Installation Instructions

N-Series Brushless Servo Motor

(Catalog Number N-2302-1, N-2304-1, N-3406-2, N-3412-2, N-4214-2, N-4220-2, N-5630-2, N-5637-2, and N-5647-2)

These *Installation Instructions* describe how to install the N-Series motors. Use this document if you are responsible for designing, installing, or troubleshooting the Allen-Bradley N-Series motor products. Read all instructions before installing this motor.

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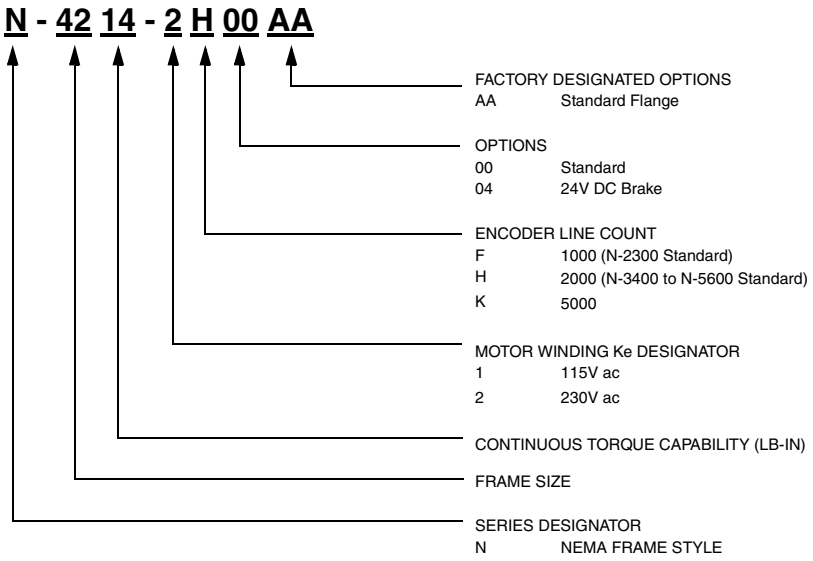
Receiving and Maintenance Information

The customer is responsible for inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order.

Maintain your motor within the following environmental conditions:

- in a clean, dry location
- within the operating temperature range, 0° to 40° C (32° to 104° F)
- within the storage temperature range, 0° to 50° C (32° to 122° F)
- within the relative humidity range, 5% to 95% non-condensing
- in a non-corrosive atmosphere

Motor Catalog Number Identification



Before You Install the Motor

Before installing or storing the motor:

1. Remove the motor carefully from its shipping container.

2. Visually inspect the motor for any damage.

3. Examine the motor frame, front output shaft, and mounting pilot for any defects.

4. Notify the carrier of any shipping damage immediately.

ATTENTION

Do not open or attempt to open the motor.

Only a qualified Allen-Bradley employee can service this type of motor.

Failure to observe these safety procedures could result in personal injury or equipment damage.

Using Couplings and Pulleys

Mechanical connections to the motor shaft, such as couplings and pulleys, require a torsionally rigid coupling or a reinforced timing belt. The high dynamic performance of servo motors can cause couplings, pulleys or belts to loosen or slip over time. A loose or slipping connection will cause system instability and may damage the motor shaft. All connections between the system and the servo motor shaft must be rigid to achieve acceptable response from the system. Periodically inspect connections to verify their rigidity.

When mounting couplings or pulleys to the motor shaft, ensure that the connections are properly aligned and that axial and radial loads are within the specifications of the motor. Refer to *Motor Load Force Ratings* on page 11 for guidelines on how to achieve 20,000 hours of motor bearing life.

Preventing Electrical Noise

ElectroMagnetic Interference (EMI), commonly called noise, may adversely impact motor performance by inducing stray signals. Effective techniques to counter EMI include filtering the AC power, shielding and separating signal carrying lines, and practicing good grounding techniques.

Effective AC power filtering can be achieved by using isolated AC power transformers or properly installed AC line filters.

To help avoid EMI:

1. Physically separate signal lines from motor cabling and power wiring. Do not route signal wires with motor and power wires, or over the vent openings of servo drives.

2. Ground all equipment using a single-point parallel ground system that employs ground bus bars or large straps. If necessary, use additional electrical noise reduction techniques to reduce EMI in noisy environments.

Building and Installing Cables

Knowledgeable cable routing and careful cable construction improves system ElectroMagnetic Compatibility (EMC).

To build and install cables, perform the following steps:

1. Keep wire lengths as short as possible.

2. Route signal cables (encoder, serial, analog) away from motor and power wiring.

3. Separate cables by a minimum of 0.3 m (1 ft) for every 9 m (30 ft) of parallel run.

4. Ground both ends of the encoder cable shield, and twist the signal wire pairs to prevent electromagnetic interference (EMI) from other equipment.

ATTENTION

High voltage can be present on the shield of a power cable if the shield is not grounded.

Ensure there is a connection to ground for any power cable shield.

Failure to observe these safety procedures could result in personal injury or equipment damage.

Installing Your Motor

The installation must comply with all local regulations and use of equipment and installation practices that promote electromagnetic compatibility (EMC) and safety. Preferred fasteners are stainless steel.

ATTENTION

Unmounted motors, disconnected mechanical couplings, and/or disconnected cables are dangerous if power is applied.

Disassembled equipment should be appropriately identified (tagged-out) and access to electrical power restricted (locked-out).

Failure to observe these safety procedures could result in personal injury or equipment damage.

Guidelines for Installation

Observe the following for installing the motor:

1. Allow sufficient clearance around the motor to keep it within its specified operating temperature range. Refer to *Receiving and Maintenance Information* on page 2 for operating range. Do not enclose the motor unless forced air is blown across the motor for cooling. A fan blowing air across the motor will improve its performance. Keep other heat-producing devices away from the motor.

2. Refer to *Mounting Dimensions* on page 8 to determine the mounting dimensions of your motor.

3. Place the motor with connectors pointing downward.

4. Properly mount and align the motor.

5. Attach all power and encoder cables after the motor is mounted, and use a drip loop in the cable to keep liquids flowing away from the connectors.

ATTENTION

Outer surfaces of motor can reach high temperatures, 100° C (212° F) during motor operation.

Take precautions to prevent accidental contact with hot surfaces. Consider motor surface temperature when selecting motor mating connections and cables.

Failure to observe these safety procedures could result in personal injury or equipment damage.

Mounting Dimensions

The dimension symbols and actual dimensions of the different models in the N-Series are referenced in a table on page 9.

Figure 1
N-2300 Mounting Dimensions

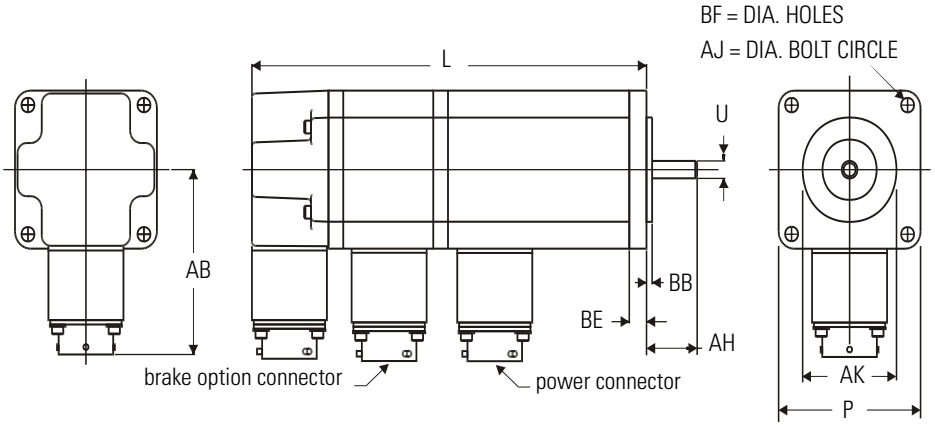
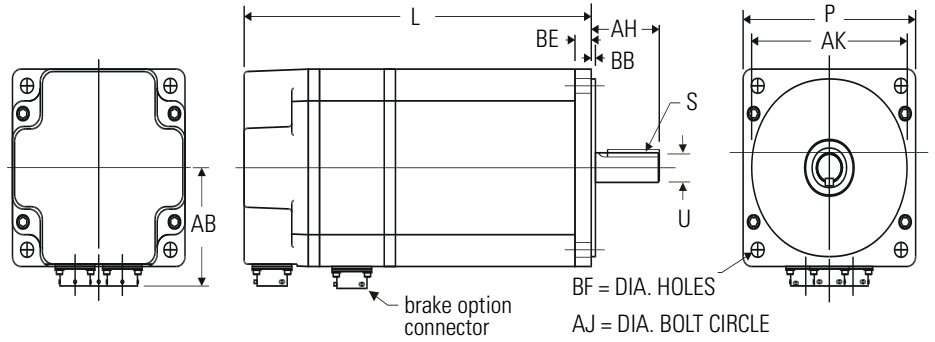


Figure 2
N-3400, N-4200, and N-5600 Mounting Dimensions



Dimension [1] (Refer to drawing)	**Motor**								
	N-2302	**N-2304**	**N-3406**	**N-3412**	**N-4214**	**N-4220**	**N-5630**	**N-5637**	**N-5647**
AB mm (in.)	69.85 (2.75)	69.85 (2.75)	62.99 (2.48)	62.99 (2.48)	62.23 (2.45)	62.23 (2.45)	75.18 (2.96)	75.18 (2.96)	75.18 (2.96)
AH mm (in.)	20.57 (0.81)[2]	20.57 (0.81)[2]	30.23 (1.19)[2]	30.23 (1.19)[2]	35.05 (1.38)[2]	35.05 (1.38)[2]	50.04 (1.97)[2]	50.04 (1.97)[2]	50.04 (1.97)[2]
AJ mm (in.)	66.67 (2.62)	66.67 (2.62)	98.42 (3.87)	98.42 (3.87)	125.73 (4.95)	125.73 (4.95)	149.22 (5.87)	149.22 (5.87)	149.22 (5.87)
AK mm (in.)	38.1 (1.5)[3]	38.1 (1.5)[3]	73.02 (2.877)[5]	73.02 (2.877)[5]	55.55 (2.187)[7]	55.55 (2.187)[7]	114.83 (4.5)[8]	114.83 (4.5)[8]	114.83 (4.5)[8]
BB mm (in.)	2.29 (0.09)	2.29 (0.09)	3.05 (0.12)	3.05 (0.12)	3.05 (0.12)	3.05 (0.12)	3.05 (0.12)	3.05 (0.12)	3.05 (0.12)
BE mm (in.)	6.98 (0.27)	6.98 (0.27)	8 (0.3)	8 (0.3)	10 (0.4)	10 (0.4)	12 (0.5)	12 (0.5)	12 (0.5)
BF mm (in.)	5.2 (0.2)	5.2 (0.2)	5.59 (0.22)	5.59 (0.22)	7.11 (0.28)	7.11 (0.28)	9.52 (0.37)	9.52 (0.37)	9.52 (0.37)
L mm (in.)	177.7 (4.63)	155.8 (6.13)	144.02 (5.67)	169.42 (6.67)	173.87 (6.84)	199.27 (7.84)	198.75 (7.82)	224.15 (8.82)	249.55 (9.82)
L with Brake mm (in.)	161.3 (6.35)	199.4 (7.8)	192.8 (7.6)	218.19 (8.59)	220.73 (8.69)	245.87 (9.68)	255.52 (10.06)	280.92 (11.06)	306.32 (12.06)
P mm (in.)	57.66 (2.27)	57.66 (2.27)	88.4 (3.48)	88.4 (3.48)	101.6 (4)	101.6 (4)	127 (5)	127 (5)	127 (5)
S mm (in.)	–	–	3.17 x 2 (0.125 x 0.085)[6]	3.17 x 2 (0.125 x 0.085)[6]	4.76 x 3 (0.187 x 0.108)[6]	4.76 x 3 (0.187 x 0.108)[6]	4.76 x 3 (0.187 x 0.108)[6]	4.76 x 3 (0.187 x 0.108)[6]	4.76 x 3 (0.187 x 0.108)[6]
U mm (in.)	6.35 (0.25)[4]	6.35 (0.25)[4]	12.7 (0.5)[4]	12.7 (0.5)[4]	15.87 (0.625)[4]	15.87 (0.625)[4]	19 (0.75)[4]	19 (0.75)[4]	19 (0.75)[4]

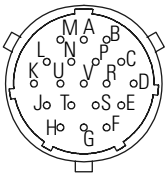
[1] N-Series motors are designed to inch dimensions. Metric measurements are mathematical conversions.
[2] Tolerance is ±0.76 mm (±0.03 in.).
[3] Tolerance is –0.05 mm (–0.002 in.).
[4] Tolerance is –0.013 mm (–0.0005 in.) diameter.
[5] Tolerance is –0.1 mm (–0.004 in.).
[6] Tolerance is –0.05 mm (–0.002 in.) width, –0.38 mm (–0.015 in.) depth.
[7] Tolerance is –0.025 mm (–0.001 in.) diameter.
[8] Tolerance is –0.076 mm (–0.003 in.) diameter.

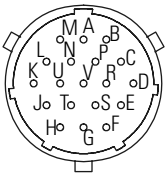
Connector Data

The tables below list the signal descriptions for the encoder, power, and brake connector pins.

NEMA 23-Series Encoder			
Pin	**Signal**	**Pin**	**Signal**
A	A+	L	Common
B	A-	M	Common
C	B+	N	Open
D	B-	P	Open
E	I+	R	Thermostat+
F	I-	S	Thermostat-
G	Open	T	Hall A
H	Open	U	Hall B
J	5 VDC	V	Hall C
K	5 VDC		

NEMA 34, 42, & 56-Series Encoder			
Pin	**Signal**	**Pin**	**Signal**
A	A+	L	Common
B	A-	M	Common
C	B+	N	Open
D	B-	P	Open
E	I+	R	Thermostat+
F	I-	S	Thermostat-
G	Open	T	Hall A
H	ABS	U	Hall B
J	5 VDC	V	Hall C
K	5 VDC		

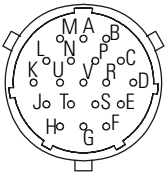


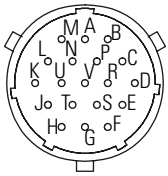


NEMA 23-Series Power Connector	
Pin	**Signal**
A	Phase U
B	Phase V
C	Phase W
D	Ground
E	Open

NEMA 34, 42 & 56-Series Power Connector	
Pin	**Signal**
A	Phase U
B	Phase V
C	Phase W
D	Ground
E	Open

Brake Connector	
Pin	**Signal**
A	BR+
B	BR-
C	Open



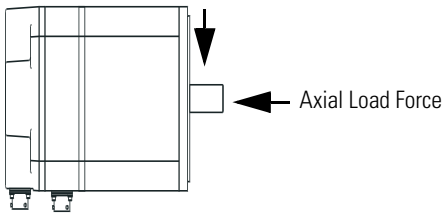


Motor Load Force Ratings

Motors are capable of operating with sustained maximum radial or maximum axial shaft loads. The measurement points for maximum radial and axial load forces are shown in the figure below.

Figure 3
Load Forces on Shaft

1 inch from mounting surface
(Location on shaft where rating is applied. FR



The following table represents load factors that provide a 20,000-hour L10 bearing fatigue life for N-Series motors. These load factors do not account for possible application-specific life reduction factors that may occur, such as bearing grease contamination from external sources.

Shaft Load Force Ratings

Motor Series	**Shaft Radial Load (FR)** kg (lb)
N-2300	2.26 (5)
N-3406	13.6 (30)
N-3412	15.9 (35)
N-4214	20.4 (45)

With no radial load, the axial load rating is 100% of the radial load rating from the table below. With a radial and an axial load, the axial load rating is 44% of the radial load rating from the table below.

Motor Radial Load Force Ratings

Motor	**500 RPM** kg (lb)	**1000 RPM** kg (lb)	**2000 RPM** kg (lb)	**3000 RPM** kg (lb)	**4000 RPM** kg (lb)	**5000 RPM** kg (lb)	**6000 RPM** kg (lb)
N-2302	8 (18)	7 (15)	6 (13)	6 (13)	5 (11)	4 (9)	3 (7)
N-2304	9 (20)	8 (18)	7 (15)	6 (13)	5 (11)	5 (11)	3 (7)
N-3406	47 (104)	37 (82)	29 (64)	26 (57)	23 (51)	22 (48)	20 (44)
N-3412	51 (112)	40 (88)	32 (71)	28 (62)	26 (57)	24 (53)	22 (48)
N-4214	62 (137)	49 (108)	39 (86)	34 (75)	31 (68)	29 (64)	–
N-4220	66 (146)	52 (115)	41 (90)	36 (79)	33 (73)	31 (68)	–
N-5630	85 (187)	67 (148)	53 (117)	47 (104)	43 (95)	–	–
N-5637	89 (196)	71 (157)	56 (123)	49 (108)	45 (99)	–	–
N-5647	92 (203)	73 (161)	58 (128)	51 (112)	–	–	–

Cables and Connector Kits

Factory manufactured cables are available in standard cable lengths. If you choose to build your own cables, the following connector kits are available for connecting N-Series motors.

Catalog Number	Description
2090-NPC-S	Straight Power Connector Kit
2090-NFC-S	Straight Feedback Connector Kit
2090-NBC-S	Straight Brake Connector Kit

Shaft Seal Kits

N-Series motors equipped with a shaft seal will have an IP65 environmental rating. The following shaft seal kits are available for N-Series motors.

Catalog Number	Description
0041-5056	Shaft Seal Kit for N-2300 Series Motors
0041-5065	Shaft Seal Kit for N-3400 Series Motors
0041-5058	Shaft Seal Kit for N-4200 Series Motors
0041-5059	Shaft Seal Kit for N-5600 Series Motors

Notes

For more information refer to our web site: **www.ab.com/motion**
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