

OPERATING MANUAL

Servo Motor

AZX Series Motor Edition

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Introduction

■ Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product.

Use the product correctly after thoroughly reading the section "Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.

The product described in this manual is designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

■ Related operating manuals




Download the operating manuals from Oriental Motor Website Download Page or contact your nearest Oriental Motor sales office.

- AZX Series OPERATING MANUAL Hardware Edition
- AZX Series OPERATING MANUAL Software Edition



Safety precautions

The precautions described below are intended to ensure the safe and correct use of the product, and to prevent the user and other personnel from exposure to the risk of injury. Use the product only after carefully reading and fully understanding these instructions.

Description of signs

	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

Explanation of graphic symbols



	Indicates "prohibited" actions that must not be performed.
	Indicates "compulsory" actions that must be performed.

Thank you for purchasing an Oriental Motor product.


This Operating Manual describes product handling procedures and safety precautions.

- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

⚠ WARNING

	Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in places subjected to splashing water, or near combustibles. Doing so may result in fire, electric shock, or injury.
	Do not transport, install, connect, or inspect the product while the power is supplied. Doing so may result in electric shock or damage to equipment.
	Do not forcibly bend, pull, or pinch the cable. Doing so may result in fire or electric shock.
	Do not disassemble or modify the motor. Doing so may result in injury or damage to equipment.
	Do not machine or modify the cable. Doing so may result in fire, electrical shock, or damage to equipment.
	Do not apply a strong force to the connector or the terminal. Doing so may damage to the connector or the terminal, resulting in fire, electric shock, or damage to equipment.
	Assign qualified personnel to the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Handling by unqualified personnel may result in fire, electric shock, injury, or damage to equipment.
	Take measures to hold the moving part in position if the product is used in vertical drive such as elevating equipment. Failure to do so may result in injury or damage to equipment.
	Do not use the brake mechanism of the electromagnetic brake motor for braking or as a safety brake. Doing so may result in injury or damage to equipment.
	Take measures to hold the moving part in position since the motor will stop and lose its holding force if an alarm is generated in the driver (any of the driver's protective functions is triggered). Failure to do so may result in injury or damage to equipment.
	Install the motor inside an enclosure. Failure to do so may result in electric shock or injury.
	Be sure to ground the motor as it is Class I equipment. Failure to do so may result in electric shock.

⚠ CAUTION

	Do not use the motor beyond its specifications. Doing so may result in electric shock, injury, or damage to equipment.	
	Keep your fingers and objects out of the openings in the motor. Failure to do so may result in fire, electric shock, or injury.	
	Do not touch the motor during operation or immediately after stopping. The surface is hot, and this may cause a skin burn(s).	
	Do not carry the motor by holding the output shaft or the cable. Doing so may result in injury.	
	Do not place combustibles around the motor. Doing so may result in fire or a skin burn(s).	
	Do not leave anything around the motor that would obstruct ventilation. Doing so may result in damage to equipment.	
	Do not touch the rotating part (output shaft) while operating the motor. Doing so may result in injury.	
	Do not touch the terminals while conducting the insulation resistance measurement or the dielectric strength test. Accidental contact may result in electric shock.	

CAUTION

Provide a cover over the rotating part (output shaft) of the motor. Failure to do so may result in injury.

Use a motor and a driver only in the specified combination. An incorrect combination may cause a fire.

Provide an emergency-stop device or emergency-stop circuit external to equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.

The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the motor during operation, affix a warning label shown in the figure on a conspicuous position. Failure to do so may result in a skin burn(s).



Warning label

- Use the motor in a state where a radial load and an axial load are equal to or less than the permissible values.

Continuing to operate the motor under an excessive radial load or axial load may damage the bearings (ball bearings). Be sure to operate the motor below the specified permissible limits of the radial load and the axial load.

- Noise elimination measures

Refer to the OPERATING MANUAL Hardware Edition for noise elimination measures.

- Do not use the electromagnetic brake for braking or as a safety brake.

Do not use the electromagnetic brake as a means to brake and stop the motor. The brake hub of the electromagnetic brake will wear significantly and the braking force will drop. Since the power off activated type electromagnetic brake is equipped, it helps maintain the position of the load when the power is cut off, but this brake cannot securely hold the load in position. Accordingly, do not use the electromagnetic brake as a safety brake. To use the electromagnetic brake to hold the load in position, do so after the motor has stopped.

- When operating the motor with key in a state where a load is not installed, make sure to provide measures so that the key is not flown off.

To fly off the key may result in injury or damage to equipment.

- Grease of geared motor

On rare occasions, a small amount of grease may ooze out from the geared motor. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

- Peak torque of geared motor

Be sure to operate the geared motor in a state where a load is equal to or less than the peak torque. Applying a load in excess of the peak torque may damage the gear.

- Rotation direction of the gear output shaft

The gearhead output shaft rotates in the same direction as the motor output shaft.

Notes when the connection cable is used

Note the following points when an Oriental Motor cable is used.

- When inserting the connector

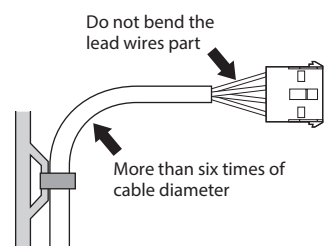
Hold the connector main body, and insert it in straight securely. Inserting the connector in an inclined state may result in damage to terminals or a connection failure.

- When pulling out the connector

Pull out the connector in straight while releasing the lock part of the connector. Pulling out the connector with holding the cable may result in damage to the connector.

- Bending radius of cable

Use the cable in a state where the bending radius of the cable is more than six times of the cable diameter. Do not bend the lead wires part or secure with a clamp, etc. Doing so may result in damage to the connector.



Precautions for use

This section explains restrictions and requirements the user should consider when using the product.

- Always use Oriental Motor cables to connect a motor and a driver.

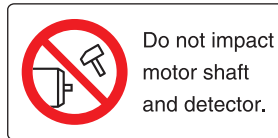
Check on the Oriental Motor Website for the model of cables.

- When conducting the insulation resistance measurement or the dielectric strength test, be sure to separate the connection between the motor and the driver.

Conducting the insulation resistance measurement or the dielectric strength test with the motor and driver connected may result in damage to the product.

- Make sure not to hit or apply a strong impact on the output shaft or the encoder (ABZO sensor).

Applying a strong impact on the output shaft or the encoder (ABZO sensor) may damage to the encoder (ABZO sensor) or cause the motor to malfunction. The warning label shown in the figure is affixed on the motor.



Warning label

- Keep the encoder (ABZO sensor) away from a strong magnetic field.

A magnetic sensor is built into the encoder (ABZO sensor). If the motor is installed close to equipment which generates a strong magnetic field, the encoder (ABZO sensor) may break or malfunction. Make sure to prevent the magnetic flux density on the surface of the encoder (ABZO sensor) from exceeding 10 mT.

- Meshing noise of mechanical sensor

A gear type mechanical sensor is built into the encoder (ABZO sensor). Although the meshing noise of gears may generate, it is not malfunction.

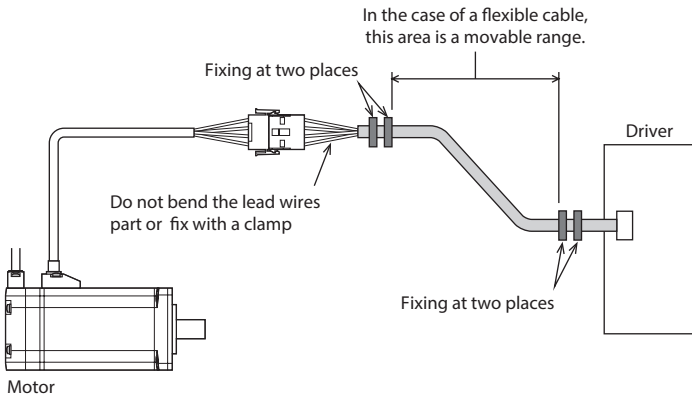
- Use the motor in conditions where its surface temperature does not exceed 80 °C (176 °F).

The surface temperature on the motor case may exceed 80 °C (176 °F) depending on operating conditions such as ambient temperature, operating speed, duty cycle, and others. In order to protect the encoder (ABZO sensor), use the motor in conditions where the surface temperature on the motor case does not exceed 80 °C (176 °F). If the encoder (ABZO sensor) temperature reaches the upper limit, an alarm of the motor overheat protection will be generated.

Use in conditions where the case temperature of the gear section does not exceed 70 °C (158 °F) in order to prevent deterioration of grease and parts in the gear section.

● **How to fix the cable**

Fix the cable at two places near the connectors as shown in the figure or fix it with a wide clamp to take measures to prevent stress from being applied to the connectors.



Preparation

■ **Checking the product**

Verify that the items listed below are included. Report any missing or damaged items to the Oriental Motor sales office from which you purchased the product.

- Motor 1 unit
- Parallel key 1 piece *
- Instructions and Precautions for Safe Use 1 copy
- APPENDIX UL Standards and CSA Standards for **AZX** Series 1 copy

* Included with the geared type.

■ **How to identify the product model**

Verify the model name of the purchased product against the model shown on the name plate of the product.

● **Standard type**

AZX 6 40 A C
1 2 3 4 5

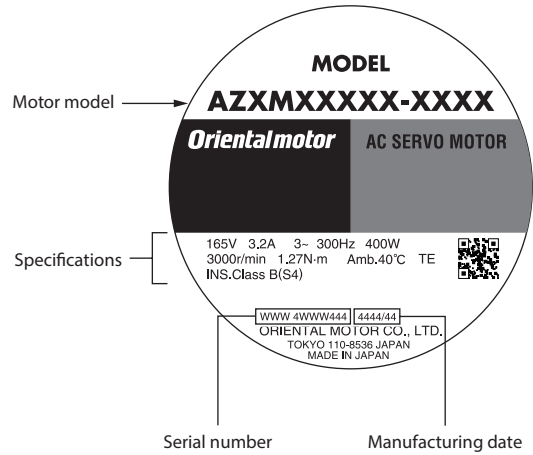
● **Geared type**

AZX 9 40 A C - PS 10
1 2 3 4 5 6 7

1	Series	AZX : AZX Series motor
2	Motor frame size	6 : 60 mm (2.36 in.) 9 : 85 mm (3.35 in.) [90 mm (3.54 in.) for geared type]
3	Output power	40 : 400 W 60 : 600 W
4	Output shaft shape	A : Single shaft M : Equipped with electromagnetic brake
5	Motor specifications	C : AC power input type
6	Gearhead Type	PS : PS geared
7	Gear ratio	

■ **Information about nameplate**

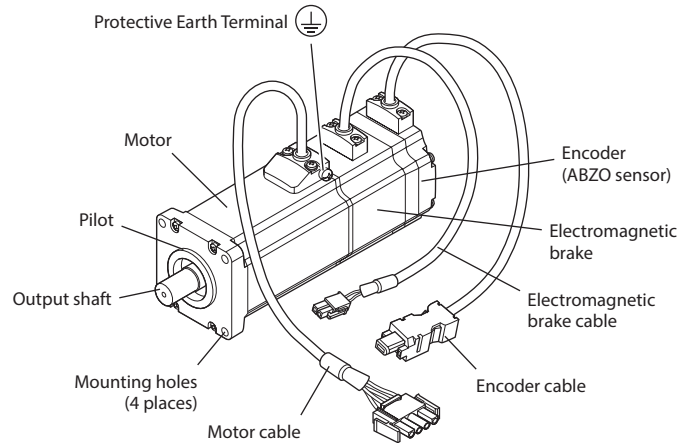
The figure shows an example.



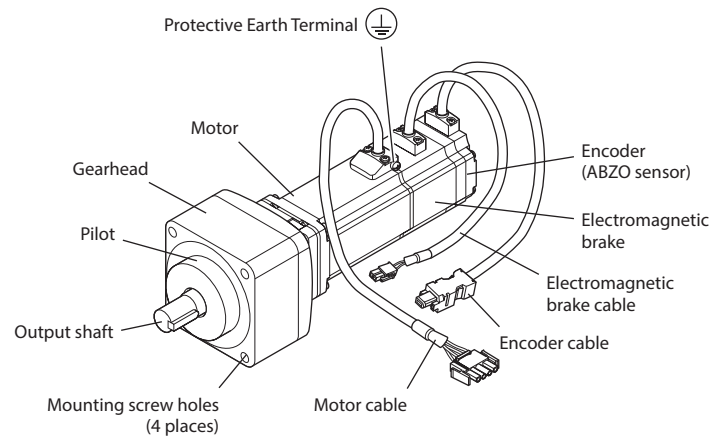
The position describing the information may vary depending on the product.

■ **Names of parts**

● **Standard type with electromagnetic brake (e.g., AZXM640MC)**



● **PS geared type with electromagnetic brake (e.g., AZXM940MC-PS10)**



Installation

Installation location

The motor is designed and manufactured to be incorporated in equipment. Install it in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: 0 to +40 °C (+32 to +104 °F) (non-freezing)
- Operating ambient humidity: 85 % or less (non-condensing)
- Area free of explosive atmosphere, toxic gas (such as sulfuric gas), or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1,000 m (3,300 ft.) above sea level

When a motor is installed in an environment where a magnetic field is generated

A magnetic sensor is built into the encoder (ABZO sensor). If the motor is installed close to equipment which generates a strong magnetic field, the encoder (ABZO sensor) may break or malfunction. Make sure to prevent the magnetic flux density on the surface of the encoder (ABZO sensor) from exceeding 10 mT.

Note Do not install the motor close to equipment which generates a strong magnetic field.

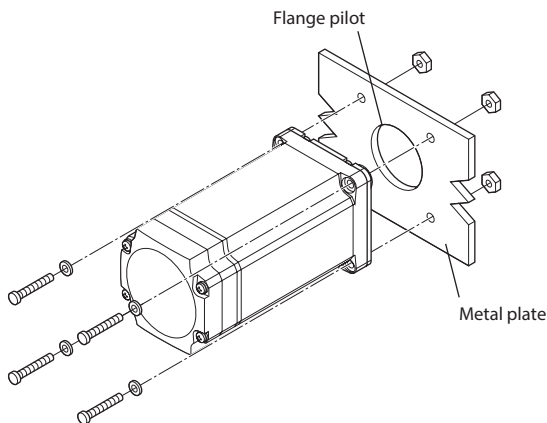
Installation method

The motor can be installed in any direction. Install it securely to a metal surface as strong as possible in consideration of heat dissipation and vibration prevention.

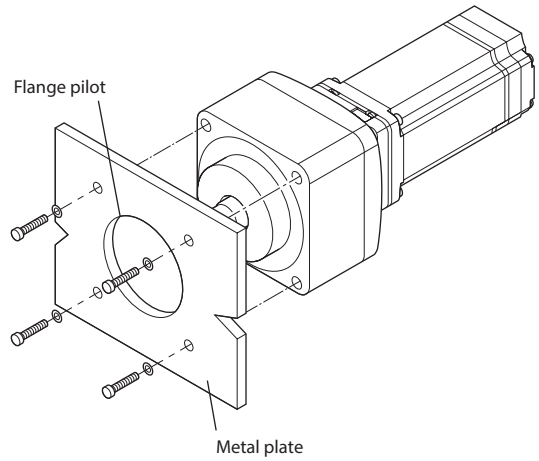
Also, install it in a place where heat dissipation capacity equivalent to a level achieved with a heat sink shown in the table is ensured.

Model	Heat sink material	Heat sink size [mm (in.)]
AZXM640 AZXM940	Aluminum	300×300×10 (11.81×11.81×0.39)
AZXM960		350×350×10 (13.78×13.78×0.39)

Installation method A



Installation method B



Nominal size, tightening torque, and installation method

The values in the tightening torque are recommended. Tighten the screws with a suitable torque according to the design conditions of the metal plate.

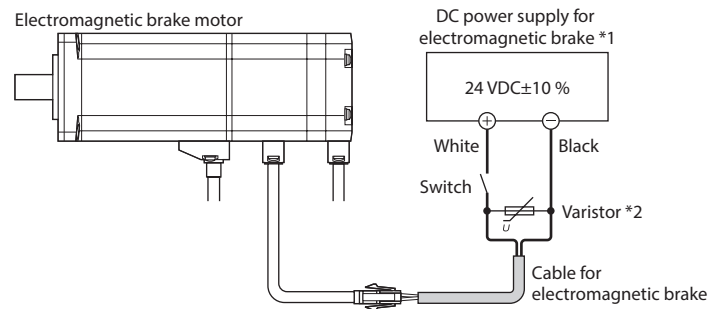
Product type	Frame size [mm (in.)]	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of screw thread [mm (in.)]	Installation method
Standard	60 (2.36)	M4	2 (280)	–	A
	85 (3.35)	M6	5 (710)	–	A
PS geared	90 (3.54)	M8	12 (1,700)	15 (0.59)	B

Installing a load

When installing a load to the motor, align the rotation axis of the load with the output shaft. When installing a coupling or a pulley on the output shaft, do not damage to the output shaft or the bearing (ball bearings).

When an electromagnetic brake motor is used

When releasing the electromagnetic brake to install a load, a DC power supply for the electromagnetic brake is required. Use a cable for electromagnetic brake to connect a DC power supply (24 VDC±10 %) to the motor.



*1 Current capacities of power supplies are as follows.

AZXM640, AZXM940: 0.3 A or more

AZXM960: 0.35 A or more

*2 Use a varistor (not included) to protect the contact of the switch and prevent noise. [Recommended varistor: Z15D121 (SEMITEC Corporation)]

When a coupling or a pulley is installed

When installing a coupling or a pulley on the output shaft, do not apply a strong force to the output shaft. Doing so may damage the encoder (ABZO sensor) due to impact, especially for the standard type.

■ Permissible radial load and permissible axial load



If the radial load or the axial load exceeds the specified permissible value, repeated load application may cause the output shaft or the bearing (ball bearings) to occur a fatigue failure.



For the **PS** geared type, the permissible value is set as a value that satisfies the life of 10,000 hours if either the radial load or the axial load is applied when the input rotation speed is 3,000 r/min.

● Permissible radial load

● Standard type

Model	Permissible radial load [N (lb.)]				
	Distance from output shaft end [mm (in.)]				
	0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZXM640	230 (51)	245 (55)	262 (58)	281 (63)	304 (68)
AZXM960	376 (84)	392 (88)	408 (91)	426 (95)	446 (100)

● PS Geared Type

Model	Gear ratio	Permissible radial load [N (lb.)]				
		Distance from output shaft end [mm (in.)]				
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZXM940	5	380 (85)	420 (94)	470 (105)	540 (121)	630 (141)
	10	480 (108)	530 (119)	590 (132)	680 (153)	790 (177)
	25	650 (146)	720 (162)	810 (182)	920 (200)	1,070 (240)
AZXM960	5	380 (85)	420 (94)	470 (105)	540 (121)	630 (141)

● Permissible axial load

Product type	Model	Permissible axial load [N (lb.)]
Standard	AZXM640	98 (22)
	AZXM960	147 (33)
PS geared	AZXM940 AZXM960	600 (135)

Grounding

The motor can be grounded by connecting the protective earth wire of the cable for motor to the Protective Earth Terminal of the driver. However, if grounding the protective earth wire of the cable for motor does not satisfy the grounding resistance required by the applicable standard of the equipment, the Protective Earth Terminal of the motor must also be grounded.

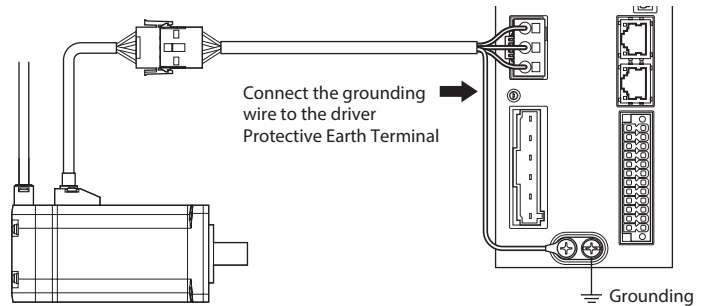


Do not share the grounding wire with a welder or power equipment.

1) Grounding the protective earth wire of the motor

Connect the protective earth wire of the cable for motor to the Protective Earth Terminal of the driver.

Description	Connection cable	Flexible connection cable
Conductor wire size	AWG 16 (1.25 mm ²)	AWG 17 (1.25 mm ²)
Maximum conductor resistance	15.1 Ω/km	18.6 Ω/km
Tightening torque	1.2 N·m (170 oz-in)	



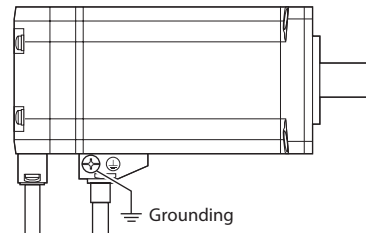
Ground the Protective Earth Terminal of the motor if the grounding resistance required by the applicable standard of the equipment is not satisfied.

2) Grounding the Protective Earth Terminal of the motor

Make sure to ground the Protective Earth Terminal of the motor.

Use a round terminal when grounding, and make sure to secure with a screw and washer. A grounding wire and a crimp terminal are not included.

- Grounding wire: AWG 18 (0.75 mm²) or thicker
- Screw size: M4
- Tightening torque: 1.2 N·m (170 oz-in)



Inspection and maintenance

■ Inspection

It is recommended that periodic inspections are conducted for the items listed below after each operation of the motor. If an abnormality is generated, discontinue any use and contact your nearest Oriental Motor sales office.

● Inspection item

- Check if any of the mounting screws of the motor is loose.
- Check if the bearing (ball bearings) of the motor generates unusual noises.
- Check if a damage or stress is applied on the cable.
- Check if any of the connection parts of the driver is loose.
- Check if the output shaft and the load shaft are out of alignment.

■ Warranty

Check on the Oriental Motor Website for the product warranty.

■ Disposal

Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.

General specifications

Degree of protection	IP65 (Excluding the mounting surface and the connector part)	
Operating environment	Ambient temperature	0 to +40 °C [+32 to +104 °F] (non-freezing) *
	Humidity	85 % or less (non-condensing)
	Altitude	Up to 1,000 m (3,300 ft.) above sea level
Storage environment	Ambient temperature	-20 to +60 °C [-4 to +140 °F] (non-freezing)
	Humidity	85 % or less (non-condensing)
Shipping environment	Altitude	Up to 3,000 m (10,000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. No exposure to water or oil.
Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the following places: - Between case and motor windings - Between case and electromagnetic brake windings	
Dielectric strength	Sufficient to withstand the specified voltage applied between the following places for 1 minute: - Between case and motor windings: 1.5 kVAC 50/60 Hz - Between case and electromagnetic brake windings: 1.0 kVAC 50/60 Hz	

* Based on measurement conditions of Oriental Motor.

Regulations and standards

■ Motor models that comply with regulations and standards

For the standard type, the motor models comply with regulations and standards.

For the geared type, the motor models shown in the table below comply with regulations and standards.

The motor model can be checked by the "Motor P/N" on the nameplate. The box (●) in the model name indicates a number representing the gear ratio.

Geared motor model	Motor model (Motor P/N) that complies with regulations and standards
AZXM940AC-PS●	AZXM640AC
AZXM940MC-PS●	AZXM640MC
AZXM960AC-PS●	AZXM960AC
AZXM960MC-PS●	AZXM960MC

■ UL Standards, CSA Standards

Refer to the "APPENDIX UL Standards and CSA Standards for AZX Series" for recognition information about safety standards.

■ CE Marking/UKCA Marking

● EU Low Voltage Directive / UK Electrical Equipment (Safety) Regulations

- This product cannot be used in IT power distribution systems.
- Isolate the motor cable, the power supply cable and other drive cables from the signal cables by means of double insulation.

● Installation conditions

- Incorporating in equipment
- Overvoltage category: II
- Pollution degree: 3
- Degree of protection: IP65
- Protection against electric shock: Class I

● EU EMC Directive / UK EMC Regulations

The EMC test is conducted in a state where the motor is connected to the driver.

The driver that is combined with the motor complies with the EMC Directive/Regulations. Refer to the OPERATING MANUAL Hardware Edition for details.

● EU RoHS Directive / UK RoHS Regulations

This product does not contain the substances exceeding the restriction values.

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