Operational Manual

Team 6

Capacitor Assembly Automation

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ACKNOWLEDGMENTS

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1. Functional Analysis/Functional Diagram

1.1 Project Function

There are four main components to this project. The tape roller (Figure 1), the L-gauge (Figure 2), wrapping mechanism (Figure 3), and the gauge block (Figure 4). All four of these devices have been created to save time in the assembly process. The tape roller helps quickly dispense tape on all four capacitors at once, instead of having to place tape individually on each one. The L-gauge helps guide the stacking process, eliminating any error. The wrapping design quickly wraps the insulation paper around the assembled stack of capacitors and the gauge block checks all 3 dimensions at once.

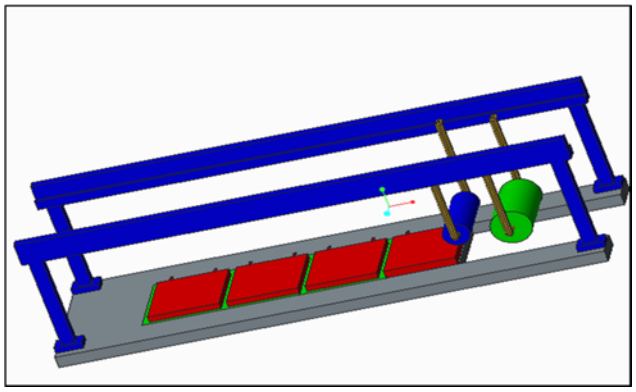

Figure 1: Tape Rolling Mechanism used to place tape on each capacitor

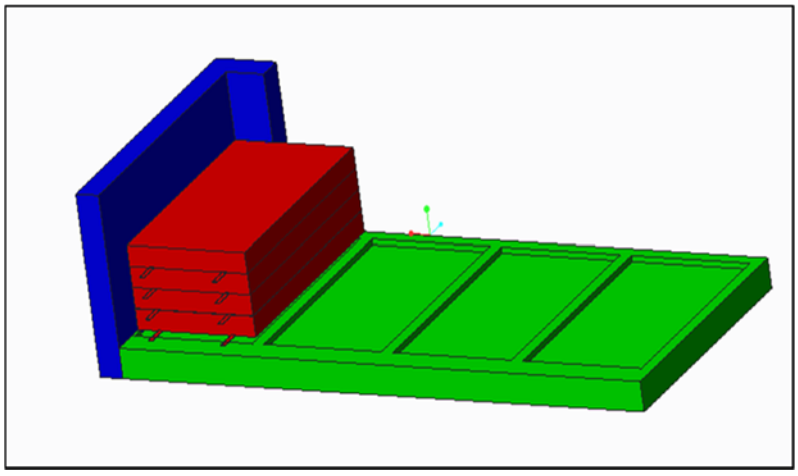

Figure 2: L-Gauge used to align capacitors in the stacking process

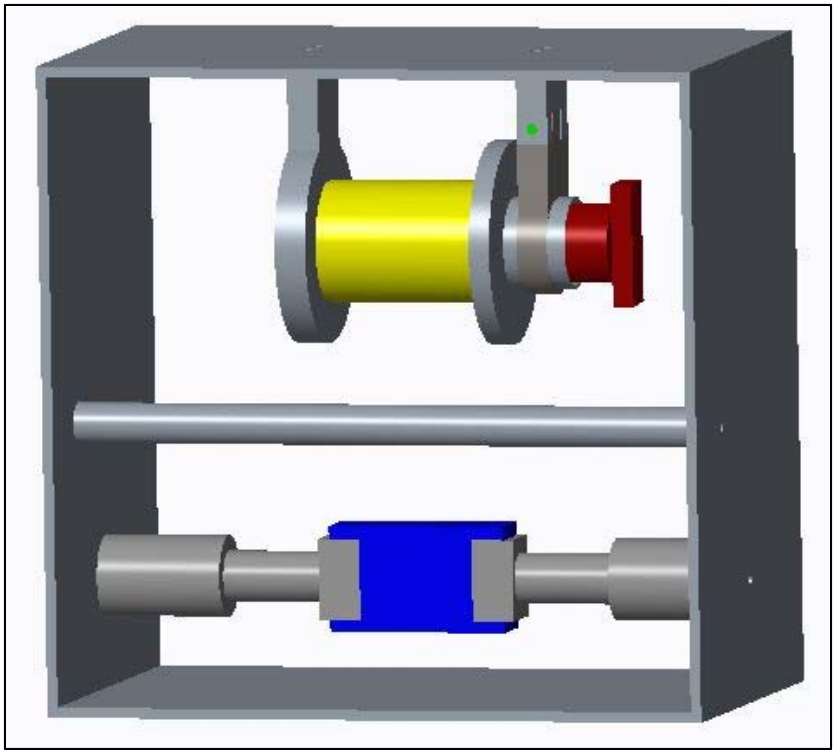

Figure 3: Wrapping Device used to wrap insulation paper around capacitor stack

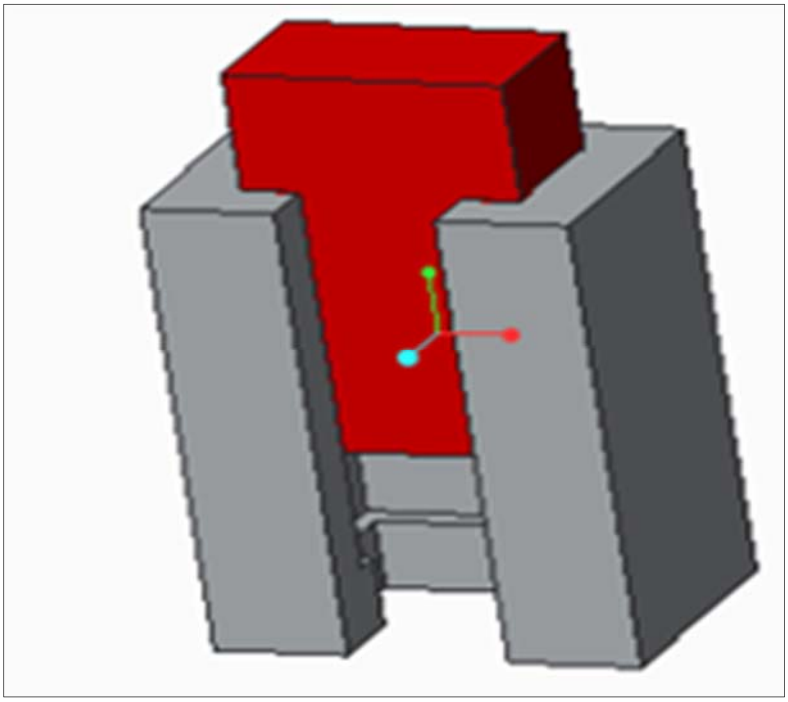

Figure 4: Gauge block used to quickly check all three dimensions

1.2 Project Analysis

Each device works separately from one another. The first process is the tape roller. This device works by placing one capacitor in each one of cut-outs on the plate. From there, the two roller arms roll down the track. The first roller has the tape on it, and as it moves down the track, tape is placed on each capacitors. The second roller arm has a weighted cylinder on it. This cylinder rolls over the tape, applying enough pressure to ensure the tape sticks onto the capacitors.

The next step in the process is stacking. The L-gauge has been created to assist in the stacking process. After the tape rolling, the plate will slide into the L-gauge. The operator will then use the L-gauge to help align the individual capacitors.

After the capacitors are stacked and attached using the double sided tape on each of the capacitors, the stack will then be ready to load into the wrapping machine. Using the piece of double sided tape that was left on the front of the capacitor from the stacking process, the operator will pull down the insulation paper from the roll on the wrapping machine and attach it to the double sided tape on the front of the stack. The operator will then load the stack into the clamps to secure the stack for wrapping. Once the stack is wrapped, the operator will cut the insulation paper and secure the insulation paper using a piece of tape and then the capacitor assembly will be ready to move on to the next step in the assembly process.

The final step is the dimensional check. The operator will use the gauge block (Figure 4) to check all three dimensions at once. The assembled capacitor has maximum dimensions of 1.38” x 2.62” x 4.25”. The cut out in the gauge block has these dimensions, meaning if the capacitor fits in the gauge block, it is within the proper dimensions.

2. Product Specification

The finished assembly must fall within the maximum dimensions of 1.38”x2.62”x4.25”. If the assembly is not within these parameters, it is a failed part and must be scrapped. Figures 5 and 6 show the stacked capacitors and the finished product after the assembly respectively.

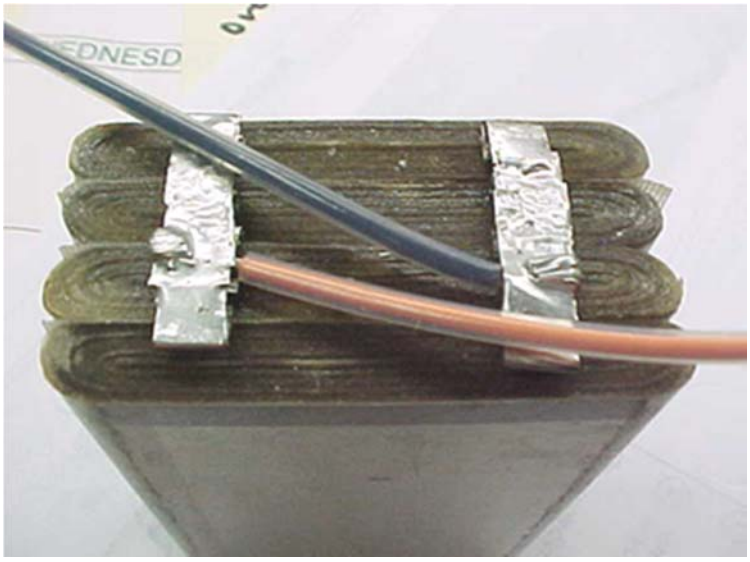

Figure 5: Assembled capacitor stack

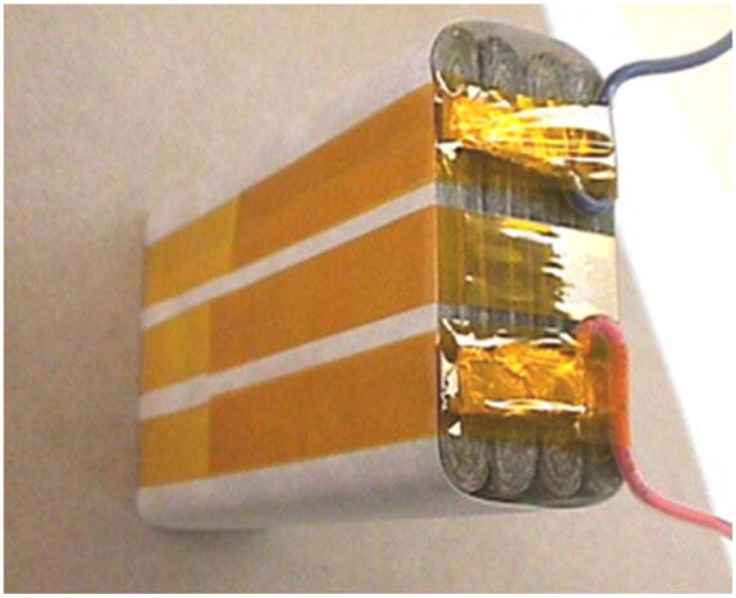

Figure 6: Finished assembled product

3. Product Assembly

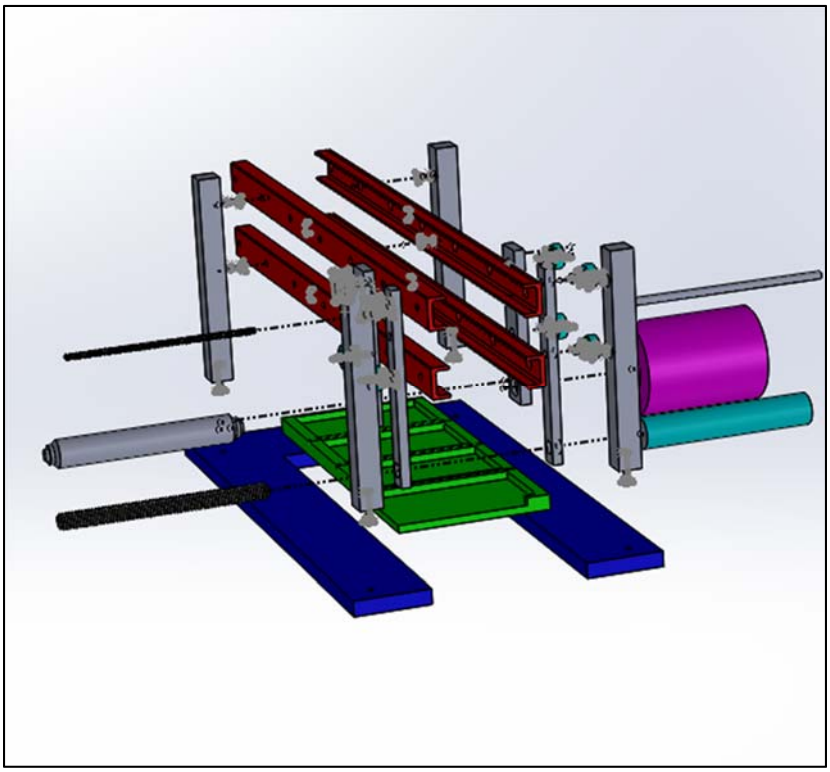

Figure 7: Exploded View of Tape Roller

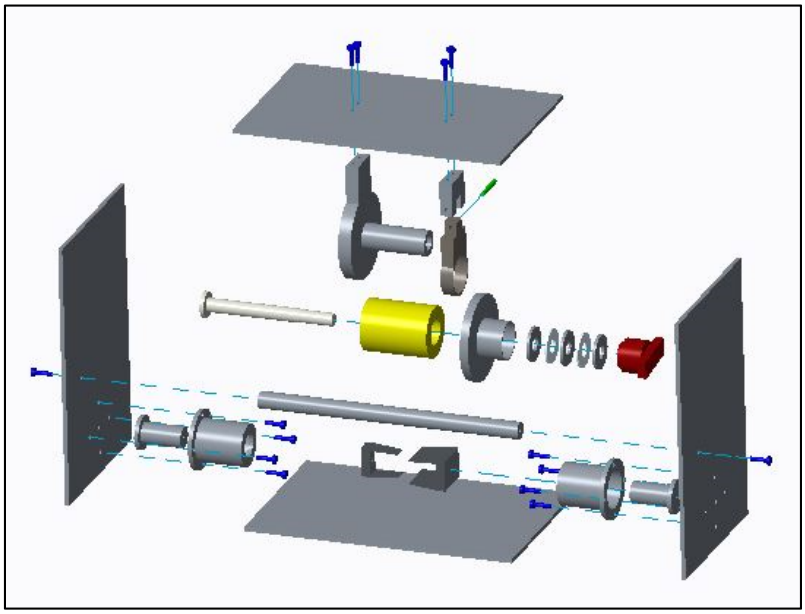

Figure 8: Exploded View of the wrapping mechanism

4. Operation Instructions

Tape Roller

Step 1: Place individual capacitor in each one of the cut-outs on the plate

Step 2: Pull a small piece of tape off the roller and place it on the first capacitor

Step 3: Roll both roller arms down the tracks

Step 4: Cut the tape off of the tape roll

Step 5: Peel back the layer covering the double sided tape

Step 6: Using the guides in the plate, cut the tape in between each capacitor using scissors

Step 7: Slide the plate into the L-gauge

L-Gauge

Step 1: Move the first capacitor into the corner of the L-gauge

Step 2: Pick up each capacitor one at a time and stack them on top of the first capacitor using the gauge as guidance

Wrapping Design

Step 1: Load the capacitor into the wrapping machine using the piece of double sided tape on the front of the capacitor assembly to attach the insulation paper from the roll in the wrapping machine.

Step 2: Remove the capacitor from the wrapping device

Gauge Block

Step 1: Place the capacitor into the gauge block. If the capacitor fits, it is a good part

Step 2: Remove capacitor and inspect for any damages/missing components

5. Troubleshooting

The main two assemblies that could cause problems are the tape roller and the wrapping mechanism. The problem most likely to arise while using the tape roller is the tape not properly sticking. If this happens, the pressure cylinder has been worn down. To fix this, wrap duct tape around the cylinder a few times to increase the diameter size, or replace the cylinder with a new one. Another issue that might occur is the capacitors sliding around in the plate. If this occurs, find a small spacer to place in the cutouts. This will help the capacitors stay in place better.

Potential problems for the wrapping design include arms becoming difficult to turn, washers wearing out over time, paper coming off of the capacitors, tape loses abrasiveness, and the clamps could come lose. To fix these issues the operator could oils the arms, replace the washers and replace the double sided tape.

6. Spare Parts

Extra rolls of tape and extra rolls of insulation paper should be nearby in case they run out during operations. This will prevent any delay in the overall process when the tape or insulation paper are empty.