Sensor solutions for industrial cooling tower and process cooler fans

Cooling towers are a critical component in many power generation and chemical plants, and other process facilities. Catastrophic equipment failure can result in safety hazards, lowered production, and expensive repairs. Vibration monitoring of cooling tower fans, gear boxes, shafts, and motors provides early warning of machine degradation and impending disaster.

Changes in cooling tower monitoring

In the past, vibration monitoring was a technical challenge due to slow rotational speeds, a variety of support structures, and wet corrosive environments. Mechanical ball/spring vibration cutoff switches were traditionally used to shut down machinery when vibration levels became excessive. These switches have proven to be unreliable and in many instances allowed extensive machinery damage before motors were disabled. Furthermore, switches did not allow for advance warning of problems. Walkaround data collection systems have also been found ineffective for measuring fan and gearbox degradation. Today, cooling towers use permanently installed sensors to effectively prevent catastrophic cooling tower failure without unscheduled downtime.

Advanced sensor solutions for early warning monitoring

By measuring vibration on a regular schedule, problems can be located and repaired before failure occurs. The most common mechanical problems are:

- >> Bearing failure
- >> Motor soft foot
- >> Shaft imbalance from thermal bow
- >> Shaft imbalance from corrosion build up
- >> Gear lock up from misalignment
- >> Blade breakage due to stress corrosion
- >> Chlorine corrosion of support structures

Wilcoxon provides total sensing solutions, from sensors and installation hardware to cabling and junction boxes. Permanently installed, industrially rugged accelerometers are field proven and mate directly with data collectors and monitoring systems.

Wilcoxon's piezoceramic sensors provide the high sensitivity and low noise electronics required for measuring slow speed machinery. Our sensors are hermetically sealed and housed in chlorine resistant 316L stainless steel. The Wilcoxon splash-proof connector ensures total sealing in all environmental conditions.

Two types of sensors are recommended for monitoring cooling towers. General purpose accelerometers, such as models 793 and 797, monitor the motor end. Low-frequency accelerometer such as the 793L and 797L are ideal for monitoring the gearbox and fan.

General purpose accelerometers exhibit the broad frequency range required to simultaneously measure drive speed, bearing harmonics, and high frequency detection (HFD). Low-frequency accelerometers provide a strong 500mV/g output to overcome data collector noise at the low frequency fan speeds.

See the following page for more information on sensor selection, mounting locations and how to interpret trends in vibration data.

8435 Progress Drive
Frederick, MD 21701, USA

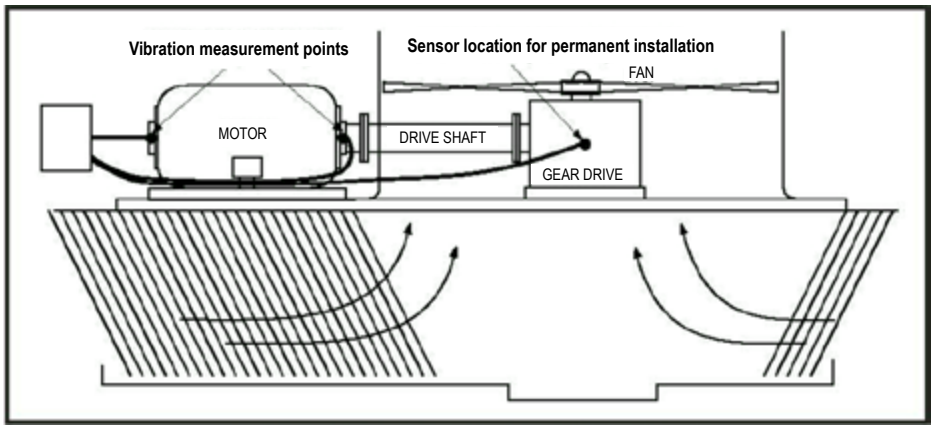
Tel: +1 301 330 8811
Email: info@wilcoxon.com

www.wilcoxon.com
buy.wilcoxon.com

Wilcoxon Sensing Technologies
An Amphenol Company

Sensor specifications	793 / 797	793L / 797L
Sensitivity (mV/g)	100	500
Frequency response, ±3 dB CPM Hz	 30 to 900,000 0.5 to 15,000	 12 to 138,000 0.2 to 2,300
Spectral noise at 1 Hz (60 CPM) g/√Hz ips/√Hz mils/√Hz	 0.000056 0.0034 0.55	 0.000004 0.00025 0.039
Voltage output for .03 ips vibration at 60 CPM (µV)	49	244

Sensor		Mounting location	Frequency/Order	Trend Indication
General purpose	793 or 797	horizontal on motor outboard and inboard bearings	1 x motor	shaft imbalance
			1, 2, 3 x motor	parallel misalignment, looseness
			2 x line	stator problems, soft foot
			hf harmonics	bearing wear, looseness
			HFD noise	bearing fault progression
	793 or 797	axial on motor outboard bearing	1, 2 x motor	bent shaft
			1, 2, 3 x motor	angular misalignment
			hf harmonics	bearing wear, looseness
Low-frequency	793L or 797L	horizontal on gearbox at mesh	1 x fan	imbalance
			2, 3 x fan	looseness
			blade pass	blade failure
			2 x mesh	gear misalignment
			3 x mesh	gear wear
			mesh harmonics	gear fault progression



Typical sensor mounting locations for a cooling tower fan

The payoff of vibration monitoring

Today's predictive maintenance programs have proven to be both cost-effective and reliable. Users of vibration monitoring programs confirm that early detection, accurate problem identification and scheduling downtimes leads to significantly lower repair bills, increases the return on investment and improves operational efficiency.

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