

Orbit Magazine

Throwback Thursday :: Mechanical Degradation

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Bently Nevada has a rich history of machinery condition monitoring experience and has always placed a high priority on educating and helping customers manage & maintain their equipment better. Every week, an article or Application Note that was published by Bently Nevada 'back in the day' will be highlighted. Although the format may be dated, the information is just as valid and informative as the original printing.

Originally published in 1988.

MECHANICAL DEGRADATION DUE TO ELECTROSTATIC SHAFT VOLTAGE DISCHARGE

The existence of shaft voltages that are detrimental to rotating machine elements has long been recognized. Studies made concerning Electrostatic voltages confirm that Electrostatic discharge is a known cause of bearing failure on machinery trains with a Condensing Steam Turbine.

The brushing effect of condensing water droplets across turbine blades produces an Electrostatic charge on the rotor. This charge periodically dissipates to ground through a low impedance point

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(e. g. heavily loaded bearing). During the discharge cycle microscopic pits are formed, and the Babbitt assumes a "frosted" or "satiniJray" finish in the loaded zone. Eventually Babbitt attrition exposes the bearing base metal to the shaft journal. When this occurs the tell-tale "frosted" appearance of the Babbitt is obliterated by the mechanical damage. A machine may go through several unexplained failures before the bearing is inspected prior to destruction, and the "frosted" appearance discovered.

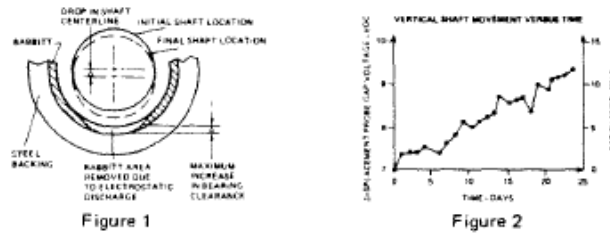
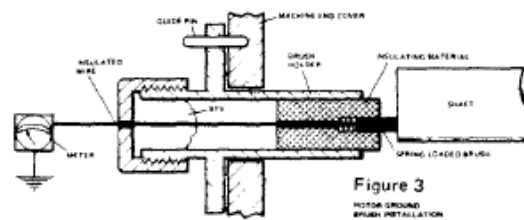


Figure 1 depicts a typical case where the journal has moved downward into the bearing. Identification of this position change can only be achieved by the variation in proximity probe DC Gap Voltage. This malfunction can occur radially or axially; and mutually perpendicular probes at each journal combined with axial position probes is mandatory. The Electrostatic voltage can traverse couplings and Gear Boxes, so the actual failure is often removed from the generating source. Therefore, it is essential to maintain accurate trend records of the DC Gap Voltage on all probes (e.g. Figure 2).

In Figure 2, note that a 12 Mil change in vertical position occurs during a 24 day period. If the bearing has a 15 Mil Babbitt thickness, the unit must be shut down for bearing replacement prior to Journal damage.

ABATEMENT TECHNIQUES

Abatement can be achieved by eliminating the generating source or isolating the bearings. Both approaches are desirable, but usually unfeasible. The most widely used technique is to provide a continuous "grounding" of the rotor using systems such as contact brushed, mercury baths, water seals, or highly conductive lubricating oil. A rotor grounding brush is the typical solution.



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Figure 3 shows a grounding brush installed on several units with excellent success. The brush material can be a soft carbon, or a wire bristle brush. These points should be considered during installation of a rotor ground system:

1. Locate the brush at a point of low running velocity to minimize brush wear.
2. Meter the ground wire to verify if the brush is operational.
3. Insulate the brush from the brush holder and the machine casing.
4. Install the brush in a holder that can be changed on the run.
5. The assembly should be sealed to retard oil leaks.
6. Install no more than two brushes on a machinery train. Too many brushes may initiate ground loops between brushes.

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