Heat Exchanger Testing Machine

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VAREX IMAGING

Introduction:

Varex Imaging is one of the leading suppliers of X-ray tubes in the world. X-ray tubes are very inefficient and use large amounts of electricity to generate X-ray images. A majority of the electricity is wasted and converted into heat. To prevent the X-ray tube from overheating oil is passed through the X-ray tube and through a heat exchanger to remove the heat from the system. To better develop the heat exchangers used on X-ray systems Varex Imaging was in need of a new heat exchanger testing machine to simulate the conditions produced by an X-ray tube.

Problem:

The previous testing method was operator intensive and prone to error. The procedure relied heavily on the technician to manually record relevant testing data with pen and paper and adjust testing parameters manually. The process was also time consuming, requiring draining of the oil heater to test different oils.

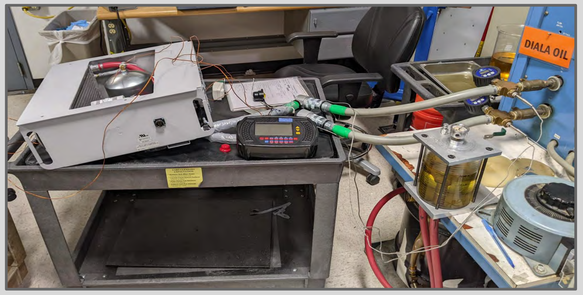

Fig.1 Current Heat Exchanger Testing Setup at Varex Imaging

Method:

We automated the heat exchanger testing process and data collection to reduce operator error and increase repeatability. Four major components were utilized to achieve the desired automated outcome. First, we used a Programmable Logic Controller (PLC) to act as the master for the automated testing, receiving sensor readings and communicating between the other electrical components. Second, we used a Human Machine Interface (HMI) to allow the user to start, monitor, and save test data. Third, we used a power controller to regulate a user defined power set point that would power the oil circulation heaters. Lastly, two oil circulation heaters were utilized to allow for testing between two oil types.

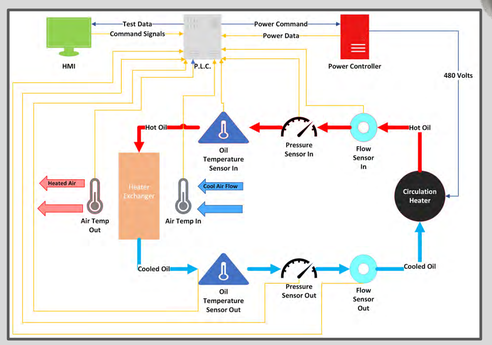

Fig.2 Power/Signal Flow Diagram

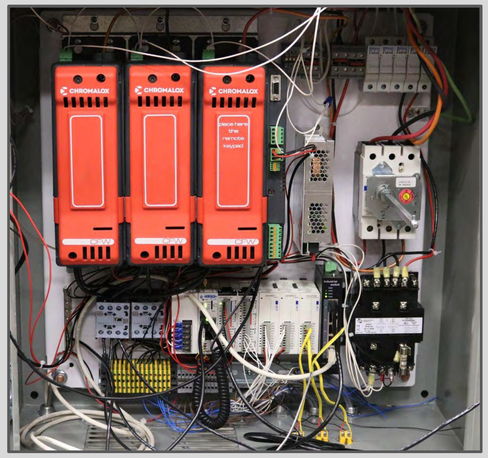

Fig.4 Electrical Cabinet

Results:

The designed system operates autonomously based on test parameters set by the operator. The test progresses through different power levels and displays current test data on the HMI. All relevant testing data is automatically saved onto a USB drive for further analysis. The Test can be performed with either oil type by a simple switch.

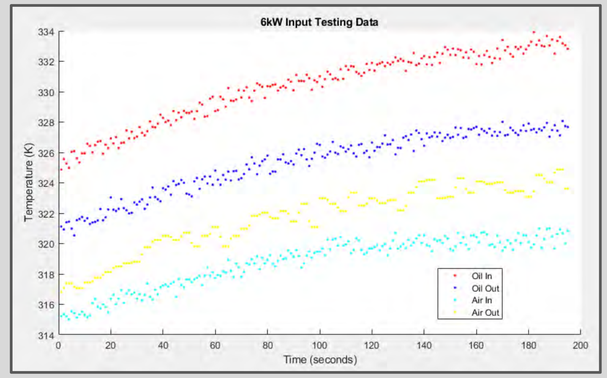

Fig.3 Example of Testing Data Saved for a 9kW Power Input

Conclusion:

The new heat exchanger tester will provide rapid testing of heat exchangers to verify proper functionality of new and existing heat exchangers. Due to the automation process implemented the test can be performed with minimal supervision and allow easy data collection for later processing.

Fig.5 New Heat Exchanger Testing Machine