Exercise

# Design FMEA RPN and Mitigation

Based upon your Design FMEA scoring that has already been done in earlier lessons, determine which failure modes exceed the threshold RPN value of 100 and select an appropriate mitigation strategy for those failure modes and re-score them.

It is June 30th and your Design FMEA analysis team has completed the initial analysis of failure modes. A number of ideas were suggested for mitigation. You asked the team to review the ideas and provide an estimate of the time and effort to do the action and its likely impact on the failure mode scores. The following list summarizes their input. Select the appropriate mitigation actions.

1. Require that the thermostat only be installed by a certified installer who will ensure all screws are correctly tightened and that the base housing is mounted to the wall correctly. This will not require any design changes. A group of contractors would be asked to test the device during development and with their approval, the detection score would lower significantly. This would add one week to the schedule. However, the product then could not be sold through Do-It-Yourself hardware and building supply stores, which is currently the number 1 channel to the market.
2. A wire sleeve could be included with the product that is used to capture and protect all the furnace and air conditioning unit control wires. This sleeve would ensure the wires are prepositioned for correct connection and would provide protection and electrical isolation for the wires in case the base housing slipped or was damaged. This would eliminate all damage and operability concerns for the wires, the only remaining issue being one of customer satisfaction about a crooked or cracked thermostat. It will take 5 weeks to complete the design and get it into test. Allow another 3 weeks for testing and an additional week to 10 days to release the drawings.
3. Eliminate the terminal blocks on the base housing. Directly connect all control wiring to the thermostat assembly. This is a totally new concept and reduces parts and terminal block failure modes, but introduces complexity for the installer (homeowner) and creates two additional failure modes. One new failure mode is the wrong connection of the control wires to the thermostat assembly. The second is a loose connection that creates an intermittent or inoperable situation. Neither of those can be detected by the development process, they would only be detected by the customer. This redesign will take 3-4 months followed by six weeks of testing.
4. Conduct a tolerance study of the plastic latches and determine tolerances on the base housing and the thermostat housing that will always provide positive connection without creating an interference. This should make a failure of the latching to occur impossible. This will be a minor design change that should be done in a week to 10 days. It will take about two weeks to get prototype parts, another week of testing and then a week to 10 days to release the new drawings.
5. Redesign thermostat assembly and base housing interface to create a keyed approach based upon terminal block position. When a terminal block is out of position so that the proper connections will not occur, the keyed interface will prevent the customer from attaching the thermostat assembly. (Using Poka Yoke principle of no round peg in a square hole – only the square peg fits into the square hole). The design work will take about 3 weeks. It will then take 3 weeks to get prototype parts and testing will take another 3 to 4 weeks. If the Poka Yoke concept works, detection and probability of occurrence becomes irrelevant since the design will not allow the failure.