Sound Test for Finish Motors
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Introduction
The objective of this project is to produce a highly accurate and reproducible method of sound testing finished motors. Currently, the process can take up to 24 hours and is done by hand in the warranty room, using an SPL meter from four sides of the motor at three feet distance, is to build a structure on the production line that provides comparable ambient sound, simultaneously measure the level of sound of the motor from four sides, while instantaneously outputting the highest measured SPL. This not only opens up the door for future depth in tests (RTA of spectrum put out by motors), but also creates a more consistent, reproducible method of testing their motors. A new method of in-line testing also saves Baldor thousands in labor.

Fundamental Requirements
Sound tests must be performed to meet NEMA standards. This means:
• Sound must be tested at 3 feet from the object
• The highest sound value must be recorded

Meeting these two requirements proved difficult, as the motor would be spinning at ideal speeds, meaning individual tests required stopping the motor to rotate or having a system with 4 separate mics. The first requires too much time, but the latter increased complexity of the system.

Enclosure Design
Following multiple design iterations, a design was laid out to put the structure together on the line. There were however several constraints that limited the options of Baldor. First was space. In order to meet the safety requirements of 36" pathways AND dual exits, an enclosure required to measure at three feet from the object simply would not fit. Second was budget. Though purchasing the materials to build the enclosure would be within the $5000 max limit, there would need to be modifications on the line, moving a tool bench, an extra line for erroneous motors, and a third line for motors to be set aside by the auditor. There would be a lot more to consider with Baldor about how this may impact other systems and standard operating procedures.

Sound Recording Design
The major requirement of this project is to be able to observe and record the sound data of each motor that requires the sound test. The basic concepts of noise measurement remained consistent throughout each design, so each enclosure had very similar testing methods. While the main requirement was to determine the lowest point of the motor, actually measuring the sound pressure level was open ended. Baldor has performed sound tests prior to this project and they concluded that the conduit box is usually the lowest part of the motor. However, there have been cases where another point was louder than the conduit box and therefore observe sound levels at multiple points around the motor, to ensure consistent measuring methods; another requirement for the hardware.

Recording Tests
Several recording tests were performed in order to provide a proof of concept for the sound measurements. The goal was to provide a basis of comparison to the current sound test procedure and SPL meter. The meter currently being used has an accuracy of ±1.4 dB rating which we wanted to match. Another goal was to check the accuracy of our measurements if the microphones were directed at the motor an angle, due to size constraints as well as allowing free travel on the conveyor belt.

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