**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 pulled filament length increased by about 15mm from 190 all the way to 270. The explanation for the lack of filament being pulled 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 and begins stepping and no filament comes out. The second explanation is that the since the filament is moving so fast through it’s not actually heating to its necessary 240 degrees. Thus, since it is partially stiff it cannot be extruded easily and hence the increasing temperature allows for it to be extruded more easily and the trend shows this as the pulled filament length increases as the temperature increases.
* 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. Clearly the extruded length increased to the temperature increase ratio is far higher for the ABS filament possibly occurring because ABS has a higher thermal conductivity allowing it melt more for each temperature increase
* 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.