



## Trouble shooting fan motor overload.

There are several reasons for fan motor overload. This paper covers the most common ones and it includes a questionnaire which might help to find the root cause of the problem.

### Incorrect fan speed.

The airflow provided by a fan is proportional to the fan speed. A variation in fan speed however changes the absorbed power to the cube. (Third power). So an increase of 5% in fan speed increases the absorbed power with approximately 15%. **Check the motor and fan pulley size (or the gearbox ratio) and compare with design data.**

The drive selection depends on the frequency of the electricity net (50/60Hz) and the accessories that influence the air resistance (total external static pressure ESP) of the cooling tower

### Reduction of air resistance.

If the air resistance is decreased on BAC Centrifugal Fans, the airflow through the unit increases and the absorbed power increases. **Any reduction in airflow resistance versus the design of the unit might result in centrifugal fan motor overload.** Reduction of resistance can occur by:

- **Dry operation:** a fluid cooler or condenser that is operated without the spray pump running.
- **Bad spray pattern** (by clogged nozzles or insufficient waterflow)
- Too **low water flow** on open cooling towers.
- **Open access doors** between the pan sections of multiple cell units.
- Open access doors in attenuators
- Operation of only a single fan motor on a VX unit with multiple motors on a single casing section. (this creates an **air bypass** towards the idle fan).
- Removal of intake or discharge accessories (attenuators, baffles, eliminators,...) which **changes** the total **ESP** (external static pressure ) of the system.
- Installation of **VX units on elevated steel structure** without solid bottom panel. VX units are designed to be installed on I beams at ground level. If they are elevated air can be drawn from the bottom of the unit and not only from front. This increases the airflow through the unit. Installing one size smaller motor pulley solves the problem in most cases.



Standard unit



unit on steel structure with increased airflow



### **Mechanical resistance in the fan system.**

Additional resistance in the drive system will increase the absorbed motor power. This might be caused by:

- Fan bearing damage.
- Insufficient greasing of the bearings
- The fan is touching the fan housing or fan cylinder (abnormal noise should be noticed).
- Damaged drives (or gearbox)
- Fan damage.
- Too high belt tension (this increases the risk for bearing damage as well)

### **Cold Weather operation**

When a unit is operated at low ambient temperatures, the density of the air will increase. The absorbed power of a fan is proportional to the air density hence the absorbed power of the fan motor will increase at low ambient temperatures. Induced draft towers are typically designed to operate with heated air by the cooling load. If the unit is operated without or with reduced heat load at cold ambient temperatures, increased amperage might be noticed.

### **Incorrect wiring:**

Motors should be wired according to the correct wiring diagram. Check the motor name plate for allowable voltages and corresponding nominal currents. The correct voltage must be applied to all phases. Make sure all cables are well fixed in the terminal boxes.

### **Defective fan motor.**

- Bearing problems might increase the absorbed power of the motor. (Bearing problems can normally be heard or felt when rotating the motor by hand).
- Electrical problems in the motor (false winding, rotor problems..). Check following things.
  - 1) Measure the current on all three phases. .The ratio between the highest measured current and the average current should not be higher as 1.1 (110%). Deviations could be created by voltage unbalance, wrong windings.
  - 2) Measure the voltage over all 3 phases. The voltages should be the same on all phases. Small differences of a few Volt are acceptable.
  - 3) Measure the winding resistance of each winding with a mili-Ohm meter. The ratio of the highest resistance over the lowest resistance should not be higher as 1.05 (105%)
  - 4) Check the windings for insulation fault using a megger with at least 500VDC. The resistance between each winding and earth should be at least 100MOhm. (Winding insulation faults result in short circuiting and high peak currents which should shut down the motor (fuses).

Note: if space heaters are provided these must be activated when the motor is idle to prevent moisture or condensation entering the motor. Motors that have been stored outside in humid conditions without space heaters might have moist in the windings. Megger the windings before starting the motor in case of doubt.

**Reporting info.**

Following information is required to report motor overload to BAC.

BAC Model and serial number of the unit.

Measured current and corresponding voltages on all phases of the motor during WET operation.

Motor nameplate data (type, serial number, power kW, Amperage A, frequency Hz, protection IP, voltage V, rpm)

Fan sheave diameter and motor sheave diameter.

Starting connection by Star-Delta, Soft start or VFD?