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Motor Control Center Design

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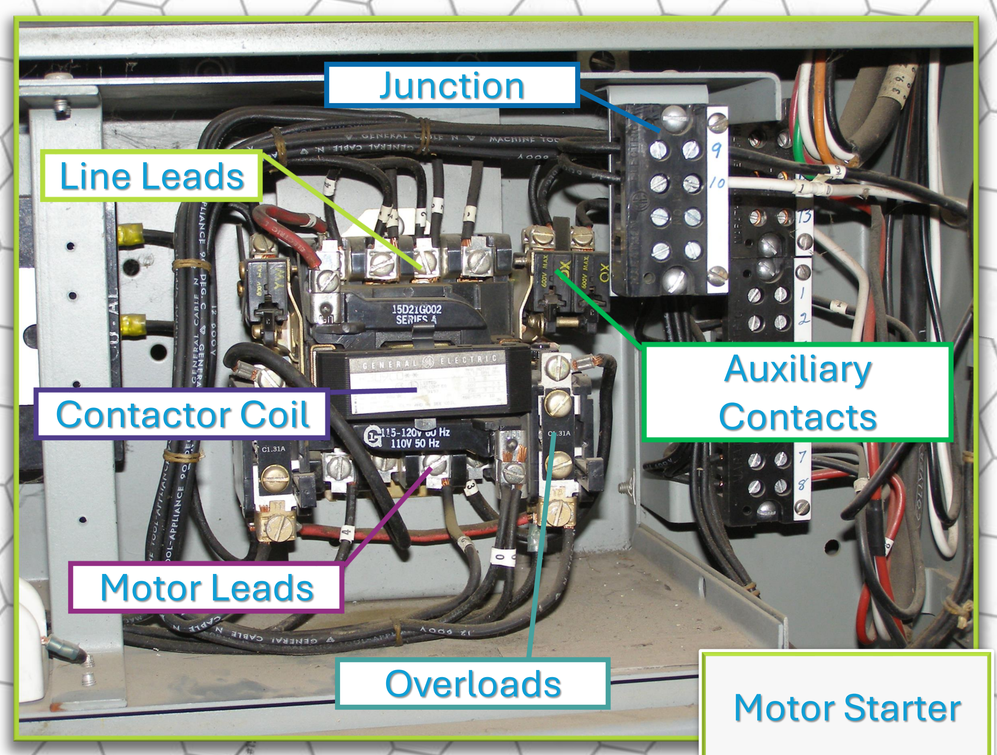
Facility Engineering Support

Introduction

The purpose of this project is to analyze, document, and redesign the replacement of a motor control center. An MCC is a housing unit for the electromechanical components, junctions, and wiring of a system. The heart of the MCC is the motor starter. The motor starter is made up of two common electrical components: the contactor and the overload unit. The magnetic contactor opens and closes the connection from power to the load. The overload unit is used to protect the motor from overcurrent. This condition happens when the motor draws an inrush of current that is higher than the circuit, ultimately damaging it. The motor starter is then equipped with auxiliary contacts to make other electrical connections that are dependent on the initial motor's engagement (heater, damper motor, etc.).

This MCC has three buckets. The first bucket contains two breakers. The second contains a singular breaker. The final bucket is the motor starter, a transformer, and a breaker.

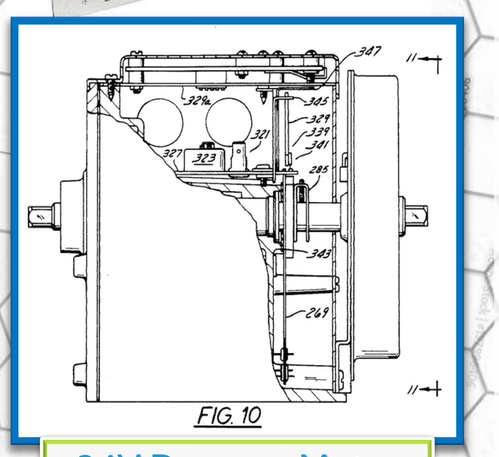


Documenting

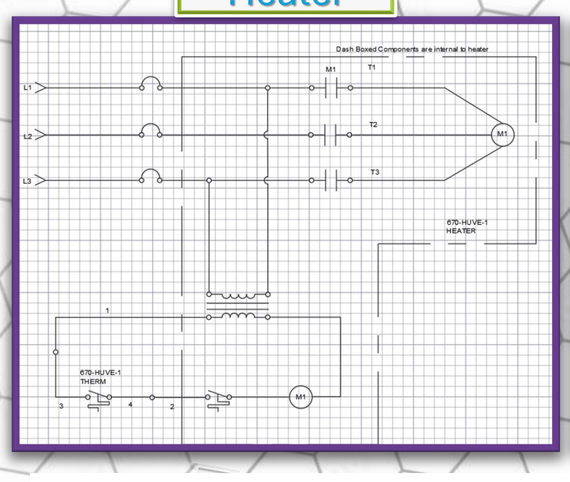
After analysis I documented the systems layout in Autodesk. The three-phase schematic and wiring diagram for this system does not exist. Therefore, I needed to create one.

I created a three-line drawing for the fan and the heater. This shows the load connections to the three-phase system. I also made the appropriate edits to the one-line drawing that displays the bus connections from the outside power source to the loads. These drawings will then assist with the instillation of the new Motor Control Center.

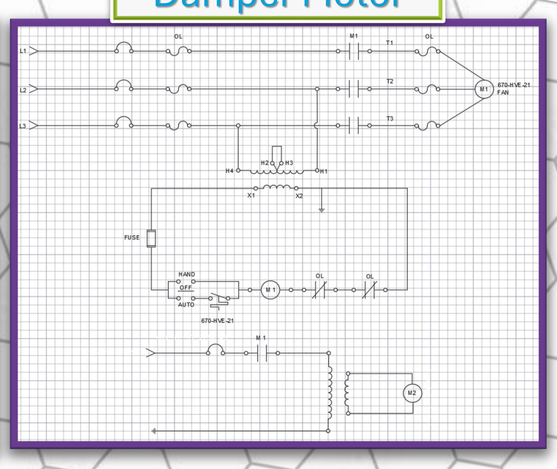
Then I needed to create a simple model to represent the new MCC.



Heater



Exhaust Fan & Damper Motor



Analysis

A ½ horsepower exhaust fan is the primary motor for the control system. The motor for the fan is controlled by the motor starter in the final bucket. The motor starter is initialized by an external thermostat that is set to a specified temperature. When the thermostat reaches the specified temperature, the circuit is complete, and the contactor coil is energized, the contactor will close. Then the exhaust fan and all auxiliary contacts, either normally open or normally closed, will be initiated.

The auxiliary contact to this contactor is the damper motor that controls louvers. This motor lives on the secondary side of a transformer that converts 240V to 24V. Although the motor circuit is completed by the contactor, it does not draw power from the 480V that powers the exhaust fan. The power for the damper motor comes from a lighting panel inside the room.

The second bucket houses the breaker for a heater that internally contains a motor starter and transformer to convert 480V to 120V. The heater is also initiated by a thermostat that is set to a predetermined temperature.
The remaining bucket houses two breakers that protect the welding plug and lighting panel.

Redesign

For the redesign, I wanted to create my own MCC using DIN rail mounting. By reviewing the specifications of the system, I could select the required components to support the system. I considered the load sizes of the contactor, transformer, heater, and motors. Then selected new components that matched the current specifications. I also wanted to add pilot lights to the replacement panel to indicate energization. Finally, I chose breakers that have enough breaking capability to interrupt current flow if there is an instance of overcurrent or short circuit.

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