**Table 1(1.75mm) 2/28/15**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 |  |
| **400** | 166.30 | 1 |  |  |  |  | 1 |  |
| **600** | 249.45 | 1 |  |  |  |  | 1 |  |
| **800** | 332.60 | 1 |  |  |  |  | 1 |  |
| **1000** | 415.75 | 1 |  |  |  |  | 1 |  |
| **1200** | 498.90 | 1 |  |  |  |  | 1 |  |
| **1400** | 582.05 | 1 |  |  |  |  | 1 |  |
| **1600** | 665.20 | 1 |  |  |  |  | 1 |  |
| **1800** | 748.35 | 2 | 2 | 2 | 2 | 2 | 2 |  |
| **2000** | 831.50 | 3 | 2 | 2 | 2 | 2 | 2.2 |  |
| **2200** | 914.65 | X | 3 | X | 3 | 3 | 3.4 |  |
| **2400** | 997.80 |  |  |  |  |  | - |  |
| **2600** | 1080.96 |  |  |  |  |  | - |  |
| **2800** | 1164.11 |  |  |  |  |  | - |  |
| **3000** | 1247.26 |  |  |  |  |  | - |  |

**Notes/Observations:**

* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)
* Clicking noise 600 flow, bad extruder design/assembly maybe?
* Filament damaged by humidity, contains a lot of water, evident by blobs which are actually bubbles, makes hard to judge failure mode
* 850 mm/min skips steps
* No stripping at all, even in failure mode

**Specifications:**

* Octave 1.75mm Black ABS Filament @ 240 C
* E3D Volcano 1.75mm

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

* 1: Best extrusion, constant, even (despite air bubbles)
* 2: Failure mode beginning to show, somewhat constant extrusion (minor)
* 3: Does not function well, motor skips steps (not enough torque? Not enough power?) loud grinding­ noise, small spinning (major)
* X: Complete failure, does not extrude at all (fail)

**Table 2(1.75mm) 2/28/15**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 |  |  |
| **2000** | 831.50 | 1 | 1 | 1 | 1 | 1 |  |  |
| **2200** | 914.65 | X | X | X | X | X |  |  |
| **2400** | 997.80 |  |  |  |  |  |  |  |
| **2600** | 1080.96 |  |  |  |  |  |  |  |
| **2800** | 1164.11 |  |  |  |  |  |  |  |
| **3000** | 1247.26 |  |  |  |  |  |  |  |

**Notes/Observations:**

* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)
* 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 power.
* 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

**Specifications:**

* 1.75 mm ABS Octave Yellow branded(poor history as oxygen has been trapping)

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

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

**Table 3(1.75mm) 3/1/15**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MELT | DRIVE | DIAMETER | ORIFICE | MATERIAL | TEMP | LENGTH |
| Volcano | Direct | 1.75 mm | 0.6 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/Observations:**

* Spring Tension: (~58.70 mm for 3mm)
* Initially was buckling around 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.
* However, the buckling still persists and now it is attributed to the smaller nozzle size’s inability to push through as much filament as that is the only variable between this trial and the other trial with red PLA that worked up till 831.
* Now after making the changes previous findings no longer relevant.
* 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 the motor doesn’t contain the power to push it.

**Specifications:**

* Volcano 0.6mm nozzle
* PLA @ 190, Unkown red PLA
* Starting trial at 582mm/s

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

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

**Table 4(1.75mm PLA) 2/28/15**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 | 1 | 1 | 2 | 1 | 2 |  |  |
| **1800** | 748.35 | 2 | 2 | 2 | 2 | 2 | 2 |  |
| **2000** | 831.50 | 1 | 1 | 1 | 1 | 1 |  |  |
| **2200** | 914.65 | X | X | X | X | X |  |  |
| **2400** | 997.80 |  |  |  |  |  |  |  |
| **2600** | 1080.96 |  |  |  |  |  |  |  |
| **2800** | 1164.11 |  |  |  |  |  |  |  |
| **3000** | 1247.26 |  |  |  |  |  |  |  |

**Notes/Observations:**

* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)
* At 665.2 Minor Threading begins to occur near the end of extrusion around a 10mm patch.
* At 748 the maximum threading occurs because this is the maximum speed at which the motor can push the filament through. Threading occurs near last 25mm and continues if extrusion length increased.
* At 831 clean trial occurs because the motor has gone past its actual limit so it extrudes as if it is extruding at a lower speed. This is proven by the grinding noise of the motor and the twitching suggesting that it is skipping steps.
* Failure mode occurs at 914.65, and severe motor grinding noise is heard, and motor gears move very slowly suggesting that failure is in lack of motor power to push the filament through.

**Specifications:**

* 1.75mm instead of 3.0mm
* Unknown red PLA filament
* 1.75mm E3D Volcano nozzle

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

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

**Table 5(1.75mm PLA) 3/1/15(Not done yet)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 | 1 | 1 | 2 | 1 | 2 |  |  |
| **1800** | 748.35 | 2 | 2 | 2 | 2 | 2 | 2 |  |
| **2000** | 831.50 | 1 | 1 | 1 | 1 | 1 |  |  |
| **2200** | 914.65 | X | X | X | X | X |  |  |
| **2400** | 997.80 |  |  |  |  |  |  |  |
| **2600** | 1080.96 |  |  |  |  |  |  |  |
| **2800** | 1164.11 |  |  |  |  |  |  |  |
| **3000** | 1247.26 |  |  |  |  |  |  |  |

**Notes/Observations:**

* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)

**Specifications:**

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

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