Save Some Green: Green Up Your Machines

Investing in more efficient process machinery makes good business sense and will help to ensure reduced costs plus a greener plant. However, not all plants can afford to replace their present equipment with newer, more efficient machines. What steps can these plants take to “green up” their business and operate more efficiently? Most plants can vastly improve machine reliability, efficiency, and reduce raw materials conversion costs by simply making improvements in their present machinery. This can be done through precision maintenance practices and defect elimination. A good PdM (predictive maintenance) process will help to achieve these goals.

Quiet, smooth-running machines are more efficient, more reliable and produce higher quality finished products. Let’s explore some PdM tools that will provide the quickest ROI (returns on investment) by helping to detect, analyze, and correct defects. Defect-free machines are green machines because they are more reliable, more efficient, and smoother running.

Infrared cameras provide quick ROI because all one has to do is point and look for temperature differences in electrical and mechanical equipment. Looking at manufactured products as they flow through the process will also help spot faults in/with both machinery and the manufacturing process. Finding heat where it shouldn’t be is usually an indication of waste and poor efficiency. We want the electricity we purchase to do work and not generate unwanted heat that subjects machinery to additional stresses. Every degree of unwanted heat is a decrease in plant efficiency.

Vibration tools provide a fast ROI simply because they are such powerful tools for detecting, analyzing, and solving problems in machinery. The chart below shows some of the faults that can be addressed with the information provided by vibration analysis tools. Unwanted vibration results in rough running and noisy machines that are also unreliable. Precise, quality products cannot be manufactured with such machines. Much energy is required to make machines vibrate. Just as with heat, unwanted vibration is a waste. With vibration, the electrical energy is converted into both mechanical energy and heat energy. If left unchecked, this conversion destroys machinery. A good vibration process is a must in achieving smooth running green machinery.

Chart A: Faults addressed by vibration analysis tools	
Unbalance	Looseness
Misalignment	Bent shafts
Anti-friction bearing faults	Aerodynamic problems
Plane bearing faults	Cavitation
Belt problems	Beats
Gear faults	Rotor rubs
Resonance problems	Inadequate lubrication
Electrical problems in motors	Cracked shafts

Oil whip	Improperly installed bearings	

Precision shaft alignment tools also offer a quick ROI because precision alignment greatly reduces unwanted stresses on rotors and bearings. Many times a misaligned machine will generate both high vibration and heat. Such machines will not be green until they are properly aligned. Most shaft seal failures are caused by misalignment. Failed seals often leak fluids or solids that are not conducive to a green environment. Good shaft alignment makes for a green plant by helping reduce environmental pollution. Precision practices are required in order to achieve the close tolerances needed for shaft alignment. Chart B shows the typical dimensions required. Note that most of the dimensions shown are much smaller than the diameter of a human hair.

TOLERANCES FOR SHAFT ALIGNMENT

RPM	OFFSET (mils)		GAP (mils/10")		SPACER SHAFT (mils/in.)	
	Excellent	Fair	Excellent	Fair	Excellent	Fair
600	5.0	9.0	10.0	15.0	1.8	3.0
900	3.0	6.0	7.0	10.0	1.2	2.0
1200	2.5	4.0	5.0	8.0	0.9	1.5
1800	2.0	3.0	3.0	5.0	0.6	1.0
3600	1.0	1.5	2.0	3.0	0.3	0.5
7200	0.5	1.0	1.0	2.0	0.15	0.25
All Speeds: Maximum Soft Foot Reading 2.0 Use OEM or in-house tolerances if available.						

Historically and even today belt drives were and are not typically maintained to a state required by a green plant. Belt drives lose efficiency because all V-belts, even new ones, slip and creep. Such action generates heat in the drive. What is the source of the energy that generates the heat? You guessed it, electricity! The unwanted heat not only does no useful work, it also damages the drive. Belt life is cut in half by every 35°F degree temperature rise above 85°F. Precision belt alignment tools along with proper belt tensioning are required to get maximum efficiency and life from belt drives. The next time you hear belts squeal on start-up, remember that drive is either improperly designed or poorly maintained. Such drives are not green because they waste both components and energy.

Tools that help to control contamination also provide quick ROIs when striving to make a plant operate greener. Contamination in lubricants and fluids not only increases machinery efficiency losses, but also adds greatly to equipment wear. Any investment in contamination control will show a ROI, but a quality contamination control process will result in a huge ROI. Investments made in oil sampling and analysis tools will help plants to attain a clean and green status. Clean is green.

The aforementioned tools, as discussed above, will all show rapid ROIs if used in a logical, well defined, and standardized process. One is reminded of a famous quote

by Virgil, *"Your descendants shall gather your fruits."* With this thought in mind, it is essential that we engage in green practices today to ensure the well being of future generations.

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