

## DEALING WITH SHAFT AND BEARING CURRENTS

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### INTRODUCTION

This paper addresses key issues related to shaft and bearing currents in electric motors and generators. Critical topics that will be covered include recognizing symptoms of shaft and bearing currents, and determining if damaging current levels are present. Also, possible causes of the damaging current, such as machine dissymmetry and operation on variable frequency drives (VFDs) will be dealt with. Methods of testing to confirm the presence of shaft or bearing currents will be described, as well as how to assess the magnitude of the damaging currents. Further, solutions to eliminate or control shaft and bearing currents, such as insulators, isolators, and ceramic bearings, will be offered.

While shaft and bearing currents are not a new problem (papers on the subject date back prior to 1930), what is "new" is the increased understanding of how to identify and solve the problem. Shaft and bearing currents have been described as shaft voltages, circulating voltages, circulating currents and bearing currents. Shaft voltage only becomes a problem when it leads to bearing current and consequential damage to the motor bearings. If this voltage, referred to as "common mode voltage" or "shaft voltage," builds up to a sufficient level, it can discharge to ground through the lubricant film on the bearings. Current that finds its way to ground through the motor bearings in this manner is called "bearing current."

This paper will primarily refer to the damage phenomenon from shaft or bearing currents as bearing current(s) because it is the current through the bearings (not the shaft) that causes the damage. In cases where the distinction between shaft and bearing currents need to be made, the specific term shaft current(s) or bearing current(s) will be used.

### RECOGNIZING SYMPTOMS OF BEARING CURRENT

All too frequently the first symptom of bearing current is audible noise from the bearing, indicating it is in advanced stages of failure. Inspection of the bearing after failure may reveal fluting of the races (Figure 1), balls or rollers "frosted" (Figure 2), or an overall dull grey or dark "smoky" finish (Figure 3) on both balls/rollers and raceways. The lubricant may also be dark in appearance.

FIGURE 1: FLUTING



Fluting of the bearing races due to electrical current.

FIGURE 2: FROSTING

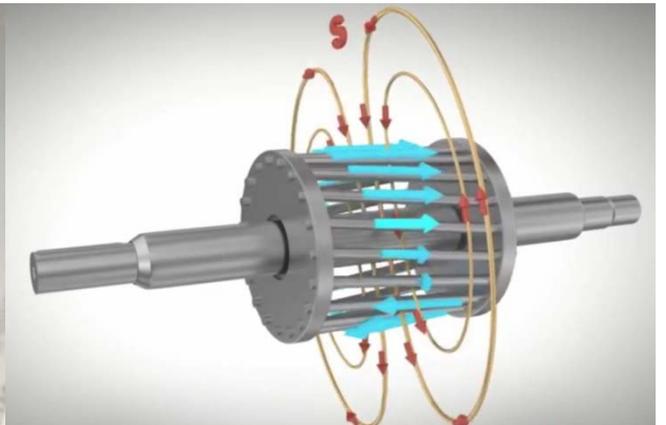


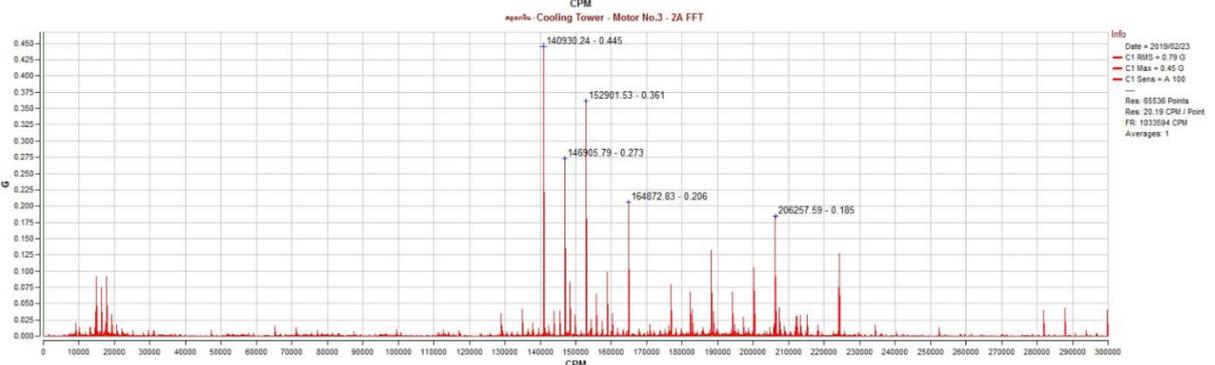
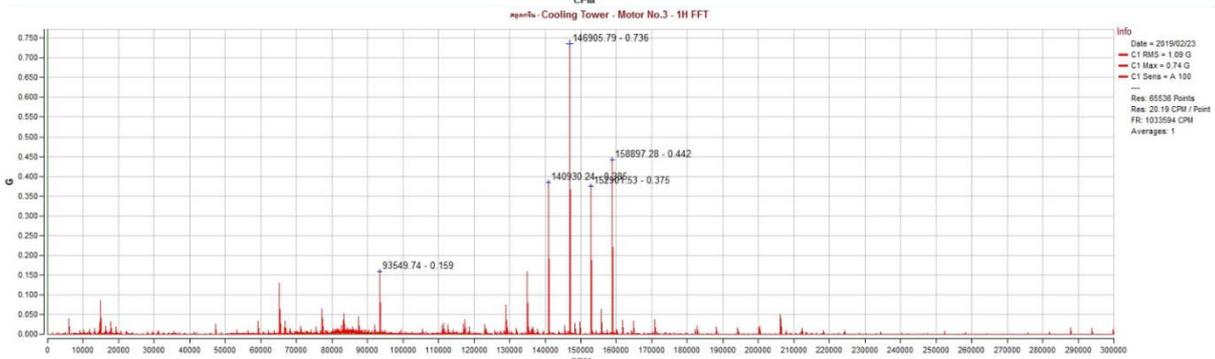
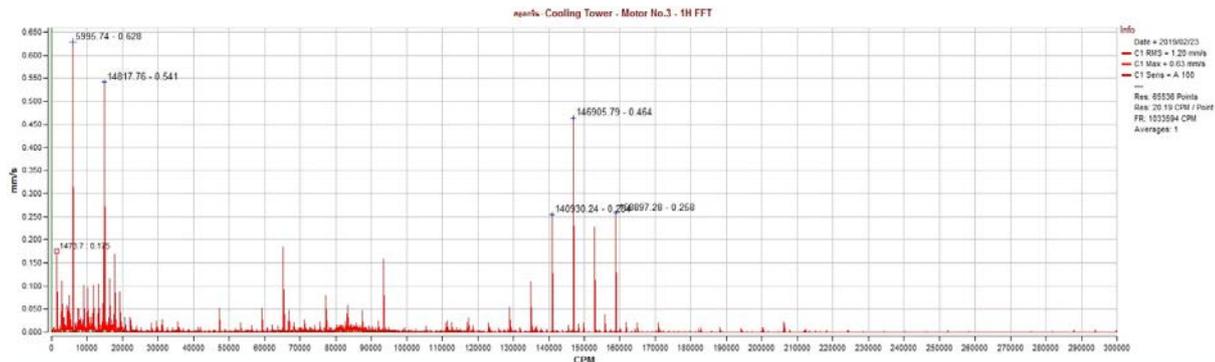
Frosting of the balls/rollers due to electrical current.

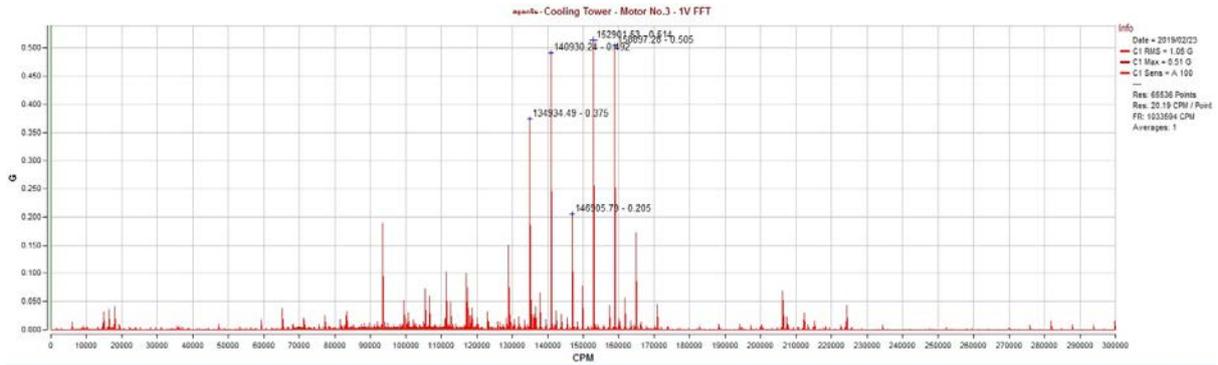
### CURRENT DAMAGE

The appearance of damaged surfaces is related to three major types of current. The first type of electric current damage is electric pitting (Figure 4). It is mostly

**FIGURE 2: FROSTING**







Story: @ Electrical generation Plant @Satun Province.

Cooling tower, the unit has been running from day one about one year, then high noise. Customer requested to replace bearing. After the bearing replaced the unit runs for a month with High G's @ high frequency and strong noise from bearing. Low vibration level as spectrums.

Report was made after investigation. Found Bearing failure as pictures above. Rotor current leaks through the bearings

Thanks & Regards,

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