Peco Mfg. Takes Out Elbow Grease

Peco Manufacturing is a world class custom manufacturer dedicated to making thermostat controls for residential, restaurant and industrial applications and has been in business since 1938, in Portland, Oregon. As a leader in the design and manufacture of electronic circuit boards, and actuators they are able to provide the highest quality at the lowest cost.

The employees at Peco recently looked at what assembly operations were causing the greatest operator fatigue and discovered it was the 103 Series Thermostat calibration process. This process requires the operator to suspend (unsupported) their arm and wrist is the air; while holding their wrist in a unnatural position during the calibration routine; causing excessive stress on the operators' shoulders, elbows and wrists. The result was a semi-automated calibration system that now only requires the operator to load, unload and initiate the calibration cycle. This came as the result of a successful project partnering Peco Manufacturing, Oregon OHSA, and the Oregon Manufacturing Extension Partnership (OMEP). Funding for the project came from Oregon's Department of Consumer and Business Services, administered by Oregon OSHA, whose "Worksite Redesign" grants were intended to design and develop equipment to address ergonomic, safety or health issues.

The Model 103 Thermostat is constructed of a copper bulb/diaphragm sub-assembly; micro-switch, a stamped metal frame and a lever arm/adjusting shaft assembly. The bulb/diaphragm sub assembly is filled with a liquid and as the temperature of the liquid changes; the liquid expands or contracts causing the diaphragm to move. Through the lever assembly this movement is transferred to the micro-switch causing the electrical circuit to either open or close.

Rotating the shaft provides the pivot point for the lever through the use of a cam profiled head. As the shaft is rotated the cam profile causes the lever to change position, representing various temperatures. The temperature range and resolution is a function of the bulb/diaphragm sub-assembly's ability to expand and contract and the profile of the cam. This process is very hard on the operators' shoulders, arms and wrists, as it requires them to rotate the shaft back and forth three times to "break in the shaft assembly" and work the grease into the mating parts prior to starting the calibration routine.

The adjusting shaft is positioned at a point on the cam that is to represent the temperature of the calibration bath by rotating a lever arm pointer. A calibration screw on the micro-switch end of the lever is adjusted to break the electrical contacts of the micro-switch. This single point calibration is all that's required. Once the shaft is set the operators take a screw driver and adjust the set screw. This is accomplished by positioning your arm out away from your body horizontally and twisting the screw driver for approximately 30 seconds to feel the switch open or close (extremely hard on shoulders). Once the set point is determined the operator then rotates the pointer away from the set point and then rotates the pointer back to the set point to verify the set point is correct. This is repeated twice. If the set point does not repeat the operator must repeat the calibration process.

Before applying for the grant application, a search was conducted to ensure that a suitable calibration station did not already exist. No solutions were found that could even be modified to automatically calibrate Peco's thermostats. The grant was approved; Peco teamed with OMEP to manage the project. Engineering and Prototype Services in Portland, OR was awarded the contract to design and build a unit that met the criteria identified in the application.

The first step in completing a design began with EPS becoming familiar with how the thermostats worked. Once this was understood the design started. We went through three design reviews. After initial testing of the calibration station, it was apparent further changes were needed. The digital display programming needed improvement so operators understood what to do; and the female receptacle for the set screw adjustment shaft needed to be redesigned to eliminate the excessive friction, remove backlash, and so the operators didn't have to push so hard. The motors supplied also had difficulty is operating smoothly without chatter and had to finally be replaced. Once we got over these hurdles, the machine repeated beautifully, beyond the ability of the most experienced calibration operator.

During the second qualification test run, 400 thermostats of five different models had to run consistently without having a failure and they did. Ergonomic issues from the first test had also been addressed. After completion of the test a post ergonomic evaluation was performed per the grant's requirements. This was the real test as to whether or not any substantial improvement had been made as the original process was documented as a benchmark. The final ergonomic report indicated that awkward postures, static postures, forces and loads, repetition, pressure points and safety hazards had been eliminated or greatly reduced.

The operators never want to go back and manually calibrate again!

Information about developments and the status of this program can be obtained from Oregon OSHA (www.orosha.org).
Phone: 1-800-922-2689.
http://www.cbs.state.or.us/osha/grants/worksiteredesign.htm

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