WILCOXON RESEARCH

Product Technology Note 104—PT104

Sensor Solutions for Industrial Cooling Tower and Process Cooler Fans

Vibration monitoring of cooling tower fans, gear boxes, shafts, and motors provides early warning of machine degradation and impending disaster.

By measuring vibration on a regular schedule, problems can be located and repaired before failure occurs.

Permanently installed, industrially rugged VibraLINK accelerometers are field proven and mate directly with major data collectors and monitoring systems.

Cooling towers are a critical component in many power generation, chemical, 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 the slow rotational speeds, 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 unreliable and in many instances allowed extensive machinery damage before motor power was 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 Research 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. Multipurpose Models 793 and 797 Accelerometers for the motor end, and Model 793L and 797L Low Frequency Accelerometers 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 500 mV/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.

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Table 1. Mounting Locations

Sensor	Location	Frequency/Order	Trend Indication
793 or 797 100 mV/g industrial accelerometer	horizontal on motor outboard and inboard bearings	1x motor	shaft imbalance
		1,2, 3 x motor	parallel misallignment, 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 outboard bearing	1, 2 x motor	bent shaft
		1, 2, 3 x motor	angular misallignment
		hf harmonics	bearing wear, looseness
793L or 797L 500 mV/g low frequency accelerometer accelerometer	horizontal on gear box at mesh	1x fan	imbalance
		2, 3 x fan	looseness
		blade pass	blade failure
		2 x mesh	gear misalligment
		3 x mesh	gear wear
		mesh harmonics	gear fault progression

Table 2. Sensor Specifications

Sensor Specifications	793/797	793L/797L
Sensitivity (mV/g)	100	500
Frequency Response (±3dB)		
CPM	30 to 900,000	12 to 138,000
Hz	0.5 to 15,000	0.2 to 2300
Spectral Noise at 1 Hz (60 cpm)		
g/√Hz	.000056	.000004
ips/√Hz	.0034	.00025
mils/√Hz	0.55	.039
Voltage output for .03 ips vibration at 60 cpm (µV)	49	244

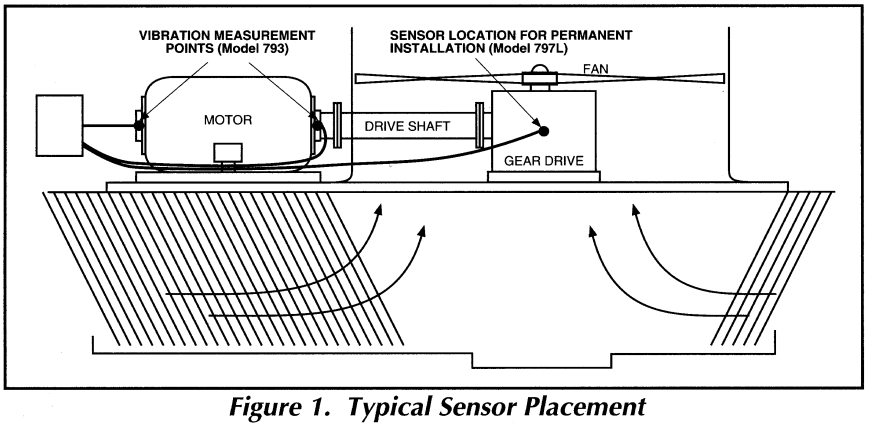

Figure 1. Typical Sensor Placement

Users of vibration monitoring programs confirm that early detection, accurate problem pinpointing, and scheduled downtimes significantly drops repair bills and increases the return on investment

The "Payoff" of Vibration Monitoring

Todays predictive maintenance vibration monitoring programs have proven to be both cost effective and reliable. Users of vibration monitoring programs confirm that early detection, accurate problem pinpointing, and scheduled downtimes significantly drops 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. ■

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