**Table 3 - Extruded Filament Length at Varying Speeds**

**Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MELT | DRIVE | DIAMETER | ORIFICE | MATERIAL | TEMP | LENGTH |
| Volcano | Direct | 1.75 mm | 1.2 mm | PLA | 190 C | 50 mm |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Flow Rate (mm3/min)** | **Speed**  **(mm2/min)** | **Trial 1** | **Trial 2** | **Trial 3** | **Trial 4** | **Trial 5** | **Avg.**  **Value** | **Deviation**  **Avg. Value** |
| **200** | 83.15 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **400** | 166.30 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **600** | 249.45 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **800** | 332.60 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **1000** | 415.75 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **1200** | 498.90 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **1400** | 582.05 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **1600** | 665.20 | 2 | 2 | 2 | 2 | 2 | 2 |  |
| **1800** | 748.35 | 2 | 2 | 2 | 2 | 2 | 2 |  |
| **2000** | 831.50 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **2200** | 914.65 | X | X | X | X | X | X |  |
| **2400** | 997.80 |  |  |  |  |  |  |  |
| **2600** | 1080.96 |  |  |  |  |  |  |  |
| **2800** | 1164.11 |  |  |  |  |  |  |  |
| **3000** | 1247.26 |  |  |  |  |  |  |  |

**Notes/Analysis:**

* Initially there was buckling around the 665 flow rate so it was attributed to a smaller length in tubing that wasn’t covering all the filament, so tubing was increased in length to circumvent this problem.
* For 665.2 speed, roughly after 76 mm the extruded filament starts to fail as it has blobs, deformed shape, with some threading, and motor grinding noise is heard with a couple skipped steps.
* For 748 same 76mm failure length as above.
* At 831 severe motor grinding noise but extrusion is flawless indicating the skipping steps mimicking a trial at a lower speed.
* Failure at 914, high grinding noise and very little filament extruded. Motor failure as with the smaller tip there is higher pressure required to push the filament through and not enough torque to push it.

**Specifications:**

* 1.75mm Unknown Red PLA @ 190
* E3D Volcano 1.2mm Orifice
* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)

**Failure Mode:** Stepper motor cannot exceed ~870 mm/min

* 1: Best extrusion
* 2: Blobbing occurs (minor)
* X: Complete failure, does not extrude at all (fail)

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