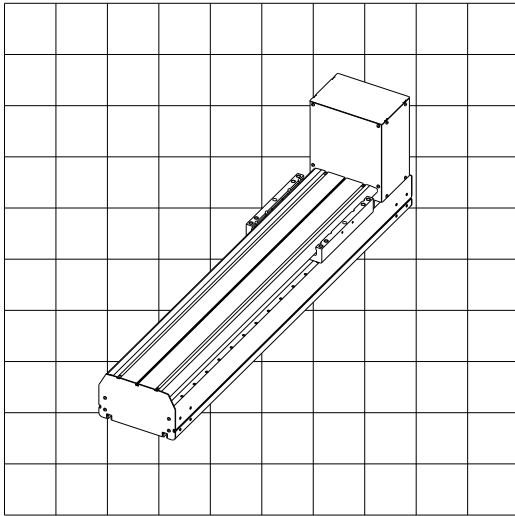


Shibaura Machine



COMPO ARM

BA-III SERIES

MODEL : BE60
High-load
Belt-Driven Actuator

ACTUATOR INSTRUCTION MANUAL

Original Instructions

Shibaura Machine

Keep this manual nearby for future reference.

Introduction

Before using the COMPO ARM BA-III series, read through and completely understand this instruction manual to assure correct use.

For general information for the COMPO ARM BA-III Series, refer to CA25 Instruction Manual (Basic Part).

CAUTION

1. About application of this product
 - This product is not designed or manufactured to be used in equipment in situations that can affect or endanger human life.
 - When considering this product for operation in special applications (passenger transportation, medical, aerospace, atomic power, electric power, etc.), please contact our sales section.
 - Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.
2. This equipment does not have an explosion-proof structure. Take utmost care of the operating environment.
3. All efforts have been made to assure the contents of this manual. If you have any questions, or find any mistakes, however, please contact Shibaura Machine.
4. Shibaura Machine will not be held responsible for any effects caused by using this equipment, regardless of Item 3 above.
5. The contents of this manual are subject to change without prior notice to effect improvements.

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The information contained in this manual is subject to change without notice to effect improvements.

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Overview

- This manual describes the axis type expression method, specifications and motor replacement procedures, etc., according to the type of axis.
- For the installation, see the instruction manual (installation of actuator) provided separately.

Chapter 1 Safety

■ 1.1 Cautions for safety

- Before the installation, programming, operation, maintenance and inspection of the equipment, be sure to read through this manual so that you can use the COMPO ARM with safety.
- After you have read this manual, keep it nearby for future reference.

Be sure to observe the instructions for ensuring operation safety of the COMPO ARM.

This manual contain the important information to prevent injury to the operators and persons nearby, to prevent damage to assets and to assure correct use of the equipment.

Make sure that you have well understood the following details (indications and symbols) before reading this manual.

Always observe the information that is noted.

WARNING

: If you have neglected this instruction and caused a handling error, death or serious injury may occur.

CAUTION

: If you have neglected this instruction and caused a handling error, human injury or property damage (damages to houses, household goods and domestic animals) may occur.

CAUTION

: This gives a brief description of the major points of operation procedures, precautions and method for effective use of the machine.

⚠ WARNING

- **Install the safety fences to prevent anyone from entering the working envelope of the robot.**
When the door is attached to the safety fence, the robot should be stopped at emergency at the same time that the door has opened.
- **Connect the EMERGENCY STOP pushbutton switch to the emergency stop input terminal of the controller and mount the same switch at an easy-to-operate place in an emergency.**
The EMERGENCY STOP switch must not be reset automatically and cannot be reset negligently by any person.
- **Wiring should be done safely and completely according to the Electrical Installations Technical Requirements and Interior Wiring Requirements of Japan.**
Incorrect wiring will result in an electric shock or a fire.
- **The equipment MUST NOT be repaired or modified without prior written permission from the manufacturer.**
Otherwise, an accident or damage will be caused.
- **Before the maintenance and inspection, be sure to turn off the controller main power switch. Take all necessary measures to prevent anyone other than the worker engaged in adjustment of the robot from negligently turning the power on. (Lock the switch and put a tag showing "DO NOT turn the power on.") Also, DO NOT touch the controller interior ten (10) minutes after the power is turned off.**
Otherwise, you may get an electric shock due to residual voltage of the capacitor.
- **DO NOT touch the motor, heat sink and cement resistor in the controller.**
They are too hot and you may get burnt. Before performing inspection, take enough time to cool them off.
- **DO NOT pour water on the equipment interior or exterior, or drain water from it. Otherwise, you may get an electric shock, or the equipment will be damaged.**
When the equipment has contaminated, wipe it off with a hard squeezed cloth. DO NOT use a thinner, benzene or other organic solvent.
- **DO NOT throw away metals, combustibles or other contaminant into the opening of this equipment.**
A fire or an electric shock will be caused.
- **DO NOT put your finger or hand on the movable part or opening of the equipment.**
Otherwise, you may get injured.
- **When using the actuator in other than the horizontal state, select the vertical actuator.**
This actuator (belt-driven) cannot be used for the vertical application.

⚠ WARNING

- **As the equipment is heavy, make sure of its weight and gravity center position and disconnect the cables when carrying the equipment.**

Also, DO NOT carry the equipment with the slider. Otherwise, the slider will move and you will get injured.

- **DO NOT use this equipment for the living body as a massaging machine.**

Otherwise, you will be injured due to incorrect teaching or mis-operation.

- **This equipment has not a sealed structure. During use, grease or wear of the belt may scatter from the opening of the equipment.**

When using this equipment for food and chemical applications, take appropriate measures against entry of them.

- **Enter the robot type and initialize the memory correctly.**

Otherwise, the robot may move unexpectedly and you will be injured.

- **DO NOT use this equipment in an atmosphere of inflammable gas or an atmosphere inducing an explosion.**

As this equipment is not explosion-proof, it may explode in the worst occasion.

- **DO NOT damage, break, process, forcibly bend, stretch, place a heavy object on or pinch the cables (power cable, controller cable).**

Otherwise, an electric shock or a fire will be caused.

- **Should an abnormality such as smoke or nasty smell occur, turn the power off immediately and stop using the equipment.**

If the equipment is used continuously, an electric shock or a fire will be caused.

⚠ CAUTION

- **DO NOT place the equipment at a place where the ambient temperature exceeds 40°C, or where the temperature changes sharply, causing condensing, or where it is exposed to direct sunlight.**

Additionally, if the equipment is installed at a narrow place, the ambient temperature rises due to heat generation in the controller itself or external device, which will result in malfunction or mis-operation of the equipment.

- **DO NOT use the equipment at a place where an impact or vibration is involved. Also, DO NOT use the equipment in an atmosphere where conductive dust, corrosive gas or oil mist generates.**

Otherwise, a fire, electric shock, malfunction or mis-operation will be caused.

- **DO NOT use the equipment at a place where too much dust or dirt exists.**

If the equipment is used at such a place, it may malfunction because this equipment is not dust-proof.

- **DO NOT use repair parts other than those designated by the manufacturer.**

Otherwise, the equipment cannot be operated to its full capacity and will cause malfunction.

- **Mount the robot on a highly rigid frame.**

If rigidity of the frame is not enough, vibration (or resonance) may be caused during the robot operation, adversely affecting the operation.

- **In the case of power failure, this equipment becomes a free running state. If there is a risk of work damage, use an axis that supports specifications with brakes.**

This machine does not have a dynamic brake function.
The "BE" belt driven axis does not support specifications with brakes.

- **Do not apply force to the slider that exceeds the maximum speed of this machine.**

It may cause a malfunction.

- **Do not connect or disconnect a connector with the controller turned ON.**

Malfunction may be caused.

- **Take safety measures against fall and scatter of a work piece.**

If collision occurs, the axis decelerates suddenly and a work piece may fall and scatter.

- **Perform risk assessment for entire equipment and take required protective measures.**

- **When discarding this product, dispose correctly as an industrial waste.**

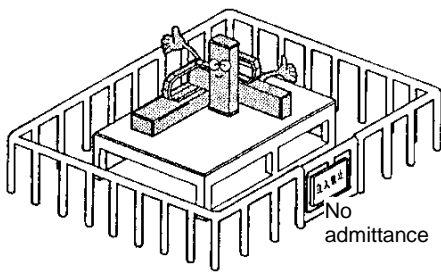
■ 1.2 For your safe operation

When you use the COMPO ARM BA-III series, be sure to take the measures in conformity to the following instruction:

This machine is an industrial robot in conformance to the provisions of Paragraph 31 of Article 36 of the Ordinance on Industrial Safety and Hygiene. Necessary cautions are specified in the "Selection", "Installation", "Use", "Periodic Inspection, etc." and "Education" of the "Technical Guideline on Safety Standards for Use of Industrial Robot" conforming to the Article 28 of the Industrial Safety and Health Law. You are requested to read them carefully and to observe the instructions. The following introduces some of them.

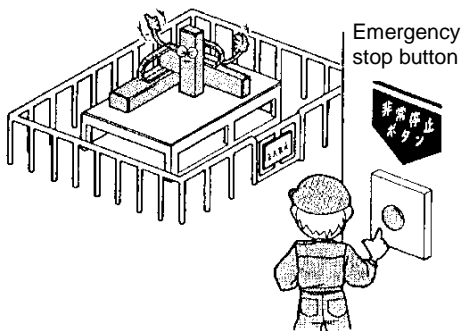
■ 1.2.1 Safety measures

(1) A safety barrier shall be provided to ensure that any person cannot enter the working area of a robot.



1. The barrier shall have sufficient strength to withstand the force generated during the work or environmental conditions. The barrier shall have such a structure that cannot be easily adjusted, removed or cleared.
2. The safety barrier shall be free from any serrated or sharp edge or protrusions.
3. The safety barrier shall be designed in a stationary structure.
4. When a safety barrier is equipped with a door, an interlock shall be provided so that the robot will be stopped by opening of the door.

(2) An emergency stop device shall be installed where the robot can be easily stopped by the operator immediately in the event of emergency.



1. The emergency stop function shall ensure immediate and reliable stop of a robot when the emergency stop button switch has been operated by an operator.
2. The emergency stop button shall be red.
3. The emergency stop device shall be located so that it can be easily pulled, pressed or touched by the operator, and it can block a beam of light.
4. The emergency stop button shall be structured in such a way that it is not automatically reset after having been operated, and cannot be reset carelessly.

(3) For safety, never modify the robot main unit or control device.

■1.2.2 Precautions for installation

Observe the following instructions when installing a robot:

- (1) The robot shall be laid out to ensure the work space required for robot teaching, maintenance and inspection.
- (2) The robot controller, other controllers and stationary operation panel shall be installed outside the movable range and where the operator can watch the robot operations.
- (3) The pressure gauge, hydraulic pressure gauge and other instruments shall be installed in clearly visible positions.
- (4) The electric wiring and hydraulic/pneumatic piping shall be provided with protective covers if they may be damaged.
- (5) To ensure effective operation of the emergency stop device in the event of emergency, emergency stop device switches shall be installed on locations other than the operation panel, as required.

■1.2.3 Precautions for use

Observe the following instructions when using a robot:

[Work within the movable range]

(1) Work provisions

Determine provisions for the following items and perform the work in conformity to them:

1. Root operation methods and procedures required in the work such as startup method and switch handling method.
2. Speed of robot main unit in teaching.
3. Signaling method for work adjustment among more than one operator.
4. Action to be taken by the operator for each problem.
5. Procedures for confirming the release of the emergency and safety when restarting the robot operation after the robot operation has been stopped due to the operation of the emergency stop device.
6. Measures to protect against the hazard due to unexpected operation of the robot described below (in addition to the above items), or the hazard caused by a robot operation error.
 - Indication on the operation panel.
 - Measures to ensure safety of the operator working within the movable range.
 - Working position and posture.
 - Prevention of operation error due to noise.
 - Signaling method for work adjustment with operators of related devices.
 - Error type and evaluation procedure.
7. The work provisions shall meet the requirements of the robot type, installation site and work.
8. The work provisions shall be prepared by consultation with the related operators, manufacturer's engineers and industrial safety consultant.

(2) Indication on the operation panel

To ensure that the start switch and selector switch will not be carelessly operated by a person other than the personnel in charge of this work, the switch shall be provided with an easy-to-read indication to show that the work is in progress. Alternatively, the operation panel cover shall be provided with locking or other means.

- (3) Measures to ensure the operation safety of the personnel working within the movable range
Any one of the following measures or other measures on the equal or higher level shall be taken so that you can stop the robot operation immediately in the event of an error when working within the movable range:
1. An adequately authorized supervisor shall be assigned outside the movable range and where the robot operations can be observed. This supervisor shall be exclusively in charge of the supervision and shall be responsible for the following:
 - The supervisor shall cause the emergency stop device to be operated immediately in the event of an error.
 - The supervisor shall ensure that a person other than the personnel in charge of this work is kept outside the movable range.
 2. The emergency stop device switch shall be placed under the control of the person working within the movable range.
 3. A portable operation panel having a structure capable of on/off operation of the power source, oil hydraulic or pneumatic source shall be used in the work.
- (4) Inspection prior to start of the work such as teaching
Prior to start of the work such as teaching, the following items shall be inspected. If any error is detected, immediately repair the trouble or take other required action.
1. Check if the covering or sheathing of the external power source is damaged or not. (This check must be made after the power has been turned off).
 2. Check if the operation of the robot proper is faulty.
 3. Check for the functions of the braking device and emergency stop device.
 4. Check if there is any leakage of air or oil from the piping.
- (5) Cleaning of working tools
When such working tools as a painting nozzle are mounted on the robot proper, and these working tools must be cleaned, it is preferred that these tools should be automatically cleaned so that the number of machines entering the movable range can be minimized.
- (6) Release of residual pressure
Before disassembling the pneumatic components or replacing their parts, release the residual pressure in the drive cylinder.
- (7) Operation check
Perform the verification operation without entering the movable range, wherever possible.
- (8) Illuminance
The illuminance required for operation safety shall be maintained.

[For automatic operation]

- (1) Action before startup
Before starting the robot, check for the following items in advance and determine a signaling method for work adjustment among related operators.
1. Make sure that there is no person within the movable range.
 2. The movable operation panel and tools shall be located at specified positions.
 3. There shall be no error indication for the robot or related devices.
- (2) Action for automatic operation and in the event of an error
1. Make sure that there is an indication to show that the automatic operation is now in progress, after the robot has been started.
 2. When a problem has occurred to the robot or related device and you have to enter the movable range to take emergency measures, stop the robot operation, for example, by operating the emergency stop device before entering the movable range. At the same time, carry a safety plug with you, and ensure that the start switch is provided with the indication to show that the work is now in progress. Take measures so that any other person than the operator in charge of the emergency measures cannot operate the robot.

Requesting your cooperation

For the safety instructions which seem especially important, relevant warning label is attached to the equipment.

When the label attached to the equipment has peeled off or the characters are defaced and unreadable, please procure it from our sales agent in your territory by specifying the part number, and attach it to the original place.

Warning label for actuator

Part number: 55620157



WARNING

- Before the installation, programming, operation, maintenance and inspection of the equipment, be sure to read through this manual so that you can use the COMPO ARM with safety.
- Install the safety fences to prevent anyone from entering the working envelope of the robot.
- DO NOT put your finger or hand on the movable part or opening of the equipment. Otherwise, you may get injured.
- When using the actuator in other than the horizontal state, be sure to select the actuator with brake. Otherwise, the slider will drop at power OFF, and you will be injured.

■ 1.3 Warranty

■ 1.3.1 Warranty period

This product is warranted for one of the following periods whichever comes first.

- (1) For 24 months after shipment from our factory.
- (2) For 18 months after installation at the customer's factory.
- (3) For 4000 hours of operation.

■ 1.3.2 Details of warranty

- (1) This product is warranted. The scope of the warrant includes the specifications and functions described in the Specification, catalog and Instruction Manual. We are not responsible for any secondary or incidental damages caused by the trouble of this product.
- (2) We will repair, on a free-of-charge basis, the trouble caused in the handling or use of the product within the warranty period of this product as described in the Instruction Manual attached to this product. Alternatively, such trouble will be repaired after the product has been returned to our factory. If the problem is solved by a dispatch of service personnel to meet the convenience of the customer, we may claim payment from your company regarding the transportation expenses, lodging expenses or other expenditures not directly related to the repair of the product.

■ 1.3.3 Exemption from responsibility

The following cases shall be excluded from the scope of warrant.

- (1) The trouble and damage caused by the use of the product according to a method not described in the Instruction Manual, or by a careless error in use.
- (2) Problems caused by chronological changes or wear by use (such as natural fading of paints, deterioration of the consumable parts *1).
- (3) Problems caused by sensory phenomena (e.g. generated noise without affecting the function).
- (4) Modification or disassembling not authorized by our company.
- (5) Troubles or damages caused by inadequate maintenance and inspection or improper repair.
- (6) Troubles or damages caused by natural disaster, fire and other external factors.
- (7) Internal data such as programs and points created or modified by the customer.
- (8) Problems caused when this product purchased in Japan is brought to an overseas country.

*1 : Consumable parts are defined as the parts maintenance replacement parts (spare parts) described in the Instruction Manual of each product, and the parts (e.g. backup battery) that must be replaced on a periodic basis.

■ 1.3.4 Precautions

- (1) When you have used the product beyond the specifications of the product, we cannot warrant the basic performances of the product.
- (2) Should you fail to observe the instructions given in "WARNING" and "CAUTION" described in the Instruction Manual, we are not responsible for any personal injury, damages or trouble that may occur.
- (3) Please note that the "WARNING" and "CAUTION" described in the Instruction Manual, and other descriptions are within the scope assumed by our company.
- (4) The numerical values given as technical data are theoretical values as a guideline showing the durability and others. They shall not be construed as indicating warranty. Note that these values are subject to change according to the conditions of use.

Chapter 2 Shipment List

■ 2.1 Shipment list

When the axis proper is shipped, it is composed of the following parts:

- (1) Actuator (axis)
- (2) Number of oval bolts attached (M8×40)
 - The above-mentioned axis-1 will be provided with the bolts in the number shown in the right-hand Table.



Axis stroke (mm)	Attached quantity
150~250	12
350~550	16
650~850	20
950~1250	26
1350~1750	32
1850~2350	40
2450~3050	50
3150~3850	60
3950~4450	70

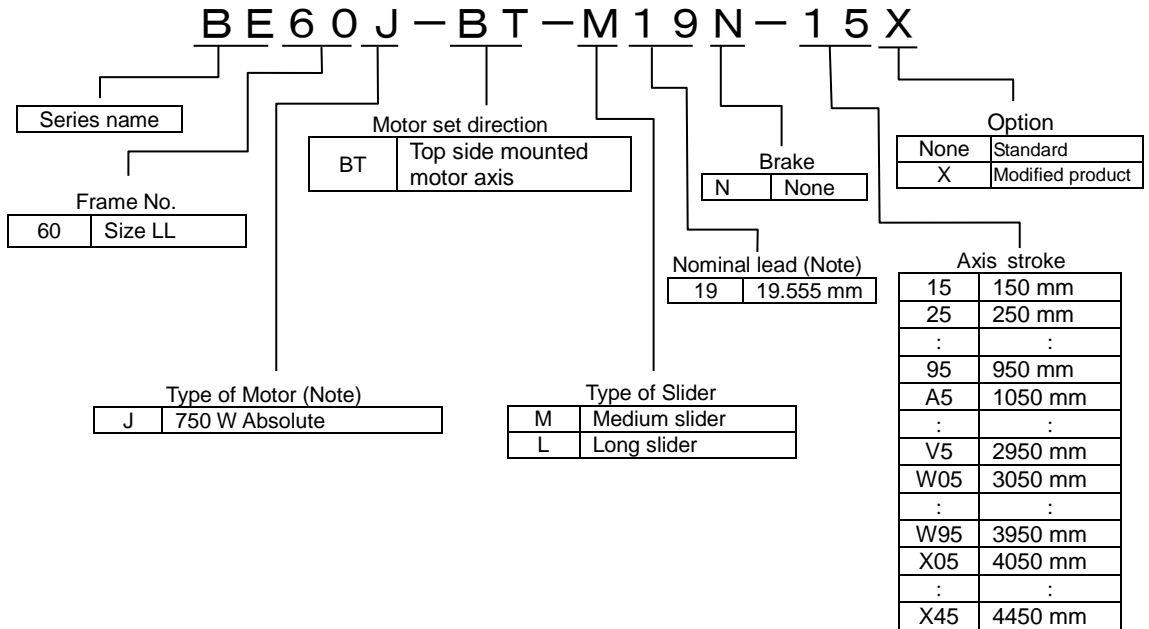
- (3) Introduction Manual

Chapter 3 Axis Specifications

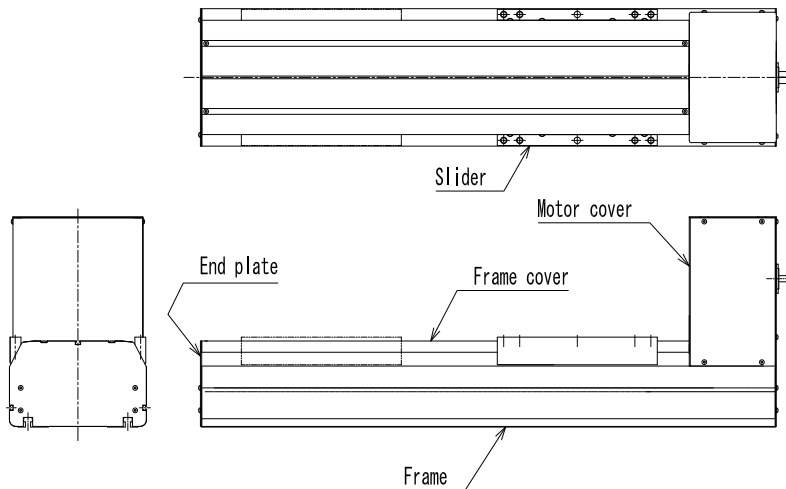
3.1 Axis type and names of individual parts

■ Type of axis

The following shows the axis type:



■ Names of individual parts



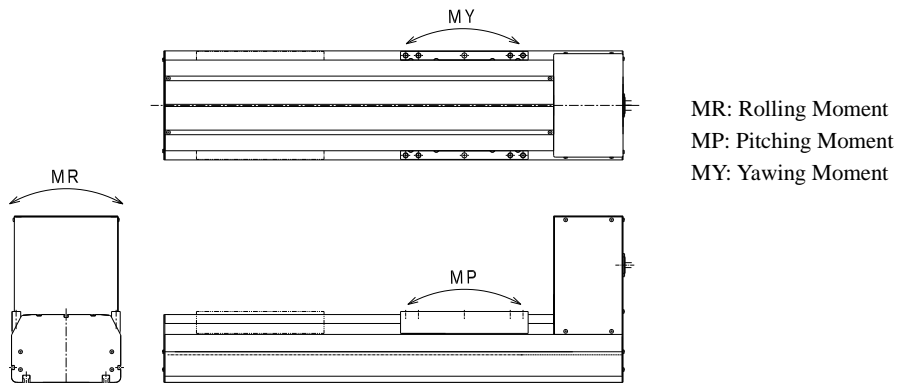
■ 3.2 Single axis specification

■ Specifications

Type of axis	BE60J—BT—□19N—□□	
Motor	AC 750-watt servo motor (absolute)	
Drive method	Timing belt Lead 19.555 mm	
Guide method	Linear guide (Double) Bearing block ... 4 pieces	
Maximum payload mass (Note 1) (Note 3)	Horizontal : 200kg	
Maximum speed (Note 3)	1000 mm/s	
Static permissible moment (Note 2)	Medium slider	MR:3350N·m MP:3850N·m MY:3100N·m
	Long slider	MR:3350N·m MP:6250N·m MY:5000N·m
Repeated positioning accuracy (Note 4)	±0.05 mm	
Resolution	0.01 mm	
Rated thrust	767N	

(Note 1) This indicates the value when the acceleration/deceleration time is 0.3 s or more.

(Note 2)



(Note 3) Set the pause time after movement to 1.0 sec or longer.

(Note 4) Repeatability in one direction during 7 trials at a constant ambient temperature of 20°C. It is not absolute positioning accuracy. Trajectory accuracy is not guaranteed.

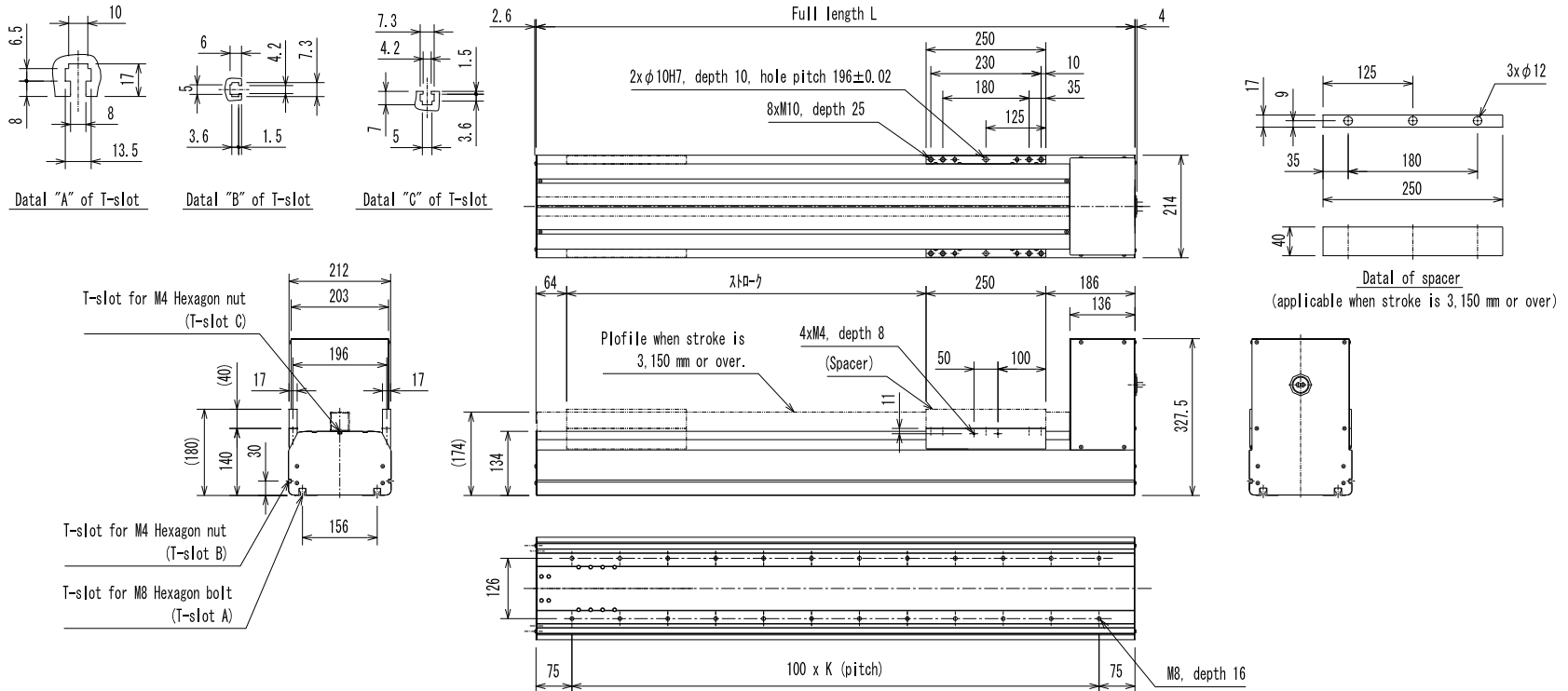
■ Axis dimensions

[BE60J-BT-M19N]

Type BE60J-BT-M19N-□□	15	25	35	45	55	65	75	85	95	A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	P5	Q5	R5	S5	T5	U5	V5
Stroke X (mm)	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950
Full length L (mm)	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450
K	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Weight (kg)	40.8	43.1	45.4	47.7	50.0	52.3	54.6	56.9	59.2	61.5	63.8	66.1	68.4	70.7	73.0	75.3	77.6	79.9	82.2	84.5	86.8	89.2	91.5	93.8	96.1	98.4	100.7	103.0	105.3

Type BE60J-BT-M19N-□□	W05	W15	W25	W35	W45	W55	W65	W75	W85	W95	X05	X15	X25	X35	X45
Stroke X (mm)	3050	3150	3250	3350	3450	3550	3650	3750	3850	3950	4050	4150	4250	4350	4450
Full length L (mm)	3550	3650	3750	3850	3950	4050	4150	4250	4350	4450	4550	4650	4750	4850	4950
K	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Weight (kg)	107.6	109.9	112.2	114.5	116.8	119.1	121.4	123.7	126.0	128.3	130.6	132.9	135.2	137.6	139.9

[NOTE] The format of the table lists only the end of the symbol "□□" part of the type. In the case of stroke is 3000mm or over, it will be a three-digit code.
The values in parentheses are applicable when the stroke is 3150mm or over.

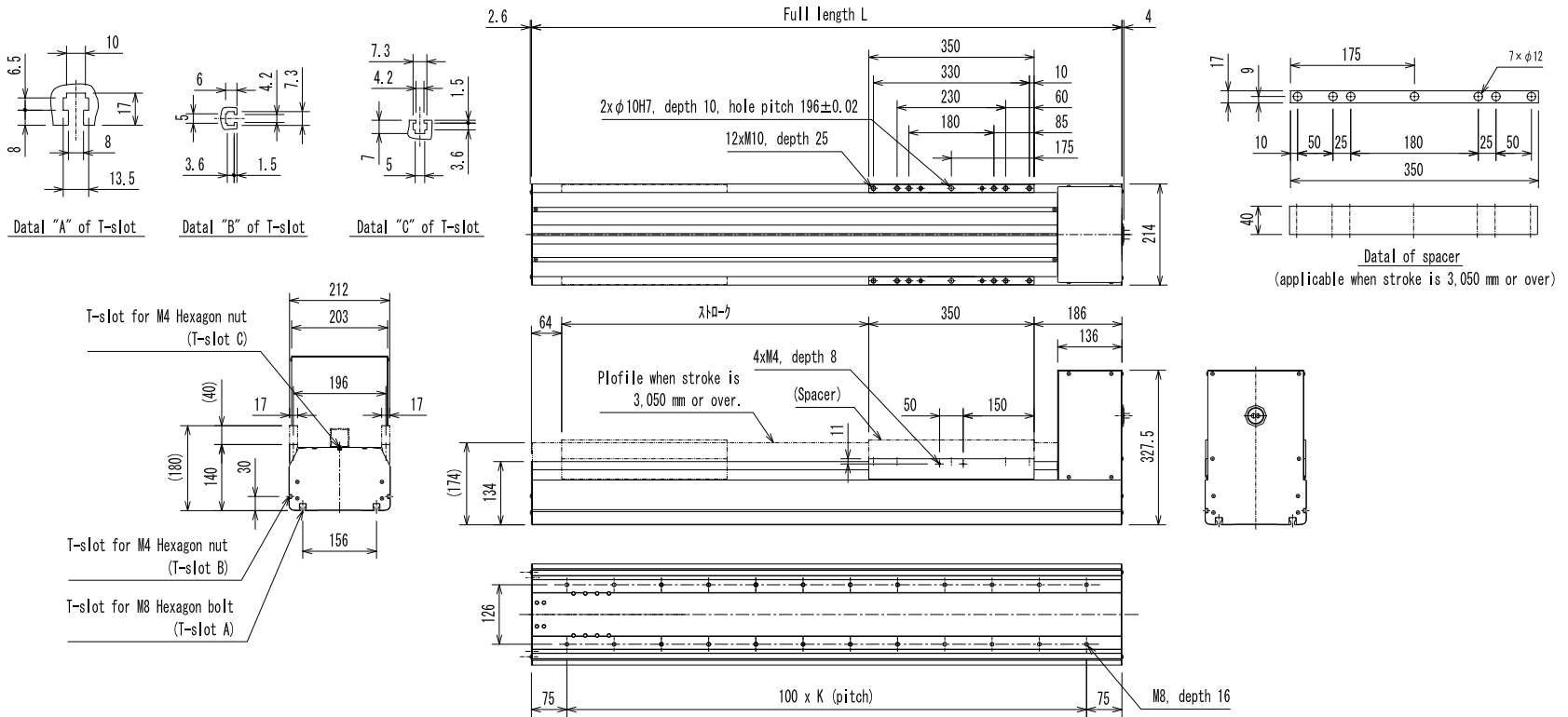


[BE60J-BT-L19N]

Type BE60J-BT-L19N-□□	15	25	35	45	55	65	75	85	95	A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	P5	Q5	R5	S5	T5	U5	V5
Stroke X (mm)	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950
Full length L (mm)	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450	3550
K	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Weight (kg)	44.1	46.4	48.7	51.0	53.3	55.6	57.9	60.2	62.5	64.8	67.1	69.4	71.7	74.0	76.3	78.6	80.9	83.2	85.5	87.8	90.1	92.5	94.8	97.1	99.4	101.7	104.0	106.3	108.6

Type BE60J-BT-LN-□□	W05	W15	W25	W35	W45	W55	W65	W75	W85	W95	X05	X15	X25	X35
Stroke X (mm)	3050	3150	3250	3350	3450	3550	3650	3750	3850	3950	4050	4150	4250	4350
Full length L (mm)	3650	3750	3850	3950	4050	4150	4250	4350	4450	4550	4650	4750	4850	4950
K	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Weight (kg)	110.9	113.2	115.5	117.8	120.1	122.4	124.7	127.0	129.3	131.6	133.9	136.2	138.6	140.9

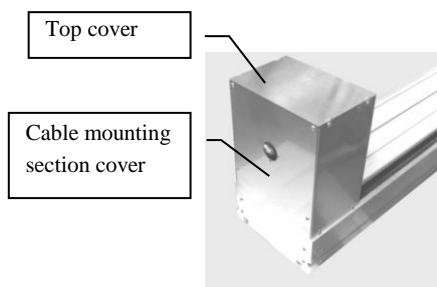
[NOTE] The format of the table lists only the end of the symbol "□□" part of the type. In the case of stroke is 3000mm or over, it will be a three-digit code.
The values in parentheses are applicable when the stroke is 3050mm or over.



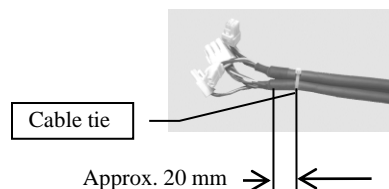
Chapter 4 Cable Installation

Install the cable according to the following procedure:

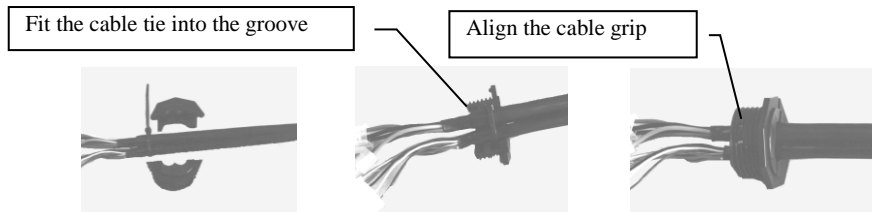
- (1) Loosen the hex button-head cap screws securing the top cover and cable mounting section cover on the motor cover, and then remove the top cover and cable mounting section cover.



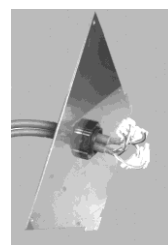
- (2) Bind with a cable tie at a position that is about 20 mm from the end of the cable sheath.



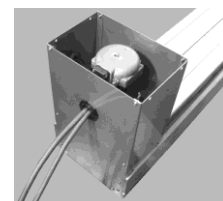
- (3) Sandwich the cable between the two split cable grip pieces, and fit the cable tie into the groove in the cable grip.



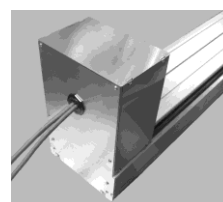
- (4) Pass the threaded section of the combined cable grip into the hole in the cable mounting section cover, and use the plastic nut to mount in place.



- (5) Mount the cable mounting section cover where the control cable was attached to the original position on the motor cover, and connect the connector of the controller cable and motor and the connector of the origin sensor.



- (6) Remount the top cover to its original position on the motor cover.



CAUTION

When mounting the motor cover, be sure that no wires become pinched in the motor cover.

Chapter 5 Installing Actuator (Axis)

- This chapter describes the basic installation procedures for the axis and peripheral equipment.
- Installation shall comply with the instructions of this Chapter. If the installation procedure is incorrect, robot performance cannot be achieved. Not only that, the service life may be seriously reduced.



CAUTION

Precautions for installation

● Environment of installation site

(1) The ambient environment for operation shall comply with the following requirements:

- Ambient temperature Working temperature: 0°C to 40°C
 Transportation and storage temperature: -10°C to 50°C
- Relative humidity: 30 to 90%RH without dew condensation
- Altitude: 1000 m or less
- Vibration 0.98 m/s² or less
- Dust: Free from conductive dust or dirt
- Gas: Free from flammable or corrosive gas
- Magnetic field: Free from a nearby device that may generate magnetic field
- Radiation: Not in the radiation controlled area
- Others: Without greasy fume

(2) This product is not designed as an explosion proof structure. Do not use it in a dusty place. Further, take sufficient care of the environment since it is not explosion-proof.

(3) Do not use it in a place with an organic solvent or white kerosene..
Of guide or ball screw grease is melted. It may cause malfunction.

● Precautions in installation

(1) Do not allow the product to fall down or be collided with other object during the transportation.

(2) Install the product where maintenance and inspection are easier.

(3) Install the controller within the range where it can be reached from the robot proper by a standard cable.

(4) Installation

- Install the product on a horizontal installation base.
- The installation base shall have the length that allows only the frame portion to be mounted.
- The installation base shall be made of a steel plate having a thickness of 20 mm or more where the plate has a machined surface with flatness of 0.2 or less. Install this product on this base to correct the bend and twist of the axis frame and to reinforce the axis frame.
- Install the oval bolts (installation bolts) of the axis at a pitch of approximately 150 mm.

■ 5.1 Installing Actuator (Axis)

Installation shall comply with the following procedures:

- (1) Setting the oval bolt
From the axis end face, insert the oval bolt in the T-groove of the frame installation surface.
- (2) Mounting on the installation base
Drill installation holes on the installation base of the carriage at a pitch of approximately 150 mm, and mount the product with oval bolts.

CAUTION

- The T-grooves (for M4 nut) on the side and top of the frame are used to install the CN box and optical parts. Never use these T-grooves to mount the axis.
- The nut tightening torque shall be 12 N-m.

■ 5.2 Robot type for each Axis

The robot type is indicated by the 6-digit numerals specified for each robot type.

If this setting is made, various parameter values suited to the axis to be used can be automatically set. The input procedure is given in CA25 Instruction Manual (Basic Part).

The major robot type for each axis is given in the following Table. The axis (new models) not described in the following Table are specified in the Actuator Instruction Manual.

When you want to use a combination of axes, see the following Table for each an axis.

[High-load Belt Axis Robot Type]

- When using as a slider movement type axis (normal operating procedure)

Axis model	Lead	Robot type
BE60J-BT-□19N-□□(□□□)	19.555 mm	605180



- When you have used the origin change sensor (optional) and set the home position to the side reverse to the normal side, input the robot type prior to change. After that, change the "Setting the motor rotating direction" in paragraph 2 of Section 13.4.5 described in the CA25 Instruction Manual (Basic Part) (Change it from 1 to 0).

■5.3 Parameter values

The parameters of this product are available in two types -- parameter 1 and parameter 2 -- depending on the frequency of use. The relationship between each parameter and the robot type is illustrated below:

Setting the robot type allows the parameters on the circled portion on the left to be automatically changed.

■5.3.1 Values of parameter 1 for each robot type

This parameter has a higher frequency of use.

- Belt-driven axis (slider movable type)

Automatic setting	Robot type		605180
	Parameter		
	Software limit value (upper limit)		0000.00
	Software limit value (lower limit)		0000.00
○	Servo gain Position/Speed	Position	10
		Speed	80
	Pass area		0200
	Origin offset value		0000.00
	Sequence of Return to Origin		1 (Note)
	JOG speed	L(Low speed)	10
		H(High speed)	50
	JOG inching movement		0.01

(Note) The Sequence of Return to Origin varies depending on the combination type, installation conditions, and other factors. The customer should make the setting based on their specific usage conditions.

The initial value is set to "1", which is the same for all robot types. If this value remains unchanged, origin return is performed for all axes simultaneously.

In the BE60J high-load belt axis, the servo gain (speed) value must be changed manually based on the stroke. After setting the robot type, change to the values below.

Stroke	Servo gain (Speed)
1550 mm or less	80 (No change)
1650 mm to 4450 mm	50

■ 5.3.2 Values of parameter 2 for each robot type

- Belt-driven axis (slider movable type)

Automatic setting	Robot type		605180			
	Parameter					
	Axis display		X			
	In position data value		00.05			
	Overflow data value		20000			
<input type="radio"/>	Feed forward data value		02000			
<input type="radio"/>	Direction of motor rotation		0			
<input type="radio"/>	Maximum speed		1000			
<input type="radio"/>	Return to origin speed	(L) Low speed	002.0			
		(M) Medium speed	020.0			
		(H) High speed	100.0			
<input type="radio"/>	Return to origin method		0			
<input type="radio"/>	Origin sensor logic		1			
	High speed return to origin position		0020.00			
<input type="radio"/>	Lead		19.555			
<input type="radio"/>	Encoder division number		2768			
<input type="radio"/>	Encoder pulse multiplier		4			
	Encoder type (Note)		a			
	Task and axis combination		[1]	[0]	[0]	[0]
	Task order of priority		[1]	[1]	[1]	[1]
	Task coordinate table		999	999	999	999
	Task step number		5000	0000	0000	0000

(Note) The encoder type cannot be set in this robot type since setting for each axis is not available. See Section 11.4.14 of the CA25 Instruction Manual (Basic Part).

Chapter 6 Precautions for Use

■ 6.1 Fluctuation in sliding resistance during long-term storage

The belt drive axis of the COMPO ARM drives the slider by meshing between the timing belt and pulley.

When the COMPO ARM has been stored or its operation has been suspended for a longer period of time (*1), the timing belt is kept curled at the meshing portion between the timing belt and pulley (or roller).

When the slider is subjected to sliding close to this curl, a fluctuation occurs to the sliding resistance, but this does not raise any problem.

This curl does not affect the timing belt. Further, the fluctuation in the sliding resistance of the slider does not have any adverse effect on the repeated positioning accuracy.

The curl of the timing belt will be removed after several days of operation (*2). The fluctuation in the sliding resistance due to the curl of the belt will also be removed.

*1: About a week. This may vary according to the environment during storage.

*2: The number of days of operation before the curl of the timing belt is removed varies according to the number of reciprocations of the slider per day and the storage period.

■ 6.2 In the event of collision

Skipping of teeth may occur to the meshing between the belt and pulley by the collision between the slider and axis end due to some trouble. If this occurs, the origin and working range will be misaligned.

In this case, the axis must be readjusted. Retighten the belt. For the belt tightening procedure, see Section 7.5 Timing belt and motor replacement procedure.

Chapter 7 Maintenance

■ 7.1 Precautions for inspection and maintenance work

(1) Precautions for inspection and maintenance work

Observe the following instructions at the time of inspection and maintenance:

1. The robot shall be inspected and maintained by the personnel having a sufficient level of skill and experience. If such personnel are not available, contact the manufacturer and request implementation of the relevant work or education of the person in charge.
2. Use adequate illumination.
3. The start switch of the stationary operation panel or some other similar portion shall be provided with a notice board to indicate that the inspection and maintenance work is currently in progress. Before entering the fence and enclosure, lock the open power switch to turn off power completely. If the access of the fence or enclosure is provided with a safety plug, be sure to carry the related plug with you.
4. If you have to enter the fence and enclosure for inspection and inspection of the control circuit, turn off the drive power source.
5. If you have to operate the industrial robot in the inspection and maintenance work within the guard fence and enclosure, you are recommended to take the following measures:
 - Two persons should be engaged in the work in cooperation with each other. This means that role assignment should be made in such a way that one person supervises the work of the other person during the work.
 - It is required to select such a speed that contact with the robot can be avoided in the event of a possible operation error of the robot. Determine the speed suited for the relevant work.
 - Take care of the robot operation during the work. Press the emergency stop button immediately when an unexpected operation has been detected.
6. Before starting disassembly of the pressure gauge or replacement of the parts, release the residual pressure of the cylinder.
7. Before starting disassembly of the hydraulic and pneumatic systems or replacement of parts, take a sufficient care to avoid deposition or mixture of foreign substances such as dust.

(2) Action to be taken subsequent to inspection and maintenance work

1. After termination of the inspection or maintenance work, the inspection or maintenance worker shall carry the tools back to the original position.
2. After termination of the maintenance work, be sure to perform a test run to verify the result. The test run shall be performed from outside the fence and enclosure in principle.
3. After action of item 2 has been taken, the inspection or maintenance worker shall report termination of the inspection or maintenance work to his superior.

■ 7.2 Inspection before starting the work

(1) Before starting your work with the robot, make sure of the following:

1. Brake device function
2. Emergency stop device function
3. Contact preventive equipment and robot interlock function
4. Related devices/robot interlocking function
5. Possible damage of the external wiring and piping
6. Error of supply voltage and hydraulic and pneumatic pressures
7. Operation error
8. Abnormal noise and vibration
9. Contact preventive equipment state

(2) This inspection shall be conducted outside the movable range wherever possible.

■ 7.3 Periodic inspection

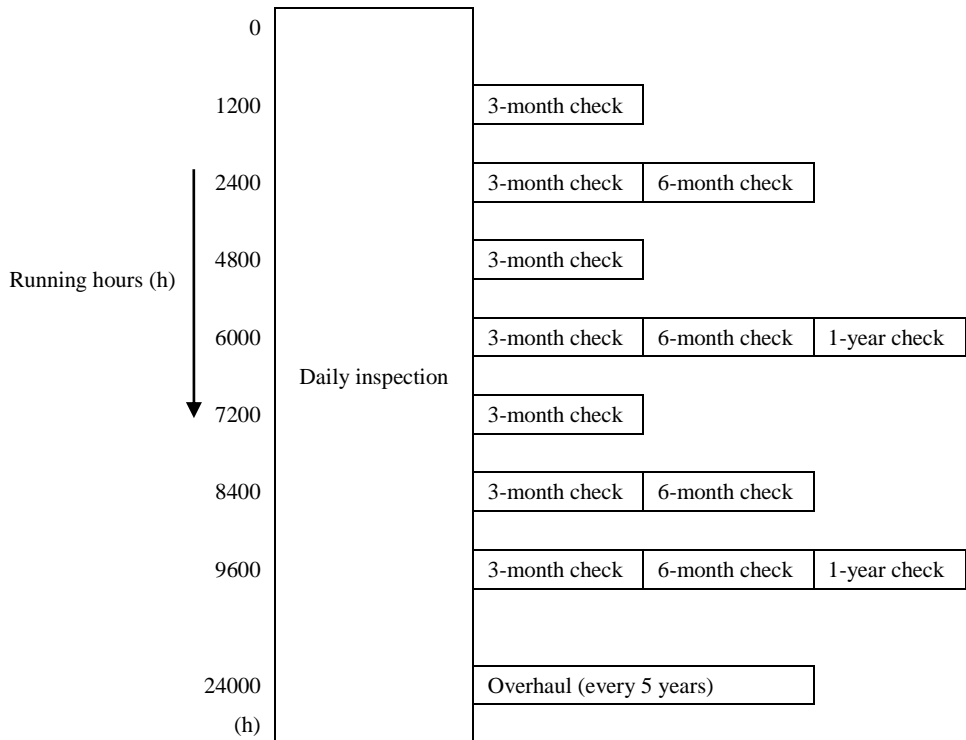
Giving consideration to the robot installation site, frequency of use and durability of the parts, determine the inspection standards including the inspection item, inspection procedure, evaluation criteria and implementation period for the following items. Start inspection in conformity to these standards.

1. Looseness of major parts
2. Lubrication and other possible errors of the movable parts
3. Power transmission component trouble
4. Hydraulic and pneumatic system error
5. Electric system error
6. Operation failure detecting function error
7. Encoder error
8. Servo system error

■ 7.4 Maintenance Schedule

Perform the pre-work inspection before starting work on a daily basis.

Periodic inspections and maintenance performed after a certain period of time should be performed in units of 1200 hours (operating hours). Also, please carry out overhaul every 24000 hours (operating hours).



Regular Inspection interval (reference)

When the system is operated for 16 hours per day: $1,200 \text{ hours} \div 16 \text{ hours} \div 25 \text{ days} = 3 \text{ months}$

When the system is operated for 24 hours per day: $1,200 \text{ hours} \div 24 \text{ hours} \div 25 \text{ days} = 2 \text{ months}$

When the system is operated for 16 hours per day, regular inspection should be conducted every three months. However, if the running hours per day are increased, regular inspection must be done at shorter intervals.

■7.4.1 Maintenance and inspection items by schedule

Determine the schedule for Inspection before starting the work and periodic inspection and maintenance.

(1) Inspection at Power OFF

Description	Inspection point	I: Inspection before starting the work S: Semi-annual inspection				Q: Quarterly inspection A: Annual inspection	
		I	Q	S	A		
Make sure that all bolts are completely tightened and secured. If there are any loosened or unsecured bolts, re-tighten them.	Tool set bolts	○	○	○	○		
	Robot installation bolts	○	○	○	○		
	Slider set bolts				○		
	Linear guide set bolts				○		
Make sure that the cables and tubing are not damage.	Cables and air tubing	○	○	○	○		
Check each axis operation. Move each axis by hand for check.	Entire robot			○	○		
Clean the contaminant, if any. Make sure that no cut or scratch is found. Refer to ■7.5	Entire robot	○	○	○	○		
Please check the condition of the grease. Greasing Refer to ■7.6	Linear guide, Resin on slider	○	○	○	○		
Please inspect the timing belt. Refer to ■7.7	Timing belt	○	○	○	○		
Please adjusting the tension of timing belt. Refer to ■7.8	Timing belt		○	○	○		

(2) Inspection at Power ON

Description	Inspection point	I: Inspection before starting the work S: Semi-annual inspection				Q: Quarterly inspection A: Annual inspection	
		I	Q	S	A		
Push each axis by hand in the servo ON condition to make sure that the slider is secured.	Slider				○		
Make sure that no abnormal vibration or noise is caused.	Entire robot	○	○	○	○		
Make sure that the teaching points are in place.	Positioning of slider		○	○	○		
Replace the batteries for position detection with new ones.	Battery for encoder backup (Attached to CA25 controller)	Replace every 3 years					
Operation check of emergency stop device and safety devices.	Emergency stop switch Safety fence switch	○	○	○	○		
Anomaly confirmation of supply voltage, supply hydraulic pressure and air pressure.	Power-supply voltage, Hydraulic pressure and air pressure	○	○	○	○		

(3) Overhaul

Description	Maintenance parts	Every 5 years
Check the consumable parts and replace as necessary.	Motor, Linear guide, Timing belt, Reducer, Controller cable (When used in movable), Battery for encoder backup	○

Depending on the device, add necessary items and perform inspection and maintenance.

7.5 Cleaning

Clean the robot proper in conformity to the following steps:



Be sure to always turn off the power before starting the procedure.

- (1) Turn off the power switch and remove the power plug.
- (2) Use waste cloth or such to remove the dust and dirt from the frame and covers etc.
- (3) Remove the frame cover and clean the dust and dirt from the frame cover. After that, supply oil for lubrication.
- (4) Mount the frame cover back.

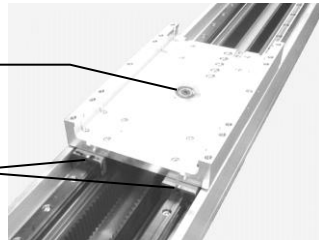
7.6 Greasing

- (1) Greasing positions

The linear guide of this equipment has an oilless seal, but to prevent accidents, inspect the lubrication state regularly to check for any damage. If you find that the seal is not lubricated in the inspection, use the procedure below to apply grease. Also, if you find any imperfections or other problems, and repair is required, please request repairs from the service department listed at the back of this manual.

Supply grease into the concave portion.

Linear guide



Greasing position	Type of grease (manufacturer)	Inspection and greasing intervals	Grease amount
Linear guide	Albania Grease S2 (Shell Lubricants Japan)	Every 6 months	Apply thinly to the grooves of the linear guide rails
Resin on slider			Fill the groove.

- (2) Greasing procedure

Turn off the power, and remove the frame cover. Apply grease to the lubrication locations shown above, move the slider slowly (approx. 50 mm/s or slower) using manual or jog operation so that it makes at least 5 back-and-forth motions and the grease enters inside the linear guide block.

Wipe off any grease that is oozing out or discolored, and then remount the frame cover.

Be sure to wipe off any oil or grease adhering to the belt because this can cause deterioration of the belt.

7.7 Timing belt inspection

The belt must be inspected every day before starting operation by visually checking from the gaps in the frame and frame cover that there is nothing unusual about the belt, and if anything unusual is found, the belt should be promptly replaced.

After every 2400 hours of operation, remove the frame cover, and check for any looseness, cracks, or other problems with the belt, and also check that no screws or bolts are loose. •If any problems are found during inspection, fix them promptly.

CAUTION

Be sure to always turn off the power before starting the inspection work.

Inspection location	Potential problems	Inspection interval
Timing belt	<ul style="list-style-type: none"> ●Surface cracking ●Gear teeth wear 	<ul style="list-style-type: none"> ●Separation of core materials
	<ul style="list-style-type: none"> ●Surface cracking ●Gear teeth wear 	<ul style="list-style-type: none"> ●Separation of core materials ●Tension
		Every day
		Every 2400 hours

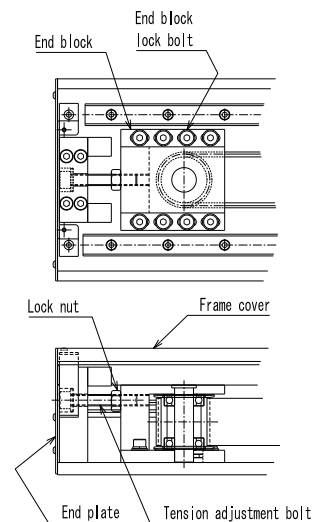
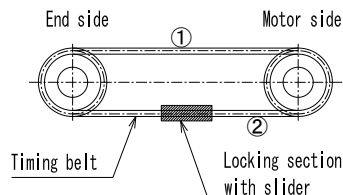
CAUTION

In certain cases, adjusting the belt tension can shift the program (teaching) position. If the position is shifted, revise the program (teaching).

7.8 Adjusting the Tension of the Timing Belt

1. Loosen the lock nuts securing the end block, and remove from the end block.
2. Loosen the lock bolts of the end block.
(Loosen evenly so that the end block can slide gently.)
3. Turn the tension adjustment bolt to adjust the tension of the belt.
Check the tension meter (Note 1), and adjust the tension so that it is within the range shown in the table below. (Measure the tension at the location indicated by ① in the belt tension measurement position drawing.)
4. Retighten the lock bolts of the end block.
5. Retighten the lock nuts.

(Note 1) The U-507 tension meter by Gates Unitta Asia is recommended.



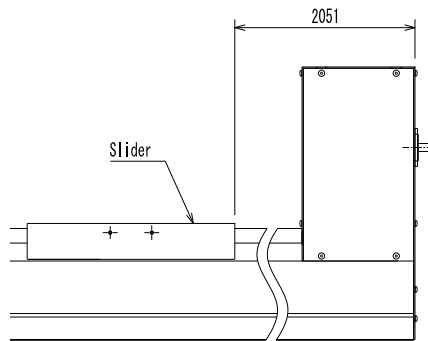
■Timing belt tension and specifications

Compatible axis	Tension (N)	Span (Note 2) (mm)	Width (mm)	Unit weight (g/mm×m)
BE60J-BT-M19	800 $\begin{matrix} +20 \\ 0 \end{matrix}$	Stroke + 291.5	50	5.1
BE60J-BT-L19	800 $\begin{matrix} +20 \\ 0 \end{matrix}$	Stroke + 391.5	50	5.1

(Note 2) For axes where the stroke is long, the long distance between pulleys may result in the tension meter having difficulty responding.

In this case, move the slider so that the distance from the motor-side end to the slider end appears as shown in the figure below, and measure using a span of 2000 mm, and adjust so that the tension is within the range shown in the table above.

(Measure the tension at the location indicated by ② in the belt tension measurement position drawing.)

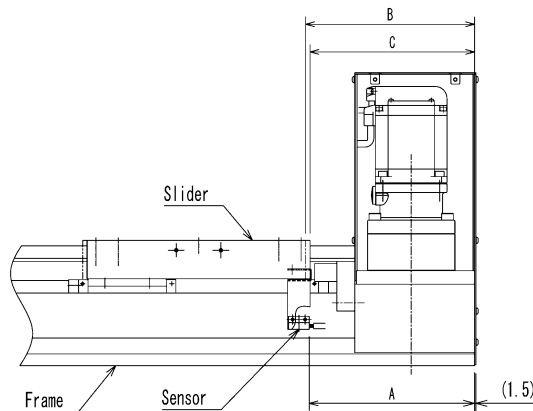


7.9 Origin position adjustment

Adjust the origin position by referring to the information below.

- (1) The various slider positions at the origin must have the relationship shown below when the origin sensor is turned on (Note).

	Sensor mounting reference position	Origin sensor ON position	Reference origin position
Compatible axis	A	B	C
BE60J-BT-□19	185.5 mm	189.5 mm	184.5 mm



NOTE

The origin sensor is always turned on even if the slider is at the negative overrun position. If the sensor is turned off at the negative-side overrun, origin return is not possible from this position.

- (Note) The origin sensor is a lead switch with B-contact specifications, and so it switched off electronically. However, in this manual, for ease of understanding, it is expressed as "ON". Also, the negative overrun position is the position where the slider contacts the motor block damper, and no further movement in this motor direction is possible. Normally, the negative overrun position is a position moved about 5 mm in the motor direction from the reference origin position.
- (2) The origin is located on one of the axis sides. If the axis tip side is used as the origin, the origin change sensor (option) is required. If the customer must change the origin to near the stroke center for a specific reason, be sure to always install a stopper at a negative overrun position of about 5 mm from the origin stop position. Set so that the distance from the origin sensor-on position to the origin stop position is 5 mm.

[Slider position confirmation procedure when origin sensor is on]

- Turn off the controller, move the slider about 50 to 100 mm from the origin position, turn on the power, and perform the origin return operation. (If the axis includes a brake, turn on the power, and move using the jog operation.)
- The position where the slider speed changes (medium speed to low speed) in the origin return operation is the origin sensor-on position.

In the above case, the slider does not stop until the origin return operation is completed (Z-phase detection). (It does not stop at the origin sensor-on position.)

- If the slider must be stopped at the origin sensor-on position and accurate confirmation is required, perform the procedure below.

1. Change the origin return system from the Z-phase detection system to the sensor detection system.

To change the setting, from the teach pendant, change 7. Origin return system in parameter group 2 from 0 to 1.

(See section 11.4.8 of the CA25 Controller Operating Manual (Basic).)

2. Turn off the controller, move the slider about 50 to 100 mm from the origin position, turn on the power, and perform the origin return operation. (If the axis includes a brake, turn on the power, and move using the jog operation.)
3. The origin return operation is completed, and the position where the slider stopped is the origin sensor-on position.
(For the sensor detection system, the sensor-on position is the origin.)



After confirmation, be sure to always return the origin return system to the Z-phase detection system.

- In addition to method above, for axes without a brake only, the method below can also be used to confirm the zero sensor-on position.

1. Connect the teach pendant, set to a servo-free state, and open the origin sensor monitor screen.
2. Slowly move the axis slider to the origin return manually from near the stroke center, and check the position where the origin sensor turns on in the monitor screen of the teach pendant.
(See section 12.5 of the CA25 Controller Operating Manual (Basic).)

[Moving the origin sensor]

- Compare the origin sensor-on position of the slider with the length B in section 7.4, and move the origin sensor position by the difference from this length only.

7.10 Replacing Parts

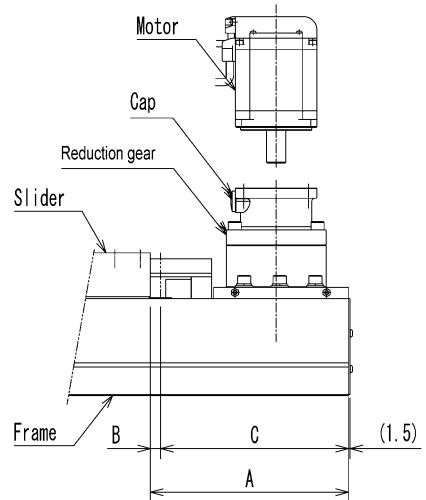
7.10.1 Replacing the Motor

To replace the motor, follow the procedure shown below.

CAUTION

Be sure to always turn off the power before starting the procedure.

- (1) Remove the motor cover.
- (2) Remove the cap of the reduction gear, and manually move the slider so that the coupling bolt is visible from the window.
- (3) Loosen the coupling bolt.
- (4) Remove the motor from the axis.
- (5) Mount a new motor to the same position.
(Do not tighten the coupling bolt yet.)
- (6) Temporarily connect the new motor and controller.
- (7) Connect the teach pendant to the controller, and perform the origin return operation.
Turn on the controller, and perform the origin return operation.



CAUTION

Before turning to the origin, set the servo gain value to "0" for both the position and speed. For the setting procedure, see section 11.3.3 of the CA25 Controller Operating Manual (Basic).

- (8) The motor starts running, and so manually move the slider near the origin.
(The origin sensor turns on.)
- (9) After the motor stops (origin return operation is completed), manually move the slider so that the coupling bolt is visible from the window of the reduction gear.
- (10) In this state, measure the distance of the slider position "A", use "MOV P" in the program to run the motor so that the slider moves virtually to the "B" distance (= "A" distance – "C" distance)
(The "C" distance is shown in the table below.)
- (11) Tighten the coupling from the reduction gear window, and then mount the cap.
- (12) Turn on the power again, set the servo gain value to its original value, and then check the origin position ("C" distance).
- (13) Remount the motor cover to the axis.

Compatible axis	"C" distance (mm)
BE60J-BT-□19	184.5

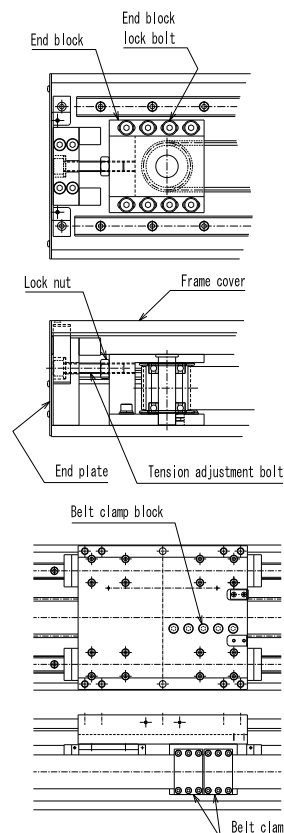
7.10.2 Replacing the Timing Belt

To replace the drive timing belt, follow the procedure shown below.

CAUTION

Be sure to always turn off the power before starting the procedure.

- (1) Remove the load from the slider.
- (2) Remove the frame cover and frame cover bracket.
- (3) Loosen the lock nuts securing the end block, and remove from the end block.
- (4) Loosen the lock bolts of the end block, and loosen the tension of the timing belt.
- (5) Remove the bolts of the belt clamp block of the slider, and move the slider to the side so that the belt clamp block is visible.
- (6) Remove the belt clamp, and take off the old belt.
Obtain a new belt, and pass the new belt through in the same way as the belt that was removed.
- (7) Secure both ends of the belt to the slider, and check that the belt will not come off.
- (8) Move the slider over the belt clamp block, and secure the belt clamp block to the slider.
- (9) Move the slider to the origin position, and then remove any slack in the belt so that the slider will not move.
- (10) Use the tension adjustment bolt to adjust the tension to the proper value.
(For details on the tension adjustment procedure, see section 7.3)
- (11) To assemble, perform the above procedure in reverse.



CAUTION

- Some initial extension may occur in new timing belts.
If initial extension occurs, making the belt tension weaker, readjust the belt to the specified value.
- In certain cases, adjusting the belt tension can shift the program (teaching) position.
If the position is shifted, revise the program (teaching).

7.10.3 Replacing the Linear Guide

- If the linear guide needs to be replaced, please contact your nearest Shibaura Machine branch or sales office.
These parts should never be replaced by the customer.
- Replacement is performed for the entire axis unit. Please be aware that replacement of parts within devices or replacement in a combination state is not possible.

■ 7.11 Bolt and screw tightening torque

For the tightening torque of bolts, etc., tighten the parts not described in the work procedure, etc. with the values in the table below.

Name	Screw size	Tightening torque (N·m)	Remarks
Hexagon socket head cap screw (Limited to use)	M3	0.29	For fixing resin parts
Hexagon socket head cap screw	M3	0.98	
	M4	2.94	
	M5	5.88	
	M6	8.82	
Pan head screw Countersunk head screw hexagon socket button head screw	M3	0.29	For fixing resin parts
	M3	0.49	
	M4	1.47	
	M5	2.94	

Chapter 8 Spare Parts

■ 8.1 Spare Parts

When a trouble has occurred to the robot proper and you have found it out at an earlier stage, you cannot repair it if you have no repair parts. Accordingly, you are recommended to keep spare parts on hand.

No.	Part name	Notes
1	Timing belt	This varies depending on the stroke. Please contact the Shibaura Machine service department for details.
2	AC servomotor (Encoder: Absolute)	750 W without brake

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