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SMART
STOP

EVAPTECH, INC. WHITE PAPER

Improving personnel safety, storm resilience, and drivetrain protection in industrial cooling tower applications.

COOLING TOWER FAN BRAKE SYSTEM

EXECUTIVE SUMMARY

Cooling tower fan brake systems control hazardous fan rotation after electrical isolation and during high-wind events. The Smart Stop fan brake addresses this problem by slowing, stopping, and positively securing fan rotation. This automated braking solution adds remote operation, intelligent brake control, startup interlocks, and fault monitoring to improve personnel safety, protect drivetrain equipment, and support broader lockout/tagout objectives consistent with OSHA hazardous energy control principles.

BACKGROUND & PROBLEM STATEMENT

Cooling tower fans store significant potential energy because of their large diameter, blade mass, and rotational inertia. De-energizing the fan motor does not always eliminate the hazard. During high-wind events, freewheeling fans may also reach unsafe speeds that threaten the blades, gearbox, drive shaft, and fan shroud.

The image to the right shows damage related to a freewheeling fan contacting the fan shroud during a high-wind event. In this case, a Category 1 hurricane.

Fig 1. Damage from freewheeling fan

Traditional field methods for restraining fan movement, such as wedging improvised materials against a driveshaft, or tying a blade to the structure, introduce safety risk and can damage the rotating equipment.

Fig 2. Example using a board to arrest rotation

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These risks are amplified when operators must rely upon manual or improvised restraint methods on fans that can reach up to 40' in diameter. An automated brake system provides controlled braking, positive isolation, and repeatable operation that can be actuated either locally or in a safe and remote environment.

Fig 3. Size reference for a 24' diameter fan

SAFETY & COMPLIANCE

OSHA Lockout/Tagout control standard 29 CFR 1910.147 reinforces the importance of addressing more than electrical isolation alone when personnel may be exposed during servicing or maintenance. In cooling tower applications, fan assemblies can retain or develop hazardous motion from stored inertia or wind-driven rotation.

- **29 CFR 1910.147(a)(1)(i):** OSHA states that the lockout/tagout standard applies where the unexpected energization, startup, or release of stored energy could injure employees.

- **29 CFR 1910.147(d)(5)(i):** OSHA also requires that potentially hazardous stored or residual energy be relieved, disconnected, restrained, and otherwise rendered safe after lockout or tagout devices are applied.

TYPICAL SYSTEM ARCHITECTURE & SELECTED MATERIALS

A typical configuration includes the following:

- **Brake assembly:** Mounted to the unitized steel support or "torque tube," brake pads on a caliper are applied to the brake disc by the Electric Actuator to induce braking
- **Brake status feedback:** Sensors to confirm open/closed or locked/unlocked position.
- **Motor interlock logic:** Controls that prevent brake application during motor operation and ensure brake release before startup.
- **Remote operation interface:** DCS/PLC, or network connection for command and monitoring.

Smart Stop has been designed and tested for use in harsh cooling tower environments. Facilities can mount the Electric Actuator inside or outside of the fan shroud.

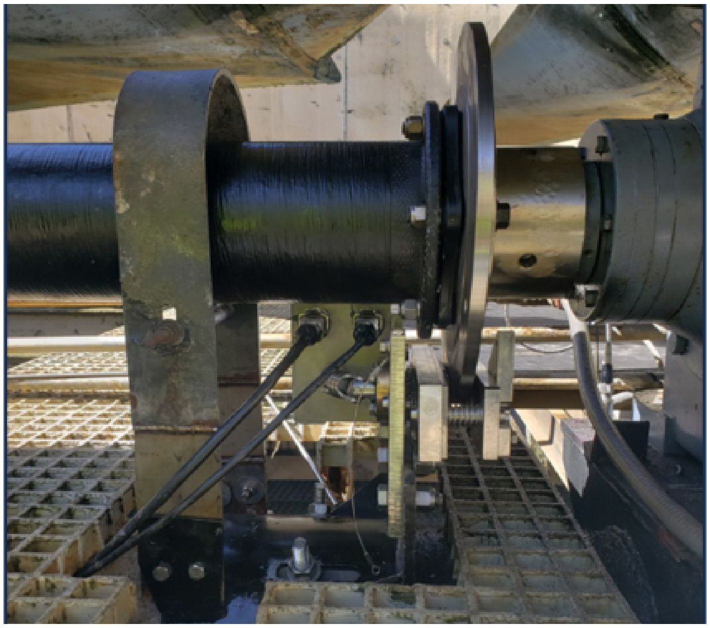

Fig 4. Inside Shroud

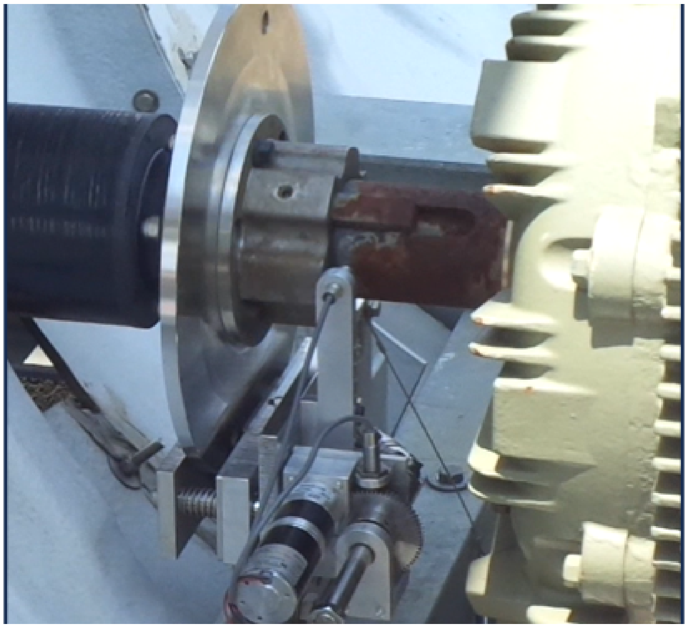

Fig 5. Outside Shroud, actuator shown without cover

The electric actuator has a powder-coated slipcover with a stainless-steel base plate and stainless-steel external hardware, and is designed for operation from 10°F to 150°F. The control panel is a fiberglass enclosure rated NEMA 4X and IP66 with stainless steel external hardware, UL508A certification, and an operating range of 0°F to 105°F.

IP67 connectors, a stainless-steel electric-actuator connector, a powder-coated zinc control-panel connector, and a UV-resistant PVC outer cable jacket make up the power and signal cabling.

KEY BENEFITS

1. Personnel safety: The primary value of a fan brake system is controlling hazardous stored energy so maintenance personnel can work in the fan stack or mechanical area more safely.

2. Storm hardening and equipment protection: During high-wind events, a brake system can quickly secure the fan and reduce the probability of damage. Remote actuation also shortens storm preparation time and reduces or eliminates need for maintenance staff to be on the cooling tower during a wind event.

3. Startup protection: Automated systems synchronize brake release with the motor start sequence, helping prevent reverse-rotation shock loading that can damage the driveshaft or gear unit and therefore extend the gear drive's useful life. This is especially valuable in locations exposed to variable winds where reverse fan movement is common during outages or idle periods.

4. Reduced Downtime: Plants that can isolate fans remotely may be able to extend operation closer to severe weather events or avoid shutting down altogether if the storm shifts paths, and resume service more quickly afterward. As well as saving time manually slowing and tying down blades during periodic maintenance efforts.

5. Retrofit & Reuse: Smart Stop can be retrofit onto the most common type of existing manual brake.

CONCLUSIONS

Smart Stop addresses a real and often underestimated risk in industrial cooling tower operations: uncontrolled fan rotation after electrical isolation or during severe weather. These systems can significantly improve maintenance safety and protect critical drivetrain components. For owners seeking to improve tower resilience and reduce hazardous energy exposure, consistent with OSHA standards, a properly specified brake system represents a practical, high-value upgrade.

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