Evaporative Cooler Circuit Stacking Mechanism

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Abstract

The purpose of this project was to move evaporator coil circuits from inside a bath to a lifting table in a more effective and timely method than the current method employed at Evapco West and to modify the existing scissor lift table and hydraulic system to be easily moved between locations in the shop. The mechanism created to move the circuits features four submerged pneumatic cylinders that raise an aluminum frame and the circuits up to an inclined angle using a set of hinges and sliders where the circuits then slide off on to a scissor lift for the next phase of production. The frame also features a slider in the front that absorbs any incidental side load to the system. The other components were made mobile by retrofitting the existing system with casters and quick disconnects.

System Requirements

Specifications

- Introduce mobility to scissor lift and associated parts
- Move circuits from water bath to scissor lift
- Perform action using machine rather than manual labor

Figure 1: Circuit rack in bath

Figure 2: Scissor lift

- Circuits range from 6' to 19' in length
- Circuits are submerged in chlorinated water for testing
- Circuits weigh anywhere from 50lbs to 200lbs
- Scissor lift is bolted to the ground
- Scissor lift utilizes hydraulic power to lift

System Design

Figure 3: Assembly, neutral position

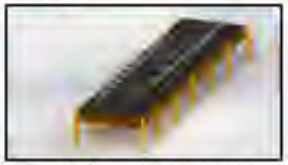

Figure 4: Assembly, raised position

- System is powered by four pneumatic cylinders
- Figures 3 and 4 show the mechanism in the neutral and raised positions
- Placement of the subassemblies are shown in Figure 3

Figure 5: Manufactured Assembly

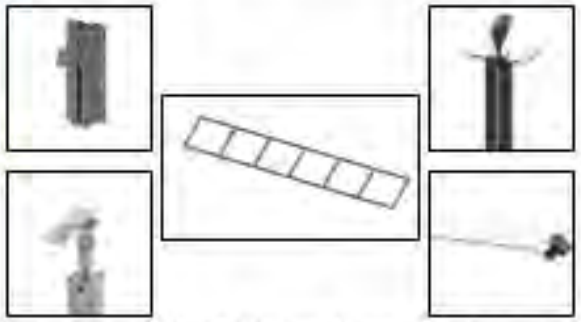

Figure 6: Subassemblies. *Top Right:* Front Rail System. *Center:* Frame. *Top Right:* Front Cylinder Assembly. *Bottom Left:* Back Cylinder Slides. *Bottom Right:* Front Drop Guards

Controls Design

Figure 7: Circuit Diagram of PLC → Solenoid Valve → Cylinders

- Programmable Logic Controller (PLC) controls solenoid valves
- Controller allows system to be raised or lowered
- Operator will use foot pedals to control system
- Mechanical splitters used to divide the air flow between the four cylinders

Conclusion

What were some important things learned?

- Simulations do not always translate well to reality
- Materials in water behave differently than expected
- Manufacturing process limitations prohibit some concepts
- The simplest solution is usually the best solution

If we did this again, what improvements would we make?

- Make all relevant parts stainless steel
- Find alternate method to connect back cylinders to frame
- Change front rail system, it is disproportionately expensive

Results and additional comments

- The final result is a simple mechanism that reduces the manual labor required for the fabrication of the circuit cooling towers
- This was an excellent learning experience for the team as it incorporated elements of machine design, manufacturing methods, material science, and mechanics of materials

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