Product Awards

CONSULTING - SPECIFYING engineer 2009 PRODUCT OF THE YEAR Finalist

2007 FROST & SULLIVAN
North American Motors & Drives
Product Value Leadership of the Year Award

2007 design news GOLDEN MOUSETRAP Finalist

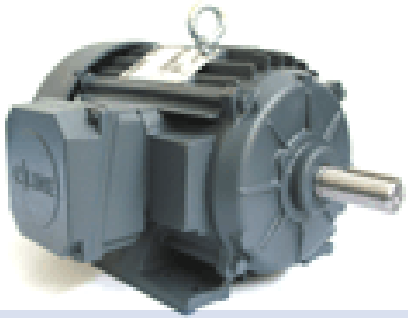
Plant Engineering PRODUCT of the YEAR 2007 Winner

Plant Engineering PRODUCT of the YEAR Finalist 2006

CONSULTING - SPECIFYING engineer A Perfect 10 2006 Product of the Year Silver Winner

Motor Failure from fluted bearings wipes out savings from VFD

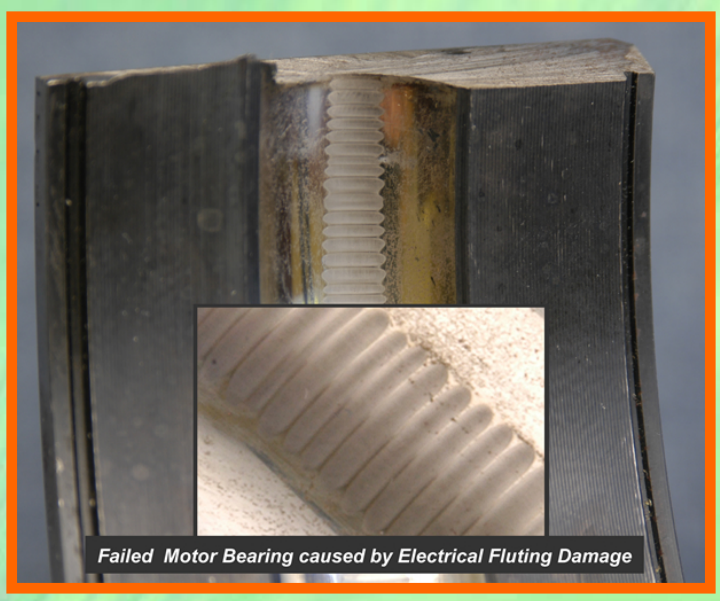
100 hp Motor fails



Repair: $3,500

Removal/rigging: $12,000

Lost Production: $$$$

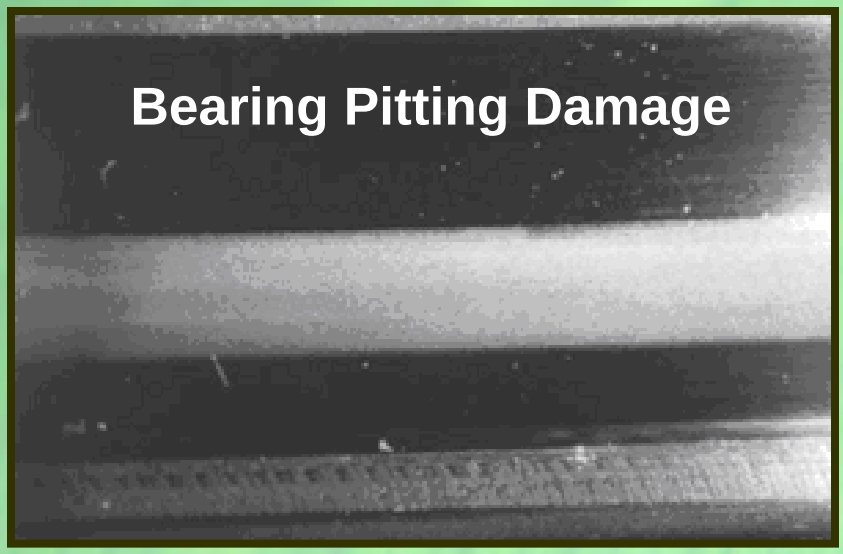


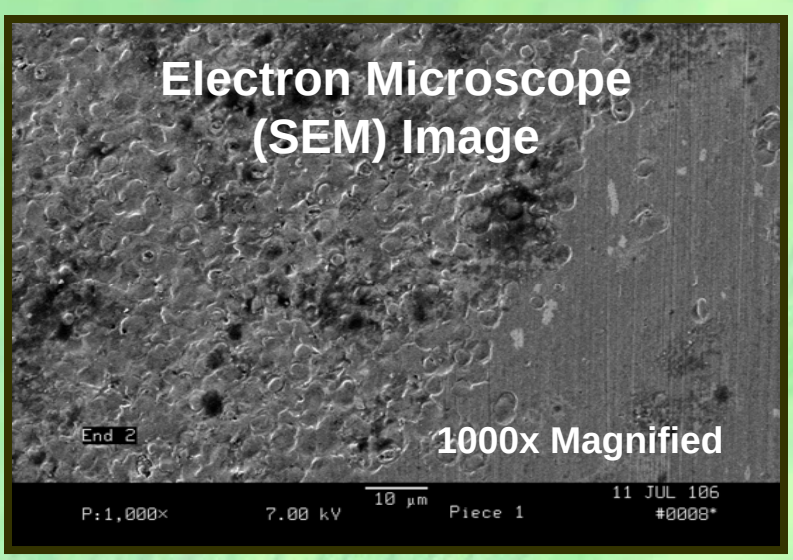
AEGIS SGR™
BEARING PROTECTION RING™

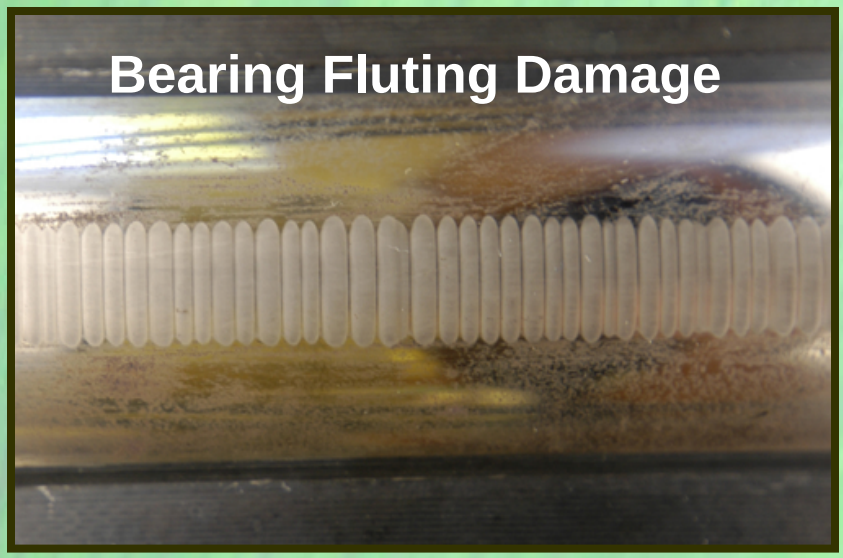
AEGIS™ Bearing Protection Ring…

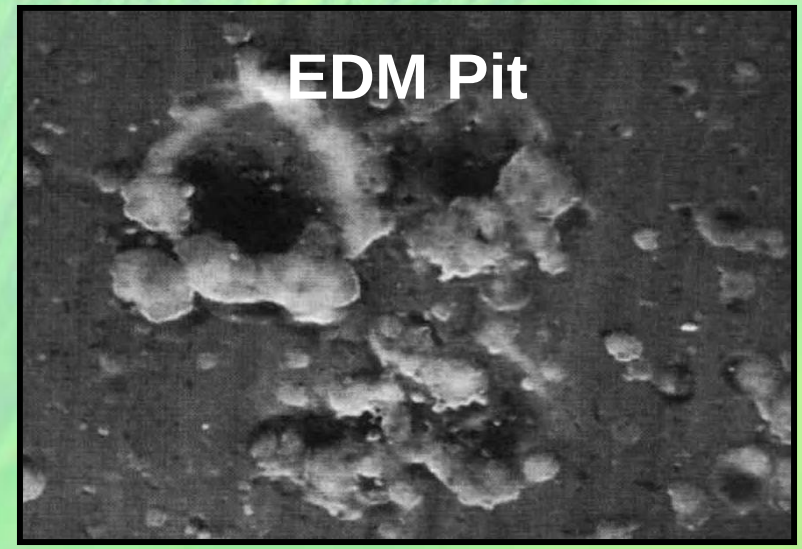
…for "True Inverter Duty Motors." The only sustainable bearing protection technology to make motors "VFD" Ready

Motor Bearing Damage from Electrical Currents (EDM)



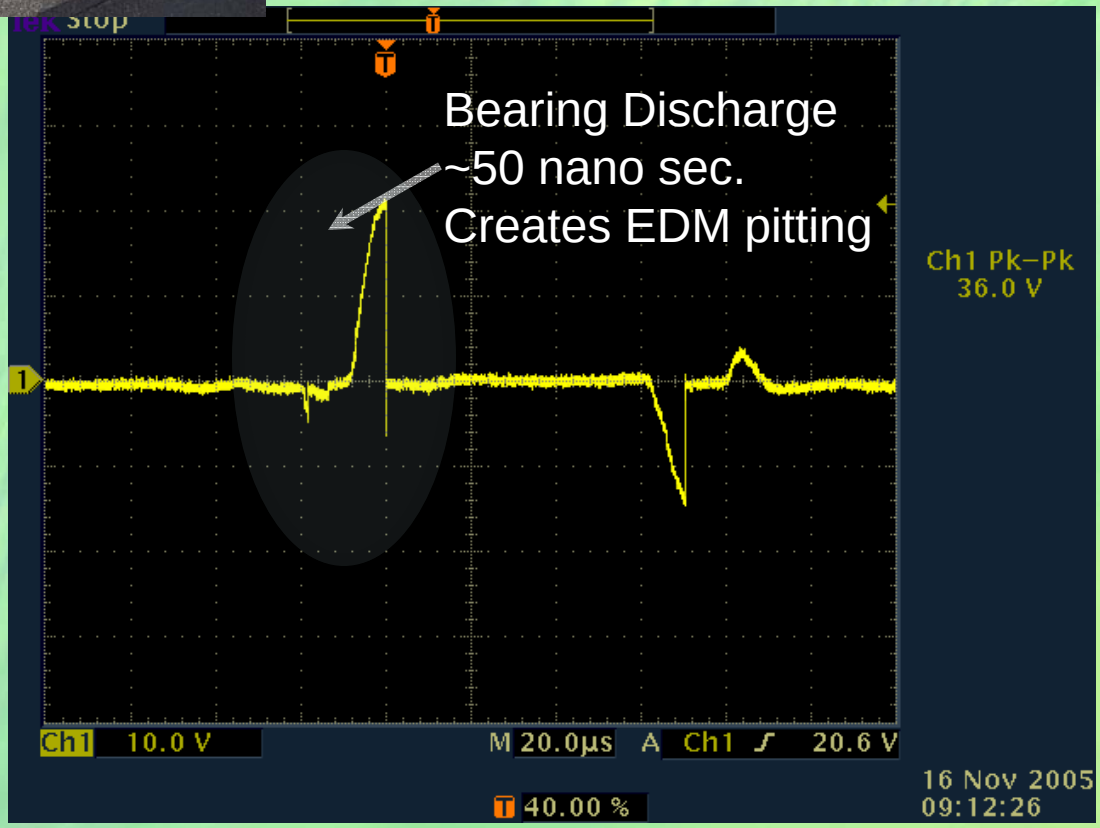






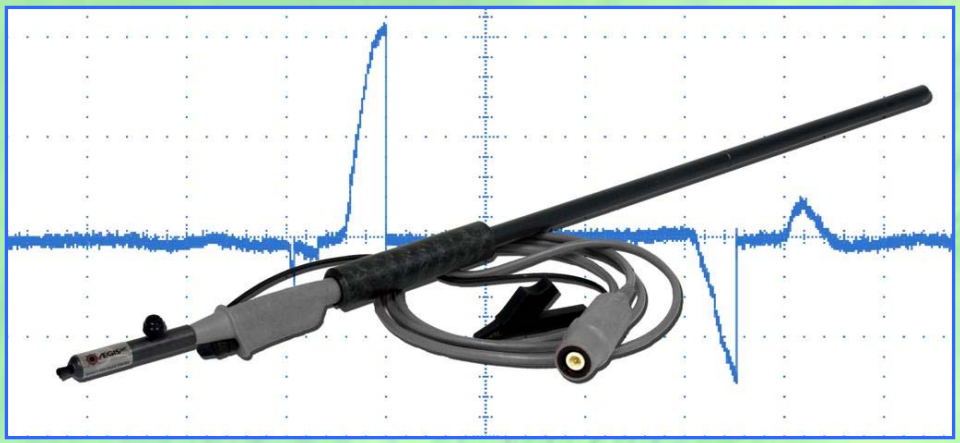
Shaft Voltage Measurement

Typical Electrical Bearing EDM discharge



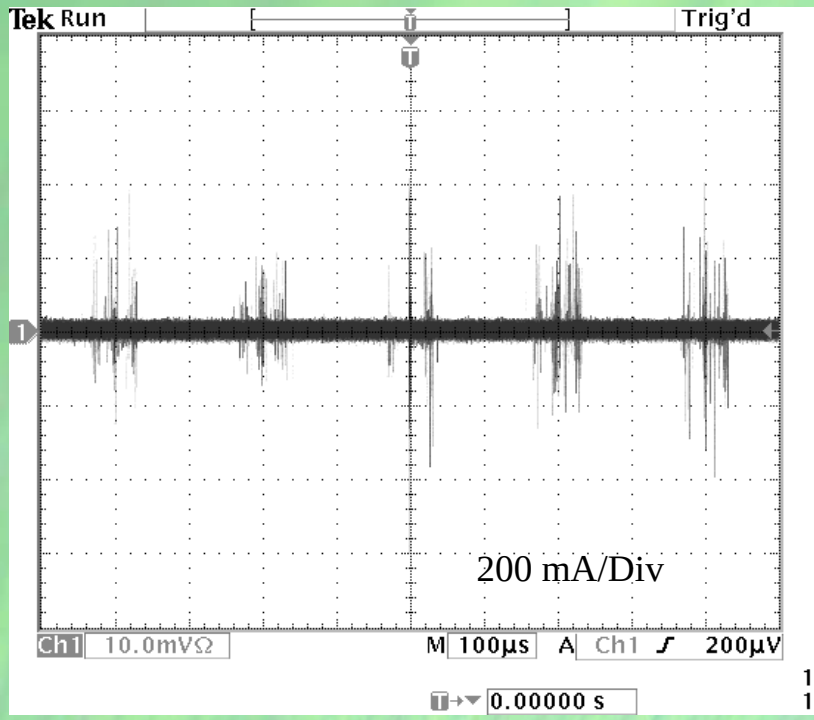
New Product

AEGIS™ SVP Shaft Voltage Probe

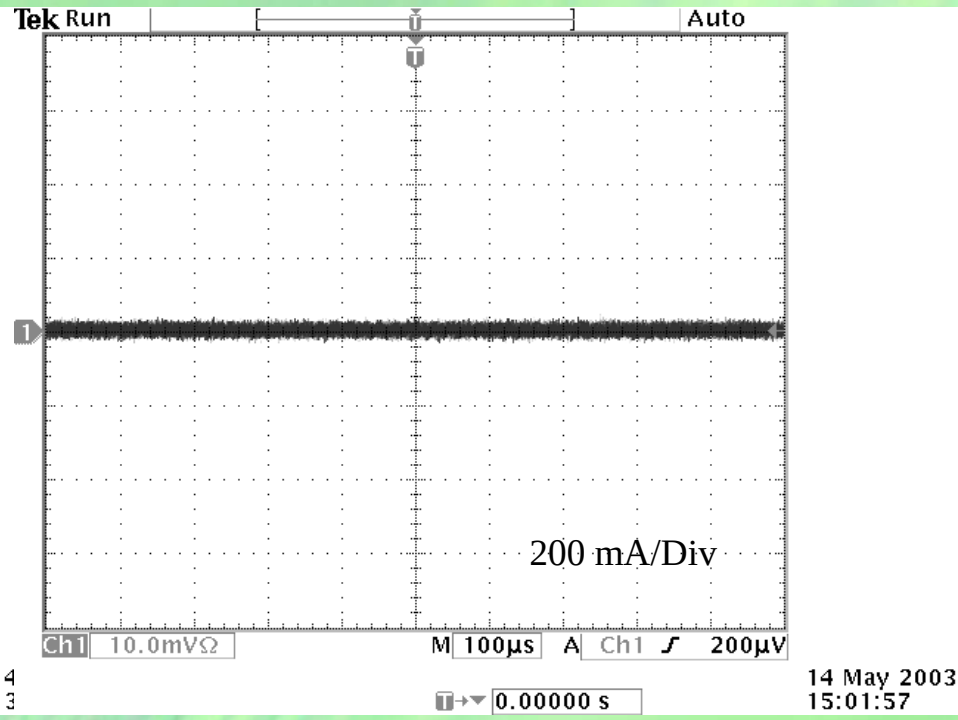


- **Measure Shaft Voltage**
- **Continuous Contact**
- **Predictive Maintenance**

Motor with No protection



Motor with AEGIS Bearing Protection Ring



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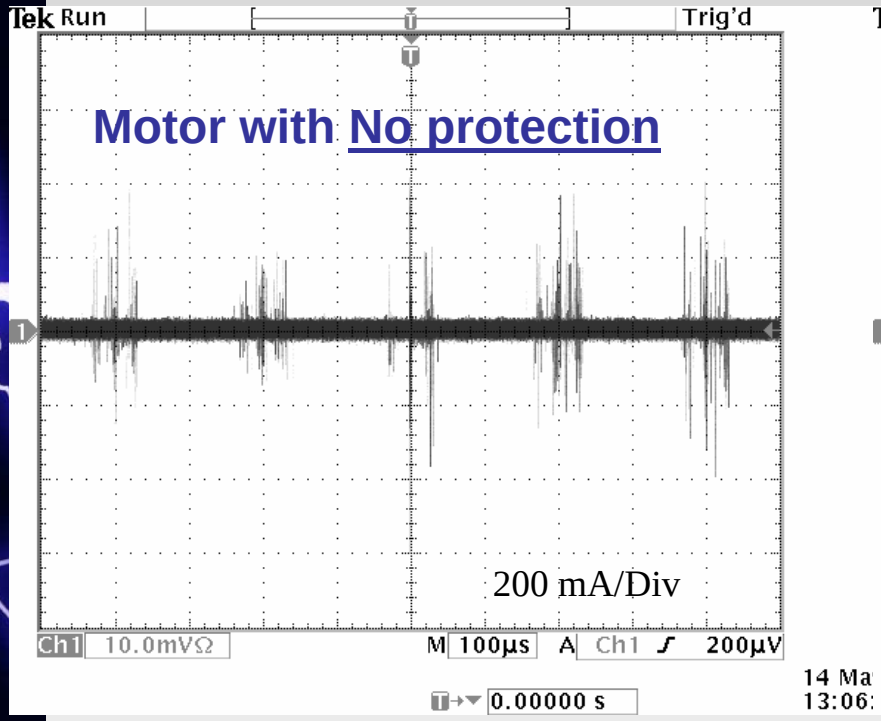
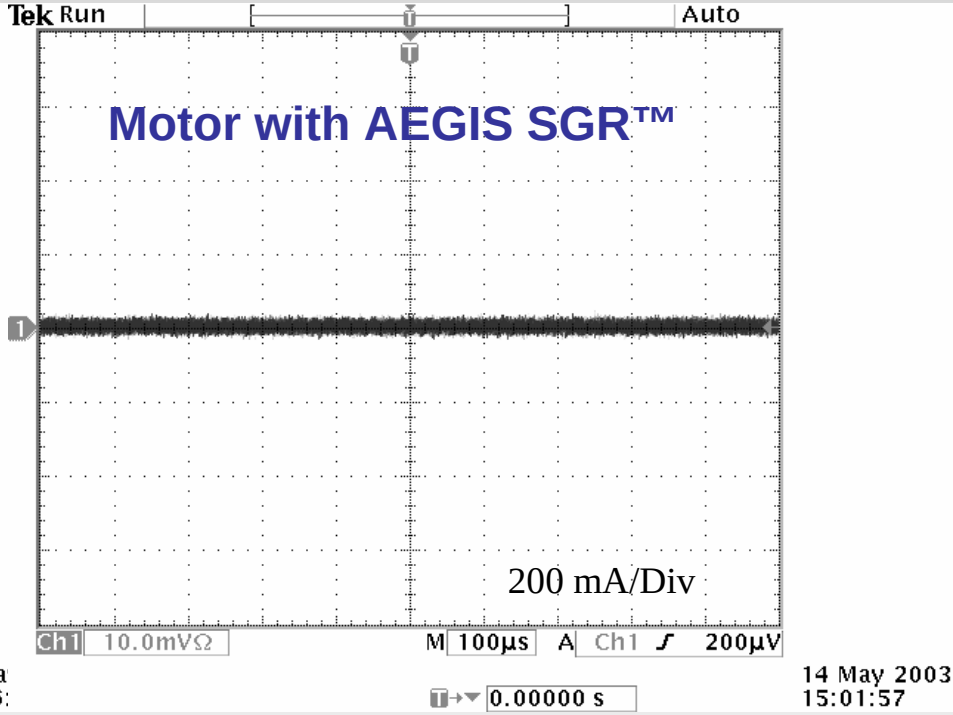
Bearing Currents



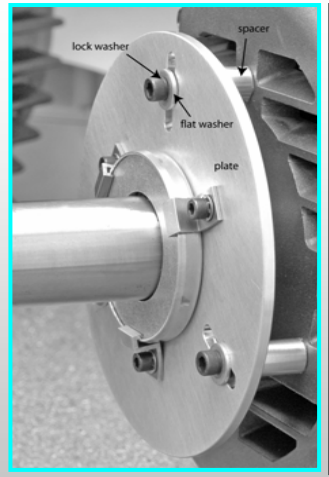


Electrical Discharge Machining (EDM) effect in Bearing

Bearing Currents diverted to AEGIS SGR™

AEGIS Shaft Grounding Ring™ Kit
for NEMA Motors

- ❑ **Long life - for service life of motor**
- ❑ **Maintenance free - No wear or adjustment needed**
- ❑ **Contamination proof – not effected by oil, grease, dirt or dust**
- ❑ **Universal fit - Ships with 3 stand-off post lengths for motor mounting: ¼”, ½” and 1”**



Kits for NEMA Motors

Solid Ring Kit

Split Kit

AEGIS SGR™
BEARING PROTECTION RING™

AEGIS™ Bearing Protection Ring…

…for "True Inverter Duty Motors." The only sustainable bearing protection technology to make motors "VFD" Ready

Select Shaft Grounding for NEMA Motors

AEGIS SGR™ Part Number	Motor shaft	NEMA Frame
SGR-0.875-NEMA	0.875	143T, 145T
SGR-1.125-NEMA	1.125	182T, 184T
SGR-1.375-NEMA	1.375	213T, 215T
SGR-1.625-NEMA	1.625	254T, 256T
SGR-1.875-NEMA	1.875	284T, 286T, 324TS, 326TS, 364TS, 365TS
SGR-2.125-NEMA	2.125	324T, 326T, 404TS, 405TS
SGR-2.375-NEMA	2.375	364T, 365T, 444TS, 445TS, 447TS, 449TS
SGR-2.875-NEMA	2.875	404T, 405T,
SGR-3.375-NEMA	3.375	444T, 445T, 447T, 449T

New Product

Conductive Epoxy Mounting

- **No drilling or tapping**
- **Available in Solid and Split Ring**

AEGIS SGR™
BEARING PROTECTION RING™

AEGIS™ Bearing Protection Ring…

…for "True Inverter Duty Motors." The only sustainable bearing protection technology to make motors "VFD" Ready

New Product

Conductive Epoxy Mounting

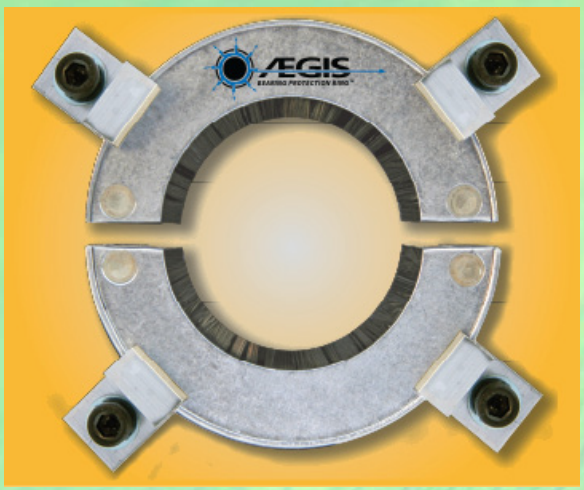
Solid Ring

Split Ring

Easy To Install

Other Installation Options

Mounting Brackets



Split Ring with Mounting Brackets

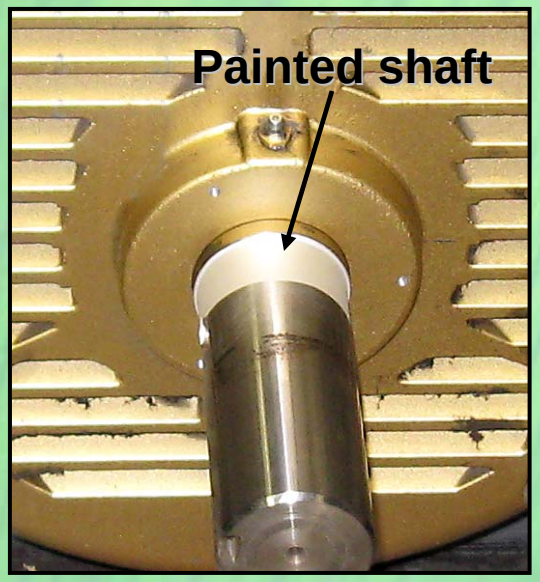
Bolt Through

Press Fit

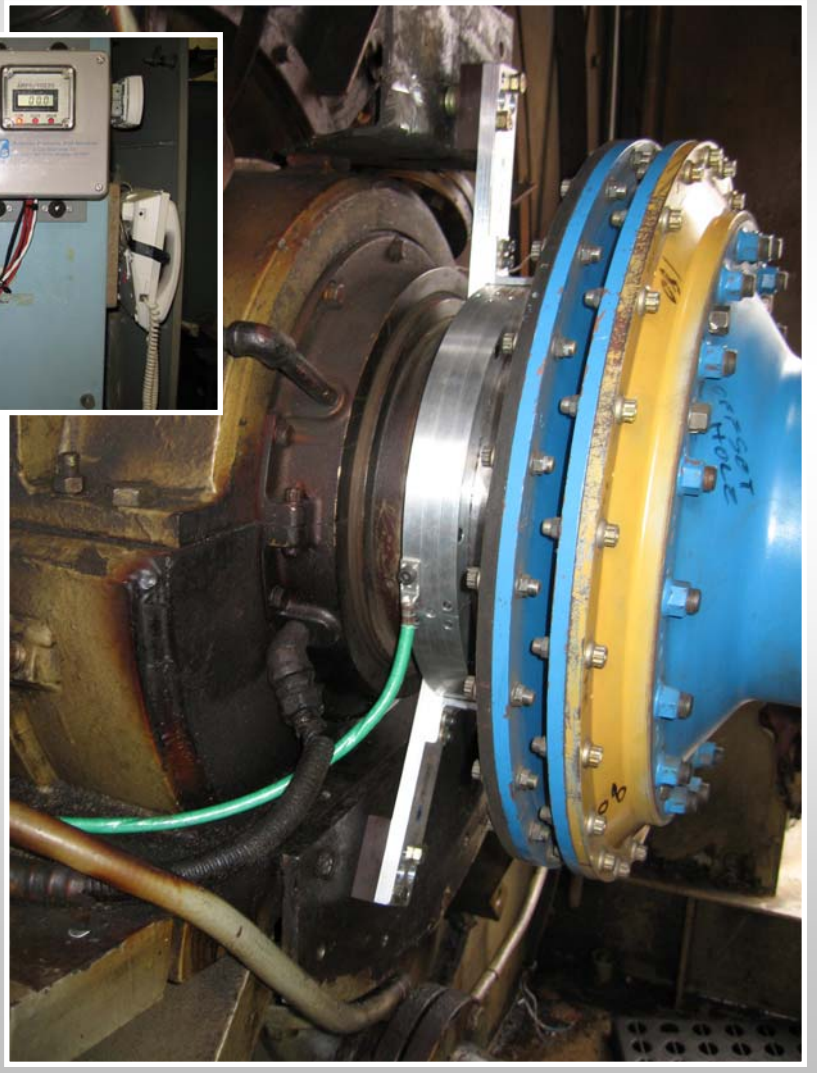
New Product

AEGIS™ Colloidal Silver Shaft Coating

- Enhances the conductive surface of the shaft
- Easy to apply
- Dries quickly



Large Fan Motor Installations, Municipal Waste Water, Processing Industries



About Shaft Current

VFD PWM Drive

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AC Motor

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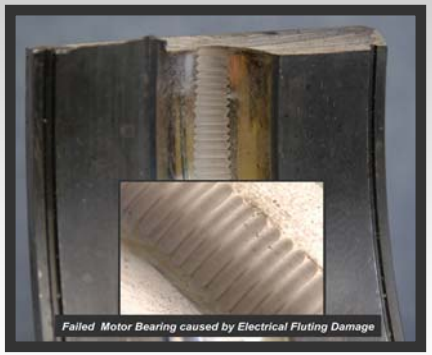
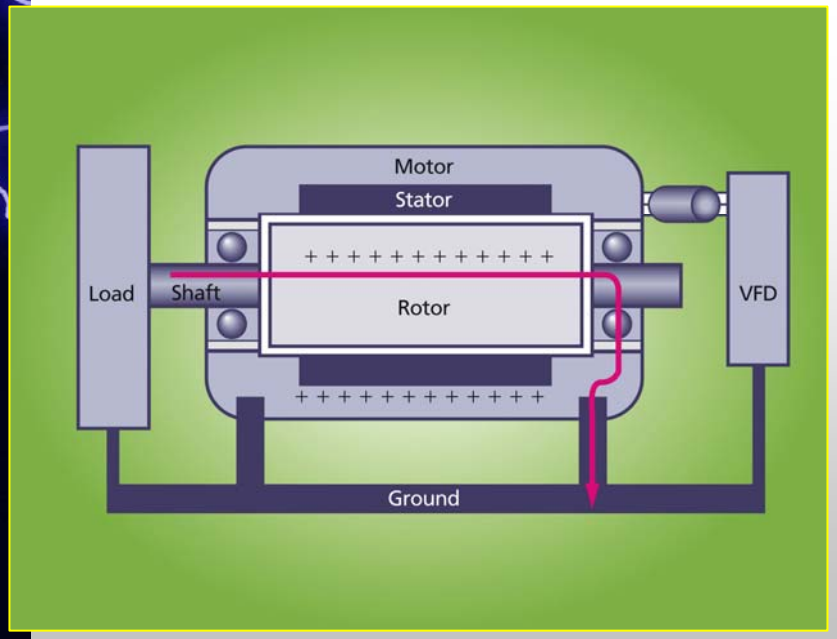


Pitting, Fluting, Failure

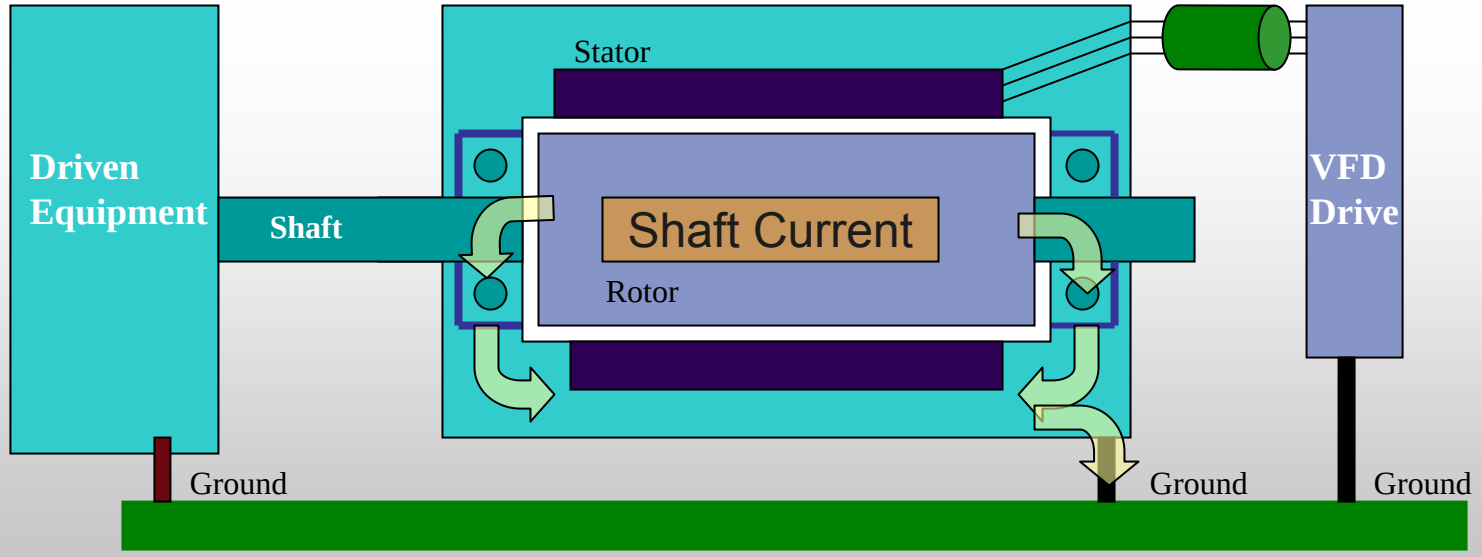


Shaft currents are present in <u>any motor</u> controlled by Variable Frequency Drives (VFD)

Shaft currents may also be present in large AC and DC motors even when <u>not</u> controlled by VFD

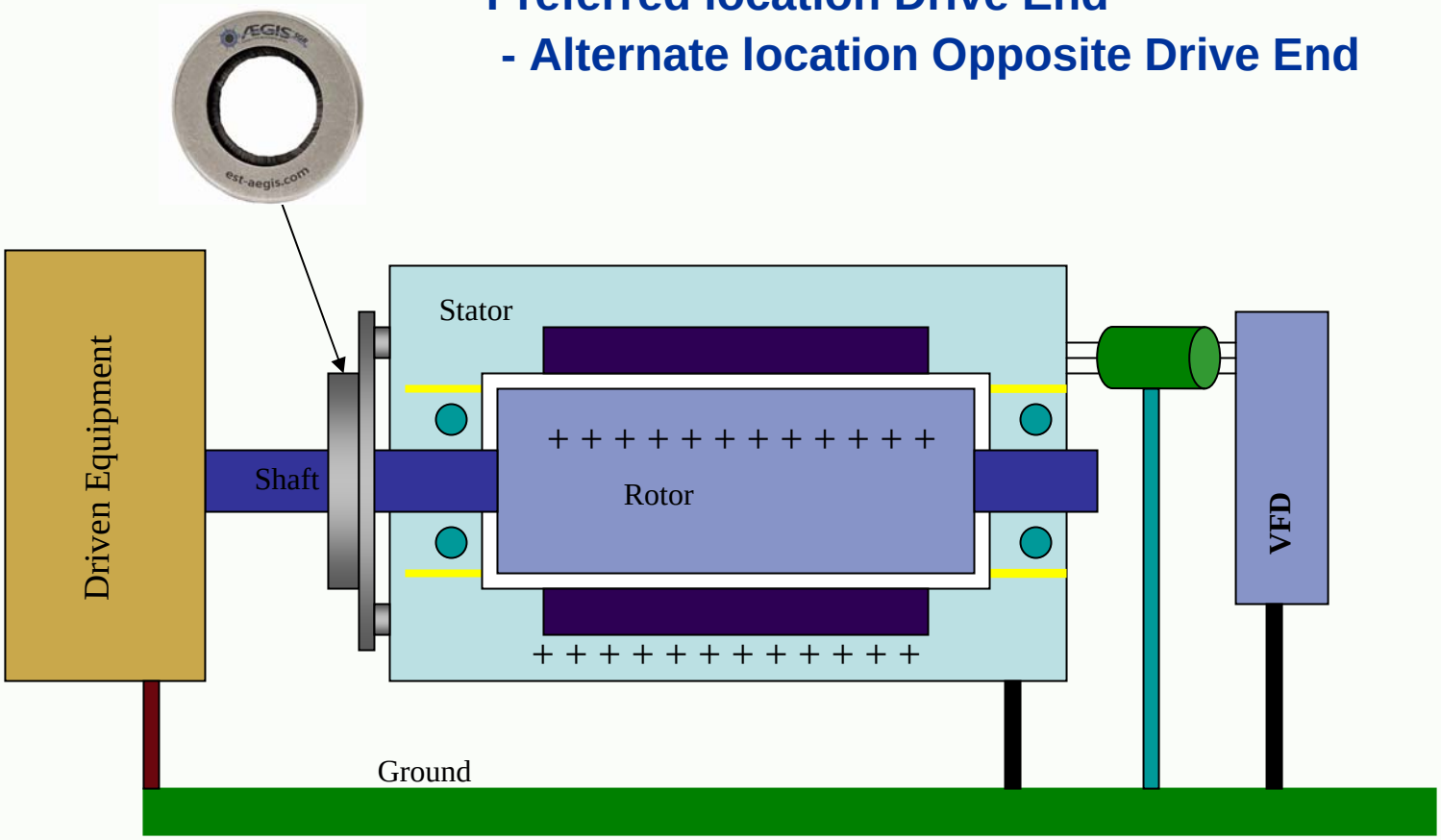
Source of motor failure:
Variable Frequency Drive (VFD) Induced Shaft Currents

- Shaft currents from VFD discharge through motor bearings
- Currents cause pitting and fluting and motor failure
- Electrical discharge machining (EDM) effect in the motor bearings
- AEGIS SGR™ is path of least resistance



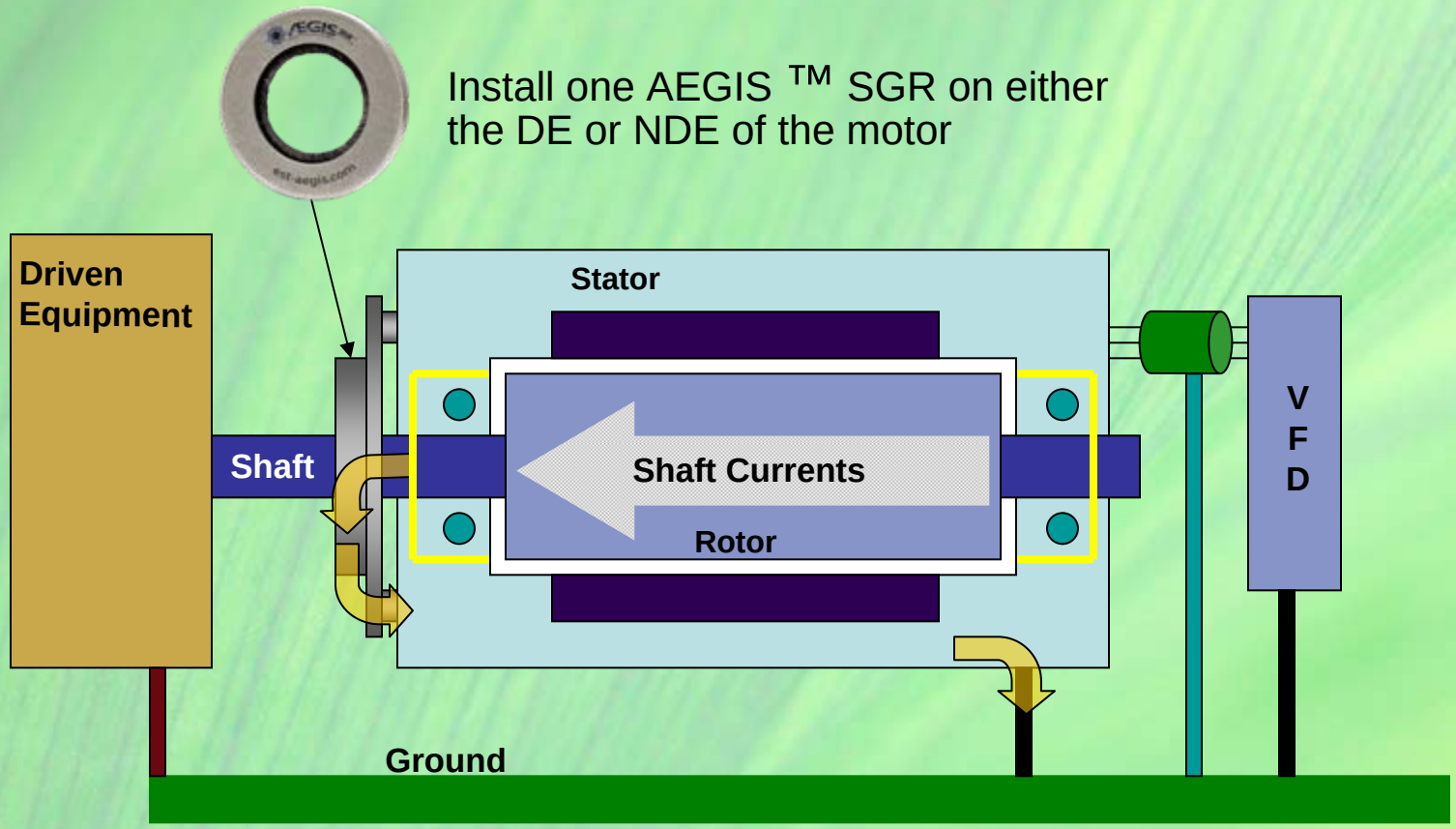
Solution: For motors below 2” diameter shaft Recommend *one* Shaft Grounding Ring NEMA Frame 324T and Below

- Preferred location Drive End
  - Alternate location Opposite Drive End



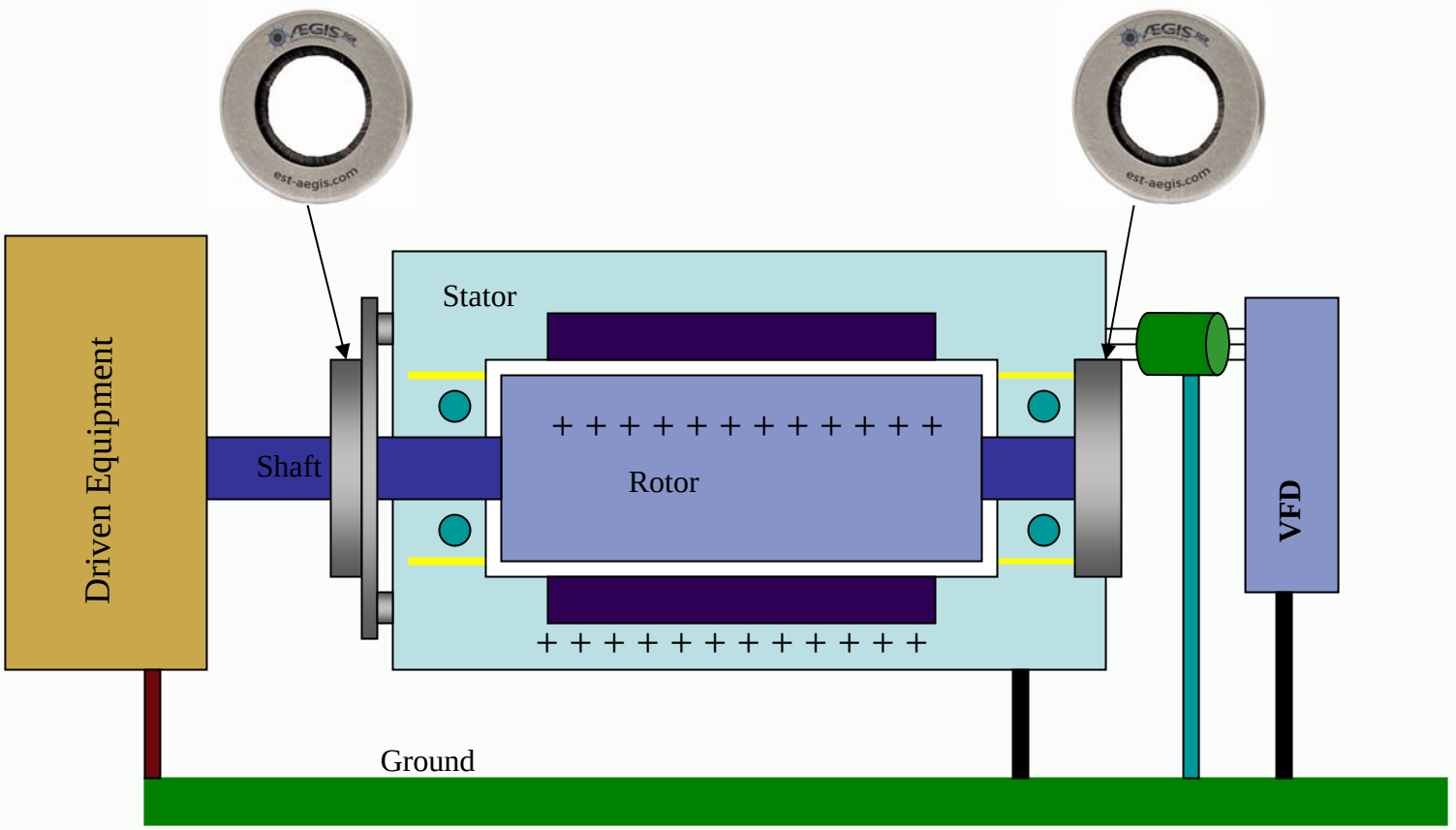
AEGIS Solution

Solution: Motors up to 100 hp
Protection for the service life of the motor!



Solution: Motors above 2” diameter shaft: Recommend *two* Shaft Grounding Rings NEMA Motors above 324T frame

Install on Drive End and Opposite Drive End*

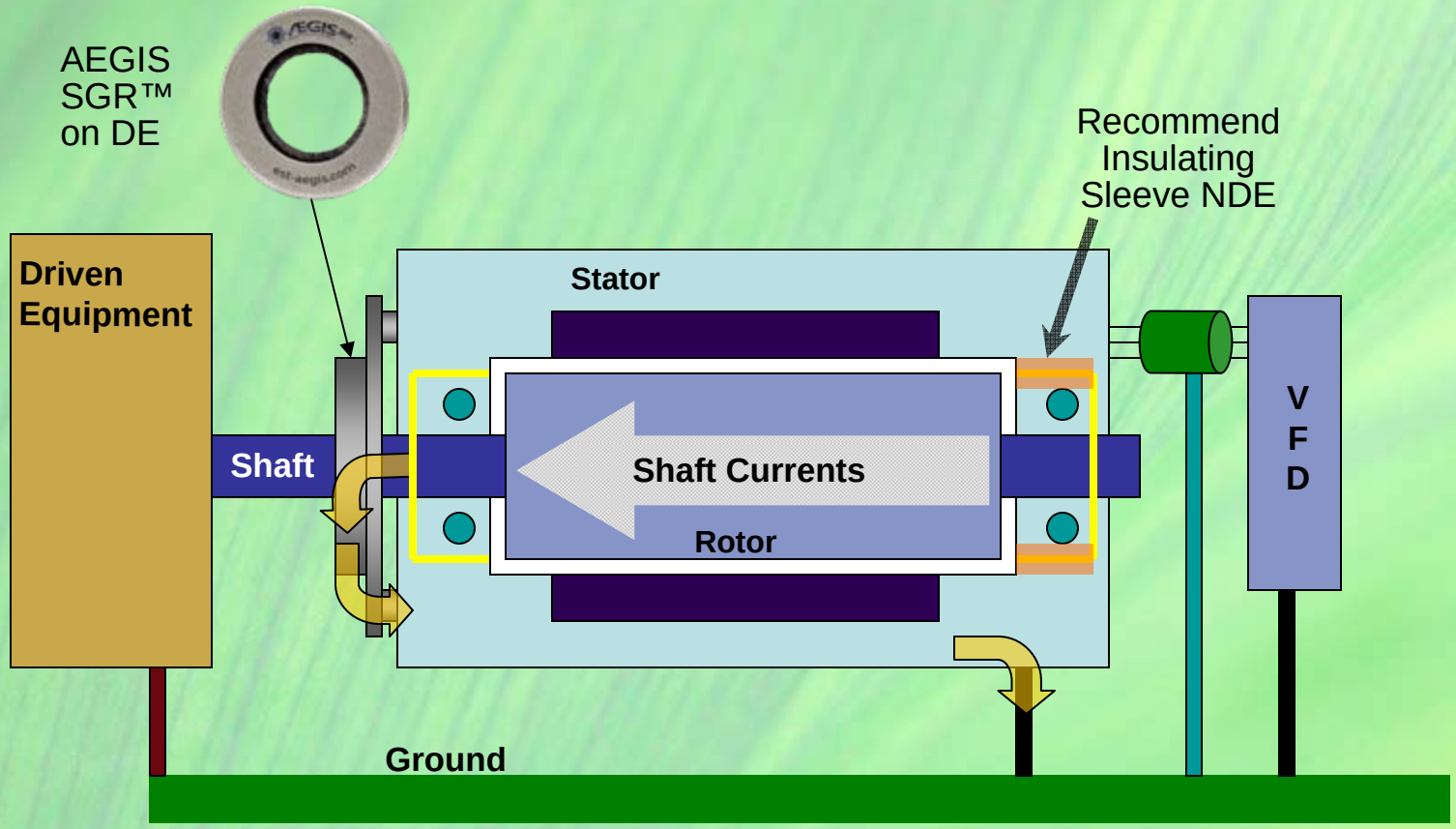


* If an insulating sleeve is on the opposite drive end, only one SGR is needed on the drive end.

AEGIS Solution

Solution: Motors 100 HP to 1000 HP (75kW to 750 kW)

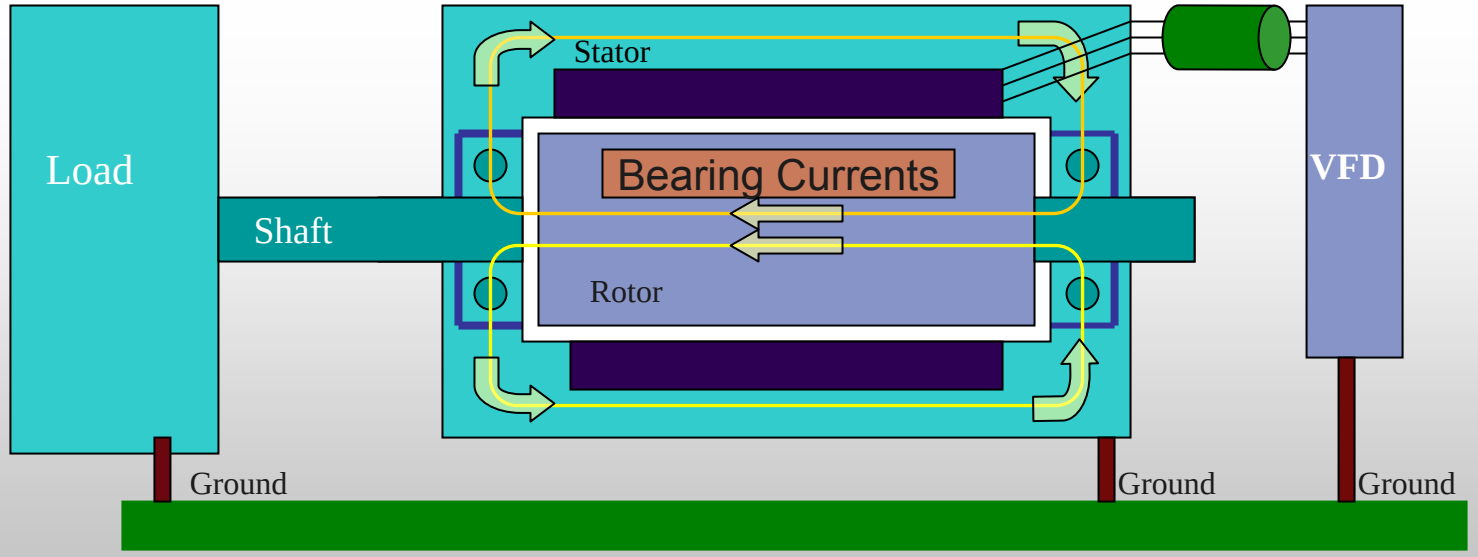
Recommend Bearing Protection Ring on Drive End and Insulation/Insulated Bearing on Non Drive End



Recommend Colloidal Silver Shaft Coating

Additional Source of motor failure: VFD Induced High Frequency Circulating Currents – Larger AC motors

- Current induced by magnetic flux imbalances around motor shaft
- Shaft currents circulate through motor bearings
- Problem in larger AC Motors with shafts over 2 inch diameter
- AEGIS SGR™ on each end provides path of least resistance



Historical Attempts to Resolve Problem:

- **Isolate** the shaft from the frame of the motor
  - Use insulated sleeve on the bearing journal
  - Replace steel bearings with ceramic bearings

Partial solution – shaft current remains

- **Ground** the shaft with spring loaded brush
  - Copper phosphor or bronze metal brush
  - Carbon block brush

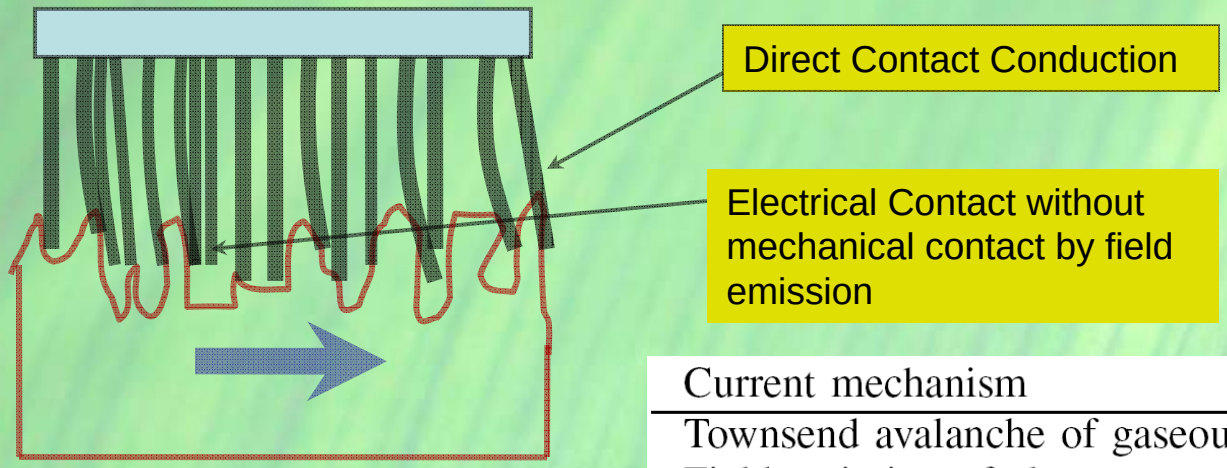
Ineffective and costly to maintain

Technology Comparison

- Improves Reliability
- Easy to install
- Long-term effectiveness
- Maintenance free
- Low lifetime cost
- For any AC or DC motor

	AEGIS SGR™	Insulating Sleeve	Ceramic/ Hybrid Bearing	Copper or Bronze Metal Brush	Carbon Block Brush	Conductive Grease
Protects Motor and Attached Equipment	**Yes**	No	No	No	No	No
Long-term Effectiveness	**Yes**	No	No	No	No	No
Easy to install	**Yes**	No	No	No	No	No
Contamination Proof	**Yes**	N/A	N/A	No	No	N/A
Low Lifetime Cost High return on Investment	**Yes**	No	No	No	No	No
Effective at any RPM	**Yes**	Yes	Yes	No	No	No
Maintenance Free Operation	**Yes**	Yes	Yes	No	No	No

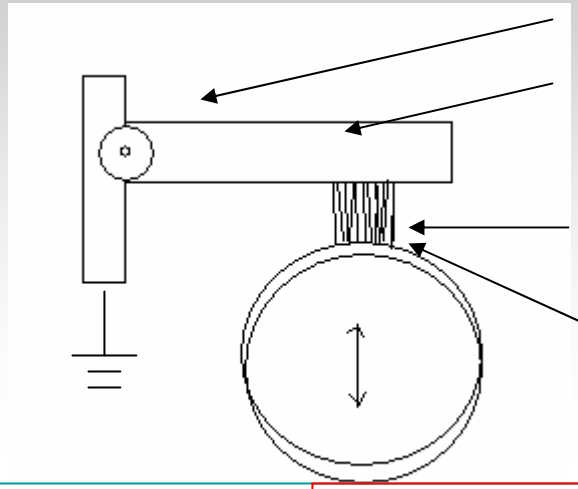
Conductive Microfiber Technology



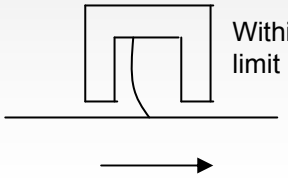
Current mechanism	Gap distance
Townsend avalanche of gaseous ions	$> 5\mu$m
Field emission of electrons	2nm to 5μm
Tunneling of electrons	< 2nm

***IEEE paper, September 2007: *Design Aspects of Conductive Microfiber Rings for Shaft Grounding Purposes*, by Dr. Annette Muetze et. Al.**

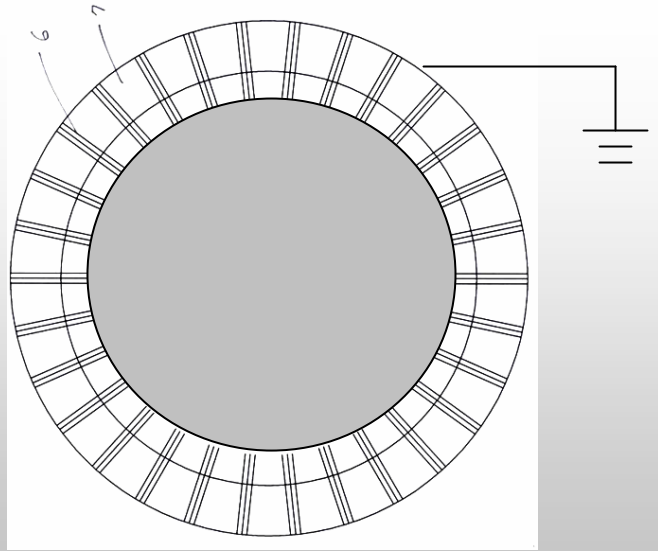
New Approach to Electrical Current Transfer



- Installation Difficulty
- Vibration due to “stick-slip”
- Material Wear (not suitable at high surface rate)
- “Shaft run-out” is compensated by spring load
- Not effective above 2MHz signal



Patented AEGIS Technology



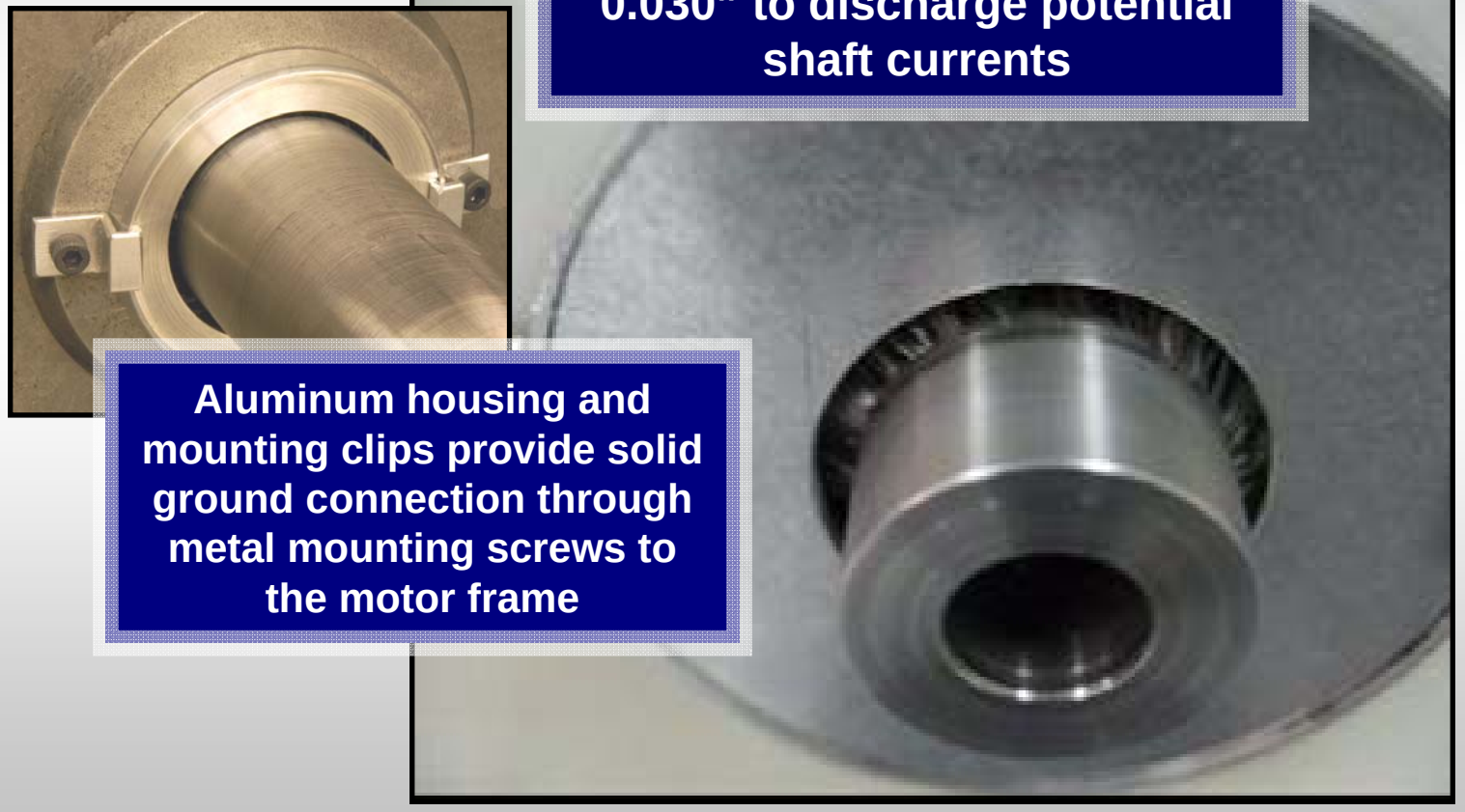
- No Spring load
- Negligible wear of micro-fibers even high surface rate
- Continuous contact despite “shaft run-out”
- Easy Installation
- Low cost
- Maintenance Free

New Patented Grounding Technology

Unique Characteristics

- ✓ Encircles complete 360 degree shaft area
- ✓ Unaffected by dirt and grease providing continuous grounding
- ✓ No maintenance required after installation

AEGIS SGR™ Technology



Over 100,000 Conductive MicroFibers™ overlap shaft by 0.030” to discharge potential shaft currents

Aluminum housing and mounting clips provide solid ground connection through metal mounting screws to the motor frame

AEGIS SGR™ Wear Testing Results

Surface rate wear test:

Measured wear less than 0.001” per 10,000 hours continuous operation

Fatigue and fiber breakage:

Zero fiber breakage after 25 million direction reversals

Results: Expected life of AEGIS SGR™ 200,000+ hours

“…lasts for the service life of the motor”

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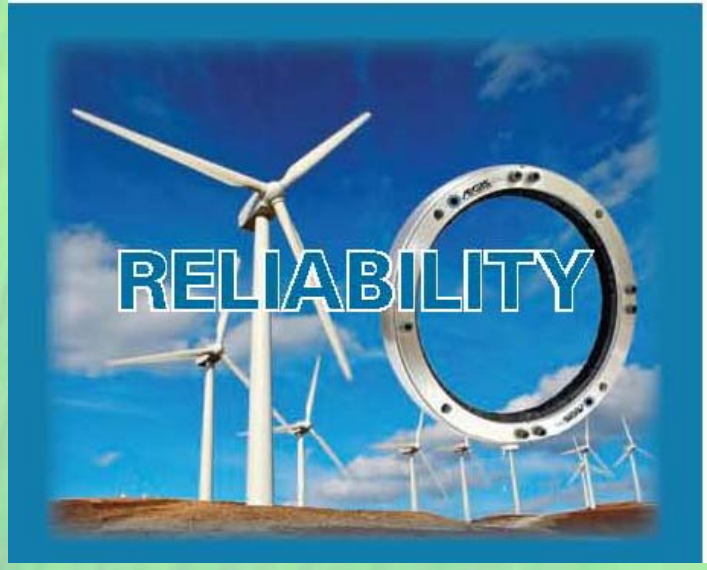
UP-Time and Reliability

- ✓ **Improves reliability of electric motors**
- ✓ **Removes a cause of bearing failure**
- ✓ **Prevents unplanned and disruptive system failure**
- ✓ **Provides the path of least resistance for shaft currents**
- ✓ **Channels harmful electrical energy to ground**
- ✓ **Boosts the longevity of AC motors - brings peace of mind that comes with planning ahead**

Conclusions

- Shaft currents cause unplanned motor failures, decrease reliability and results in increase operating costs
- All VFD motors must have protection to ensure reliability – otherwise motor is exposed to potential unplanned failure
- Installing AEGIS SGR™ channels harmful shaft currents to ground
- Shaft Grounding Ring™ kit for NEMA motors simplifies installation
- AEGIS SGR™ achieves unparalleled protection for motor bearings – improves up time

AEGIS SGR™ Bearing Protection Ring



Shaft Grounding Specification for Motors Controlled by PWM Drives (VFD)

Specification:

Whenever variable frequency PWM drives are installed to control AC motors, a maintenance free, circumferential, conductive micro fiber shaft grounding brush (AEGIS SGR™) shall be installed on the AC motor to discharge shaft currents to ground.