INDUSTRIAL **BEARING PROTECTION** HANDBOOK

4th Edition

Best Practices for Bearing Protection in New and Repaired Motors, Testing In-Service Motors, and Inspecting Damaged Motor Bearings

Electro Static Technology™
An ITW Company

Company Information

Electro Static Technology, an ITW Company, is a global manufacturer and the inventor of AEGIS® Shaft Grounding Rings, used in electric motors and other rotating equipment to safely discharge stray voltage to ground. AEGIS® Shaft Grounding Ring technology is installed in all ranges of motors, from fractional horsepower to thousands of HP/kW, used in virtually all commercial and industrial applications.

AEGIS® Shaft Grounding Rings use 360° of conductive contact to reliably protect bearings from electrical discharges that cause frosting and fluting damage. AEGIS® technology uses proprietary conductive microfibers arranged circumferentially around the motor shaft and secured in our patented AEGIS® FiberLock™ channel, protecting them during operation. The following patents apply: 8199453, 8169766, 7193836, 7136271, 7528513, 7339777, and other patents pending.

Electro Static Technology is proud to be an ISO 9001:2015 company. Certificate Number: 17116

This is the 4th Edition of the AEGIS® Industrial Bearing Protection Handbook. For electric vehicle applications, see **est-aegis.com/applications/electric-vehicle-solutions**

2-YEAR EXTENDED WARRANTY

Electro Static Technology (EST, AEGIS®) guarantees that AC induction motor bearings will not fail from electrical fluting damage when AEGIS® Shaft Grounding Rings have been installed with new bearings in accordance with EST's recommended best practices, as published in the AEGIS® Bearing Protection Handbook (current edition). See page **47** for more information about the 2-Year Extended Warranty, or visit **est-aegis.com**.

Register your motor at **est-aegis.com/warranty**

Units are guaranteed for one year from date of purchase against defective materials and workmanship. Replacement will be made except for defects caused by abnormal use or mishandling. All statements and technical information contained herein, or presented by the manufacturer or their representative are rendered in good faith. User must assume responsibility to determine suitability of the product for intended use. The manufacturer shall not be liable for any injury, loss, or damage, direct or consequential, arising from the use, or attempt to use, the product.

⚠ SAFETY

Follow all workplace safety policies and procedures applicable to electric motor repair and for all hazardous operations. Wear all applicable personal protective equipment (PPE) required by the applicable law. Employees should be informed of the relevant safety rules and employers should enforce compliance. The manufacturer shall not be liable for any injury, loss or damage, direct or consequential arising out of the use, or attempt to use the product or procedures described in this manual.

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The Electro•Mechanical Authority

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ISO 9001 QUALITY MANAGEMENT

ANAB ACCREDITED ISO/IEC 17021 MANAGEMENT SYSTEMS CERTIFICATION BODY

ELECTRIC MOTOR CONTROL BY VARIABLE FREQUENCY DRIVES

Variable frequency drives (VFDs) are widely used to control electric motors in applications from HVAC to manufacturing to electric vehicles. Current estimates suggest that up to 30% of electric motors are controlled by VFD. These drives can run motors at a wide range of speeds. This enables precise control, and also significant energy savings in variable torque applications (fans, pumps, etc.).

Three Phase Power

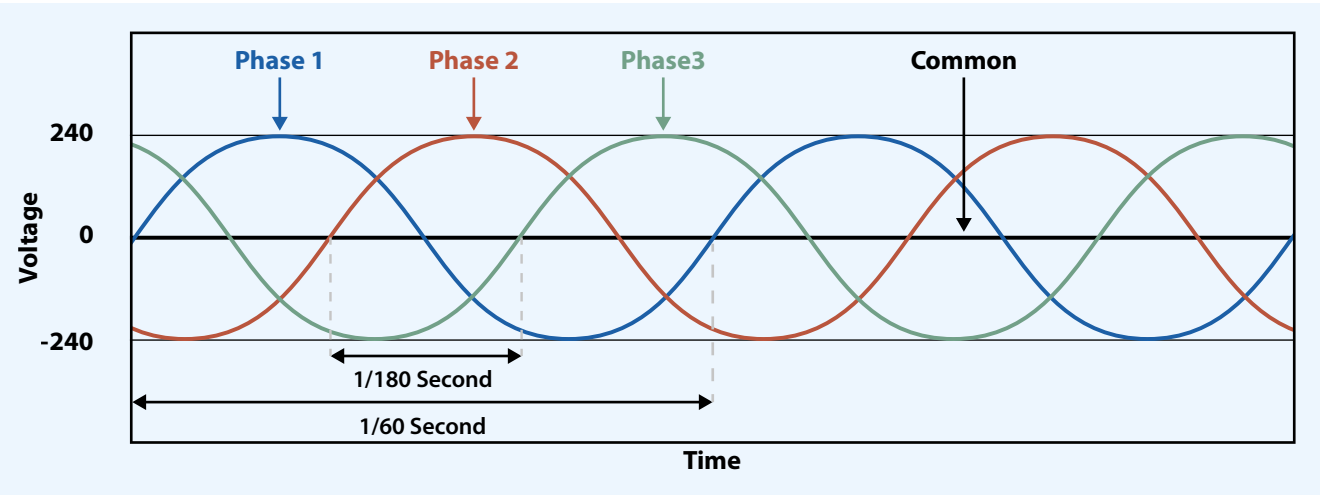


Figure 1

VFDs do this by a process called pulse width modulation (PWM), rectifying AC voltage from the mains (Figure 1), storing it in the DC bus, and then releasing precisely timed pulses of voltage to simulate a sinusoidal waveform (Figure 2). The pulses are typically controlled by IGBTs, a type of diode with very high switching speeds (around 100 nanoseconds, or one ten-millionth of a second).

Common Mode Voltage (CMV)

With line power, the voltage of the three phases always adds to zero (black line in Figure 1). This minimizes the risk of charging stray capacitances when three phase machines are run on line voltage. This is not the case with PWM voltage. The "common mode voltage," the average of the three phase voltages (Figure 3), has peak values of hundreds of volts. This large CMV produces stray currents in electric motors by charging internal capacitances. The problem is made worse by the drive's fast switching speeds, which lead to rapid voltage changes ("high dv/dt") in the phase and CM voltages.

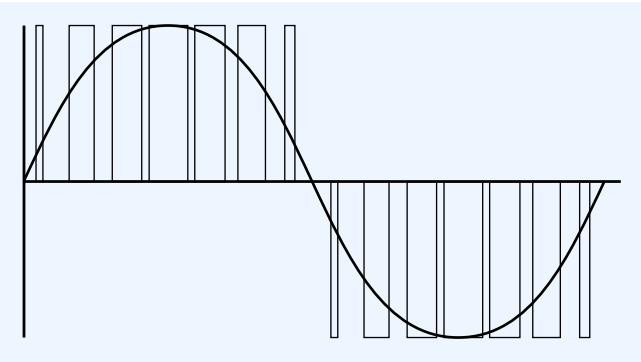


Figure 2

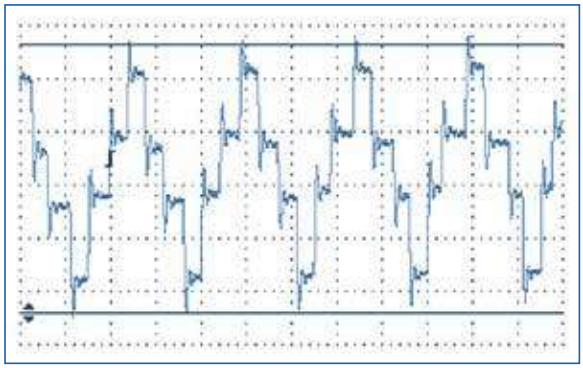
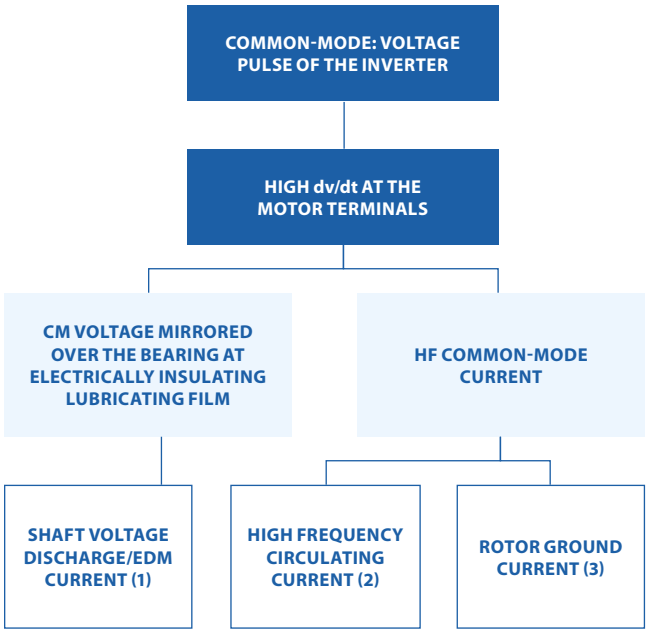


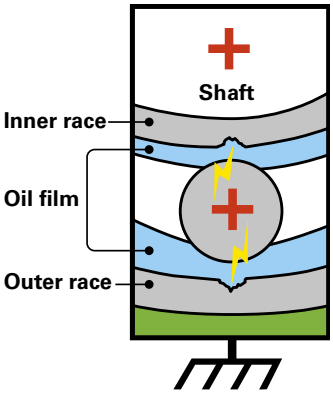
Figure 3

The CMV causes several problems in motors, but we are only concerned with bearing currents. When voltage pulses reach the motor, they charge the rotor, creating a voltage on the shaft, and also drive high frequency current into the frame. Shaft voltage can discharge through the bearings, and high frequency current in the frame can drive high frequency circulating current and rotor ground current through the bearings.

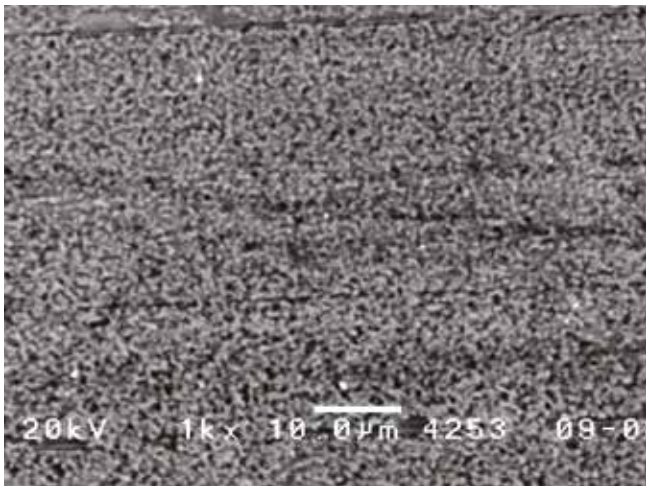
VFD-SOURCED BEARING CURRENTS

These three types of bearing current electrically damage motor bearings. When they arc through the grease, they strike and melt the bearing steel, creating microscopic pits. Over time, these pits accumulate to produce "frosting" of the bearing. As the damage progresses, the bearing race develops a "picket-fence" pattern called fluting. By the time fluting develops, failure is imminent.

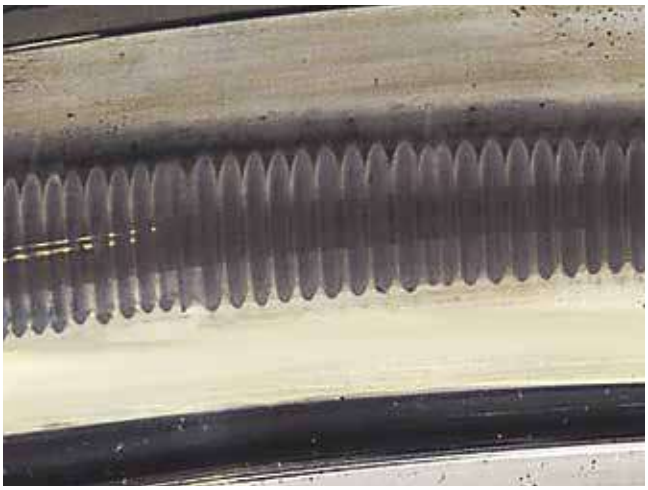




EDM Pit, ~ 0.5 micron



Frosted Bearing Race, scale 10 microns



Fluted Outer Bearing Race

BEARING CURRENT 1: SHAFT VOLTAGE DISCHARGE/EDM CURRENT

The common mode voltage from the VFD produces a charge on the rotor by capacitive coupling, or electrostatic induction [Figure 1]. (This is the same phenomenon as a static-charged balloon attracting hair). Voltage builds up on the shaft because, when the motor is running, there is no conductive path from the rotor to ground. In the motor bearings, a thin layer of lubricant separates the rolling elements and raceways. The lubricant is an insulator, like air. But like air breaking down in a lightning strike, lubricant will break down and conduct electricity if the voltage across it gets high enough.

If the shaft voltage gets high enough, it will discharge by arcing through the bearing [Figure 2]· This has two main deleterious effects:

- It blasts out microscopic pits in the smooth surfaces of the bearing
- It contaminates the lubricant with microscopic metal debris

Although the damage from one individual discharge is small, the damage is cumulative, and these arcs may occur thousands of times per second. Damaged grease and roughened bearings will cause increasing heat, noise, and vibration. Premature bearing failure is likely if protective measures are not taken.

Our recommended best practice is to install one AEGIS® Shaft Grounding Ring on all motors controlled by variable frequency drives. An AEGIS® ring provides a path of least resistance to electrical charge/voltage on the shaft, so instead of arcing through the bearing, it flows harmlessly through the ring to the motor frame, and then back to the drive.

Insulating both motor bearings can also protect them from shaft voltage discharge. However, without shaft grounding, the shaft voltage will still be present. This can lead to the shaft voltage discharging through the bearings or gear teeth of coupled equipment. So insulating the motor bearings without grounding the shaft can simply transfer the damage to the driven equipment.

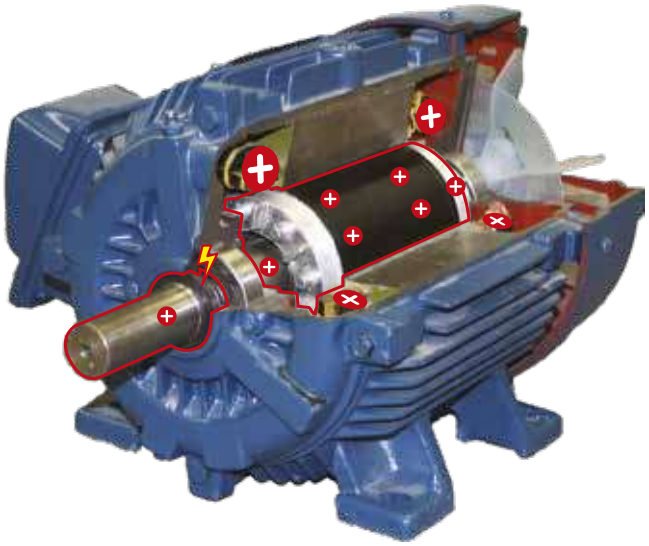


Figure 1

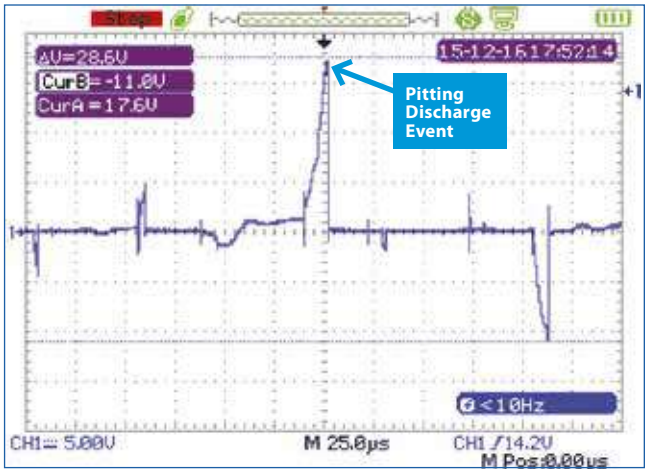
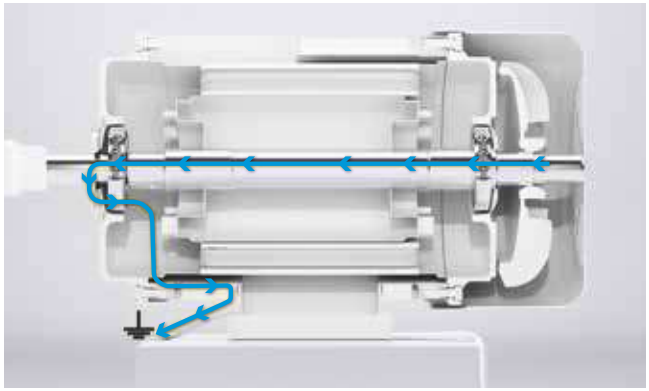


Figure 2



Best Practice: One AEGIS Shaft Grounding Ring

COMMON MODE CURRENT (CMC)

We have explained how the common mode voltage capacitively charges the rotor, and how that capacitive shaft voltage can discharge through the bearings. The shaft voltage produced by the CMV is a problem in all motors on drives. Common mode current is a separate problem, and can cause two other types of bearing current, in some motors.

Every time the drive switches a phase from positive to negative, the CMV abruptly changes [Figure 1]. This rapid large change in voltage ("high dv/dt") drives pulses of common mode current through all of the stray capacitances in the motor-drive system [Figures 2, 3]. Whenever the voltage changes on one side of a capacitor, current will flow between the two sides. The amount of current through the capacitor is equal to the capacitance times the rate of voltage change (I = C*dv/dt).

The largest capacitance in the motor is between the stator windings and the stator frame. When the common mode voltage switches, most of the common mode current moves from the windings into the frame [Figure 2]. From here, it returns to the drive. That return can cause damage in two ways.

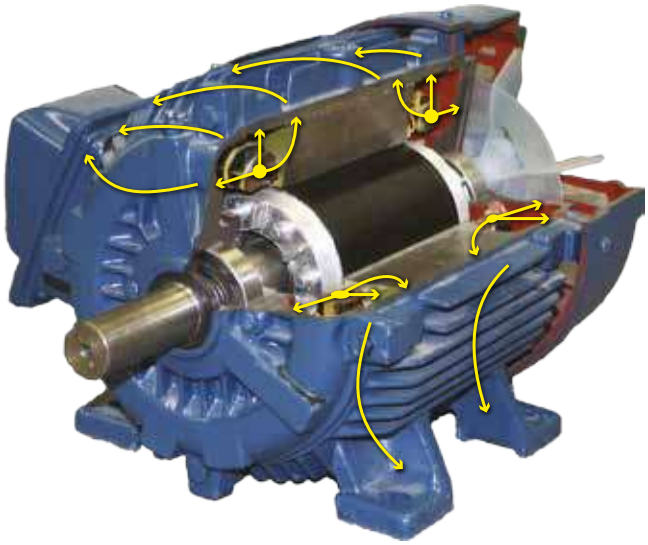


Figure 2

Figure 1

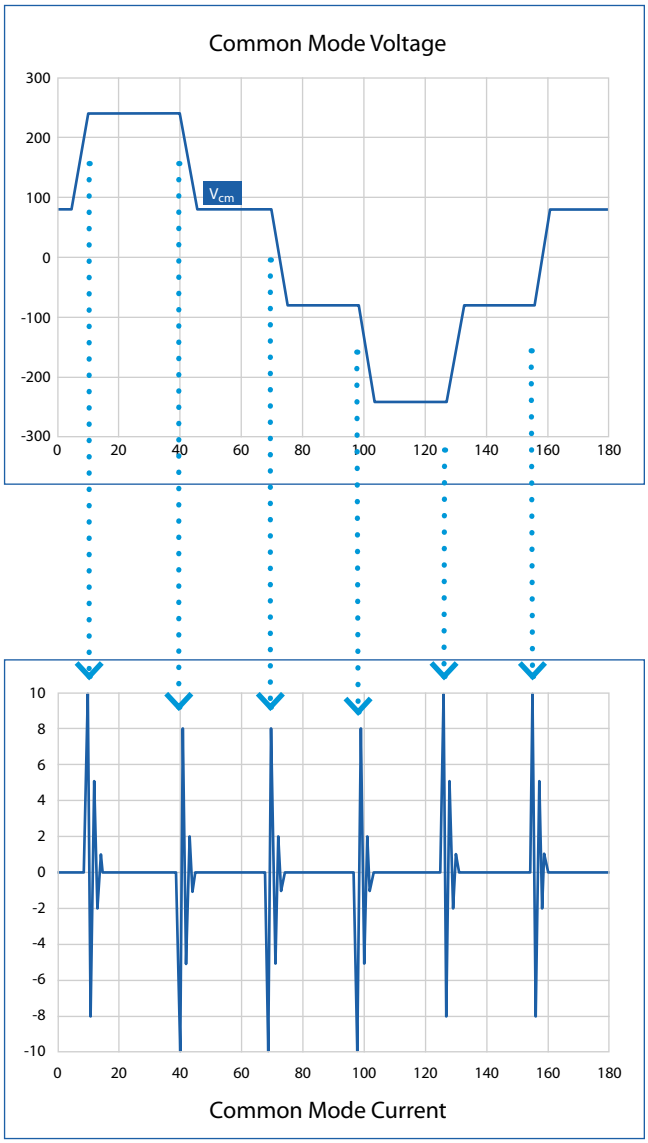


Figure 3

BEARING CURRENT 2: HIGH FREQUENCY CIRCULATING CURRENT (HFCC)

Common mode current leaks into the frame from the whole length of the stator windings. This means that more current enters the windings than exits through them. (The "missing" current has moved into the frame and returns to the drive through ground.) This current imbalance produces high frequency magnetic flux inside the motor [Figure 1, green]. This flux in turn induces a high frequency *end-to-end* shaft voltage [Figure 1, red].

The end-to-end shaft voltage drives high frequency circulating currents in large motors, over 100 HP / 75 kW. Current arcs through one bearing from shaft to frame, and simultaneously arcs through the other bearing from frame to shaft. They damage both motor bearings simultaneously.

The best way to combat HFCC is to install one hybrid/ceramic bearing to interrupt the current path. If current can't get through one bearing, it won't move through the other, either. In practice, an insulated sleeve or coating is usually good enough to prevent circulation.

HFCC can also be reduced with common mode chokes, which can decrease the common mode current by 50% or more. But they do not affect the peak common mode voltage, so they cannot replace shaft grounding for protection against shaft voltage build up and EDM current.

HFCC is mainly a problem in larger motors, but these motors are also subject to damage from capacitive shaft voltage discharge, as discussed. For protection against Bearing Currents 1 and 2, you need an AEGIS® Shaft Grounding Ring at one end of the motor, and bearing insulation at the opposite end.

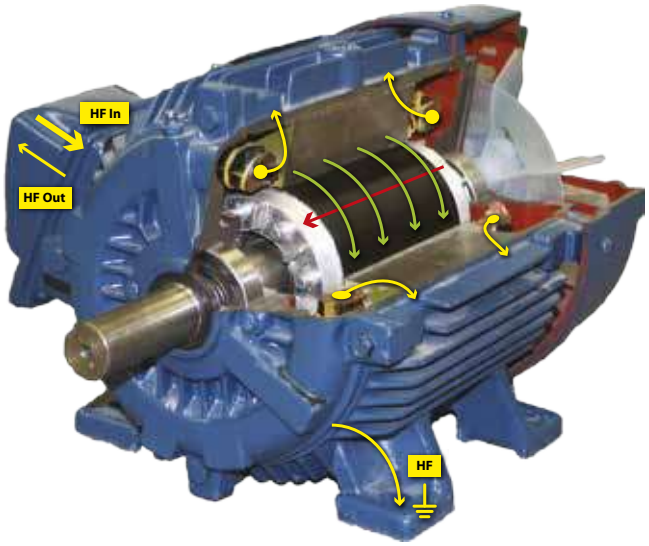
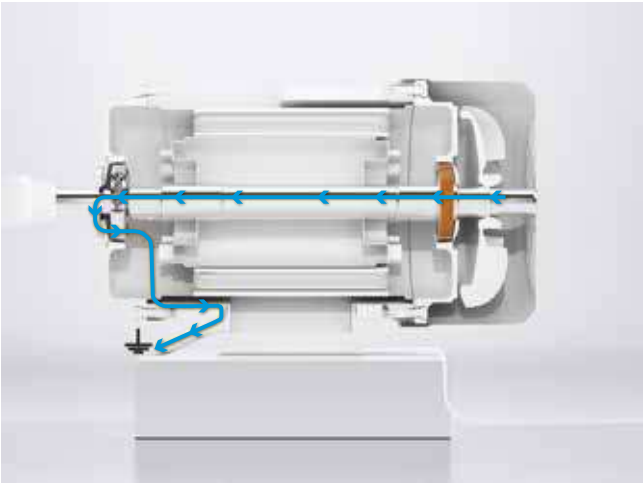


Figure 1



Best Practice: One insulated bearing and one AEGIS Shaft Grounding Ring at the opposite end

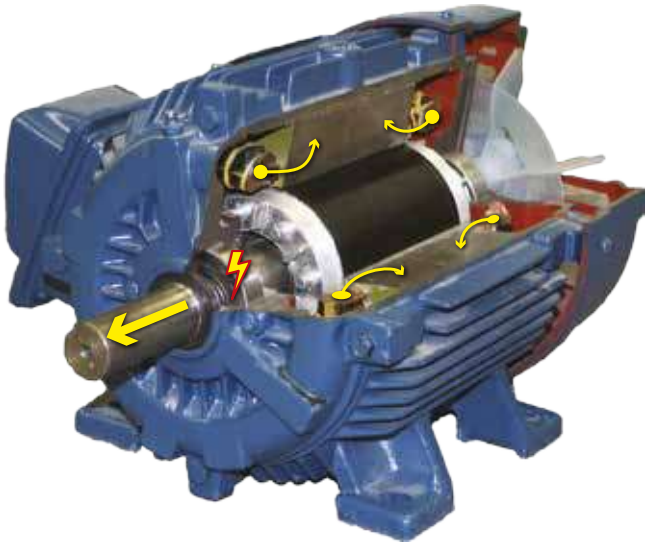
BEARING CURRENT 3: ROTOR GROUND CURRENT

Common mode current moves from the stator windings to the motor frame (curved yellow arrows), and returns to the drive. This may be through the ground conductors or shielding of the power cable, or through the facility ground. These are safe paths. But if the cable is not suitable, or is improperly installed, or the motor is poorly grounded, the current will seek other return paths.

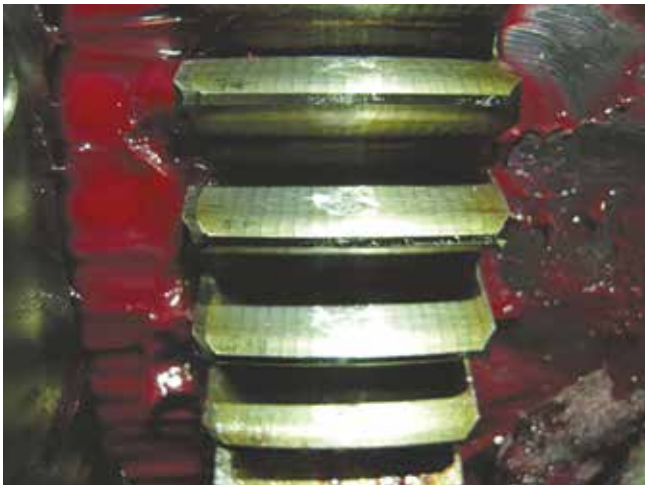
If the motor's driven equipment is better grounded than the motor itself, rotor ground current may be a problem. In rotor ground current, common mode current in the frame arcs through a motor bearing to the shaft, travels through the shaft to the coupled equipment, arcs through the equipment bearings, and then goes to ground/returns to the drive. So rotor ground current damages the motor and the load bearings simultaneously.

The single best way to avoid Bearing Current 3 is by using proper VFD cable. Typically, that means shielded cable, with symmetrically arranged conductors within. But VFD cable can be very expensive. As with HFCC, common mode chokes can combat this bearing current as well. Common mode chokes, however, do not reduce Bearing Current 1/EDM Current.

A more affordable way to avoid rotor ground current is to bond the motor frame to the equipment frame with a high frequency grounding strap, like the AEGIS® HFGS. These are tin-plated braided copper straps with very low impedance to high frequency current. The destructive path through the bearings has higher impedance. So with a grounding strap, if the equipment is better-grounded than the motor, the stray current will get to the equipment through the strap, instead of arcing through the bearings.



Motor frame bonded to its support by a high frequency grounding strap



Tiger striping on the teeth of a gearbox caused by rotor ground current

ELECTRICAL BEARING PROTECTION FOR MOTORS ON VFD

VFD-Driven Motors are at risk of Electrical Bearing Damage!

Motors operated by variable frequency drives (VFD) are vulnerable to VFD-induced shaft voltage and bearing currents that can cause premature bearing failure - often in as little as 3 months!

VFDs induce destructive shaft voltage that can discharge through motor bearings, burning bearing grease and reducing its effectiveness. Through electrical discharge machining (EDM), these discharges can also cause pitting, frosting, and fluting damage to the motor's bearings and eventual bearing failure. The result is costly repairs, downtime, and lost production.

Protect Motor Bearings with AEGIS® Shaft Grounding Rings

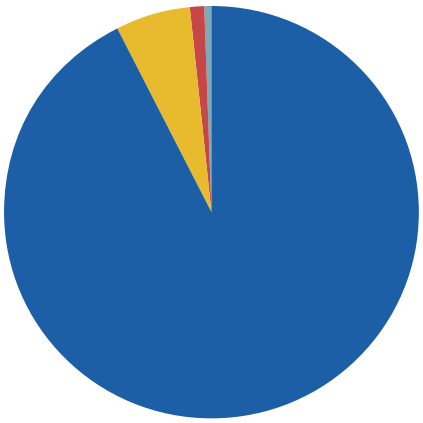
By channeling harmful VFD-induced shaft current away from bearings and safely to ground AEGIS® Shaft Grounding Rings protect motors from costly bearing damage.

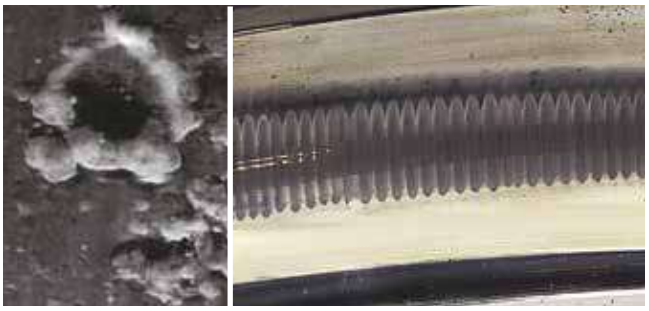
Bearing Protection Best Practices

This Handbook details best practices for protecting VFD-driven motors from electrical bearing damage and preventing costly repairs, downtime, and lost production.

Learn about:

- Bearing currents and shaft voltage
- AEGIS® technology
- Shaft voltage testing
- Installation best practices





Prevent EDM Pitting and Fluting Damage

AEGIS® SHAFT GROUNDING RINGS PROVIDE 360° OF SHAFT GROUNDING

The Only Product of its Kind

AEGIS® Shaft Grounding Ring Uses 360 Degree Conductive Contact

- 360 degrees circumferential conductive microfiber ring
- Multiple row design – greatest reliability
- Ensures unmatched shaft grounding and performance

Proprietary Conductive Microfibers Last for the Service Life of the Motor

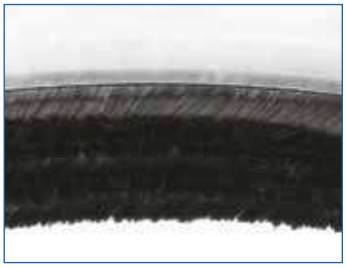
The AEGIS® Shaft Grounding Ring's unique design features hundreds of thousands to millions of specially engineered conductive microfibers that encircle the motor shaft. With so many electrical transfer points the ring provides continuous electrical contact.

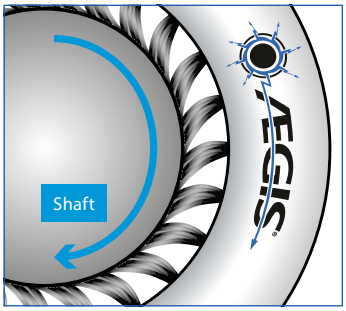
Specially Designed Microfibers Flex Without Breaking

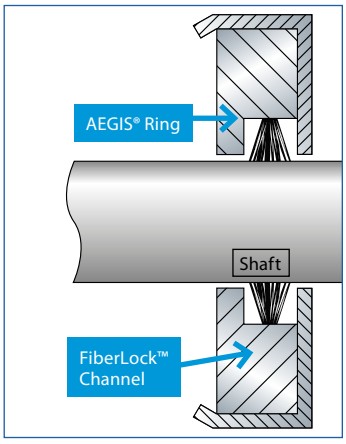
Designed with specific mechanical and electrical characteristics that minimize wear and maintain conductivity, AEGIS® microfibers will last for the life of the motor. Based on wear of less than 0.001" / 0.025mm during 10,000 hours of testing, proven to withstand over 200,000 hours of continuous operation. Testing has also shown that AEGIS® fibers can withstand 2 million direction reversals (to 1800 RPM) with no fiber fatigue or breakage.

Patented FiberLock™ Channel Secures and Protects Fibers

AEGIS's patented, protective FiberLock™ channel locks the ring's conductive microfibers securely in place around the motor shaft, allowing them to flex without breaking.







AEGIS® SGR FOR LOW VOLTAGE AND AEGIS® PRO SERIES FOR MEDIUM VOLTAGE MOTORS

Description:

- Design Type: AEGIS® SGR
- Circumferential Conductive MicroFiber rows in FiberLock™ Channel
- Rows of fiber: 2
- Fiber overlaps shaft 0.030" / 0.76mm
- OAL: 0.295" / 7.5mm
- OD: listed in AEGIS® Parts List

AEGIS® SGR

Mounting:

- Internal or External
- Select based on shaft diameter
- Split and Solid versions available
- Custom brackets optional

Low Voltage Motors UP TO 500 HP / 375 kW

Supply voltage: 600 VAC or less Recommended Technology: AEGIS® SGR

Motors up to 100 HP / 75 kW: Install one AEGIS® SGR

Motors over 100 HP / 75 kW: Isolate one bearing and install one AEGIS® SGR near the opposite bearing.

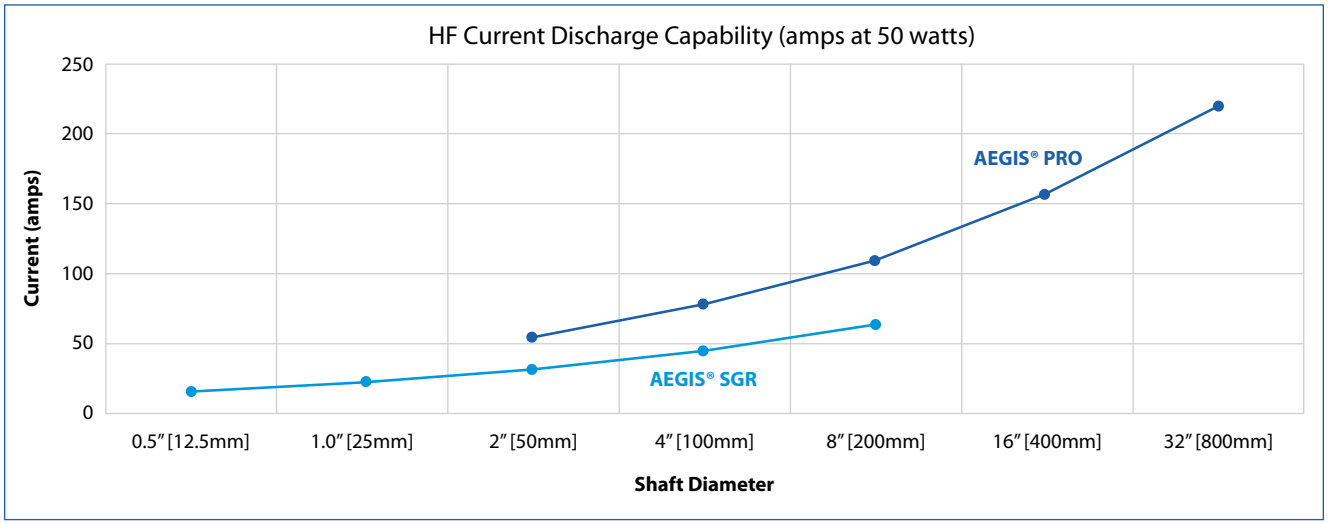
AEGIS® PRO

Medium Voltage motors and Low Voltage Motors > 500 HP / 375kW

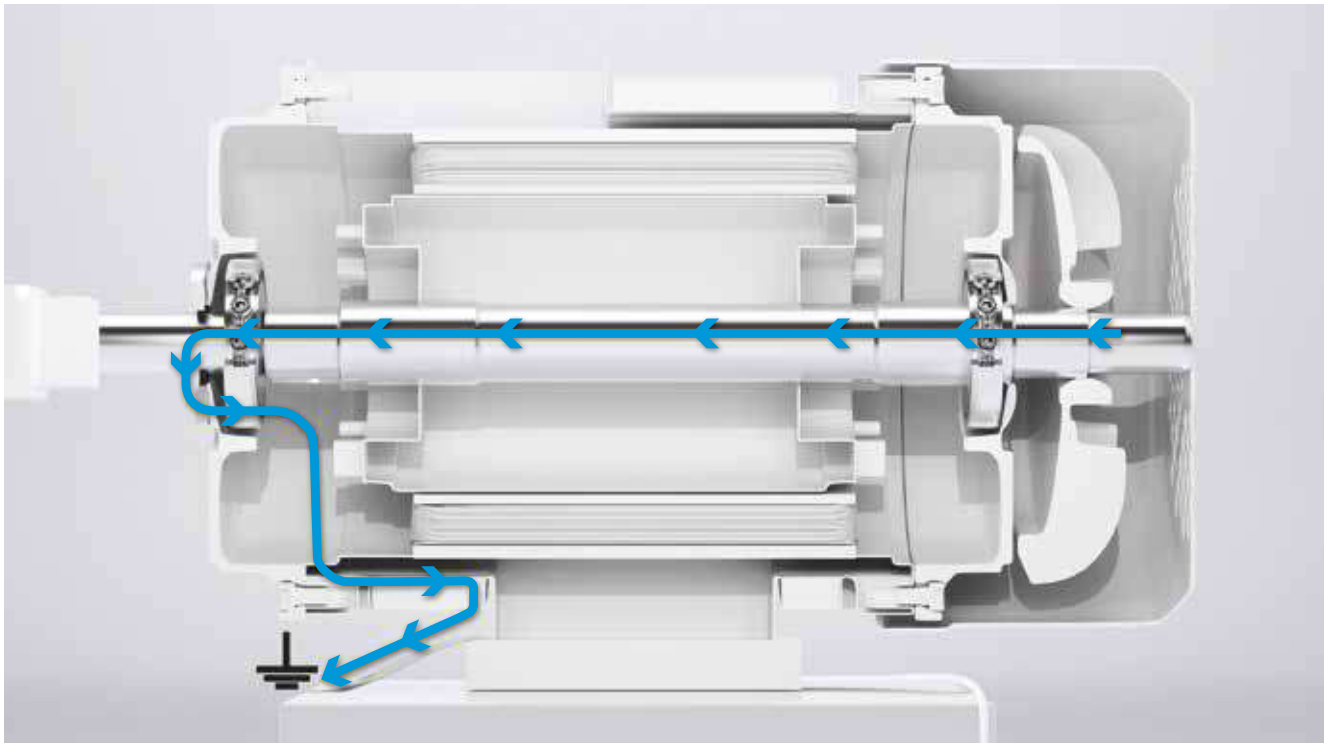
Recommended Technology: AEGIS® PRO Series

Recommend isolation of one bearing and AEGIS® PRO Series on the opposite bearing.

Current Capability Chart



LOW VOLTAGE HORIZONTAL MOTORS



Low Voltage Motors:

General recommendations: For induction motors operated on PWM IGBT VFD's either foot mounted, C-face or D-flange mounted motors with single row radial ball bearings on both ends of the motor. Motors may be installed either horizontally or vertically in the customer's application.

- Install one AEGIS® SGR Bearing Protection Ring on either the drive end or the non-drive end of the motor to discharge capacitive induced shaft voltage.
- AEGIS® SGR may be installed either internally or externally.
- For motors over 100 HP / 75 kW, we also recommend bearing insulation at the opposite end from the SGR. A hybrid (ceramic) bearing is best, but an alumina coating is acceptable.
- **Recommended:** AEGIS® Colloidal Silver Shaft Coating (PN CS015) on the motor shaft where the fibers touch.

Product recommendation: AEGIS® SGR

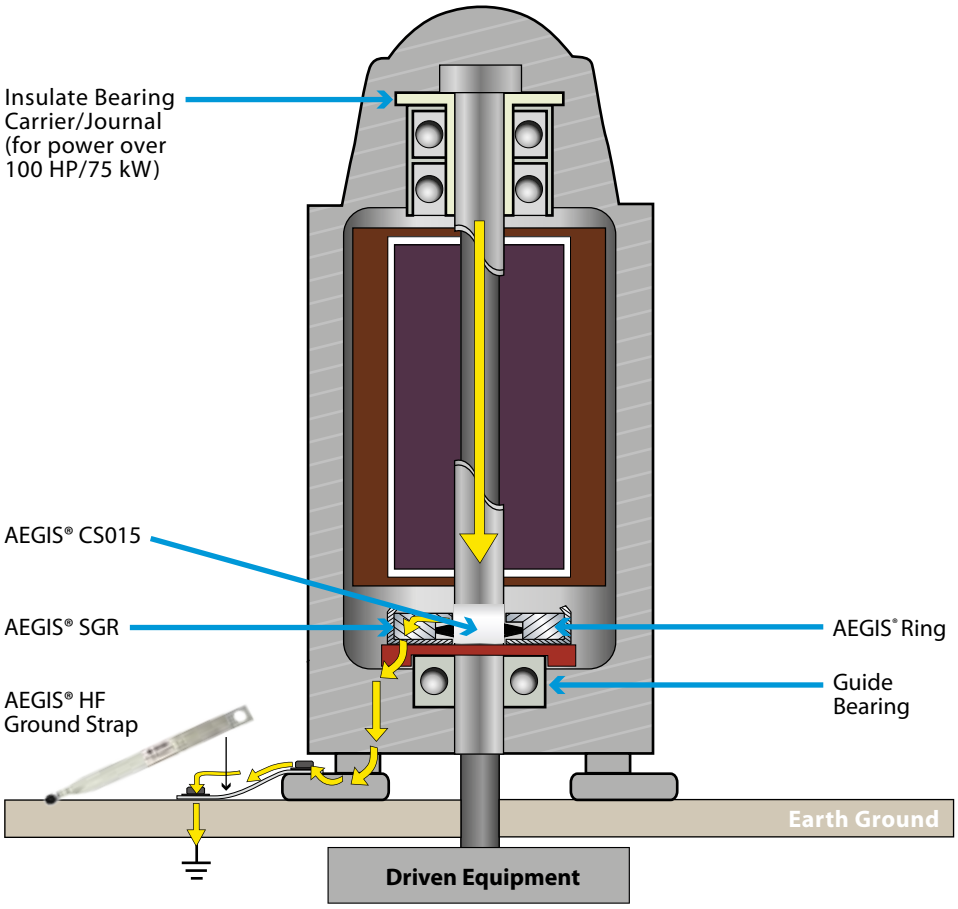
Follow all safety precautions. SDS available for download at **est-aegis.com/cs-sds**

AEGIS® SGR

AEGIS® CS015

Ground Strap

VERTICAL (HOLLOW & SOLID SHAFT) THRUST HANDLING MOTORS UP TO AND INCLUDING 100 HP / 75 KW



Low Voltage Motors:

- Lower Bearing: Install one AEGIS® SGR Shaft Grounding Ring.
- AEGIS® SGR can be installed internally on the back of the bearing cap.
- Above 100 HP / 75 kW, the upper bearing carrier or journal should be isolated, or an insulated/hybrid ceramic bearing should be installed.
- **Recommended:** AEGIS Colloidal Silver Shaft Coating (PN CS015) is strongly recommended on the shaft where the fibers touch.

Product recommendation: AEGIS® SGR

Follow all safety precautions. SDS available for download at **est-aegis.com/cs-sds**

Note: For external installation, the AEGIS® Ring must run on the motor or pump shaft at the lower bearing. Ring must not be mounted around the steady bushing.

Upper bearing may be isolated with insulated bearing carrier for added protection.

AEGIS® PRO SERIES – SHAFT GROUNDING RINGS FOR MAXIMUM BEARING PROTECTION

The AEGIS® PRO Series design provides reliable shaft grounding for high-power (over 500 HP / 375 kW applications, generators and turbines to divert harmful shaft voltages to ground and extend bearing life. Install the AEGIS® PRO on the DE and insulate the bearing on the opposite end (NDE) for best results. Large motors and generators often have much higher induced shaft voltages and bearing currents. The six circumferential rows of conductive microfiber provide the extra protection for these high current applications.

Generators may experience current surges and stray voltage from the exciter, which can cause electrical arcing in their bearings and associated equipment. The AEGIS® PRO Rings have a high ampacity design and can dissipate high levels of stray current and voltage.

Designed for:

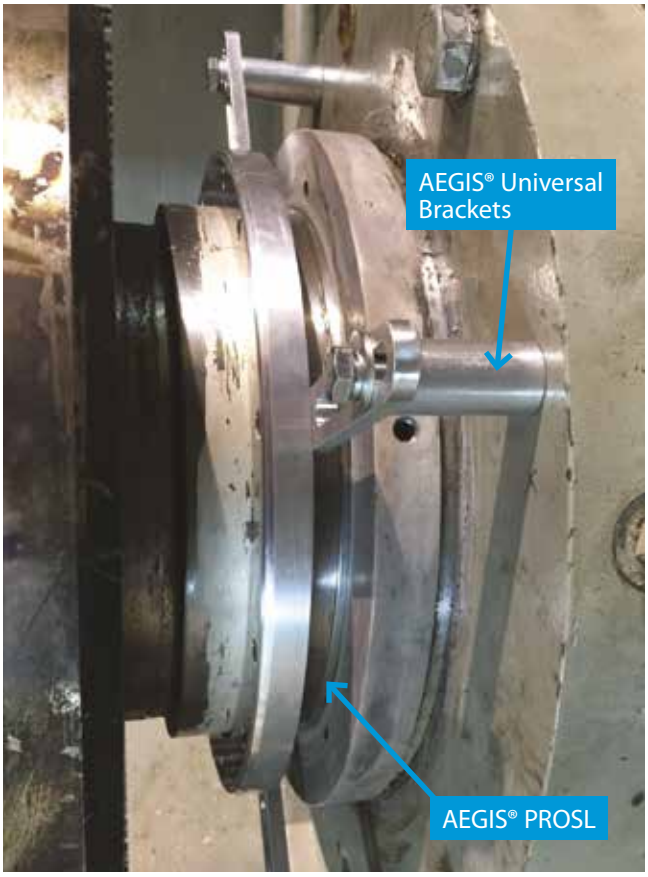
- Large frame low-voltage motors:
  – Intermittent duty, 500 HP / 375 kW or greater
  – Continuous duty, 300 HP / 225 kW or greater
- Medium voltage motors (600V or greater)
- DC motors: 300 HP / 225 kW or greater

Specifications:

- Available in shaft diameters from 2.5" / 63.5mm to 30" / 762mm
- Circumferential Conductive MicroFiber rows in FiberLock™ Channel
- Rows of fiber: 6
- Fiber overlaps shaft 0.030" / 0.76mm
- Ships with CS015 AEGIS® Colloidal Silver Shaft Coating

Options:

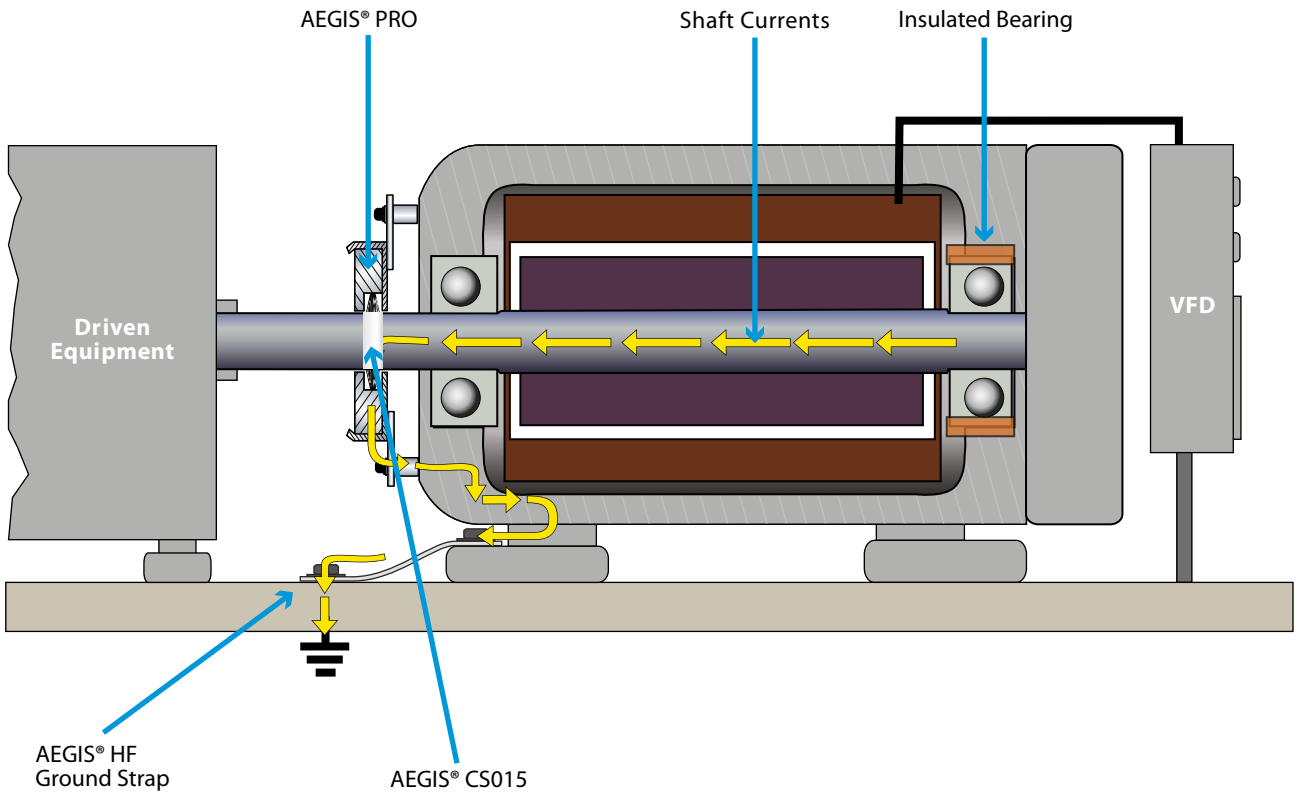
- Solid and split ring designs
- Monitoring ring option for voltage monitoring
- Stock brackets and stand-off kits
- Custom brackets available



AEGIS® PROSL with Universal Brackets

6 rows of Conductive MicroFiber

MEDIUM VOLTAGE AND HIGH POWER MOTORS:



For horizontally mounted motors with single row radial ball bearings on both ends of the motor:

- Non-Drive end: Bearing housing must be isolated with insulated sleeve or coating or use insulated ceramic or hybrid bearing to disrupt circulating currents.
- Drive end: Install one AEGIS® Shaft Grounding Ring.
- AEGIS® Ring can be installed internally on the back of the bearing cap or externally on the motor end bracket.

Recommended: AEGIS® Colloidal Silver Shaft Coating (PN CS015) is highly recommended on the motor shaft where the fibers touch.

Product recommendation:

- **AEGIS® PRO Series**

Follow all safety precautions. SDS available for download at **est-aegis.com/cs-sds**

AEGIS®PRO Series - external (shown) or internal installation

Sleeve

Ground Strap

AEGIS® CS015

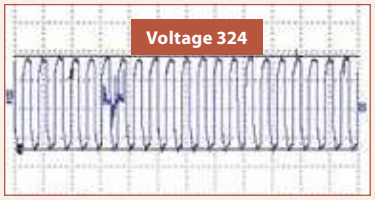
Insulated bearing

AEGIS® SHAFT GROUNDING FOR DC MOTORS

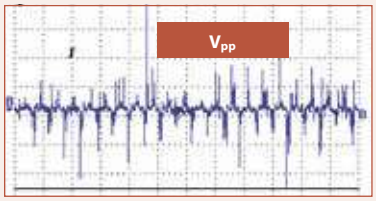
DC motors operated by drives also require bearing protection from capacitive shaft voltage. Capacitively induced shaft voltage may reach hundreds of volts peak-to-peak, and depending on the drive topology, may increase in size as the motor speed is increased. Additionally, circulating current from magnetic dissymmetry may exist in DC motors over 10 HP / 7.5 kW.

DC Motor – Before and After Testing with AEGIS® Installed

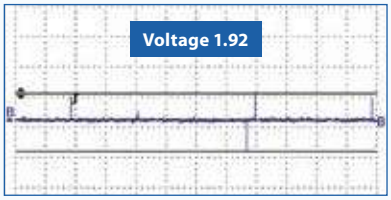
350 HP / 262 kW DC Motor – DC Inverter Drive.



Capacitive induced shaft voltage before bearing current discharge through the bearings. Square wave from DC SCR drive.



No Shaft Grounding
Volts: 65.2 V pk-pk
Bearing discharges (EDM)



AEGIS® Shaft Grounding
Volts: 1.92 V pk-pk
Discharge through AEGIS® Shaft Grounding Ring

BEST PRACTICES FOR DC MOTOR BEARING PROTECTION

Install one AEGIS® SGR Shaft Grounding Ring on either the drive end or the non-drive end of the motor to discharge induced shaft voltage.

AEGIS® SGR should be installed internal to the motor if possible but may also be attached externally to the motor's end bracket.

Recommended: AEGIS® Colloidal Silver Shaft Coating (PN CS015) on the shaft where the fibers touch.

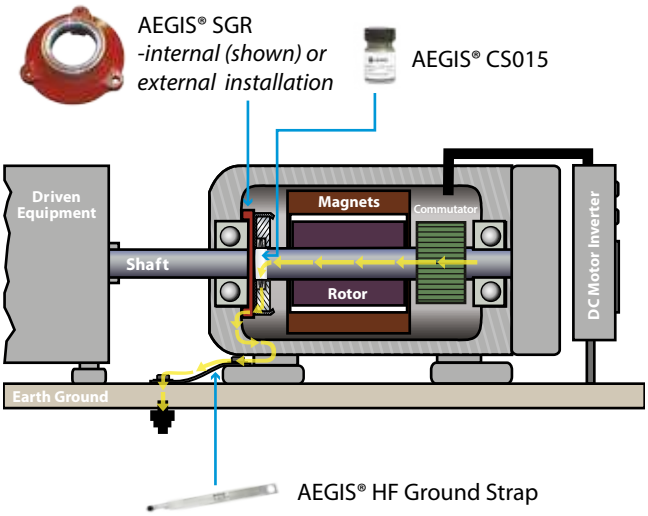
Motors over 10 HP / 7.5 kW should also include one insulated bearing, at the end opposite from the AEGIS® Ring.

Product recommendation:

Motor power rating under 300 HP / 225 kW:
- **AEGIS® SGR**

Motor power 300 HP / 225 kW or greater:
- **AEGIS® PRO Series**

Follow all safety precautions. SDS available for download at **est-aegis.com/cs-sds**



AEGIS® SHAFT GROUNDING FOR ELECTRIC VEHICLES

Electric vehicles (EVs) are inherently variable speed applications. Although different makes and models of EV use different traction motor topologies (induction, synchronous permanent magnet, etc.), they all control the motors' speed with inverter drives. Hence, all EV motors need protection from electrical bearing damage from capacitive shaft voltage discharge. As with industrial motors, AEGIS® Shaft Grounding Rings are an effective long-term solution to this problem.

Additionally, drive operation in EVs may cause electromagnetic compatibility (EMC) problems with other vehicle systems. Electromagnetic interference/ radio frequency interference (EMI/RFI) can be problems with in-vehicle sensors, controls, and communications. EMI/RFI can be suppressed by grounding the traction motor shafts.

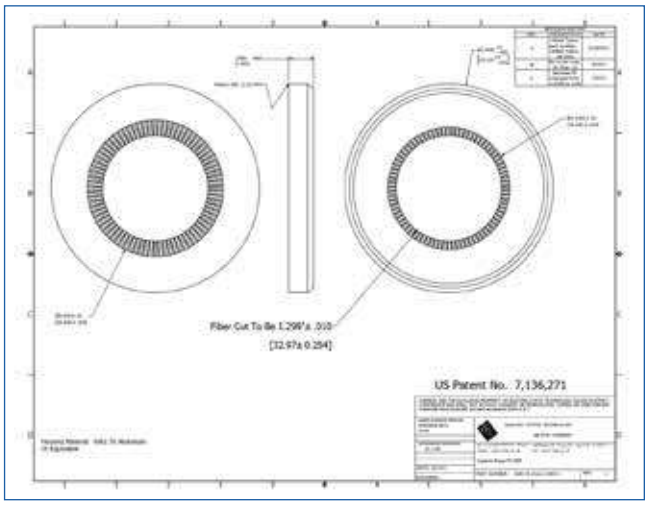
Shaft voltage discharge in an EV motor bearing

Systems affected by EMI/RFI

Shaft voltage buildup is prevented by an AEGIS EV Ring

BEST PRACTICES FOR EV SHAFT GROUNDING

Standard AEGIS® Shaft Grounding Rings are not recommended for use in EVs. Instead, we recommend specialized AEGIS® EV Rings. EV designers should contact Electro Static Technology's Engineering department early in the design phase to facilitate proper integration of AEGIS® shaft grounding into the drivetrain.



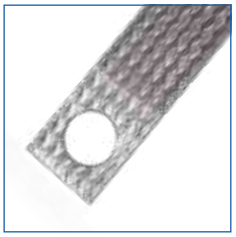
HIGH-FREQUENCY BONDING MITIGATES RISK OF ROTOR GROUND CURRENT

An AEGIS® Ring protects motor bearings from damage from shaft voltage buildup and discharge. A High Frequency Grounding Strap (HFGS) provides a low-impedance path between system components, and mitigates the risk of motor and equipment bearing damage by rotor ground current and other stray currents.

Proper high-frequency (HF) bonding of VFD-driven motor systems is vital to prevent voltage differences between system components. It is especially critical in applications involving a motor and coupled equipment that are not mounted to a common baseplate. In such cases, effective HF bonding of all system components is necessary to equalize the potential between equipment frames and to prevent ground loops between the motor and coupled equipment. If the motor and driven equipment frames are at different potential, rotor ground current can flow, damaging both motor and equipment bearings.

HF bonding straps are efficient means of bonding for high frequency current, and are recommended by major motor and drive manufacturers. AEGIS® High-Frequency Ground Straps ensure a very-low impedance path for VFD-sourced HF currents from the motor frame, either to the coupled equipment's frame or to ground. Used in conjunction with AEGIS® Rings, which provide a safe path for damaging VFD-induced current around the motor's bearings to its frame, AEGIS® HFGS bonding straps protect the driven equipment's bearings.

AEGIS® HFGS are designed with a tinned hole on one end (size based on NEMA/IEC frame) and a ring terminal on the opposite end to fit a 5/16" / 8mm screw. Standard lengths are available in 12" / 305mm and 24" / 610mm increments. Also available is a universal strap which includes a ring terminal on both ends. Longer straps and other terminations are available upon request. See page **46** for parts list.



tinned end

ring terminal

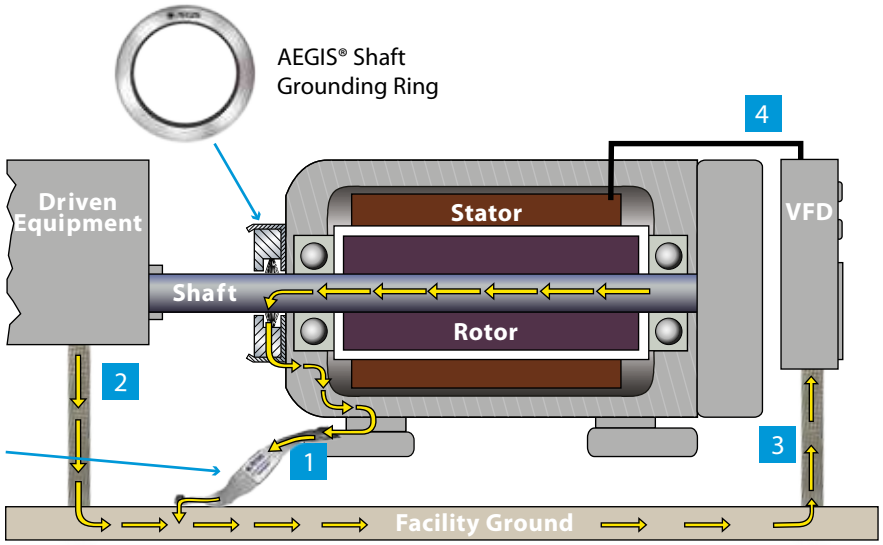
1 Motor foot to facility ground

2 Driven equipment to motor or common facility ground

3 Motor foot/facility ground to VFD ground bus

4 Motor frame to metal conduit; VFD ground to metal conduit

AEGIS® HF Ground Strap



MOTORS WITH AEGIS® SHAFT GROUNDING FACTORY INSTALLED

AEGIS® Shaft Grounding Rings can be retrofit to new or repaired electric motors, and the next section gives best practices for installing them.

But they can also be installed by the motor manufacturer on general purpose and specialized motors ranging from vertical hollow shaft to explosion proof.

AEGIS® Rings come standard on hundreds of motor models, and are available as a mod on most others.

The advantages of factory-installation include:

- **Saving time**
  There's no need to find the part number for the AEGIS® ring, and no need to install it yourself.
- **Saving money**
  The cost of the motor with AEGIS® installed is less than the cost of the motor and an AEGIS® ring separately. You also save the cost of installing it yourself.
- **Wide choice of motor manufacturers**
  Manufacturers like Baldor (ABB), GE Industrial Motors (Wolong), LEESON and Marathon (Regal Rexnord), U.S. MOTORS (Nidec), TECO-Westinghouse, and WEG Electric provide AEGIS® rings on stock motor lines. Others, including ABB, Fuji, Siemens, and Toshiba offer AEGIS® Rings as an option.
- **Minimal risk of improper installation**
  Motor manufacturers have installed hundreds of thousands of shaft grounding rings. They know exactly how to install AEGIS® rings according to best practices.

Accept No Substitutes

When ordering a motor with shaft grounding factory-installed, be sure to specify AEGIS® Shaft Grounding Rings.

General purpose

Vertical hollow shaft

Explosion proof motors

AEGIS® INSTALLATION – INTERNAL

AEGIS® Shaft Grounding Rings are ideally installed on the inside of the motor to provide protection from ingress of dirt and dust. Motor manufacturers commonly use this installation as a best practice in stock catalog motors equipped with AEGIS® rings.

⚠ Follow all safety precautions. SDS for CS015 and EP2400 available for download at **est-aegis.com**

Follow AEGIS® best practices for motor shaft preparation and ring installation. Use AEGIS® Colloidal Silver Shaft Coating when installing AEGIS® rings to enhance the shaft conductivity and help prevent oxidation.

Press Fit Installation:

- Press into bearing retainer
- Press into custom bracket

English:	Ring OD tolerance +0 / -0.001"	Bore tolerance +0.001 / -0"
Metric:	Ring OD tolerance +0 / -0.025mm	Bore tolerance +0.025 / -0mm

Bolt-through installation:

- Drill into bearing retainer
- Drill into custom bracket

STOP Do not use non-conductive thread-lock

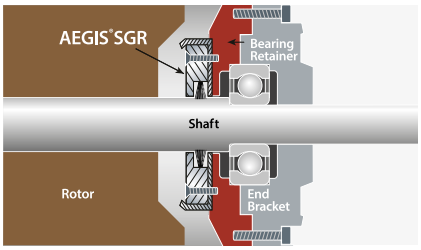
Drill/tap holes per AEGIS® Ring drawing location

- Flat head cap screws
- Socket head cap screws/lock washer

In some motors it may be desirable to attach an additional machined spacer to locate the ring further away from the bearing grease cavity.

A grease seal may be added to reduce grease ingress to the fibers.

AEGIS® Rings are commonly installed internal to the motor on the bearing retainer. This is typically done with bolt through hardware.



AEGIS® INSTALLATION – EXTERNAL

AEGIS® Shaft Grounding Rings may be installed on the outside of the motor but care must be taken to protect the ring from excessive ingress of dirt and dust.

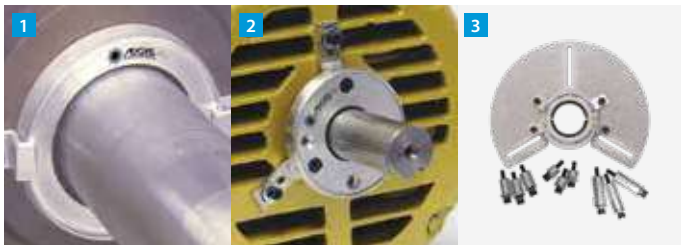
Follow AEGIS® best practices for motor shaft preparation and ring installation. Use AEGIS® Colloidal Silver Shaft Coating when installing AEGIS® rings to enhance the shaft conductivity and help prevent oxidation.

An O-ring or V-slinger may be installed against the AEGIS® Ring to help prevent excessive ingress of dirt, dust or liquid.

Standard bracket or uKIT bracket Installation:

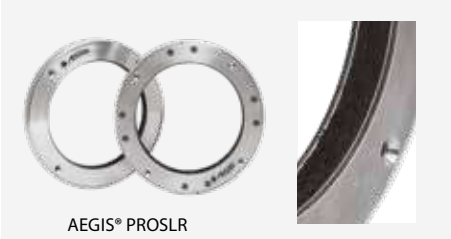
1. Standard Brackets (3 or 4 depending on ring size)
2. uKIT includes various bracket options
3. Custom brackets available

To view product line or download the AEGIS® Catalog visit **est-aegis.com**



Large Severe Duty AC and DC Motors: These motors are operated in severe environmental conditions where there is debris, powder, dirt, liquids, lubricants or other contaminants which can collect around the shaft of the motor. For these applications the AEGIS® PROSLR incorporates a rubber dust and debris barrier to prevent ingress of these materials. See page **43**.

Note: Some seal manufacturers such as Garlock and Flowserve provide bearing isolators with AEGIS® Rings installed inside.


AEGIS® PROSLR

Bolt-through installation into:

- End Bracket
- Custom Bracket

Drill/tap holes per AEGIS® Ring drawing location

- Flat head cap screws
- Socket head cap screws/lock washer

Do not use non-conductive thread-lock

CAUTION: Be careful not to drill into the grease passage. This can cause debris contamination on regreasing, leading to premature bearing failure.

Epoxy Mounting – External

Motor end bracket must be clean & free of any coatings, paint, or other nonconductive material where AEGIS® SGR will be mounted using conductive epoxy. This is the discharge path to ground therefore metal to metal contact is essential.

Curing can be achieved in 4 hours at or above 75° F (24°C). For faster curing times and maximum adhesion, heat the bond to between 150°- 250° F (66°-121° C) for 10 minutes and allow to cool.

Pot-life is approximately 10 minutes at 75° F (24° C).

AEGIS® Conductive Epoxy was specially developed and tested to stringent vibration and pull test requirements to ensure a strong and reliable long term adhesive bond.

Do not use a substitute epoxy as only the AEGIS® EP2400 has been tested and approved for AEGIS® ring installation.

SHAFT PREPARATION FOR INTERNAL AND EXTERNAL INSTALLATION

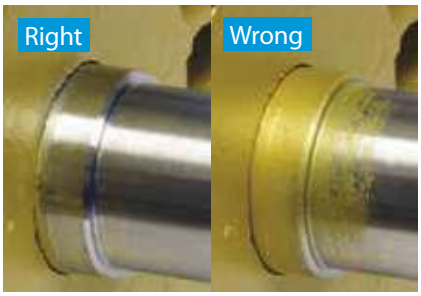
AEGIS® Rings should not operate over a keyway or balancing hole because the edges are very sharp. For proper performance:

Adjust or change spacer and screw lengths to avoid the keyway or balancing hole (preferred); or

Fill the keyway (in the area where the AEGIS® microfibers will be in contact with the shaft) with a fast-curing epoxy putty such as Devcon® Plastic Steel® 5 Minute® Putty(SF). Slightly overfill the keyway and then buff it down to round with emery tape, making sure to eliminate the sharp edge.

Required: Motor shaft must be conductive

Shaft must be clean and free of any coatings, paint, or other nonconductive material (clean to bare metal). Depending on the condition of the shaft, this may require using emergy cloth or Scotch-Brite™. Small defects filled as above are acceptable. If the shaft is visibly clean, a non petroleum based solvent may be used to remove any residue. If possible, check the conductivity of the shaft using an ohm meter.



Recommended: Conductive shaft surface test

Place the positive and negative meter leads on the shaft at a place where the microfibers will contact the shaft. Each motor will have a different reading but in general you should have a maximum reading of less than 2 ohms. If the reading is higher, clean the shaft again and retest.

Recommended: Colloidal silver shaft coating

Colloidal Silver Shaft Coating (CS015) is recommended for all applications (we don't recommend any substitutions). The silver enhances the conductivity of the shaft and also lessens the amount of corrosion that can impede the grounding path.

1. Treating the shaft of the motor prior to installing the AEGIS® Ring:
2. Shaft must be clean and free of any coatings, paint, or other nonconductive material. The shaft must be clean to bare metal.
3. If possible, gently warm the shaft where the AEGIS® CS015 will be applied. This helps the CS015 cure faster. Allow CS015 to come to room temperature prior to opening.
4. Apply a thin, uniform coat of the AEGIS® Colloidal Silver Shaft Coating to the area where the AEGIS® microfibers will be in contact with the motor shaft. Apply all around the shaft. Wait for the first coat to dry to a tack free surface. Drying can be accelerated with the use of gentle heat from a heat gun, but don't exceed 200°F (93°C) while curing.
5. Apply a 2nd thin, uniform coat of CS015.
6. Allow CS015 to dry to a tack free surface before installing the AEGIS® Ring.
7. Allow the CS015 to cure completely before running the motor. The coating will cure at room temperature in 16-20 hours or in about 60 minutes at 200°F (93°C).

Follow all safety precautions. SDS for CS015 available for download at **est-aegis.com**

Colloidal Silver Shaft Coating PN# CS015

SHAFT PREPARATION
Continued

Centering the AEGIS® ring

Install the AEGIS® SGR so that the aluminum frame maintains an even clearance around the shaft. AEGIS® conductive microfibers must be in contact with conductive metal surface of the shaft.

STOP Do not use thread lock to secure the mounting screws as it may compromise the conductive path to ground.

Ring-motor electrical continuity test

After installation, test for electrical continuity using an Ohm meter. Place one probe on metal frame of AEGIS® SGR and one probe on motor frame.

Motor must be grounded to common earth ground with drive according to applicable standards.

Optional: Debris protection

Where the AEGIS® Ring is exposed to excessive debris, protection of the AEGIS® fibers may be necessary.

Install a rubber shroud against the ring.

For medium voltage and higher power motors in severe duty environments, the AEGIS® PRO SLR incorporates two specially customized rubber shrouds to shield the fibers from excessive dirt and grease.

For custom applications, contact AEGIS® Customer Service/Engineering for assistance.

SHAFT VOLTAGE TESTING – MEASURING SHAFT VOLTAGES

Shaft Voltage Test Report

Measuring the shaft voltage on VFD driven motors provides the user with valuable information to determine if there is a risk of bearing damage from electrical discharge. Surveying and documenting shaft voltage levels and waveforms will help determine the appropriate mitigation method.

Note: The best time for shaft voltage measurements is during initial start-up in new or repaired motors operated by the VFD. Shaft voltage measurements should be incorporated into preventive and predictive maintenance programs and may be combined with vibration analysis, thermography, or other services.

Report template available at: **est-aegis.com/reports**

Recommended Testing Equipment:

AEGIS® Shaft Voltage Tester™ 100 MHz Digital Oscilloscope with a 10:1 Shaft Voltage Probe™ kit. We recommend a minimum 100MHz bandwidth to accurately measure the high frequency transitions associated with bearing discharge and VFD waveforms.

Recommended Product: PN: AEGIS-OSC-9200MB-W2

- Two 1X/10X probes, one with Shaft Voltage Probe™ SVP Tip attached
- 1000V CAT III multimeter test leads
- AEGIS® One-Touch™ instant image capture feature
- USB flash drive for waveform recording
- 5 hour+ rechargeable Li-ion battery
- Carrying case

AEGIS-OSC-9200MB-W2

AEGIS® SVP Shaft Voltage Probe™

The AEGIS® SVP Shaft Voltage Probe™ tip attaches to an oscilloscope voltage probe to easily and accurately measure the voltage on a rotating shaft. The high density of conductive microfibers ensures continuous contact with the rotating shaft. The SVP-KIT-9100MB includes replacement tips, extender rods, a magnetic base/probe holder, and AEGIS® Ring simulator.

Caution: Use appropriate safety procedures near rotating equipment.

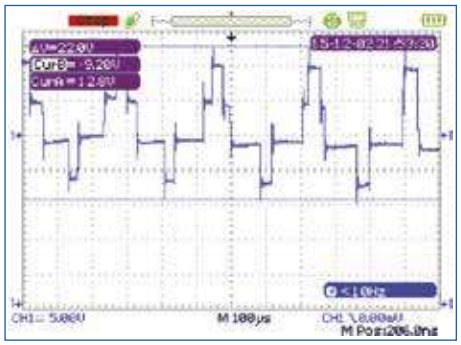
PN: SVP-KIT-9100MB

EXAMPLES OF SHAFT VOLTAGE READINGS

High Peak to Peak common mode voltage

Typically 20 to 120 volts peak to peak (10 to 60 volts peak). The waveform at right shows the capacitive coupled common mode voltage on the shaft of the motor. The "six-step" wave form is the result of the 3 phases of pulses from the VFD. The timing of the pulse width modulation (PWM) pulses to the motor from the drive determines what the waveform looks like. Sometimes it will look like a square wave.

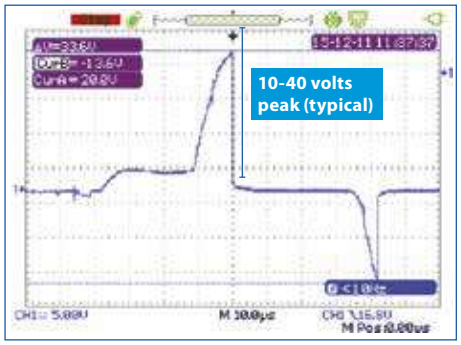
This six-step or square wave is what is seen when there is no bearing discharge and the peak to peak shaft voltage is at its maximum level. The voltage may eventually overcome the dielectric in non-isolated bearings and begin discharging.



High amplitude EDM discharge pattern

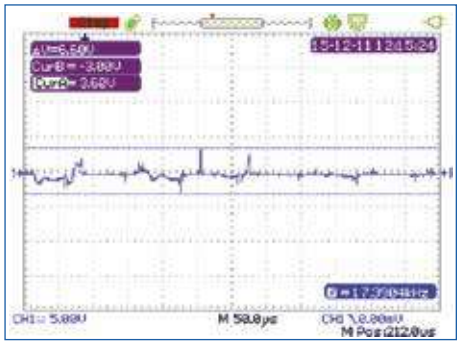
Typically EDM discharges can occur from 20 to 80 volts peak to peak (10 to 40 volts peak) depending on the motor, the type of bearing, the age of the bearing, and other factors. The waveform at right shows an increase in voltage on the shaft and then a sharp vertical line indicating a voltage discharge. This can occur thousands of times in a second, based on the carrier frequency of the drive. The sharp vertical discharge at the trailing edge of the voltage is an ultra high frequency dv/dt with a typical "discharge frequency" of 1 to 125 MHz (based on testing results in many applications).

Reference: NEMA MG1 Section 31.4.4.3



Low amplitude voltage discharge pattern

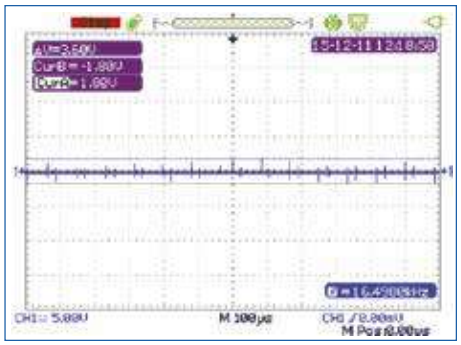
Typically the shaft voltage is 4 to 15V peak to peak (2 to 8 volts peak). The waveform shows a more continuous discharge pattern with lower dv/dt frequencies. This condition is usually found in motors that have been in operation for months or years. As discharge occurs in the bearings, the lubrication is contaminated with carbon and metal particles. This lowers the impedance of the grease. The lower shaft voltage in this condition may be due to greater current flow in the bearings, or could be a function of the drive, speed, loading, and other factors.



Peak to Peak voltage with AEGIS® ring installed

With an AEGIS® ring installed, a bare steel shaft will typically show shaft voltage of 2 to 10 volts peak to peak (1 to 5 volts peak) depending on the power of the motor, ground noise, the conductivity of the shaft, and other factors. The voltage may be decreased further with the application of AEGIS® Colloidal Silver Shaft Coating to increase the shaft surface conductivity.

The waveform at right shows low peak to peak shaft voltage of a motor with an AEGIS® ring installed and discharging shaft voltage normally.



AEGIS® SVP TIP INSTALLATION

AEGIS® Meter Probe PP510 Note: The AEGIS® meter comes with one SVP probe tip already installed)

1. The probe has an insulated sleeve over the tip. Do not remove this cover.

2. Set the probe to 10X.

3. Secure the probe tip using the thumb screw. Be careful not to overtighten.

4. Connect the probe to Channel 1 (CH 1).

DEFAULT SETTINGS FOR SHAFT VOLTAGE TESTING

1. Press **DEFAULT**
2. Press **DEFAULT** again to confirm

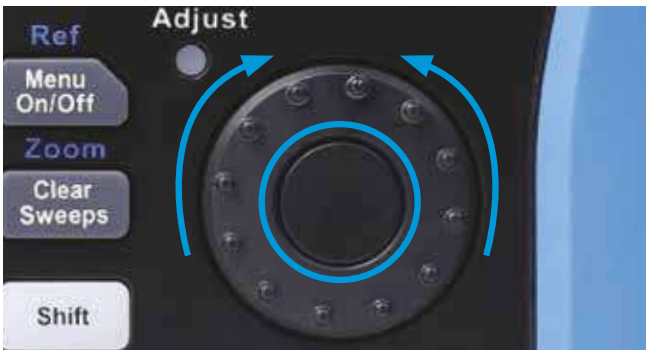
Default parameters include:

- DC Coupling
- 10:1 (10X) in both channels
- 5V/div voltage scale
- 50us/div time scale

For the full list of factory settings, see the user manual included on the flash drive

USING THE DIAL

When using the menu buttons (CH1, Cursors, Measure, etc.) you choose and select options using the scope's dial. Move between options by turning the dial, and make your selection by pressing the button in the middle of the dial.

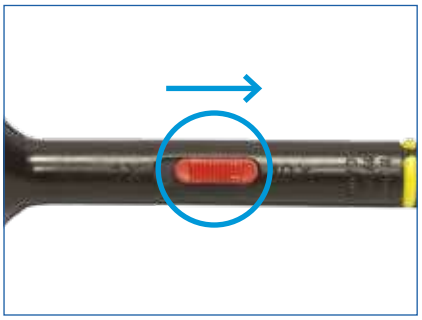


10:1 ATTENUATION

The Default settings include 10:1 attenuation on Channel I. If you somehow lose those settings and need to set them manually:

Press **CH1** to bring up the **CH1** menu on Page 1/3. (If a different page pops up, press **F5** to cycle back to Page 1/3). Press **F4 Probe**

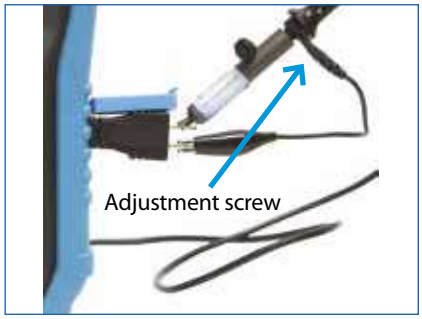
Press **F1** and use the dial to choose 10X. Then press **F5** to go back. Press **Menu** to collapse the **CH1** menu.



Make sure the probe is also set to 10X

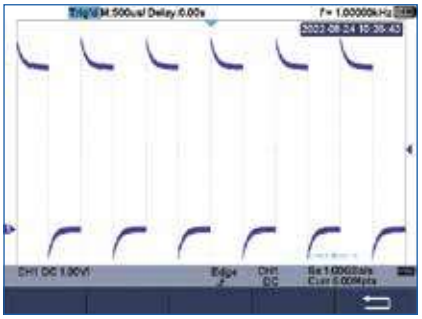
TUNING THE PROBE (COMPENSATION)

Now the scope is set up to fine-tune the probe. The AEGIS-OSC-9200 includes two prongs (under the right-side flap) that generate a square wave to help you fine-tune the probe's compensation for maximum accuracy. This calibration must be done the first time a new probe is used, and should be checked periodically to ensure accurate waveform measurements.



Clamp the probe ground lead to the lower prong (labelled) and touch the SVP Tip to the upper prong ("Cal").

NOTE: Lower prong is labelled with this icon:



1. Press **AUTO**. The scope will display a train of approximately square waves of amplitude about 6V and frequency 1 kHz.

2. The plastic envelope the probe came in includes a small plastic screwdriver. Use it to adjust the screw in the probe until the waves are displayed with square edges. The probe is now ready to use.

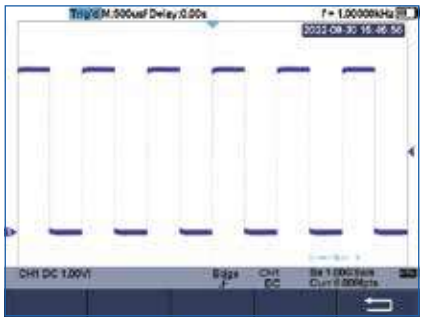
3. Pressing **AUTO** changed the scope's voltage and time scales from the Default values. Press Default twice more to restore them.

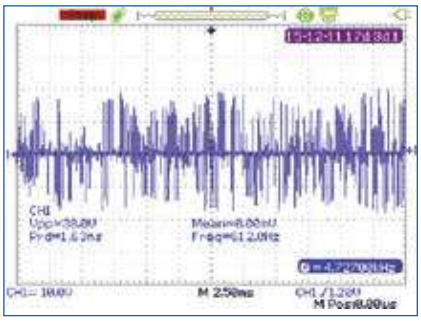
MENUS & THE MENU BUTTON

Here is the **CH1** menu. On this and all menus, you select an item by pushing the F key **(F1-F5)** beneath it. Pressing **MENU** hides the current menu, and pressing **MENU** again opens it back up. Generally, the **MENU** button opens (or closes) the last menu viewed.

AUTO BUTTON

When viewing a waveform, pressing **AUTO** resizes the voltage and time scales to fit the waveform...

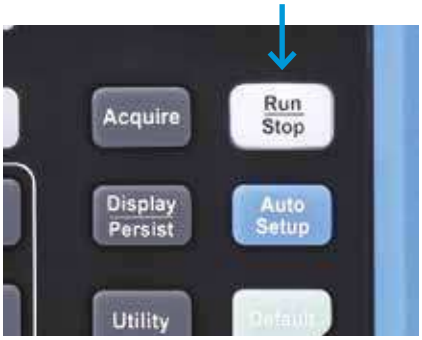




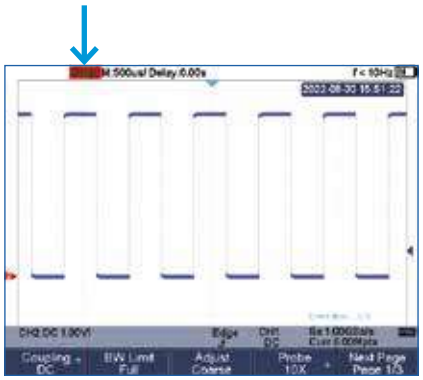
Caution: Shaft voltages are highly random so using **AUTO** mode may give too large a timescale. This can be adjusted. See Setting Time Period below.

Note: Noise from the VFD may also cause CH2 to be displayed – even if no probe is plugged into the CH2 BNC. If this occurs, press **CH2** until the red trace disappears, and find V_{pp} using **Measure** or **Cursors**.

RUN/STOP BUTTON



While making measurements, **RUN/STOP** freezes the screen. When stopped, the word STOP will appear in the upper left of the screen.



This enables you to analyze the waveform more easily and save if desired.

Pressing **RUN/STOP** again resumes measurement. The message in the upper left will change to "Trig'd" or "Auto".

SETTING VOLTAGE SCALE (V/div)

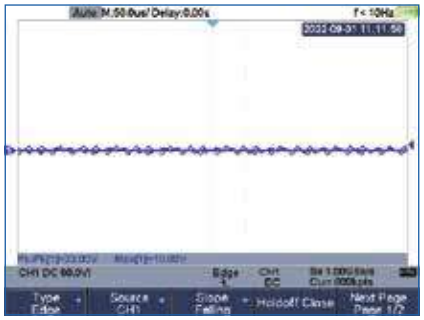
An EDM discharge pattern will show a climb in voltage and then a sharp vertical line. The sharp vertical line shows the moment of discharge to ground. To get a good image of a discharge, you may need to adjust the display scale.

Control the vertical scale of the displayed signal by adjusting the volts per division. The entire signal, from peak to peak, should all be displayed on the screen. 5V is a good place to start, and then adjust up or down based on the conditions. The setting selected in volts per division is shown in the lower left of the screen.

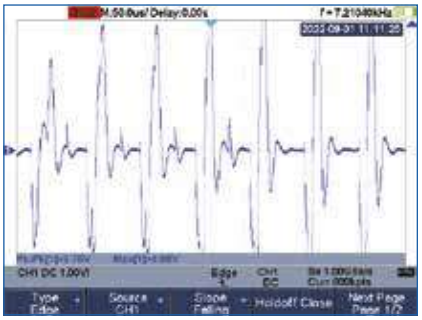
Press "V" to increase vertical scale (shorter waveforms)

Press "mV" to decrease vertical scale (taller waveforms)

Amplitude will need to be adjusted according to the conditions. Set V/div to show complete wave from top peak to bottom peak.



In this example the vertical scale is too large. Press **mV** to shrink the scale and show more detail.



In this example the vertical scale is too small. Press **V** to enlarge the scale and show the whole waveform.

SETTING HORIZONTAL SCALE (s/div)

Control the horizontal scale of the displayed signal by adjusting the time scale. 500µs (microseconds) is a good place to start and then adjust the time based on the conditions. The selected seconds per division setting is shown at the bottom center of the screen. The EDM waveforms are best displayed at a setting of 50us/div or less. Adjust the time setting to show the desired waveform.

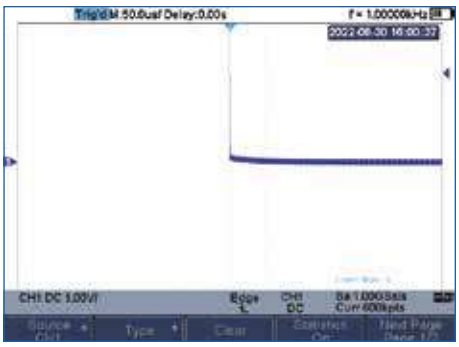
Press "s" to increase horizontal scale (narrower waveforms)

Press "ns" to decrease horizontal scale (wider waveforms)

The image at left has a timescale of 20 µs/div. It clearly shows a rise in voltage and an abrupt, sharp discharge (third peak).

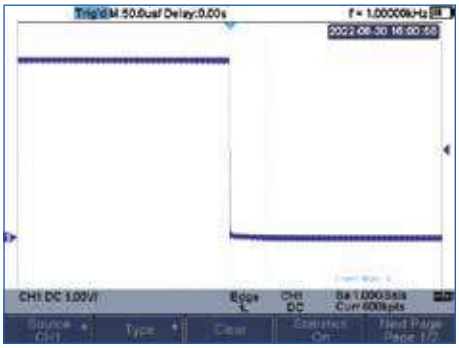
ADJUSTING WAVEFORM POSITION

Some waveforms may display too high or low on the screen. This often happens when using the **Measure** function.

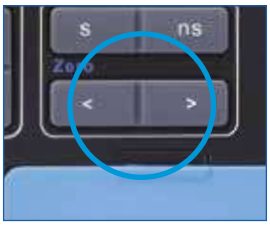


The waveform's onscreen position can be adjusted by offsetting the voltage.

The up arrow moves the waveform higher onscreen and the down arrow moves it lower. The current offset level is indicated by the blue 1 and arrow at the extreme left of the screen.



The time can also be offset. The arrows under the s/ns buttons similarly move waveforms left and right.



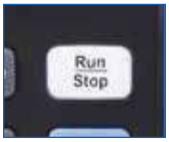
SCREEN CAPTURE: SAVING IMAGES TO FLASH DRIVE

Plug in a USB flash drive. A message will pop up: "USB flash drive detected."

1. Push Print. This automatically captures the screen and saves it to the flash drive. You can view the images on any computer with a USB port when you're finished making images.

Screen capture may be done either while actively collecting data or while collection is paused:

1. Press **RUN/STOP** to pause the screen. Voltage & time scales can be changed while screen is paused.
2. Pressing **RUN/STOP** will resume data collection



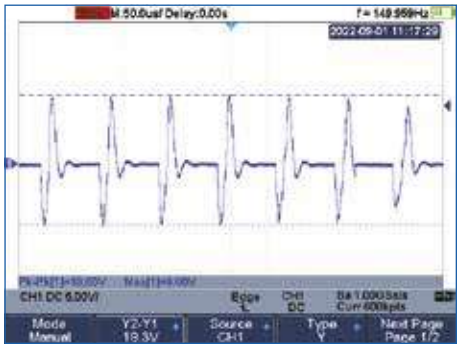
PEAK TO PEAK VOLTAGE (V_{PP}) WITH MEASURE

The AEGIS-OSC-9200 offers two main methods to measure peak to peak voltage (Vpp): **Measure**, and **Cursor**.

Press **Measure** and make sure Source = CH1.

Press **F2** for Type. This brings up a list of all available properties to Measure (Peak-Peak is first). You can select up to four measurements with the dial. You can also choose to display statistics onscreen.

Press **F2** again to collapse the Type menu. The measurements you selected are displayed at the bottom of the screen, along with statistics for each (if selected).



PEAK TO PEAK VOLTAGE WITH CURSORS

Press Cursors and make sure Type is Y or XY. If not, press **F4** and use the dial to change it to Y.

Press **F1** for Mode and then select Manual.

The selected cursor (Y1/Y2) is listed over **F2**. Move it up or down using the dial, and then press **F2** and switch to the other cursor, and position it.

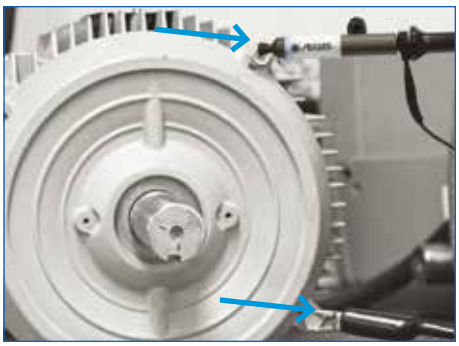
The difference between the cursors is displayed at top left. DY = Y2 – Y1, so position the Y2 cursor at the top of the waveform, and Y1 at the bottom.

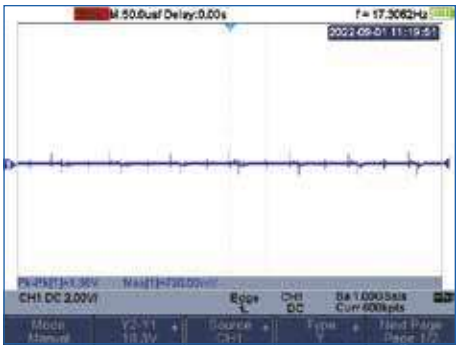
TAKING THE MEASUREMENTS – EMI

Ground Reference Reading: EMI

Before measuring the shaft voltage, take an EMI reading of electrical noise on the motor frame as a baseline. This noise may remain after installing the AEGIS® Ring. This reading will show ground noise or EMI being produced by the motor/drive system, or other systems in the area.

1. Find 2 ground points on the motor. Must be bare metal and conductive.
2. Place the SVP on one of the points and the probe grounding clip on the other point.
3. Measurements will vary depending on the motor size and conditions.



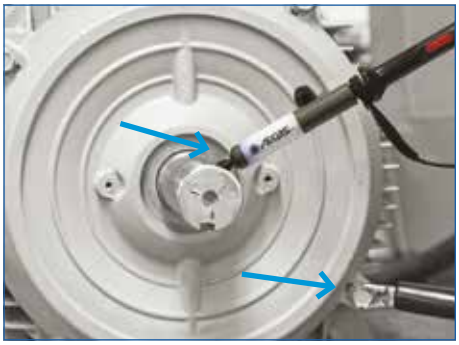


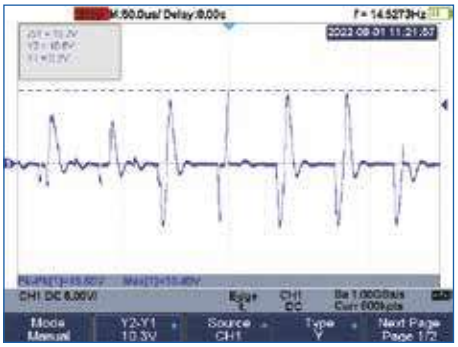
TAKING THE MEASUREMENTS – SHAFT VOLTAGE

Shaft Voltage Reading

1. Shaft must be clean & free of any coatings, paint, or other nonconductive material.
2. Secure the probe in place with magnetic base.
3. Align AEGIS® SVP on shaft end or side ensuring continuous contact. Avoid keyway if possible.
4. Place oscilloscope ground lead on bare metal of motor ensuring conductive path to ground.
5. If this test is to be used in a report, save an image to a USB drive.

⚠ Follow all safety precautions when working with rotating equipment.

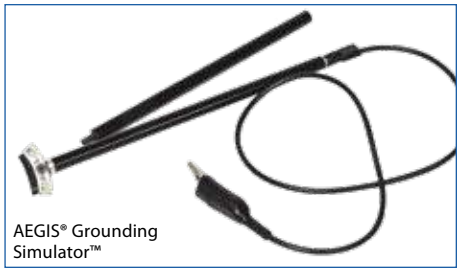




MEASUREMENTS USING THE AEGIS® GROUNDING SIMULATOR™

The AEGIS® Grounding Simulator™ can be used to simulate how the shaft voltage will change after an AEGIS® Ring is installed. It is a quick way of showing a "Before & After". Since only a small number of conductive microfibers are touching the shaft the shaft voltage may be higher than when the circumferential AEGIS® Ring is installed.

1. Take a shaft voltage reading without shaft grounding.
2. Take a shaft voltage reading with the AEGIS® Grounding Simulator.



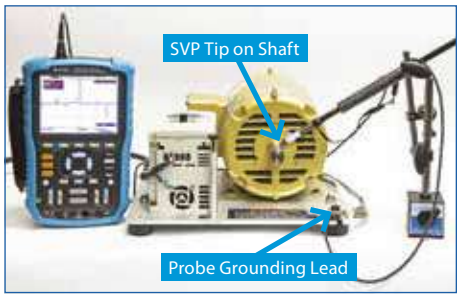
AEGIS® Grounding Simulator™

First Take the Shaft Voltage Reading without Shaft Grounding

1. Shaft must be clean & free of any coatings, paint, or other nonconductive material.
2. Secure the probe in place with magnetic base.
3. Align AEGIS® SVP™ on shaft end or side ensuring continuous contact. Avoid keyway if possible.
4. Place probe grounding lead on bare metal of motor ensuring conductive path to ground.
5. Save the image, as described on page **31**.

The voltage measurement of 28.6V peak to peak is an example of the shaft voltage discharging through the bearings without AEGIS® shaft grounding.

⚠ Follow all safety precaution when working with rotating equipment.

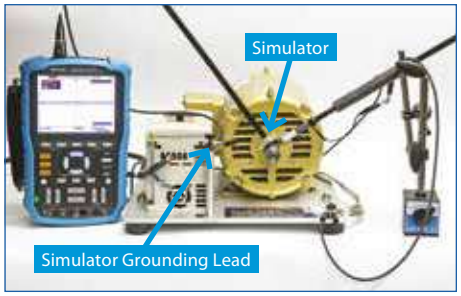


Next Take the Shaft Voltage Reading with the Grounding Simulator™ Touching the Shaft

1. Maintain the same setup as above.
2. Place the AEGIS® Grounding Simulator™ grounding lead on bare metal of motor ensuring conductive path to ground.
3. Place the Simulator against the shaft to simulate the AEGIS® SGR Shaft Grounding Ring.
4. Freeze the screen and save the image.

The voltage measurement of 2.2V peak to peak is an example of the shaft voltage discharging through the AEGIS® Grounding Simulator to ground. To achieve long term shaft grounding with equal or better performance, install an AEGIS® Shaft Grounding Ring.

⚠ Follow all safety precautions when working with rotating equipment.



TESTING & INSPECTION

Cutting and inspecting every bearing in motors that come in for repair, especially motors operated on variable frequency drives, will often provide vital information to make the best repair recommendation and thus improve the machine's overall lifetime performance.

Report template available at: est-aegis.com/reports

1. **Inspect the outside and the inside of both bearings** and retain a sample of the lubricant for analysis. Look for:
   a. Contamination
   b. Signs of excessive heat
   c. Hardening of grease
   d. Abnormal coloration (blackened grease)
   e. Excess grease and oil escaping the bearing

2. **Cut the outer race into halves.** Remove seals or shields prior to cutting.

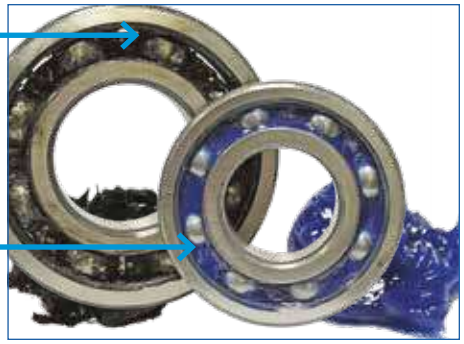
⚠ Follow established safety precautions and use personal protective equipment including eye protection, hearing protection, face shield, gloves, and protective clothing.

3. **Inspect the grease** and any contamination in the bearing.
   a. **Burnt Grease:** Continuous electrical arcing in the motor bearings will often rapidly deteriorate the lubricating capability of the grease and cause bearing race damage. When an arc occurs, the oil component of the grease is heated beyond its temperature capacity.
   b. **Contamination:** In addition to the burnt grease, the arcing causes small metal particles to detach from the bearing races/balls, which then get distributed throughout the grease. These particles are abrasive and will cause the bearing to prematurely wear.

Bearing Inspection

Burnt bearing grease is blackened and oftentimes contaminated with metal particles.

New bearing grease is available in many colors. Blue grease (as shown) is Polyrex EM. It is commonly found in electric motor bearings.

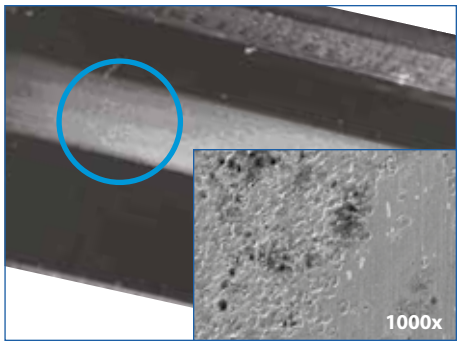


4. **Clean the bearing's** components using a degreaser or solvent.

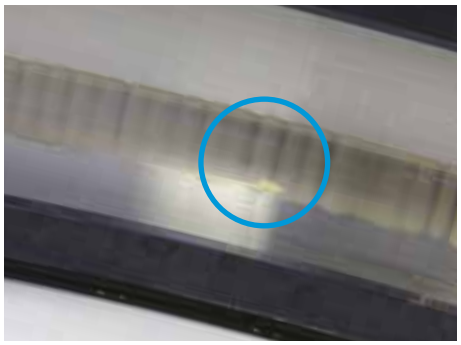
   ⚠ Follow all safety precautions.

5. **Inspect for evidence of Electrical Discharge Machining (EDM):** EDM damage is millions of microscopic electrical pits that are created when current arcs through the motor's bearings. The shaft voltage overcomes the dielectric of the bearing lubrication and arcs through the inner race, through the rolling elements and to the outer race. The individual pits are usually between 5 and 10 microns in diameter.

6. **Frosting:** This will appear to be a grey discolored line around all or part of the bearing race and may be evident in both the inner and outer race. The discoloration may be caused by mechanical wear or by EDM. Examination under a microscope may be required to determine if the line is EDM or of mechanical origin. If the motor was operated on a VFD with no bearing protection there is a high likelihood that the frosting is from EDM.



7. **Fluting Damage:** Identified by a distinctive washboard pattern. Fluting can be identified with the naked eye or with 10x magnification. Fluting is sometimes confused with mechanical bearing damage such as brinelling/false brinelling, so care should be taken to correctly assign electrical fluting damage to the pattern observed.



In addition to using this manual, please refer to other bearing failure analysis experts in order to determine the root cause of failure.

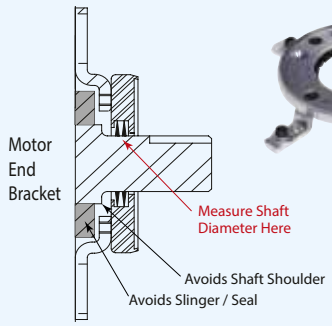
Install new AEGIS® Ring whenever bearings are replaced on an inverter-driven motor.

For standard NEMA or IEC frame motors, the AEGIS® uKIT is the best option. It avoids most shaft shoulders and slingers/seals.

AEGIS® uKIT includes 4 different bracket sizes to suit most situations.

Question to ask:
Does the motor have a shaft shoulder?

If YES or NOT SURE, then the AEGIS® uKIT is the easiest option because it avoids the shaft shoulder area, any slingers/seals or irregular shaped end bracket.

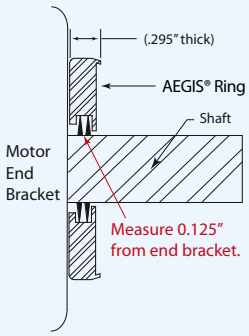


AEGIS® uKIT is attached to motor with screws/washers provided or with conductive epoxy. AEGIS® EP2400 Conductive Epoxy sold separately.

See AEGIS® website for bolt hole circle and installation instructions.

See page 42 for more details.

If NO, the ring can be mounted directly to the end bracket using screws or conductive epoxy.

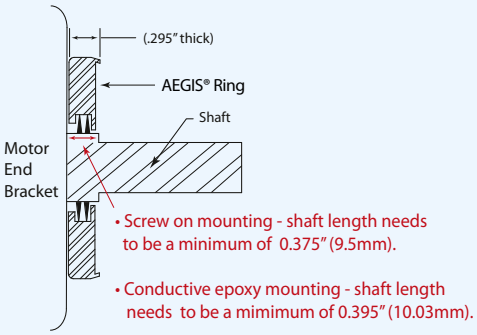


Measure shaft diameter at a point 0.125" from motor end bracket. Then refer to the parts list to locate the correct part number and mounting option of your choosing.

Example shaft measurement 0.445"fits between

Solid Ring Catalog Number	Split Ring Catalog Number	Bolt Through Catalog Number	Solid Ring with Conductive Epoxy	Split Ring with Conductive Epoxy	Min. Shaft Diameter	Max. Shaft Diameter
SGR-9.0-1	SGR-9.0-1A4	SGR-9.0-3FH	SGR-9.0-0AW	SGR-9.0-0A4W	0.396	0.435
SGR-10.1-1	**SGR-10.1-1A4**	**SGR-10.1-3FH**	**SGR-10.1-0AW**	**SGR-10.1-0A4W**	**0.436**	**0.480**
SGR-11.2-1	SGR-11.2-1A4	SGR-11.2-3FH	SGR-11.2-0AW	SGR-11.2-0A4W	0.481	0.520

If YES and you want to mount the ring to fit the shaft shoulder then you need to measure the length of the shoulder. See note in red below. If still applicable, measure shaft shoulder diameter then refer to parts list (as shown above) to locate the correct SGR part number.

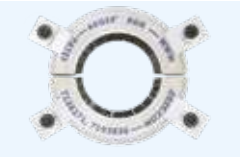


If the shaft shoulder is less than 0.375" / 9.5mm, please refer to the appropriate uKIT based on frame size. If there is no standard uKIT available for the motor's frame size, please contact Customer Service at **+1 866 738 1857** or **sales@est-aegis.com**.

AEGIS® PARTS LIST

Page 39-40

Standard Mounting Clamps (-1)
Shaft diameters: 0.311" to 6.02"
3 to 4 mounting clamps, 6-32 x 1/4" cap screws and washers
Quick and easy installation to most surfaces



Page 39-40

Split Ring (-1A4)
Shaft diameter: 0.311" to 6.02"
4 to 6 mounting clamps, 6-32 x 1/4" cap screws and washers
Installs without decoupling motor

Page 39-40

Bolt Through Mounting (-3FH)
Shaft diameters: 0.311" to 6.02"
6-32 x 1/2" flat head screws
2 mounting holes up to shaft size 3.395"
4 mounting holes for larger sizes

Page 39-40

Conductive Epoxy Mounting (-0AW, -0A4W)
Shaft diameters: 0.311" to 6.02"
Solid and Split Ring
Quick and easy installation to metal motor frame
Conductive Epoxy Included

Page 41

Press Fit Mounting (-0A6)
Shaft diameters: 0.311" to 6.02"
Clean dry 0.004" press fit
Custom sizes available

Page 42

uKIT – SGR with Universal Mounting Bracket
Sized for NEMA and IEC Frame motors
Solid and Split Ring
Can be mounted with hardware or conductive epoxy

Page 43-44

AEGIS® PRO Series
6 rows of conductive microfiber
AEGIS® PRO Series

Page 45

AEGIS® Shaft Voltage Tester™
AEGIS® Shaft Voltage Tester™
SVP – AEGIS® Shaft Voltage Probe

Page 46

Accessories
HFGS – High-Frequency Ground Strap
CS015 – AEGIS® Colloidal Silver Shaft Coating
EP2400 – AEGIS® Conductive Epoxy

Solid Ring, Split Ring, and Bolt Through Mounting for Low Voltage Motors to 500 HP

Solid Ring Catalog Number	Split Ring* Catalog Number	Bolt Through Catalog Number	Solid Ring with Conductive Epoxy	Split Ring* with Conductive Epoxy	Min. Shaft Diameter (in)	Max. Shaft Diameter (in)	Outside Diameter (in)	Thickness Max (in)
SGR-6.9-1	SGR-6.9-1A4	SGR-6.9-3FH	SGR-6.9-0AW	SGR-6.9-0A4W	0.311	0.355	1.60	0.295
SGR-8.0-1	SGR-8.0-1A4	SGR-8.0-3FH	SGR-8.0-0AW	SGR-8.0-0A4W	0.356	0.395	1.60	0.295
SGR-9.0-1	SGR-9.0-1A4	SGR-9.0-3FH	SGR-9.0-0AW	SGR-9.0-0A4W	0.396	0.435	1.60	0.295
SGR-10.1-1	SGR-10.1-1A4	SGR-10.1-3FH	SGR-10.1-0AW	SGR-10.1-0A4W	0.436	0.480	1.60	0.295
SGR-11.2-1	SGR-11.2-1A4	SGR-11.2-3FH	SGR-11.2-0AW	SGR-11.2-0A4W	0.481	0.520	1.60	0.295
SGR-12.2-1	SGR-12.2-1A4	SGR-12.2-3FH	SGR-12.2-0AW	SGR-12.2-0A4W	0.521	0.560	1.60	0.295
SGR-13.2-1	SGR-13.2-1A4	SGR-13.2-3FH	SGR-13.2-0AW	SGR-13.2-0A4W	0.561	0.605	1.60	0.295
SGR-14.4-1	SGR-14.4-1A4	SGR-14.4-3FH	SGR-14.4-0AW	SGR-14.4-0A4W	0.606	0.645	1.60	0.295
SGR-15.4-1	SGR-15.4-1A4	SGR-15.4-3FH	SGR-15.4-0AW	SGR-15.4-0A4W	0.646	0.685	2.10	0.295
SGR-16.4-1	SGR-16.4-1A4	SGR-16.4-3FH	SGR-16.4-0AW	SGR-16.4-0A4W	0.686	0.730	2.10	0.295
SGR-17.6-1	SGR-17.6-1A4	SGR-17.6-3FH	SGR-17.6-0AW	SGR-17.6-0A4W	0.731	0.774	2.10	0.295
SGR-18.7-1	SGR-18.7-1A4	SGR-18.7-3FH	SGR-18.7-0AW	SGR-18.7-0A4W	0.775	0.815	2.10	0.295
SGR-19.7-1	SGR-19.7-1A4	SGR-19.7-3FH	SGR-19.7-0AW	SGR-19.7-0A4W	0.816	0.855	2.10	0.295
SGR-20.7-1	SGR-20.7-1A4	SGR-20.7-3FH	SGR-20.7-0AW	SGR-20.7-0A4W	0.856	0.895	2.10	0.295
SGR-21.7-1	SGR-21.7-1A4	SGR-21.7-3FH	SGR-21.7-0AW	SGR-21.7-0A4W	0.896	0.935	2.10	0.295
SGR-22.8-1	SGR-22.8-1A4	SGR-22.8-3FH	SGR-22.8-0AW	SGR-22.8-0A4W	0.936	0.980	2.10	0.295
SGR-23.9-1	SGR-23.9-1A4	SGR-23.9-3FH	SGR-23.9-0AW	SGR-23.9-0A4W	0.981	1.020	2.10	0.295
SGR-24.9-1	SGR-24.9-1A4	SGR-24.9-3FH	SGR-24.9-0AW	SGR-24.9-0A4W	1.021	1.060	2.10	0.295
SGR-25.9-1	SGR-25.9-1A4	SGR-25.9-3FH	SGR-25.9-0AW	SGR-25.9-0A4W	1.061	1.105	2.10	0.295
SGR-27.1-1	SGR-27.1-1A4	SGR-27.1-3FH	SGR-27.1-0AW	SGR-27.1-0A4W	1.106	1.145	2.10	0.295
SGR-28.1-1	SGR-28.1-1A4	SGR-28.1-3FH	SGR-28.1-0AW	SGR-28.1-0A4W	1.146	1.185	2.10	0.295
SGR-29.1-1	SGR-29.1-1A4	SGR-29.1-3FH	SGR-29.1-0AW	SGR-29.1-0A4W	1.186	1.230	2.10	0.295
SGR-30.3-1	SGR-30.3-1A4	SGR-30.3-3FH	SGR-30.3-0AW	SGR-30.3-0A4W	1.231	1.270	2.10	0.295
SGR-31.3-1	SGR-31.3-1A4	SGR-31.3-3FH	SGR-31.3-0AW	SGR-31.3-0A4W	1.271	1.310	2.10	0.295
SGR-32.3-1	SGR-32.3-1A4	SGR-32.3-3FH	SGR-32.3-0AW	SGR-32.3-0A4W	1.311	1.355	2.10	0.295
SGR-33.4-1	SGR-33.4-1A4	SGR-33.4-3FH	SGR-33.4-0AW	SGR-33.4-0A4W	1.356	1.395	2.10	0.295
SGR-34.4-1	SGR-34.4-1A4	SGR-34.4-3FH	SGR-34.4-0AW	SGR-34.4-0A4W	1.396	1.435	2.68	0.295
SGR-35.5-1	SGR-35.5-1A4	SGR-35.5-3FH	SGR-35.5-0AW	SGR-35.5-0A4W	1.436	1.480	2.68	0.295
SGR-36.6-1	SGR-36.6-1A4	SGR-36.6-3FH	SGR-36.6-0AW	SGR-36.6-0A4W	1.481	1.520	2.68	0.295
SGR-37.6-1	SGR-37.6-1A4	SGR-37.6-3FH	SGR-37.6-0AW	SGR-37.6-0A4W	1.521	1.560	2.68	0.295
SGR-38.6-1	SGR-38.6-1A4	SGR-38.6-3FH	SGR-38.6-0AW	SGR-38.6-0A4W	1.561	1.605	2.68	0.295
SGR-39.8-1	SGR-39.8-1A4	SGR-39.8-3FH	SGR-39.8-0AW	SGR-39.8-0A4W	1.606	1.645	2.68	0.295
SGR-40.8-1	SGR-40.8-1A4	SGR-40.8-3FH	SGR-40.8-0AW	SGR-40.8-0A4W	1.646	1.685	2.68	0.295
SGR-41.8-1	SGR-41.8-1A4	SGR-41.8-3FH	SGR-41.8-0AW	SGR-41.8-0A4W	1.686	1.730	2.68	0.295
SGR-43.0-1	SGR-43.0-1A4	SGR-43.0-3FH	SGR-43.0-0AW	SGR-43.0-0A4W	1.731	1.770	2.68	0.295
SGR-44.0-1	SGR-44.0-1A4	SGR-44.0-3FH	SGR-44.0-0AW	SGR-44.0-0A4W	1.771	1.810	2.68	0.295
SGR-45.0-1	SGR-45.0-1A4	SGR-45.0-3FH	SGR-45.0-0AW	SGR-45.0-0A4W	1.811	1.855	2.68	0.295
SGR-46.1-1	SGR-46.1-1A4	SGR-46.1-3FH	SGR-46.1-0AW	SGR-46.1-0A4W	1.856	1.895	2.68	0.295
SGR-47.1-1	SGR-47.1-1A4	SGR-47.1-3FH	SGR-47.1-0AW	SGR-47.1-0A4W	1.896	1.935	2.68	0.295
SGR-48.2-1	SGR-48.2-1A4	SGR-48.2-3FH	SGR-48.2-0AW	SGR-48.2-0A4W	1.936	1.980	2.68	0.295
SGR-49.3-1	SGR-49.3-1A4	SGR-49.3-3FH	SGR-49.3-0AW	SGR-49.3-0A4W	1.981	2.020	2.68	0.295
SGR-50.3-1	SGR-50.3-1A4	SGR-50.3-3FH	SGR-50.3-0AW	SGR-50.3-0A4W	2.021	2.060	3.10	0.295
SGR-51.3-1	SGR-51.3-1A4	SGR-51.3-3FH	SGR-51.3-0AW	SGR-51.3-0A4W	2.061	2.105	3.10	0.295
SGR-52.5-1	SGR-52.5-1A4	SGR-52.5-3FH	SGR-52.5-0AW	SGR-52.5-0A4W	2.106	2.145	3.10	0.295
SGR-53.5-1	SGR-53.5-1A4	SGR-53.5-3FH	SGR-53.5-0AW	SGR-53.5-0A4W	2.146	2.185	3.10	0.295
SGR-54.5-1	SGR-54.5-1A4	SGR-54.5-3FH	SGR-54.5-0AW	SGR-54.5-0A4W	2.186	2.230	3.10	0.295
SGR-55.7-1	SGR-55.7-1A4	SGR-55.7-3FH	SGR-55.7-0AW	SGR-55.7-0A4W	2.231	2.270	3.10	0.295
SGR-56.7-1	SGR-56.7-1A4	SGR-56.7-3FH	SGR-56.7-0AW	SGR-56.7-0A4W	2.271	2.310	3.10	0.295
SGR-57.7-1	SGR-57.7-1A4	SGR-57.7-3FH	SGR-57.7-0AW	SGR-57.7-0A4W	2.311	2.355	3.10	0.295
SGR-58.8-1	SGR-58.8-1A4	SGR-58.8-3FH	SGR-58.8-0AW	SGR-58.8-0A4W	2.356	2.395	3.10	0.295
SGR-59.8-1	SGR-59.8-1A4	SGR-59.8-3FH	SGR-59.8-0AW	SGR-59.8-0A4W	2.396	2.435	3.60	0.295
SGR-60.9-1	SGR-60.9-1A4	SGR-60.9-3FH	SGR-60.9-0AW	SGR-60.9-0A4W	2.436	2.480	3.60	0.295
SGR-62.0-1	SGR-62.0-1A4	SGR-62.0-3FH	SGR-62.0-0AW	SGR-62.0-0A4W	2.481	2.520	3.60	0.295
SGR-63.0-1	SGR-63.0-1A4	SGR-63.0-3FH	SGR-63.0-0AW	SGR-63.0-0A4W	2.521	2.560	3.60	0.295
SGR-64.0-1	SGR-64.0-1A4	SGR-64.0-3FH	SGR-64.0-0AW	SGR-64.0-0A4W	2.561	2.605	3.60	0.295
SGR-65.2-1	SGR-65.2-1A4	SGR-65.2-3FH	SGR-65.2-0AW	SGR-65.2-0A4W	2.606	2.645	3.60	0.295
SGR-66.2-1	SGR-66.2-1A4	SGR-66.2-3FH	SGR-66.2-0AW	SGR-66.2-0A4W	2.646	2.685	3.60	0.295
SGR-67.2-1	SGR-67.2-1A4	SGR-67.2-3FH	SGR-67.2-0AW	SGR-67.2-0A4W	2.686	2.730	3.60	0.295
SGR-68.4-1	SGR-68.4-1A4	SGR-68.4-3FH	SGR-68.4-0AW	SGR-68.4-0A4W	2.731	2.770	3.60	0.295
SGR-69.4-1	SGR-69.4-1A4	SGR-69.4-3FH	SGR-69.4-0AW	SGR-69.4-0A4W	2.771	2.810	3.60	0.295
SGR-70.4-1	SGR-70.4-1A4	SGR-70.4-3FH	SGR-70.4-0AW	SGR-70.4-0A4W	2.811	2.855	3.60	0.295
SGR-71.5-1	SGR-71.5-1A4	SGR-71.5-3FH	SGR-71.5-0AW	SGR-71.5-0A4W	2.856	2.895	3.60	0.295
SGR-72.5-1	SGR-72.5-1A4	SGR-72.5-3FH	SGR-72.5-0AW	SGR-72.5-0A4W	2.896	2.935	4.10	0.295
SGR-73.6-1	SGR-73.6-1A4	SGR-73.6-3FH	SGR-73.6-0AW	SGR-73.6-0A4W	2.936	2.980	4.10	0.295
SGR-74.7-1	SGR-74.7-1A4	SGR-74.7-3FH	SGR-74.7-0AW	SGR-74.7-0A4W	2.981	3.020	4.10	0.295
SGR-75.7-1	SGR-75.7-1A4	SGR-75.7-3FH	SGR-75.7-0AW	SGR-75.7-0A4W	3.021	3.060	4.10	0.295
SGR-76.7-1	SGR-76.7-1A4	SGR-76.7-3FH	SGR-76.7-0AW	SGR-76.7-0A4W	3.061	3.105	4.10	0.295
SGR-77.9-1	SGR-77.9-1A4	SGR-77.9-3FH	SGR-77.9-0AW	SGR-77.9-0A4W	3.106	3.145	4.10	0.295
SGR-78.9-1	SGR-78.9-1A4	SGR-78.9-3FH	SGR-78.9-0AW	SGR-78.9-0A4W	3.146	3.185	4.10	0.295
	*Custom Part-No Return			*Custom Part-No Return				

AEGIS® Parts List

Note: Use PRO Series Rings for Low Voltage Motors Greater than 500 HP / 375 kW and All Medium Voltage Motors See page 43

Solid Ring Catalog Number	Split Ring* Catalog Number	Bolt Through Catalog Number	Solid Ring with Conductive Epoxy	Split Ring* with Conductive Epoxy	Min. Shaft Diameter (in)	Max. Shaft Diameter (in)	Outside Diameter (in)	Thickness Max (in)
SGR-79.9-1	SGR-79.9-1A4	SGR-79.9-3FH	SGR-79.9-0AW	SGR-79.9-0A4W	3.186	3.230	4.10	0.295
SGR-81.1-1	SGR-81.1-1A4	SGR-81.1-3FH	SGR-81.1-0AW	SGR-81.1-0A4W	3.231	3.270	4.10	0.295
SGR-82.1-1	SGR-82.1-1A4	SGR-82.1-3FH	SGR-82.1-0AW	SGR-82.1-0A4W	3.271	3.310	4.10	0.295
SGR-83.1-1	SGR-83.1-1A4	SGR-83.1-3FH	SGR-83.1-0AW	SGR-83.1-0A4W	3.311	3.355	4.10	0.295
SGR-84.2-1	SGR-84.2-1A4	SGR-84.2-3FH	SGR-84.2-0AW	SGR-84.2-0A4W	3.356	3.395	4.10	0.295
SGR-85.2-1	SGR-85.2-1A4	SGR-85.2-3FH	SGR-85.2-0AW	SGR-85.2-0A4W	3.396	3.435	4.60	0.295
SGR-86.3-1	SGR-86.3-1A4	SGR-86.3-3FH	SGR-86.3-0AW	SGR-86.3-0A4W	3.436	3.480	4.60	0.295
SGR-87.4-1	SGR-87.4-1A4	SGR-87.4-3FH	SGR-87.4-0AW	SGR-87.4-0A4W	3.481	3.520	4.60	0.295
SGR-88.4-1	SGR-88.4-1A4	SGR-88.4-3FH	SGR-88.4-0AW	SGR-88.4-0A4W	3.521	3.560	4.60	0.295
SGR-89.4-1	SGR-89.4-1A4	SGR-89.4-3FH	SGR-89.4-0AW	SGR-89.4-0A4W	3.561	3.605	4.60	0.295
SGR-90.6-1	SGR-90.6-1A4	SGR-90.6-3FH	SGR-90.6-0AW	SGR-90.6-0A4W	3.606	3.645	4.60	0.295
SGR-91.6-1	SGR-91.6-1A4	SGR-91.6-3FH	SGR-91.6-0AW	SGR-91.6-0A4W	3.646	3.685	4.60	0.295
SGR-92.6-1	SGR-92.6-1A4	SGR-92.6-3FH	SGR-92.6-0AW	SGR-92.6-0A4W	3.686	3.730	4.60	0.295
SGR-93.8-1	SGR-93.8-1A4	SGR-93.8-3FH	SGR-93.8-0AW	SGR-93.8-0A4W	3.731	3.770	4.60	0.295
SGR-94.8-1	SGR-94.8-1A4	SGR-94.8-3FH	SGR-94.8-0AW	SGR-94.8-0A4W	3.771	3.810	4.60	0.295
SGR-95.8-1	SGR-95.8-1A4	SGR-95.8-3FH	SGR-95.8-0AW	SGR-95.8-0A4W	3.811	3.855	4.60	0.295
SGR-96.9-1	SGR-96.9-1A4	SGR-96.9-3FH	SGR-96.9-0AW	SGR-96.9-0A4W	3.856	3.895	4.60	0.295
SGR-97.9-1	SGR-97.9-1A4	SGR-97.9-3FH	SGR-97.9-0AW	SGR-97.9-0A4W	3.896	3.935	5.10	0.295
SGR-99.0-1	SGR-99.0-1A4	SGR-99.0-3FH	SGR-99.0-0AW	SGR-99.0-0A4W	3.936	3.980	5.10	0.295
SGR-100.1-1	SGR-100.1-1A4	SGR-100.1-3FH	SGR-100.1-0AW	SGR-100.1-0A4W	3.981	4.020	5.10	0.295
SGR-101.1-1	SGR-101.1-1A4	SGR-101.1-3FH	SGR-101.1-0AW	SGR-101.1-0A4W	4.021	4.060	5.10	0.295
SGR-102.1-1	SGR-102.1-1A4	SGR-102.1-3FH	SGR-102.1-0AW	SGR-102.1-0A4W	4.061	4.105	5.10	0.295
SGR-103.3-1	SGR-103.3-1A4	SGR-103.3-3FH	SGR-103.3-0AW	SGR-103.3-0A4W	4.106	4.145	5.10	0.295
SGR-104.3-1	SGR-104.3-1A4	SGR-104.3-3FH	SGR-104.3-0AW	SGR-104.3-0A4W	4.146	4.185	5.10	0.295
SGR-105.3-1	SGR-105.3-1A4	SGR-105.3-3FH	SGR-105.3-0AW	SGR-105.3-0A4W	4.186	4.230	5.10	0.295
SGR-106.5-1	SGR-106.5-1A4	SGR-106.5-3FH	SGR-106.5-0AW	SGR-106.5-0A4W	4.231	4.270	5.10	0.295
SGR-107.5-1	SGR-107.5-1A4	SGR-107.5-3FH	SGR-107.5-0AW	SGR-107.5-0A4W	4.271	4.310	5.10	0.295
SGR-108.5-1	SGR-108.5-1A4	SGR-108.5-3FH	SGR-108.5-0AW	SGR-108.5-0A4W	4.311	4.355	5.10	0.295
SGR-109.6-1	SGR-109.6-1A4	SGR-109.6-3FH	SGR-109.6-0AW	SGR-109.6-0A4W	4.356	4.395	5.10	0.295
SGR-110.6-1	SGR-110.6-1A4	SGR-110.6-3FH	SGR-110.6-0AW	SGR-110.6-0A4W	4.396	4.435	5.60	0.295
SGR-111.7-1	SGR-111.7-1A4	SGR-111.7-3FH	SGR-111.7-0AW	SGR-111.7-0A4W	4.436	4.480	5.60	0.295
SGR-112.8-1	SGR-112.8-1A4	SGR-112.8-3FH	SGR-112.8-0AW	SGR-112.8-0A4W	4.481	4.520	5.60	0.295
SGR-113.8-1	SGR-113.8-1A4	SGR-113.8-3FH	SGR-113.8-0AW	SGR-113.8-0A4W	4.521	4.560	5.60	0.295
SGR-114.8-1	SGR-114.8-1A4	SGR-114.8-3FH	SGR-114.8-0AW	SGR-114.8-0A4W	4.561	4.605	5.60	0.295
SGR-116.0-1	SGR-116.0-1A4	SGR-116.0-3FH	SGR-116.0-0AW	SGR-116.0-0A4W	4.606	4.645	5.60	0.295
SGR-117.0-1	SGR-117.0-1A4	SGR-117.0-3FH	SGR-117.0-0AW	SGR-117.0-0A4W	4.646	4.685	5.60	0.295
SGR-118.0-1	SGR-118.0-1A4	SGR-118.0-3FH	SGR-118.0-0AW	SGR-118.0-0A4W	4.686	4.730	5.60	0.295
SGR-119.2-1	SGR-119.2-1A4	SGR-119.2-3FH	SGR-119.2-0AW	SGR-119.2-0A4W	4.731	4.770	5.60	0.295
SGR-120.2-1	SGR-120.2-1A4	SGR-120.2-3FH	SGR-120.2-0AW	SGR-120.2-0A4W	4.771	4.810	5.60	0.295
SGR-121.2-1	SGR-121.2-1A4	SGR-121.2-3FH	SGR-121.2-0AW	SGR-121.2-0A4W	4.811	4.855	5.60	0.295
SGR-122.3-1	SGR-122.3-1A4	SGR-122.3-3FH	SGR-122.3-0AW	SGR-122.3-0A4W	4.856	4.895	5.60	0.295
SGR-123.3-1	SGR-123.3-1A4	SGR-123.3-3FH	SGR-123.3-0AW	SGR-123.3-0A4W	4.896	4.935	6.10	0.295
SGR-124.4-1	SGR-124.4-1A4	SGR-124.4-3FH	SGR-124.4-0AW	SGR-124.4-0A4W	4.936	4.980	6.10	0.295
SGR-125.5-1	SGR-125.5-1A4	SGR-125.5-3FH	SGR-125.5-0AW	SGR-125.5-0A4W	4.981	5.020	6.10	0.295
SGR-126.5-1	SGR-126.5-1A4	SGR-126.5-3FH	SGR-126.5-0AW	SGR-126.5-0A4W	5.021	5.060	6.10	0.295
SGR-127.5-1	SGR-127.5-1A4	SGR-127.5-3FH	SGR-127.5-0AW	SGR-127.5-0A4W	5.061	5.105	6.10	0.295
SGR-128.7-1	SGR-128.7-1A4	SGR-128.7-3FH	SGR-128.7-0AW	SGR-128.7-0A4W	5.106	5.145	6.10	0.295
SGR-129.7-1	SGR-129.7-1A4	SGR-129.7-3FH	SGR-129.7-0AW	SGR-129.7-0A4W	5.146	5.185	6.10	0.295
SGR-130.7-1	SGR-130.7-1A4	SGR-130.7-3FH	SGR-130.7-0AW	SGR-130.7-0A4W	5.186	5.230	6.10	0.295
SGR-131.9-1	SGR-131.9-1A4	SGR-131.9-3FH	SGR-131.9-0AW	SGR-131.9-0A4W	5.231	5.270	6.10	0.295
SGR-132.9-1	SGR-132.9-1A4	SGR-132.9-3FH	SGR-132.9-0AW	SGR-132.9-0A4W	5.271	5.310	6.10	0.295
SGR-133.9-1	SGR-133.9-1A4	SGR-133.9-3FH	SGR-133.9-0AW	SGR-133.9-0A4W	5.311	5.355	6.10	0.295
SGR-135.0-1	SGR-135.0-1A4	SGR-135.0-3FH	SGR-135.0-0AW	SGR-135.0-0A4W	5.356	5.395	6.10	0.295
SGR-136.0-1	SGR-136.0-1A4	SGR-136.0-3FH	SGR-136.0-0AW	SGR-136.0-0A4W	5.396	5.435	6.60	0.295
SGR-137.1-1	SGR-137.1-1A4	SGR-137.1-3FH	SGR-137.1-0AW	SGR-137.1-0A4W	5.436	5.480	6.60	0.295
SGR-138.2-1	SGR-138.2-1A4	SGR-138.2-3FH	SGR-138.2-0AW	SGR-138.2-0A4W	5.481	5.520	6.60	0.295
SGR-139.2-1	SGR-139.2-1A4	SGR-139.2-3FH	SGR-139.2-0AW	SGR-139.2-0A4W	5.521	5.560	6.60	0.295
SGR-140.2-1	SGR-140.2-1A4	SGR-140.2-3FH	SGR-140.2-0AW	SGR-140.2-0A4W	5.561	5.605	6.60	0.295
SGR-141.4-1	SGR-141.4-1A4	SGR-141.4-3FH	SGR-141.4-0AW	SGR-141.4-0A4W	5.606	5.645	6.60	0.295
SGR-142.4-1	SGR-142.4-1A4	SGR-142.4-3FH	SGR-142.4-0AW	SGR-142.4-0A4W	5.646	5.685	6.60	0.295
SGR-143.4-1	SGR-143.4-1A4	SGR-143.4-3FH	SGR-143.4-0AW	SGR-143.4-0A4W	5.686	5.730	6.60	0.295
SGR-144.6-1	SGR-144.6-1A4	SGR-144.6-3FH	SGR-144.6-0AW	SGR-144.6-0A4W	5.731	5.770	6.60	0.295
SGR-145.6-1	SGR-145.6-1A4	SGR-145.6-3FH	SGR-145.6-0AW	SGR-145.6-0A4W	5.771	5.810	6.60	0.295
SGR-146.6-1	SGR-146.6-1A4	SGR-146.6-3FH	SGR-146.6-0AW	SGR-146.6-0A4W	5.811	5.855	6.60	0.295
SGR-147.7-1	SGR-147.7-1A4	SGR-147.7-3FH	SGR-147.7-0AW	SGR-147.7-0A4W	5.856	5.895	6.60	0.295
SGR-148.7-1	SGR-148.7-1A4	SGR-148.7-3FH	SGR-148.7-0AW	SGR-148.7-0A4W	5.896	5.935	7.10	0.295
SGR-149.8-1	SGR-149.8-1A4	SGR-149.8-3FH	SGR-149.8-0AW	SGR-149.8-0A4W	5.936	5.980	7.10	0.295
SGR-150.9-1	SGR-150.9-1A4	SGR-150.9-3FH	SGR-150.9-0AW	SGR-150.9-0A4W	5.981	6.020	7.10	0.295

*Custom Part-No Return

*Custom Part-No Return

Note: Use PRO Series Rings for Low Voltage Motors Greater than 500 HP / 375 kW and All Medium Voltage Motors See page 43

AEGIS® SGR – Press Fit Mounting for Low Voltage Motors to 500 HP / 375 kW

Catalog Number	Min. shaft diameter (in)	Max. shaft diameter (in)	SGR OD Tolerance +0/-0.001	Thickness Max (in)	Bore Tolerance +0.001/-0 (in)
SGR-6.9-0A6	0.311	0.355	1.580	0.295	1.576
SGR- 8.0-0A6	0.356	0.395	1.580	0.295	1.576
SGR-9.0-0A6	0.396	0.435	1.580	0.295	1.576
SGR-10.1-0A6	0.436	0.480	1.580	0.295	1.576
SGR-11.2-0A6	0.481	0.520	1.580	0.295	1.576
SGR-12.2-0A6	0.521	0.560	1.580	0.295	1.576
SGR-13.2-0A6	0.561	0.605	1.580	0.295	1.576
SGR-14.4-0A6	0.606	0.645	1.580	0.295	1.576
SGR-15.4-0A6	0.646	0.685	2.080	0.295	2.076
SGR-16.4-0A6	0.686	0.730	2.080	0.295	2.076
SGR-17.6-0A6	0.731	0.774	2.080	0.295	2.076
SGR-18.7-0A6	0.775	0.815	2.080	0.295	2.076
SGR-19.7-0A6	0.816	0.855	2.080	0.295	2.076
SGR-20.7-0A6	0.856	0.895	2.080	0.295	2.076
SGR-21.7-0A6	0.896	0.935	2.080	0.295	2.076
SGR-22.8-0A6	0.936	0.980	2.080	0.295	2.076
SGR-23.9-0A6	0.981	1.020	2.080	0.295	2.076
SGR-24.9-0A6	1.021	1.060	2.080	0.295	2.076
SGR-25.9-0A6	1.061	1.105	2.080	0.295	2.076
SGR-27.1-0A6	1.106	1.145	2.080	0.295	2.076
SGR-28.1-0A6	1.146	1.185	2.080	0.295	2.076
SGR-29.1-0A6	1.186	1.230	2.080	0.295	2.076
SGR-30.3-0A6	1.231	1.270	2.080	0.295	2.076
SGR-31.3-0A6	1.271	1.310	2.080	0.295	2.076
SGR-32.3-0A6	1.311	1.355	2.080	0.295	2.076
SGR-33.4-0A6	1.356	1.395	2.080	0.295	2.076
SGR-34.4-0A6	1.396	1.435	2.660	0.295	2.656
SGR-35.5-0A6	1.436	1.480	2.660	0.295	2.656
SGR-36.6-0A6	1.481	1.520	2.660	0.295	2.656
SGR-37.6-0A6	1.521	1.560	2.660	0.295	2.656
SGR-38.6-0A6	1.561	1.605	2.660	0.295	2.656
SGR-39.8-0A6	1.606	1.645	2.660	0.295	2.656
SGR-40.8-0A6	1.646	1.685	2.660	0.295	2.656
SGR-41.8-0A6	1.686	1.730	2.660	0.295	2.656
SGR-43.0-0A6	1.731	1.770	2.660	0.295	2.656
SGR-44.0-0A6	1.771	1.810	2.660	0.295	2.656
SGR-45.0-0A6	1.811	1.855	2.660	0.295	2.656
SGR-46.1-0A6	1.856	1.895	2.660	0.295	2.656
SGR-47.1-0A6	1.896	1.935	2.660	0.295	2.656
SGR-48.2-0A6	1.936	1.980	2.660	0.295	2.656
SGR-49.3-0A6	1.981	2.020	2.660	0.295	2.656
SGR-50.3-0A6	2.021	2.060	3.080	0.295	3.076
SGR-51.3-0A6	2.061	2.105	3.080	0.295	3.076
SGR-52.5-0A6	2.106	2.145	3.080	0.295	3.076
SGR-53.5-0A6	2.146	2.185	3.080	0.295	3.076
SGR-54.5-0A6	2.186	2.230	3.080	0.295	3.076
SGR-55.7-0A6	2.231	2.270	3.080	0.295	3.076
SGR-56.7-0A6	2.271	2.310	3.080	0.295	3.076
SGR-57.7-0A6	2.311	2.355	3.080	0.295	3.076
SGR-58.8-0A6	2.356	2.395	3.080	0.295	3.076
SGR-59.8-0A6	2.396	2.435	3.580	0.295	3.576
SGR-60.9-0A6	2.436	2.480	3.580	0.295	3.576
SGR-62.0-0A6	2.481	2.520	3.580	0.295	3.576
SGR-63.0-0A6	2.521	2.560	3.580	0.295	3.576
SGR-64.0-0A6	2.561	2.605	3.580	0.295	3.576
SGR-65.2-0A6	2.606	2.645	3.580	0.295	3.576
SGR-66.2-0A6	2.646	2.685	3.580	0.295	3.576
SGR-67.2-0A6	2.686	2.730	3.580	0.295	3.576
SGR-68.4-0A6	2.731	2.770	3.580	0.295	3.576
SGR-69.4-0A6	2.771	2.810	3.580	0.295	3.576
SGR-70.4-0A6	2.811	2.855	3.580	0.295	3.576
SGR-71.5-0A6	2.856	2.895	3.580	0.295	3.576
SGR-72.5-0A6	2.896	2.935	4.080	0.295	4.076
SGR-73.6-0A6	2.936	2.980	4.080	0.295	4.076
SGR-74.7-0A6	2.981	3.020	4.080	0.295	4.076
SGR-75.7-0A6	3.021	3.060	4.080	0.295	4.076
SGR-76.7-0A6	3.061	3.105	4.080	0.295	4.076
SGR-77.9-0A6	3.106	3.145	4.080	0.295	4.076
SGR-78.9-0A6	3.146	3.185	4.080	0.295	4.076
Custom Part-No Return					

Catalog Number	Min. shaft diameter (in)	Max. shaft diameter (in)	SGR OD Tolerance +0/-0.001	Thickness Max (in)	Bore Tolerance +0.001/-0 (in)
SGR-79.9-0A6	3.186	3.230	4.080	0.295	4.076
SGR-81.1-0A6	3.231	3.270	4.080	0.295	4.076
SGR-82.1-0A6	3.271	3.310	4.080	0.295	4.076
SGR-83.1-0A6	3.311	3.355	4.080	0.295	4.076
SGR-84.2-0A6	3.356	3.395	4.080	0.295	4.076
SGR-85.2-0A6	3.396	3.435	4.580	0.295	4.576
SGR-86.3-0A6	3.436	3.480	4.580	0.295	4.576
SGR-87.4-0A6	3.481	3.520	4.580	0.295	4.576
SGR-88.4-0A6	3.521	3.560	4.580	0.295	4.576
SGR-89.4-0A6	3.561	3.605	4.580	0.295	4.576
SGR-90.6-0A6	3.606	3.645	4.580	0.295	4.576
SGR-91.6-0A6	3.646	3.685	4.580	0.295	4.576
SGR-92.6-0A6	3.686	3.730	4.580	0.295	4.576
SGR-93.8-0A6	3.731	3.770	4.580	0.295	4.576
SGR-94.8-0A6	3.771	3.810	4.580	0.295	4.576
SGR-95.8-0A6	3.811	3.855	4.580	0.295	4.576
SGR-96.9-0A6	3.856	3.895	4.580	0.295	4.576
SGR-97.9-0A6	3.896	3.935	5.080	0.295	5.076
SGR-99.0-0A6	3.936	3.980	5.080	0.295	5.076
SGR-100.1-0A6	3.981	4.020	5.080	0.295	5.076
SGR-101.1-0A6	4.021	4.060	5.080	0.295	5.076
SGR-102.1-0A6	4.061	4.105	5.080	0.295	5.076
SGR-103.3-0A6	4.106	4.145	5.080	0.295	5.076
SGR-104.3-0A6	4.146	4.185	5.080	0.295	5.076
SGR-105.3-0A6	4.186	4.230	5.080	0.295	5.076
SGR-106.5-0A6	4.231	4.270	5.080	0.295	5.076
SGR-107.5-0A6	4.271	4.310	5.080	0.295	5.076
SGR-108.5-0A6	4.311	4.355	5.080	0.295	5.076
SGR-109.6-0A6	4.356	4.395	5.080	0.295	5.076
SGR-110.6-0A6	4.396	4.435	5.580	0.295	5.576
SGR-111.7-0A6	4.436	4.480	5.580	0.295	5.576
SGR-112.8-0A6	4.481	4.520	5.580	0.295	5.576
SGR-113.8-0A6	4.521	4.560	5.580	0.295	5.576
SGR-114.8-0A6	4.561	4.605	5.580	0.295	5.576
SGR-116.0-0A6	4.606	4.645	5.580	0.295	5.576
SGR-117.0-0A6	4.646	4.685	5.580	0.295	5.576
SGR-118.0-0A6	4.686	4.730	5.580	0.295	5.576
SGR-119.2-0A6	4.731	4.770	5.580	0.295	5.576
SGR-120.2-0A6	4.771	4.810	5.580	0.295	5.576
SGR-121.2-0A6	4.811	4.855	5.580	0.295	5.576
SGR-122.3-0A6	4.856	4.895	5.580	0.295	5.576
SGR-123.3-0A6	4.896	4.935	6.080	0.295	6.076
SGR-124.4-0A6	4.936	4.980	6.080	0.295	6.076
SGR-125.5-0A6	4.981	5.020	6.080	0.295	6.076
SGR-126.5-0A6	5.021	5.060	6.080	0.295	6.076
SGR-127.5-0A6	5.061	5.105	6.080	0.295	6.076
SGR-128.7-0A6	5.106	5.145	6.080	0.295	6.076
SGR-129.7-0A6	5.146	5.185	6.080	0.295	6.076
SGR-130.7-0A6	5.186	5.230	6.080	0.295	6.076
SGR-131.9-0A6	5.231	5.270	6.080	0.295	6.076
SGR-132.9-0A6	5.271	5.310	6.080	0.295	6.076
SGR-133.9-0A6	5.311	5.355	6.080	0.295	6.076
SGR-135.0-0A6	5.356	5.395	6.080	0.295	6.076
SGR-136.0-0A6	5.396	5.435	6.580	0.295	6.576
SGR-137.1-0A6	5.436	5.480	6.580	0.295	6.576
SGR-138.2-0A6	5.481	5.520	6.580	0.295	6.576
SGR-139.2-0A6	5.521	5.560	6.580	0.295	6.576
SGR-140.2-0A6	5.561	5.605	6.580	0.295	6.576
SGR-141.4-0A6	5.606	5.645	6.580	0.295	6.576
SGR-142.4-0A6	5.646	5.685	6.580	0.295	6.576
SGR-143.4-0A6	5.686	5.730	6.580	0.295	6.576
SGR-144.6-0A6	5.731	5.770	6.580	0.295	6.576
SGR-145.6-0A6	5.771	5.810	6.580	0.295	6.576
SGR-146.6-0A6	5.811	5.855	6.580	0.295	6.576
SGR-147.7-0A6	5.856	5.895	6.580	0.295	6.576
SGR-148.7-0A6	5.896	5.935	7.080	0.295	7.076
SGR-149.8-0A6	5.936	5.980	7.080	0.295	7.076
SGR-150.9-0A6	5.981	6.020	7.080	0.295	7.076
Custom Part-No Return					

AEGIS® UKIT WITH UNIVERSAL MOUNTING NEMA AND IEC MOTORS

for Low Voltage Motors to 500 HP / 375 kW

- Kit is designed to avoid any slinger or shaft shoulder. Order based on NEMA or IEC Frame size.
- Install with 3 or 4 brackets depending on motor end bracket design.
- uKIT can be attached to motor with screws/washers provided or with conductive epoxy. AEGIS® EP2400 Conductive Epoxy sold separately.
- See AEGIS® website for bolt hole circle and installation. **est-aegis.com/uKIT**

Solid Ring

Split Ring

AEGIS® EP2400 Conductive Epoxy installation

Solid Ring with 3 brackets

IEC uKIT – Solid Ring Catalog Number	NEMA uKIT – Split Ring Catalog Number	Motor shaft diameter "u"	NEMA Frame
SGR-0.625-UKIT	SGR-0.625-UKIT-1A4	0.625"	56
SGR-0.875-UKIT	SGR-0.875-UKIT-1A4	0.875"	56HZ, 143T, 145T
SGR-1.125-UKIT	SGR-1.125-UKIT-1A4	1.125"	182T, 184T
SGR-1.250-UKIT	SGR-1.250-UKIT-1A4	1.250"	
SGR-1.375-UKIT	SGR-1.375-UKIT-1A4	1.375"	213T, 215T
SGR-1.625-UKIT	SGR-1.625-UKIT-1A4	1.625"	254T, 256T, 284TS, 286TS
SGR-1.875-UKIT	SGR-1.875-UKIT-1A4	1.875"	284T, 286T, 324TS, 326TS, 364TS, 365TS
SGR-2.125-UKIT	SGR-2.125-UKIT-1A4	2.125"	324T, 326T, 404TS, 405TS
SGR-2.375-UKIT	SGR-2.375-UKIT-1A4	2.375"	364T, 365T, 444TS, 445TS, 447TS, 449TS
SGR-2.875-UKIT	SGR-2.875-UKIT-1A4	2.875"	404T, 405T
SGR-3.375-UKIT	SGR-3.375-UKIT-1A4	3.375"	444T, 445T, 447T, 449T
SGR-3.625-UKIT	SGR-3.625-UKIT-1A4	3.625"	
SGR-3.875-UKIT	SGR-3.875-UKIT-1A4	3.875"	
SGR-4.375-UKIT	SGR-4.375-UKIT-1A4	4.375"	
SGR-4.875-UKIT	SGR-4.875-UKIT-1A4	4.875"	

Includes: AEGIS® SGR Shaft Grounding Ring, (4) universal brackets of each size – 16 total, (4) 5-40 x 3/8" flat head screws. (4) 6-32 x 3/8" socket head cap screws, (4) #6 split lock washers, (4) #6 flat washers, 5/64" allen wrench, 7/64" allen wrench

IEC uKIT – Solid Ring Catalog Number	IEC uKIT – Split Ring Catalog Number	Motor shaft diameter "d"	IEC Frame
SGR-28-UKIT	SGR-28-UKIT-2A4	28mm	IEC 100L, 112M (2, 4, 6, 8 pole)
SGR-38-UKIT	SGR-38-UKIT-2A4	38mm	IEC 132S, 132M (2, 4, 6, 8 pole)
SGR-42-UKIT	SGR-42-UKIT-2A4	42mm	IEC 160M, 160L (2, 4, 6, 8 pole)
SGR-48-UKIT	SGR-48-UKIT-2A4	48mm	IEC 180M, 180L (2, 4, 6, 8 pole)
SGR-55-UKIT	SGR-55-UKIT-2A4	55mm	IEC 200L (2, 4, 6, 8 pole), IEC 225S, 225M (2 pole)
SGR-60-UKIT	SGR-60-UKIT-2A4	60mm	IEC 225S, 225M (4, 6, 8 pole), IEC 250M (2 pole)
SGR-65-UKIT	SGR-65-UKIT-2A4	65mm	IEC 250M (4, 6, 8 pole), IEC 280M, 280S, 315S, 315M,315L (2 pole)
SGR-70-UKIT	SGR-70-UKIT-2A4	70mm	
SGR-75-UKIT	SGR-75-UKIT-2A4	75mm	IEC 280S, 280M (4, 6, 8 pole), IEC 355M, 355L (2 pole)
SGR-80-UKIT	SGR-80-UKIT-2A4	80mm	IEC 315S, 315M, 315L (4, 6, 8 pole)
SGR-85-UKIT	SGR-85-UKIT-2A4	85mm	
SGR-90-UKIT	SGR-90-UKIT-2A4	90mm	
SGR-95-UKIT	SGR-95-UKIT-2A4	95mm	IEC 335L, 335M, 355L, 355M (4, 6, 8, 10 pole)
SGR-100-UKIT	SGR-100-UKIT-2A4	100mm	
SGR-110-UKIT	SGR-110-UKIT-2A4	110mm	

Includes: AEGIS® SGR Shaft Grounding Ring, (4) universal brackets of each size – 16 total, (4) 5-40 x 3/8" flat head screws, (4) M4 x 10 socket head cap screws, (4) M4 split lock washers, (4) M4 flat washers, 5/64" allen wrench, 3mm allen wrench

AEGIS® PRO SERIES SHAFT GROUNDING RING

AEGIS® PROSL

The AEGIS® PROSL is a high current capable AEGIS® Shaft Grounding Ring for large motors, generators, and turbines operated by VFDs. The slim design and flexible installation options allow for adaptation to virtually all large motors.

Specifications

Designs: Solid, Split and Press Fit
Shaft Dia: 2.5" / 63.5mm to 15.75" / 400mm
OD: Shaft Dia + 1.86" / 47.24mm
OAL: 0.650" / 16.51mm MAX assembled with mounting screws
Mounting: Supplied with screws for bolt through mounting
English: 8-32 x 1" Flat Head Cap Screws
Metric: M4 x 0.7mm x 25mm Flat Head Cap Screws

Optional Universal Brackets for easy mounting.

AEGIS® PROSLR

Severe Duty motors are operated in general processing industry applications requiring protection from severe environmental operating conditions – often where there is debris, powder, dirt, liquids, lubricants, or other contaminants. For these applications the AEGIS® PROSLR incorporates a rubber dust and debris barrier to protect against ingress of materials that could interfere with the contact of the conductive microfibers to the motor's shaft.

Specifications

Designs: Solid and Split
Shaft Dia: 2.5" / 63.5mm to 15.75" / 400mm
OD: Shaft Dia + 1.86" / 47.24mm
OAL: 0.775" / 19.68mm assembled with mounting screws
Mounting: Supplied with screws for bolt through mounting
English: Solid Ring 8-32 x 1" FHCS, Split Ring 8-32 x 1.25" FHCS
Metric: Solid Ring M4 x 0.7mm x 25mm FHCS, Split Ring M4 x 0.7mm x 30mm FHCS

Optional Universal Brackets for easy mounting.

AEGIS® PROMAX

The AEGIS® PROMAX is designed for installation on the most critical and largest motors, generators, and turbines. The high current capable AEGIS® PROMAX Shaft Grounding Ring is custom engineered for each application to ensure the best bearing protection possible.

Specifications

Designs: Split Ring only
Shaft Dia: Typically over 15.75" / 400mm
OD: Shaft Dia + 3.0" / 76.2mm
OAL: 1.875" / 47.62mm assembled with mounting screws
Mounting: Supplied with screws for bolt through mounting
English: (4) 5/16-18 x 2" Socket Head Cap Screws
Metric: (4) M8 x 1.25mm x 50mm Socket Head Cap Screws

Custom brackets available upon request

AEGIS® PRO SERIES SHAFT GROUNDING RING

AEGIS® PROMR

The AEGIS® PROMR combines the AEGIS® PROSL with an additional isolated SGR ring that can be used as a monitoring device. The PROSL discharges shaft voltage safely to ground while the monitoring SGR ring measures voltage on the shaft and is not grounded. A phenolic plate between the 2 rings is used to isolate the monitoring ring.

For shaft diameter of 2.5" / 63.5mm to 15.75" / 400mm.

Designs: Solid and Split

OD: Shaft Dia + 1.86" / 47.24mm

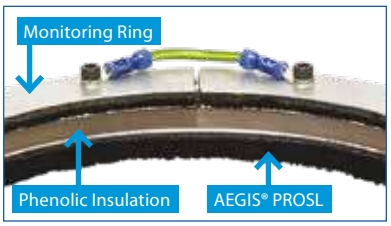
OAL: 1.312" / 33.32mm assembled with mounting screws

Mounting: Supplied with screws for bolt through mounting

English Screws: 8-32 x 1" Flat Head Cap Screws

Metric Screws: M4 x 0.7mm x 25mm Flat Head Cap Screws

Optional Universal Brackets for easy mounting.



OPTIONAL MOUNTING BRACKETS FOR AEGIS® PRO SERIES

For AEGIS® PROSL, PROSLR, PROMR

AEGIS® PROSL Universal Brackets

Kit includes brackets, four different spacer lengths and hardware for each.

Custom Brackets/Installation Examples

Contact our Engineering Team for special mounting applications.

Custom Split Mounting Plate with tie bars

Bearing Cap Mounting

Custom Mounting Brackets

AEGIS® SHAFT VOLTAGE TESTER™

The AEGIS® Shaft Voltage Tester™ kit includes everything you need to start testing motor shaft voltage. At its core is a 2 channel, 100 MHz digital oscilloscope with a 5.6" screen and easy screen capture.

	AEGIS-OSC-9200A	AEGIS-OSC-9200-W2	AEGIS-OSC-9200MB-W2	AEGIS-OSC-9200MB-W2-IC
AEGIS® Shaft Voltage Tester™ Digital Oscilloscope	●	●	●	●
AEGIS® Shaft Voltage Probe™ with Tip Installed	●	●	●	●
Spare 1X/10X Oscilloscope Probe	●	●	●	●
Multimeter Test Leads	●	●	●	●
Rechargeable Battery	●	●	●	●
Power Supply (9V, 4A DC; 120/240 VAC)	●	●	●	●
Compact Carrying Case	●	●	●	●
USB Flash drive, loaded with manual	●	●	●	●
AEGIS® Bearing Protection Handbook	●	●	●	●
Alligator Grounding Clips	1	1	2	2
Spare AEGIS® Shaft Voltage Probe™ Tips			3	3
AEGIS® Shaft Grounding Simulator™			●	●
Probe Holder			●	●
Magnetic Base			●	●
Universal Power Adapter				●
ISO 17025 Calibration				●
Warranty Length	90 days	2 years	2 years	2 years

Catalog Number	Includes:
SVP-KIT-9100MB	3 SVP tips, probe holder with two piece extension rod (total length of probe holder with extension rod is 18 inches), AEGIS® Grounding Simulator with alligator ground clip, and magnetic base.
AEGIS-SVP-510	AEGIS® Shaft Voltage Probe™ PP510 with BNC connector. 1 AEGIS® SVP Tip 1 alligator ground clip
SVP-TIP-9100	3 SVP replacement tips only

SVP-KIT-9100MB AEGIS-SVP-510

AEGIS® HFGS AND ACCESSORIES

AEGIS® HFGS High-Frequency Ground Strap Length: 12″ / 305mm and 24″ / 610mm

Catalog Number	Terminations	Fits Frame Sizes
HFGS-T0410-R0312-12 12″ / 305mm **HFGS-T0410-R0312-24** 24″ / 610mm	**Term1: Punched hole** 0.41″ / 10mm **Term 2: Ring terminal** for 5/16″ / 8 mm screws	**NEMA**: 48, 48H, 56, 56H, 143T, 145T, 182T, 184T, 213T, 215T **IEC** 80M, 90S, 90L
HFGS-T0660-R0312-12 12″ / 305mm **HFGS-T0660-R0312-24** 24″ / 610mm	**Term1: Punched hole** 0.66″ / 17mm **Term 2: Ring terminal** for 5/16″ or 8 mm screws	**NEMA:** 254T, 256T, 284T, 284TS, 286T, 286TS, 324T, 324TS, 326T, 326TS, 364T, 364TS, 365T, 365TS **IEC:** 100S, 100L, 112S, 112M, 132S, 132M, 160S, 160M, 160L, 180S, 180M, 180L
HFGS-T0940-R0312-12 12″ / 305mm **HFGS-T0940-R0312-24** 24″ / 610mm	**Term1: Punched hole** 0.94″ / 24mm Term 2: Ring terminal for 5/16″ or 8 mm screws	**NEMA:** 404T, 404TS, 405T, 405TS, 444T, 444TS, 445T, 445TS, 447T, 447TS, 449T, 449TS **IEC:** 200S, 200M, 200L, 225S, 225M, 250S, 250M, 280S, 280M
HFGS-R0312-R0312-12 12″ / 305mm **HFGS-R0312-R0312-24** 24″ / 610mm	**Term 1: Ring terminal** for 5/16″ or 8 mm screws **Term 2: Ring terminal** for 5/16″ or 8 mm screws	**NEMA/IEC:** universal terminations

Screws included

Custom lengths and terminations available on request

AEGIS® Colloidal Silver Shaft Coating

Catalog Number	Coverage
CS015	20-25 applications based on a 3″ / 76mm shaft diameter

Used to improve the conductivity of the steel shaft surface. Apply to any VFD driven motor shaft prior to installing the AEGIS® Shaft Grounding Ring.

Note: Application instructions in installation section. Shelf life is 6 months. SDS available at **est-aegis.com**

AEGIS® Conductive Epoxy

Catalog Number	Coverage
EP2400	2-3 applications

Used to install the AEGIS® Shaft Grounding Ring without drilling and tapping into the motor end bell.

Note: Application instructions in installation section. Shelf life is 9 months. SDS available at **est-aegis.com**

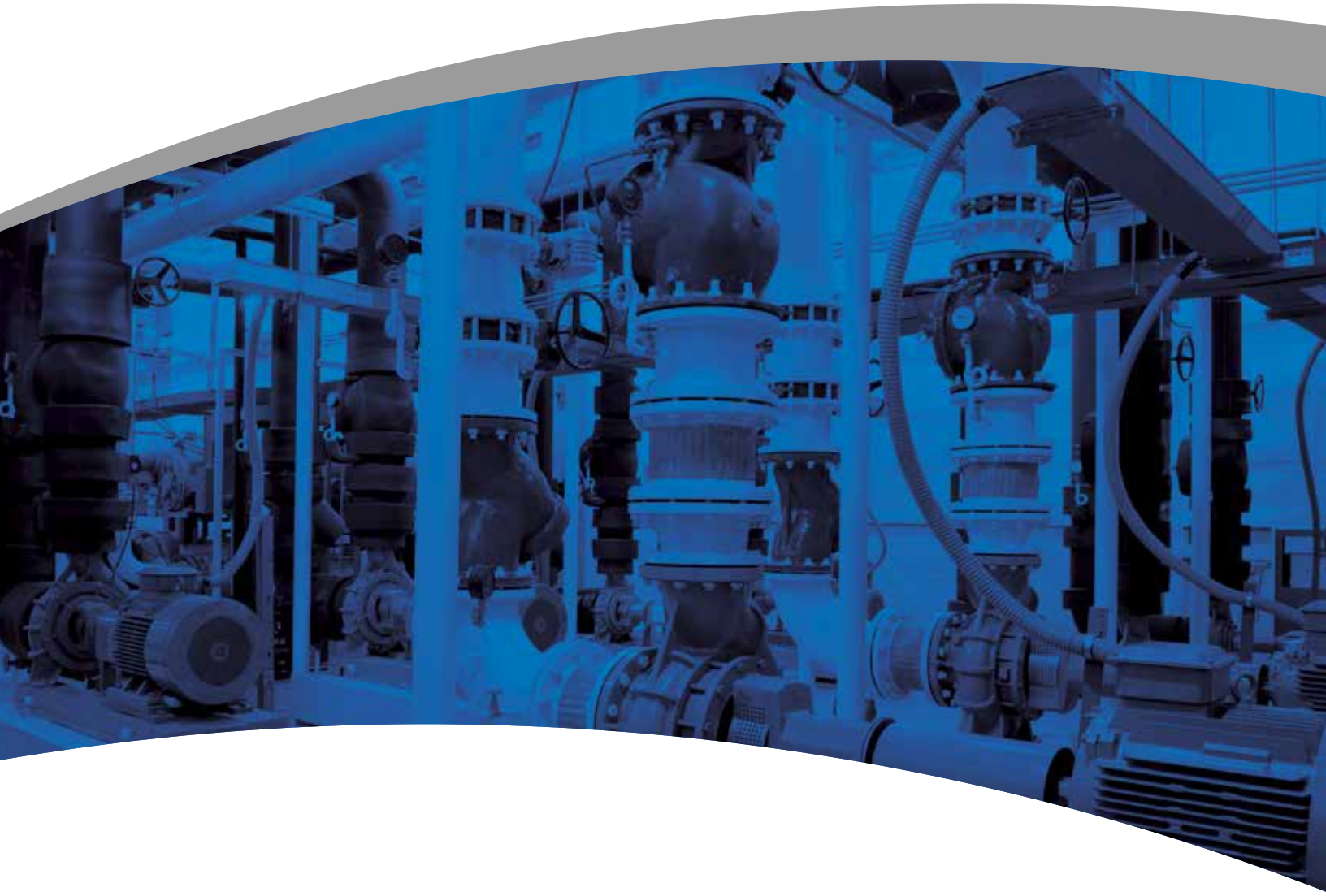
REGISTER YOUR MOTOR FOR THE AEGIS® 2-YEAR\ WARRANTY AGAINST BEARING FLUTING DAMAGE

Electro Static Technology (EST, AEGIS®) guarantees that AC induction motor bearings will not fail from electrical fluting damage when AEGIS® Shaft Grounding Rings have been installed with new bearings in accordance with EST's recommended best practices, as published in the AEGIS® Bearing Protection Handbook (current edition).

- The AC induction motor must meet the conditions listed below and new bearings must be installed at the time of AEGIS® Ring installation for the warranty to be approved.
- For repaired motors or for field installations: Upon registration and approval the warranty shall be for 2 years from the installation date of the new motor bearings and AEGIS® Ring.
- For new motors with AEGIS® rings installed by the motor manufacturer: Upon registration the warranty shall be for a 2 year period after the motor manufacturer's bearing warranty ends.
- If electrically induced bearing fluting damage occurs, EST will pay the current Vaughen's National Average Price for "Furnish/Install 2 Standard Ball Bearings" and will supply a new shaft grounding ring (SGR or PRO as appropriate) and CS015. The warranty shall apply to any AC induction motor whether new or repaired which conforms to the AEGIS® Bearing Protection Handbook's best practices.

Conditions:

1. For All Motors: New bearings MUST be installed at the time of AEGIS® Ring installation.
2. All Motors: For this warranty to be valid, the owner must register the motor within 30 days of receipt, by filling out and submitting the information at **est-aegis.com/warranty**.
3. For AC Induction motors up to 100 HP / 75 kW: The warranty shall apply when AEGIS® Rings have been installed on the motor per the AEGIS® Bearing Protection Handbook's best practices.
4. AC Induction motors greater than 100 HP / 75 kW: The warranty shall apply when AEGIS® Rings and insulated bearings/insulation have been installed on the motor per the AEGIS® Bearing Protection Handbook's best practices.
5. AC Induction motors greater than 500 HP / 375 kW and ANY motor with supply voltage of greater than 600 VAC (medium/high voltage): The warranty shall only apply when AEGIS® PRO Series Rings and insulated bearings/insulation have been installed on the motor per the AEGIS® Bearing Protection Handbook's best practices.
6. The best practices shall apply per the current edition of the AEGIS® Bearing Protection Handbook at the time of installation.
7. Selection of the applicable ring (AEGIS® SGR or PRO Series) must conform to the requirements in the AEGIS® Bearing Protection Handbook.
8. The owner of the motor must verify that the installation of AEGIS® Rings and bearing insulation, if applicable, was per the AEGIS® Bearing Protection Handbook's best practices in order to receive approval for the warranty.
9. EST shall retain the sole authority to issue and approve the warranty for any application.
10. The warranty shall be activated and conferred to the motor owner upon the issuance by EST of an email or certificate confirming warranty acceptance.



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