**Table 8 - Pulled Filament Length at Varying Temp’s**

**Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MELT | DRIVE | DIAMETER | ORIFICE | MATERIAL | Flow Rate | LENGTH |
| Volcano | Direct | 1.75 mm | 1.2 mm | PLA | 2200mm^3/s | 50 mm |

|  |  |
| --- | --- |
| **Temp Celsius** | **Length of Pulled Filament (mm)** |
| **190** | 14.39 |
| **200** | 16.92 |
| **210** | 16.90 |
| **220** | 23.11 |
| **230** | 22.00 |
| **240** | 22.35 |
| **250** | 24.11 |
| **260** | 26.52 |
| **270** | 29.43 |

Rate of pulled filament over increase in temperature is .188mm/C

**Summary:**

* After noticing that at the failure rates less than the specified filament was pulled, we decided to measure the pulled filament at the failure flow rate as the temperature was increased.

**Notes/Observations:**

* We noticed that as the temperature increased the motor grinding noise became noticeably less audible.
* The explanation for the lack of filament being pulled in general has a two-fold explanation. First, the motor is reaching its maximum speed so the torque is decreasing thus it can no longer exert the force to drive the filament. The second explanation is that the since the filament is moving so fast it doesn’t spend enough time in the hot end to heat up to its melting point. This data shows that the pulled filament length increased by about 15mm from 190 all the way to 270. Thus it is shown that the of extruder temperature does contribute to an lower failure volumetric flow rate hence increasing the temperature allows for the filament passing through the hot end at high speeds reach a temperature closer to its actual melting point.
* An interesting observation is that for this trial, over a temperature differential of 80 degrees Celsius, the extruded length increased by 15mm while for the ABS over a temperature differential of 30 degrees the extruded length increased by 10mm.
* Our theory (2.25) was correct in that the higher thermal conductivity for ABS and the lower specific heat capacity results in a greater change in temperature thus ABS melts more the higher the temperature increases compared to PLA thus the rate of filament pulled for ABS is 3 times higher for every degree increase in temperature.

**Specifications:**

* Unknown Red PLA 1.75mm
* 1.2mm orifice, E3D volcano
* Spring Tension: (~58.70 mm for 3mm) (~58.90 mm for 1.75mm)

**Failure Mode:** Not applicable as whole test is run at failure speed.