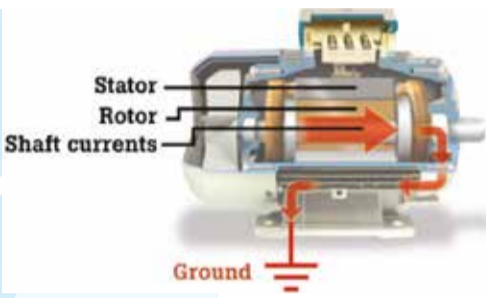


01

**The Problem:**

**VSD Bearing Failure:** Drives increase shaft voltages, that arc over the bearing grease, this arcing causes damage to the inner ring, outer ring or ball bearings of the motor. As well as damaging the bearing grease.



02

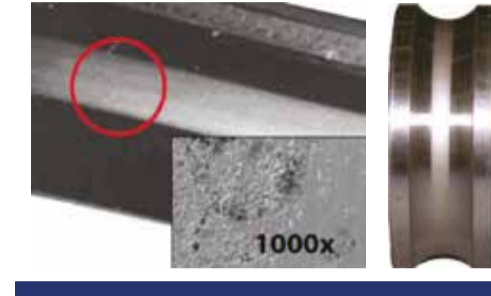
**How many motors have high shaft voltages?**

90 % of motors in S.A. have shaft voltages higher than the allowable limit recommended by IEC and NEMA which combined with normal "wear and tear" lower the design life of the motor. And 30 % of these have excessively high voltages (more than 10 X the, allowable limit) that are the sole cause of breakdowns and electric motor failures in Factories and Mines in S.A.

03

**What is Frosting?**

Frosting: This will appear to be a grey discoloured line around all or part of the bearing race and may be evident in the inner and outer race (see photo). EDM arcing causes millions of pitting marks that gives a matt look on the ball bearing raceway.



**What is Fluting?**

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



04

**Bearing Grease Failures?**

Electrical Arcing Destroys Grease in VFD driven Electric Motors. One can observe strong oxidation and hardening of the grease that occurs following high-temperature stress, which is produced through electrical grounding (arcing). Loss of lubricant health produces mixed friction and wear in the roller contact area. The fact that a bearing cannot be easily relubricated from the outside plays a crucial role in eventual element failure. The newly added grease cannot displace the hardened and oxidized lubricant already present, and it makes an exchange of grease impossible. With normal relubrication intervals, bearing failure is inevitable. Relubrication is not possible, bearing fails due to Damage from Bad Lubrication.



Hardening of Grease, stops Relubrication. Hardened oxidation of Grease stops new Grease entering Rollers.

05

**Bearing Damage?**

Electrical Arcing Destroys Bearings in VFD driven Electric Motors. Will electrical bearing damage always occur in a VSD application? The answer is "Yes, in 9 out of 10 motors - with no alternate path to discharge shaft current, pitting of the motor bearing will take place during VSD operation. These discharges will continue and will always seek the path of the least resistance - usually through the motor bearings". Yes, many motors still last for some time on a VSD application but bearing life is drastically reduced by up to 50 percent, even when the problem is not critical.



Frosted (matt) balls, frosted inner ring & fluted outer ring of ball bearing. Fluted inner ring of Roller bearing.

06

**Why Insulated Bearings & housings are not enough?**

They eliminate Eddy currents, but not "Capacitive Currents, so they only solve half the problem and therefore don't always stop motor failure, that's why motor manufacturers insist that Shaft Grounding is necessary even with insulated endshields are installed.

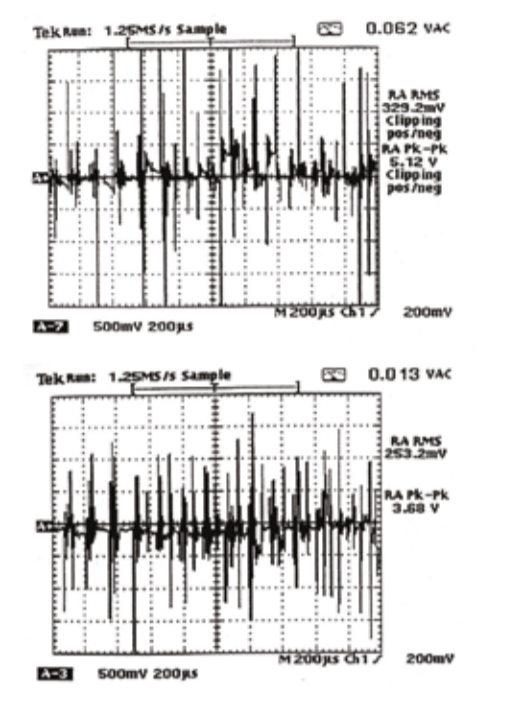


FIGURE 4: Shaft induced voltage of a 150HP motor with no shaft brush and no insulated bearings. FIGURE 5: Shaft induced voltage of a 150HP motor with shaft brush and no insulated bearings. FIGURE 6: Shaft induced voltage of a 10HP motor with no shaft brush and without insulated bearings (left) and with NDE insulated bearing only (right). There is only a small drop from 5.12v to 3.68v, which shows an insulated bearing reduces Eddy Currents, but not Capacitive Currents from drives.

07

**Why Carbon spring brushes are not enough?**

Carbon spring brushes need replacing and maintenance. Carbon brushes wear so they need replacing. Plus Carbon build-up on the shaft gets contaminated by dirt and moisture which increases resistance and reduces the ability to remove shaft voltages, regular cleaning is definitely required... Earthing last the life of the motor and require no maintenance.



08

**What do Motor Manufacturers say?**

Shaft Grounding is a necessity Worldwide, ... even when insulated housings/bearings are used.

09

**Who uses this Technology Worldwide?**

Weg, Regal Beloit, General Electric, Baldor, Siemens etc

10

**Why are Earthing's the best Solution?**

Earthing is the only product that is an all-in-one effective standalone solution, no other protection required (up to 400kw Guaranteed), and the only product that lasts the Lifetime of the motor.

11

**Should Earthing's be purchased in a Recession?...**

Capital repairs or losses hurt companies far more in a recession, the low price of Earthing's is not even felt by most companies.

**CASE STUDIES**

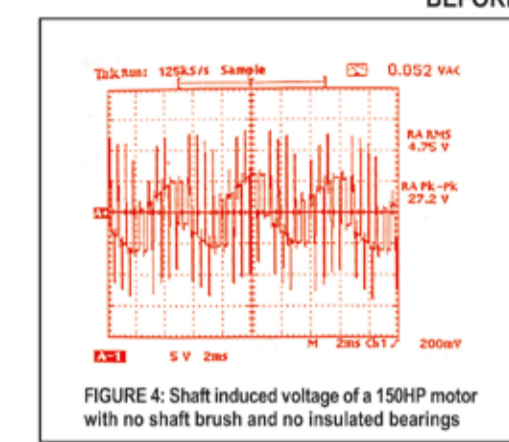


FIGURE 4: Shaft induced voltage of a 150HP motor with no shaft brush and no insulated bearings. A 150 HP Motor was tested on a VSD Drive, shaft currents were 27.2v Pk-Pk

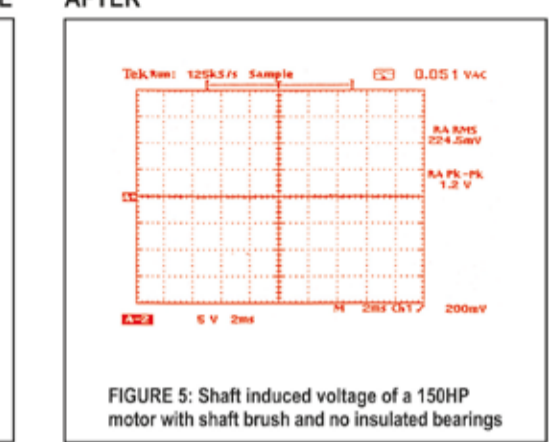


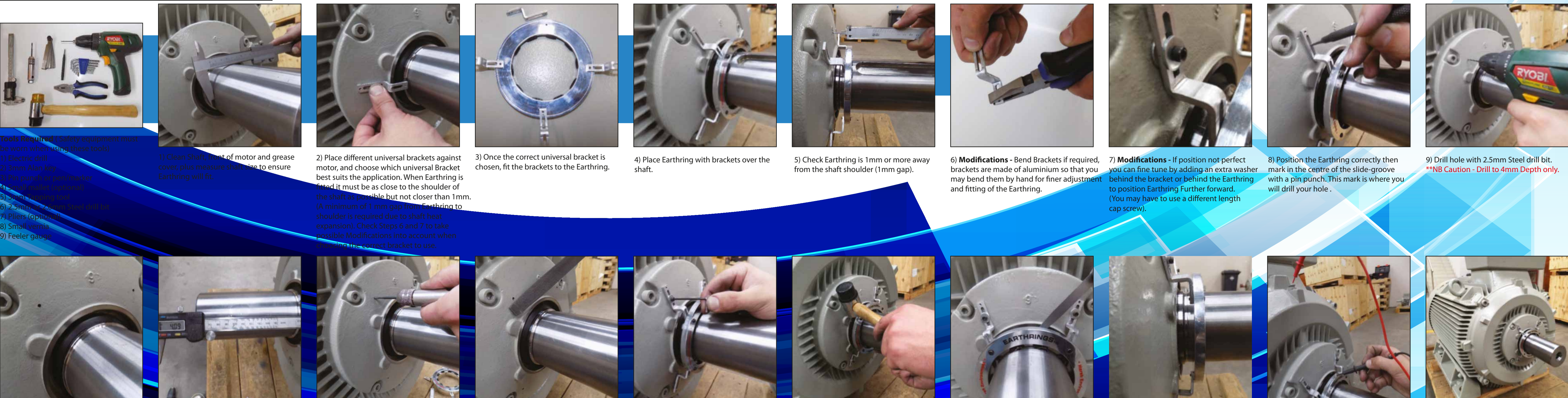
FIGURE 5: Shaft induced voltage of a 150HP motor with shaft brush and no insulated bearings. A 150 HP Motor with a shaft brush & no insulated bearing fitted, has reduced shaft currents to only 1.2v Pk-Pk



# EARTHINGS™

T: (0)11 894 4208 • C: (0)83 955 8722

## HOW TO FIT EARTHINGS:



- Tools Required** (Safety equipment must be worn when using these tools):
- 1) Electric drill
  - 2) 3mm Allen key
  - 3) Pin punch or gear puncher
  - 4) Small shoulder tap
  - 5) Small tapping fluid
  - 6) 2.5mm or 3mm steel drill bit
  - 7) Pliers (optional)
  - 8) Small vernia
  - 9) Feeler gauge

- 1) Check Depth of hole with vernia and make sure you have drilled completely through. (If you have removed the tap and or grease cover, re-drill grease cover bearing and Grease cover with thinness. i.e. grease bearing and fit Grease cover back in place)
- 11) Tap Grease cover /endshield holes with 3mm Tap (0.5mm pitch). Use tapping fluid
- 12) If you happen to break the tap, do not panic, file down the broken tap until it is flush with the grease cover, then drill a new hole 3 or 4mm below or above the old hole.
- 13) Fasten Earthing to grease cover /end shield with 3mm Cap screws and 1.5mm washer. Do not tighten, leave cap screw firm but slightly loose to enable to move.
- 14) Move or tap Earthing so it is evenly positioned around shaft. Use vernia to check gap. Use feeler gauge 0.9mm or less in thickness to ensure even gap all around shaft.
- 15) Use 100mm feeler gauge to check Earthing has a minimum of 1mm gap from the shaft shoulder. Also check that Earthing is parallel to shaft and parallel to end shield / parallel with the shaft and grease cover /end shield.
- 16) Check conductivity with multi meter between Electric motor casing and Earthing, the reading should be 2 ohms or less.

Earthing Installation Completed.