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Maintenance on computer-assisted machinery

Scope

Review the function of electrical and/or electronic maintenance requirements in a corrugated box plant with computer-assisted machinery.

Safety precautions

Working with electricity has the potential for causing serious personal injury or death. Warning! Prior to performing any maintenance on equipment, ensure that all lockout; tag-out; and test procedures have been completed. Follow all state and federal safety measures regarding PPE (Personal Protective Equipment) when appropriate. Use appropriate PPE for trouble shooting as per your corporate and local guidelines. If you are not sure of the voltages, use PPE until you guarantee that the controls are safe. Observe all manufacturers' instructions and precautionary statements.

Introduction

Computer-assisted machinery is in common use in box plants today. In order for the box manufacturer to get the full benefits of this equipment, it must be kept up and running. With a large amount of computer-assisted machinery in a box plant today, the box plant personnel need to be current on computer technology and its methods of troubleshooting.

The box plant maintenance personnel must be able to understand the concept behind how the control adapts to the machinery and be able to talk with the appropriate machine operators to gather details of the malfunction, perform basic test functions in cooperation with technicians from the control supplier, and keep good records of the work performed.

Access to the Internet can provide an important tool in troubleshooting. Many suppliers can link directly to the machine controls to assist in diagnostic tests and software updates. The proper use of virtual private network techniques with continually changing access passwords will ensure that this work can be done without risking the entry of a virus into the system.

Boxplant electronic maintenance requirement

Both electrical and electronic maintenance capability are required in the boxplant. We define the electrical maintenance capability to include a complete understanding of local electrical wiring codes, safety procedures AC/DC motors/generators/tachometers, and associated motor starters, control relays and timers, and circuit protection including circuit breakers, fuses, and thermomechanical devices.

The need for electronics maintenance at the machine level exists because of the many electronics used in current design motor drives and machine control. Machine control includes everything from PLC's, dedicated hardwired electronic controls to programmable controllers (PC) and custom-designed microcomputer-based controllers.

Electronic maintenance function

It is expected that the electronic maintenance function is to:

1. Determine if an electronics equipment failure is directly contributing to machinery being down. The level of electronic system knowledge is a basic requirement, as this knowledge needs to understand the hardware module, circuit board, or circuit function level. The technician must be able to determine, either by a meter or by the use of available system test procedures that a loss of signal is either a component failure or an open/short circuit condition. Electronic signals for measurement are basically two types: analog and logic signals. Analog signals are voltages measuring position feedback or circuit signal gains in voltage and current with a level proportional to the measured function. Logic signals operate at two distinct levels equivalent to switches being turned on and off. Logic signals in industrial computer control applications can switch at very high frequencies. It is often difficult to isolate electronic control system failures from mechanical problems. An example is a binding mechanical system that could appear as a fault in the electrical/electronic drive control. There is a close relationship between understanding of the electronic hardware and the machine control that is required.
2. Determine what can be done short term to eliminate the effects of the problem to allow limited machine productivity. Often the technician can swap a circuit board/module and/or bypass a circuit to keep the machine running. That is to say, a problem can be temporarily removed at the sacrifice of a lesser function to keep the equipment running. A specific knowledge of the electronics hardware obtained either by self-training using vendor support documentation or by attending vendor training schools is a requirement. It is important that careful analysis is used to avoid any safety problems.

Electronic maintenance technician qualifications

The electronics knowledge and the test and repair capability required by boxplant maintenance personnel should include at least the following:

1. An ability to read electronic wiring diagrams and schematics. In many cases, considerable troubleshooting/testing can be accomplished at electronic module test points, or even using available system indicator lights as an aid.
2. The ability to meter test points at the module or subassembly level without mixing incompatible signals/voltages and adding to the existing equipment failure. This requires an understanding of the difference between AC and DC control circuits, analog and logic voltage levels and switching rates, and circuit metering sensitivity levels, as well as the effects of isolated grounds in circuitry.
3. The ability to communicate results from metering and/or diagnostic tests over the phone to supplier service personnel.
4. The ability to accurately follow the instructions of the supplier service personnel and report results.
5. The ability to safely remove and install soldered components in electronic modules, subassemblies, and change/remove/add wires on terminals and connectors.
6. The ability to use in-house test equipment which includes: a digital multifunction meter (DMM) to measure volts/ohms/amps, a hand tachometer (analog readout or electronic digital—either is acceptable in most cases), and a clamp-on type AC/DC ammeter, 0-300 amps. An electronic maintenance technician should also be capable of using an oscilloscope for monitoring signal waveforms and frequencies when required.

Electronic maintenance personnel training

Level of training can range from high school level to a two-year associate degree in electronic technology. Some of the best technicians are high school graduates who have received some form of electronic training in