Machine Condition Monitoring

Machine Condition Monitoring or **Total Preventive Maintenance** is done with the use of **Predictive Maintenance**, which is not only determining present systems, but it is a technology for monitoring continuous change, and **Preventive Maintenance,** which is the rapid detection of equipment abnormalities forming a baseline or footprint of the machine. By having a Preventive Maintenance program in place, studies have shown large savings in maintenance costs and increased productivity due to less down time.

CNC Solutions, LLC accomplishes the above by doing several in depth checks on the CNC machine tool, including **Ballscrew Inspection**. Ballscrews are an important part of the machine. The ballscrews in the machine drive each axis. While inspecting the ballscrews our MCM engineers will look at the machine **Backlash.** Backlash is lost motion in a ballscrew. Having backlash will affect machine accuracy and repeatability; this can be corrected by changing machine parameters. By monitoring and recording backlash we can predetermine bearing and ballscrew failures.

Another key element in predicting ballscrew and spindle bearing failure is **Vibration Analysis**. Based on monitoring the machine footprint and industry standards, premature bearing failure is predictable, and can be corrected at a scheduled time as opposed to waiting for failure.

Temperature Monitoring is very important in **M**achine **C**ondition **M**onitoring. While inspecting the CNC machine tool, we check temperatures in several different places starting with the ballscrew and spindle bearings. By tracking temperature,

CNC Solutions, LLC can determine premature failures and lubrication problems. High temperatures in the **Hydraulic System** will show signs of faulty valves or other hydraulic components. If the temperature in the hydraulic system rises due to a faulty valve or component the extreme temperature will cause damage to other components in the system resulting in down time and high repair bills. High temperature in the electrical cabinet will result in premature failure of the electronic equipment.

It is crucial to the machines longevity that proper temperatures are maintained through out the machine. The **Oil Cooler** is the unit, which helps maintain constant spindle temperature.

Without this unit functioning properly there will be thermal growth in the spindle causing accuracy problems or premature spindle failure. During **CNC Solutions, LLC** inspections we will clean the condenser fins, and the filter so proper airflow will be maintained.

The **Lubrication System** is one of the most important parts of the machine. A faulty lubrication system will be devastating to your machine tool. In our **MCM** program we change and inspect the oils in your machine as well as clean or change your in-line filters. Contamination in your lubrication system can cause premature failure in many components of the machine, causing large amounts of downtime. We will also monitor the amount of oil being added to the machine throughout the year, if we see an unusual amount being added we will have to inspect the system for leaks or any other unusual condition. If we see that there is no oil or a small amount being added then we will determine if there is a blockage or another cause for this occurrence. Most of the oil distributors will offer oil analysis for no charge or a minimal fee to inspect the oil for contaminants; this will tell you if the oil needs to be changed more or less frequently, possibly saving your company money. A very important thing to remember when it comes to your equipment "Oil is Cheaper than Metal".

Correct **Machine Geometry** is critical to maintaining accuracy in the machine tool. If any of the machine tool geometry's are off, there can be problems holding the correct tolerance on the parts you are machining. While inspecting the machine, we will check the machine level, twist, square, tram, spindle run out and we will run the **Ballbar.** The ballbar test determines squareness, servo accuracy, and backlash. The ballbar test creates a footprint of the machine and is highly valuable in the event of a machine crash to determine what damage actually occurred. On a CNC lathe, we will do a complete alignment check including headstock, tailstock, and turret.

The **Memory Backup Battery** helps maintain the machine's memory (parameters and programs) while the machine is powered down. These batteries should be changed on a yearly basis, which is typically overlooked. If the machine is powered down for an extended period of time, it is possible that when the machine is powered back up the parameters or programs will either be lost or scrambled. This will result in a large amount of time hand punching in the parameters if they are not saved to disk, not to mention the time involved in reloading programs and re-setting up the machine.

While inspecting the machine we will check the **Mechanical Alignments** including the automatic tool changer (ATC) and the automatic pallet changer (if applicable). An improperly aligned tool changer will result in the failure of the cam followers (small drive bearings) in the ATC gearbox or possibly damage the spindle. Misalignment of the APC will result in premature failure of the APC gearbox or the B-axis.

Do to the environment and surrounding conditions, we will inspect the **Electrical System** of the machine. This inspection includes checking for hard or cracked cables, damaged shielding, loose or damaged connections. Faulty cables or connections could cause intermittent alarms or damage to some of the electrical / electronic components as well as solenoid valves, and electric motors.

In order for the MCM program to work we must have commitment from the customer. Along with the inspections we will be doing, we will provide a list of **Daily Inspections** for the customer to do. Our MCM team will offer training for the customer so the operators will be able to properly do a few inspections on a daily basis.

If a MCM inspection is done too frequently, profitability goes down and costs go up unnecessarily (machines are precluded from production while production parts and operators sit idle, maintenance workers could be doing something more productive, spare parts are used up prematurely). If a MCM inspection is done too infrequently, quality and profitability go down and costs go up unnecessarily (machines run past optimal, MCM may produce marginal or scrap parts or cause emergency maintenance situations, which typically take longer to fix than planned maintenance).

CNC Solutions, LLC will develop a MCM program that is custom tailored to your machine tool needs. Our goal is to maximize the use of your assets, improve the efficiency and effectiveness of your CNC, train and improve the skills of your people, help with ISO certification, extend the longevity, and maintain the resale value of your machine. In order to make this program a success there is a small bit of information that CNC Solutions will need from you. At the back of this packet there is a machine information page if you could fill this out for each machine you would like included in this program CNC Solutions would be happy to get you set up in our database and get your MCM program set up. Also included in this information packet is a copy of the detailed report that you will receive after the preventive maintenance is complete. If you would like more information on this process, please do not hesitate to give us a call. We would be more than happy to work with you in finding your needs for better productivity and efficiency.