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I'm surprised that some companies discourage the use of shaft brushes because—*they claim*—conditions calling for these brushes don't exist. If I were in a mischievous mood, I might say dissemination of such information could be considered a positive by the motor-repair industry. After all, bearing replacement is simple and lucrative (LOL). But I'm really not feeling mischievous about this topic.

Capacitive coupling and resulting shaft voltages and currents exist in all induction machines. It's part of the reason why very large machines (over 1000 Volts) will have insulated opposite drive-end bearings and grounded drive-end bearings. The amount of voltage is considerably higher than in a low voltage (<1000 Volt) machine that is operating on a sinusoidal voltage. The amount of energy isn't great enough, in the smaller machines, to discharge across bearing surfaces, in a majority of cases. However, in pulse-width modulated variable-frequency-drive (VFD) applications, the high carrier frequency (pulses) and resulting wave-shapes induce a voltage and resulting current into the shaft.

On smaller motors—*those under 100 hp*—you can ground the drive-end shaft and reduce the current to a manageable level. On units over 100 hp, you usually have to insulate the opposite drive end and ground it with a shaft brush in order to re-direct and reduce shaft currents. The reason for this is to prevent circulating currents from damaging the bearings in the driven equipment (something that could happen if you only insulate the bearings).

It's true that shaft voltages and currents will not always reach levels that are high enough to rapidly degrade bearings in all VFD applications. There are typically several options for determining if this is going to be an issue: Your first option is to allow the motor to operate and fail, then address the issue and install shaft brushes after that or a subsequent failure. The second option is to install shaft brushes and insulated bearings on all VFD-operated machines. Your last option is to let a service company test for shaft voltage.

Shaft voltages can't be detected with a multi-meter unless they are extremely severe. Rather, it requires an oscilloscope of 100 MHz or greater, preferably 200-300MHz. In analyzing the voltage, note values of 20-120+ Volts peak-to-peak for common mode voltage, and discharge patterns ranging from 6 volts to 80+ Volts peak. They point to issues that MUST be addressed. **MT**

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