Cooling Tower Performance

FAN MOTOR OVERAMPING

Overamping

Overamping occurs when the amperage drawn by the motor exceeds the amperage specified on the nameplate. In other words, more power is required than the recommended maximum for the motor. It is often assumed an incorrect fan pitch causes overamping, but it is more likely the result of other issues that are not inherently related to the fan. The Troubleshooting Checklist included in this document provides actions and solutions to help identify and solve typical causes of overamping. **Please follow all steps on the checklist before submitting a support request.**

If the troubleshooting steps are not effective, the issue may be related to fan pitch. The blades are pitched to draw approximately the same volume of air year-round while consuming power that is less than or equal to the design power. However, air density is higher in winter; the fan motor will draw more horsepower than in summer to move the same volume of air. The air density can vary up to 10% between seasons.

The air density will also increase when the heat load applied to the tower is less than as designed. In addition, the initial fan pitch is calculated using theoretical models; due to deviations in the system, it might not be exact. If incorrectly pitched, the fan can draw more amperage than specified on the motor nameplate, leading to overamping. When full nameplate amps are drawn at tower design conditions, the cold water temperature will be in alignment with the contractual guarantee. Please follow the Fan User Manual for the correlation between air density and motor amperage.

Finally, it is important to note that overamping can be acceptable in certain situations without fear of overheating the fan motor. Particularly, if the ambient conditions are much colder and/or the range is much lower than design (the full design heat load is not being applied to the tower), the increased air density may cause overamping. Many motors are selected with a 1.15 service factor (SF). If your motor specifies a 1.15 SF, a small amount of overamping below the design ambient conditions will not cause the motor to overheat.

The relationship between power draw and amperage for 3-phase power is shown by the following equations:

$$hp = V \times I \times \sqrt{3} \times f_p \times \frac{\eta}{746}$$

$$kW = V \times I \times \sqrt{3} \times f_p \times \frac{\eta}{1000}$$

V = *Voltage (V)*

I = *Current (A)*

f_p = *Power Factor*

η = *Efficiency*

For example, assume an 1800 rpm motor has a nameplate of 40 hp, voltage of 460 V, and amperage of about 46 A. Efficiency is normally about 95% while the power factor usually has a value around 0.86. If the fan motor is overamping by 5%, it is drawing about 48.3 A, or 42 hp. With constant voltage, this is within the specified 1.15 service factor. It is important to note that the power factor is not constant for any particular system. Therefore, a calibrated wattmeter is preferred when measuring power because it automatically measures the motor power factor.

TROUBLESHOOTING CHECKLIST

Step	Action	Solution
1	Measure the voltage and amperage as close to the motor as possible after the tower has been running for 15 minutes.	
2	Is the wattmeter/voltmeter/ammeter calibrated?	If not, please calibrate the device per manufacturer's instructions and re-measure the power draw across the motor.
3	Is the design heat load being applied to the tower?	Apply the full design heat load to the tower if possible.
4	Is the voltage lower than the motor nameplate?	If it is, check the system wiring (connection, lengths of wire, wire gauge, etc.), and fix any discrepancies with the system design.
5	Is the overload heater tripping?	If yes, make sure that the heater is wired and sized correctly in the proper location.
6	Run the system in bypass mode (if on a VFD).	If the overamping stopped, consult the VFD provider for proper wiring, settings and installation.
7	Is the wiring correct according to the system wiring diagram?	Fix the wiring to align with the wiring diagram.
8	Is the motor nameplate speed in alignment with the tower design specifications? (1800, 1500, 1200, 900 rpm)	If not, install the motor per the system design.
9	Is the gear/sheave ratio correct per the design specification?	If not, please run the fan at the correct design speed using the specified reduction ratio.
10	Does the fan have the specified number of blades? Are the blades pitched using the correct measurement method (consult the Fan User Manual)?	If wrong fan blade count, replace the fan with the specified fan. Re-pitch the fan blades using the proper procedure found in the Fan User Manual for specific fan models.
11	Is everything per design with a full heat load on the tower, and is overamping persisting?	Reduce fan blade pitch by 1.5 degrees and re-measure. If the tower has a fixed-pitch fan, reduce the fan speed by adjusting the sheave ratio. Try either a smaller motor sheave or larger fan sheave.

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