

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 at measuring fan and gearbox degradation. Today, cooling towers use permanently installed sensors to effectively and safely 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

The Wilcoxon VibraLINK® system provides the total sensing solution from installation hardware to cabling and junction boxes. Permanently installed, industrially rugged VibraLINK® accelerometers are field proven and mate directly with major data collectors and monitoring systems.

Wilcoxon's piezoceramic sensors provide the high sensitivity and low noise electronics required for measuring slow speed machinery. All VibraLINK® 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 VibraLINK® sensors are recommended for monitoring cooling towers. General purpose accelerometers, such as models 793 and 797, monitor the motor end. Low frequency accelerometer models 793L and 797L are ideal for monitoring the gearbox and fan.

The 793 and 797 IsoRing® sensors exhibit the broad frequency range required to simultaneously measure drive speed, bearing harmonics, and high frequency detection (HFD).

The "L" Series provides a strong 500mV/g output to overcome data collector noise at the low frequency fan speeds.

Table 1 gives mounting locations and trend indication. Table 2 gives sensor specifications. Figure 1 shows a typical arrangement for vibration monitoring of a cooling tower fan.

Table 1: Sensor mounting locations and trend indications

Sensor	Location	Frequency/Order	Trend Indication
793 or 797 100 mV/g industrial accelerometer	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 797 100 mV/g industrial accelerometer	axial on motor out- board bearing	1, 2 x motor	bent shaft
		1, 2, 3 x motor	angular misalignment
		hf harmonics	bearing wear, looseness
793L or 797L 500 mV/g low frequency accel- erometer	horizontal on gear- box 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

Table 2: Sensor specifications for 793, 797, 793L and 797L

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

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 and increases the return on investment.

Modern machinery health monitoring gives the reliable information needed to confidently plan inspections and equipment maintenance without unexpected failures or wasted time.

Figure 1: Sensor mounting locations

