HELWIG®
CARBON
PRODUCTS, INC.

BPK™ Pocket Guide

A Comprehensive Guide to the Industry's Leading Shaft Grounding Solution

Specifications • Installation • Troubleshooting

What is Shaft Grounding?

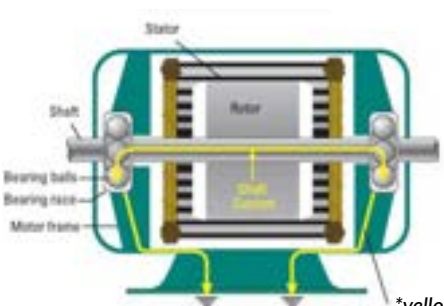
The method or process of reducing induced shaft voltage to prevent unwanted electrical discharges through motor bearings or connected downstream equipment.

Variable frequency drives (VFD) that are used on AC motors and PWM drives that are used on DC motors produce induced electrical currents on the motor shaft, also referred to as common mode voltage. This current seeks the path of least resistance to ground, which is typically through the motor bearings.

Industries Served:

- Motor OEMs
- Electric Vehicles
- HVAC
- Fans
- Wind Power
- Facilities Maint.
- Manufacturing
- Medical
- Large Industrial
- Marine
- Military
- Food Service
- Pumps
- Paper
- Steel
- Elevators
- And More!

Discharge Path on Unprotected Motor



Current discharges through the bearings, then flows through the motor frame to ground.

**yellow line is path of discharge*

What Does Bearing Failure Look Like?

When the current passes through the bearings, electrical arcing takes place, leading to fluting, pitting, and bearing failure.

The resulting irregular surface on the bearing causes noise, vibration, and premature bearing failure.

Symptoms

- Vibration
- Overheating
- Noise
- Burnt Grease

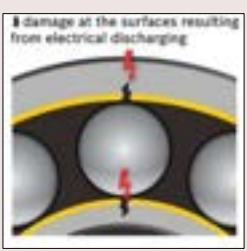
Results

- Frequent downtime
- Overheating
- Costly repairs

Harmful electrical currents that discharge through the motor bearings can result in pitting, fluting, arcing, and/or burnt grease in the raceway or gearbox.

KEY POINTS TO REMEMBER

- Accumulated electric charges seek path of least resistance to ground
- Often path leads through ball bearings and possibly other downstream equipment
- COMMON MODE THAT IS MEASURED AT 2V OR HIGHER MAY CAUSE BEARING DAMAGE*



**Voltage is the preferred unit of measurement when detecting common mode or electrical discharge on the motor shaft (see page 14).*

Electrical Failure vs. Mechanical Failure

Motor bearings have two main causes for failure, mechanical and electrical.

Mechanical failure can result from many root causes such as load misalignment, vibration, heat, over/under greasing, etc.

Electrical failure, or failure due to electrical discharge machining (EDM) typically has two root causes: circulating current and common mode voltage discharges.

While both can reduce the life of your bearings, it is important to learn the root cause of your failure. If your bearings are prematurely failing, ask an EASA accredited repair shop to cut the damaged bearing. By examining the wear pattern on the raceway, roller assembly, grease condition, etc., your shop can quickly determine the cause of failure.

EASA®
The Electro•Mechanical Authority

Beyond the Bearings

Damage from electrical discharge is not limited to motor bearings.

Static charges on a motor shaft seek a path of least resistance to a ground source. The path of least resistance is typically through the motor's bearings, but that is not always the case.

On occasion electrically connected equipment like gearboxes offer a very low resistance path to ground. In this case, the static charge on the motor shaft will bypass the bearings and discharge through the gears of the gearbox or other connected equipment.

Shaft Grounding Methods of Mitigation

Inductive Choke	– Expensive & only partially effective.
Conductive Grease	– Generally accepted as not a viable solution. – Conductive particles increase bearing wear.
Insulated/Ceramic Bearings	– Very expensive with significant lead times. – Used to prevent circulating current. Not effective for mitigating common mode.
Carbon Fiber Ring	– Only reduced current flow. Difficult to install. – Needs different size for each shaft size. – Need silver epoxy to enhance the performance. – Poor performance in contaminated environments.
Helwig Carbon Bearing Protection Kit (BPK™)	– Affordable & provides the path of least resistance to ground. – Typically reduces voltage to less than 1 volt. – Maintenance-free throughout long life cycle.

Bearing Protection Kit (BPK™)

The Industry's Best Shaft Grounding Solution

Helwig Carbon BPKs™ are designed to protect bearings better than any other shaft grounding solution.

Unlike other options, this sliding electrical contact technology uses a proprietary silver graphite brush that provides superior voltage mitigation by redirecting harmful discharges away from the motor bearings.

Features of BPK™

- **Longevity: Kits will typically last 10+ years**
- Provides lowest resistant path to ground
- Low to high current carrying capacity and effective at high frequencies
- Options available for harsh & contaminated environments
- **MAINTENANCE-FREE**

Specially Engineered for Long Life and Durability

Sealed & durable brass holder containing a constant force spring

BPK-SB (pictured) is the ideal shaft grounding system for contaminated environments

Proprietary silver graphite brush

What's in the Brush?

*Proprietary Shaft Grounding Grade - **K007***

Helwig Carbon's proprietary shaft grounding brush protects motors from damaging VFD-induced current by providing the industry with the lowest resistant path to ground.

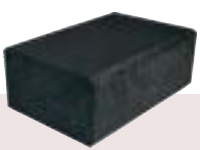
After years of testing, the K007 brush grade was released. This one-of-a-kind, specially engineered brush will typically provide **10 or more years** of bearing protection.*

**life cycle of brush may vary based on size of BPK™ and application*

Features of K007

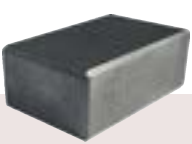
- 10x lower in resistance than carbon
- Very little wear - 3x lower in friction than carbon
- Extra long life! 10+years
- Self-lubricating and **maintenance-free**

Note: cleaning grades available for corrosive or harsh environments



MYTH

Shaft grounding brushes are made from a **carbon block**, and therefore wear easily and quickly.



FACT

BPK **silver graphite** brushes are a highly conductive material that provides long lasting, superior performance.

Call Toll Free: (800) 962-4851 or (414) 354-2411 for more information
Email: carboncrew@helwigcarbon.com

Bearing Protection Kit (BPK™)

The Industry's Best Shaft Grounding Solution

BPK-IM2

- Smallest BPK has a small, durable brass holder containing a compression spring and silver graphite brush
- Ideal for small size motors and internal mounting
- **Typical Applications:** HVAC, Small Pumps, Fans, Internal Mounts
- Dimensions: .241"x.75"x.75"inch (6.1x19x19mm)

BPK-IM5

- Larger than the IM2, the IM5 also has a brass holder containing a compression spring and silver graphite brush
- Idea for small/medium size motors
- **Typical Applications:** HVAC, Small-Medium Pumps, Fans, Internal Mounts
- Dimensions: .325"x1.0"x1.0"inch (8.26x25.4x25.4mm)

BPK-S

- Patented sealed thermoplastic holder containing a constant force spring with silver graphite brush
- Ideal for contaminated environments
- **Typical Applications:** Paper Industry, Food Service, and any contaminated environment
- Dimensions: .45"x1.63"x1.50"inch (11.4x41.4x38mm)

BPK™ Selection Guide

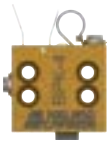
Scan QR code to learn more about BPKs™ online

**for larger shaft sizes, please contact Helwig Tech Squad, (800) 962-4851*

Shaft Diameter	0.0" 0mm	0.5" 13mm	1.0" 25mm	1.5" 38mm
BPK-IM2	■	■		
BPK-IM5		■	■	■
BPK-4 / S / SB				■
BPK-AM				

BPK-SB

- Patented sealed brass holder containing a constant force spring with silver graphite brush
- Ideal for contaminated environments
- **Typical Applications:** OEMs, Paper Industry, and any contaminated environment
- Dimensions: .45”x1.59”x1.52”inch (11.4x41.3x38.1mm)



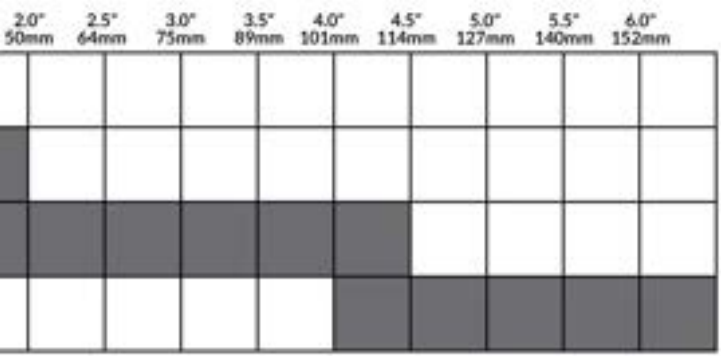
BPK-4

- Durable brass holder containing a constant force spring with silver graphite brush
- Ideal for medium-sized motors and harsh environments
- **Typical Applications:** Industrial, Manufacturing, Medical, Steel, Elevator Industries
- Dimensions: .5”x1.5”x1.38”inch (12.7x38x35mm)

BPK-AM

- Largest BPK has a heavy-duty brass holder containing a constant force spring with silver graphite brush
- Ideal for large motors and shafts greater than 4”
- **Typical Applications:** Wind Power, Large Industrial, Marine, and Military Applications
- Dimensions: .63”x2.09”x1.26”inch (16x53x32mm)

For special applications please contact Helwig at (800) 962-4851 or techsquad@helwigcarbon.com



Special Applications

Axially Mounted Kits

BPK-GA

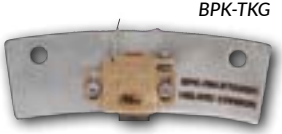
Alternative mounting options are available when it is not possible to install a BPK™ radially on the motor shaft. Typically for the non-drive end of motor.

OEM-APPROVED

Typical applications: Pitch motors, fan walls, compressors, & more.

Wind Turbine Main Shaft Bearing Protection

BPK-TKG



Instantly grounds damaging currents that threaten main bearings on wind generators that can be a result of static discharges or lightning strikes.

OEM-APPROVED

Contaminated Environments

Silver graphite brushes have a cleaning property that when combined with a constant force spring, provides a contaminant-free brush track.

Note: BPKs are also effective in submerged water applications.

CUSTOM ENGINEERED DESIGNS

Engineers are available to create custom designs that are application-specific to any customer. Work with Helwig's talented team to develop the best solution for your bearing protection needs.

Call Toll Free: (800) 962-4851 or (414) 354-2411 for more information

Bearing Protection FAQs

How long do BPKs™ last once installed?

The proprietary silver graphite brush in the BPK™ allows for superior performance, typically lasting more than 10 years. Contact Helwig Carbon Products for application-specific calculations.

When should insulated bearings be installed?

For motors larger than 100HP, Helwig recommends using insulated bearings on NDE of the motor. A BPK™ should be installed on the DE to ensure sufficient protection.

Why does my grounding scheme matter?

A solid, uninterrupted ground path is needed not only to measure voltage on the motor shaft, but to redirect harmful discharges away from bearings. Use the BPK-Probe™ (*see page 16*) to ensure installed BPK™ is redirecting common mode voltage away from motor bearings or other down-stream equipment.

Does silver epoxy need to be applied for conductivity?

No. Helwig Carbon's silver graphite brush has self-lubricating properties that ensure minimal wear and maximum conductivity throughout the life of the brush, without any required maintenance or silver epoxy applied to the shaft.

MYTH

Grounding brushes **CANNOT** handle high frequency discharges.

FACT

Silver graphite has proven to be an **EXCELLENT** conductor at high frequencies, up to and **exceeding 10 MHz**.

Mounting & Installation Methods

Installation Tips to Get Started:

- We recommend the brush ride perpendicular to the shaft.
- The track in which the brush rides on the shaft should be free of scratches, nicks, dents, or defects of any kind.
- Ideally the shaft surface should be clean with a surface finish within the standard range of most motor manufacturers of 8 to 63 RMS
- Do not use any external lubrication. The brush grade has the optimal lubrication needed.

Option 1: MultiFit Bracket

Durable bracket that is easily adjusted and installed using existing motor bolts. No need to drill and tap, decouple the motor, or realign motor components.

Option 2: Dual Lock/VHB Tape

A 3M designed solution specifically created for harsh industrial environments, temporary, or hard-to-access applications. Adhere tape to BPK™ first, and then to the motor.

Option 3: Drill & Tap

Traditional mounting method that requires (2) holes to be drilled into the end bell of the motor, typically the drive end. BPK™ should be installed with provided mounting screws.

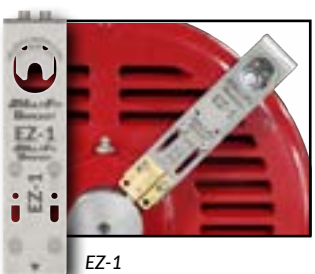
MULTIFIT® BRACKET
BEARING PROTECTION

MultiFit Brackets provide a solid and adjustable base using existing motor bolts to mount a Helwig Bearing Protection Kit™ without drilling, tapping, or decoupling.

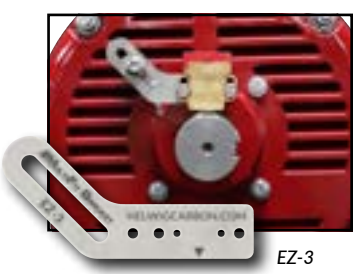
These brackets were designed with versatility in mind, catering to field installs, motor shops, and harsh environments.

Features of MultiFit Bracket System

- Eliminates need to drill & tap for mounting
- Designed for easy install in the field
- Available for multiple bolt designs
- In-stock for fast turn-around



EZ-1



EZ-3

Custom brackets & mounting options available for motors with recessed bolts or other specialized needs. Contact Helwig at (800) 962-4851.

BPK FIELD PACK

Order online at www.helwigcarbon.com

The versatile BPK™ Field Pack provides quick & easy shaft grounding solutions in the field.

INCLUDES KITS & BRACKETS TO FIT MOST MOTOR FRAMES.

More Effective than Other Shaft Grounding Solutions

Bearing Protection Kits™ mitigate shaft voltage and other electrical noise.

The following oscilloscope screenshots were taken in a controlled testing environment, using Helwig Carbon's patented BPK-Probe™. They compare induced shaft voltage with our BPK-4 vs. a carbon fiber shaft grounding ring. Lower voltage values show more effective protection.

Silver graphite is more than 10X lower in resistance than carbon fiber, which significantly reduces the risk of induced shaft currents flowing through the bearings.

The test was conducted on a 10HP Nidec motor with the following specifications: 460VAC, 1765RPM, and driven by an Emerson VFD at 52Hz.

Images captured using BPK-Probe™ (see page 16)

BPK-4 INSTALLED

UNPROTECTED VFD MOTOR

CARBON FIBER RING INSTALLED

13.5V detected *80.0mV detected* *2.76V detected*

PRO TIP: Measure Voltage, Not Current

- Measuring voltage is much easier than measuring current in the field.
- No specialized tools or instruments needed.
- Voltage and current closely match each other in bearing discharges.

Shaft Grounding Comparison-at-a-Glance

Carbon Fiber Ring

Helwig Carbon BPK™

SHAFT GROUNDING EFFECTIVENESS	
Carbon fibers have higher electrical resistance. The fibers can wear over time from mechanical friction. This will lead to decreased grounding effectiveness and increased likelihood of bearing damage.	Engineered silver graphite brush has lower resistance than the carbon fibers. The constant force spring ensures continuous contact to motor shaft, which effectively diverts shaft currents to ground.
WEAR/LIFE	
Carbon fibers are prone to mechanical wear from friction with the shaft.	Typically, the silver graphite brush will outlast the life expectancy of the motor.
INSTALLATION	
Difficult to install and may require uncoupling of motor components.	Quick & easy to install with multiple options available.
PRODUCT SELECTION	
Requires a different product for each shaft size, leading to increased inventory, longer lead times, and added expense.	One BPK™ model can fit many shaft diameters, which reduces inventory and lead times. Reference BPK™ Selection Guide (see pg. 8)
MAINTENANCE	
Silver epoxy must be applied to the motor shaft every 6-12 months to maintain conductivity.	MAINTENANCE-FREE

BPK-Probe™

Shaft Voltage Detection Device

Helwig Carbon's patented BPK-Probe™ is an instrument designed to measure common mode voltage on a motor shaft and determine the risk of discharge through the motor bearings or other downstream equipment. This feature allows the user to measure the performance of any grounding device and the risk of further damage to the motor bearings once installed.

Features of BPK-Probe™

- Point-and-shoot diagnostic tool
- Enhanced color display
- Simple-action test trigger
- Rechargeable battery
- Bluetooth capabilities
- Embedded Bearing Protection Kit™
- Verify motor ground quality

POSSIBLE TEST RESULTS

Scan QR code to learn more about BPK-Probe™ online

What's in the Kit?

The BPK-Probe™ comes as part of a complete kit including everything you need to test motor shafts where damaging discharges may be present. A tablet oscilloscope is included for more detailed analysis of shaft voltages, but is not required to conduct tests.

Kit includes:

- BPK-Probe™
- Probe Preparation Tool
- Probe Extension Tube
- Replacement Brushes/Tip
- Micro-USB Charge Cable
- Tablet Oscilloscope*
- BNC Cable
- SD Card Adapter
- USB Stick

also available without oscilloscope

DATALINK MOBILE APP

The world's only shaft voltage testing mobile app, the BPK-Probe™ DataLink, was designed to pair with the BPK-Probe™ via Bluetooth and effortlessly record shaft voltage results from VFD-driven motors.

- Comprehensive app to test, record, and report test data
- Easy & simple to use format
- Designed for consultants or in-house use
- Free on the Apple Store & Play Store
- Auto-generated, easy-to-read report saves time & money
- Useful preventative maintenance tool

IDEAL FOR:

- Motor Shops
- Technicians
- Predictive and Preventative Maintenance Professionals

BPK™ Additional Resources

Brochures, Case Studies, & Whitepapers

Scan QR code to download product literature

Training & Educational Support

Our team of local experts and internal engineers can be available to present and educate at any level of complexity necessary.

Contact us today to set up your one-on-one or team training!

Call Toll Free: (800) 962-4851

- Virtual Webinar
- On-site Product Demo
- Lunch & Learn
- Event Seminar
- Workshop
- Facility Survey
- Instructional Videos

Contact Your Local Sales Representative

BPKs™ are also available internationally! Visit us online or call for more information.

Scan QR code to find your local Sales Represntative

Specify BPKs™ in Your Next Construction Project

If motors controlled by a VFD are specified in a project, it will most likely also require bearing protection. BPKs™ offers a superior method of protection that will last well beyond other mitigation methods. **BPKs™ can be ordered from the equipment OEM pre-installed on the motor or can be fitted with a MultiFit Bracket.**

Call Toll Free: (800) 962-4851 or (414) 354-2411 for more information
Email: carboncrew@helwigcarbon.com

Major OEMs with Helwig BPKs™

TRANE · WEG · WORLDWIDE ELECTRIC CORPORATION · BROOK CROMPTON · Regal Rexnord · TECO · Westinghouse · Nidec · BALDOR · SIEMENS

The Industry's Leading Shaft Grounding Solution

HELWIG® CARBON PRODUCTS, INC.

8900 W. Tower Ave., Milwaukee, WI 53224-2849
Customer Service: (800) 962-4851 | (414) 354-2411
carboncrew@helwigcarbon.com | www.helwigcarbon.com

GDE-009/2023