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HVAC Startup Troubleshooting

Part II—No Whining

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No Whining.

In the last article I wrote for *The Engineering Consultant,* I discussed a few of the factors to consider when commissioning fans, motors, and variable frequency drives (VFD's). Another related item that merits discussion is attention to acoustics. On a recent project SBM was commissioning, the owner pointed out that the motors on the new fans were extremely noisy. On most projects this might not be a problem in a mechanical room, however due to the close proximity of occupied spaces, every noise source would add to the discomfort of his tenants. The noise also happened to be at a frequency that was very distinct even outside the mechanical room. He wanted to know whether the contractor might have installed sub-standard motors. A quick inspection of the motors (provided as part of the fan by the manufacturer) indicated that they were premium-efficiency motors, suitable for VFD applications and complied with our specifications. What we did discover, after some additional research, was that the factory default switching frequency for the VFD's was the likely culprit.

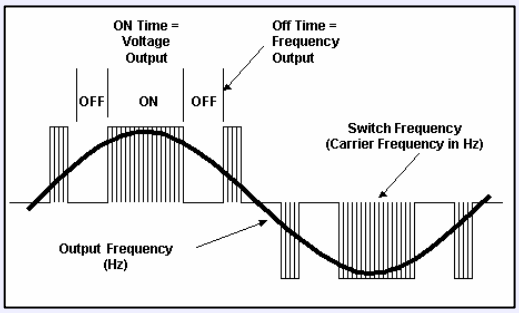

Figure 1—Simulated Power Sine Curve
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I am simplifying this a bit, but the VFD is essentially producing a simulated power sine curve by generating pulses of power (see Figures 1 and 2). The faster these pulses occur, the smoother the sine wave will be. Fifteen to twenty years ago, the frequency of these pulses would be as low as 250 to 500 pulses per second (Hz), however advances in circuitry now allow those frequencies to be as high as 14,000 Hz. Faster switching is generally better for motors, decreasing the likelihood of objectionable noise and motor winding failures. The disadvantage to higher switching speed is that the power efficiency of the VFD drops slightly and the allowable distance between the VFD and its driven motor decreases. These are not critical issues for most HVAC applications, but do need to be acknowledged.

In the case above, the factory-default frequency was low, and the vendor was able to easily program higher values until the motor noise ceased. The owner was happy that the noise was reduced and all were satisfied that the system would not reduce the life of the motors.

Lessons learned in this installment?

Do not presume that factory defaults are correct. Software and devices that are pre-configured are typically conservative, erring on the side of protecting equipment. Such settings may not be optimum and may actually sacrifice efficiency or equipment life.

The squeaky wheel may not *need* the grease. In this case the old adage may be misleading. The loud motor was a symptom of a deeper problem. Blaming the motor was a logical first step, but a thorough investigator often must look beyond the obvious.

VFD's are not "plug and play" devices. Both parts of this series illustrated that there is no equal to having a qualified, knowledgeable product representative assist in startup and commissioning of VFD's. This is a service that should be non-negotiable when writing specifications or dealing with installing contractors.

Next time – *Common SBM Mechanical and Electrical Punch List Items*

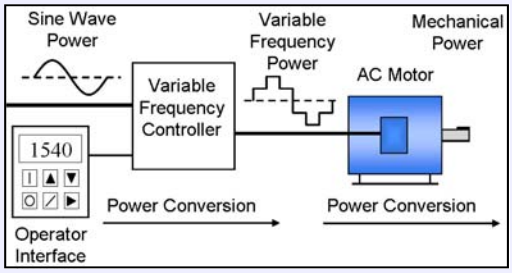

Figure 2—Variable Frequency Drive Diagram,
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