Shop "Tech Talk" December 2007

Q.	**I need to speed up a fan I have in my facility. Can you tell me what I need to be aware of when changing the speed of my fan ?**
A.	**I am glad you asked because you should be aware of the possibly harmful results you could encounter with the speed change.**

Well let's just jump right in!
If we have a 75 HP across the line motor driving a belt driven fan and we have a 10" OD sheave on the motor shaft and we need more air, ie. more flow and let us say the motor is name-plated 96 amps full load and when we measure the current we show 75 amp per phase. Also let's say we want 10% more air flow.
What will happen to the amps on the motor?
As it turns out the amps will increase not 10% but 33% so now the motor will likely pull in the vicinity of 100 amps and this would now mean that it was pulling over its name-plate rating and be running into its service factor rating.
All we did was go from a 10" OD sheave to a 11" sheave and we increased motor current from 75 to 100 amps.
A small change but a large result!
In this day of inverter driven apparatus it is so easy to change speed 10% , so we must be vigilant about the effects of speed changes as to how they will affect motor load current.

Note: A 25% increase in rpm results in a 95% increase in horsepower needed. Considering this, initial fan selections should be sized with a motor horsepower greater than necessary if any increase in fan rpm is likely in the future.

This change above occurs because of what are called the Affinity Laws, which relate to fans, blowers and pumps. These laws predict how the Horsepower , the CFM and the Pressure are altered by speed changes. From the table below we can see that the Horsepower changes as the cube of the speed change. So a 10% speed change changes the HP needed to 1.1 x 1.1 x1.1 = 1.33 times the original HP at the lower speed.

Affinity Laws for Centrifugal Applications:

$$\frac{\text{Flow}_1}{\text{Flow}_2} = \frac{\text{rpm}_1}{\text{rpm}_2}$$

$$\frac{\text{Pres}_1}{\text{Pres}_2} = \frac{(\text{rpm}_1)^2}{(\text{rpm}_2)^2}$$

$$\frac{\text{hp}_1}{\text{hp}_2} = \frac{(\text{rpm}_1)^3}{(\text{rpm}_2)^3}$$

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