**Table 9 – Extruded Length at Varying Temp’s**

**Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MELT | DRIVE | DIAMETER | ORIFICE | MATERIAL | Flow Rate | LENGTH |
| V6 | Direct | 1.75 mm | 0.6 mm | PLA | 2200mm^3/s | 50 mm |

|  |  |  |  |
| --- | --- | --- | --- |
| **Temp Celsius** | **Cross Section Diameter (mm)** | **Die Swell Ratios** | **Extruded Length (mm)** |
| **190** | .98 | 1.63 | 76 |
| **200** | .80 | 1.33 | 90 |
| **210** | .75 | 1.25 | 96 |
| **220** | .67 | 1.12 | 99 |
| **230** | .64 | 1.06 | 108 |
| **240** | .62 | 1.03 | 116 |
| **250** | .61 | 1.01 | 124 |
| **260** | .60 | 1.00 | 158 |

**Notes/Observations:**

* For each trial a certain length is extruded at a diameter as noted in the table, however after that extruded length failure occurs for every trial as motor grinding noise heard, filament gets noticeably thicker, and hardly any filament is extruded.
* Extruded length increases for higher temperatures since the increased temperature is more conducive towards the filament melting so it can escape the hot end quicker.
* In the trial at 190 degrees Celsius greatest degree die swell occurs because the diameter is .98mm which is greater than the nozzle orifice of 0.6mm, however as the temperature increases the die swell reduces as the diameter at 260 degrees is equal to the diameter of the nozzle itself.
* However, it is important to note that at the end of a certain length of the extruded filament (as seen in the picture below) die swell begins to reoccur as the diameter of the extruded filament becomes noticeably thicker. This occurs since the filament was sitting in the hot end before hand it is sufficiently melted, however, but once the motor starts the filament near the end doesn’t spend as much time in the hot end as did the filament in the beginning thus it doesn’t get hot enough and failure as well as die swell occur.
* It is important to note that increasing the temperature did not prevent failure, just alleviated the extent of the failure as occurrence of die swell in the beginning is avoided completely at high temperatures as .6 was the cross section diameter for 260, and its occurrence later is delayed as the extruded length (before major die swell) grows steadily for each temperature.

**Specifications:**

* 1.75 Unknown red PLA filament @ 190
* V6 nozzle with 0.6mm orifice
* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)

**Failure Mode:** Not Applicable

**Photo**

