# NVA CORELESS LINEAR MOTOR

## Manual

Ver. 2.0

Nikki Denso Co., Ltd.

Document number: TI-14240

#### **Preface**

We would like to thank you for adopting  $\tau$  linear servo motor **<NVA coreless linear motor series>**.

#### [Confirmation items]

#### 1. Inspection at delivery

Check the following items when receiving our motor:

- (1) Is the motor what you ordered? (Check the model number, rated output, combined driver, accessories, etc.)
- (2) Is no portion damaged during transportation? (Is packing free from breakage? Is the motor free from abnormalities in appearance?)
- (3) Does the motor come with accessories?
- \* If you find a packing material such as a cardboard box being broken, contact our sales representative without unpacking the motor.

If you find any abnormality listed above, contact our sales representative immediately.

#### 2. Precautions before installation (during transportation)

\* When transporting the motor, handle it with care so as not to damage it.

#### \* Precautions

Do not stack motors or put anything on the motor.

Do not apply any shock to the motor.

Do not handle the motor cable to transport the motor.  $\rightarrow$  This action may cause cable disconnection.

#### 3. Precautions in storage

Store our motor in an environment in which the following conditions are satisfied if not used for some time after delivery to prevent insulation deterioration and rusting. Immediately after delivery, unpack the motor and be sure to confirm that there is no abnormality caused during transportation including damage on the motor.

	Item	Description						
	Temperature	-10°C to +60°C						
ent ions	Humidity	85% or less (no condensation allowed)						
Ambient conditions	Storage place	Store the motor at a clean and dust-free place.  Do not store the motor in any harmful atmosphere such as corrosive gas, cutting oil, metal dust, or oil.						
Vibi	ration	Store the motor in a place where there is no vibration.						
Oth	ers	The period during which rust prevention treatment is effective is within three months after the shipment from our factory under the above ambient conditions. If you want to store the motor longer, perform rust prevention treatment and periodic inspection.						

Motor storage conditions

#### Preventions in transportation

If you want to transport our motor after delivery, transport it under the following conditions.

	Item	Description
t ns	Temperature	-10°C to +60°C
Ambient onditions	Humidity	85% or less (no condensation allowed)
Ambien	04	Do not transport the motor in any harmful atmosphere such as
1 0	Storage area	corrosive gas, cutting oil, metal dust, or oil.
Vibra	tion	0.5 G or less

Motor transportation conditions



Storage and transportation at a humidity of 65%RH or less is recommended. If the humidity is higher than 65%RH, contact our sales representative.

#### [About this manual]

This manual describes the specifications, driving directions, installation, precautions for use, and others of the NVA linear motors.

To use the motor properly, understand the contents of this manual completely.

When performing installation, operation, and other work, follow the conditions and procedures described in this manual.

When using a customized motor, read the specifications for the customized motor in addition to this manual

If the description of an item differs between the specifications and this manual, follow the description in the specifications.

#### [About the warranty period]

The warranty period for our product is one year from the date of shipment.

However, note that failures and abnormalities resulting from the following causes are not covered by this warranty:

- 1 Modifications by the customer
- 2 Improper use different from the description in this manual
- 3 Natural disasters
- 4 Improper connection with any manufacturer's product not approved by Nikki Denso

If you find a failure or abnormality during or not during the warranty period, contact our sales representative.

\* Nikki Denso Co., Ltd. reserves the right to revise this manual at any time. Information in this manual is subject to change without notice.

Although the information from Nikki Denso is correct and reliable, Nikki Denso assumes no responsibility for the use of the information unless specially guaranteed by Nikki Denso.

## Safety precautions

Before performing installation, wiring, operation, maintenance, and inspection, diagnosing abnormalities, and taking action against them, be sure to read this manual and other related instruction manuals thoroughly and use the motor properly.

After getting the proper and adequate knowledge of the motor and understanding the safety information and precautions, use the motor.

In this manual, safety precautions are ranked in the following two categories: "Danger" and "Caution".

And, handling precautions are classified in "Prohibition" and "Compulsion". "Action not to be done" is defined as "Prohibition" and "action to be done" is defined as "Compulsion".



Mishandling may cause a dangerous situation, which could lead to user's death or serious injury.



Mishandling may cause a dangerous situation, which could lead to user's medium or light injury or property damage.

An item marked with Caution could also lead to serious results depending on the actual situation. Be sure to follow any item marked with Danger or Caution since it describes an important precaution.



#### Action not to be done

If this precaution is ignored, the motor does not operate normally.



#### Action to be done

If this precaution is ignored, the motor does not operate normally.

## **Danger**

#### ★ To avoid the danger of electric shock and injury, be sure to follow the instructions below.

- ① Make sure to ground the ground terminal or ground wire of the motor.
  - Use a ground wire with at least the thickness specified in this manual and apply at least class 3 grounding.
  - "Electric shock may occur".
- ② Do not damage the cable, pull it forcibly, apply excessive force to it, put any heavy thing on it, or let it get caught in something.
  - "Electric shock may occur".
- 3 Never touch the motor while it is running.
  - "Injury may occur".
- Do not touch the terminal for five minutes after a withstand voltage test or insulation resistance
  test
  - "Electric shock may occur".

## **⚠** Caution

- ① Use the motor in combination with the specified driver and controller.
  - "Fire or failure may occur".
- ② Never use the motor in a place where it will get water, in a corrosive or flammable gas atmosphere, or near a combustible material.
  - "Fire or failure may occur".
- The motor, driver, controller, and peripheral devices are very hot during operation. Do not touch them.
  - "Burn injury may occur".
- 4 The motor could be very hot while the power is being supplied and for a while after the power is turned off. Do not touch it.
  - "Burn injury may occur".

#### [Receiving and checking the motor]



- ① When you receive the motor, if it is not what you ordered or the quantity of any item is not correct, contact our sales representative without using the motor.
  - "Electric shock, injury, damage, fire, or failure may occur".
- ② If you find a packing material being broken, notify our sales representative of the fact without unpacking the motor.
  - "Electric shock, injury, damage, fire, or failure may occur".



Do not store the motor in a place exposed to rain, water, or poisonous gas or liquid. **"Failure may occur".** 

[Storage]

## Compulsion

- ① Store the motor in a place free from direct sunlight at a temperature and humidity within the ranges specified in this manual.
  - "Failure may occur".
- When the motor is stored for more than three years after purchased, be sure to contact our sales representative.
  - "Failure may occur".

[Transportation]



When transporting the motor, do not hold the cable or motor shaft.

"Injury or failure may occur".

## Compulsion

Overloading products may cause load to drop. Follow the instructions.

"Injury or failure may occur".

[Installation]



- ① Do not climb on the motor or put any heavy thing on it.
- "Injury or failure may occur".
- ② Prevent foreign matters from getting into the motor.
  - "Fire may occur".
- 3 Make sure to install the motor in the specified orientation.
  - "Fire or failure may occur".
- 4 Do not apply strong impact to the motor.
  - "The motor may be damaged".
- ⑤ Install the motor appropriately according to the output or weight of the main unit.
  - "The motor may be damaged".
- 6 Install the motor on an incombustible material such as metal.
  - "Fire may occur".
- ① Use the motor in an environment free from dust.
- 8 Firmly fix the motor on a mounting surface with enough rigidity.
  - Protect the installed motor so that it does not get hit by articles such as dropping items.

## **⚠** Caution

- Make sure to conduct correct wiring.
  - "Motor runaway or burning, injury, or fire may occur".
- 2 To avoid the effect of noise, use cables having lengths and following specifications (shielded, twisted, and/or other treatment applied) that are specified in the driver and controller manuals.
  - "Motor runaway, injury, or damage to the machine may occur".
- To prevent electric shock and avoid the effect of noise, make sure to perform proper grounding. "Motor runaway, electric shock, injury, or damage to the machine may occur".

#### [Operation]

## **⚠** Caution

- The motor has no protective device. Use an overcurrent protection device, ground-fault circuit interrupter, thermal overtemperature control device, and emergency stop device for protection. "Injury or fire may occur".
- 2 Make sure that the combination of the motor, driver, and controller is correct.
  - "Injury, fire, or damage to the machine may occur".
- 3 Before performing trial operation, fix the motor, separate the motor from the load system, and confirm the operation. Then, mount the load system.
  - "Injury or damage to the machine may occur".
- 4 Extreme adjustment or change may make operation unstable. Be careful when making such adjustment or change.
  - "Injury or damage to the machine may occur".
- When an alarm occurs, reset the alarm. Make sure to remove the cause before restarting the motor.
  - "Injury or damage to the machine may occur".
- 6 At the recovery from an instantaneous interruption, the machine may restart suddenly. In this case, keep away from the machine.
  - (Design the machine so that the safety of workers is ensured at the restart of the machine.)
  - "Injury may occur".
- If any hazardous situation is assumed when the motor stops or fails, install an external braking mechanism to avoid accident.
  - "Injury or damage to the machine may occur".



Do not turn the power on in the motor driven or vibrated status.

"Motor runaway, injury, or damage to the machine may occur".



Configure an external emergency stop circuit to stop operation and shut down the power immediately.

"Injury or damage to the machine may occur".

#### [Maintenance and inspection]



The motor shall be overhauled only by Nikki Denso or by a company specified by Nikki Denso.

"A failure may be caused".

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#### 1. Outline

#### 1-1. Features

#### **Coreless linear motor**

A coreless linear motor can make smooth movement possible since its coil unit does not have magnetic materials, so no attraction is generated and the speed ripple and cogging can be suppressed.

#### **NVA** series

The NVA series has the advantages of coreless linear motors and magnetic characteristics have been improved to add three new specialized types including a high-efficiency type with high thrust density and a type providing high low-speed stability with a new structure to the lineup.

#### Features of the three types

#### Low-profile flat type

The coil unit has a straddle mounted structure, which is suitable for variable speeds from very low speed to ultrahigh speed. This type shows high stability at a low speed in particular.

#### · High-thrust type/large-thrust type

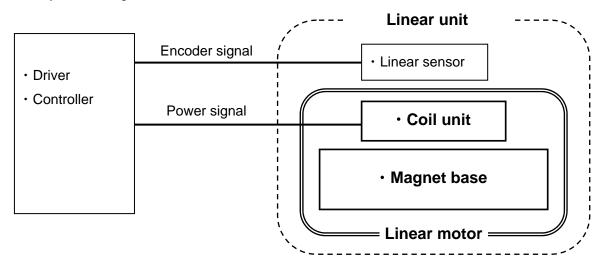
The efficiency of magnetic flux density has been increased to reduce the footprint to 70% of the conventional model. This type allows the downsizing of the driving and transfer mechanisms, which makes machine design more flexible.

#### Standard type

This type keeps high accuracy positioning characteristics and greatly improves cost performance.

#### 1-2. System configuration

The system configuration of a linear motor is shown below.



#### 2. Specifications

#### 2-1. Model number

#### 2-1-1. Motor model number

A model number of the NVA linear motor series is shown below.

	① Motor		Magnet	_	verall coil	4	Subtype		ltage	6	Design	⑦ Customized		
	type		type	uni	t length			specifi	cation		order	model		
Α	Flat	М		Α	60 mm	Flat		A1	100 VAC	Α	1st version	None	Standard model	
В	High thrust	L		В	120 mm	30	Mounting height	A2	200 VAC	В	2nd version	S01 S02	Customized model	
D	Standard			С	180 mm	High thrus	st/standard				(serial number)		(serial	
				D	240 mm	00	Standard nameplate Coil mounted on a side						number)	
				E	360 mm	01	Standard nameplate Coil mounted on the bottom							
				F	360 mm	Only	high thrust							
				G	480 mm	20	Side nameplate Coil mounted on a side							
				н	600 mm	21	Side nameplate Coil mounted on the bottom							

<sup>\* 4</sup> Explanation of standard nameplate and side nameplate in "Subtype"

Standard nameplate: The nameplate of this subtype of product is located on the top of the MG base.

Side nameplate: The nameplate of this subtype of product is located on a side of the MG base. This is because the standard nameplate side may become the motor installation side depending on the installation method. For details, see "6. Notes on using multiple axes".

#### 2-1-2. Magnet base (called MG base below) model number

A model number of an MG base is shown below.

1 (1)	Motor type	2 Magnet		3	3 Overall		Subtype		Design	6 Customized		
			type	magnet base				order		model		
				length								
Α	Flat	М		Α	96 mm	Flat	or standard	Α	1st version	None	Standard	
											model	
В	High	L		В	144 mm	00	Standard	В	2nd	S01	Customized	
	thrust								version	S02	model	
D	Standard			С	192 mm				(serial	-	(serial	
				D	240 mm	High	thrust		number)	-	number)	
				Е	288 mm	00	Standard					
							nameplate					
				F	384 mm	20	Side nameplate					
				G	480 mm							
				Ι	576 mm							
				М	96 mm							
				Ν	288 mm							

<sup>\* 4</sup> Explanation of standard nameplate and side nameplate in "Subtype"

Standard nameplate: The nameplate of this subtype of product is located on the top of the MG base.

Side nameplate: The nameplate of this subtype of product is located on a side of the MG base. This is because the standard nameplate side may become the motor installation side depending on the installation method. For details, see "6. Notes on using multiple axes".

#### 2-1-3. Coil unit (called CL unit below) model number

A model number of a CL unit is shown below.

1	① Motor type		② Magnet ③ Overall type coil unit		4			⑤ Voltage specification		Design order	<ul><li>⑦ Customized model</li></ul>		
					length								
Α	Flat	М		Α	60 mm		Flat	A1	AC 100	Α	1st	None	Standard
											version		model
В	High	L		В	120 mm	30	Mounting	A2	AC 200		(serial	S01	Customized
	thrust						height				number)	S02	model
D	Standard			С	180 mm		High						(serial
						thru	st/standard						number)
				D	240 mm	00	Mounted						
							on a side						
				Е	360 mm	01	Mounted						
							on the						
							bottom						
				F	360 mm								
				G	480 mm								
				Н	600 mm								

#### 2-2. General specifications

The following table lists general specifications.

Table 1. General specifications

	Item	Description				
ıt ns	Temperature	0°C to 40°C				
Ambient conditions	Humidity	85% or less (No condensation allowed)				
A P	Installation	Do not install the motor in any harmful atmosphere				
< 8	place	such as corrosive gas, cutting oil, metal dust, or oil.				
Install	ation	Horizontal, vertical				
orient	ation					
Drivin	g direction	Both directions				
Coolir	ng method	Natural cooling				
Finish	ed color	Black and white mixed together				
Insula	tion class	Class F				
Dielec	tric strength	1500 V (for 1 minute)				
voltag	е					
Vibrat	ion resistance	1 G (for 2 hours in each of three directions)				
Impac	t resistance	5 G (three times for each of three directions)				
Protec	ction mode	Open				
Protec	ction class	IP40				

#### 2-3. Rated specifications

The following sections describe rated specifications of each type.

#### 2-3-1. Rated specifications of the low-profile flat type

Table 2a. Rated specifications of the low-profile flat type

Motor model	NVA-AM	A30A2A	B30A2A	C30A2A	D30A2A	E30A2A		
Rated thrust	N	23	45	68	90	135		
Maximum	N	69	135	204	261	405		
thrust								
Rated output	W	69	135	204	270	405		
Rated current	Α	0.85	1.7	2.55	3.4	5.1		
Maximum	m/s	3.5						
speed								
Sensor	μ <b>m</b>	5.0, 1.0, 0.5, 0.1						
resolution								
Power supply	ACV	200 VAC, three	phase, 50/60 Hz					
CL unit model	CLV-AM	A30A2A	B30A2A	C30A2A	D30A2A	E30A2A		
MB base model		MBV-AM*00A						
VC driver	NCR-DA	B0A2C101D	B0A2C201D	B0A2C401D	*B0A2C401D	B0A2C801D		
VC controller	NCR-CA	B0A2C101D	B0A2C201D	B0A2C401D	*B0A2C401D	B0A2C801D		

<sup>\*</sup> Maximum thrust: 290%

The specification values listed above are measured at an ambient temperature of 25°C when the motor mounted on a heatsink (aluminum plate) operates:

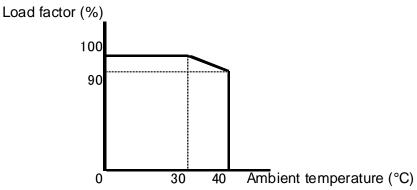
Heatsink size Applicable CL units

 $250 \times 250 \times 15 \text{ mm}$  CLV-AMA30A2A, AMB30A2A, AMC30A2A

 $450 \times 450 \times 15$  mm CLV-AMD30A2A, AME30A2A

Load factor-ambient temperature characteristics

The following figure shows low-profile flat type characteristics for ambient temperatures.



(For details including setting in the derating mode, see "5-2. Operation".)

Load factor-operation characteristics

#### 2-3-2. Rated specifications of the high-thrust (BM) type (called high-thrust type below)

Table 2b. Rated specifications of the high-thrust type

Motor model	NVA-BM	A*0A2A	B*0A2A	C*0A2A	D*0A2A	E*0A2A		
		A*1A2A	B*1A2A	C*1A2A	D*1A2A	E*1A2A		
Rated thrust	N	50	100	150	200	300		
Maximum	N	150	300	450	600	900		
thrust								
Rated output	W	150	300	450	600	900		
Rated current	Α	0.95	1.9	2.85	3.8	5.7		
Maximum	m/s	3.5						
speed								
Sensor	μm	5.0, 1.0, 0.5, 0.1						
resolution								
Power supply	ACV	200 VAC, three	phase, 50/60 Hz					
CL unit model	CLV-BM	A00A2A	B00A2A	C00A2A	D00A2A	E00A2A		
		A01A2A	B01A2A	C01A2A	D01A2A	E01A2A		
MG base model		MBV-BM*00A, MBV-BM*20A						
VC driver	NCR-DA	B0A2C101D	B0A2C201D	B0A2C401D	B0A2C801D	B0A2C801D		
VC controller	NCR-CA	B0A2C101D	B0A2C201D	B0A2C401D	B0A2C801D	B0A2C801D		

The specification values listed above are measured at an ambient temperature of 25°C when the motor mounted on a heatsink (aluminum plate) operates:

Heatsink size Applicable CL units

 $250 \times 250 \times 15 \text{ mm}$  CLV-BMA\*0A2A, BMB\*0A2A, BMC\*0A2A

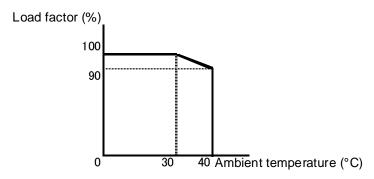
CLV-BMA\*1A2A, BMB\*1A2A, BMC\*1A2A

 $450 \times 450 \times 15 \text{ mm} \qquad \qquad \text{CLV-BMD*0A2A}, \quad \text{BME*0A2A}$ 

CLV-BMD\*1A2A, BME\*1A2A

#### Load factor-ambient temperature characteristics

The following figure shows high-thrust type characteristics for ambient temperatures.



(For details including setting in the derating mode, see "5-2. Operation".)

#### Load factor-operation characteristics

2-3-3. Rated specifications of the high-thrust (BL) type (called the large-thrust type below)

Table 2c. Rated specifications of the large-thrust type

			3	71		
Motor model	NVA-BL	F*0A2A	G*0A2A	H*0A2A		
Rated thrust	N	540	720	900		
Maximum thrust	N	1620	2160	2700		
Rated output	kW	1.6	2.2	2.7		
Rated current	А	9.3	12.5	15.5		
Maximum speed	m/s	3.5				
Sensor resolution	μ <b>m</b>	5.0, 1.0, 0.5, 0.1				
Power supply	ACV	200 VAC, three pha	ase, 50/60 Hz			
CL unit model	CLV-BL	F00A2A	G00A2A	H00A2A		
MG base model		MBV-BL*00A, MBV-BL*20A				
VC driver	NCR-DA	B0A2C152D	B0A2C222D	B0A2C302D		
VC controller	NCR-CA	B0A2C152D	B0A2C222D	B0A2C302D		

The specification values listed above are measured at an ambient temperature of 25°C when the motor mounted on a heatsink (aluminum plate) operates:

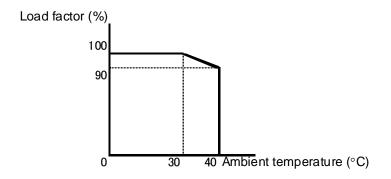
Heatsink size Applicable CL units

 $450 \times 450 \times 20 \text{ mm}$  CLV-BLF\*0A2A

 $700 \times 500 \times 20 \text{ mm}$  CLV-BLG\*0A2A, BLH\*0A2A

#### Load factor-ambient temperature characteristics

The following figure shows large-thrust type characteristics for ambient temperatures.



(For details including setting in the derating mode, see "5-2. Operation".)

#### Load factor-operation characteristics

#### 2-3-4. Rated specifications of the standard type

Table 2d. Rated specifications of the standard type

Motor model	NVA-DM	A00A2A	B00A2A	C00A2A	D00A2A	E00A2A		
		A01A2A	B01A2A	C01A2A	D01A2A	E01A2A		
Rated thrust	N	30	60	90	120	180		
Maximum thrust	N	90	180	270	360	510		
Rated output	W	90	180	270	360	540		
Rated current	Α	1	2	3	4	6		
Maximum speed	m/s	3.5						
Sensor resolution	μ <b>m</b>	5.0, 1.0, 0.5, 0.1						
Power supply	ACV	200 VAC, three	phase, 50/60 Hz					
CL unit model	CLV-BM	A00A2A	B00A2A	C00A2A	D00A2A	E00A2A		
		A01A2A	B01A2A	C01A2A	D01A2A	E01A2A		
MG base model		MBV-DM*00A						
VC driver	NCR-DA	B0A2C101D	B0A2C201D	B0A2C401D	B0A2C801D	*B0A2C801D		
VC controller	NCR-CA	B0A2C101D	B0A2C201D	B0A2C401D	B0A2C801D	*B0A2C801D		

<sup>\*</sup> Maximum thrust: 280%

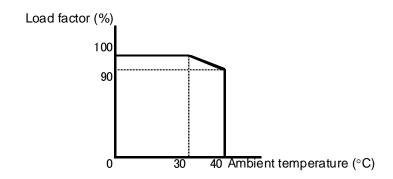
The specification values listed above are measured at an ambient temperature of 25°C when the motor mounted on a heatsink (aluminum plate) operates:

Heatsink size	Applicable CL units		
$250\times250\times15~mm$	CLV-DMA00A2A, DMB00A2A, DMC00A2A		
	CLV-DMA01A2A, DMB01A2A, DMC01A2A		
$450 \times 450 \times 15 \text{ mm}$	CLV-DMD00A2A, DME00A2A		

CLV-DMD00A2A, DME00A2A CLV-DMD01A2A, DME01A2A

Load factor-ambient temperature characteristics

The following figure shows standard type characteristics for ambient temperatures.



(For details including setting in the derating mode, see "5-2. Operation".) Load factor-operation characteristics

#### 2-4. Wiring specifications

MATE-N-LOK connectors are used for connecting terminals (U, V, W, and E). Prepare wiring cable side connectors by yourself or use our options. The following tables list connector and contact model numbers, used wire, and pin configuration.

Table 3a. Wiring specifications (for other than the large-thrust type)

Table	ba. Willing specifications (for other	i tilali tilo laigt	o anaor typo)	
Used connectors	AMP mini-universal MATE-N-LOK connectors (4-pin) of AMP			
Osed connectors	Motor side connector	Wiring cable side connector		
Connector main unit	Plug housing 172167-1	Cap housing 172159-1		
Contact	Pin 170360-1 or 170364-1	Socket 170362-1 or 170366-1		
Used wire	U,V,W,E: 0.75 mm <sup>2</sup>	U,V,W,E: At least 0.75 mm <sup>2</sup>		
Wiring cable side pin configuration	View from the connection side	Pin No.  1 2 3 4	Signal name U V W E	

Table 3b. Wiring specifications (for the large-thrust type)

Used connectors	D5200 series cor	of AMP		
OSCO CONNECTORS	Motor side connector	Wiring cal	Wiring cable side connector	
Connector main unit	Tab housing 1-917808-2	Receptacle housing 1-917807-2		
Contact	Tab contact 917804-2	Receptacle contact 316040-2		
Used wire	U,V,W,E: 1.25 mm <sup>2</sup>	U,V,W,E: At least 1.25 mm <sup>2</sup>		
Wiring cable side pin configuration	A 2 B 2 B 1 B 1 View from the connection	Pin No. B1 B2 A1 A2	Signal name U V W E	

#### 2-5. Effective moving length

Calculate the effective moving length (stroke) of the linear motor when used as described below. Based on the calculated value, design the moving length of your system.

2-5-1. When an automatic pole position detection function is used and no pole sensor is used

The effective moving length is calculated as follows: **Effective moving length = overall** 

#### MG base length - overall CL length.

Note that during automatic pole position detection, the motor reciprocates from the start position of pole position detection in the positive and negative directions with the stroke listed in Table 2-5-1.

(The motor moves from the start position of detection. If the start position is set at an end, the motor may not be able to move.)

Even when the required moving length is very short, set the effective moving length to at least the stroke for automatic pole position detection listed in the table below.

For a  $\tau$  linear/ $\tau$  disc motor, if "automatic pole position detection (motor reciprocation)" at the power-on cannot be performed for the machine (due to interference of a workpiece), use a pole sensor, which is an option of the linear motor.

Table 2-5-1. Stroke for automatic pole position detection

	<u> </u>	
	Stroke for automatic pole	
Motor type	position detection	
	mm	
NVA-AM	±12	
NVA-BM	±12	
NVA-BL	±24	
NVA-DM	±12	

#### 2-5-2. When a pole sensor is used

For how to set the effective moving length, refer to "2-5. Notes on use" in separate manual " $\tau$  Linear Motor Options".

#### 3. Driving direction

When the MG base is fixed and CL unit is movable, for the driving direction of the CL unit, the cable side direction is determined to be the forward direction (FD). (This is independent of the orientation of the MG base.) (Common to each type: See the figure below.)

- \* Installing the linear motor as follows is recommended: The forward direction of the linear motor and that of the linear sensor are the same. (Refer to the sensor specifications to check the driving direction of the linear sensor.)
  - If the forward direction of the linear motor must be opposite to that of the linear sensor for some reason, you can change the direction in either of the following methods:
  - ① When you use a VC II series motor amplifier of Nikki Denso: Change the forward direction of the linear sensor using motor parameter setting.
  - ② When you use an ST700 series absolute encoder of Mitutoyo and a motor amplifier of Nikki Denso: Change the forward direction of the linear sensor using motor parameter setting.

#### 3-1. Low-profile flat type

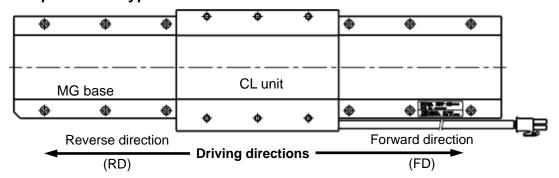


Figure 1a. Driving directions of the low-profile flat type

#### 3-2. High-thrust/large-thrust/standard types

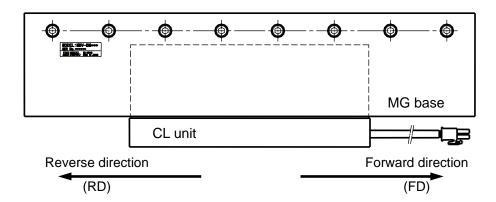


Figure 1b. Driving directions of the high-thrust/large-thrust/standard types

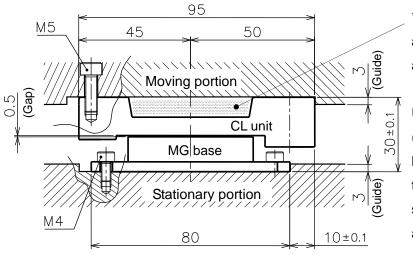
<sup>\*</sup> For both the side and bottom installation types, the driving directions are as shown above.

#### 4. Installation

#### 4-1. Mounting the MG base and CL unit

#### 4-1-1. Low-profile flat type

The following figures show mounting dimensions of the low-profile flat type and recommended surface accuracy.



\* In this space, do not set any obstacle blocking airflow.

Use a mounting guide (such as dowel pins or level differences) to mount the MG base and CL unit so that the centers of them are aligned together as shown the left figure.

Figure 2a. Mounting dimensions of the flat type

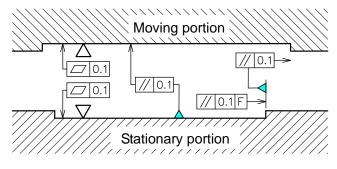


Figure 2b. Recommended surface accuracy

\* Remove foreign matters including burrs and remaining coating materials completely from the motor installation surfaces so that the surfaces are free from gaps and differences in level.

∇: Ry 50S (Rmax 50S)

#### 4-1-2. High-thrust type

#### 4-1-2a. High-thrust type (side installation)

The following figures show mounting dimensions of the high-thrust type (side installation) and recommended surface accuracy.

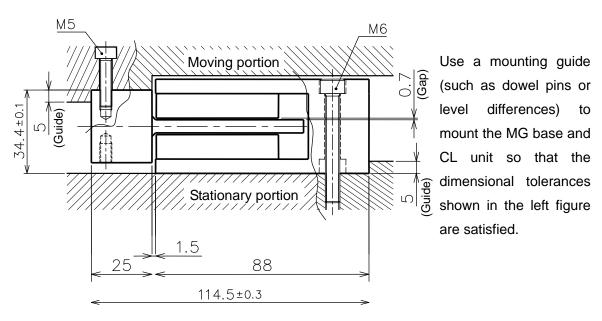


Figure 3a. Mounting dimensions of the high-thrust type (side installation)

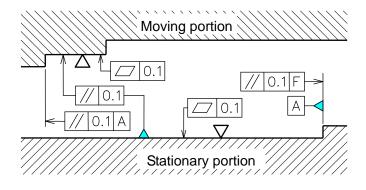


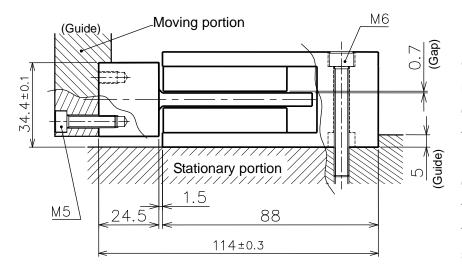
Figure 3b. Recommended surface accuracy

\* Remove foreign matters including burrs and remaining coating materials completely from the motor installation surfaces so that the surfaces are free from gaps and differences in level.

∇: Ry 50S (Rmax 50S)

#### 4-1-2b. High-thrust type (bottom installation)

The following figures show mounting dimensions of the high-thrust type (bottom installation) and recommended surface accuracy.



Use a mounting guide (such as dowel pins or level differences) to mount the MG base and CL unit so that the dimensional tolerances shown in the left figure are satisfied.

Figure 4a. Mounting dimensions of the high-thrust type (bottom installation)

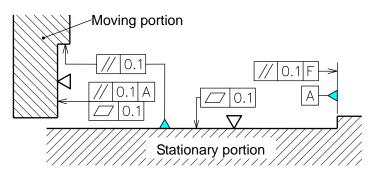


Figure 4b. Recommended surface accuracy

\* Remove foreign matters including burrs and remaining coating materials completely from the motor installation surfaces so that the surfaces are free from gaps and differences in level.

∇: Ry 50S (Rmax 50S)

#### 4-1-3. Large-thrust type

The following figures show mounting dimensions of the large-thrust type and recommended surface accuracy.

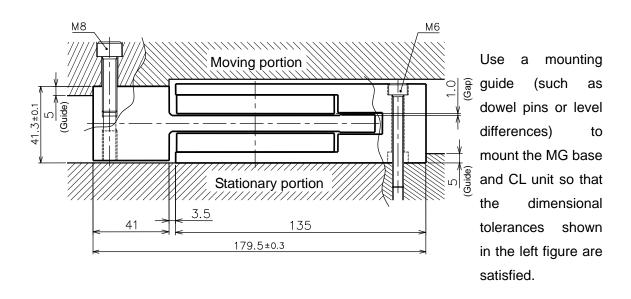


Figure 5a. Mounting dimensions of the large-thrust type

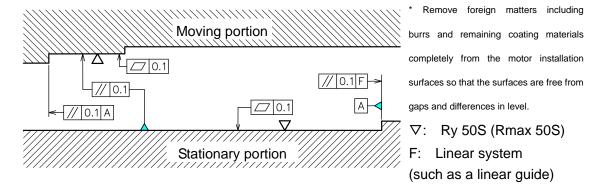


Figure 5b. Recommended surface accuracy

#### 4-1-4. Standard type

#### 4-1-4a. Standard type (side installation)

The following figures show mounting dimensions of the standard type (side installation) and recommended surface accuracy.

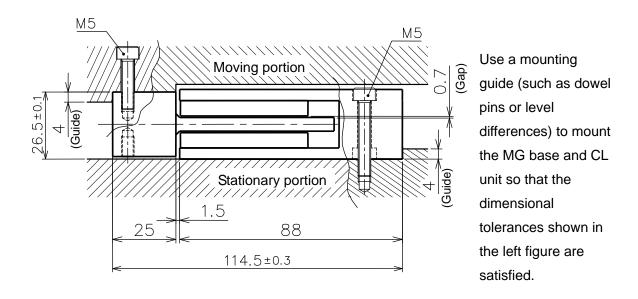


Figure 6a. Mounting dimensions of the standard type (side installation)

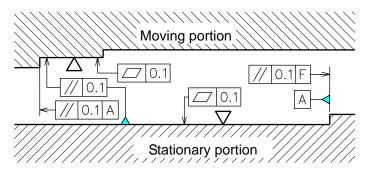


Figure 6b. Recommended surface accuracy

\* Remove foreign matters including burrs and remaining coating materials completely from the motor installation surfaces so that the surfaces are free from gaps and differences in level.

∇: Ry 50S (Rmax 50S)

#### 4-1-4b. Standard type (bottom installation)

The following figures show mounting dimensions of the standard type (bottom installation) and recommended surface accuracy.

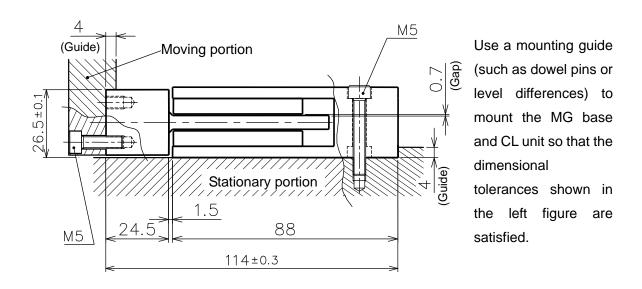


Figure 7a. Mounting dimensions of the standard type (bottom installation)

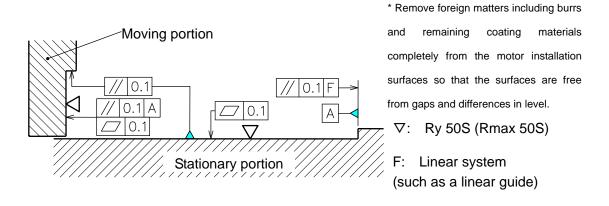
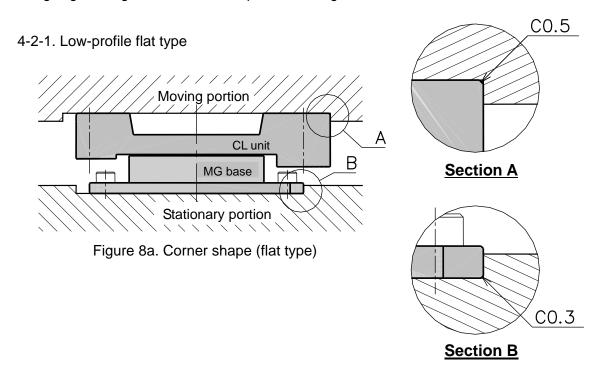


Figure 7b. Recommended surface accuracy

#### 4-2. Corner shape

The following sections describe the "corner shape" of each of the low-profile flat type and high-thrust/large-thrust/standard types. Be careful about the "corner shape" when designing the target machine so that precise butting is made.



#### 4-2-2. High-thrust/large-thrust/standard types

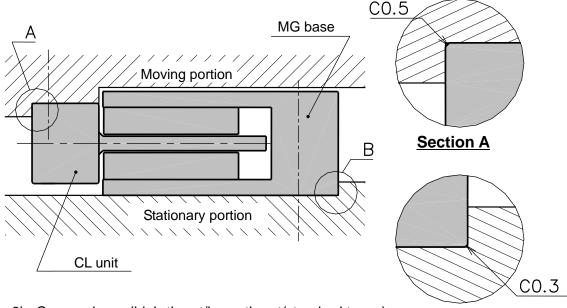


Figure 8b. Corner shape (high-thrust/large-thrust/standard types)

**Section B** 

#### 4-3. Connecting MG bases

#### 4-3-1. Low-profile flat type

Connect MG bases <u>from the left</u> in the descending order of size by following the procedure below.

1) Fix the first MG base.

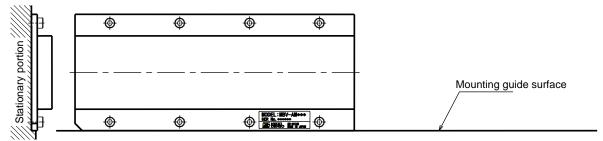


Figure 9a. Connecting MG bases of the low-profile flat type ①

Align the first MG base with the mounting guide surface as shown in the figure above (be careful about the orientation) and fix it.

2) Make the second MG base ready on the right.

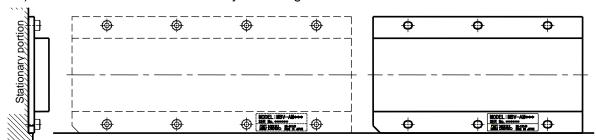


Figure 9b. Connecting MG bases of the low-profile flat type ② Place the second MG base to the right of the first MG base (nameplate side), but keep them away, and align it with the mounting guide surface. (\* Make sure to place the second MG base in the same orientation as for the first MG base.)

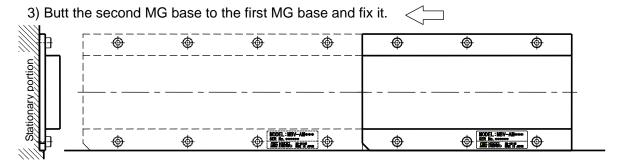


Figure 9c. Connecting MG bases of the low-profile flat type ③

While holding the second MG base so that it does not lift, slide it along the mounting guide surface, butt it to the first MG base slowly, and fix the second MG base with bolts. (\* When they are arranged correctly, they repel each other. Carefully connect them since thrust is not generated with wrong connection.)

#### 4-3-2. High-thrust/large-thrust types

Connect MG bases <u>from the left</u> in the descending order of size by following the procedure below.

1) Fix the first MG base.

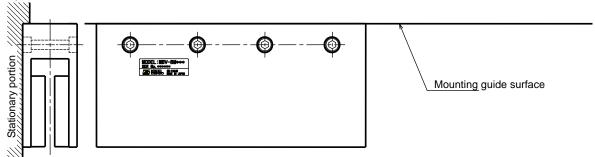


Figure 10a. Connecting MG bases of the high-thrust/large-thrust types ①

Align the first MG base with the mounting guide surface as shown in the figure above (be careful about the orientation) and fix it.

2) Make the second MG base ready on the right.

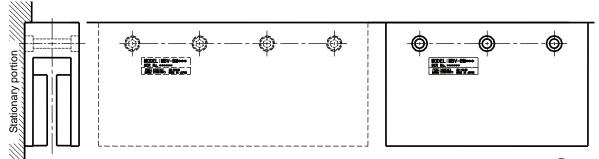


Figure 10b. Connecting MG bases of the high-thrust/large-thrust types ②

Place the second MG base to the right of the first MG base (nameplate side), but keep them away, and align it with the mounting guide surface. (\* Make sure to place the second MG base in the same orientation as for the first MG base.)

3) Butt the second MG base to the first MG base and fix it.

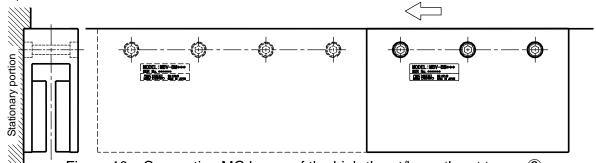


Figure 10c. Connecting MG bases of the high-thrust/large-thrust types ③

While holding the second MG base so that it does not lift, slide it along the mounting guide surface, butt it to the first MG base slowly, and fix the second MG base with bolts. (\* When they are arranged correctly, they repel each other. Carefully connect them since thrust is not generated with wrong connection.)

#### 4-3-3. Standard type

Connect MG bases from the left in the descending order of size by following the procedure below.

1) Fix the first MG base.

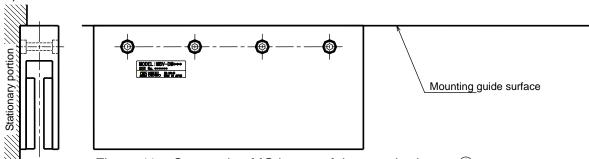


Figure 11a. Connecting MG bases of the standard type ①

Align the first MG base with the mounting guide surface as shown in the figure above (be careful about the orientation) and fix it.

2) Make the second MG base ready on the right.

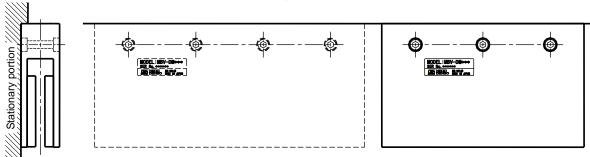


Figure 11b. Connecting MG bases of the standard type ② Place the second MG base to the right of the first MG base (nameplate side), but

keep them away, and align it with the mounting guide surface. (\* Make sure to place the second MG base in the same orientation as for the first MG base.)

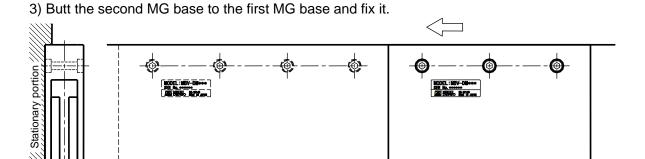


Figure 11c. Connecting MG bases of the standard type ③

Slide the second MG base along the mounting guide surface, butt it to the first MG base slowly, and fix the second MG base with bolts. (\* The MG bases attract each other. Be careful not to catch your finger between them.)

#### 5. Notes on use

When using and operating the motor, follow the precautions below and handle the motor paying due attention to the safety.

#### 5-1. Preparations

- Make sure to properly connect the power lines (including ground wire) and signal cables to the driver.
- · Before wiring work, make sure to turn the power to the used driver off.
- · Carefully conduct wiring so that external noise does not affect the motor or encoder.
- Fix the wires from the motor and encoder appropriately so that they are not moved or no force is applied to them.
- Before running the motor by supplying the power, move the motor moving portion at very low speed manually and confirm that there is no abnormal sound from the motor and the motor does not interfere with any peripheral device.
- Before turning the power on, confirm that nobody is within the machine operation range.
- To clean the CL unit and MG base, wipe them with a dry cloth without using any solvent.

#### 5-2. Operation

- Specify the motor number of the motor to be used for driver parameter "P000: Motor type" correctly. (The motor number is listed in "Applicable motors" in the driver manual.)
- Parameter "P144: Electronic thermal detection selection" is factory-set to "STD: Standard" to prevent the CL unit from being damaged by heat concentrating on one phase. When using the motor under any of the following conditions, set this parameter to "O.L.70%":
  - 1) Synchronous speed and torque control with which each axis cannot be controlled individually are performed with a two-axis specification in which both axes are mechanically connected and interfere with each other. (Example: Gantry control)
  - 2)-1. Repetitive positioning operation within a stroke of 24 mm is performed (for a type other than the large-thrust type).
  - 2)-2. Repetitive positioning operation within a stroke of 48 mm is performed (for the large-thrust type).
  - 3) Torque control is performed for pushing motion against the motor direction in the zero speed state.
  - (Set the above value if the above condition is satisfied also when the master controller performs torque control over a Nikki Denso motor.)
  - 4) The motor is run at a low speed slower than 24 mm/s.
- As described in "Load factor-ambient temperature characteristics" in "2-3. Rated specifications", when degrading is applied according to the ambient temperature depending on the model, set "P144: Electronic thermal detection selection" to "O.L.90%". When "O.L.70%" setting is required as described above, set the parameter to "O.L.70%".
- Conduct a test run by supplying power and mounting neither load nor workpiece, that is, in the no load state.
- \* For details of parameter setting and operation procedure, thoroughly read the manual of the driver you use to perform them properly.

#### 6. Notes on using multiple axes

When mounting CL units for parallel use on multiple axes on the same machine surface and driving them using one driver, install the motor according to the instructions below. (Common to each type)

#### Instructions common to each linear motor type

- Use a driver and controller whose capacity is greater than the total capacity of the CL units and connect them via a terminal block in parallel. (See Figure 1.2.)
- Be sure to make the cables of the CL units face in the same direction and align the direction with the linear sensor as described in "3. Driving direction".
- Place the MG base and CL unit for each axis so that the relative position relationship is within  $\pm 0.15$  mm.
- When you want to use a pole sensor, mount it only on either CL unit.

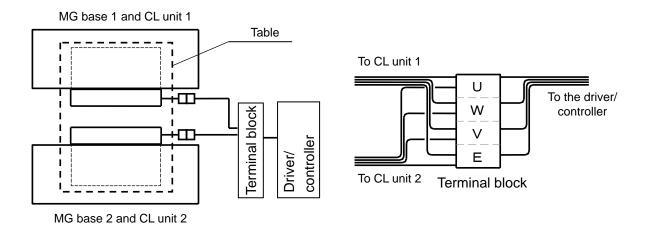


Figure 12. Outline configuration diagram and terminal block wiring specifications

#### 6-1. Low-profile flat type

This section describes the arrangement when motors of the low-profile flat type are used along multiple axes.

While referencing the figure below, mount the MG bases and CL units by checking the nameplate positions particularly.

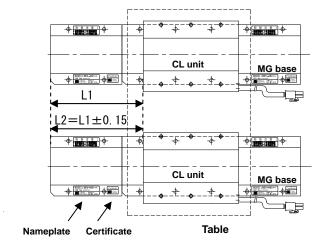
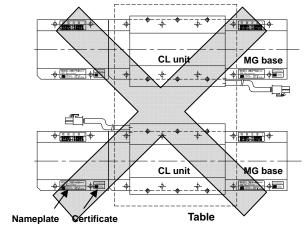
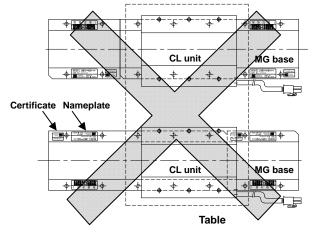


Figure 6-1a. Correct arrangement of motors of the low-profile flat type



Incorrect since the cable directions from the CL units are not the same

Figure 6-1b. Incorrect arrangement of motors of the low-profile flat type



Incorrect since the MG base orientation (nameplate position) is not the same for both CL units

Figure 6-1c. Incorrect arrangement of motors of the low-profile flat type

#### 6-2. High-thrust/large-thrust types

This section describes the arrangement when motors of the high-thrust/large-thrust type are used along multiple axes.

When linear motors of this type are used along multiple axes, either MG base must be turned upside down. For this reason, be sure to use an MG base on which the nameplate is attached on a side.

While referencing the figure below, mount the MG bases and CL units by checking the nameplate positions particularly.

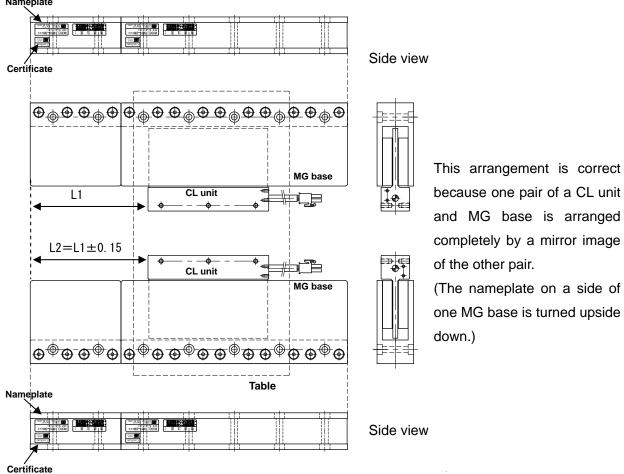
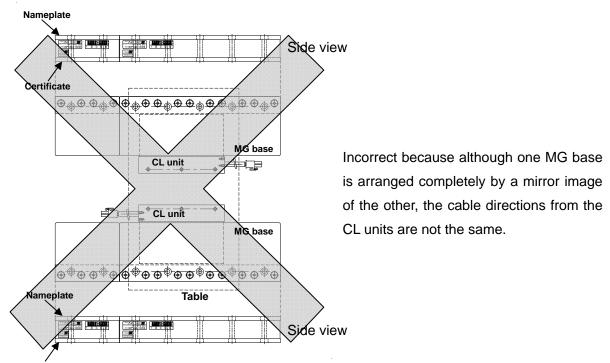


Figure 6-2a. Correct arrangement of motors of the high-thrust/large-thrust type



Certificate Figure 6-2b. Incorrect arrangement of motors of the high-thrust/large-thrust type

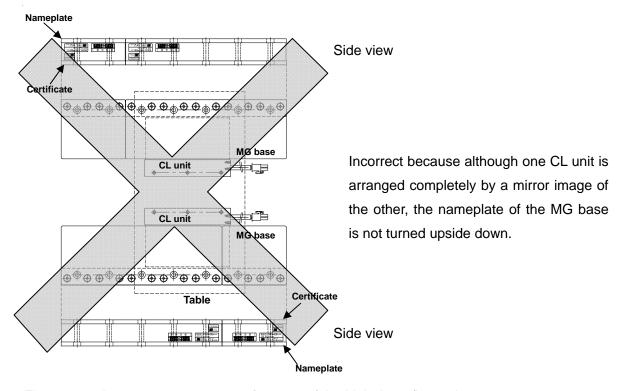


Figure 6-2c. Incorrect arrangement of motors of the high-thrust/large-thrust type

#### 6-3. Standard type

This section describes the arrangement when motors of the standard type are used along multiple axes.

When linear motors of this type are used along multiple axes, either MG base does not need to be turned upside down unlike the MG base described in "6-2. High-thrust/large-thrust types".

While referencing the figure below, mount the MG bases and CL units by checking the nameplate positions particularly.

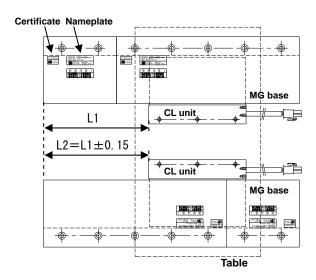
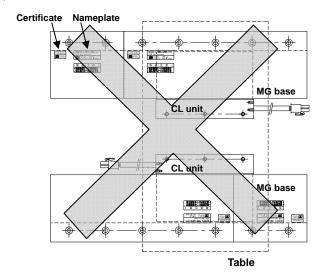


Figure 6-3a. Correct arrangement of motors of the standard type



Incorrect since the cable directions from the CL units are not the same

Figure 6-3b. Incorrect arrangement of motors of the standard type

#### 7. Maintenance

The motor is maintenance-free; however, to prevent a failure due to a change in the use environment, periodically inspect it according to the following instructions.

- Before inspecting the motor, be sure to turn the power to the used driver off.
- The worker who inspects the motor should check the on and off states of the used driver.
- Inspect the motor according to the precautions for maintaining the driver that are described in the manual of the used driver.
- Before measuring the insulation of the motor, completely disconnect the wires between the motor and driver (U, V, and W).

#### 7-1. Daily inspection

Inspect the following items as daily inspection.

- Whether the motor runs normally
- Whether there is any abnormality in the installation environment (check the power supply, temperature, humidity, dust, and other items.)
- Whether there is any abnormality in the cooling system (such as whether anything blocks airflow)
- Whether any terminal or connector is loose
- Whether there is any abnormal sound or vibration
- Whether there is abnormal heat or discoloration

#### 7-2. Periodic inspection

Inspect the following items at intervals of the specified operating time or period (for such as once half a year or once a year) as periodic inspection.

- Whether the section connecting to the load is loose
- Whether there is any abnormality in the installation environment (check the power supply, temperature, humidity, dust, and other items.)
- Whether there is any abnormality in the cooling system (such as whether anything blocks airflow)
- · Whether any terminal or connector is loose
- Whether there is any abnormal sound or vibration
- · Whether there is abnormal heat or discoloration
- Whether there is any scratch or wear on any cable

#### 7-3. Warranty period

The warranty period for the motor is one year from the date of shipment. However, note that failures and abnormalities resulting from the following causes are not covered by this warranty.

- · Modifications by the customer
- · Improper use different from the description in this manual
- Natural disasters
- Improper connection with any manufacturer's product not approved by Nikki Denso

This warranty shall cover only repair of the driver and motor main units. Any damage and loss of chance at your side, which will be induced by a failure of the delivered product, is excluded from the warranty.

## **⚠** Caution

Our products have been designed and manufactured for general-purpose applications in the general industry and are not intended to be used in any equipment or system that may be involved with human life.

For this reason, Nikki Denso assumes no responsibility if our product is used for any other application than we intend.

(Examples: Applications in equipment and systems for atomic, aerospace, medical, and passenger vehicles that may greatly be involved with human-life and assets)