



Installation Instructions

W-Series Brushless Servo Motor

(Catalog Number W-3016-N, W-4030-M, W-4030-P, W-4050-P, and W-4075-R)

These installation instructions describe how to install the W-Series motors. Use this document if you are responsible for installing, maintaining, or troubleshooting the Allen-Bradley® W-Series motor products. Please read all instructions before installing the motor.

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Receiving and Maintenance Information

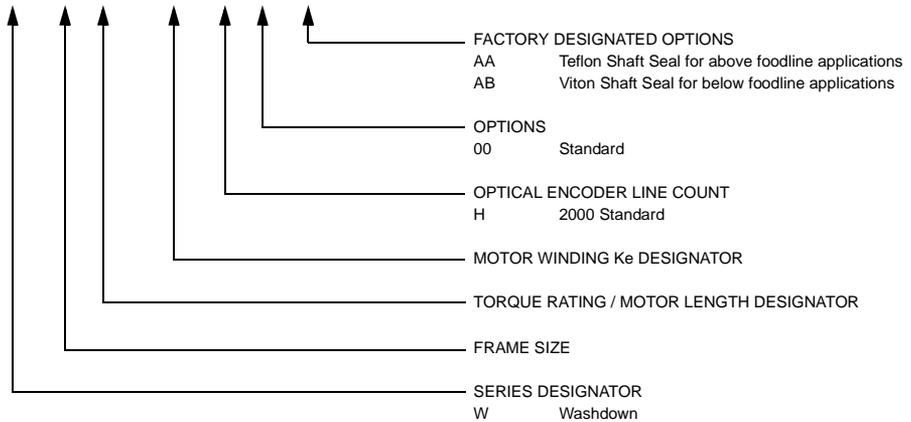
The customer is responsible for inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order. Notify the carrier of any shipping damage immediately.

W-Series (washdown) motors are designed for long-term use in harsh environments. However, you should store your motor for future use within the following environmental conditions:

- in a clean, dry location
- within the storage temperature range, -30° to 70° C (-22° to 158° F)
- within the relative humidity range, 5% to 95% non-condensing
- in a non-corrosive atmosphere

Motor Catalog Number Identification

W - 3016 - N - H 00 AA



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.

ATTENTION



Do not open or attempt to open the motor while power is applied to the motor.

Only a qualified Allen-Bradley employee can service this type of motor. However, the user can access the power and feedback connectors by removing the back cover.

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

Guidelines for Installation and Maintenance

The following sections provide general installation and maintenance information. The information should assist you to correctly install and to provide maintenance that will prolong the lifetime of your W-Series servo motor.

Prolonging Washdown Motor Life

Thoughtful design and proper maintenance can increase the life of a washdown motor. The following are guidelines to maximize the life of a servo motor in a washdown environment:

- Avoid spraying liquids under high pressure directly on the junction of the motor shaft and housing. Fluids under high pressure can be forced around worn seals, and contaminate the motor bearings. Bearing contamination will significantly shorten the life of a servo motor.

If design requirements permit, provide shields that protect the motor housing, shaft, seals and their junctions from product contamination and high pressure fluids.

- Always use watertight cord grips (cable glands) to seal the encoder and power cable openings, and provide a drip loop in each cable.
- If conduit encloses the power or encoder cables:
 - Ensure that conduit lines do not have a negative pressure (vacuum) that may draw water into the conduit line or motor enclosure.
 - Install a short section of flexible conduit between the motor and the rigid conduit to prevent machine vibration or constant pressure from causing cable abrasion or motor misalignment.
- Replace the shaft seal at or before its expected lifetime.
 - Teflon seals have an expected lifetime of 3 to 6 months.
 - Viton seals have an expected lifetime of 12 months or greater.Refer to *Shaft Seals* on page 18 for more information on shaft seals.
- Inspect the motor and seals for damage or wear on a regular basis. If damage or adverse wear is suspected, replace the item.

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 17 for guidelines on how to achieve 20,000 hours of motor bearing life.

ATTENTION



Damage may occur to the motor bearings and the feedback device if sharp impact to the shaft is applied during installation of couplings and pulleys. Damage to the feedback device may result by applying leverage from the motor mounting face to remove devices mounted on the motor shaft.

Do not strike the shaft, couplings, or pulleys with tools during installation or removal. Use a wheel puller applying pressure from the user end of the shaft to remove any friction fit or stuck device from the motor shaft.

Failure to observe these safety procedures could result in damage to the motor and its components.

Building and Installing Cables

Knowledgeable cable routing and careful cable construction improves system ElectroMagnetic Compatibility (EMC). Refer to *Installing Your Motor* on page 9 for suggested feedback and power cable trim lengths, and for cable shield grounding at the motor frame.

To build and install cables, perform the following steps:

1. Keep wire lengths as short as physically possible.
2. Route signal cables (encoder, serial, analog) away from motor and power wiring.
3. Separate cables by 0.3 m (1 ft) minimum for every 9 m (30 ft) of parallel run.
4. Ground both ends of the 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 damage to equipment.

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:

- 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.
- 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.

Using Shaft Seals

A seal is required on the motor shaft near the motor front bearing to reduce exposure to fluids or fine dust that could contaminate the motor bearing and reduce its lifetime. Refer to *Motor Catalog Number Identification* on page 2 to identify the Frame Size and Shaft Seal type for a particular motor. Refer to *Shaft Seals* on page 18 for usage information.

Installing Your Motor

W-Series motors include a mounting pilot for aligning the motor on a machine. Preferred fasteners are stainless steel. The installation must comply with all local regulations and use of equipment and installation practices that promote electromagnetic compatibility (EMC) and safety.

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.

Allow sufficient clearances in the area of the motor for it to stay within its specified operating temperature range, 0° to 40° C (32° to 104° F). 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.

Refer to *Mounting Dimensions* on page 14 to determine the mounting dimensions of your motor.

To install your motor:

1. Remove the endplate (back cover) of the motor by loosening the screws securing it to the motor housing.

IMPORTANT

Use care when removing or installing the endplate to avoid damaging the seal.

2. External feedback and power cables must be stripped to a specified length to provide effective electrical contact with the connector without exposing excessive bare wire. Refer to the table on page 12 for recommended wire strip lengths for Feedback and Power cables.

- trim length for the cable jacket
- shield and strip lengths for wire exposure
- location and length of shield to expose for ground clamp contact

Note that power cable strip lengths differ for the W-3000 or W-4000 servo motors. Refer to *Interconnect Cables* on page 20 for factory available feedback and power cables.

3. Route the external power and feedback cables through the plastic cord grips (cable glands) in the motor endplate. The opening of the strain relief extension may be increased by turning it counterclockwise.
4. Connect the power and feedback cables to the motor as shown in Figure 1 or Figure 2 on page 13 and described below:
 - a. Connect the ground clamps to the power and feedback cables where the shield wire is exposed. Refer to the figures on page 12.
 - b. Connect the ground clamps to the motor.
 - c. Route and connect the individual feedback and power wires to their respective terminals. *Connector Data* on page 16 lists the signal terminals, screw torque values, and acceptable wire sizes.

Note: The top terminal bar on the feedback connector is removable. Removing it improves access to the power cable terminals in addition to providing clear access to the feedback cable terminals and screws.

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5. Seal the motor housing by performing the following sequential steps:
 - a. Position the endplate on the motor while ensuring the cable lengths and routing internal to the motor remain proper.
 - b. Torque the screws securing the endplate to 3.4 Nm (30 in-lb) to seal the motor.
 - c. Turn clockwise the strain relief extension on the plastic cord grips (cable glands) to seal the encoder and power cable openings.
 6. Properly mount and align the motor. Refer to *Mounting Dimensions* on page 14 as necessary.
 7. After the motor is mounted, ensure that all power and encoder cables have a drip loop in the cable to keep liquids flowing away from the motor.
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ATTENTION

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



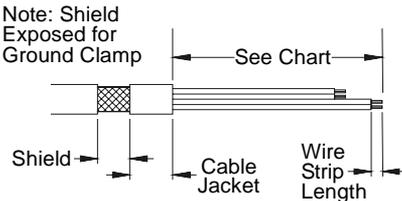
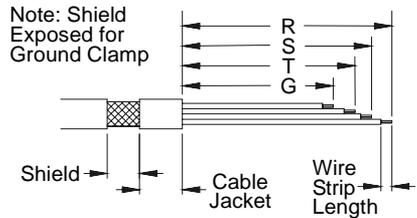
Take precautions to prevent accidental contact with hot surfaces. Consider motor surface temperature when selecting motor mating connections and cables.

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

Feedback Cable			
Terminal No. or Wire	W-3000 and W-4000		Signal
	mm	(in.)	
1	101.60	(4.0)	A
2	101.60	(4.0)	A-
3	101.60	(4.0)	B
4	101.60	(4.0)	B-
5	101.60	(4.0)	I
6	101.60	(4.0)	I-
7	101.60	(4.0)	Ground
8	101.60	(4.0)	ABS
9	114.30	(4.5)	+5VDC
10	114.30	(4.5)	COM
11	114.30	(4.5)	Hall B
12	114.30	(4.5)	Hall C
13	114.30	(4.5)	Thermostat
14	114.30	(4.5)	Thermostat
15	114.30	(4.5)	Hall A
Shield	9.53	(0.38)	Shield
Cable Jacket	12.7	(0.50)	—
Wire Strip Length	7.0	(0.28)	—

Power Cable				
Terminal or Wire	W-3000		W-4000	
	mm	(in)	mm	(in.)
R ¹	55.75	(2.25)	69.85	(2.75)
S ¹	53.98	(2.125)	63.50	(2.5)
T ¹	50.8	(2.0)	57.15	(2.25)
G	44.45	(1.75)	50.8	(2.0)
Shield	9.53	(0.38)	9.53	(0.38)
Cable Jacket	12.7	(0.50)	12.7	(0.50)
Wire Strip Length	4.76	(0.19)	4.76	(0.19)

¹ Cables and drives may label the R, S and T power phases as U, V and W respectively.



Note: Shield Exposed for Ground Clamp

See Chart

Shield

Cable Jacket

Wire Strip Length

Figure 1
W-3000 Cable Connector and Ground Clamp Locations

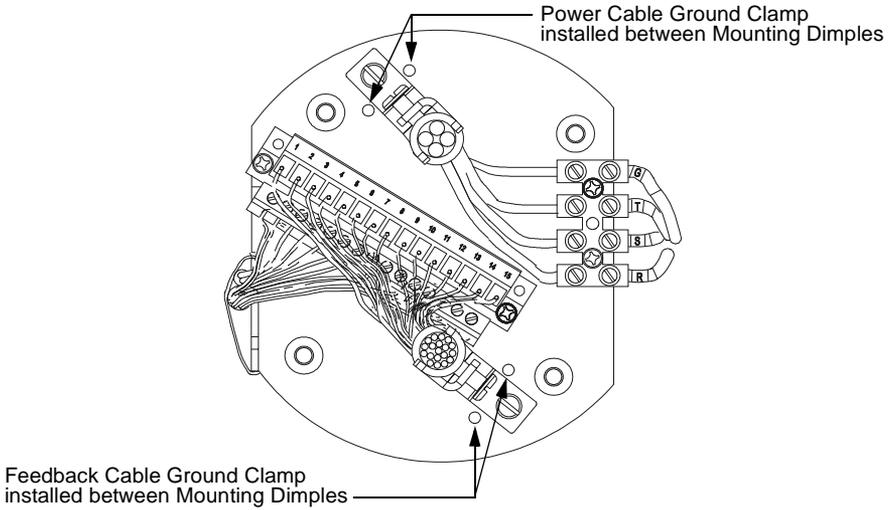
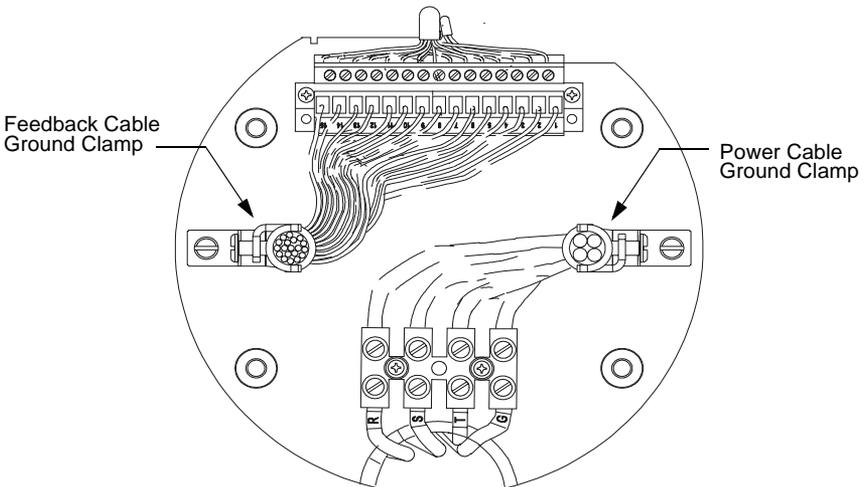


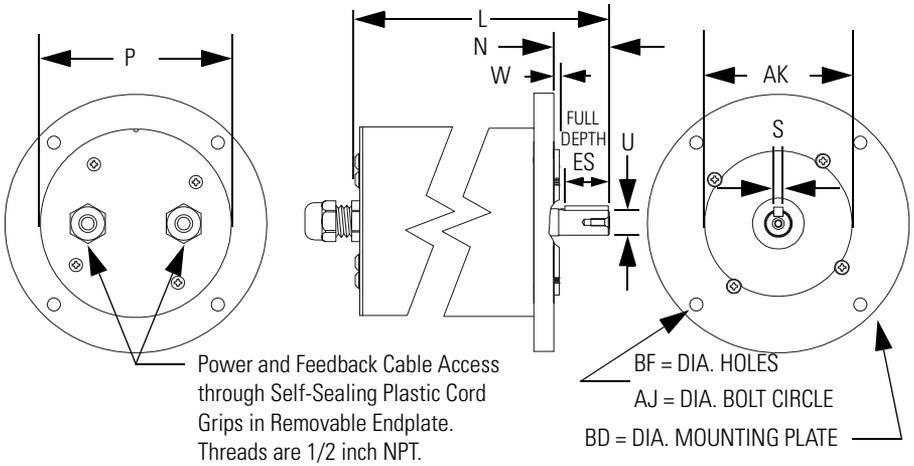
Figure 2
W-4000 Cable Connector and Ground Clamp Locations



Mounting Dimensions

The dimension symbols and actual dimensions of the different models in the W-Series are referenced in the table on the next page.

Figure 3
Reference Drawing for Mounting Dimensions



Dimension (Refer to drawing)		Motor Measurement ¹				
		W-3016	W-4030	W-4050	W-4075	
AJ	mm	125.7	145.0	145.0	145.0	
	(in.)	(4.95)	(5.71)	(5.71)	(5.71)	
AK	mm	80.0	110.0	110.0	110.0	
	(in.)	(3.15)	(4.33)	(4.33)	(4.33)	
BD	mm	142.0	162.8	162.8	162.8	
	(in.)	(5.59)	(6.41)	(6.41)	(6.41)	
BF	mm	7.1	10.0	10.0	10.0	
	(in.)	(0.28)	(0.39)	(0.39)	(0.39)	
ES	mm	20.0	40.0	40.0	40.0	
	(in.)	(0.79)	(1.57)	(1.57)	(1.57)	
L	mm	305.0	317.0	368.0	419.0	
	(in.)	(12.01)	(12.48)	(14.49)	(16.50)	
N	mm	30	50	50	50	
	(in.)	(1.18)	(1.97)	(1.97)	(1.97)	
P	mm	102	126	126	126	
	(in.)	(4.02)	(4.96)	(4.96)	(4.96)	
S	mm	5	6	6	6	
	(in.)	(0.20)	(0.24)	(0.24)	(0.24)	
U	mm	14	19	19	19	
	(in.)	(0.59)	(0.79)	(0.79)	(0.79)	
W	mm	3	3	3	3	
	(in.)	(0.12)	(0.12)	(0.12)	(0.12)	
Key (supplied)	mm	5 x 5 x 20	6 x 6 x 40	6 x 6 x 40	5 x 5 x 20	
Shaft End Hole Thread	mm	M4 x 0.7	M6 x 1	M6 x 1	M6 x 1	
Shaft End Hole Thread Depth	mm	10	15	15	15	
	(in.)	(3.94)	(5.90)	(5.90)	(5.90)	
Tolerances	AK	mm	-0.030	-0.35	-0.35	-0.35
		(in.)	(-0.001)	(-0.001)	(-0.001)	(-0.001)
	L	mm	±0.5	±0.5	±0.5	±0.5
		(in.)	(±0.002)	(±0.002)	(±0.002)	(±0.002)
	N	mm	±0.5	±0.5	±0.5	±0.5
		(in.)	(±0.002)	(±0.002)	(±0.002)	(±0.002)
	S	mm	-0.030	-0.030	-0.030	-0.030
		(in.)	(-0.001)	(-0.001)	(-0.001)	(-0.001)
	U	mm	-0.011	-0.013	-0.013	-0.013
		(in.)	(-0.0005)	(-0.0005)	(-0.0005)	(-0.0005)
	W	mm	±0.2	±0.2	±0.2	±0.2
		(in.)	(±0.008)	(±0.008)	(±0.008)	(±0.008)

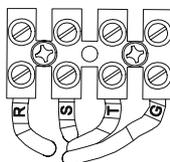
¹ W-Series motors are designed to metric dimensions. Inch measurements are mathematical conversions.

Connector Data

The tables below list the signal descriptions for the feedback and power connector terminals.

Feedback Connector ¹	
Terminal ²	Signal
1	A
2	A-
3	B
4	B-
5	I
6	I-
7	Ground ³
8	ABS
9	+5VDC
10	Common
11	Hall B
12	Hall C
13	Thermostat
14	Thermostat
15	Hall A

Power Connector ⁴	
Terminal ⁵	Lead
1	Phase R ⁶
2	Phase S ⁶
3	Phase T ⁶
4	Ground

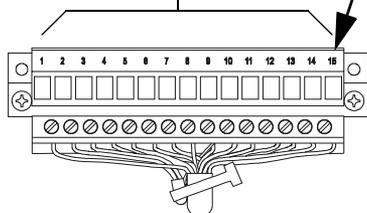


NOTES:

- ¹ Feedback connector accepts wire diameter 0.08–1.5 mm² (AWG 28–16).
- ² Screw torque values for the feedback signal wires are 0.23–0.25 Nm (2.0–2.2 lb-in).
- ³ Terminal 7, Ground is provided for termination of a cable drain wire when braided shield is not available. Use of the ground clamp for termination of braided shield is preferred over the use of terminal 7.
- ⁴ Power connector accepts wire diameter:
W-3000 = 4 mm² (AWG 12) maximum
W-4000 = 6 mm² (AWG 10) maximum
- ⁵ Screw torque values for the power leads are 0.45–0.68 Nm (4.0–6.0 lb-in).
- ⁶ Cables and drives may label the R, S and T power phases as U, V and W respectively.

Removable Top Terminal Half

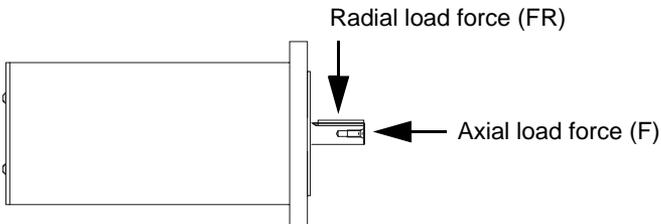
Terminal Screws for Feedback Signal Wires located on the front of Top Terminal Half



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 4
Load Forces on Shaft



Radial load force (FR) applied to center of shaft extension

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

Radial Load and Axial Load Force Ratings

Motor	500 rpm		1000 rpm		2000 rpm		3000 rpm	
	kg	(lbs)	kg	(lbs)	kg	(lbs)	kg	(lbs)
W-3016	57.2	(126)	45.8	(101)	35.8	(79)	31.3	(69)
W-4030	76.7	(169)	69	(152)	54.4	(120)	47.6	(105)
W-4050	93	(205)	74.4	(164)	58.5	(129)	51.3	(113)
W-4075	97.5	(215)	78.5	(173)	62.1	(137)	53.5	(118)

When motor shaft has no radial load, axial load rating = 100% of radial load rating listed above.

When motor shaft has both a radial load and an axial load, axial load rating = 44% of radial load rating listed above.

Shaft Seals

Shaft seals that provide environmental sealing of W-Series motors are available from Allen-Bradley. They provide an additional barrier to moisture and particle intrusion to the motor bearings. W-Series motors are shipped with either a Teflon or a Viton shaft seal installed.

Using Shaft Seals

Teflon shaft seals are primarily for applications above a foodline. As such, Teflon shaft seals are not lubricated and are typically replaced at 3 to 6 month intervals.

Viton shaft seals may be lubricated and should only be used in applications below a foodline. Viton shaft seals are typically replaced at 12 month or greater intervals when lubricated. Lubricant is supplied with Viton shaft seal kits.

Removal and Installation of Shaft Seals

IMPORTANT

Damage to the motor surface where shaft seals make contact can cause excessive wear and early failure of the shaft seal.

Use care to prevent scratching or damaging the surface of the motor.

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

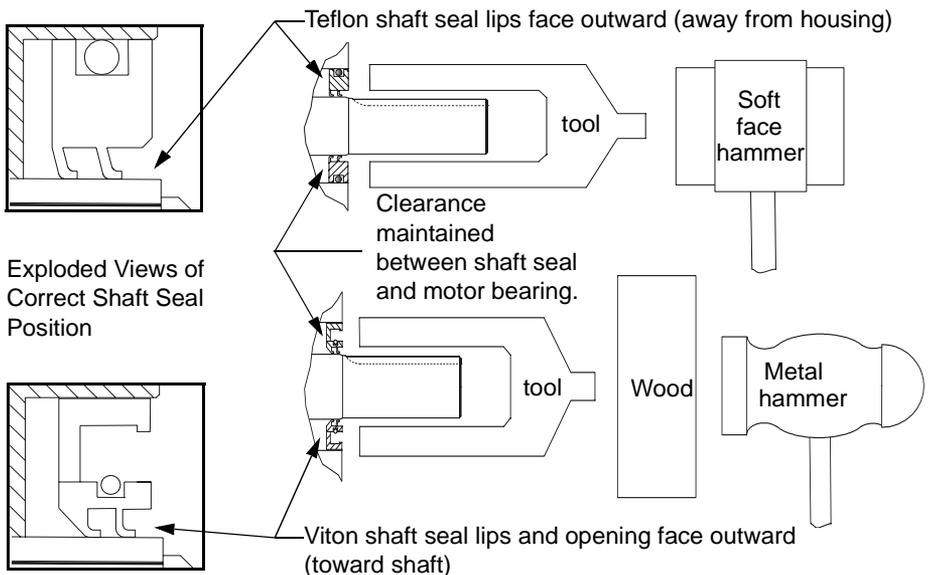
Teflon seals may be removed by carefully lifting with a small, flat-bladed screwdriver around the outside edge of the seal.

Viton seals are mounted on a steel carrier. They may be removed by carefully forcing a small, flat-bladed screwdriver between the seal and the end cap periphery. This deforms the metal inward until there is sufficient room to grasp the deformed steel with a needle-nose pliers and remove the seal.

To install a new shaft seal:

1. Remove shaft key, if provided.
2. Check the motor shaft and faceplate. Remove nicks and burrs.
3. Protect the seal lip from the sharp edges of the keyway. If necessary, place masking tape over the keyway.
4. Position the seal on the shaft with the sealing lips positioned and slanting outward as shown in Figure 5. If using a Viton shaft seal, lubricant may be applied prior to seating the shaft seal. Do not use lubricant with a Teflon shaft seal.
5. Use proper tooling to seat the shaft seal. Do not hammer directly on shaft seal. Apply force evenly around the outer edge with a soft face tool, arbor press, or a work piece made from soft wood.
6. Push shaft seal into motor just far enough so outer diameter of the seal is flush with the front surface of the motor. This leaves a slight clearance between the shaft seal and the motor bearing.

Figure 5
Teflon and Viton Shaft Seal Installation



Shaft Seal Kits

Shaft seal kits available from the factory include:

Catalog Number	Description	Applicable Motor
0041-5072	Teflon shaft seal kit for use above foodlines	W-3000
0041-5073	Viton shaft seal for use below foodlines ¹	
0041-5074	Teflon shaft seal kit for use above foodlines	W-4000
0041-5075	Viton shaft seal for use below foodlines ¹	

¹ Lubricant is provided with Viton shaft seal kits.

Interconnect Cables

Factory manufactured cables are available in standard cable lengths. They can provide environmental sealing and shield termination. The following cables are for connecting the W-Series motors.

Catalog Number	Description	Applicable Motor
2090-UXNPAHF-16-Sxx ¹	H-3000 Power Cable ²	W-3000
2090-UXNPAHF-14-Sxx ¹	H-4000 Power Cable ²	W-4000
2090-UXNFBHF-Sxx ¹	H-Series Feedback Cable ²	W-3000 and W-4000

¹ Cable length (xx) is specified in meters: 01, 03, 09, 15 or 30 (3.3, 9.8, 29.5, 49.2 or 98.5 ft)

² H-Series Power and Feedback Cables have an MS connector on the motor end of the cable. Remove the MS connector to use the cable with W-Series motors.

Notes

Allen-Bradley is a registered trademark of Rockwell Automation.

www.rockwellautomation.com

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