface of the base.

- RA4R, RA6R and RA7R



Type	Tapped Hole Size	Tapped Holes Depth	Tightening Torque		Reamed Hole [mm]	Oblong Hole
			In the case that steel is used for the bolt seating surface:	In the case that aluminum is used for the bolt seating surface:		
RA4R	M4	Through (screwed depth should be 5mm max.)	3.59N•m (0.37kgf•m)	1.76N•m (0.18kgf•m)	φ3H7 Depth 4	A: $3^{+0.012}_0$ B: 4 Depth 4mm or less
RA6R	M5	Through (screwed depth should be 10mm max.)	7.27N•m (0.74kgf•m)	3.42N•m (0.35kgf•m)	φ4H7 Depth 5.5	A: $4^{+0.012}_0$ B: 5 Depth 5.5mm or less
RA7R	M5	9mm	7.27N•m (0.74kgf•m)	3.42N•m (0.35kgf•m)	φ4H7 Depth 6	A: $4^{+0.012}_0$ B: 5 Depth 6mm or less

- RA8R and RA10R



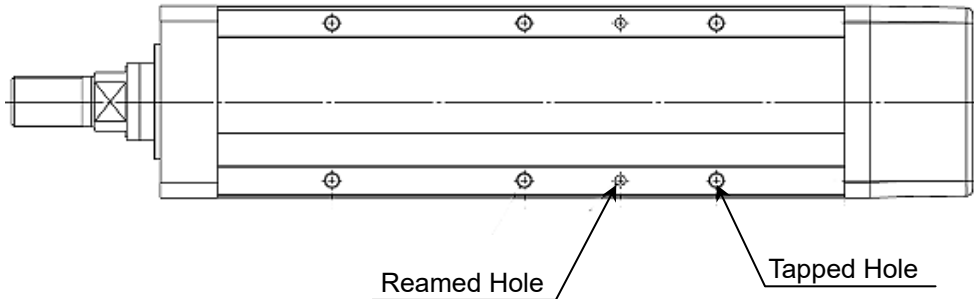
Type	Tapped Hole Size	Tapped Holes Depth	Tightening Torque		Reamed Hole [mm]	Oblong Hole
			In the case that steel is used for the bolt seating surface:	In the case that aluminum is used for the bolt seating surface:		
RA8R	M8	Through (screwed depth should be 12mm max.)	30.0N•m (3.06kgf•m)	11.4N•m (1.17kgf•m)	φ8H7 Depth 6.5	A: $8^{+0.015}_0$ B: 9 Depth 6.5mm or less
RA10R	M10	Through (screwed depth should be 15mm max.)	59.3N•m (6.06kgf•m)	23.3N•m (2.38kgf•m)	φ10H7 Depth 6.5	A: $10^{+0.015}_0$ B: 11 Depth 6.5mm or less

Tightening Screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- As the length of thread engagement for screws, set to 4mm or less for RA4R, approx. 1.8 times of the nominal diameter for RA6R and RA7R, 12mm or less for RA8R and 15mm or less for RA10R, so screws will not go through inside the actuator.

⚠ Caution: Be careful when selecting the bolt length. If bolts of inappropriate lengths are used, the tapped holes may be damaged, actuator mounting strength may become insufficient, or contact with driving parts may occur, resulting in lower precision or unexpected accidents.

- RA15R, RA20R (Conveyor Type (with No Loadcell Equipped))
 (Note) Installation with the bottom of the base affixed cannot be conducted to an actuator equipped with the loadcell.



Type	Tapped Hole Size	Tapped Holes Depth	Tightening Torque	Reamed Hole [mm]
			In the case that steel is used for the bolt seating surface:	
RA15R	M12	20	103.5N•m (10.57kgf•m)	φ 8H7 Depth 10
RA20R	M12	24	103.5N•m (10.57kgf•m)	φ 8H7 Depth 10

Tightening Screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- As the length of thread engagement for screws, set to 20mm or less for RA15R and 24mm or less for RA20R, so screws will not go through inside the actuator.

⚠ Caution: Be careful when selecting the bolt length. If bolts of inappropriate lengths are used, the tapped holes may be damaged, actuator mounting strength may become insufficient, or contact with driving parts may occur, resulting in lower precision or unexpected accidents.

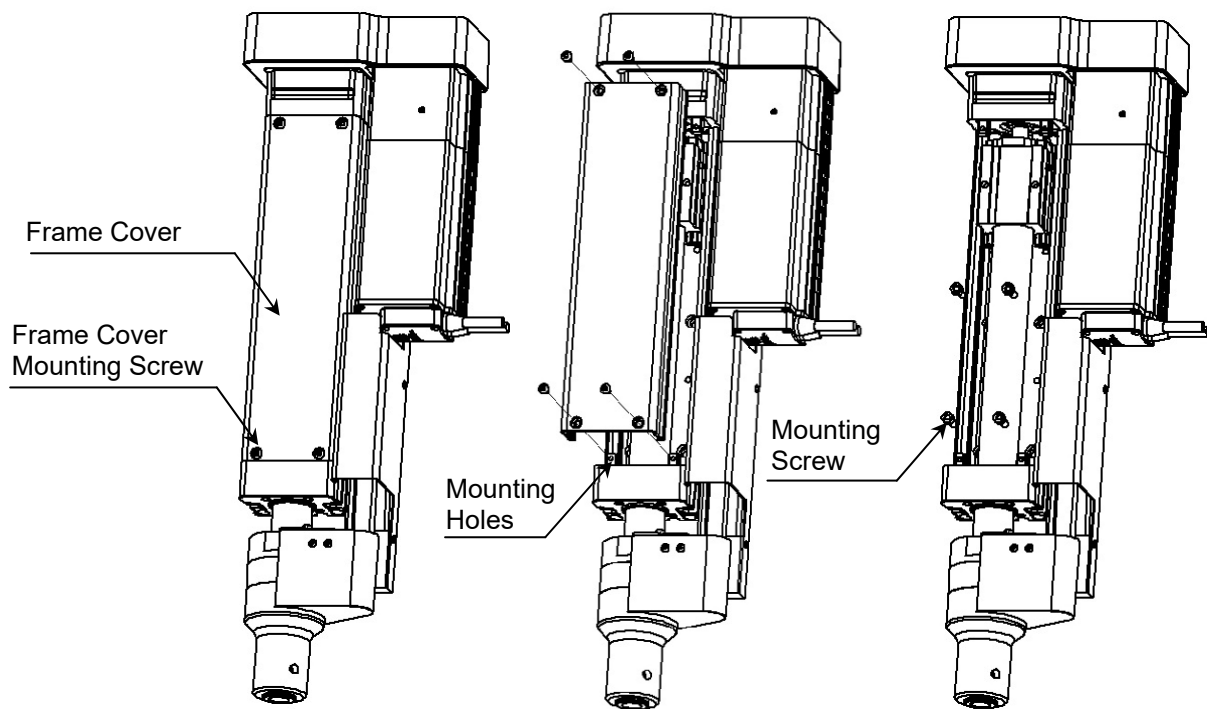
[2] Using the Mounting Holes on the Top of the Base

For RA4R, RA6R and RA7R, there are through holes equipped on the base so the unit can be attached from the top of the base.

To install the unit, loosen the frame cover mounting screws with a 2.5mm-sized hex wrench to detach the frame cover. (Remove 4 hex socket head cap screws.)

The rod cannot be driven only with ROBO Cylinder itself if it is equipped with a brake. Connect a controller and have JOG operation to move the rod to perform installation.

- RA4R, RA6R and RA7R



When affixing the frame cover, tighten the screws with the tightening torque described below.

Type	Screw Diameter	Tightening Torque
RA4R	M3	0.62N•m (0.06kgf•m)
RA6R	M4	1.76N•m (0.18kgf•m)
RA7R	M4	1.76N•m (0.18kgf•m)

Apply the socket head cap screw indicated in the table below suitable.

Type	Through Holes	Mounting Screw	Tightening Torque
RA4R	φ3.4 drilled hole, φ6.5 counter boring depth 3.5	M3	0.83N•m (0.085kgf•m)
RA6R	φ4.5 drilled hole, φ8 counter boring depth 4.5	M4	1.76N•m (0.18kgf•m)
RA7R	φ6 drilled hole, φ9.5 counter boring depth 5.5	M5	3.42N•m (0.35kgf•m)

Tightening Screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- For the effective engagement length between the bolt and female thread, provide at least the applicable value specified below:
Female thread is made of steel material → Same length as the nominal diameter
Female thread is made of aluminum → 1.8 times of nominal diameter



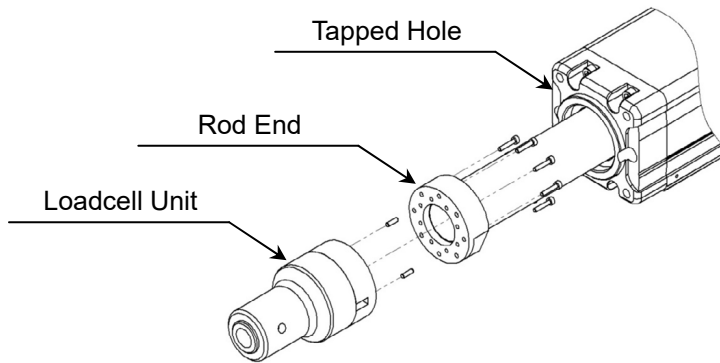
Caution: Pay attention when choosing the screw length. In case that insufficient length of screws is chosen, it may cause such problems as the strength not being enough on the actuator attachment, interference with driving part, drop in accuracy performance and unexpected accidents.

[3] When using Tapped Holes on Front Bracket

(1) RA4R, RA6R and RA7R

The rod end is as shown in the figure below so the loadcell can be attached.

As the tapped hole gets covered by the rod end, mounting with a front bracket cannot be performed.



(2) RA8R and RA10R

There are tapped holes equipped on the front bracket.

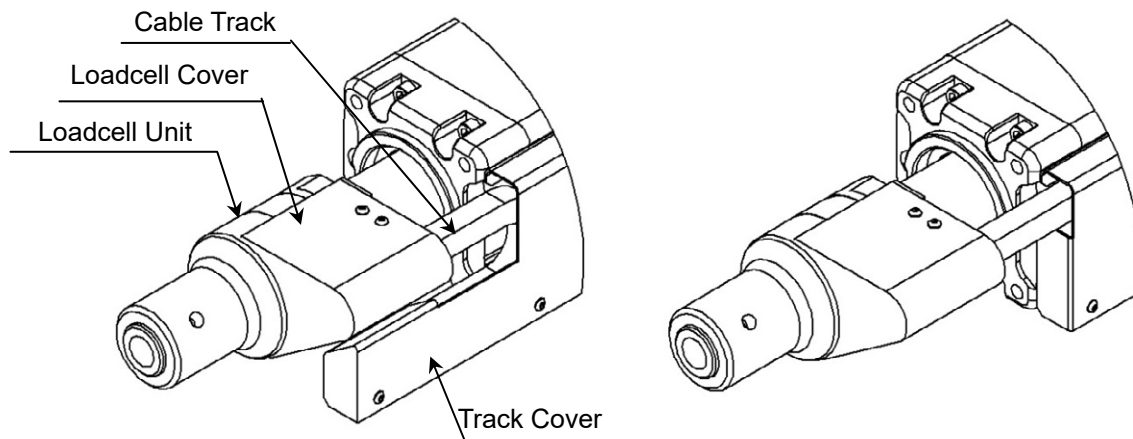
Even though the tapped holes can be utilized for installation, it is necessary to remove the cable track from the loadcell unit when attaching.

[Refer to How to Remove Cable Track in the next page]

Pay attention also on the interference to cable track and loadcell unit when attaching.

For those with short stroke, pay attention also on the interference to the track cover.

The profile of the track cover differs depending on the stroke.



1: Short Stroke

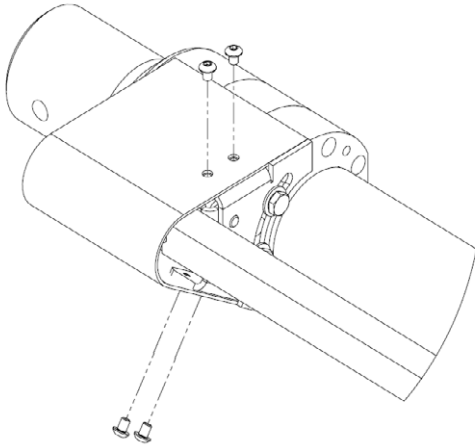
2: Long Stroke

Type	Stroke [mm]	
	1	2
RA8R	100 to 250	300 to 500
RA10R	100 to 200	250 to 500

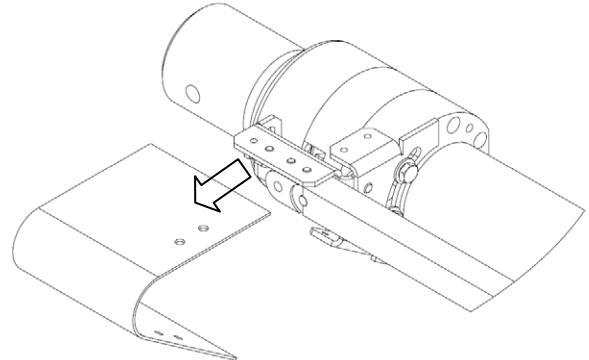
- How to Remove and Attach Cable Track
Remove the cable track by following the procedure below.

1) Remove the screws.

- * Hex Socket Button Head Screw 3×4 4pcs
Bolt Tightening Torque: 102N•cm (10.4kgf•cm)

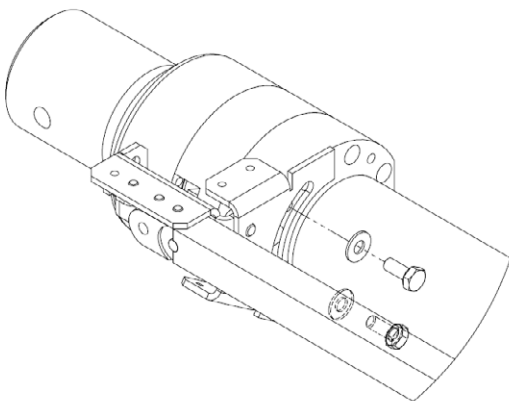


2) Detach the cover and disconnect the connector inside.

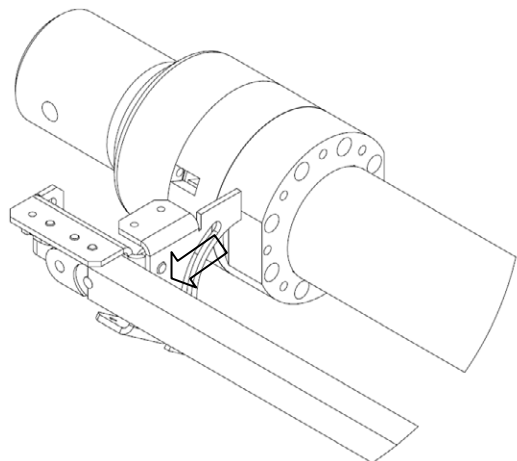


3) Remove the screws and washers.

- * Hex Socket Head Cap Screw with Captive Washer
RA4R: M3×8 2pcs
Bolt Tightening Torque: 154N•cm (15.8kgf•cm)
- * Hex Socket Flange Head Cap Screw
RA6R/7R/8R/10R: M4×10 P=1 2pcs
Bolt Tightening Torque: 359N•cm (36.7kgf•cm)

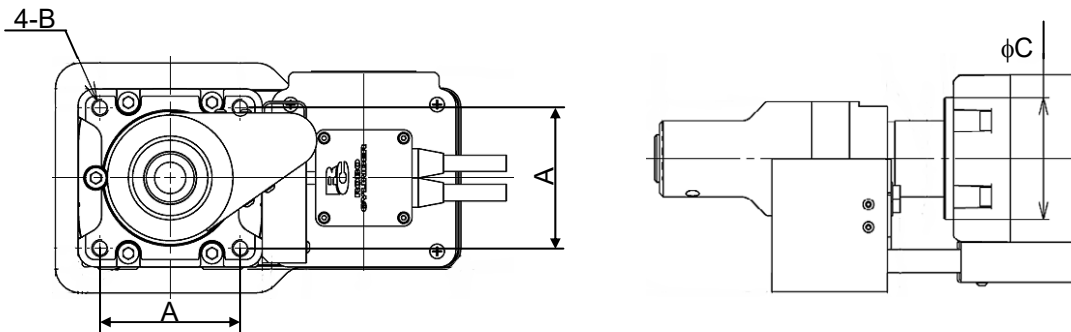


4) Detach the bracket.



Follow the steps in the back order to detaching.

The effective depth for the attachment screws is as shown below;



Type	Tapped Hole Size B	A	Screw Effective Depth	Tightening Torque		φC
				In the case that steel is used for the bolt seating surface:	In the case that steel is used for the bolt seating surface:	
RA8R	M8	67	16	30.0N•m (3.06kgf•m)	11.4N•m (1.17kgf•m)	φ 65h7
RA10R	M10	80	20	59.3N•m (6.06kgf•m)	23.3N•m (2.38kgf•m)	φ70h7

Make sure to follow “ⓈCaution for Installation using Front Bracket and Front Flange”

Tightening Screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- Have the length of thread engagement approximately 1.8 times of the nominal diameter.

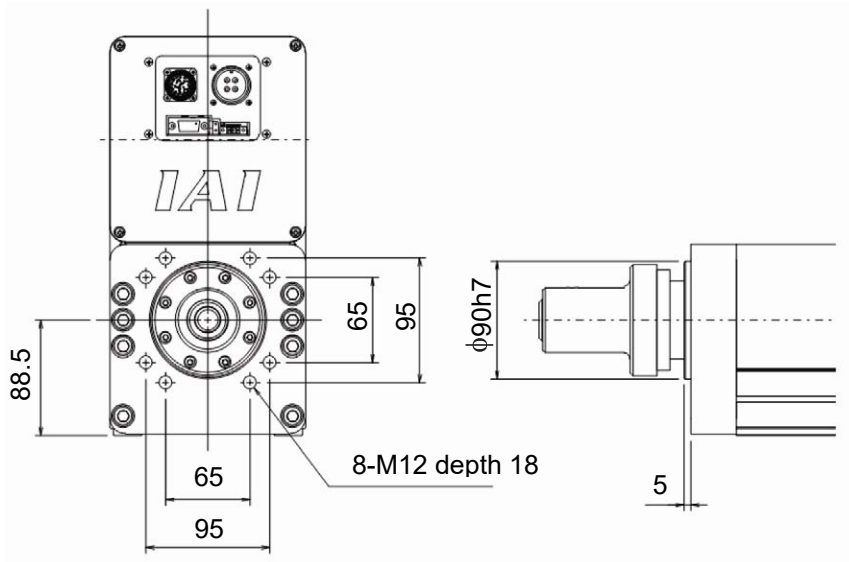


Caution: Pay attention when choosing the bolt length. In case that insufficient length of bolts is chosen, it may cause such problems as the strength not being enough on the actuator attachment, interference with driving part, drop in accuracy performance and unexpected accidents.

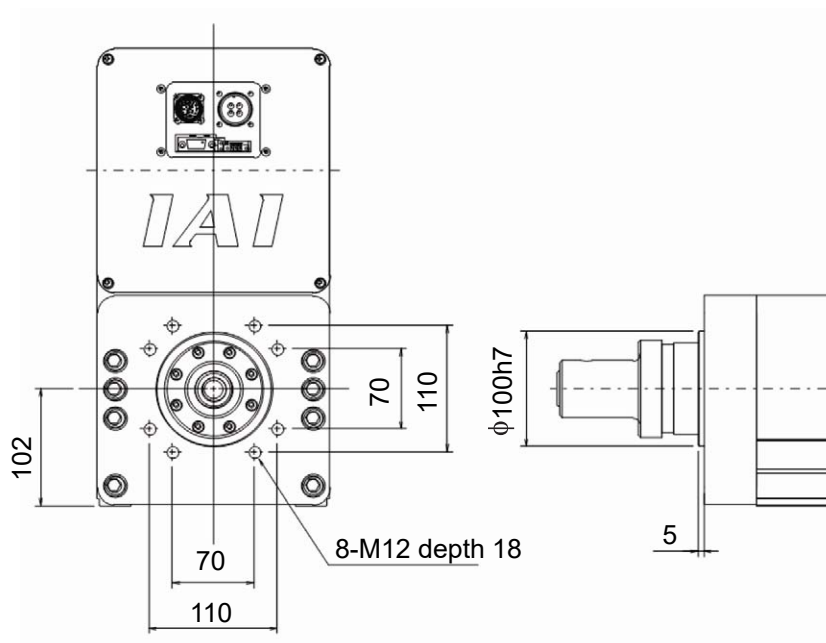
(3) RA15R, RA20R

There are tapped holes equipped for attachment on the front bracket.

[RA15R]



[RA20R]



The effective depth for the attachment screws is as shown below;

Model	Tapped Hole Size	Effective Thread Depth	Tightening Torque
RA15R RA20R	M12	18	121.2N•m (12.36kgf•m)

Make sure to follow “ⓈCaution for Installation using Front Bracket and Front Flange”

Tightening Screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- Have the length of thread engagement 18mm or less times of the nominal diameter.



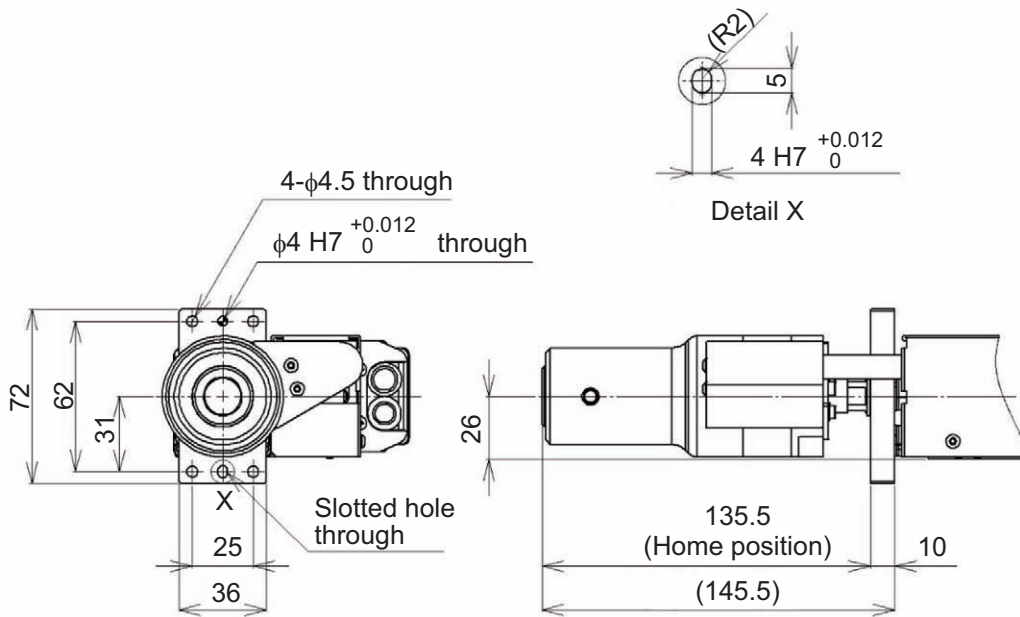
Caution: Pay attention when choosing the bolt length. In case that insufficient length of bolts is chosen, it may cause such problems as the strength not being enough on the actuator attachment, interference with driving part, drop in accuracy performance and unexpected accidents.

[4] When using Frange Bracket (Front) (Option)

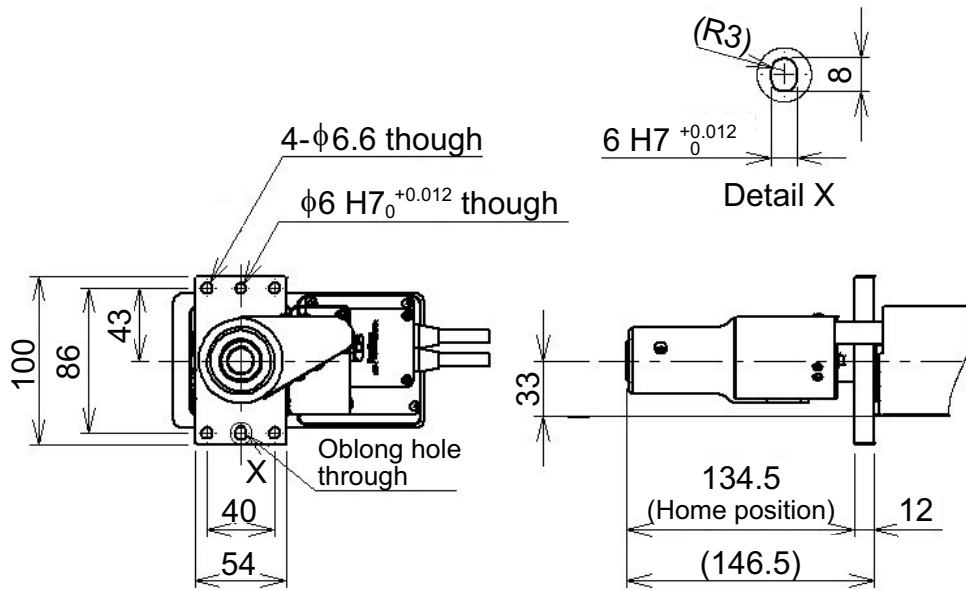
Frage bracket (front) (option) is to be attached in our factory at the delivery. It is not available for customers to attach it later on.

There are tapped holes equipped on the frange bracket (front) (option). Utilize these holes for the installation. The attachment holes are located as shown below;

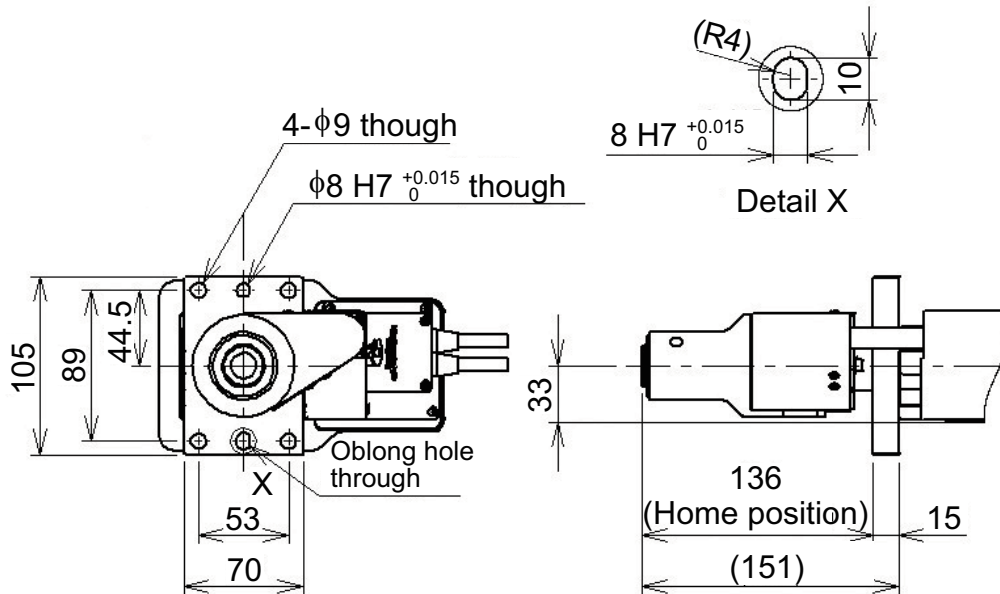
- RA4R



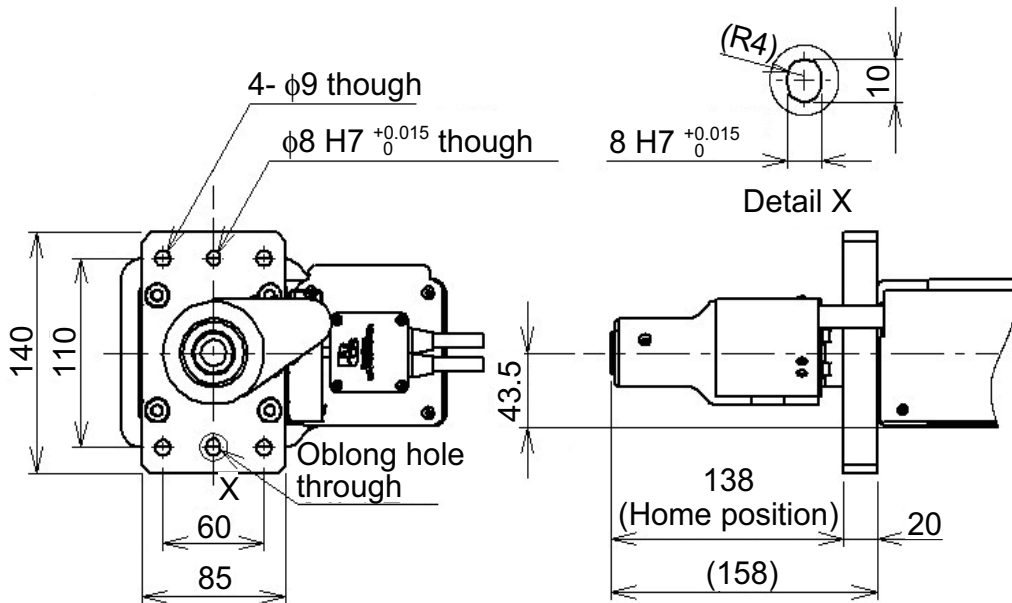
- RA6R



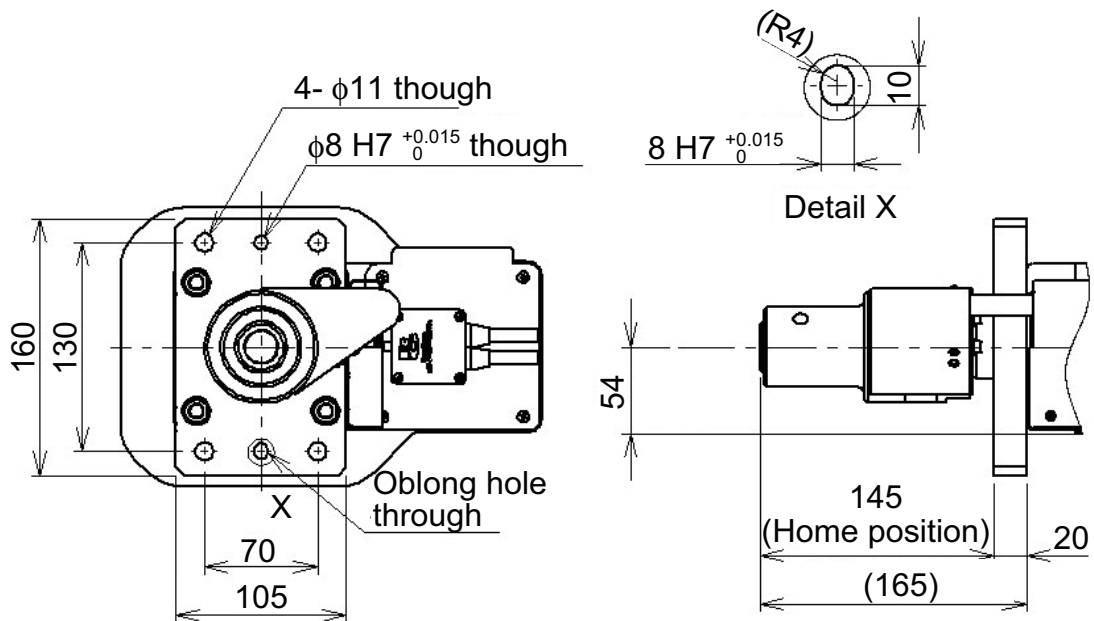
- RA7R



● RA8R



● RA10R



Make sure to follow “Caution for Installation using Front Bracket and Front Flange”

Tightening screws

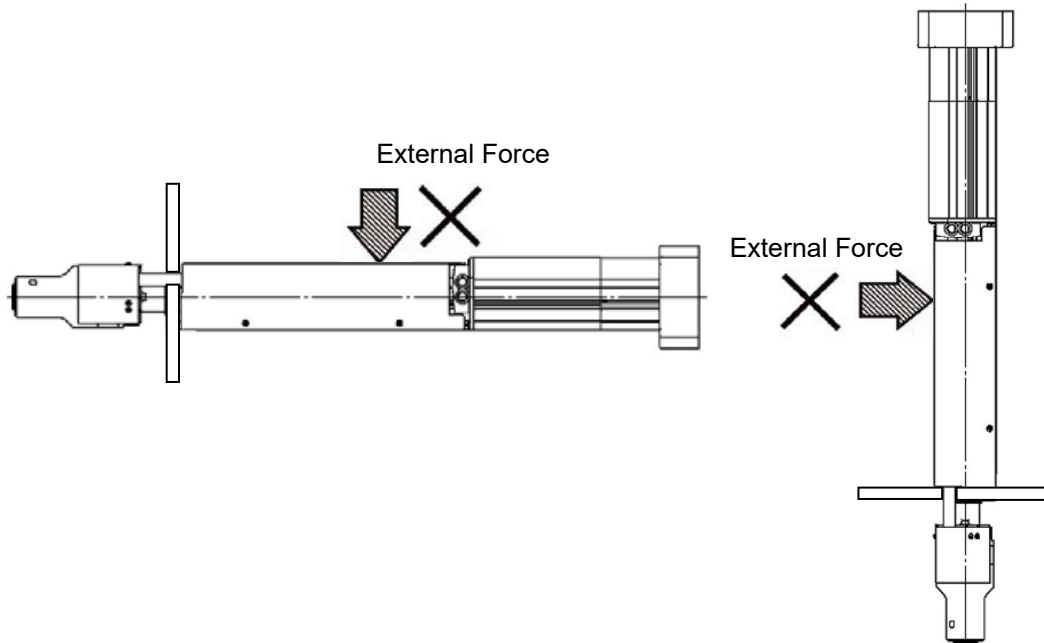
- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- For the effective engagement length between the bolt and female thread, provide at least the applicable value specified below:
Female thread is made of steel material → Same length as the nominal diameter
Female thread is made of aluminum → 1.8 times of nominal diameter



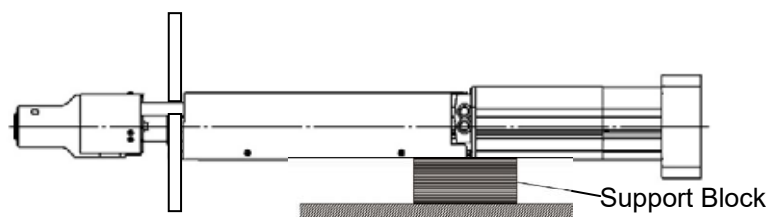
Caution: Pay attention when choosing the bolt length. In case that insufficient length of bolts is chosen, it may cause such problems as the strength not being enough on the actuator attachment, interference with driving part, drop in accuracy performance and unexpected accidents.

Ⓢ Caution for Installation using Front Bracket and Front Flange

Do not attempt to apply any external force to the body when installing with front bracket or front flange (option). External force may cause an operation failure or parts malfunction



Prepare a support block as shown in the figure below for the horizontal installation of the unit with its stroke more than 150 even if there is no external force applied on the body. Even for those with the stroke less than 150, it is recommended to have a support block to avoid vibration being generated due to the operation condition or installation environment, which may cause an operation failure or parts malfunction.

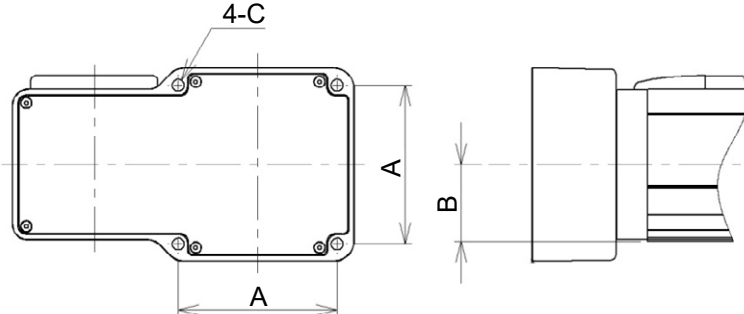


Operation of the actuator with attachment only on the front bracket and the front flange (option) applies the external force of the acceleration / deceleration multiplied by the weight of the actuator to the unit body.

Control the acceleration / deceleration at 0.05G or less (for reference) when the actuator is moved with attachment only on the front bracket and the front flange (option).

[5] When Utilizing Attachment Holes on the Bracket for Motor-Reversed Type

For RA4R, RA6R, RA7R, RA8R and RA10R, there are tapped holes prepared on the reversing bracket. (See the table below for the detailed dimensions.)




Type	A	B	C
RA4R	32	10	M4 depth 9
RA6R	67	33	M6 depth 12
RA7R	82	33	M8 depth 16
RA8R	90	43.5	M8 depth 16
RA10R	135	54	M10 depth 20

Type	Attachment Holes	Attachment Hole Depth	Tightening Torque	
			In the case that steel is used for the bolt seating surface:	In the case that steel is used for the bolt seating surface:
RA4R	M4	9mm	3.59N•m (0.37kgf•m)	1.76N•m (0.18kgf•m)
RA6R	M6	12mm	12.3N•m (1.26kgf•m)	5.4N•m (0.55kgf•m)
RA7R RA8R	M8	16mm	30.0N•m (3.06kgf•m)	11.4N•m (1.17kgf•m)
RA10R	M10	20mm	59.3N•m (6.06kgf•m)	23.3N•m (2.38kgf•m)

Tightening screws

- Use hexagonal socket head bolts for the male threads for installing the base.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- Have the length of thread engagement approximately 1.8 times of the nominal diameter.

 **Caution:** Pay attention when choosing the bolt length. In case that insufficient length of bolts is chosen, it may cause such problems as the strength not being enough on the actuator attachment, interference with driving part, drop in accuracy performance and unexpected accidents.

[Precautions for Attachments]

Please note the following caution notes when installing the unit with using the tapped holes on the reversing bracket.

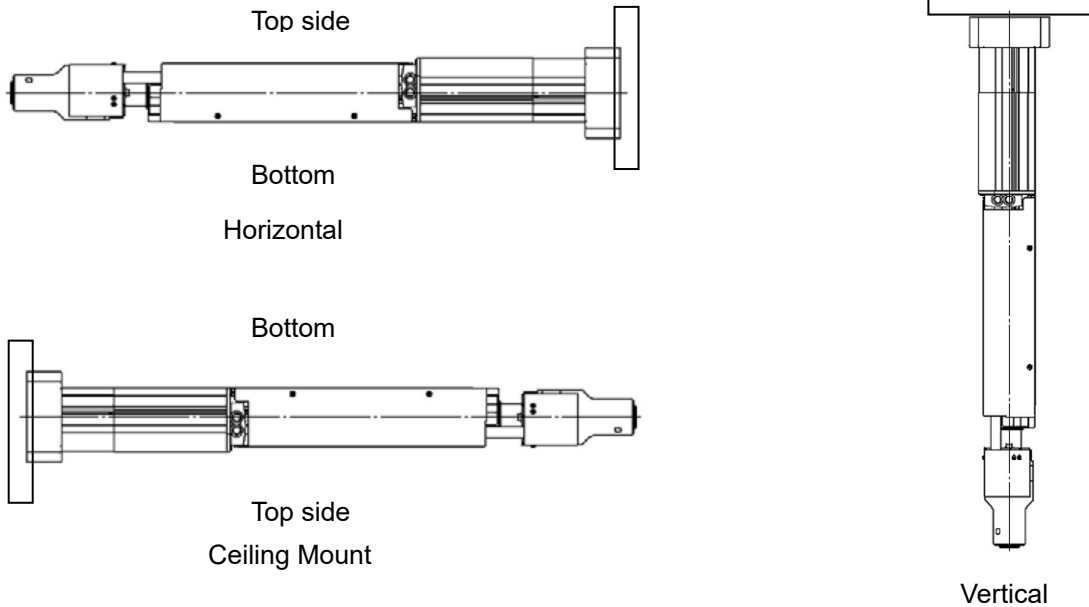
Do not attempt to affix the unit only with the tapped holes on the reversing bracket.

Do not apply external force to the main body.

There may be caused vibration due to the operating condition or installation environment, which may result in operational failures or components malfunction.

Refer below for whether it is feasible or not for installation in each posture when it is to be installed at the back.

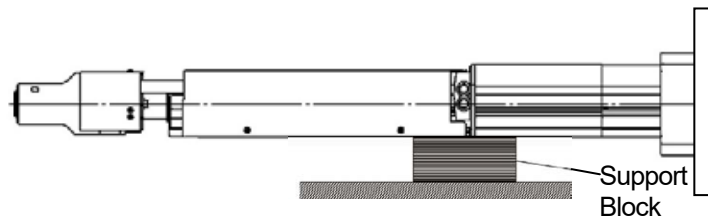
(Note) When it is perpendicular installation without support etc., external force does not act, it is not attempt to apply the radial load.



Installation Posture			Supports
Horizontal	Vertical	Ceiling Mount	
×	△	×	No
○	○	×	Yes

- : Possible
- △ : Mandatory to have daily inspection
- ×

When using the product in horizontal or vertical orientation, have a support block to support the main body to avoid any external force to be applied on the body.



[6] When Using Foot Bracket (Option)

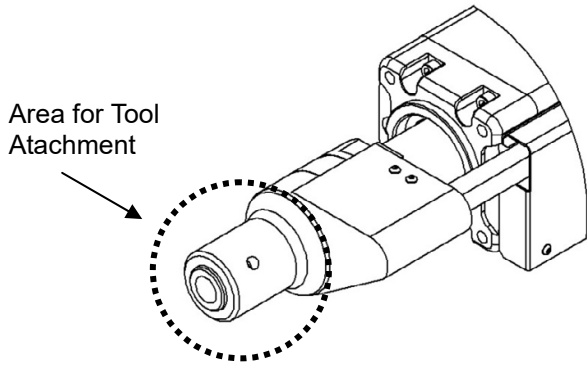
Installation can be performed with using a foot bracket (option). There are holes provided for installation on the foot bracket (option). Utilize these tapped holes for installation. [Refer to the 1.3 External Dimensions]

[7] Attachment of Tool (prepared by user)

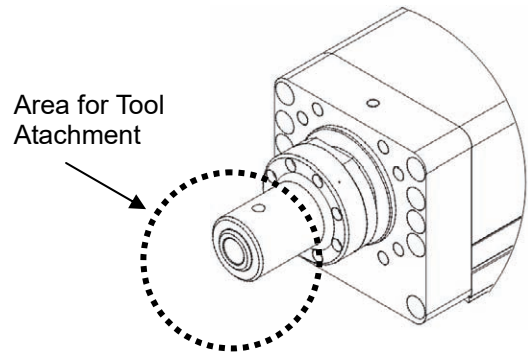
(1) Other Types Than RA15R and RA20R (Equipped with Loadcell (New Type))

On the end of the loadcell unit, there is a feature to attach a tool (prepared by a user). A tool is to be inserted in the tool attachment hole on the tip of the loadcell unit, and to be affixed with an attachment screw. The dimensions on the loadcell unit end are as shown below.

(Note) There is no tapped holes (8 × M5) equipped around the center hole for RA15R and RA20R (equipped with the loadcell (old type)).



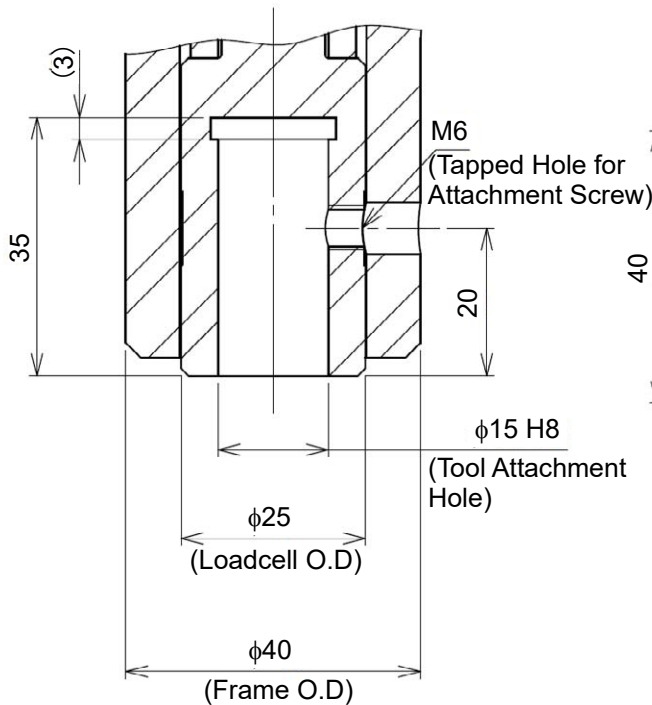
[RA4R, RA6R, RA7R, RA8R, RA10R]



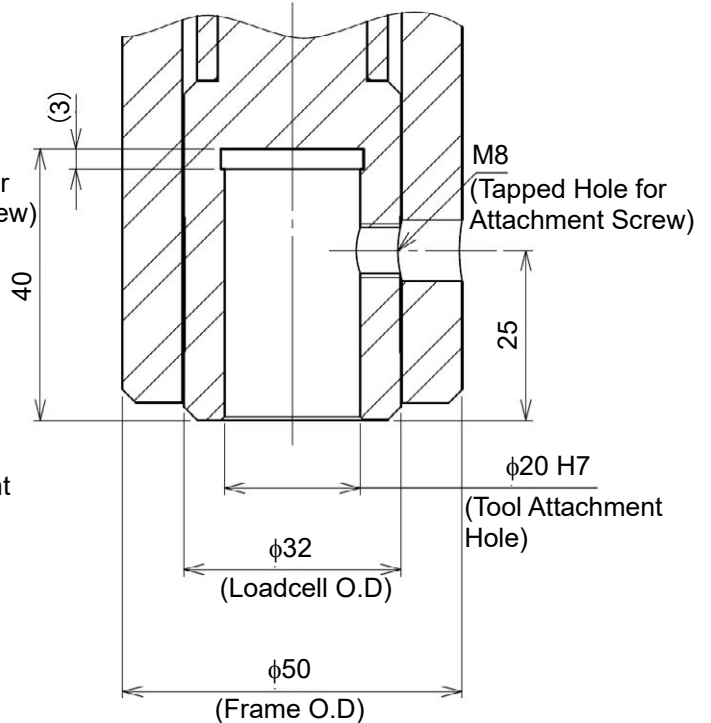
[RA15R, RA20R (Equipped with Loadcell (Old Type))]

[Dimensions on Loadcell Unit End]

● RA4R, RA6R, RA7R, RA8R



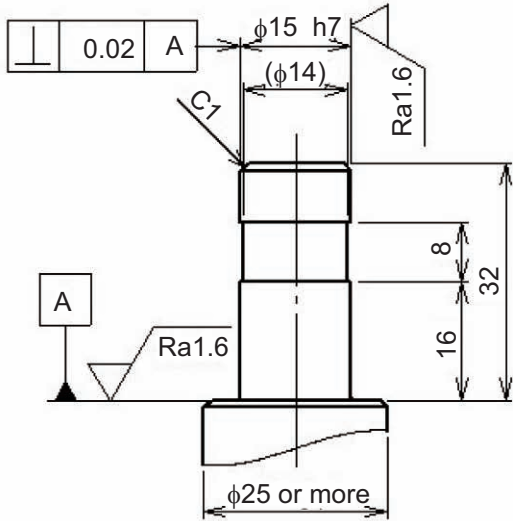
● RA10R, RA15R, RA20R



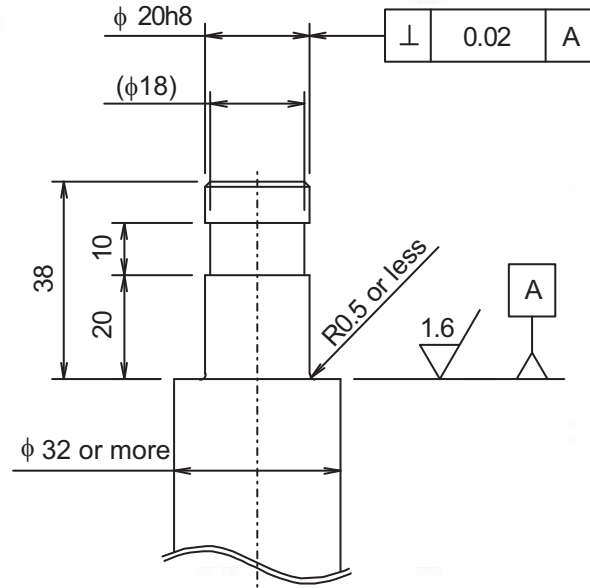
[Reference Dimension for Work Piece (Tool)]

In the figures below show the reference dimensions of attachment side of a tool to the loadcell.

- RA4R, RA6R, RA7R, RA8R



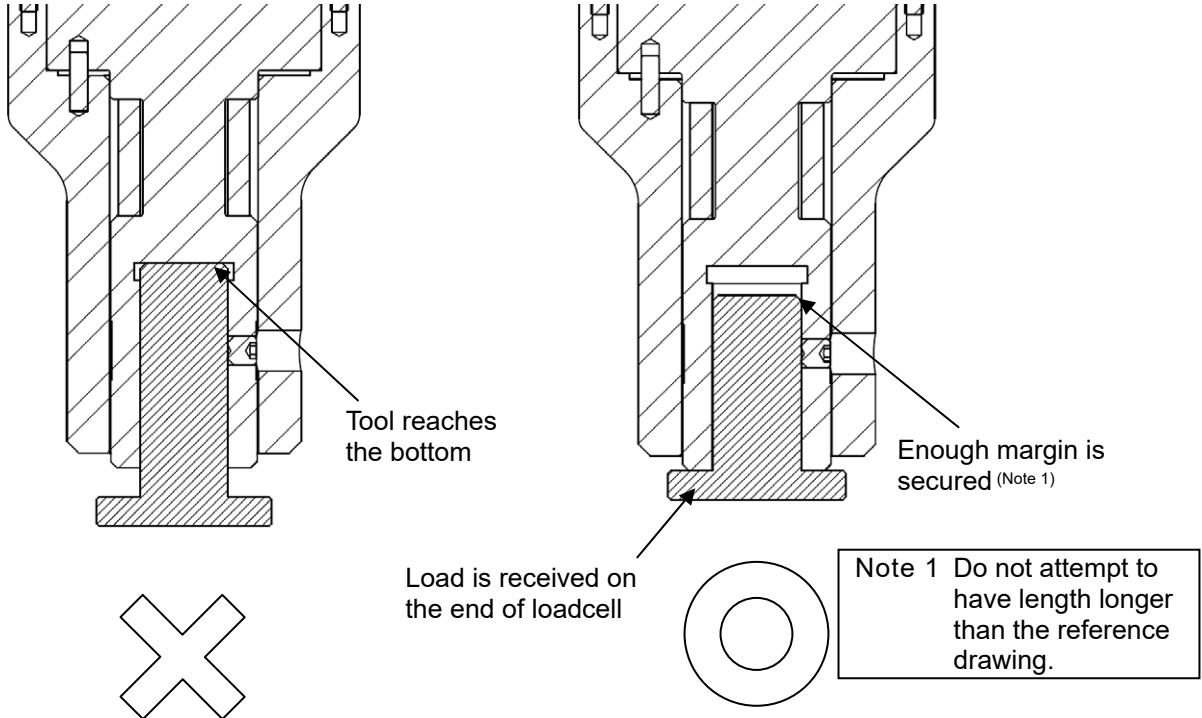
- RA10R, RA15R, RA20R



Reference specifications for attachment screws for work piece (tool)

Type	Screw Size	Tightening Torque
RA4R, RA6R, RA7R, RA8R	M6×6, Half-point, Steel	590N•cm
RA10R, RA15R, RA20R	M8×8, Half-point, Steel	1420N•cm

[How to Attach Work Piece (Tool) Appropriately]



Caution:

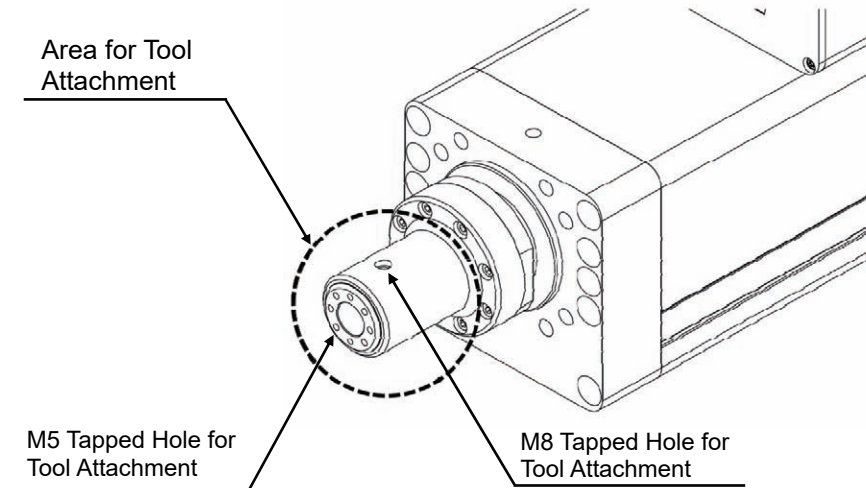
- Set the payload of the actuator or below.
- When attaching a tool, pay attention not to apply impact load or unbalanced load to the loadcell or peripheral components. It may cause malfunction of the loadcell.
- Inside of the loadcell cannot receive force. Make sure not to have a tool hit on the bottom inside the loadcell. (Do not attempt to have length more than the reference drawing). It may cause malfunction of the loadcell.
- When attaching a tool in horizontal orientation, avoid moment load from being applied to the loadcell.

(2) RA15R, RA20R (Equipped with Loadcell (New Type))

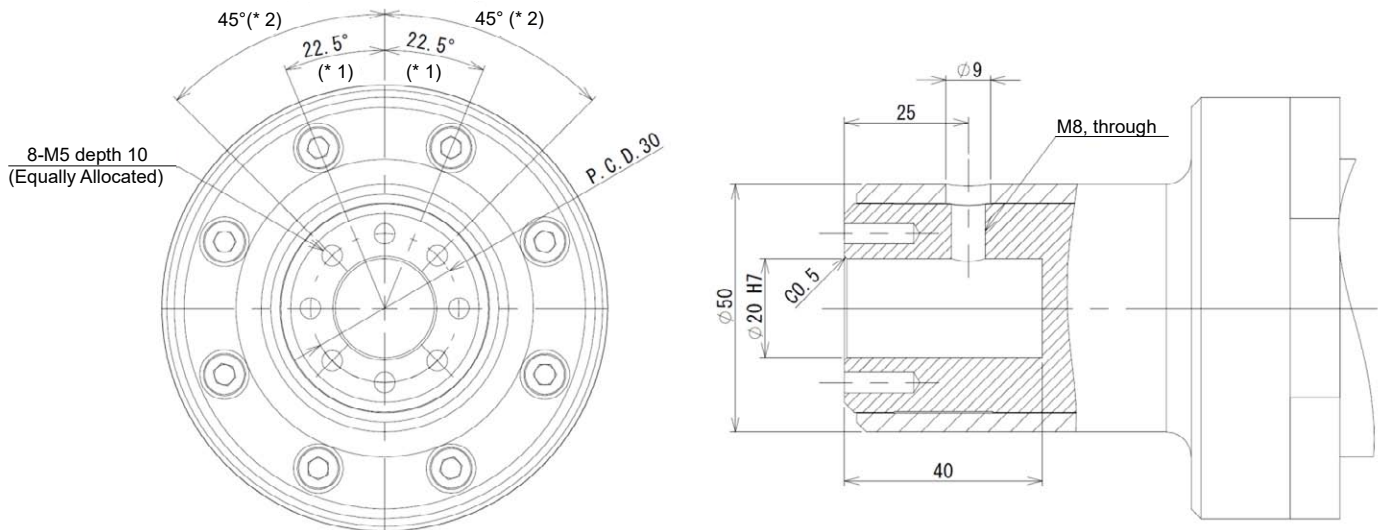
On the end of the loadcell unit, there is a feature to attach a tool (prepared by a user).

The tapped hole (M5) at the tip is available to attach a fixture.

Also, it is available to insert it to the fixture attachment hole equipped on the tip of the loadcell unit and affix it with a screw. The dimensions on the loadcell unit end are as shown below.



[Dimensions on Loadcell Unit End]

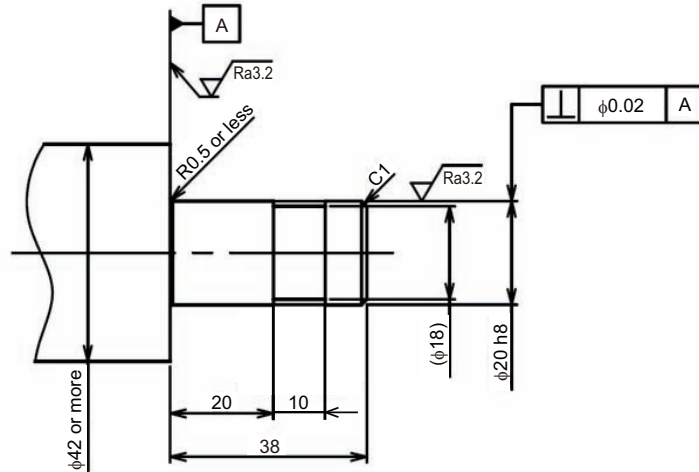


* 1 The range the hole for tool attachment (M8, tapped) is allocated.

* 2 The angle from the hole for tool attachment (M8, tapped)

· Reference Dimension for Work Piece (Tool)

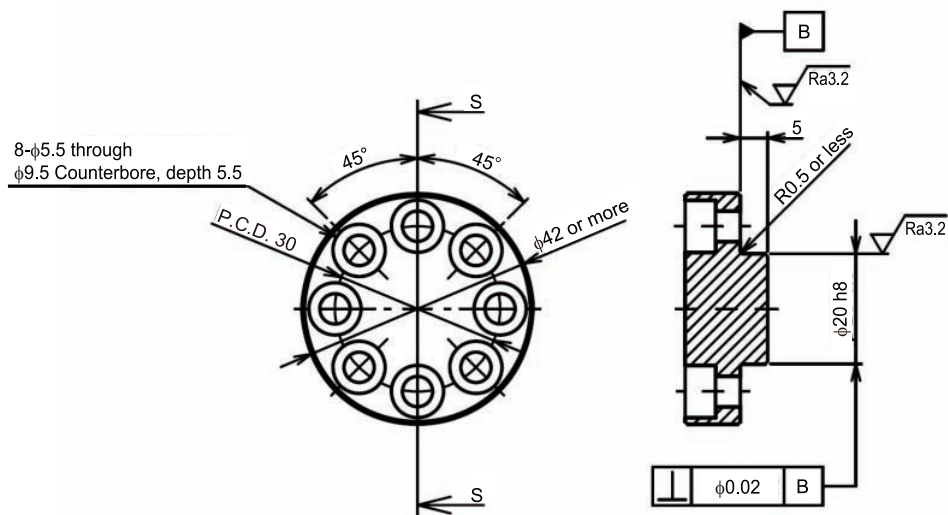
In the figures below show the reference dimensions of attachment side of a tool to the loadcell. When attaching with a screw by using the center hole, the tool weight should be 15kg or less.



Reference specifications for attachment screws for work piece (tool)

Screw Size	Tightening Torque
M8 × 8, Half-point, Steel	1420N•cm

When using 8 × M5 tapped holes around the center hole, refer to the fitting and hole positions when making a tool. It is not mandatory to attach a tool as shown in the figure below on the rod end and attach a chuck.

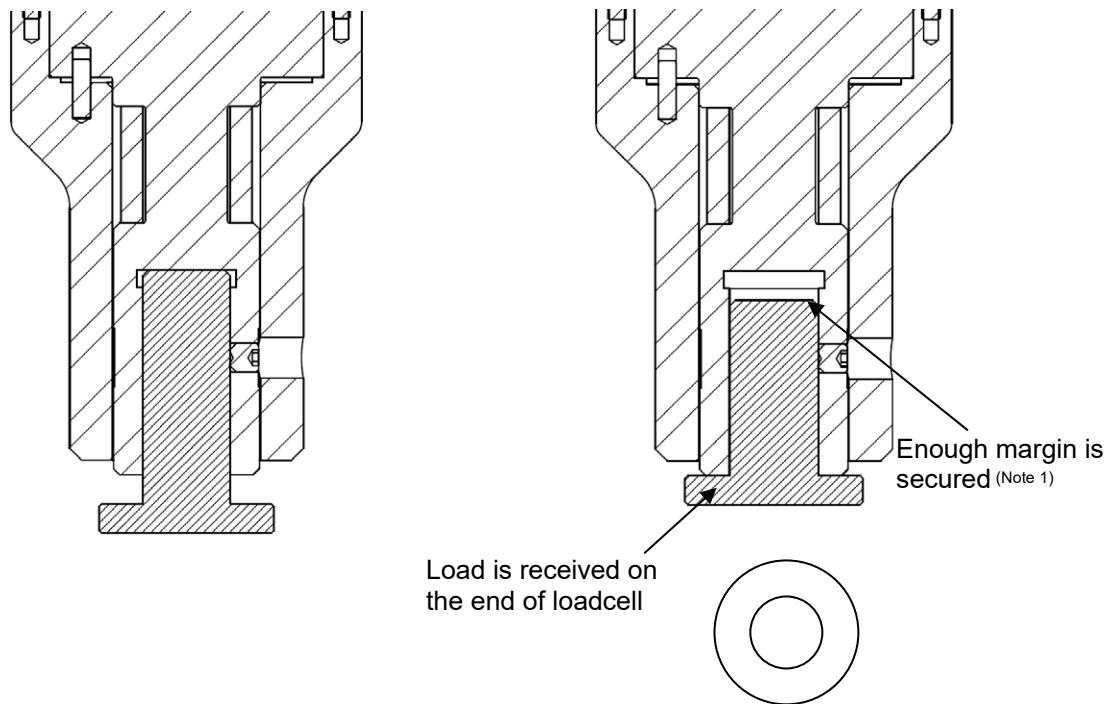


Section of S-S

Reference specifications for attachment screws for work piece (tool)

Screw Size	Tightening Torque
M5 hex socket-head screw Tensile Strength Rank 10.9 or higher	727N•cm

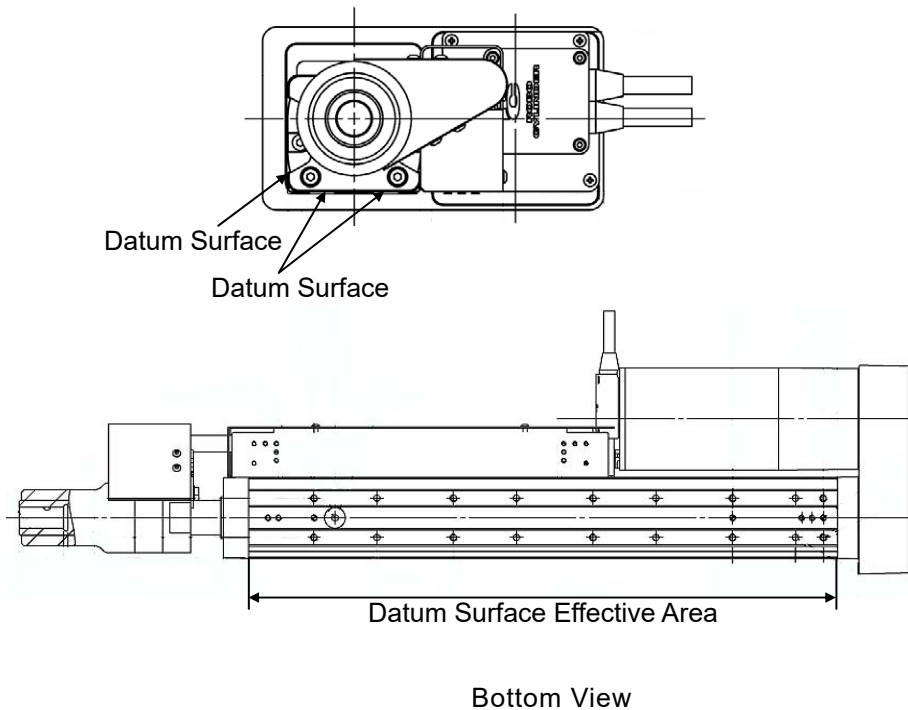
[How to Attach Work Piece (Tool) Appropriately]



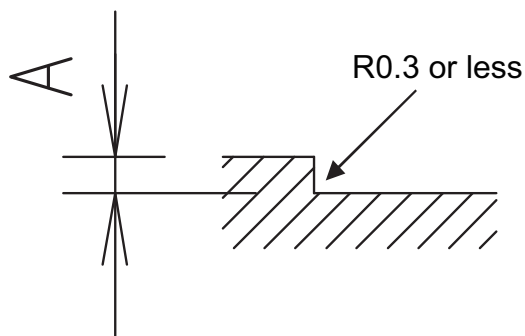
- ⚠ Caution:**
- Set the payload of the actuator or below. However, when attaching with a screw by using the center hole, the tool weight should be 15kg or less.
 - When attaching a tool, pay attention not to apply impact load or unbalanced load to the loadcell or peripheral components. It may cause malfunction of the loadcell.
 - Inside of the loadcell cannot receive force. Make sure not to have a tool hit on the bottom inside the loadcell. (Do not attempt to have length more than the reference drawing). It may cause malfunction of the loadcell.
 - When attaching a tool in horizontal orientation, avoid moment load from being applied to the loadcell.
 - In order to attach a tool, use either the center hole and affix with a M8 screw or 8 × M5 tapped holes around the center hole.

[8] Mounting Surface

- The platform to install the actuator should possess a structure that ensures enough stiffness, and should be free from vibration.
 - The surface where the actuator will be mounted should be a machined surface or that with an accuracy equivalent to it, and the flatness should be 0.05mm/m or below.
 - Ensure a room for maintenance work.
 - The side and bottom surfaces of the base on actuator other than RA15R and RA20R work as the datum surfaces for the side of the rod.
- Use these surfaces as the datum surfaces for mounting.



Follow the diagram below when installing the device using the reference surface.



Type	A Dimensions [mm]
RA4R, RA6R, RA7R	2 to 4
RA8R, RA10R	3 to 5

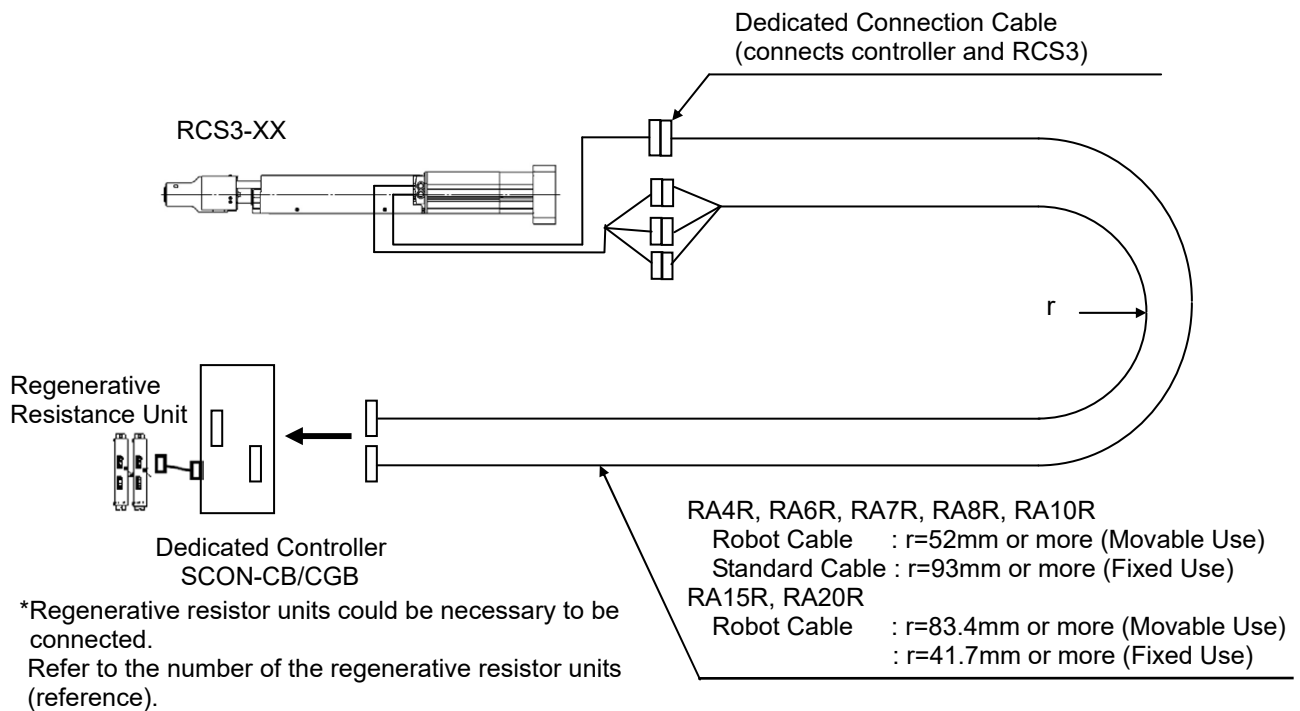
3. Connecting with the Controller

As the connection cable for the controller and RCS3 (this actuator), use the IAI-dedicated controller and dedicated connection cable.

This section explains the wiring method for a single axis.

- If the dedicated connection cable cannot be secured, reduce the load on the cable by allowing it to deflect only by the weight of the cable or wire it in a self-standing cable hose, etc., having a large radius.
- Do not cut and reconnect the dedicated connection cable for extension or shorten the cable.
- Do not pull on the dedicated connection cable or bend it forcibly.
- The actuator cable coming out of the motor unit is not meant to be bent. Fix the cable so it would not be bent repeatedly

Please consult with IAI if you require a different kind of cable than the one supplied.

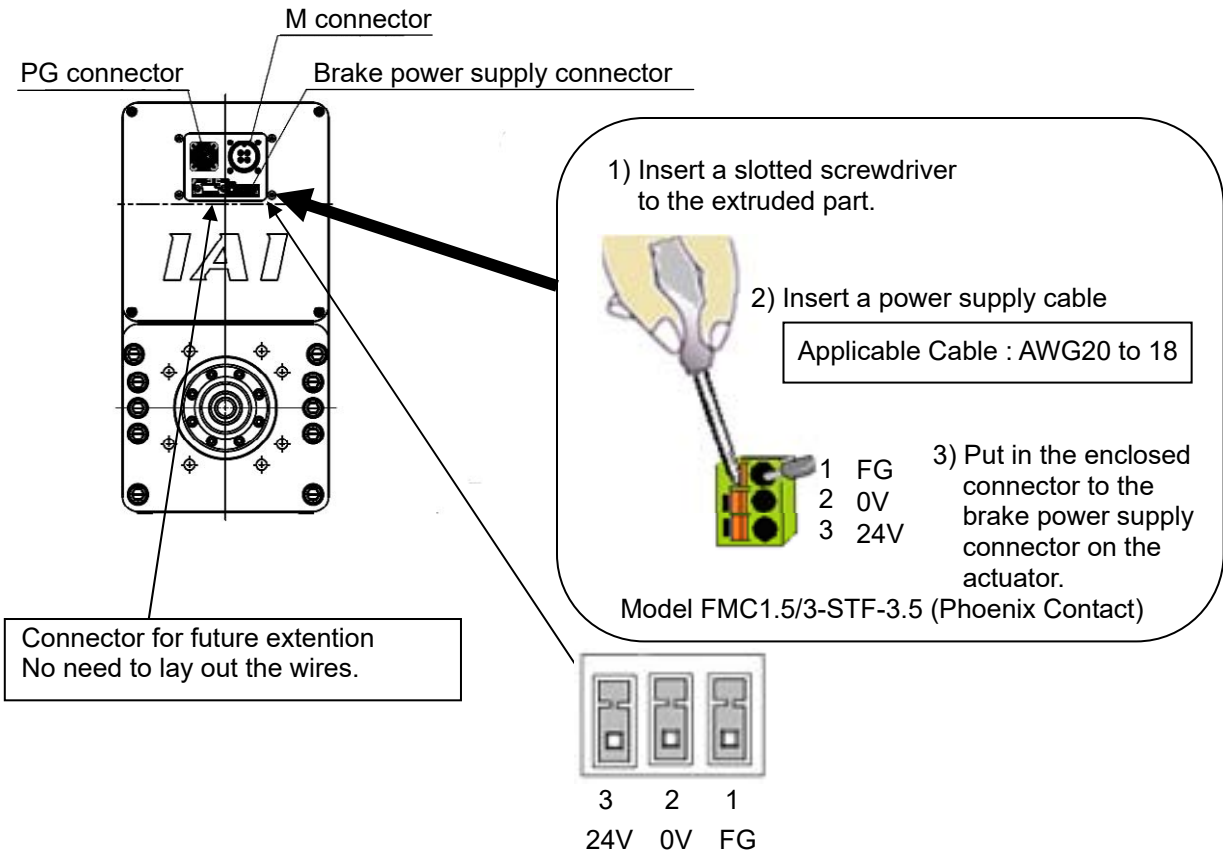


- Dedicated cable
- RA4R, RA6R, RA7R, RA8R, RA10R
- Motor cable : CB-RCC-MA□□□
 - Motor cable robot type : CB-RCC-MA□□□-RB
 - Encoder cable : CB-RCS2-PLDA□□□
 - Encoder cable robot type : CB-RCS2-PLDA□□□-RB
- RA15R, RA20R
- Motor cable : CB-RCS3-MA□□□-RB
 - Encoder cable : CB-RCS3-PLA□□□-RB
- (Note) □□□ indicates the cable length. Up to 30m can be specified.
 Example) 080=8m

[Wiring of Brake Power Supply for RA15R and RA20R]

For RA15R and RA20R, it is necessary to supply +24V power also to the actuator side. Supply power following the wiring shown in the figure below.

*The connector next to the brake power supply connector is one for extension in the future. It is not necessary for wiring.




[Number of Regenerative Resistor Units for Models other than RCS3-RA15R and RA20R (reference)]

- Model No. of regenerative resistance unit

		Item		Accessories
Model No.	1st Unit	Screw-Fixed Standard Type	REU-2	SCON Controller Connection Cable (Model: CB-SC-REU010) 1m enclosed
		Screw-Fixed Small Type	RESU-2	
		DIN Rail-Fixed Small Type	RESUD-2	
	2nd Unit or later	Screw-Fixed Standard Type	REU-1	Regenerative Resistor Unit Connection Cable (Model: CB-ST-REU010) 1m enclosed
		Screw-Fixed Small Type	RESU-1	
		DIN Rail-Fixed Small Type	RESUD-1	

- [Reference connectable quantity]

Number of Motor W		Number of Connectable Regenerative Resistance Unit
Horizontal Mount/ Vertical Mount	to 100W	Not required
	101 to 400W	1

 **Caution:** 1. The table for reference of the number of units to be connected shows the reference when a back and forth operation is performed in 50% of the operation duty of the actuator with the rated acceleration / deceleration and rated load in the whole stroke.

2. Regenerative energy is absorbed inside the controller and when it exceeds the limit, Error Code OCA "Overheat Error" is generated. Add an external regenerative unit if this occurs.

In case the operation duty is higher than 50%, it is necessary to have more regenerative resistor units shown in the table for reference of the number of units to be connected. The maximum quantity of the external regenerative resistor units that can be connected is as stated below:

Less than 400W: two units
(Make sure not to connect more units than shown above as it may cause malfunction.)

[Number of Regenerative Resistor Units for RCS3-RA15R and RA20R (Equipped with Loadcell) (reference)]

For the conveyor type in RCS3-RA15R and RA20R, select the number of units considering the condition of use. [Refer to 1.3.4 Checking Duty Conveyor Type (with No Loadcell Equipped)]

- Model No. of regenerative resistance unit

Model	Accessories
RESU-35T	None

- [Reference connectable quantity]

The Model of the Actuator	Cycle Time [sec]	No. of Connectable Units [unit]
RCS3-RA15R (3t type)	2.5 or more	0 (Not required)
	2.5 less than	1
RCS3-RA20R (5t type)	12 or more	0 (Not required)
	6 or more to 12 less than	1
	3.5 or more to 6 less than	2
	Not available for setting below 3.5	

The connectable number of units is the same regardless of the actuator orientation of installation.

The maximum number of connectable regenerative resistor units is two units. If “OCA” Overheat Alarm gets generated even with two units connected, revise the operational conditions such as to make the standby time longer or lower the velocity.

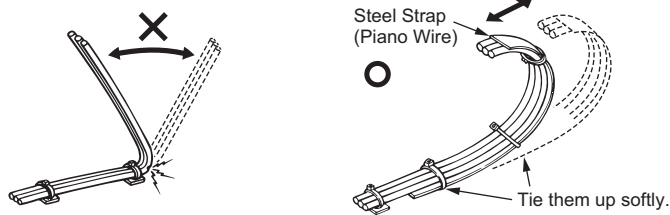


- Caution:
- 1) Connect three or more regenerative units and malfunction may occur.
 - 2) Do not attempt to touch the regenerative units as they get hot during use.
 - 3) Do not install the system near flammable materials.
 - 4) It is recommended to use cables with high heat resistance performance. Also, pay attention, when performing wiring, not to have the power supply code touch the regenerative units.
 - 5) Built-in temperature sensor is equipped. Have a circuit structure to shut off the driving source while the temperature sensor is in operation.
 - 6) The table for reference of the number of units to be connected shows a reference assuming a workpiece with 10kg is mounted and held for 1sec or more as the standby time.

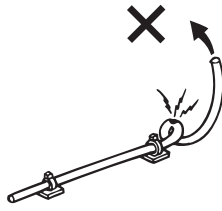


Warning: For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause not only a malfunction such as cable breakage or connection failure, or an operation error, but also electric shock or electric leakage, or may even cause a fire.

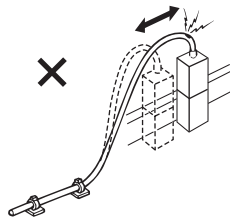
- Use dedicated cables of IAI indicated in this instruction manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with connectors on both ends to extend, shorten or re-joint it.
- Hold the dedicated cable to avoid mechanical force being applied to the terminals and connectors.
- Use a cable pipe or duct to have an appropriate protection when there is a possibility of mechanical damage on a dedicated cable.
- In case a dedicated cable is to be used at a moving part, make sure to lay out the cable without applying any force to pull the connector or extreme bend on the cable. Do not attempt to use the cable with a bending radius below the allowable value.
- Make certain that the connectors are plugged properly. Insufficient connection may cause an operation error, thus it is extremely risky.
- Do not lay out the cables to where the machine runs over them.
- Pay attention to the cable layout so it would not hit peripherals during an operation. In case it does, have an appropriate protection such as a cable track.
- When a cable is used hanging on the ceiling, prevent an environment that the cable swings with acceleration or wind velocity.
- Make sure there is not too much friction inside the cable storage equipment.
- Do not apply radiated heat to power line or cables.
- Have a sufficient radius for bending, and avoid a bend concentrating on one point.



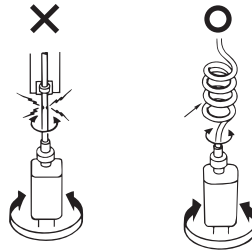
- Do not let the cable bend, kink or twist.



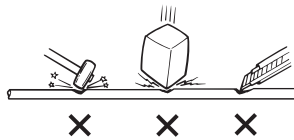
- Do not pull the cable with a strong force.



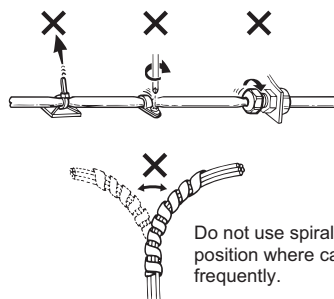
- Pay attention not to concentrate the twisting force to one point on a cable.



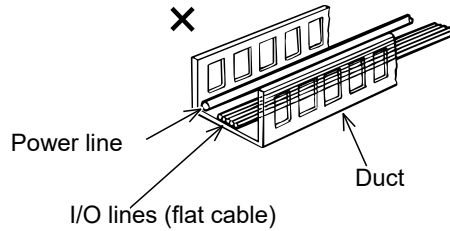
- Do not pinch, drop a heavy object onto or cut the cable.



- When a cable is fastened to affix, make sure to have an appropriate force and do not tighten too much.

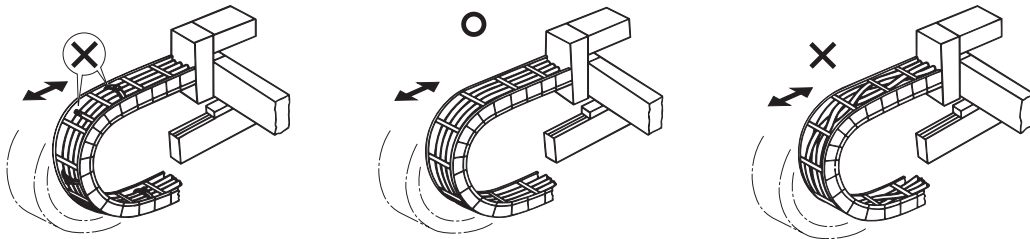


- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



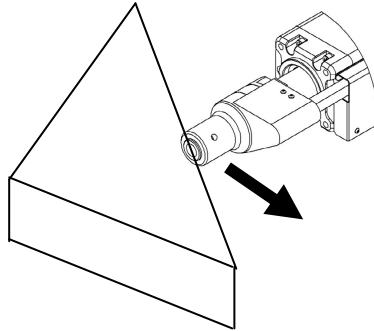
Follow the instructions below when using a cable track.

- If there is an indication to the cable for the space factor in a cable track, refer to the wiring instruction given by the supplier when storing the cable in the cable track.
- Avoid the cables to get twined or twisted in the cable track, and also to have the cables move freely and do not tie them up. (Avoid tension being applied when the cables are bent.) Do not pile up cables. It may cause faster abrasion of the sheaths or cable breakage.



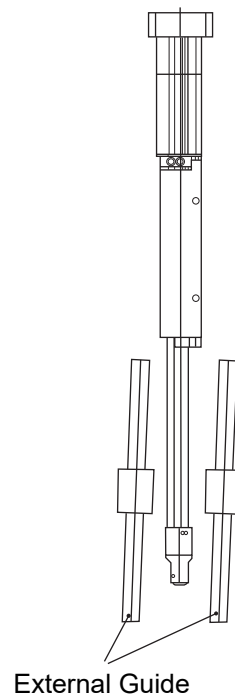
4. Caution for Operation

- When the reaction force of pressing is side load, any load is not given to the loadcell.



Be careful on the direction of the reaction force against the pressing

- When connecting the rod to external guides, be careful on the parallelism of the guides to the rod. When connecting and fixing the rod to external guides, be careful not to apply excess side-way load to the rod because of the assembly variation. For the connection of the rod and guides, have a component such as a free joint to accept the assembly variation.



5. Maintenance and Inspection

5.1 Inspection Items and Schedule

5.1.1 RA4R, RA6R, RA7R, RA8R and RA10R

Follow the maintenance inspection schedule below.

It is assumed that the equipment is operating 8 hours per day.

If the equipment is running continuously night and day or otherwise running at a high operating rate, inspect more often as needed.

	External Visual Inspection	Internal Inspection ^(Note 1)	Greasing
Start of work inspection	○		
1 month inspection	○		
3 month inspection	○		○ (Rod sliding surface, ball screw and guide)
Every 3 months since	○		○ (Rod sliding surface)
3 months after starting operation			Depends on grease supply timing (reference) of ball screw and guide
6 month inspection	○	○ ^(Note 2)	
Every 6 month since	○	○ ^(Note 2)	

Note 1 Conduct this only for RA4R, RA6R and RA7R.

Note 2 Check the condition of grease, and wipe off the grease before supplying new in case it is extremely dirty.

- *1 Supply grease to the rod sliding surface when grease is used up in the inspection at work start or every three months. First, wipe off the old grease and then supply new grease. Sometimes grease is separated from the base oil due to the installing posture or operating conditions and the base oil leaks from the inside of actuator to the outside. Check visually whether the oil drips or not when supplying grease.

[Grease Supply Timing of Ball Screw and Guide (Reference)]

Perform grease supply when it has reached to either the operation distance or spent months described in the table below.

Maximum Speed of Use [mm/s]	Grease Supply Timing (Reference)	
	operated distance	Months
0 to 125 or less	1,250 km	12 month

- ⚠ Caution:
- An actuator after 6 months of storage may have caused a degradation of the grease. Supply grease before start using. [Refer to 5.6 "Grease Supply"]
 - Degradation speed of grease may differ depending on the environment of use (temperature, humidity and ambient conditions). It is recommended to shorten the grease supply period if the actuator is used under a bad condition such as in high temperature, high humidity or in dusty ambience. Also, it is recommended to improve the environment conditions in case the grease changes its color due to the bad condition of use.

5.1.2 RA10R and RA20R

Follow the maintenance inspection schedule below.

It is assumed that the equipment is operating 8 hours per day.

If the equipment is running continuously night and day or otherwise running at a high operating rate, inspect more often as needed.

	External Visual Inspection	Internal Inspection	Greasing
Start of work inspection	○		
1 month inspection	○		
3 month inspection	○		○ (Rod sliding surface)
Every 3 months since	○		○
6-month inspection or every 5000km of operated distance	○	○	Depends on grease supply timing (reference) of ball screw and guide
Every 1 year since	○	○	

- *1 Supply grease to the rod sliding surface when grease is used up in the inspection at work start or every three months. First, wipe off the old grease and then supply new grease. Sometimes grease is separated from the base oil due to the installing posture or operating conditions and the base oil leaks from the inside of actuator to the outside. Check visually whether the oil drips or not when supplying grease.

[Grease Supply Timing of Ball Screw and Guide (Reference)]

Perform grease supply when it has reached to either the operation distance or spent months described in the table below.

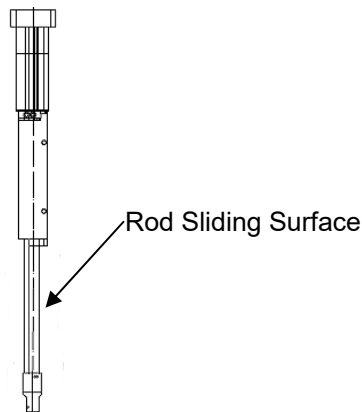
Maximum Speed of Use [mm/s]	Grease Supply Timing (Reference)		
	Operated distance	Times of pressing	Months
0 to 240 or less	1,250 km	1,000,000 times	12 month

- ⚠ Caution:
- An actuator after 6 months of storage may have caused a degradation of the grease. Supply grease before start using. [Refer to 5.6 “Grease Supply”]
 - Degradation speed of grease may differ depending on the environment of use (temperature, humidity and ambient conditions). It is recommended to shorten the grease supply period if the actuator is used under a bad condition such as in high temperature, high humidity or in dusty ambience. Also, it is recommended to improve the environment conditions in case the grease changes its color due to the bad condition of use.

5.2 External Visual Inspection

An external visual inspection should check the following things.

Main Unit	Loose actuator mounting bolts, other loose items
Rod Sliding Surface	Grease lubrication Dripping of grease base oil, etc. Dust or foreign objects on sliding surface
Cables	Scratches, proper connections
Overall	Irregular noise, vibration



5.3 Cleaning

- Clean exterior surfaces as necessary.
- If the grease base oil or others drip on the rod sliding surface and its periphery, wipe it off with a soft cloth, etc.
- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air as it may cause dust to get in through the gaps.
- Do not use oil-based solvents as they can harm lacquered and painted surfaces.
- To remove severe buildup, wipe gently with a soft cloth soaked in a neutral detergent or alcohol.

5.4 Internal Inspections

5.4.1 RA4R, RA6R and RA7R

[1] Internal Inspection of the Main body, Guide, Ball screw

For turn OFF the power, remove the frame cover and have a visual inspection. When inspecting the interior, check the following items.

Main Unit	Loose mounting bolts, other loose items
Guide Section	Lubrication, buildup
Ball Screw	Lubrication, buildup

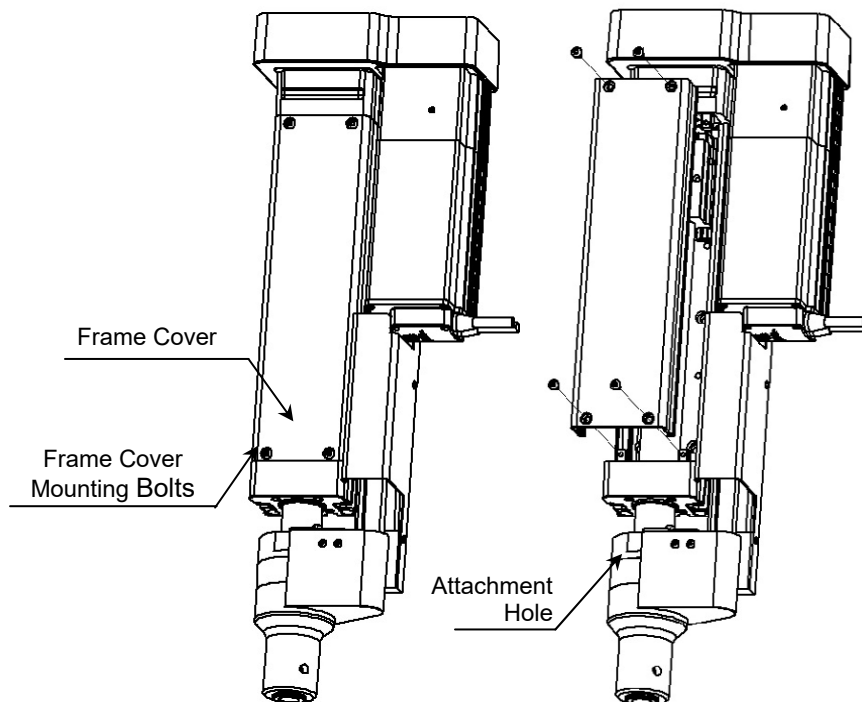
Visually inspect the interior of the equipment. Check whether dust or other foreign matter has gotten inside and check the lubrication state.

The lubrication may have turned brown. This is not a problem as long as the travel surfaces shine as though they are wet.

If the grease is mixed with dust and does not have a shiny appearance, or if the grease has lost its efficacy due to prolonged use, then clean each section and reapply grease.

The procedure for internal inspections is outlined below.

- 1) With 1.5mm (RA4R) hex wrench, 2.5mm (RA6R and RA7R) hex wrench, loosen the bolts holding the frame cover, and detach the frame cover.
- 2) Check inside.
Extend the rod when checking the ball screw. The ball screw will appear. Slide the rod manually with hand or move it with JOG operation of the controller.
- 3) After finishing the inspection, assemble back in the reverse order.



When affixing the frame cover, tighten the bolts with the tightening torque described below.

Type	Screw Diameter	Tightening Torque
RA4R	M3	0.62N•m (0.06kgf•m)
RA6R	M4	1.76N•m (0.18kgf•m)
RA7R	M4	1.76N•m (0.18kgf•m)

[2] Internal Inspection of the Belt

For turn OFF the power, remove the pulley cover and have a visual inspection.

When inspecting the interior, check the following items.

Check if there is any foreign substance such as dust.

[Refer to 5.7.1 Inspection of the Belt for how to inspect the belt]

Belt	Abnormality such as abrasion, missing tooth and crack of belt and pulley Refer to 5.4.3 Inspection of the Belt for contents of belt inspection.
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Have a replacement work if any abnormality was found on the belt or reached the timing for replacement in the inspection.

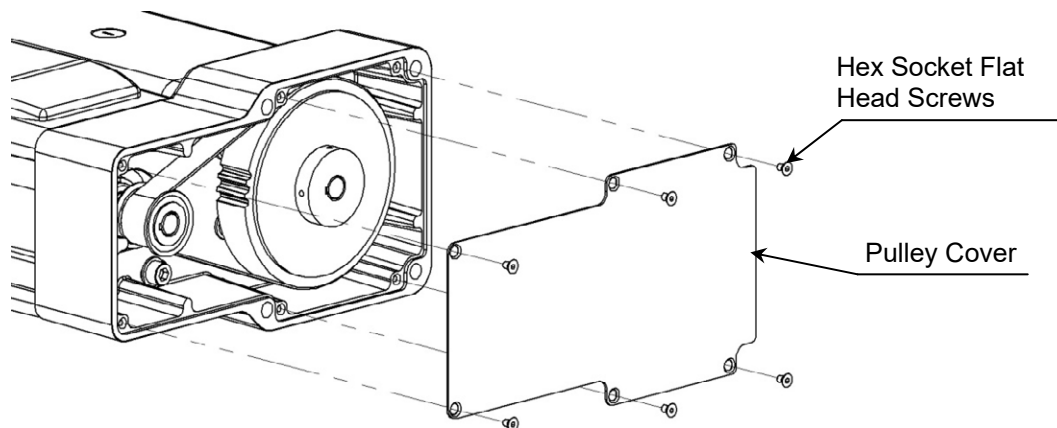
[Refer to 5.7.3 Replacement of the Belt for how to replacement the belt]

[Inspection of the Belt]

For inspection work, detach the pulley cover with a hex wrench and carry it out by visual.

Remove the three cross recessed flat head cap screws (M2.5×6) for RA4R.

Remove the four hex socket flat head bolt (M3×5) for RA6R, and six for RA7R, RA8R, RA10R.



The replacement period cannot be determined in general because the durability of the deceleration belt can be greatly influenced by the conditions of operation.

It generally has life of hundreds of times for bending movement.

The timing belt requires replacement regularly under the following conditions as a reference since degradation such as abrasion proceeds as the time passes for usage.

- When remarkable abrasion is confirmed on the teeth or edges of the belt.
- When the belt is swelled for such reasons as oil being attached on.
- When damage is confirmed such as crack on the tooth or back of the belt.

Also, since it is difficult to confirm the degradation of the core wires to retain the strength of the toothed belt by visual or looseness caused by being elongated, it is recommended to set regular replacement periods in advance in case the product is used under such conditions that gives the core wires great fatigue due to high acceleration and deceleration speed.

5.4.2 RA15R and RA20R

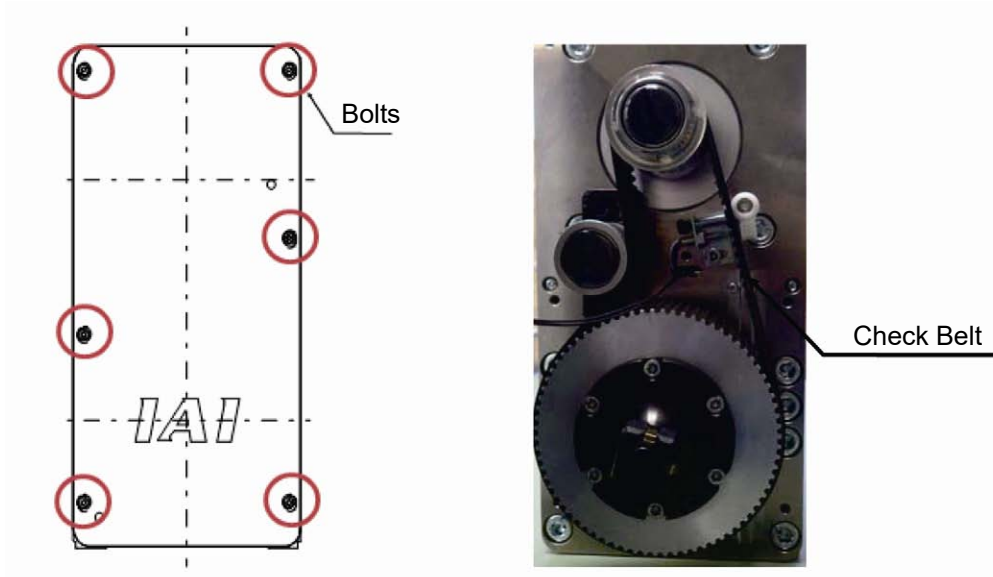
For turn OFF the power, remove the pulley cover and have a visual inspection. When inspecting the interior, check the following items. Check if there is any foreign substance such as dust.

Belt	Refer to 5.4.3 Inspection of the Belt for contents of inspection.
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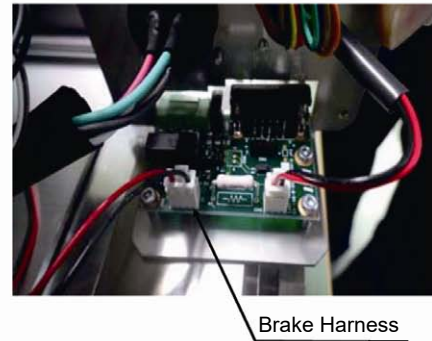
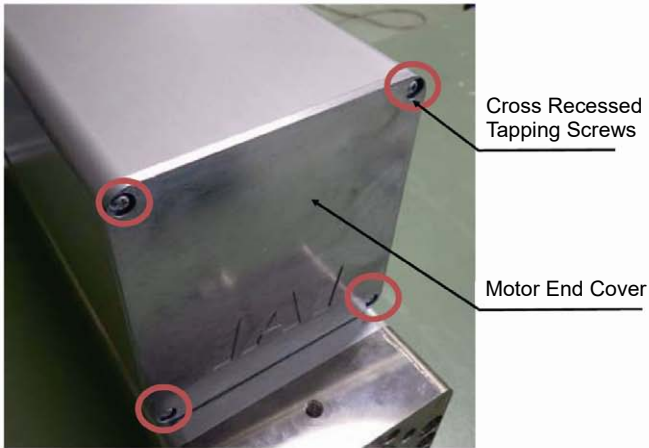
Take off the pulley cover and put it back on by following the steps below.

- [1] For types with no brake
- 1) Remove the six hex socket head cap bolts affixing the pulley cover to take of the pulley cover.
Hex wrench to use: 5mm
 - 2) Have an internal inspection conducted.
 - 3) Affix the pulley cover with bolts after inspection is finished.

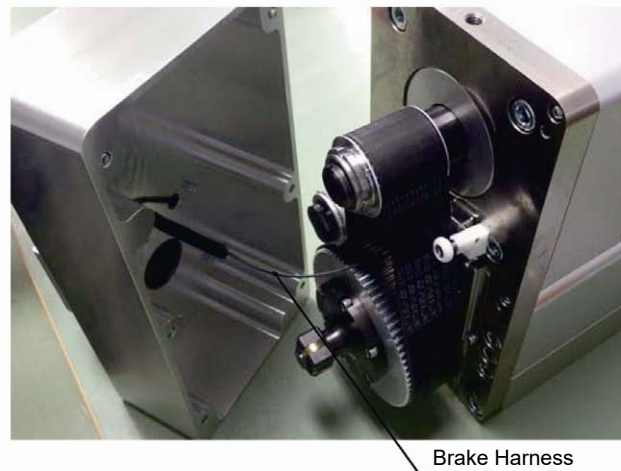
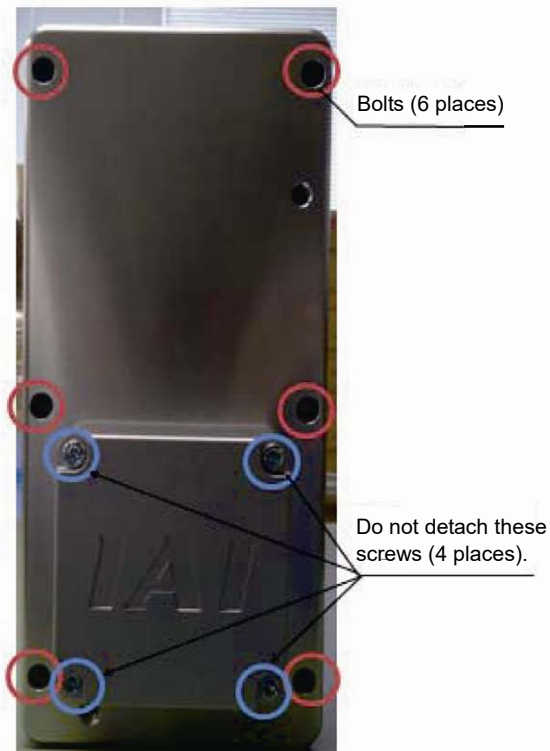
Tightening Torque	12.3N•m [126kgf•cm]
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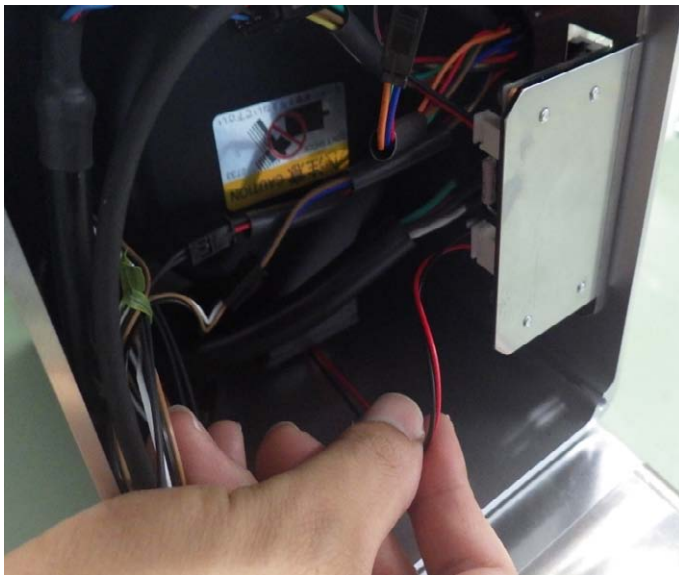
- [2] For brake-equipped type
- 1) Remove the four cross recessed tapping screws affixing the motor end cover.
Tools to use : Phillips Screwdriver
 - 2) Confirm the position of the brake harness.



- 3) Detach the pulley cover in the same way as the model with no brake, and have an internal inspection conducted.
 - * Pay attention not to pull the brake harness forcefully.
 - * In case the brake harness gets stuck, move the brake harness from the motor end cover side.



- 4) Once the inspection is finished, keep the brake harness pulled from the motor end cover and fix the pulley cover with the bolts.
 * Do not pull the brake harness too much.



- 5) Affix the pulley cover with the six hex socket head cap bolts.
 Hex wrench to use : 5mm

Tightening Torque	12.3N•m [126kgf•cm]
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- 6) Affix the motor end cover with the four cross recessed pan head machine screws.
 Tools to use : Phillips Screwdriver

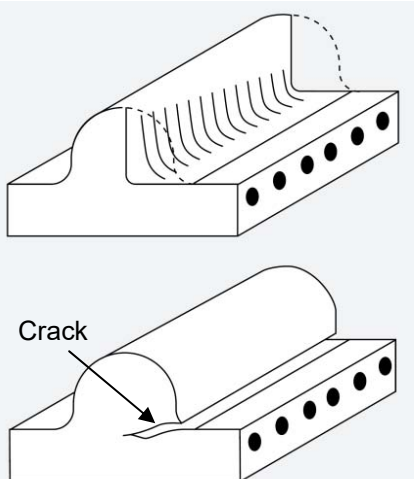
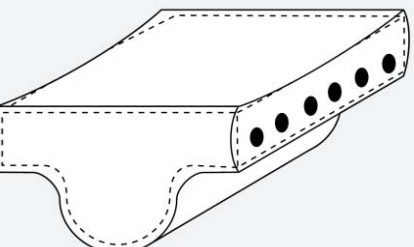
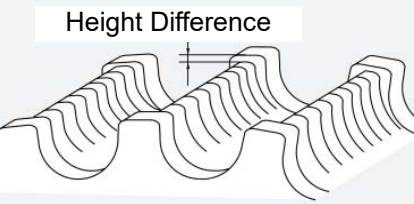
Tightening Torque	1.43N•m [14.6kgf•cm]
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5.4.3 Inspection of the Belt

Check the belt visually.

The replacement period of the belt cannot be unconditionally defined as the durability of the belt is remarkably influenced by the duration of operation.

Since degradation such as abrasion proceeds along the duration of use, check these items shown below.

Check Items	Check Details
Breakage of Belt	<ul style="list-style-type: none"> • Check if there is breakage on belt
Abrasion, Crack, Missing Tooth on Belt 	<ul style="list-style-type: none"> • Check if teeth on belt are worn out extremely • Check if there is any crack on the root of teeth • Check if there is missing tooth
Belt Hardened, Softened, Deformed 	<ul style="list-style-type: none"> • Check if there is any area on belt hardened, softened or deformed (shrank or swelled)
Abrasion on Pulley Teeth Height Difference 	<ul style="list-style-type: none"> • Check if teeth on pulley are worn out extremely

In case that any abnormality is found in inspection, it is necessary to replace the belt.

Please ask IAI for belt replacement and tension adjustment as the work requires Sonic Belt Tension Meter U-508 (Gates Unitta Asia).

5.5 Internal Cleaning

Conduct it only for RA4R, RA6R, RA7R, RA15R and RA20R.

- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air as it may cause dust to get in through the gaps.
- Do not use oil-based solvents, neutral detergent or alcohol.

5.6 Grease Supply


5.6.1 What Grease to Use

[1] RA4R, RA6R and RA7R

IAI uses the following grease in our plant.

Guide and Ball Screw	Kyodo Yushi	Multitemp LRL 3
Rod (sliding surface)	Kyodo Yushi	Multitemp LRL 3

Other companies also sell similar types of grease. For more detailed information, ask the supplier to find an equivalent for you by telling them the name of the grease.

 **Warning:** Never use any fluorine-based grease. Mixing with lithium-based grease with other grease not only reduces the performance of the grease, it may even cause damage to the actuator.

[2] RA8R and RA10R

IAI uses the following grease in our plant.


(1) RA8R

Guide, Rod (sliding surface) and Ball Screw	Idemitsu Kosan	Daphne Eponex Grease No. 2
---	----------------	----------------------------

(2) RA10R

Guide and Rod (sliding surface)	Idemitsu Kosan	Daphne Eponex Grease No. 2
Ball Screw	Kyodo Yushi	Multitemp PS No.2

Other companies also sell similar types of grease. For more detailed information, ask the supplier to find an equivalent for you by telling them the name of the grease.

 **Warning:** Never use any fluorine-based grease. Mixing with lithium-based grease with other grease not only reduces the performance of the grease, it may even cause damage to the actuator.

[3] RA15R, RA20R

IAI uses the following grease in our plant.

Place	Manufacturer	Mane
Guide and Rod (sliding surface)	Idemitsu Kosan	Daphne Eponex Grease No. 2
Ball screw	THK	L500

Apart from above, there are equivalent sorts of grease sold in the market. For more detailed information, ask the supplier to find an equivalent for you by telling them the name of the grease.

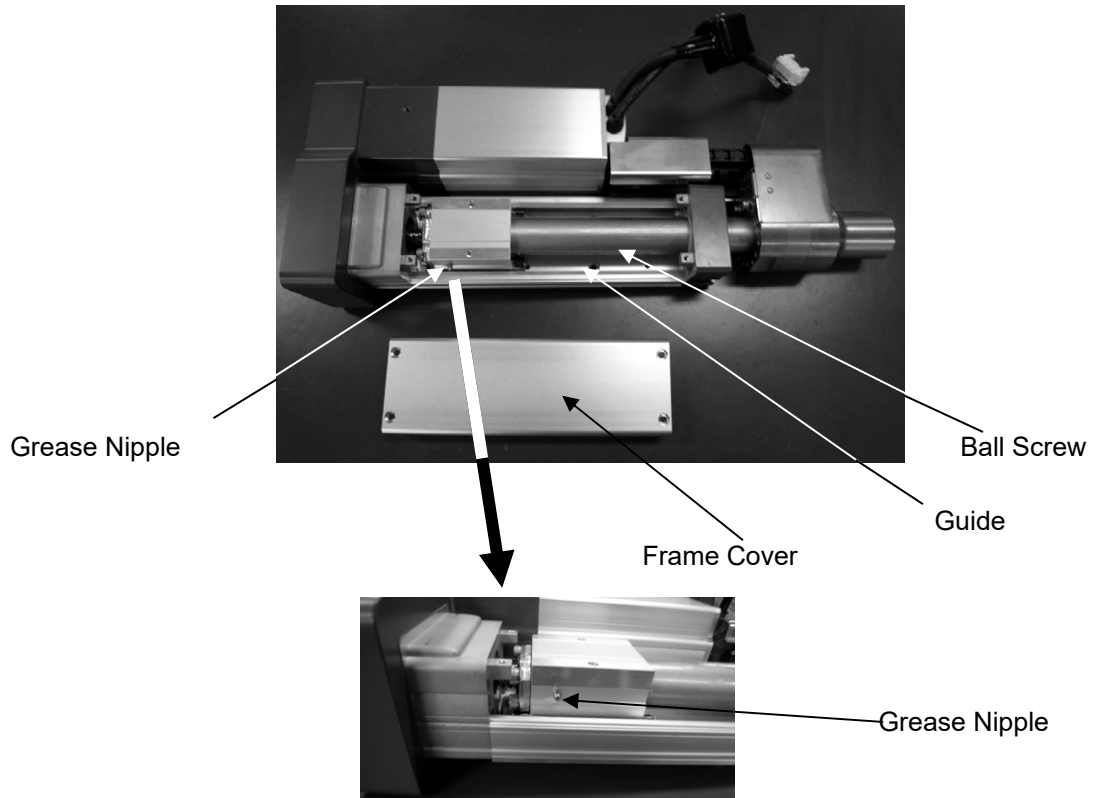


Warning: Never use any fluorine-based grease. Mixing with lithium-based grease with other grease not only reduces the performance of the grease, it may even cause damage to the actuator.

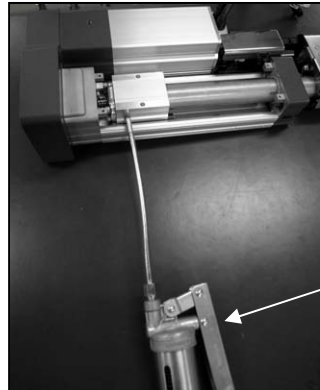
5.6.2 How to Apply Grease

[1] RA4R, RA6R and RA7R

- 1) With 1.5mm-sized (RA4R) hex wrench, 2.5mm-sized (RA6R and RA7R) hex wrench, loosen the screws holding the frame cover, and detach the frame cover. The grease nipple appears.



- 2) Supply grease from the grease nipple on either side, using the grease gun. Wipe off the grease before supplying new in case it is extremely dirty. When grease is applied from the grease nipple, grease is supplied to the ball screw and the guides on both sides.



Grease Gun

(Note) Make sure to use a grease gun that is applicable for the grease nipple inlet diameter shown below.

Grease Nipple Diameter
φ3.5

Recommended Grease Gun	Nozzle	Supplier
HGP	NZ3	NSK

Type	Amount of Grease Supply (Reference)
RA4R	0.5cc to 1.0cc
RA6R, RA7R	1.5cc to 2.0cc

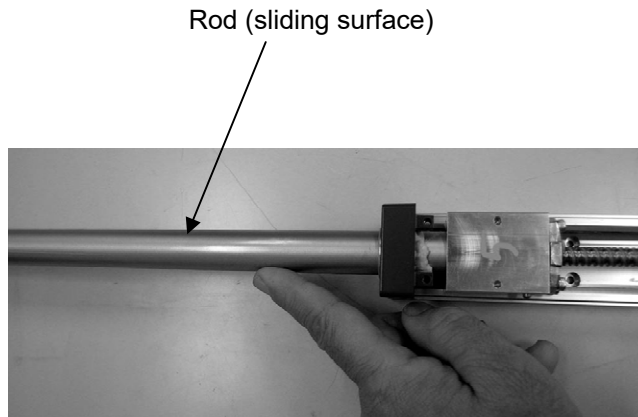
Move the slider back and forth in the stroke range after supplying grease so it spreads out evenly in the area.

Low lead type actuator may not be moved manually. Use JOG operation on the controller to move the rod.

- Confirm that the ball tracks on the ball screw and guide look glossy with oil of grease. Supply grease again if it is not spread enough.
- Wipe off excess grease.

Caution: Supplying too much grease may increase sliding resistance and load to the motor, resulting in a drop of performance.

- 3) Clean up the rod (sliding surface) and apply the grease with hands. Move the rod back and forth to evenly apply the grease.
For some of the low lead actuators, the rod would not move manually with hand. Move it with JOG operation of the controller.
Wipe off the excess grease at last.



- 4) After supplying the grease, attach the frame cover.
When affixing the frame cover, tighten the screws with the tightening torque described below.

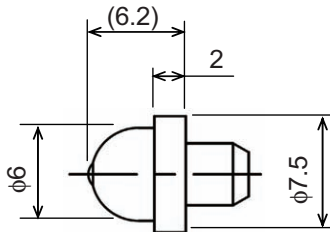
Type	Screw Diameter	Tightening Torque
RA4R	M3	0.62N•m (0.06kgf•m)
RA6R	M4	1.76N•m (0.18kgf•m)
RA7R	M4	1.76N•m (0.18kgf•m)

⚠ Caution: In case the grease got into your eye, immediately go see the doctor to get appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

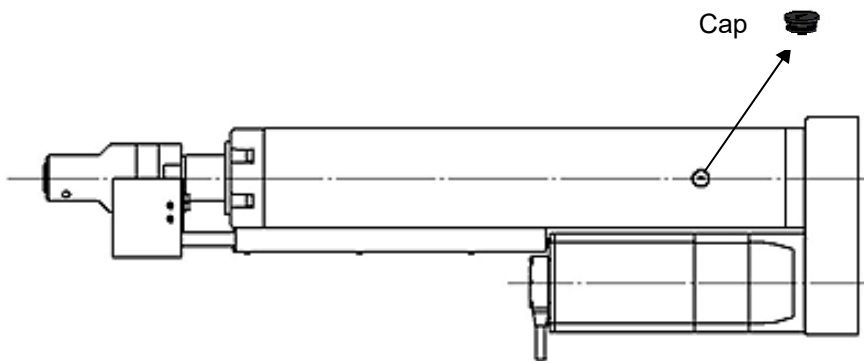
[2] RA8R

For the grease supply to the ball screw and guide, apply on the inlets (grease nipples) on the top of the frame.

◎ Size of Grease Nipple

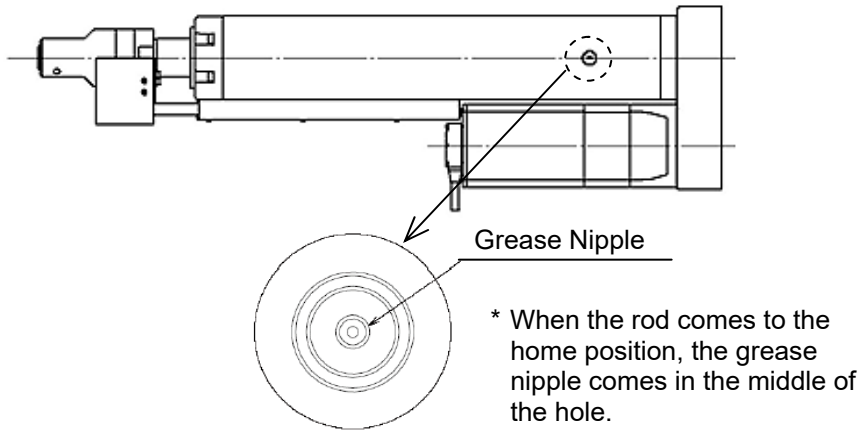


- 1) Take off the cap on the front side



- 2) Move the rod to the home position manually or with JOG operation of the controller.

- 3) Insert a grease gun to the supply hole ($\phi 11$) on the top of the frame, hold the gun on the grease nipple and supply grease.
By supplying grease only to this grease nipple, grease can be supplied to both the ball screw and guide.



Recommended Grease Gun	Nozzle	Supplier
N type	MG70	THK

Amount of Grease Supply (Reference)
3.0cc to 3.5cc

⚠ Caution: Supplying too much grease may increase sliding resistance and load to the motor, resulting in a drop of performance.

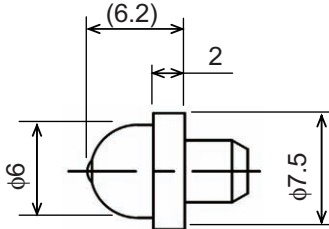
- 4) Clean up the rod (sliding surface) and apply the grease with hands.
5) Slide the rod back and forth manually with hand or by the controller with JOG operation to spread out the grease evenly.
6) Attach the cap.

⚠ Caution: In case the grease got into your eye, immediately go see the doctor to get appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

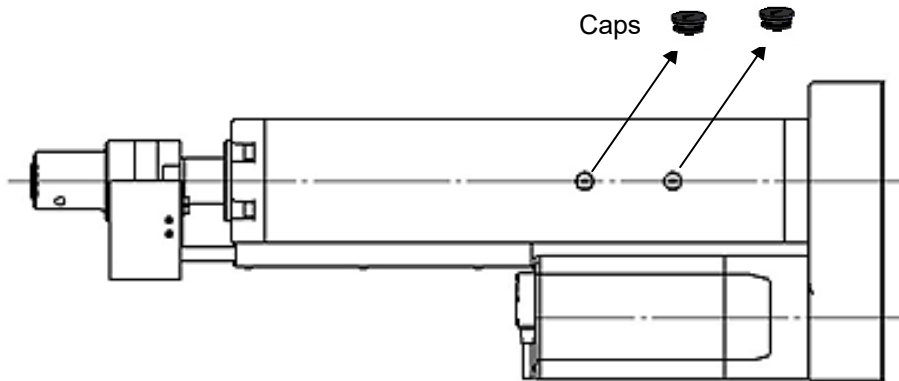
[3] RA10R

For the grease supply to the ball screw and guide, apply on the inlets (grease nipples) on the top of the frame.

◎ Size of Grease Nipple

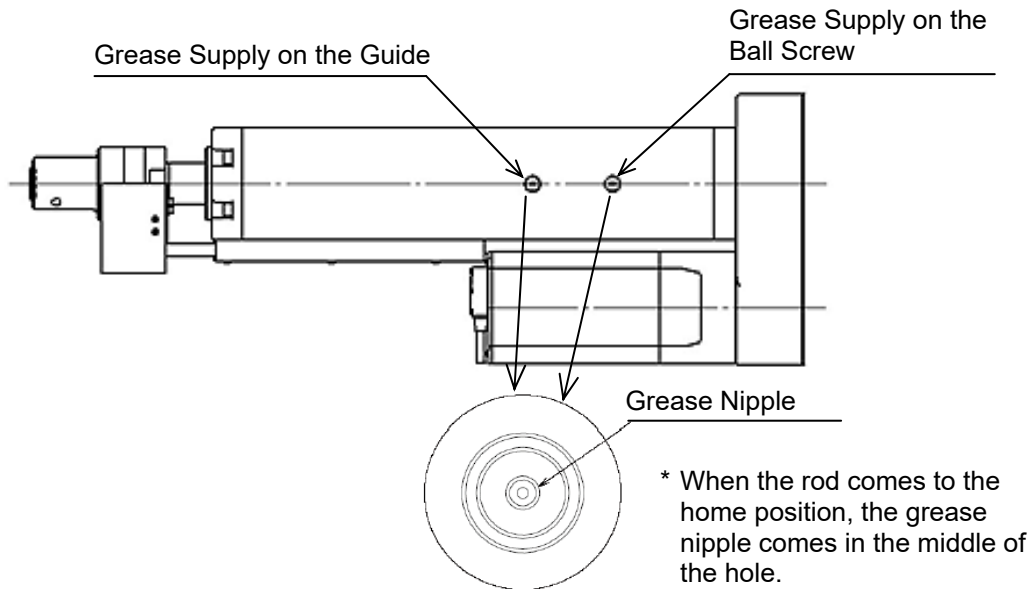


- 1) Take off the cap on the front side and the middle.



- 2) Move the rod to the end of the home position manually or with JOG operation of the controller.

- 3) Insert a grease gun to the supply hole ($\phi 11$) on the top of the frame, hold the gun on the grease nipple and supply grease.
 By supplying grease on the grease nipple in the front side, the grease can be supplied to the ball screw.
 By supplying grease on the grease nipple in the middle, the grease can be supplied to the guide.



Recommended Grease Gun	Nozzle	Supplier
N type	MG70	THK

Place to Supply	Amount of Grease Supply (Reference)
Guide	2.0cc to 2.5cc
Ball screw	2.0cc to 2.5cc

⚠ Caution: Supplying too much grease may increase sliding resistance and load to the motor, resulting in a drop of performance.

- 4) Clean up the rod (sliding surface) and apply the grease with hands.
- 5) Slide the rod back and forth manually with hand or by the controller with JOG operation to spread out the grease evenly.
- 6) Attach the cap.

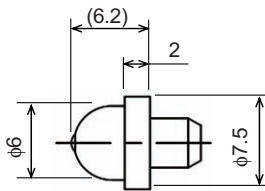
⚠ Caution: In case the grease got into your eye, immediately go see the doctor to get appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

[4] RA15R and RA20R

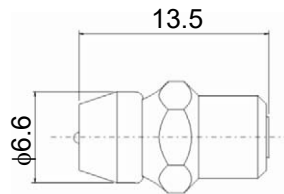
[How to Supply Grease on Ball Screw and Guides]

- Set the rod at the home position and turn the power off before starting to supply grease.
- For the grease supply to the ball screw and guide, apply on the inlets (grease nipples) on the both sides (right and left) of the frame.
- The grease nipple to supply to the ball screw and those to supply to the guides have different profiles.

◎ Size of grease nipple

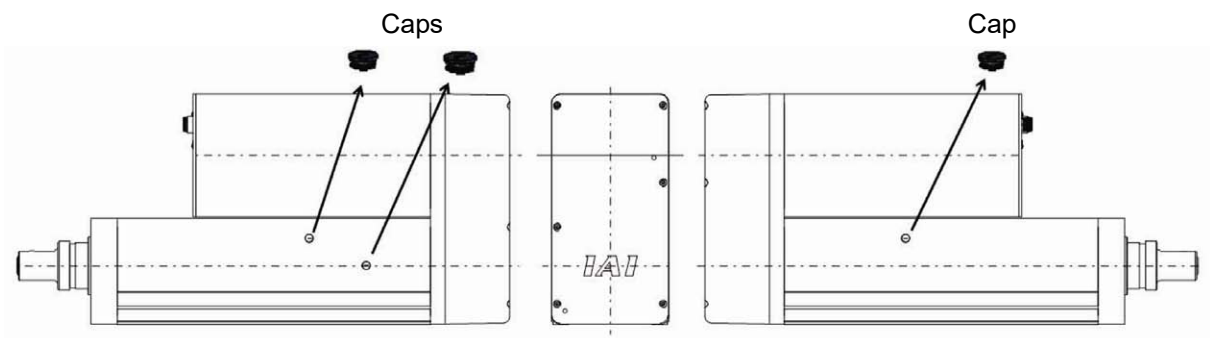


Grease Nipple to Supply to Guides
(Staking Type)

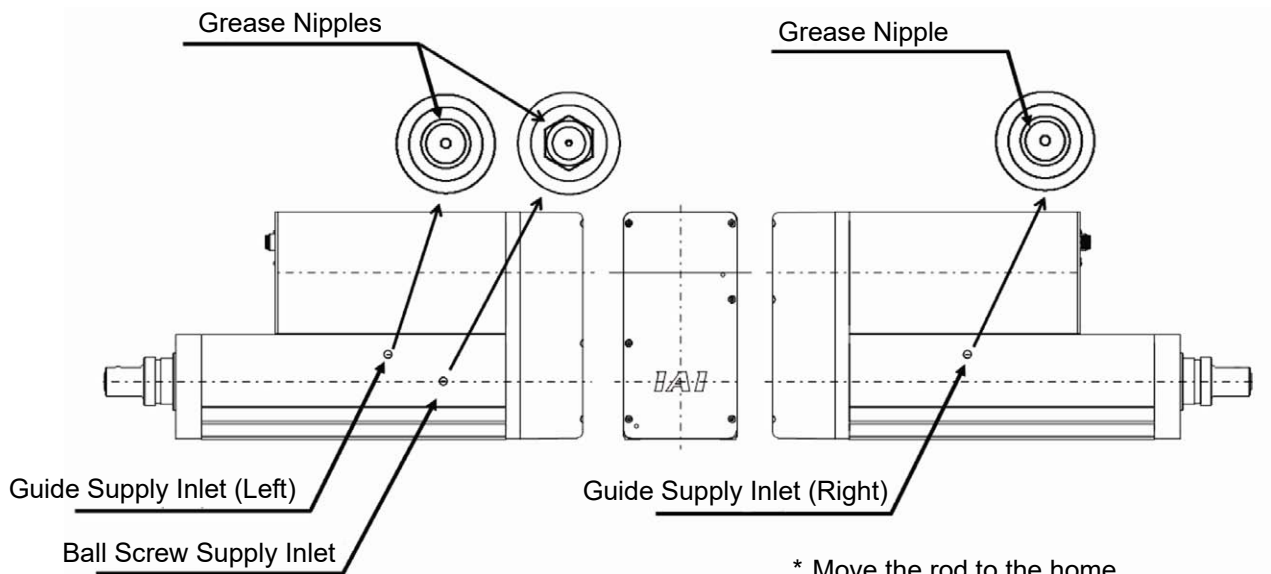


Grease Nipple to Supply to Ball Screw
(Screwing Type)
JIS A Type

- 1) Remove the caps attached on the sides of the frame.



- 2) Insert a grease gun to the supply inlets ($\phi 11$) on the frame and put the gun on the nipples to supply grease.



* Move the rod to the home position and the grease nipples come in the center of the inlets.

Recommended Grease Gun	Nozzle	Manufacturer
N Type	MG70	THK

Area to Supply	Grease supply volume (reference)
One Side of Guide	RA15R : 4.5cc to 5cc, RA20R : 5.5cc to 6cc
Ball Screw	RA15R : 17cc, RA20R : 21cc

- 3) Attach the caps.
- 4) Move the rod back and forth with JOG operation on the controller to spread the grease.

[How to Supply Grease on Rod]

- 1) Move the rod to the stroke end with JOG operation on the controller, and turn the power off.
- 2) Clean up the rod (on sliding surface) and apply grease with hand.
- 3) Move the rod back and forth with JOG operation on the controller to spread the grease.

5.7 Procedure for Belt Replacement and Tuning

(Note) Please ask IAI for belt replacement of the RA15R and RA20R and tension adjustment as the work requires Sonic Belt Tension Meter U-508 (Gates Unitta Asia).

5.7.1 Belts to be Used

The following belt is applied when the product is shipped out from IAI factory.

Model	IAI Maintenance Parts Mdel	Supplier Model	
RA4R	TB-RCS3-RA4R	60S2M162R	Rubber STS type (Bando Chemical Industries, Ltd.)
RA6R	TB-RCS3-RA6R	100S2M280R	Rubber STS type (Bando Chemical Industries, Ltd.)
RA7R	TB-RCS3-RA7R	100S3M336R	Rubber STS type (Bando Chemical Industries, Ltd.)
RA8R	TB-RCS3-RA8R	150S3M378R	Rubber STS type (Bando Chemical Industries, Ltd.)
RA10R	TB-RCS3-RA10R	150HP-S5M565	Rubber High Performance Super Torque Synchronous Belt (Bando Chemical Industries, Ltd.)

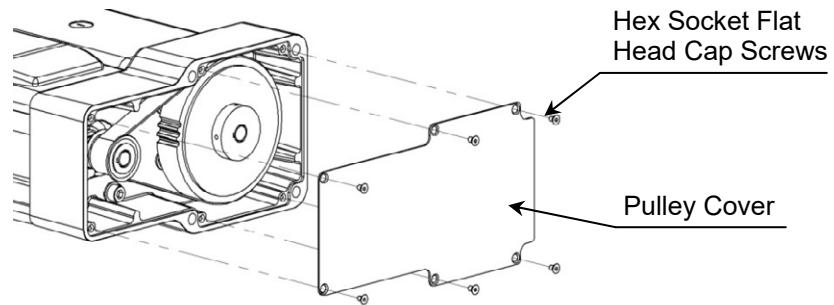
5.7.2 Replacement of the Belt

[Items Required for Replacemet Work]

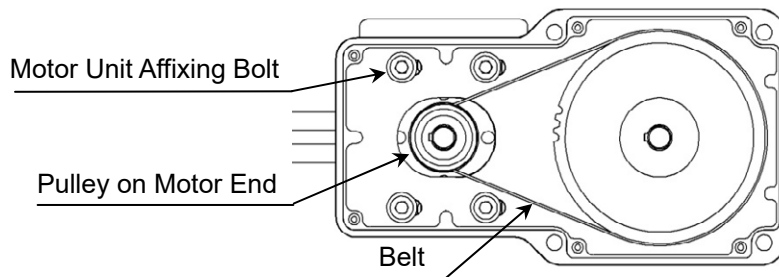
- Belt for replacement
- Hex wrench 2.5mm (RA4R), 3mm (RA6R, RA7R), 5mm (RA8R), 6mm (RA10R) or 2mm (for hex socket flat head bolt) - sized
- Phillips screwdriver (RA4R)
- Tension gauge (Any gauge that is capable for tension measurement)
- Long tie-band (thin string)

[Procedures]

- 1) Detach the seven hex socket flat head bolt (M3×5) (4pcs for RA6R, 6pcs for RA7R, RA8R and RA10R) with using a 2mm-sized hex wrench. Remove the cross recessed flat head cap screws (M2.6×6) (3pcs for RA4R) with using a phillips screwdriver (No. 0). Detach the pulley cover.



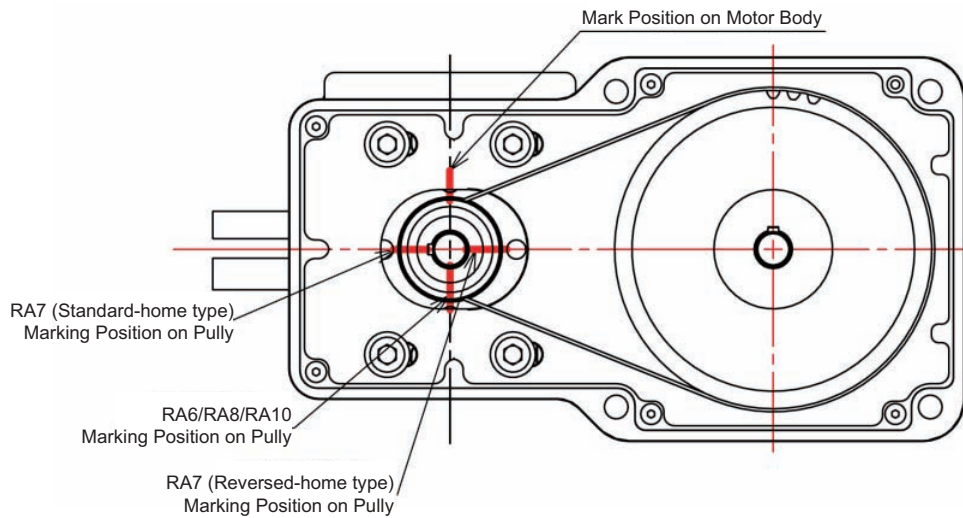
- 2) Loosen the four motor unit fixing screws holding the motor unit with using a hex wrench. Take the belt off the pulley, and attach a new belt for replacement.



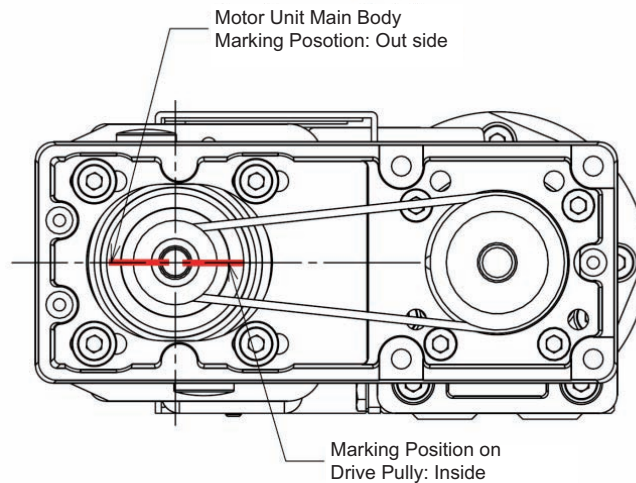
Type	Types of belt	Wrentch size
RA4R	Hex socket flange head bolt M3x12	2.5mm
RA6R	Hexagon head bolt with captive washer M4x12	3mm
RA7R		
RA8R	Hexagon head bolt with captive washer M6x20	5mm
RA10R	Hexagon socket flat head bolt, plane washers M8x22	6mm

- 3) Pull in the rod and push it towards the mechanical end.
With the rod pulled in, adjust the phase of the motor as shown below.

Type	Mark on Motor Body	Marking on Drive Pulley
RA6R/RA8R/RA10R	Top side	Bottom end
RA7R	Top side	Standard-home type : Left side Reversed-home type: Right side
RA4R	Out side	Inside

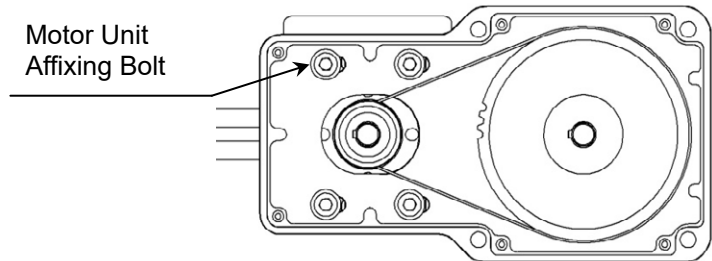
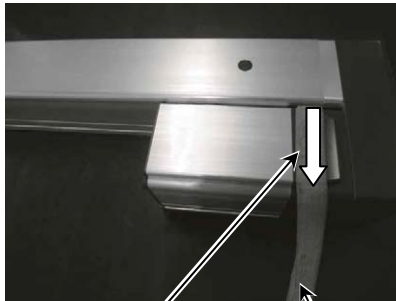


RA6R/RA7R/RA8R/RA10R



RA4R

- 4) Hand a tie band (thin string) on the edge of the motor unit and pull it on a tension gauge with the specified load (specified value of the belt tension).
When the load has reached the specified load, tighten the four motor unit affixing bolt with using a hex wrench to affix the pulley.



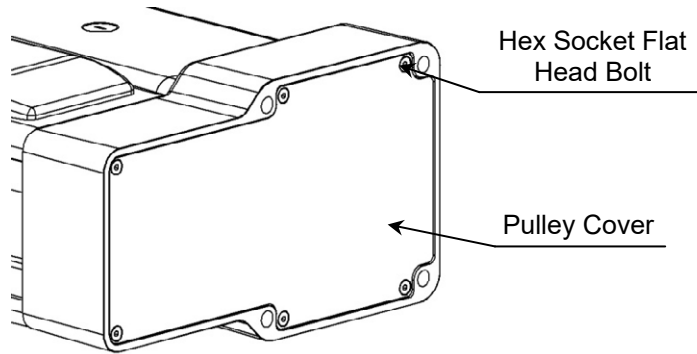
Pull with a Tension Gauge

Tie-band (thin string)

Type	Types of belt	Wrench size
RA4R	Hex socket flange head bolt M3x12	2.5mm
RA6R	Hexagon head bolt with captive washer M4x12	3mm
RA7R		
RA8R	Hexagon head bolt with captive washer M6x20	5mm
RA10R	Hexagon socket flat head bolt, plane washers M8x22	6mm

Type	Belt Tensile Strength	Tightening Torque of Motor Unit Affixing Bolt
RA4R	24 to 34N	1.62N•m (0.165kgf•m)
RA6R	36 to 46N	3.23N•m (0.33kgf•m)
RA7R	70 to 80N	3.23N•m (0.33kgf•m)
RA8R	110 to 150N	5.36N•m (0.55kgf•m)
RA10R	170 to 210N	11.48N•m (1.17kgf•m)

- 5) Detach the seven hex socket flat head bolt (M3×5) (4pcs for RA6R, 6pcs for RA7R, RA8R and RA10R) with using a 2mm-sized hex wrench.
 Remove the cross recessed flat head cap screws (M2.6×6) (3pcs for RA4R) with using a phillips screwdriver (No. 0).
 Attach the pulley cover.



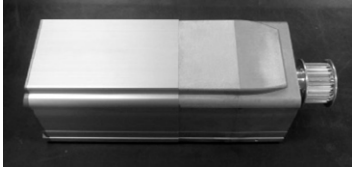
Type	Tightening Torque
RA4R	0.43N•m (0.044kgf•m)
RA6R, RA7R RA8R, RA10R	0.74N•m (0.075kgf•m)

5.8 Replacement Process of Motor Unit

5.8.1 RA4R, RA6R, RA7R, RA8R, RA10R

[Items required for replacing the motor]

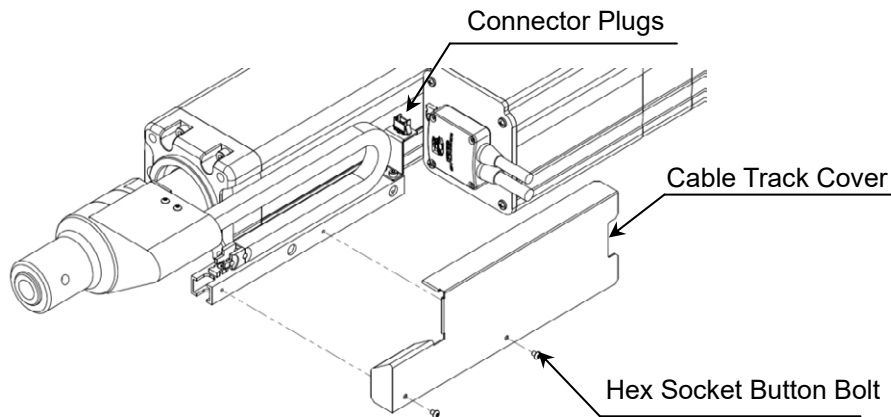
- Motor unit for replacement



- Hex wrenches with size of 2.5mm (RA4R), 3mm (RA6R/RA7R), 5mm (RA8R), 6mm (RA10R) and 2mm (for hex socket flat head bolt)
- Tension gauge (Any gauge that is capable for tension measurement)
- Long tie-band (thin string)

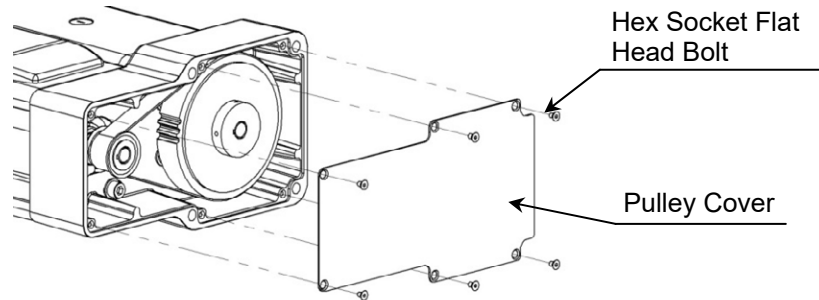
[Procedure]

- 1) Remove the hex socket button head bolts with a hex wrench and remove the track cover. Pull out the relay connector on the loadcell cable.

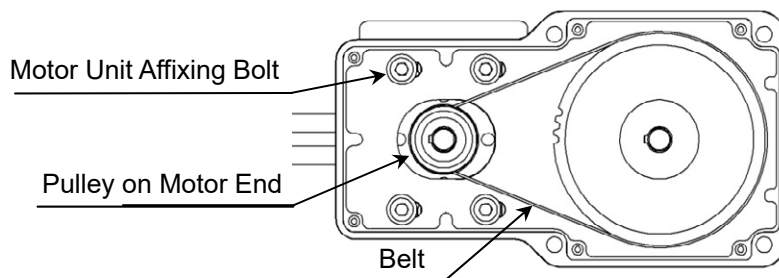


Type	Types of belt	Wrench size	Quantity
RA4R	Hex socket button bolt M3x4	2mm	2 to 5 (It differs depending on stroke)
RA6R			
RA7R			
RA8R			
RA10R			

- 2) Detach the seven hex socket flat head bolt (M3×5) (4pcs for RA6R, 6pcs for RA7R, RA8R and RA10R) with using a 2mm-sized hex wrench.
Remove the cross recessed flat head cap screws (M2.6×6) (3pcs for RA4R) with using a phillips screwdriver (No. 0).
Detach the pulley cover.

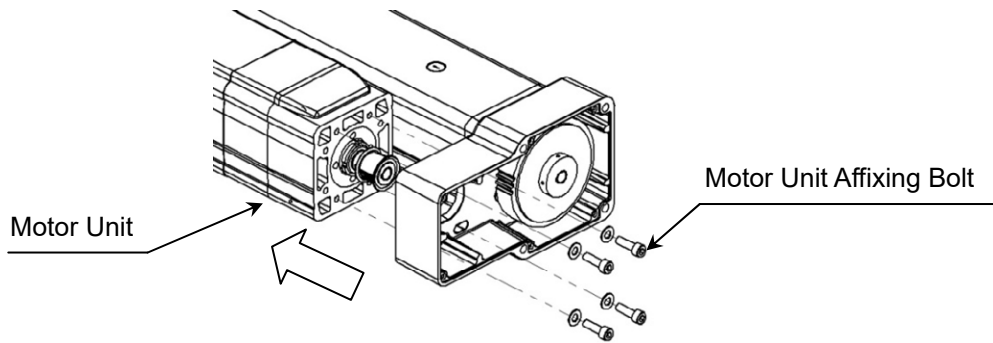


- 3) Loosen the four motor unit affixing bolt holding the motor unit with using a hex wrench.
Take the belt off the pulley, and attach a new belt for replacement.

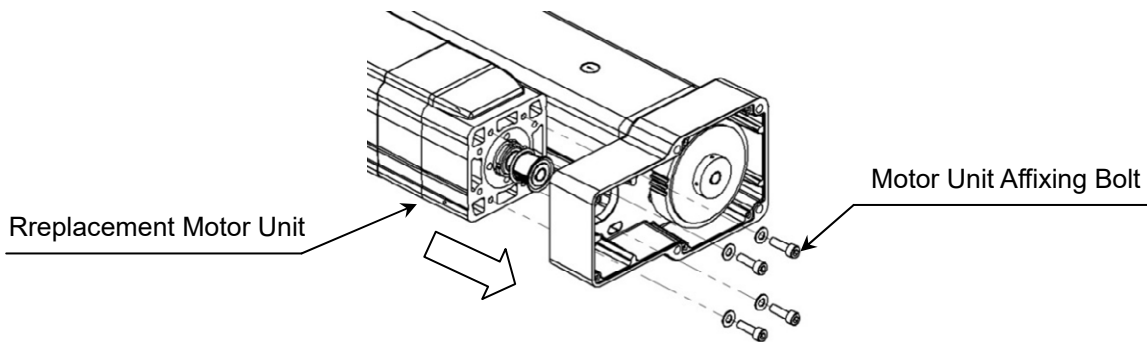


Type	Types of belt	Wrench size
RA4R	Hex socket flange head cap bolt M3x12	2.5mm
RA6R	Hexagon head bolt with captive washer M4x12	3mm
RA7R		
RA8R	Hexagon head bolt with captive washer M6x20	5mm
RA10R	Hexagon socket flat head bolt, plane washers M8x22	6mm

4) Take out the four motor unit affixing bolt and pull out the motor unit.

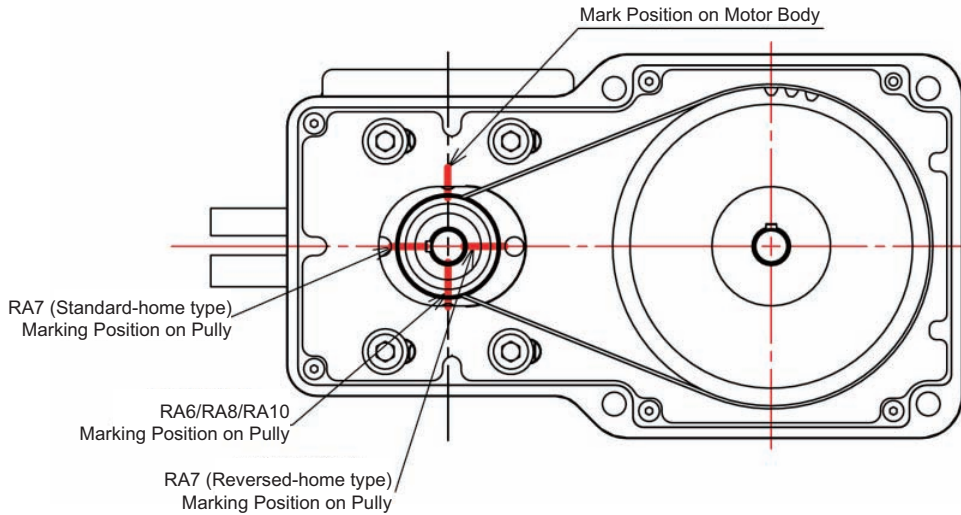


5) Attach the replacement motor unit, and temporarily tighten it with the motor unit affixing bolt.

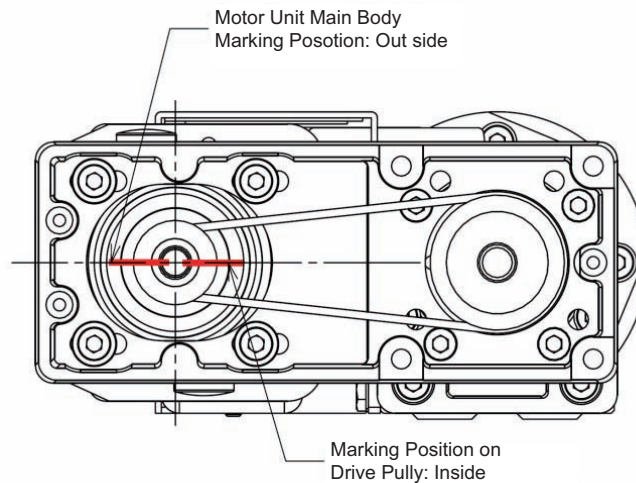


- 6) Pull in the rod and push it towards the mechanical end.
With the rod pulled in, adjust the phase of the motor as shown below.

Type	Mark on Motor Body	Marking on Drive Pulley
RA6R/RA8R/RA10R	Top side	Bottom end
RA7R	Top side	Standard-home type : Left side Reversed-home type: Right side
RA4R	Out side	Inside

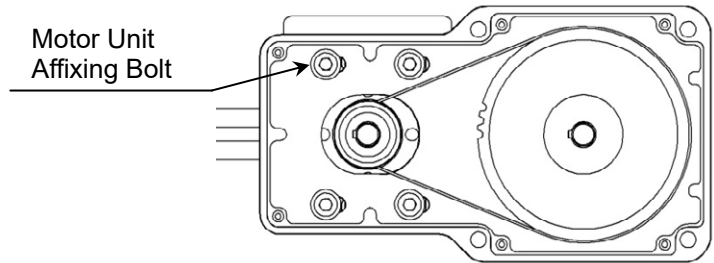
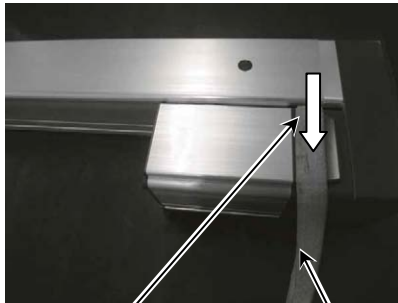


RA6R/RA7R/RA8R/RA10R



RA4R

- 7) Hand a tie band (thin string) on the edge of the motor unit and pull it on a tension gauge with the specified load (specified value of the belt tension).
When the load has reached to the specified load, tighten the four motor unit affixing bolt with using a hex wrench to affix the pulley.



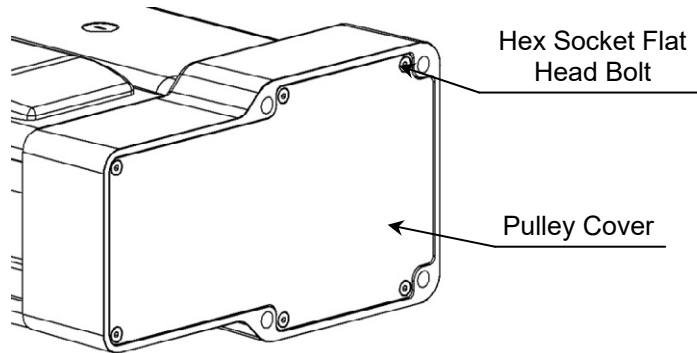
Pull with a Tension Gauge

Tie-band (thin string)

Type	Types of belt	Wrench size
RA4R	Hex socket flange head cap screw M3x12	2.5mm
RA6R	Hexagon head screw with captive washer M4x12	3mm
RA7R		
RA8R	Hexagon head screw with captive washer M6x20	5mm
RA10R	Hexagon Socket Flat Head Cap Screw, plane washers M8x22	6mm

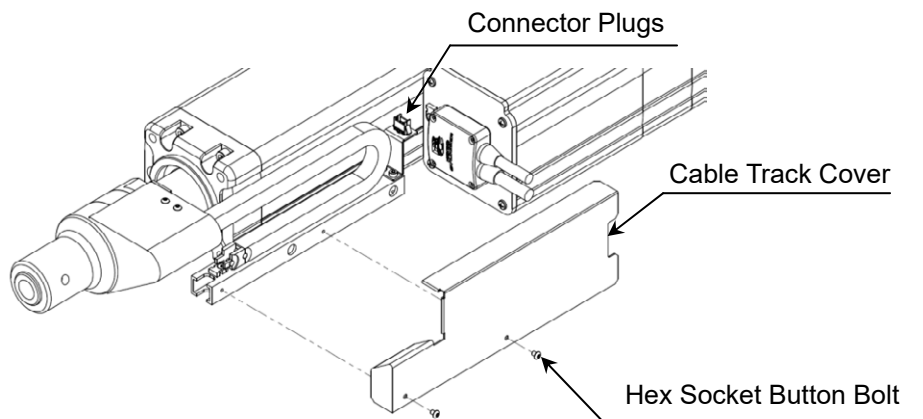
Type	Belt Tensile Strength	Tightening Torque of Motor Unit Affixing Bolt
RA4R	24 to 34N	1.62N•m (0.165kgf•m)
RA6R	36 to 46N	3.23N•m (0.33kgf•m)
RA7R	70 to 80N	3.23N•m (0.33kgf•m)
RA8R	110 to 150N	5.36N•m (0.55kgf•m)
RA10R	170 to 210N	11.48N•m (1.17kgf•m)

- 8) Detach the seven hex socket flat head bolt (M3×5) (4pcs for RA6R, 6pcs for RA7R, RA8R and RA10R) with using a 2mm-sized hex wrench.
 Remove the cross recessed flat head cap screws (M2.6×6) (3pcs for RA4R) with using a phillips screwdriver (No. 0).
 Attach the pulley cover.



Type	Tightening Torque
RA4R	0.43N•m (0.044kgf•m)
RA6R, RA7R RA8R, RA10R	0.74N•m (0.075kgf•m)

- 9) Plug in the loadcell cable to the relay connector.
 Attach the cable track cover with the hex socket button bolt and tighten them up.



Type	Types of belt	Wrench size	Quantity	Type
RA4R	Hex Socket Button Bolt M3x4	2mm	1.02N•m (0.104kgf•m)	2 to 4 (It differs depending on stroke)
RA6R				
RA7R				
RA8R				
RA10R				

5.9 How to Replace Loadcell

It is necessary to return the loadcell when calibrating it.

It is also necessary to return the loadcell for repair (or to replace with a new unit in some cases) in case of any error on the loadcell such as end of life or malfunction.

To take off the loadcell unit, follow the procedure below.

Put the loadcell back on after calibration or repair (or replace with a new unit).

5.9.1 RA4R, RA6R, RA7R, RA8R and RA10R

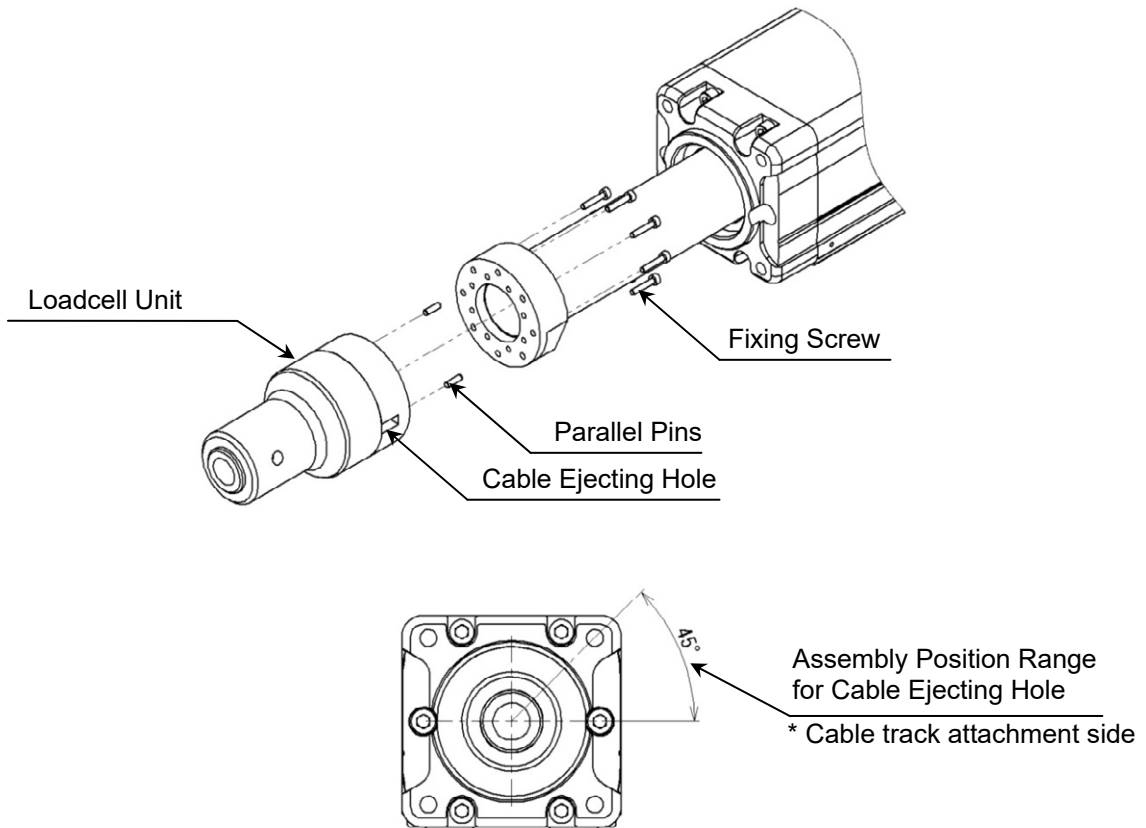
[1] How to Take Off

- 1) Detach the cable track from the loadcell unit by following “●How to Remove Cable Track” in “2.3.2 Installation of Main Unit [3] When Using Tapped Holes on Front Bracket”.
- 2) Loosen the eight screws fixing the loadcell unit with using a hex wrench to detach the loadcell unit.

Type	Loadcell unit affixing screws		Wrench size	Quantity
	Type			
RA4R	Hex socket head cap bolt	M3x12	2.5mm	8
RA6R	Hex socket head cap bolt	M3x22		
RA7R				
RA8R	Hex socket head cap bolt	M3x15		
RA10R	Hex socket head cap bolt	M4x18	3mm	

[2] How to Put On

- 1) Put the loadcell unit in the right place with pins by following the figures below.
- 2) Tighten the eight screws with using a hex wrench to affix it.
- 3) Put on the cable track to the loadcell unit in the reversed order of the way to detach.

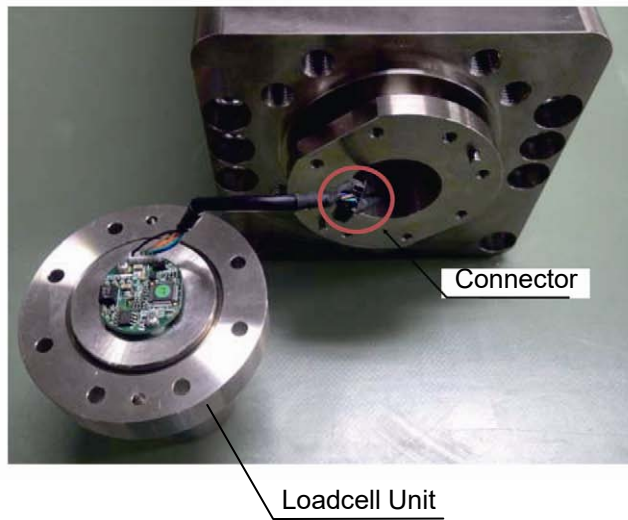


Type	Loadcell unit affixing screws		Wrench size	Quantity
	Type	Tightning torque		
RA4R	Hex socket head bolt M3x12	0.89N•m (0.09kgf•m)	2.5mm	8
RA6R	Hex socket head bolt M3x22	1.54N•m (0.16kgf•m)		
RA7R				
RA8R	Hex socket head bolt M3x15	3.59N•m (0.37kgf•m)	3mm	
RA10R	Hex socket head bolt M4x18			

5.9.2 RA15R, RA20R

[1] How to Take Off

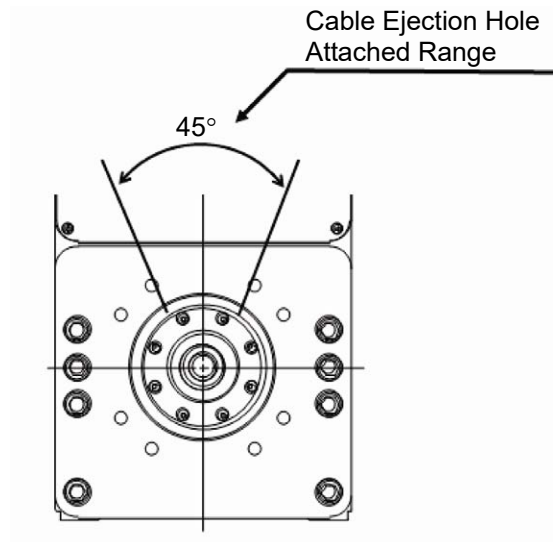
- 1) Remove the eight bolts holding the loadcell unit.
Hexagon Wrench Size : 4mm
- 2) Take off the connector



[2] How to Put On

- 1) Have the loadcell unit positioned with a pin as shown in the figure below.
- 2) Tighten the eight screws with a hex wrench to affix the unit.
Wrench size: 4mm.

Tightening Torque	7.27N•m [74.2kgf•cm]
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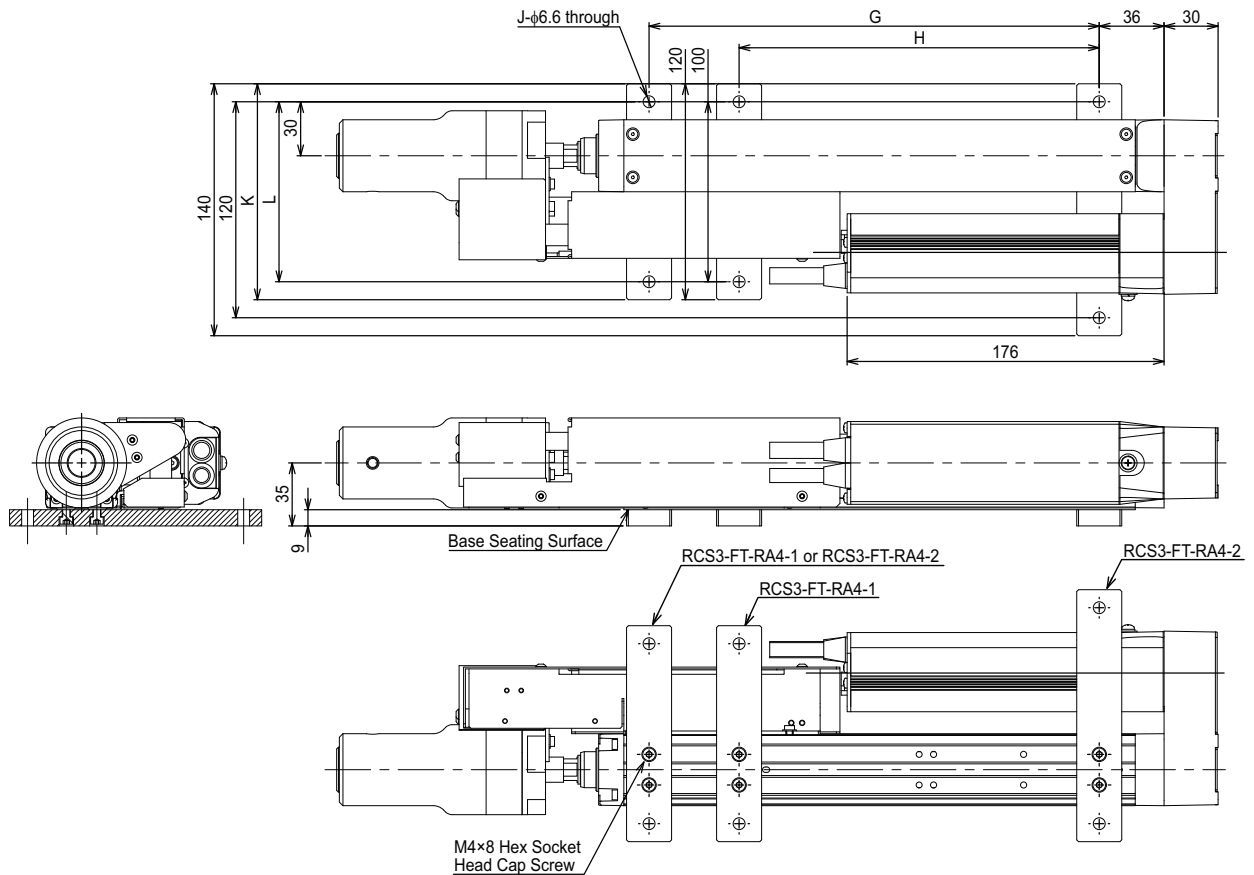


Foot Bracket (Option Model Code: FT)

- Model Code Of Single Product
- Foot Bracket (Short) : RCS3-FT-RA4-1
 - Foot Bracket (Long) : RCS3-FT-RA4-2

Number for the Set

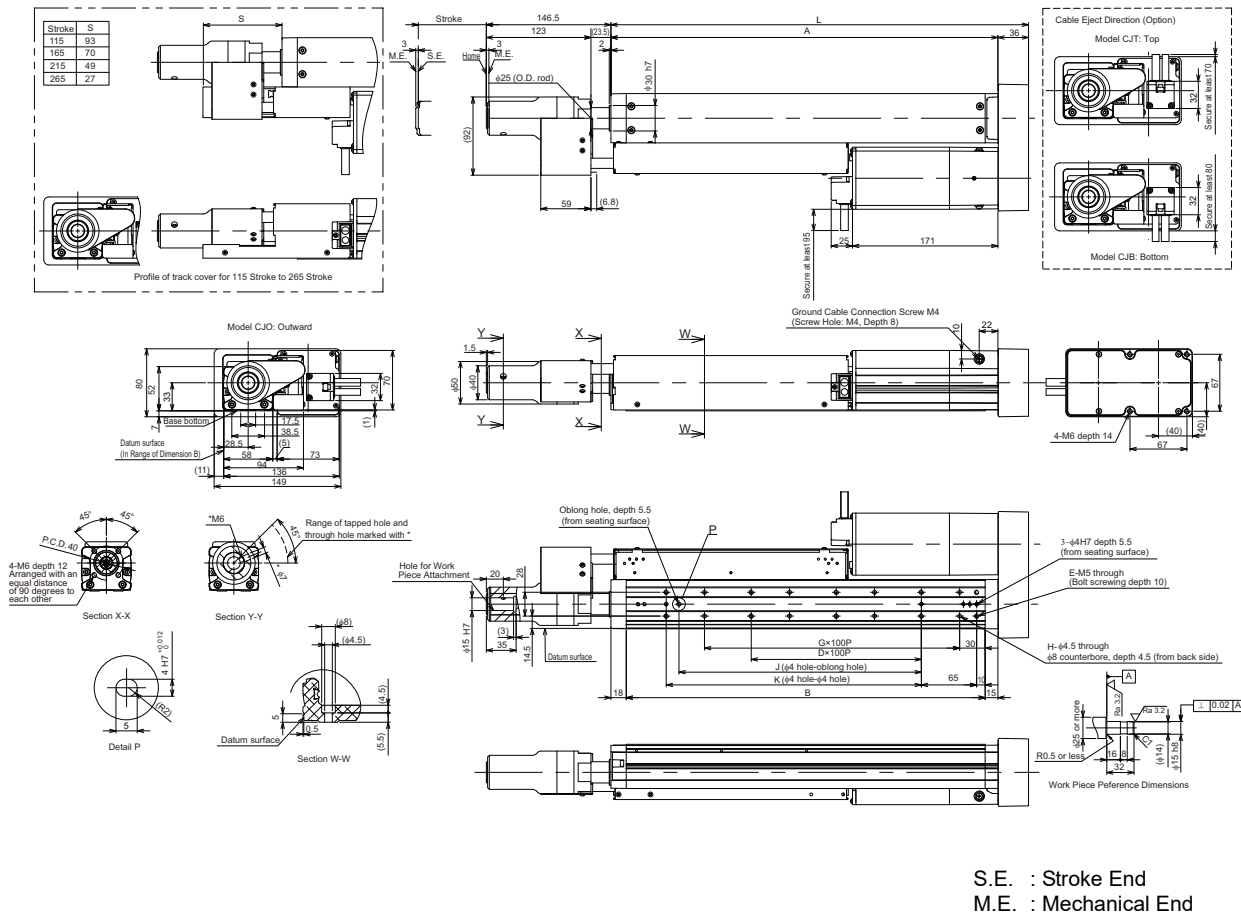
Stroke	Foot Bracket (Short)	Foot Bracket (Long)	Hex Socket Head Cap Screw
110	0	2	4
160	1	1	4
210 to 410	2	1	6



Foot Bracket Installed Position

Stroke	G	H	J	K	L
110	150	0	4	140	120
160	200	0	4	120	100
210	250	200	6	120	100
260	300	200	6	120	100
310	350	200	6	120	100
360	400	200	6	120	100
410	450	200	6	120	100

6.2 RCS3-RA6R Equipped with Loadcell (WA, A and I in Common)



Stroke	L	A	B	D	E	G	H	J	K	Mass [kg]	
										w/o Brake	With Brake
115	291	255	222	1	6	1	4	85	100	4.7	4.9
165	341	305	272	1	6	2	6	85	100	4.9	5.1
215	391	355	322	2	8	2	6	185	200	5.2	5.4
265	441	405	372	2	8	3	8	185	200	5.5	5.7
315	491	455	422	3	10	3	8	285	300	5.8	6.0
365	541	505	472	3	10	4	10	285	300	6.1	6.3
415	591	555	522	4	12	4	10	385	400	6.4	6.6

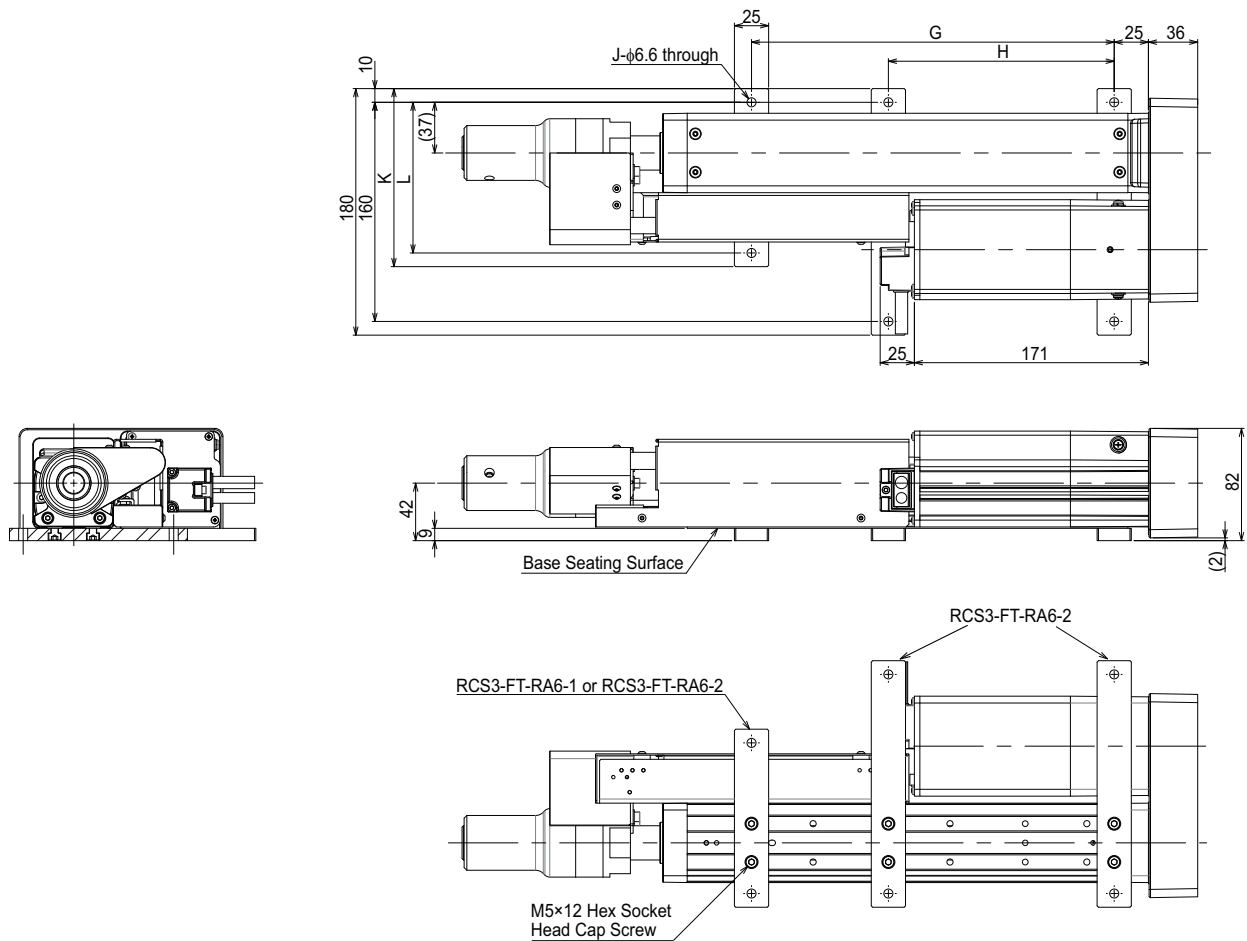
Foot Bracket (Option Model Code: FT)

- Model Code Of Single Product
- Foot Bracket (Short) : RCS3-FT-RA6-1
 - Foot Bracket (Long) : RCS3-FT-RA6-2

Number for the Set

Stroke	Foot Bracket (Short)	Foot Bracket (Long)	Hex Socket Head Cap Screw
115 to 165	0	2	4
215 to 415	1	2	6

(Note) Foot bracket (FT) option is not available to choose when CJB (bottom) is selected for the cable ejected direction except for those with 415mm of stroke.
The reason is the cable interferes with the foot bracket.



Foot Bracket Installed Position

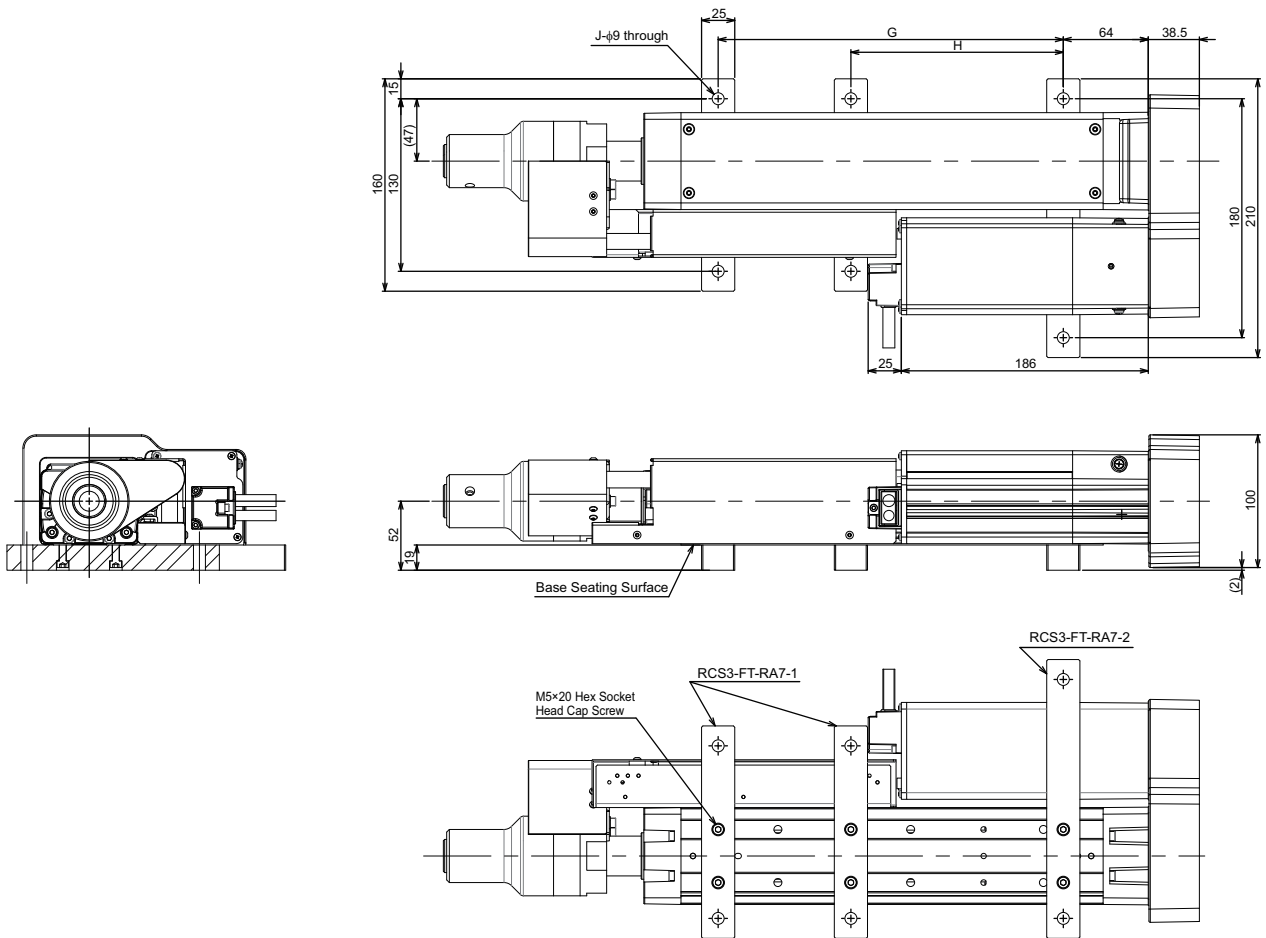
Stroke	G	H	J	K	L
115	165	0	4	180	160
165	165	0	4	180	160
215	265	165	6	130	110
265	265	165	6	130	110
315	365	165	6	130	110
365	365	165	6	130	110
415	465	265	6	130	110

Foot Bracket (Option Model Code: FT)

- Model Code Of Single Product
- Foot Bracket (Short) : RCS3-FT-RA7-1
 - Foot Bracket (Long) : RCS3-FT-RA7-2

Number for the Set

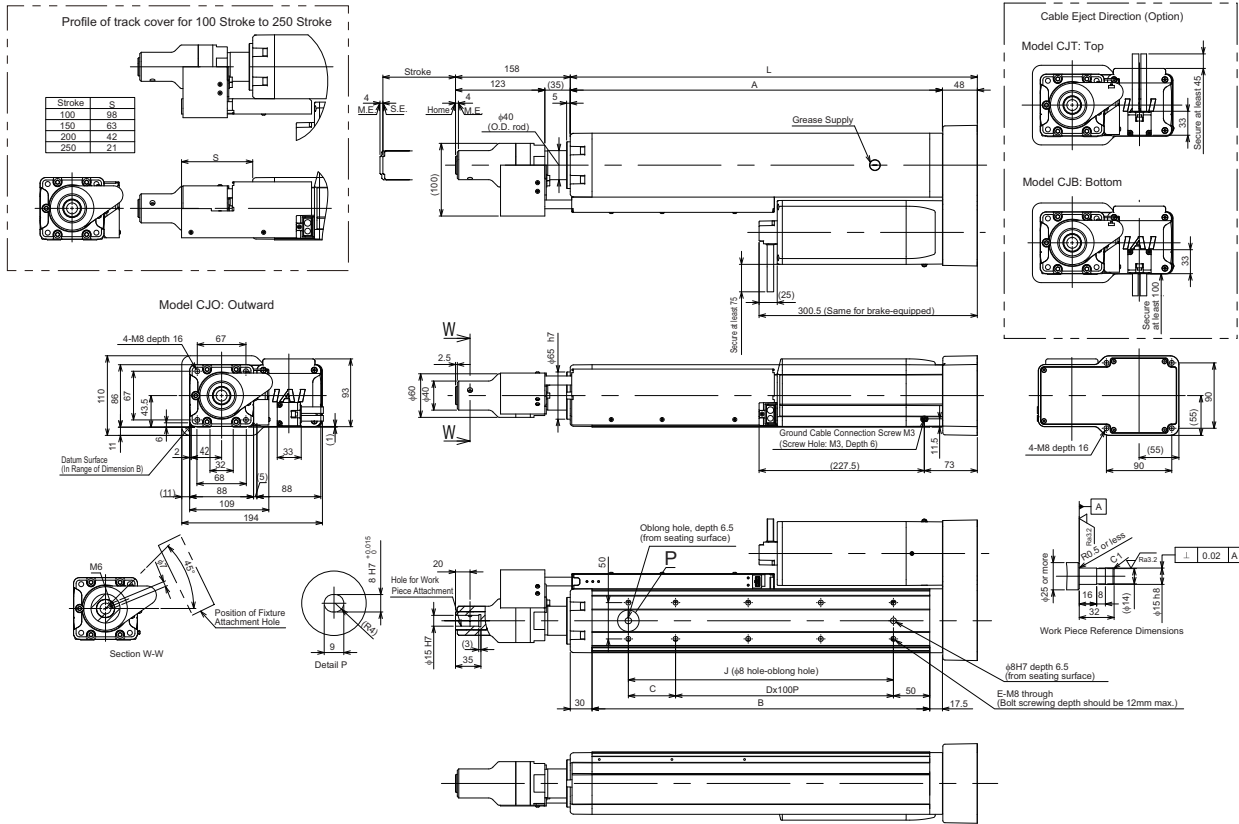
Stroke	Foot Bracket (Short)	Foot Bracket (Long)	Hex Socket Head Cap Screw
120 to 170	1	1	4
220 to 520	2	1	6



Foot Bracket Installed Position

Stroke	G	H	J
120	160	0	4
170	160	0	4
220	260	160	6
270	260	160	6
320	360	160	6
370	360	160	6
420	460	260	6
470	460	260	6
520	560	260	6

6.4 RCS3-RA8R Equipped with Loadcell (WA, A and I in Common)



S.E. : Stroke End
M.E. : Mechanical End

Stroke	L	A	B	C	D	E	J	Mass [kg]	
								w/o Brake	With Brake
100	360.5	312.5	265	65	1	6	165	10.2	10.7
150	410.5	362.5	315	115	1	6	215	10.8	11.3
200	460.5	412.5	365	65	2	8	265	11.3	11.8
250	510.5	462.5	415	115	2	8	315	11.9	12.4
300	560.5	512.5	465	65	3	10	365	12.5	13.0
350	610.5	562.5	515	115	3	10	415	13.0	13.5
400	660.5	612.5	565	65	4	12	465	13.6	14.1
450	710.5	662.5	615	115	4	12	515	14.1	14.6
500	760.5	712.5	665	65	5	14	565	14.7	15.2

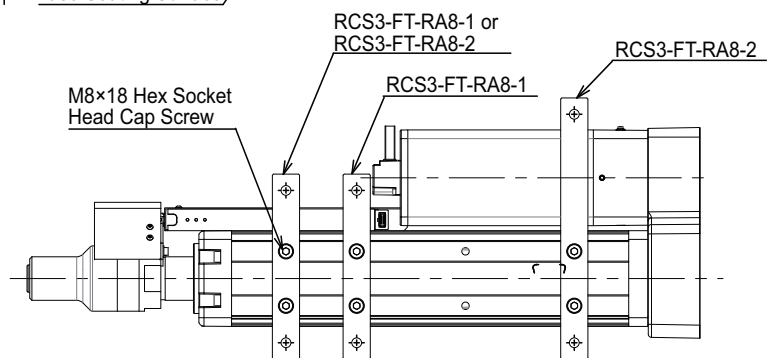
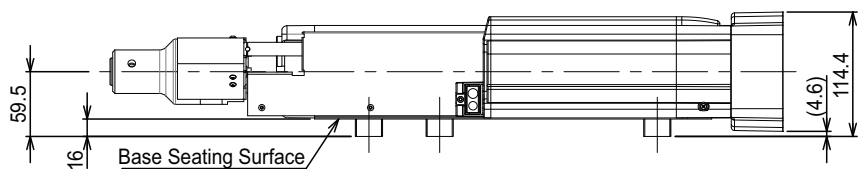
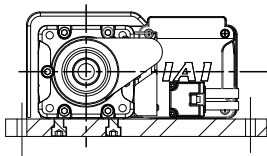
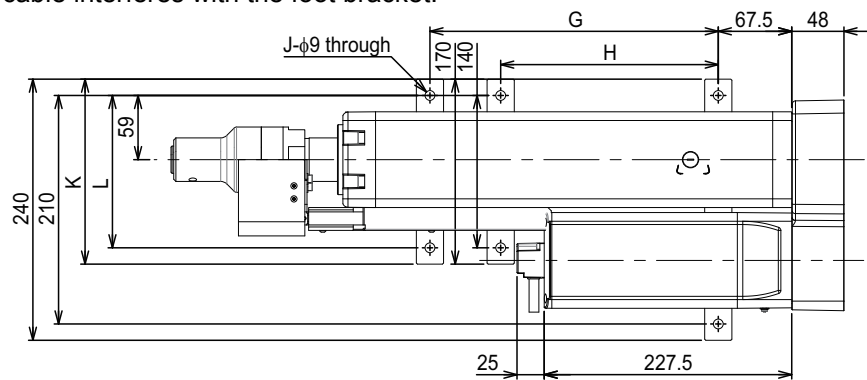
Foot Bracket (Option Model Code: FT)

- Model Code Of Single Product
- Foot Bracket (Short) : RCS3-FT-RA8-1
 - Foot Bracket (Long) : RCS3-FT-RA8-2

Number for the Set

Stroke	Foot Bracket (Short)	Foot Bracket (Long)	Hex Socket Head Cap Screw
100	0	2	4
150	1	1	4
200 to 500	2	1	6

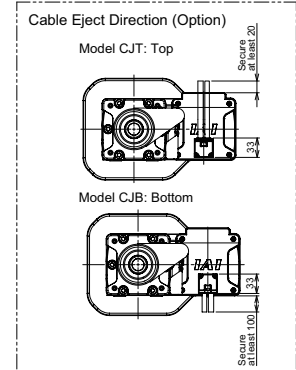
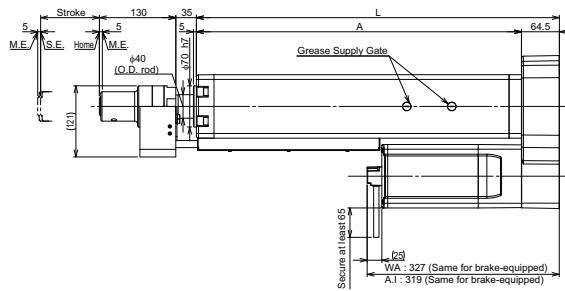
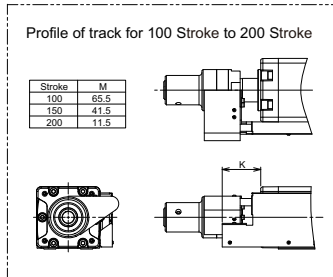
(Note) Foot bracket (FT) option is not available to choose when CJB (bottom) is selected for the cable ejected direction except for those with 415mm of stroke. The reason is the cable interferes with the foot bracket.



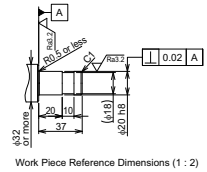
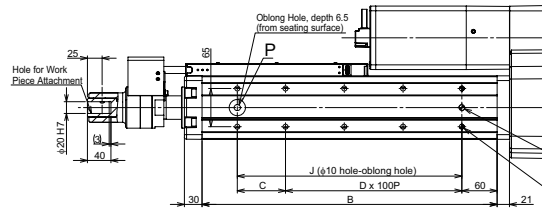
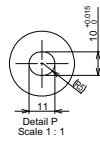
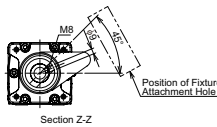
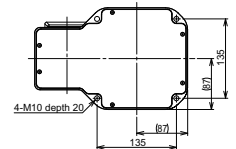
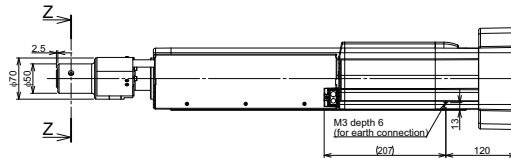
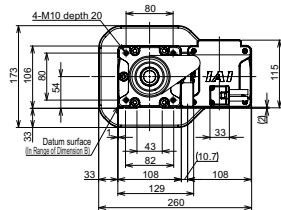
Foot Bracket Installed Position

Stroke	G	H	J	K	L
100	165	0	4	240	210
150	215	0	4	170	140
200	265	200	6	170	140
250	315	200	6	170	140
300	365	200	6	170	140
350	415	200	6	170	140
400	465	200	6	170	140
450	515	300	6	170	140
500	565	300	6	170	140

6.5 RCS3-RA10R Equipped with Loadcell (WA, A and I in Common)



Model CJO: Outward



S.E. : Stroke End
M.E. : Mechanical End

Stroke	L	A	B	C	D	E	J	Mass [kg]	
								w/o Brake	With Brake
100	417.5	353	302	82	1	6	182	17.1	17.6
150	467.5	403	352	132	1	6	232	17.9	18.4
200	517.5	453	402	82	2	8	282	18.7	19.2
250	567.5	503	452	132	2	8	332	19.5	20.0
300	617.5	553	502	82	3	10	382	20.4	20.9
350	667.5	603	552	132	3	10	432	21.2	21.7
400	717.5	653	602	82	4	12	482	22.0	22.5
450	767.5	703	652	132	4	12	532	22.9	23.4
500	817.5	753	702	82	5	14	582	23.7	24.2

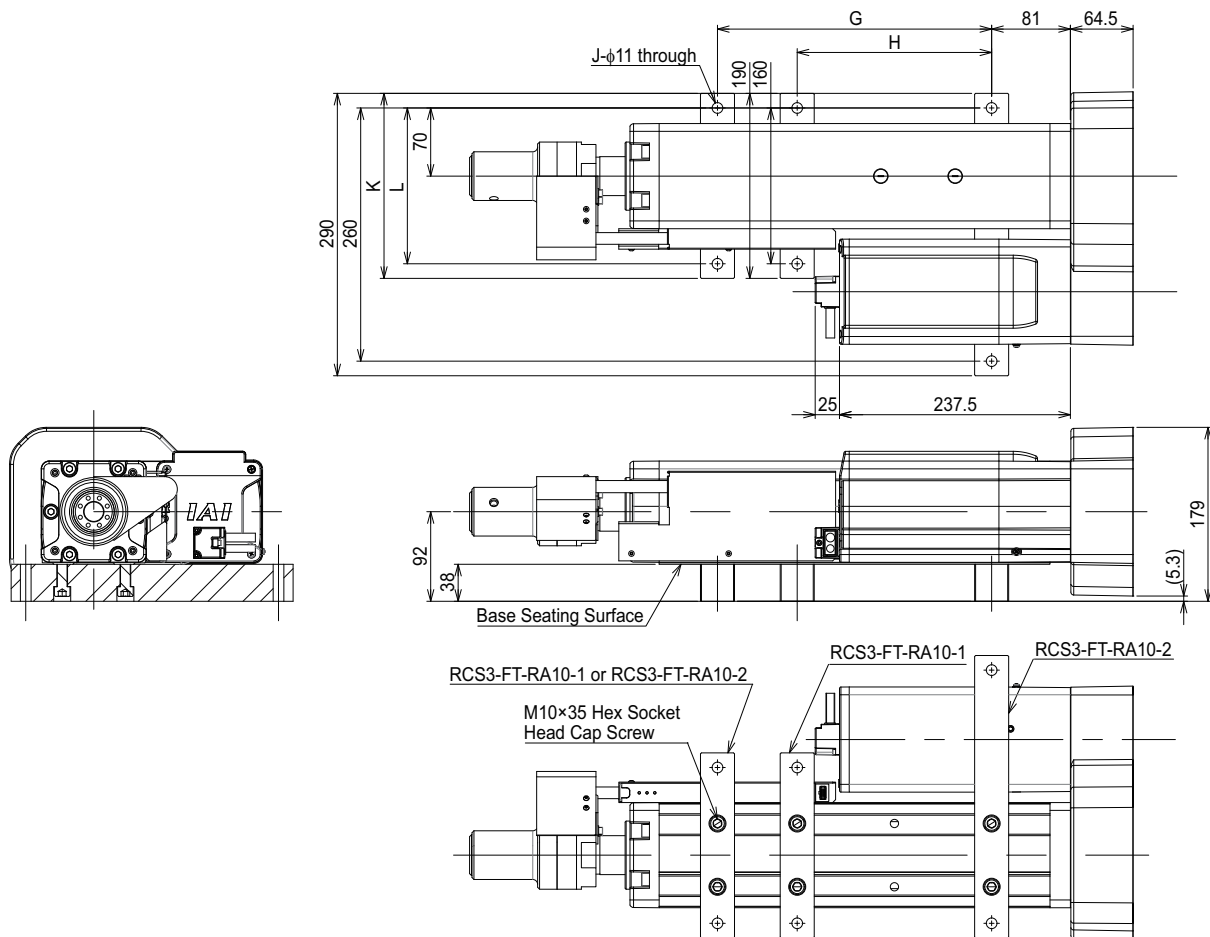
Foot Bracket (Option Model Code: FT)

- Model Code Of Single Product
- Foot Bracket (Short) : RCS3-FT-RA10-1
 - Foot Bracket (Long) : RCS3-FT-RA10-2

Number for the Set

Stroke	Foot Bracket (Short)	Foot Bracket (Long)	Hex Socket Head Cap Screw
100	0	2	4
150	1	1	4
200 to 500	2	1	6

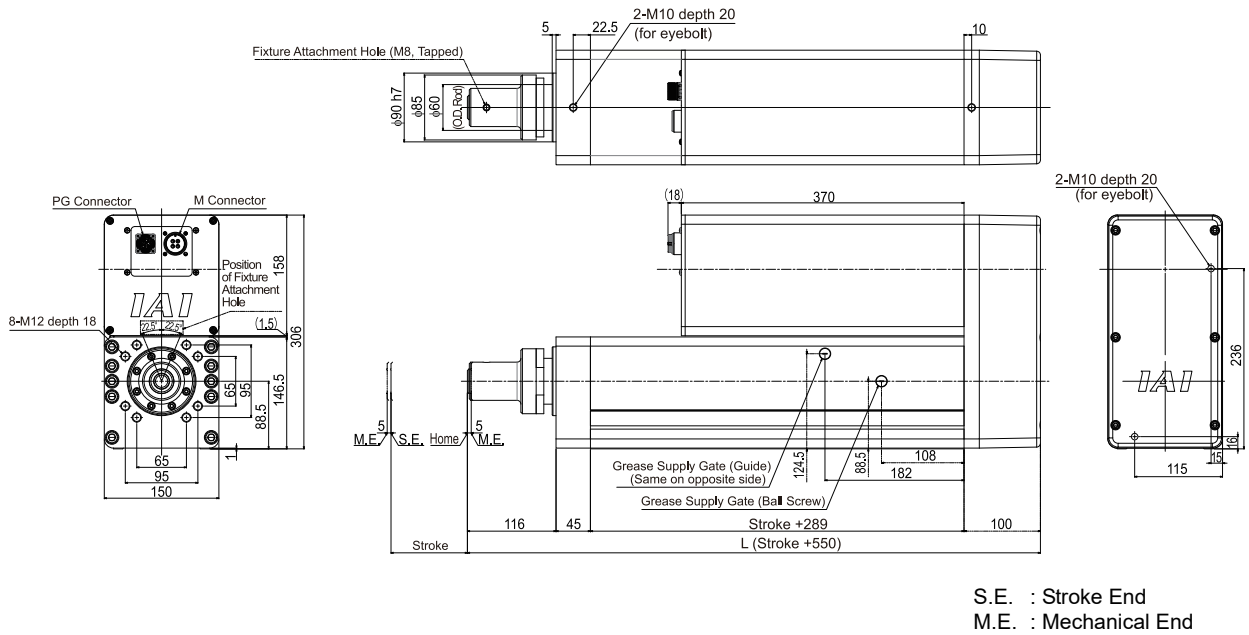
(Note) Foot bracket (FT) option is not available to choose when CJB (bottom) is selected for the cable ejected direction except for those with 415mm of stroke. The reason is the cable interferes with the foot bracket.



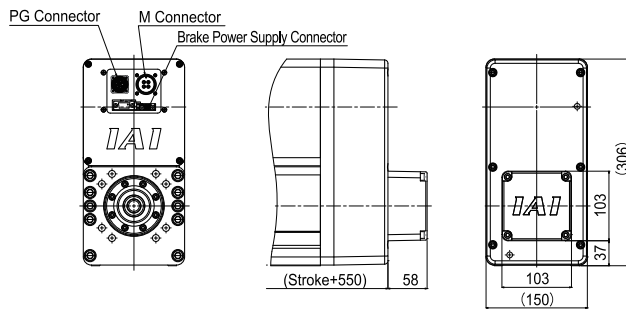
Foot Bracket Installed Position

Stroke	G	H	J	K	L
100	182	0	4	290	260
150	232	0	4	190	160
200	282	200	6	190	160
250	332	200	6	190	160
300	382	200	6	190	160
350	432	200	6	190	160
400	482	200	6	190	160
450	532	300	6	190	160
500	582	300	6	190	160

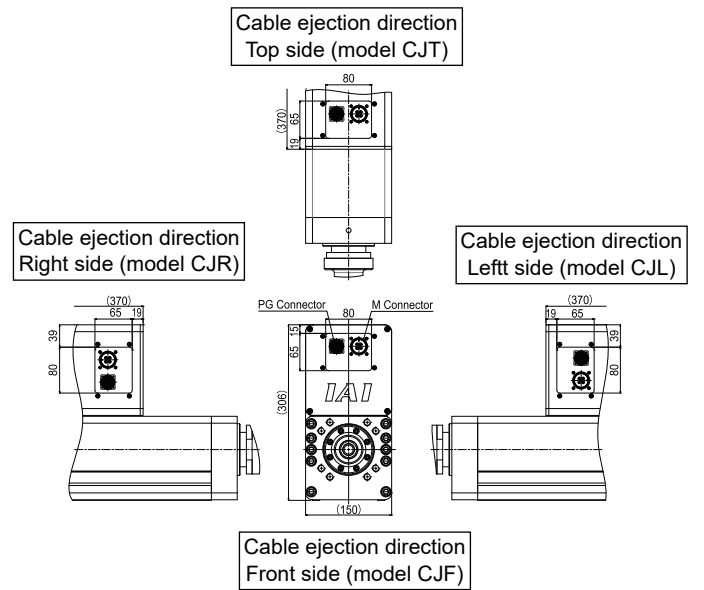
6.7 RCS3-RA15R (Equipped with Loadcell (Old Type))



[With Brake (Option)]

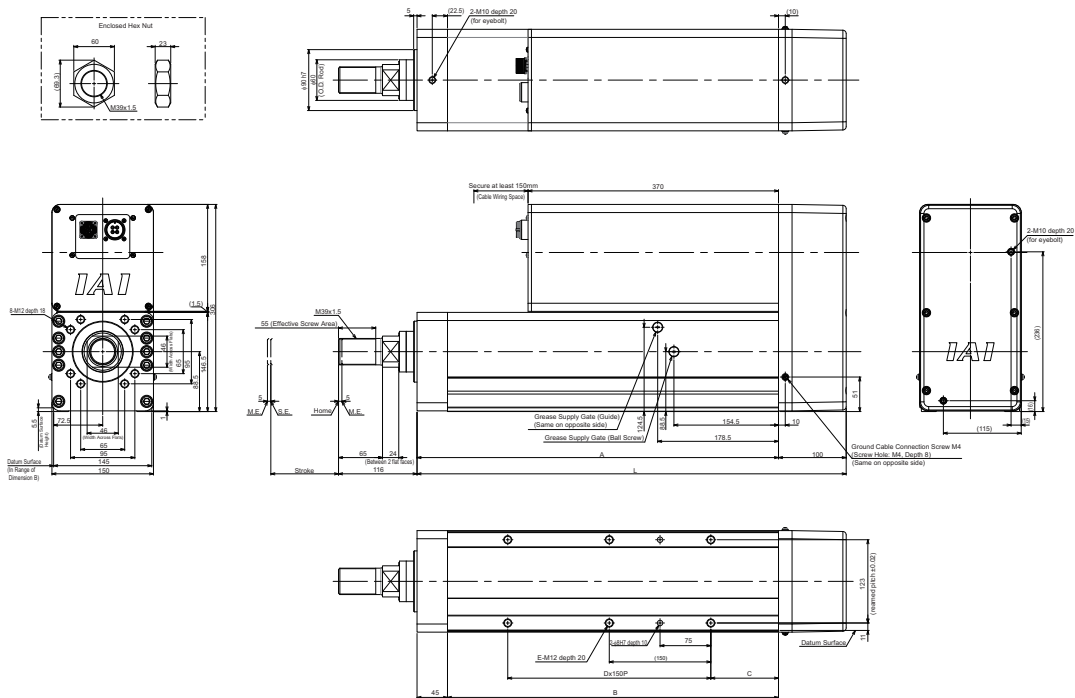


[Cable Eject Direction (Option)]



Stroke	L w/o Brake	Mass [kg]	
		w/o Brake	With Brake
100	650	61	63
200	750	64.9	66.9
300	850	68.7	70.7
400	950	72.6	74.6
500	1050	76.5	78.5

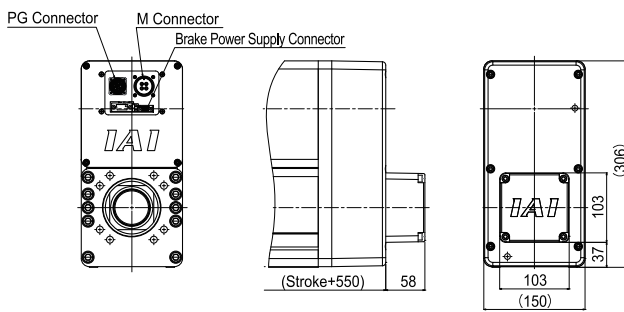
6.8 RCS3-RA15R (Conveyor Type (with No Loadcell Equipped))



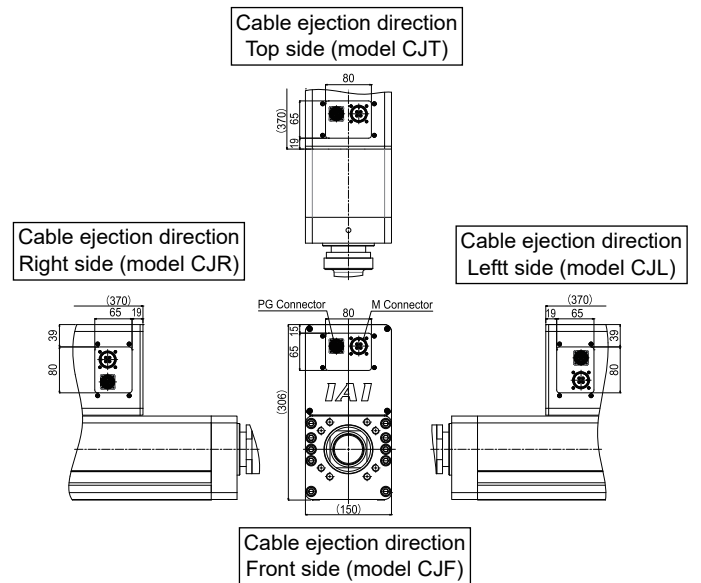
(Note) The orientation of the width across flats differs depending on the model.

S.E. : Stroke End
M.E. : Mechanical End

[With Brake (Option)]

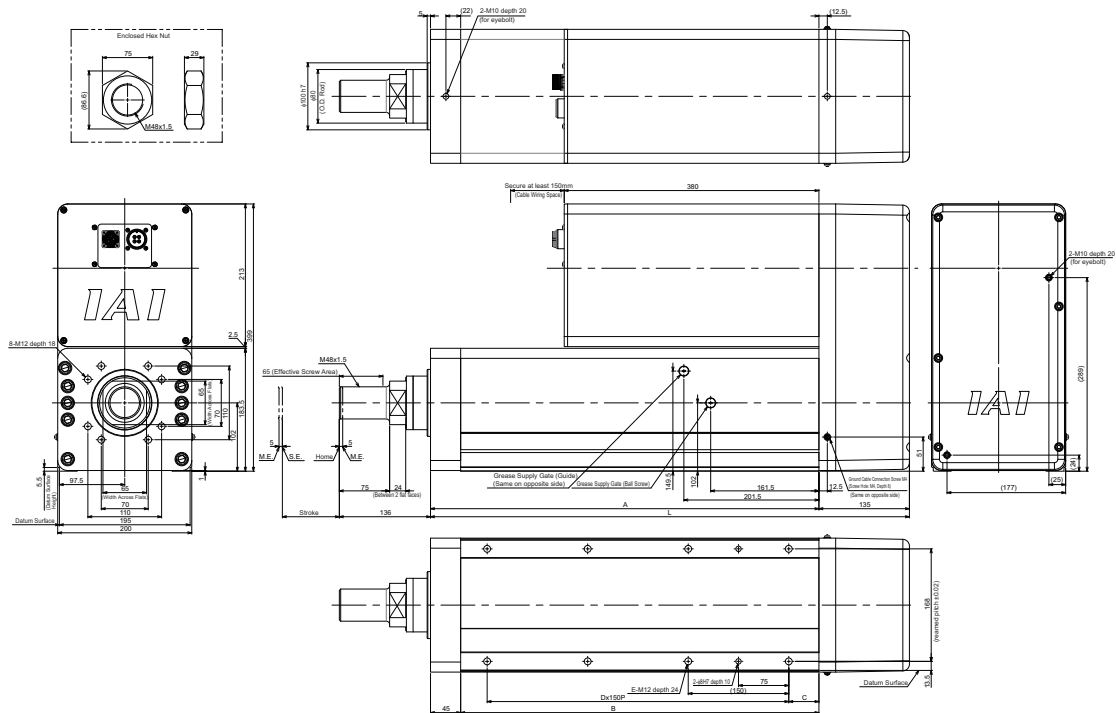


[Cable Eject Direction (Option)]



Stroke	L w/o Brake	A	B	C	D	E	Mass [kg]	
							w/o Brake	With Brake
100	534	434	389	50	2	6	58.8	60.8
200	634	534	489	100	2	6	62.6	64.7
300	734	634	589	70	3	8	66.4	68.5
400	834	734	689	50	4	10	70.3	72.4
500	934	834	789	100	4	10	74.1	76.3

6.11 RCS3-RA20R (Conveyor Type (with No Loadcell Equipped))

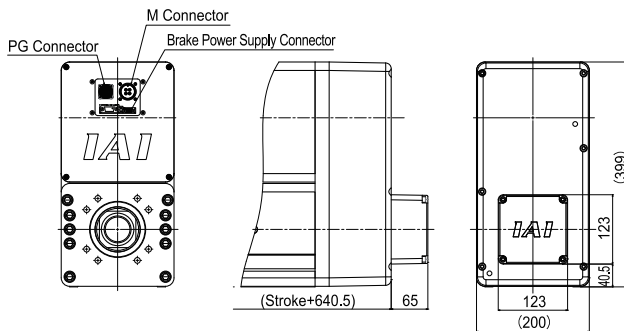


(Note) The orientation of the width across flats differs depending on the model.

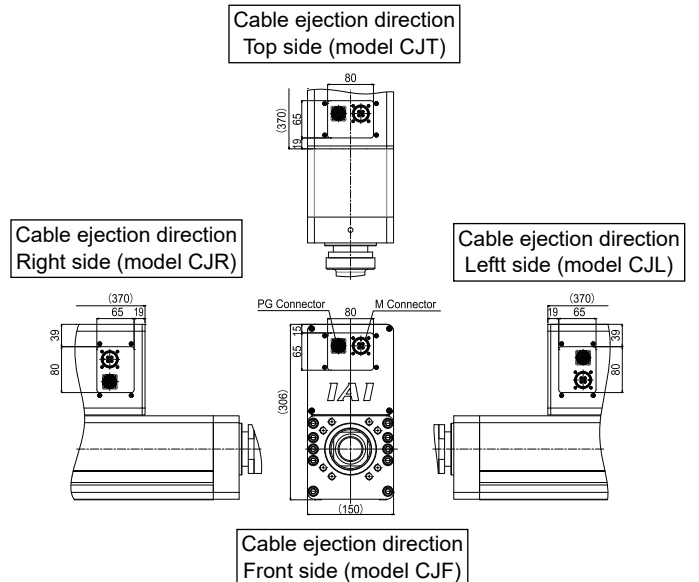
S.E. : Stroke End

M.E. : Mechanical End

[With Brake (Option)]



[Cable Eject Direction (Option)]



Stroke	L w/o Brake	A	B	C	D	E	Mass [kg]	
							w/o Brake	With Brake
100	614.5	479.5	434.5	70	2	6	58.8	60.8
200	714.5	579.5	534.5	45	3	8	62.6	64.7
300	814.5	679.5	634.5	100	3	8	66.4	68.5
400	914.5	779.5	734.5	70	4	10	70.3	72.4
500	1014.5	879.5	834.5	120	4	10	74.1	76.3

7. Life

- Operation Distance

The operation distance that product life is assumed to be 5,000km (reference) under the condition that it runs with maximum transportable weight and maximum acceleration/deceleration.

- Upper Limit for Times of Pressing

When having maximum pressing force (70% of current boundary) with pressing distance*1 at 1mm to operate the pressing movement, take the values for the times of pressing stated in the below as a reference for the upper limit.

*1 Distance to move while pressing with maximum pressing force

(Note) The values for times of pressing stated in the below are those under assumption that there is no impact or vibration applied. The upper limit of times of pressing may differ depending on the operational conditions such as impact and vibration.

Type	Max. Pressing Force (Current Limiting Value)	Times of Pressing
RA4R	200N (120%)	340,000,000 times
RA6R	600N (100%)	95,000,000 times
RA7R	1200N (140%)	25,000,000 times
RA8R	2000N (140%)	25,000,000 times
RA10R	6000N (200%)	15,000,000 times

Type	Max. Pressing Force (Current Limiting Value)	Times of Pressing
RA15R	30000N (200%)	100,000,000 times
RA20R	50000N (200%)	44,000,000 times

(Note) The number of pressing operation for RA15R and RA20R delivered before July 2017 is 10,000,000 times for RA15R and 5,000,000 times for RA20R.

8. Calibration on Loadcell

8.1 Frequency of Calibration

Basically, the frequency of calibration should be determined by the user.
As a reference, below describes some examples of standards for calibration frequency.

The reference of calibration frequency is six months after purchased, twelve months after purchased and every one year after that.

However, it is recommended, in such a circumstance that the frequency of use is high as, for example, number of pressing reaches 2,000,000 times which is the end of pressing life in three years, to conduct calibration every month.

On the other hand, if the frequency of use is low, you can set the frequency of calibration lower, but it is still recommended to have calibration every year if considering aged deterioration and unexpected errors.

9. Warranty

9.1 Warranty Period

One of the following periods, whichever is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to the specified location
- 2,500 hours of operation

9.2 Scope of the Warranty

Our products are covered by warranty when all of the following conditions are met. Faulty products covered by warranty will be replaced or repaired free of charge:

- (1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.
- (2) The breakdown or problem in question occurred during the warranty period.
- (3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the instruction manual and catalog.
- (4) The breakdown of problem in question was caused by a specification defect or problem, or by a quality issue with our product.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty:

- [1] Anything other than our product
- [2] Modification or repair performed by a party other than us (unless we have approved such modification or repair)
- [3] Anything that could not be easily predicted with the level of science and technology available at the time of shipment from our company
- [4] A natural disaster, man-made disaster, incident or accident for which we are not liable
- [5] Natural fading of paint or other symptoms of aging
- [6] Wear, depletion or other expected result of use
- [7] Operation noise, vibration or other subjective sensation not affecting function or maintenance

Note that the warranty only covers our product as delivered and that any secondary loss arising from a breakdown of our product is excluded from the scope of warranty.

9.3 Honoring the Warranty

As a rule, the product must be brought to us for repair under warranty.

9.4 Limited Liability

- (1) We shall assume no liability for any special damage, consequential loss or passive loss such as a loss of expected profit arising from or in connection with our product.
- (2) We shall not be liable for any program or control method created by the customer to operate our product or for the result of such program or control method.

9.5 Conditions of Conformance with Applicable Standards/Regulations, Etc., and Applications

- (1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.
- (2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:
 - [1] Medical equipment pertaining to maintenance or management of human life or health
 - [2] A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
 - [3] Important safety parts of mechanical equipment (such as safety devices)
 - [4] Equipment used to handle cultural assets, art or other irreplaceable items
- (3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or instruction manual.

9.6 Other Items Excluded from Warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:

- [1] Guidance for installation/adjustment and witnessing of test operation
- [2] Maintenance and inspection
- [3] Technical guidance and education on operating/wiring methods, etc.
- [4] Technical guidance and education on programming and other items related to programs

Change History

Revision Date	Description of Revision
October 2015	First edition
February 2016	Second edition RA4R, RA15R and RA20R added
April 2016	2B edition Pg. 16 T2 : SCON-CB → T2 : SCON-CB/CGB T3 : SCON-CB → T3 : SCON-CGB Pg. 45 Applicable models added Pg. 76 Change a diagram of RA10R, RA15R and RA20R Pg. 84 to 86 The contents about grease supply on rod sliding surface and cleaning are added
April 2016	2C edition Pg. 42 Change a continuous operational thrust [N] RA6R 481 → 420 RA7R 679 → 600 RA8R 1367 → 1000 RA10R 2577 → 2100
April 2016	2D edition Pg. 132 Calibration on Loadcell added
May 2016	2E edition Pg. 44 Unit of velocity [mm/s] added Pg. 131 Max. pressing force for RA15R and RA20R added Change a times of pressing for RA10R 2,000,000 times → 15,000,000 times
July 2016	2F edition Pg. 80 to 82 Note added for brake power supply cable wiring and number of regenerative resistor units (reference)
November 2016	2G edition Pg. 120 Unit of loadcell replacement (loadcell unit) for RA15R and RA20R changed to integrated unit with frame
December 2016	2H edition Pg. 80 Connector for brake power supply changed
December 2016	2I edition Pg. 19 Note added stating alarm should be generated when exceeded 125% R.C of pressing force and 25% R.C of tensile force
January 2017	2J edition Pg. 109, 115 Note added instructing to pull in rod when aligning to marking

Revision Date	Description of Revision
February 2017	2K edition Pg. 8 Caution note deleted for allowable rod tip dynamic load and load offset distance Caution note added stating not to apply radial load and load moment to rod
August 2017	2L edition Pg. 122 to 131 Change an external dimension of RA4R, RA6R, RA7R, RA8R and RA10R.
September 2017	Third edition · Battery-less absolute type WA added · Conveyor type (with no loadcell equipped) of RA15R and RA20R added · Contents added for Warning Label · Change made to External Dimensions (ground cable connection screw added)
October 2017	3B edition · Pg. 23 Tolerance of temperature drift deleted · Pg. 77 Change made to tightening torque for RA20R · Pg. 119 Change made to grease on ball screw · Pg. 157, 160 Equipped with brake (option) and cable ejection direction (option) added · Correction made
December 2017	3C edition · Pg. 146, 148, 152, 154 Change an external dimensions
March 2018	3D edition · Pg. 9 Description added in Caution in Handling for minimum velocity available for setting in pressing program
March 2018	3E edition · Pg. 100 Model added for enclosed connector for brake of RA15R and RA20R
June 2018	3F edition · Pg. 129 Change made to belt manufacturer model code RA10R 150S5M565R → 150HP-S5M565
August 2018	3G edition · Pg. 132, 138 Correction made Table Tension Adjustment Screws → Motor Unit Affixing Bolt



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