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Machine Diagnostics

Knowing the systems of your equipment can make diagnosing problems a lot simpler. Most equipment is broken down into several basic systems.

- Mechanical
- Electrical
- Pneumatic
- Software

Having a basic understanding of each of these systems can help isolate problems that come up unexpectedly.

Mechanical

- Tooling
- Bearings
- Hardware
- Joints
- Belts

Electrical

- Power Supplies
- Cables
- Electrical connections
- Servo Drives
- Encoders
- I/O Boards
- Switches
- Relays

Pneumatic

- Filter Regulator
- Gauges
- Hoses
- Fittings
- Air cylinders
- Valves
- Flow controls

Software

- Communication
- Diagnostics
- Computer or Controller

Breaking these down even further gives us a better understanding.

I have included some little details about each system to help in what to look for when a system fails.



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Mechanical

Tooling

Tooling is usually a high tolerance machined part. They are subject to wear and breakage. Any parts that look excessively worn or damaged should be replaced.

Bearings

Bearings are used to help things slide or rotate easier. Looseness or play can cause misalignments, vibration, and premature wear.

Hardware

Hardware holds everything together. If the hardware is worn replace it.

Joints

Clevises, pins, heim joints and other types of joints allow some flexibility in a system. Whether it's a slide connected to an air cylinder or a pin connecting a clevis to a mechanical part. Play or looseness in these parts can cause inconsistent function.

Belts

Inspect and replace belts regularly. Replace any belt that is cracked or dry.

Electrical

Power Supplies

Critical to all electrical functions. Identify and check voltages regularly. Can be intermittent. Also subject to failure if not protected from shorts in circuits it supplies.

Cables

Check for anything that is deforming the wire. Breaks in wires can be intermittent.

Electrical Connections

As with the wires. Electrical connections can become loose overtime. These can also exhibit intermittent behavior.

Servo Drives

Servo Drives control your motors direction and speed. Loss of servos can cause the drive not to move or drive erratically. Newer drives have fault codes build in.

Encoders

Encoders tell the position that the axis is at. Loss of encoder count can lead to parts not being placed properly, erratic axis location and homing problems.

I/O Boards

I/O Boards read from your switch inputs. It helps to know whether the inputs and outputs are NPN or a sinking circuit or PNP or sourcing circuit. This helps in being able to test the input by bypassing the switch and going direct to the controller.

Switches

Switches feed a signal to your PC or Controller. Learning how to bypass them helps in testing. Also testing with an Ohm meter can help.

Relays

Allows you to use a lower signal voltage to control a higher voltage. You can usually jumper the relay to bypass it for diagnostic purposes.



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Pneumatic

Filter Regulator

The Filter Regulator controls the flow of compressed air into the machine. The filter should be checked on regular basis. If a regulator is plugged, you can possibly have the proper pressure but not enough volume. Causing pneumatic failures.

Gauges

Gauges wear out over time. Regular calibration or replacement can prevent pneumatics running out of spec.

Oiler

Oilers do not usually fail but need to be checked on a regular basis.

Hoses

Check on a regular basis for dry rot and cracking. Hoses should be changed on a regular basis.

Air Cylinders

Pneumatic cylinders usually have a life cycle of around four to ten million cycles. Testing a cylinder can be easily done by simply testing for blow by in each direction.

Valves

Valves like cylinders usually have about the same life cycle. Failure of a valve can either be not firing due to a failed solenoid or sticking due to a bad spool valve.

Flow Controls

Although flow controls are relatively simple but still can be prone to failure. Seals inside

can deteriorate over time causing blow by therefore losing their efficiency.

Software

Communication

Interfacing with your equipment usually requires some form of GUI or other interface. Something as simple as a failed cable or connection can cause lack of communication. Port failures can also cause communication issues. Whether connecting through USB, RS232 or Ethernet check the port for proper operation.

Diagnostics

Most software has some form of diagnostics incorporated. From simple tests of Inputs and Outputs to actual driving individual axis these can be really handy in diagnosing simple problems.

Computer, Controller or PLC

The brains of a machine. Controls the sequence of events. In diagnosing problems, you need to know the sequence in which the machine operates.