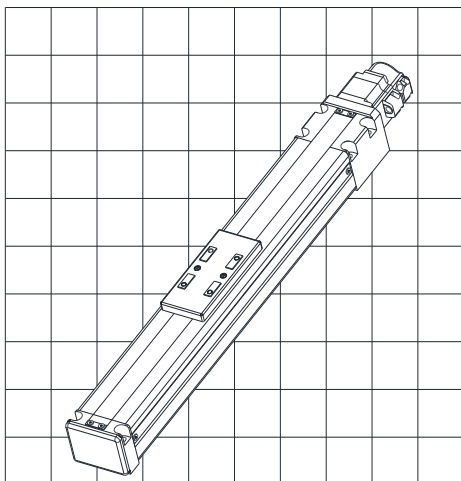


**TOSHIBA MACHINE**

---



**ROI BOT**  
*BA-III* SERIES

MODEL : BET5 & BET7

Straight axis

**ACTUATOR INSTRUCTION MANUAL**

**TOSHIBA MACHINE CO., LTD.**

Keep this manual nearby for future reference.

# Introduction

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

For general information for the ROIBOT Arm BAIII Series, refer to CA25 Instruction Manual (Basic Part).

## CAUTION

1. The contents of this manual are subject to change without prior notice.
2. The contents of this manual are subject to change without prior notice to effect improvements.
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 Toshiba Machine.
4. Toshiba Machine will not be held responsible for any effects caused by using this equipment, regardless of Item 3 above.
5. This equipment does not have an explosion-proof structure. Take utmost care of the operating environment.

# Contents

- Chapter 1 Safety..... 1
  - 1.1 Cautions for safety..... 1
  - 1.2 For your safe operation.....5
  - 1.3 Warranty.....8
- Chapter 2 Shipment List..... 10
  - 2.1 Shipment list..... 10
- Chapter 3 Axis Specifications..... 11
  - 3.1 Axis type and names of individual parts..... 11
  - 3.2 Single axis specification..... 12
- Chapter 4 Installing Actuator (Axis)..... 16
  - 4.1 Installing Actuator (Axis)..... 16
  - 4.2 Robot type for each Axis..... 17
  - 4.3 Parameter values..... 17
- Chapter 5 Maintenance..... 19
  - 5.1 Precautions for inspection and maintenance work..... 19
  - 5.2 Inspection before starting the work..... 20
  - 5.3 Periodic inspection..... 20
  - 5.4 Adjusting Home Position..... 21
  - 5.5 Changing Home Position..... 23
  - 5.6 Replacing Motor and Changing Motor Lead Wire Hole Direction..... 23
  - 5.7 Removal and installation of Stainless Sheet..... 25
  - 5.8 Greasing..... 26
  - 5.9 Replacement of ball screw..... 27
  - 5.10 Replacement of linear guide..... 27
  - 5.11 Clamping Torque of Bolts and Nuts..... 27
- Chapter 6 Spare Parts..... 28
  - 6.1 Maintenance..... 28

# 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 ROIBOT 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 ROIBOT.

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.



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



: 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 three (3) 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, benzine 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, be sure to select the actuator with brake.**  
Otherwise, the slider will drop at power OFF, and you will be injured.

**⚠ 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.

- **Because this equipment does not have a completely sealed structure, during operation, grease or wear-away resin can spray out from the gaps, and liquefied grease can drip from the axis unit.**

If using the equipment for applications in food processing or pharmaceuticals, be sure to implement measures to prevent mixing with these substances.

- **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.

**When using the side mounted motor axis in the vertical condition, be sure to check for the belt on a regular basis. Replace the belt every 3,000-hour operation.**

If the belt whose service life already ended is used continuously, it may be broken or the slider may drop, and you will be injured.

**⚠ 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.

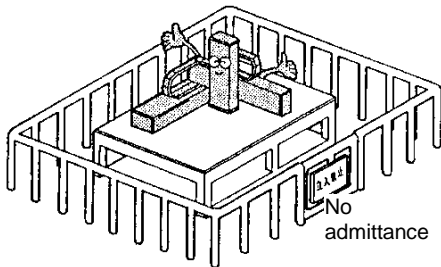
## ■ 1.2 For your safe operation

When you use the ROIBOT BE 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.

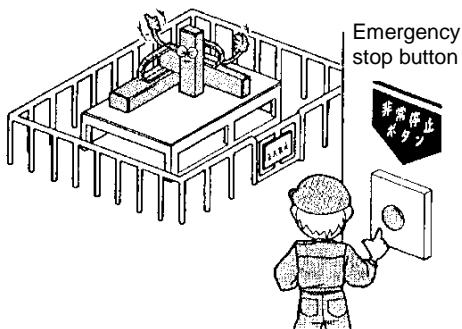
### ■ 1.2.1 Safety measures

(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

 <b>WARNING</b>	<ul style="list-style-type: none"><li>• Before the installation, programming, operation, maintenance and inspection of the equipment, be sure to read through this manual so that you can use the ROIBOT with safety.</li><li>• Install the safety fences to prevent anyone from entering the working envelope of the robot.</li><li>• DO NOT put your finger or hand on the movable part or opening of the equipment. Otherwise, you may get injured.</li><li>• 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.</li></ul>
--	--

## ■ 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 <sup>\*1</sup>).
- (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:

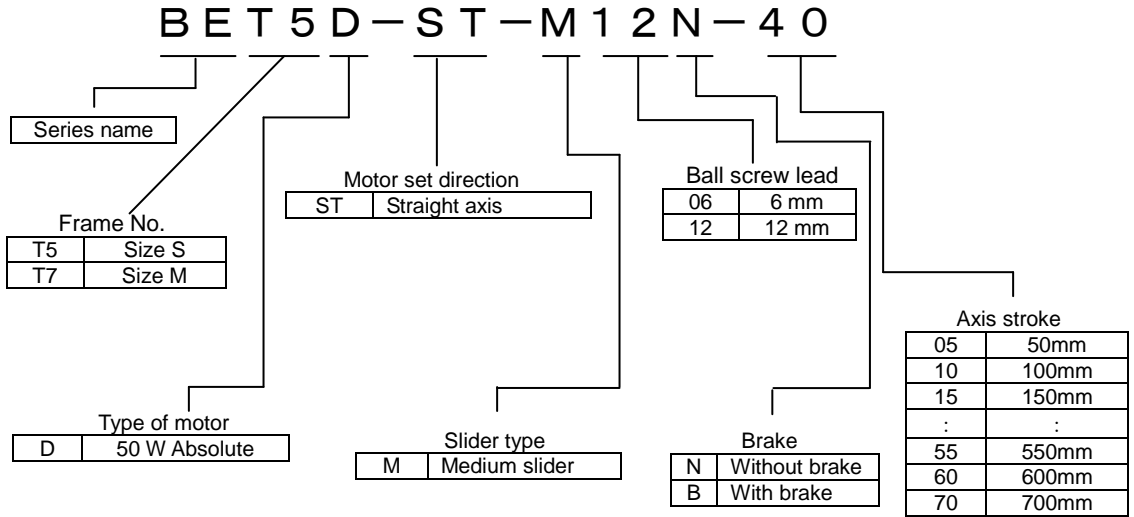
- (1) Actuator(axis)
- (2) Actuator Instruction Manual (this Manual)

# Chapter 3 Axis Specifications

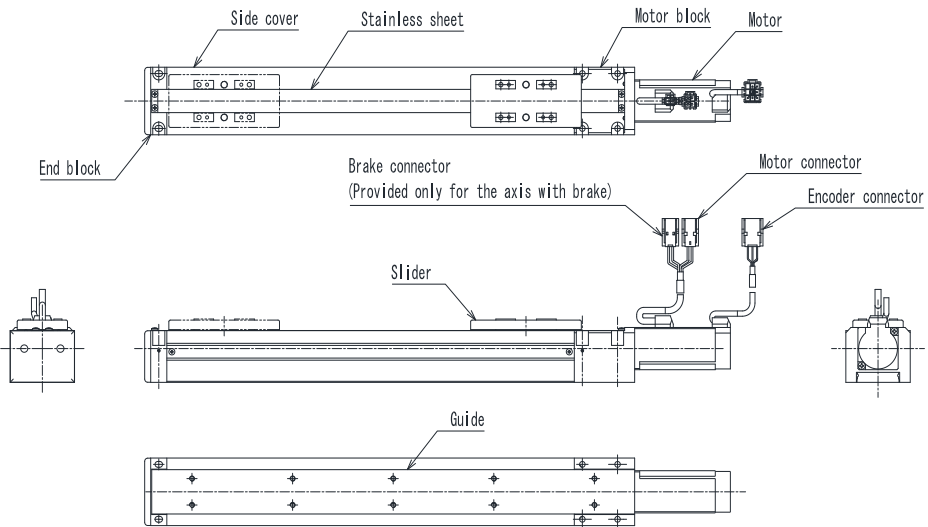
## 3.1 Axis type and names of individual parts

### ■ Type of axis

The following shows the axis type:



### ■ Names of individual parts



## ■ 3.2 Single axis specification

### ■ Specifications

Type of axis BET5D-ST-M□□□-□□

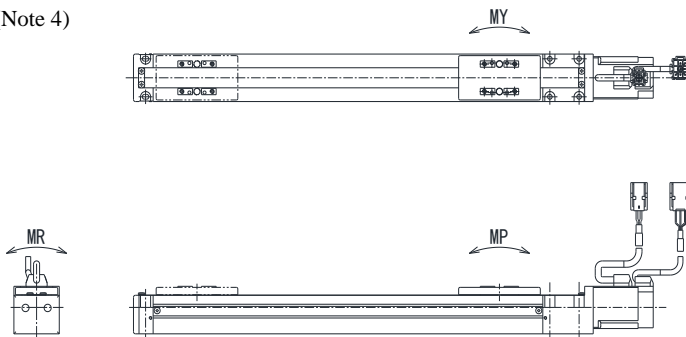
Motor		AC 50-watt servo motor absolute	
Drive method		Ball screw $\phi 8$	Lead 12 mm Lead 6 mm
Guide method		Linear guide (Single rail) bearing block ... 1 piece	
Maximum payload mass (Note 1)	Ball screw lead	Horizontal	Vertical
	12 mm	5 kg	1.5 kg
	6 mm	10 kg	3 kg
Maximum speed	Ball screw lead 12 mm	800 mm/s (Note 2)	
	Ball screw lead 6 mm	400 mm/s (Note 3)	
Static permissible moment (Note 4)	Medium slider	MR: 31 N·m, MP: 12 N·m, MY: 12 N·m	
Repeated positioning accuracy		$\pm 0.02$ mm	
Resolution		0.01 mm	
Rated thrust	Ball screw lead 12 mm	83 N	
	Ball screw lead 6 mm	166 N	

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

(Note 2) 680 mm/s when the axis stroke is 500 mm.

(Note 3) 340 mm/s when the axis stroke is 500 mm.

(Note 4)



MR: Rolling Moment  
MP: Pitching Moment  
MY: Yawing Moment

Type of axis BET7D-ST-M□□□-□□

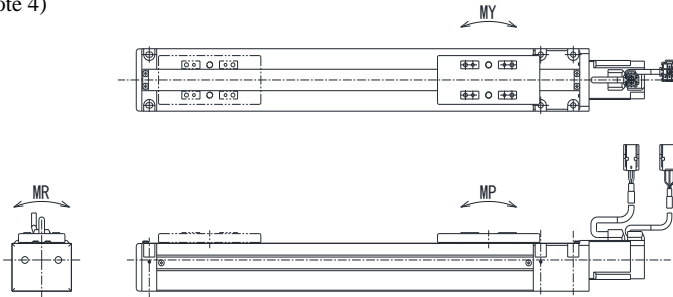
Motor		AC 50-watt servo motor absolute	
Drive method		Ball screw $\phi 12$ Lead 12 mm Lead 6 mm	
Guide method		Linear guide (Single rail) bearing block ... 1 piece	
Maximum payload mass (Note 1)	Ball screw lead	Horizontal	Vertical
	12 mm	12 kg	4 kg
	6 mm	30 kg	8 kg
Maximum speed	Ball screw lead 12 mm	800 mm/s (Note 2)	
	Ball screw lead 6 mm	400 mm/s (Note 3)	
Static permissible moment (Note 4)	Medium slider	MR: 58 N·m, MP: 25.7 N·m, MY: 25.7 N·m	
Repeated positioning accuracy		$\pm 0.02$ mm	
Resolution		0.01 mm	
Rated thrust	Ball screw lead 12 mm	83 N	
	Ball screw lead 6 mm	166 N	

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

(Note 2) 680 mm/s when the axis stroke is 600 mm, and 500 mm/s when the axis stroke is 700 mm.

(Note 3) 340 mm/s when the axis stroke is 600 mm, and 250 mm/s when the axis stroke is 700 mm.

(Note 4)



MR: Rolling Moment  
MP: Pitching Moment  
MY: Yawing Moment

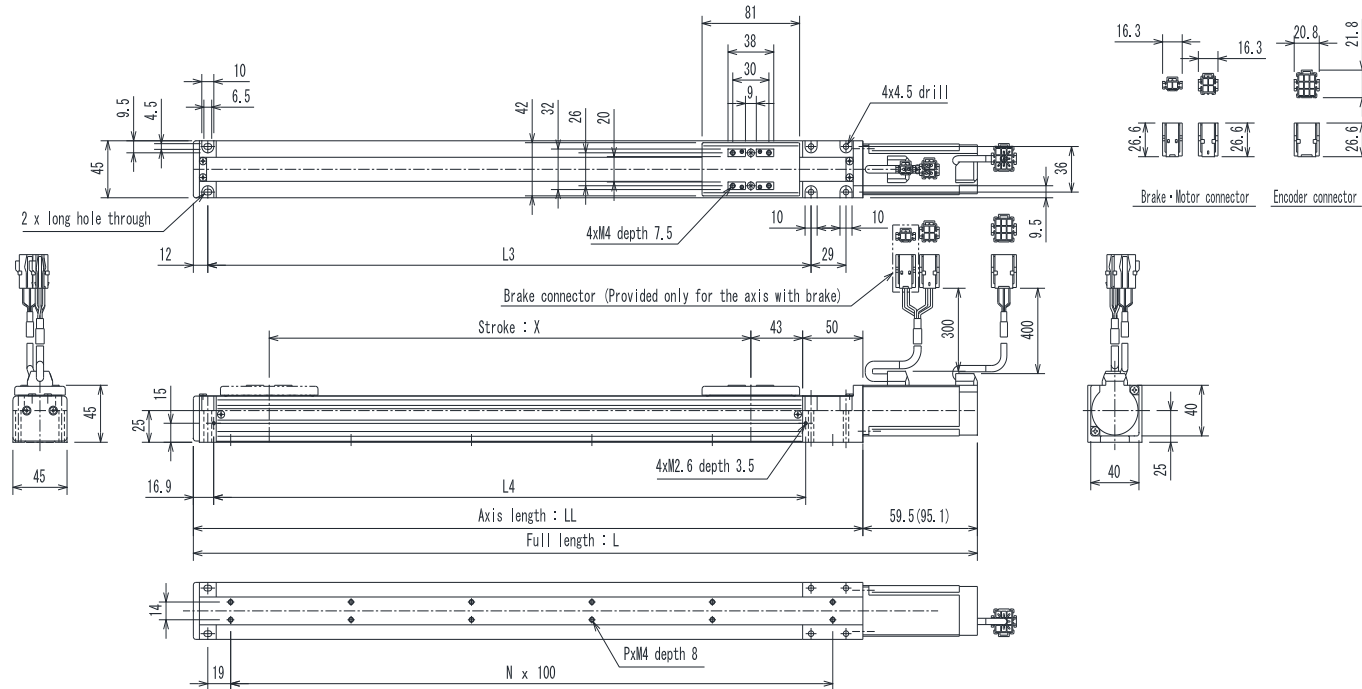


■ Axis dimensions

[BET5D-ST-M\*\*\*]

Type	Without brake	BET5D-ST-M**N-05	BET5D-ST-M**N-10	BET5D-ST-M**N-15	BET5D-ST-M**N-20	BET5D-ST-M**N-25	BET5D-ST-M**N-30	BET5D-ST-M**N-35	BET5D-ST-M**N-40	BET5D-ST-M**N-45	BET5D-ST-M**N-50
	With brake	M**B-05	M**B-10	M**B-15	M**B-20	M**B-25	M**B-30	M**B-35	M**B-40	M**B-45	M**B-50
Stroke X (mm)	50	100	150	200	250	300	350	400	450	500	500
Full length L (mm)	265.5 (301.1)	315.5 (351.1)	365.5 (401.1)	415.5 (451.1)	465.5 (501.1)	515.5 (551.1)	565.5 (601.1)	615.5 (651.1)	665.5 (701.1)	715.5 (751.1)	715.5 (751.1)
Main unit length LL (mm)	206	256	306	356	406	456	506	556	606	656	656
L3 (mm)	151	201	251	301	351	401	451	501	551	601	601
L4 (mm)	141.6	191.6	241.6	291.6	341.6	391.6	441.6	491.6	541.6	591.6	591.6
No. of holes P (q'ty)	4	6	6	8	8	10	10	12	12	14	14
Intervals between mounting holes N	1	2	2	3	3	4	4	5	5	6	6
Weight (kg)	1.2 (1.4)	1.3 (1.5)	1.4 (1.6)	1.5 (1.7)	1.6 (1.8)	1.7 (1.9)	1.8 (2)	1.9 (2.1)	2 (2.2)	2.1 (2.3)	2.1 (2.3)

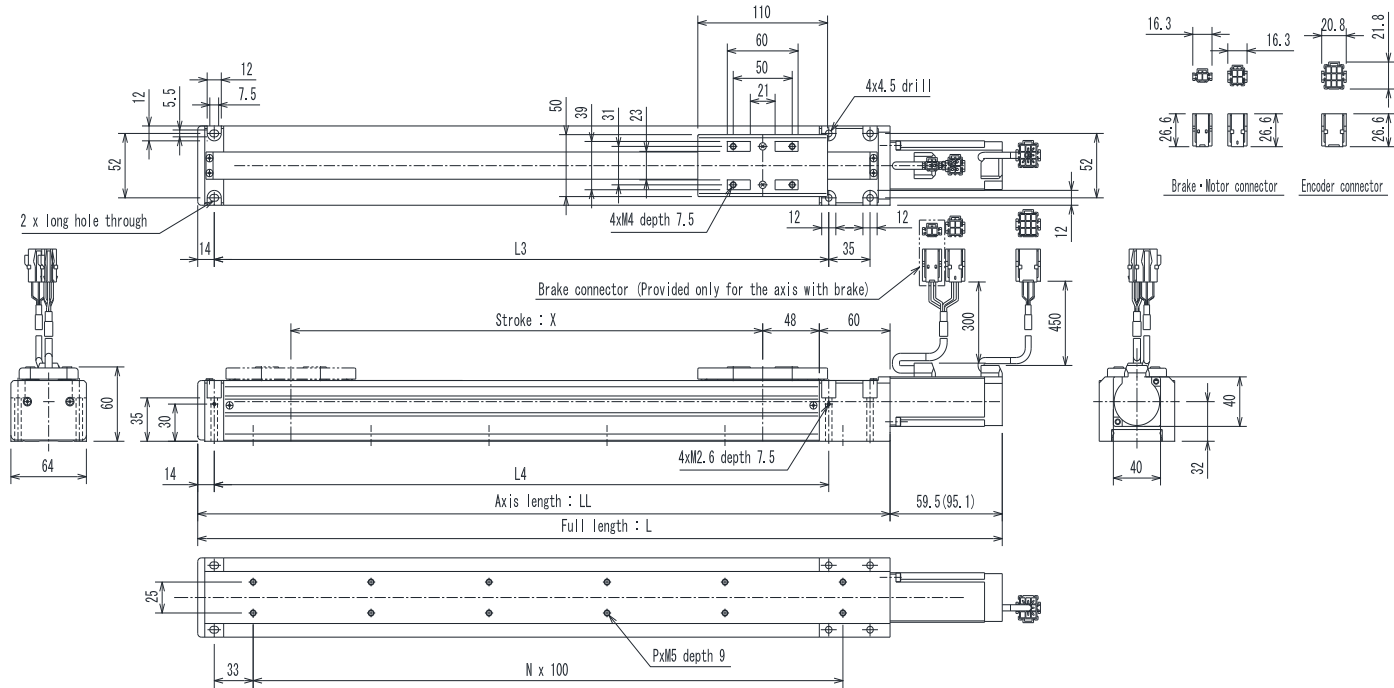
Note: The value in parenthesis applies to the axis with a brake.  
 The "\*\*\*" portion of the type indicates the ball screw lead.  
 (12 for the ball screw lead of 12 mm, and 06 for the ball screw lead of 6 mm)



[BET7D-ST-M\*\*\*]

Type	Without brake	BET7D-ST-M**N-05	BET7D-ST-M**N-10	BET7D-ST-M**N-15	BET7D-ST-M**N-20	BET7D-ST-M**N-25	BET7D-ST-M**N-30	BET7D-ST-M**N-35	BET7D-ST-M**N-40	BET7D-ST-M**N-45	BET7D-ST-M**N-50	BET7D-ST-M**N-55	BET7D-ST-M**N-60	BET7D-ST-M**N-70
	With brake	BET7D-ST-M**B-05	BET7D-ST-M**B-10	BET7D-ST-M**B-15	BET7D-ST-M**B-20	BET7D-ST-M**B-25	BET7D-ST-M**B-30	BET7D-ST-M**B-35	BET7D-ST-M**B-40	BET7D-ST-M**B-45	BET7D-ST-M**B-50	BET7D-ST-M**B-55	BET7D-ST-M**B-60	BET7D-ST-M**B-70
Stroke X (mm)	50	100	150	200	250	300	350	400	450	500	550	600	700	
Full length L (mm)	296.5 (332.1)	346.5 (382.1)	396.5 (432.1)	446.5 (482.1)	496.5 (532.1)	546.5 (582.1)	596.5 (632.1)	646.5 (682.1)	696.5 (732.1)	746.5 (782.1)	796.5 (832.1)	846.5 (882.1)	896.5 (932.1)	
Main unit length LL (mm)	237	287	337	387	437	487	537	587	637	687	737	787	837	
L3 (mm)	171	221	271	321	371	421	471	521	571	621	671	721	771	
L4 (mm)	171	221	271	321	371	421	471	521	571	621	671	721	771	
No. of holes P (q'ty)	4	6	6	8	8	10	10	12	12	14	14	16	18	
Intervals between mounting holes N	1	2	2	3	3	4	4	5	5	6	6	7	8	
Weight (kg)	2.3(2.5)	2.5(2.7)	2.7(2.9)	2.9(3.1)	3.1(3.3)	3.3(3.5)	3.5(3.7)	3.7(3.9)	3.9(4.1)	4.1(4.3)	4.3(4.5)	4.5(4.7)	4.9(5.1)	

Note: The value in parenthesis applies to the axis with a brake.  
 The "\*\*\*" portion of the type indicates the ball screw lead.  
 (12 for the ball screw lead of 12 mm, and 06 for the ball screw lead of 6 mm)



## Chapter 4 Installing Actuator (Axis)

### 4.1 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/s<sup>2</sup> 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 9 mm or more where the plate has a machined surface with flatness of BET5D:0.05mm/200mm,BET7D:0.06mm/200mm or less. Install this product on this base to correct the bend and twist of the axis frame and to reinforce the axis frame.

#### ● installation

Install the actuator on the set base, using the holes of tap, motor block and end block on the bottom surface of the actuator.

## ■ 4.2 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 Section 4.2 of the CA25 Instruction Manual (Basic Part).

- When used as a slider traveling type axis (in normal use)

	Lead (mm)	Type of axis	Robot type
BET5D	6	BET5D-ST-M06□-□□	600200
	12	BET5D-ST-M12□-□□	600210
BET7D	6	BET7D-ST-M06□-□□	600220
	12	BET7D-ST-M12□-□□	600230



- 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).

## ■ 4.3 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.

### ■ 4.3.1 Values of parameter 1 for each robot type

This parameter has a higher frequency of use.

- Straight axis (slider movable type)

Automatic setting	Robot type		600200	600210	600220	600230
			(Lead 6)	(Lead 12)	(Lead 6)	(Lead 12)
	Software limit value (upper limit)		0000.00	0000.00	0000.00	0000.00
	Software limit value (lower limit)		0000.00	0000.00	0000.00	0000.00
○	Servo gain Position/Speed	Position	31	31	29	30
		Speed	22	22	28	30
	Pass area		0200			
	Origin offset value		0000.00	0000.00	0000.00	0000.00
	Sequence of Return to Origin		1 (Note)	1 (Note)	1 (Note)	1 (Note)
	JOG speed	L(Low speed)	010	010	010	010
		H(High speed)	050	050	050	050
	JOG inching movement		00.01	00.01	00.01	00.01

(Note) The Sequence of Return to Origin varies according to the combination format, installation conditions and others. The customer is requested to set it in conformity to your operation conditions.

The initial value is common at "1" for all robot types. Thus, if there is no change, simultaneous origin return of all axes can be achieved.

## ■4.3.2 Values of parameter 2 for each robot type

### • Straight axis (slider movable type)

Automatic setting	Robot type		600200	600210	600220	600230
			(Lead 6)	(Lead 12)	(Lead 6)	(Lead 12)
	Parameter					
	Axis display		X	X	X	X
	In position data value		00.05	00.05	00.05	00.05
	Overflow data value		20000	20000	20000	20000
<input type="radio"/>	Feed forward data value		02000	02000	02000	02000
<input type="radio"/>	Direction of motor rotation		1	1	1	1
<input type="radio"/>	Maximum speed		400	800	400	800
<input type="radio"/>	Return to origin speed	(L) Low speed	002.0	002.0	002.0	002.0
		(M) Medium speed	020.0	020.0	020.0	020.0
		(H) High speed	100.0	100.0	100.0	100.0
<input type="radio"/>	Return to origin method		2	2	2	2
<input type="radio"/>	Origin sensor logic		0	0	0	0
	High speed return to origin position		0020.00	0020.00	0020.00	0020.00
<input type="radio"/>	Lead		6.000	12.000	6.000	12.000
<input type="radio"/>	Encoder division number		32768	32768	32768	32768
<input type="radio"/>	Encoder pulse multiplier		4	4	4	4
	Encoder type (Note)		a	a	a	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 13.4.17 of the CA25 Instruction Manual (Basic Part).

## Chapter 5 Maintenance

### ■ 5.1 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.

## ■5.2 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.

## ■5.3 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

## ■ 5.4 Adjusting Home Position

Adjust the home position in the following manner.

- (1) Turn the power off.
- (2) Loosen and remove the two (2) low-head plus screws from the top side of the motor block.

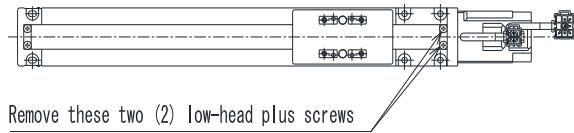


Fig. 5.4-1

- (3) Remove the stainless sheet and loosen one (1) hexagon socket head cap screw (M2.5) of the coupling connecting the motor and ball screw. (DO NOT remove the screw.)

### **⚠ CAUTION**

Take careful precautions not to cut your hand by the stainless sheet.

- If the coupling screw cannot be loosened so easily when the actuator (axis) is provided with a brake, rotate the motor shaft a little by jog operation until the tool can be inserted. (See Para. 16.5 of the instruction manual (basic) provided separately.)

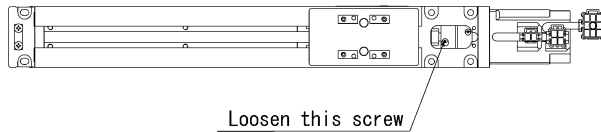


Fig. 5.4-2



- (4) Temporarily connect the actuator and controller, connect the teach pendant with the controller, then turn the power on. For how to connect, see Para. 2.5.4 of the instruction manual (basic) provided separately.
- (5) Set the servo gain values (position and speed) of Parameter 1 to zero (0). For the setting procedures, see Para. 13.3.3,13.3.4 of the instruction manual (basic).
- (6) Specify "3" for the home return method of Parameter 2.
- (7) Execute the home return. After the motor has stopped, move the slider end manually to the position "A" mm away from the motor block end surface. (See Fig. 5.4-3.)  
With the slider moved to the "A" position, if the coupling bolt is hidden with the stainless sheet, move it to the position "A + 48" and perform the work.

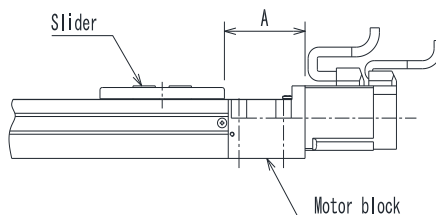


Fig. 5.4-3

Type of axis	A (mm)	A + 48 (mm)
BET5D-ST-M***_**	52.5	100.5
BET7D-ST-M***_**	53	101

- (8) Turn off the controller power and tighten the coupling clamp screw on the ball screw side.  
(Clamping torque: 1.0 N·m) (See Para. 5.11.)

**CAUTION**

Before tightening the coupling clamp screw, be sure to turn off the controller power.  
DO NOT shift the motor shaft and coupling from the stopped positions.

- (9) Turn the power on again, return the servo gain values (position and speed) to the previous values, then specify "2" for the home return method of Parameter 2.
- (10) After the power is turned off, then on again, execute the home return and make sure that the actuator is as shown in Fig. 5.4-3.
- (11) Reassemble the stainless sheet in Step (3) above as originally set. The stainless sheet should be stretched straight not to cause a sag.
  - If the stainless sheet will bend (i.e., a clearance is caused between the stainless sheet and side cover) after the slider is moved while the stainless sheet is stretched straight, adjust the tension.

## ■ 5.5 Changing Home Position

- (1) Specify "1" for the motor revolving direction of Parameter 2.
- (2) Adjust the home position. As in Para. 5.4 above, the position "B" mm away from the end block should be the home point. (See Fig. 5.5-1.)

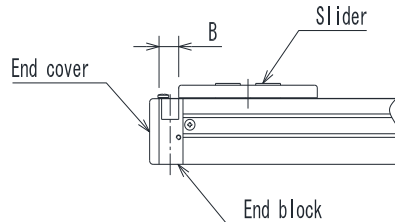


Fig. 5.5-1

Type of axis	B (mm)
BET5D-ST-M***_**	11.5
BET7D-ST-M***_**	12

## ■ 5.6 Replacing Motor and Changing Motor Lead Wire Hole Direction

When replacing the motor or changing the direction of the motor lead wire hole, observe the following procedures.

- (1) Turn the power off.
- (2) Loosen and remove the two (2) low-head plus screws from the top side of the motor block.

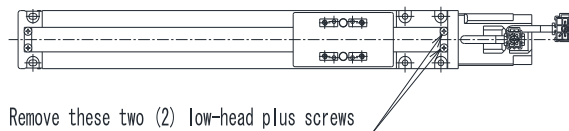


Fig. 5.6-1

- (3) Remove the stainless sheet and loosen the two (2) hexagon socket head cap screws (BET5D:M2,BET7D:M2.5) of the coupling connecting the motor and ball screw. (DO NOT remove the screws.)

### ⚠ CAUTION

Take careful precautions not to cut your hand by the stainless sheet.

- If the coupling screw cannot be loosened so easily when the actuator (axis) is provided with a brake, rotate the motor shaft a little by jog operation until the tool can be inserted. (See Para. 16.5 of the instruction manual (basic).)

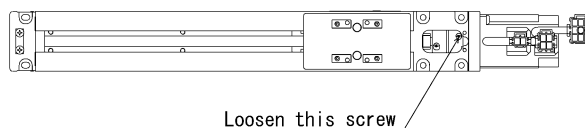


Fig. 5.6-2

- (4) Remove the two (2) screws clamping the motor, and rotate the motor in a desired direction. Mount the motor on the actuator again, using the removed screws.

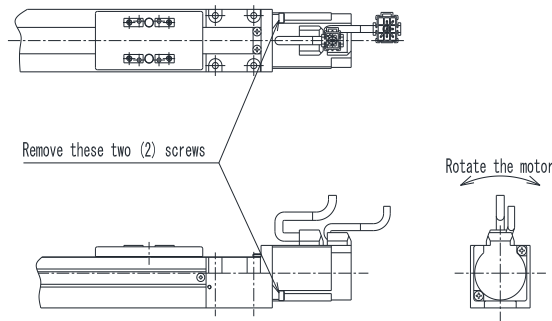


Fig. 5.6-3

- (5) Temporarily connect the actuator and controller, connect the teach pendant with the controller, then turn the power on. For how to connect, see Para. 2.4.5 of the instruction manual (basic) provided separately.
- (6) Set the servo gain values (position and speed) of Parameter 1 to zero (0). For the setting procedures, see Para. 13.3.3, 13.3.4 of the instruction manual (basic).
- (7) Specify "3" for the home return method of Parameter 2.
- (8) Execute the home return.
- (9) Move the slider to the position shown in Fig. 5.6-4 and tighten the coupling clamp screw.  
(Clamping torque: BET5D:0.4~0.5 N·m, BET7D:1.0~1.1 N·m) (See Para. 5.11.)

**CAUTION**

Before tightening the coupling clamp screw, be sure to turn off the controller power. DO NOT shift the motor shaft and coupling from the stopped positions

The home position differs between the BET5 and BET7 actuators. (See Fig. 5.6-4.)

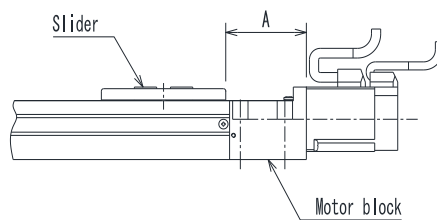


Fig. 5.6-4

Type of axis	A (mm)
BET5D-ST-M***-**	52.5
BET7D-ST-M***-**	53

- (10) Turn the power on again, return the servo gain values (position and speed) to the previous values, then specify "2" for the home return method of Parameter 2.
- (11) After the power is turned off, then on again, execute the home return and make sure that the actuator is as shown in Fig. 5.6-5.
- (12) Reassemble the stainless sheet in Step (3) above as originally set. The stainless sheet should be stretched straight not to cause a sag.
- If the stainless sheet will bend (i.e., a clearance is caused between the stainless sheet and side cover) after the slider is moved while the stainless sheet is stretched straight, adjust the tension.

## ■ 5.7 Removal and installation of Stainless Sheet

When removing and installing the stainless sheet by maintenance etc., follow the procedure below.



Take careful precautions not to cut your hand by the stainless sheet.

- (1) Remove the four (4) screws securing the stainless sheet, using a screwdriver, and remove the plate.

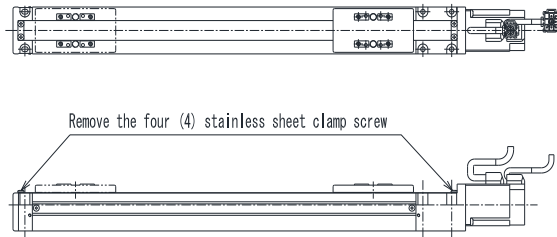


Fig. 5.7-1

- (2) Likewise, remove the two (2) screws securing the slider cover, then remove the cover followed by the two (2) springs.

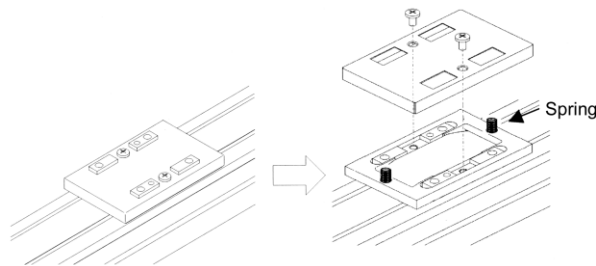


Fig. 5.7-2



The springs inside may bound. Take utmost care not to miss them.

- (3) Remove the slide table together with the stainless sheet.

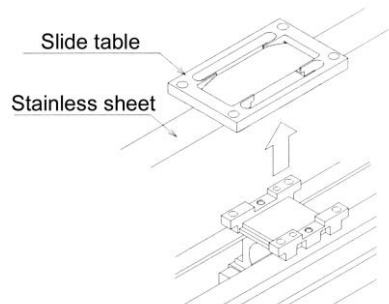


Fig. 5.7-3

- (5) After completion of work such as maintenance, reassemble according to Steps (3) to (1) in the reverse order. The stainless sheet should be stretched to prevent it from sagging.

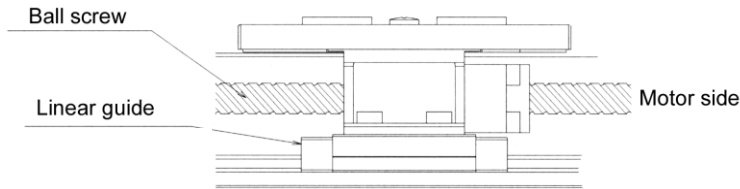
- If the stainless sheet which was stretched distorts (i.e., clearance exists with the side cover) when the slider is moved, correct the stretching condition.

## ■ 5.8 Greasing

### Greasing procedures

- Ball screw and linear guide
  1. Turn off the drive power.
  2. Remove the screws (4 places) fixing the stainless sheet.
  3. Greasing according to the table and figure shown below.

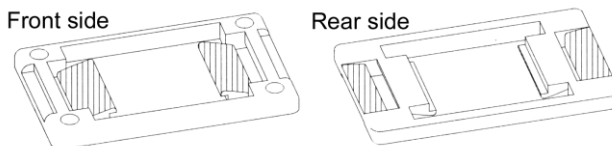
Greasing position	Type of grease (manufacturer)	Inspection and greasing intervals	Volume of grease
Ball screw	AFF Grease (THK)	Every three (3) months	A thin layer of grease applied on the ball screw shaft
Linear guide			A thin layer of grease applied on the linear guide rail



4. Wipe away any oozing oil and tarnished oil.
5. Attach the stainless sheet again.

- Slide table
  1. Turn off the drive power.
  2. Remove the slide table from the actuator, then remove the stainless sheet from the slide table. (See Steps (1) through (4) of Para. 5.7.)
  3. Greasing according to the table and figure shown below.

Greasing position	Type of grease (manufacturer)	Inspection and greasing intervals	Volume of grease
Slide table	AFF Grease (THK)	Every three (3) months	Apply a thin coat of oil to the shaded areas in the figure below (i.e., contact areas of the stainless sheet).



4. Wipe away any oozing oil and tarnished oil.
5. Mount the stainless sheet and slide table again.

## ■5.9 Replacement of ball screw

- If the replacement of ball screw needs to be replaced, contact our sales office closest to your company. It must not be replaced by the customer.
- This replacement is performed for each axis. It should be noted that this replacement cannot be made inside the device or in the combined state.

## ■5.10 Replacement of linear guide

- Replace the linear guide in the same procedure as the ball screw. Contact our sales office.

## ■5.11 Clamping Torque of Bolts and Nuts

Part name	Nominal size of screw	Clamping torque (N·m)	Remarks
Hexagon socket head cap screw	M2	0.4~0.5	Motor side screw for BET5D coupling.
Hexagon socket head cap screw	M2.5	1.0~1.1	Ball-screw side screw for BET5D coupling.
			Motor side and Ball-screw side screw for BET7D coupling.
Hexagon socket head cap screw	M4	2.45	For securing the motor.
Low-head plus screw	M3	0.59	For securing the cover and stainless sheet.

## Chapter 6 Spare Parts

### ■6.1 Maintenance

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	Remarks
1	AC servo motor (encoder: absolute)	For BET5 and BET7 (commonly used) (50 W)
2	AC servo motor with brake (encoder: absolute)	For BET5 and BET7 (commonly used) (50 W)
3	Slide table	For BET5 For BET7

## **TOSHIBA MACHINE CO.,LTD.** HEAD OFFICE

Electronic Equipment Sales Group, Control Systems Division  
2068-3, Ooka, Numazu-shi, Shizuoka-ken 410-8510, Japan  
TEL: [81]-(0)55-926-5032 FAX: [81]-(0)55-925-6527

## **TM ROBOTICS (AMERICAS) INC.**

755 Greenleaf Avenue, EIK Grove Village, IL 60007, U.S.A.  
TEL:[1]-847-593-1616 FAX:[1]-847-593-0897

## **TOSHIBA MACHINE (THAILAND)CO.,LTD.**

127/28 Panjathanee Tower, 23th Floor, Nothree Road, Khwaeng  
Chong Nonthree, Khet Yannawa, Bangkok 10120, THAILAND  
TEL: [66]-(0)2-681-0158 FAX: [66]-(0)2-681-0162

## **TM ROBOTICS(EUROPE) LTD.**

Unit 2, Bridge Gate Centre,  
Martinfield, Welwyn Garden City, Herts AL7 1JG UK  
TEL: [44]-(0)1707-290370 FAX: [44]-(0)1707-376662

URL: <http://www.toshiba-machine.co.jp/seiji/prod/sr>

<http://www.tmrobotics.com>

<http://www.tmrobotics.co.uk>