PRECIOUS PLASTIC
MONASH UNIVERSITY

Start Here:

Throughout the process of building and running the machines we found various problems which were not accounted for during the design phase. This document describes these issues and the solutions or work-arounds implemented in order to meet operational requirements. General changes were added to the original machine's designs not as solutions to any problems, but as general improvements to better suit the overall aesthetics or to make use of easily obtainable components. In the document, future possible upgrades have been added to help collaboration from other Precious Plastic chapters, so have fun, and let's recycle!

1. Problems Encountered:

1.1 Loosening of fasteners and cracking of the hopper faces:

The hopper went through multiple design phases. Initially, an entirely clear acrylic hopper was conceived ass to enhance visibility of the shredding process. These faces were held together with the use of M3 nuts, bolts and nylon washers. After testing it was observed, due to machine vibration, the fasteners became loose. With this the nuts were changed to lock nuts. However, the vibrations were extensive enough to lead to cracking of one of the hopper faces and causing a great risk for the hopper collapsing, and thus the possibility of causing harm.

The hopper had to be redesigned with these issues in mind. The hopper was then made out of aluminium with three faces having rectangular cut-outs for the clear acrylic to be installed. This change in design gave the hopper a steady frame that would be able to tolerate mechanical vibrations and would not lead to cracking of any face. It also ensured that visibility was still maintained from the previous design, by providing three acrylic windows surrounded by the aluminium frame.

1.2 Plastic being thrown out during operation:

Due to the power of the blades, during initial testing, plastic was getting thrown out the hopper. This caused a large hazard as there was a possibility of plastic flying into someone's eye, regardless the use of the required personal protection equipment. In order to work around this issue, a lid was placed on the top of the hopper.

1.3 Manufacturing defect causing higher tolerance between blades and shaft:

The shaft was manufactured before the laser cut blades were made. In the manufacturing process the shaft ended up being made smaller in diameter. This caused the clearance between the blades and shaft being greater than it should have been. Due to the loose fit, the blades would rattle and make noise whilst shredding. Since the shaft was manufactured out of house it would be easiest for the shaft to be manufactured first and then the blades can be adjusted accordingly. New blades were made and this stopped the rattling and the unnecessary damage being caused to the blades.

1.4 Finding the perfect blade configuration:

The original design contemplated a specific blade configuration, seen as a ‘W’. This was the idea for the shredder but after some initial test runs with the machine, the team realized that the configuration needed to be altered for more efficient shredding. Through multiple testing phases, the best results were found by using a ‘V’ formation. This arrangement prevented the plastic from being thrown onto the bearing plate and ensures the shredding takes place in the centre, where it is most effective. With this higher efficiency, a better output was achieved.

1.5 Quantity of Plastic

After a few test runs, it was observed that bigger chunks of plastic had trouble being shredded, eventually leading to clogging. This could lead to damage to the blades, hopper and engine. Therefore, it is essential to use smaller pieces in the shredder. This can be done by breaking up big chunks prior to shredding.

2. Future Upgrades:

2.1 Laser Cut Hopper:

The current hopper was cut to size manually. This resulted in unevenness and slight roughness around the edges. Laser cutting the hopper would eliminate misalignment errors between the hopper and the shredder box as it would be cut to precise measurements.

2.2 Switch for reverse polarity:

The shredding axe is connected to the motor shaft with the help of a coupling. The motor shaft can only rotate clockwise. The machine tends to stall at times and requires the removal of stuck plastic via plyers. This leads to a large risk of cutting a person's hand on the blades. Providing a reverse polarity switch would give the motor shaft a two-way motion. Therefore, if a chunk of plastic gets stuck in the blades, flicking this switch would cause the plastic to dislodge and then be able to run smoothly.