**Table 2 - Extruded Filament Length at Varying Speeds**

**Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MELT | DRIVE | DIAMETER | ORIFICE | MATERIAL | TEMP | LENGTH |
| Volcano | Direct | 1.75 mm | 1.2 mm | ABS | 240 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 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **1800** | 748.35 | 1 | 2 | 1 | 2 | 1 | 1.4 |  |
| **2000** | 831.50 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **2200** | 914.65 | X | X | X | X | X | 3 |  |
| **2400** | 997.80 |  |  |  |  |  |  |  |
| **2600** | 1080.96 |  |  |  |  |  |  |  |
| **2800** | 1164.11 |  |  |  |  |  |  |  |
| **3000** | 1247.26 |  |  |  |  |  |  |  |

**Notes/Observations:**

* Clicking noise on motor starts on the first trial.
* At 750 mm/s minor blobbing begins to occur as well as minor threading (intermittent occurrence). Blobbing occurs around every 30mm even if the extruded length is increased.
* The 831 mm/s doesn’t cause any blobbing but loud motor grinding noise heard and stepping visible thus really extruding at a smaller volumetric flow rate.
* At 914 high grinding noise heard, and wheels barely turn and no filament extruded thus motor failure had occurred due to lack of motor torque at high speeds.
* Important observation is that no need for number 3 on the rating scheme because extrusion quality goes from minor blobbing and threading to sudden failure.
* Failure for ABS(this trial) occurs at the same volumetric flow rate as for PLA, thus although this material has higher thermal conductivity than PLA, its not enough to heat up to 240 fast enough to offset the higher motor speeds. Or it can still melt but the motor doesn’t have enough torque at higher speeds to push the filament through. However, since threading was visible the limitation for this trial probably is the filament not being able to get hot enough rather than the motor lacking torque.

**Specifications:**

* 1.75 mm ABS Octave Yellow branded(poor history as oxygen has been trapping)
* E3D Volcano 1.2mm Orifice
* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)

**Failure Mode:** Stepper motor cannot exceed ~914 mm/min

* 1: Best extrusion
* 2: extrusion (minor threading or blobbing)
* X: Complete failure, does not extrude at all (fail)

2/28/15