

Final Operation and Assembly Manual

Senior Capstone Design Project

Open-Source 3D Printed Foot Prosthesis

Team 18F04

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DISCLAIMER

This report was prepared by students as part of a university course requirement. While considerable effort has been put into the project, it is not the work of licensed engineers and has not undergone the extensive verification that is common in the profession. The information, data, conclusions, and content of this report should not be relied on or utilized without thorough, independent testing and verification. University faculty members may have been associated with this project as advisors, sponsors, or course instructors, but as such they are not responsible for the accuracy of results or conclusions.

1 Introduction

The goal of this assignment is to demonstrate how the manufacturing and operation works for the project of the open-source 3D printed foot prosthesis. Section 2 will cover the manufacturing, section 3 will cover the operation, and section 4 will cover the troubleshooting information.

2 Manufacturing

This section will cover the exact procedures and progress of the manufacturing of each part in the project which are the foot, PVC pipes, screws, and the supporting channel.

2.1 Foot

The foot is meant to be 3D printed from any 3D printer available with the filament PLA. Any material other than PLA can be used as far as it is stronger than PLA, but the team recommends using PLA to fully function. The team have created several designs of the foot in solidworks in this semester and in the previous semester. The most recent and effective design will be shown in Figure 1. The foot is designed with solidworks, the foot has a hole of the upper surface with a diameter of 1.35 inches to fit the smaller PVC pipe in which has an outer diameter of 1.30 inches. The infill of the foot while 3D printing it must be exactly 70%.



Figure 1: 3D printed foot

2.2 PVC pipes and screws

The PVC pipes are bought from Home Depot or any other store that sells tools, or construction product, with two different width sizes. The bigger pipe has an inner diameter of 1.25 inches, and the small pipe has an inner diameter of 1 inch. They have been cut to reduce the length of each pipe to 6 inches. The team also have made 5 holes inside each pipe and the length between each hole is 1 inch. The screws are bought also from Home Depot with diameter of 0.25 inch and length of 2 inch. The pipes will be attached with the foot and with the supporting channel with Oatey Handy Pack glue. The PVC pipes can be shown in Figure 2.



Figure 2: PVC pipes

2.3 Supporting Channel

The supporting channel is also meant to be 3D printed from any 3D printer available with the recommendation of using the PLA material. The supporting channel is meant to be the connector from the below-knee and the PVC pipes. The supporting channel has a hole that has a radius of 1.70 inches, to fit the bigger PVC pipe which has an outer diameter of 1.65 inches. The infill while 3D printing the supporting channel should be anything equal to 30% or more, but the team recommends an infill of 30%. The supporting channel can be viewed in Figure 3.



Figure 3: 3D Printed supporting channel

2.4 Liner

The liner must be bought from the website amputestore.com. Each user will buy the liner based of his/her below-knee size. The function of the liner is to hold the below-knee with the supporting channel, and the most important thing is that it is comfortable to wear for the users. The liner can be viewed in Figure 4.



Figure 4: Liner

3 Operation

This section will explain the steps needed in order to operate the prosthetic leg:

Step 1: Buy the indicated PVC pipes and cut them to make the length 6 inches for each pipe.

Step 2: Make 5 exact holes (0.25 inch size), between each hole 1 inch. The first and the last holes must be 0.5 inches from the edge of the PVC pipe.

Step 3: Buy screws from any tools store with the indicated length and width above in manufacturing.

Step 4: Request a 3D printing job from any 3D printer service available to print the foot and the supporting channel.

Step 5: Adjust the height of the prosthetic leg by removing the screw and inserting it in the right hole that comfortable the user with the height.

Step 6: Attach the foot with the smaller PVC pipe using Oatey Handy Pack glue, and attach the bigger PVC pipe with the supporting channel using the same Oatey Handy Pack glue.

Step 7: Wear the liner where the below knee amputee is.

Step 8: Add sanitizer to the liner.

Step 9: Insert the below knee inside the supporting channel.

Step 10: The user can work normally.

4 Troubleshooting Information

The user will not have any problem with building this design using the team's information, but the user must be aware that the most common mistakes might face him/her drilling holes procedure into the PVC pipe. The user must be very careful while drilling the holes and must be very specific that the holes are identical to each other, so that when the user want to adjust the height will not have a problem.

Appendix A:

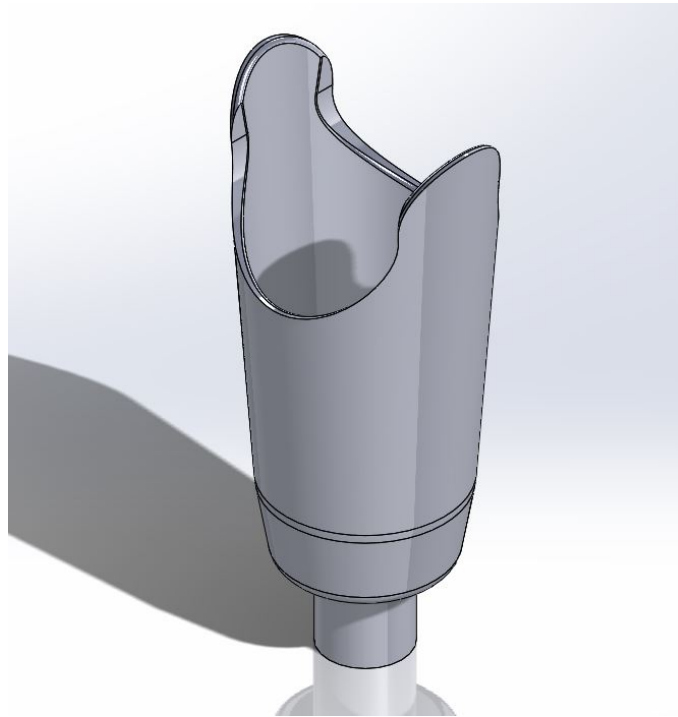


Figure A.1: Supporting Channel in CAD

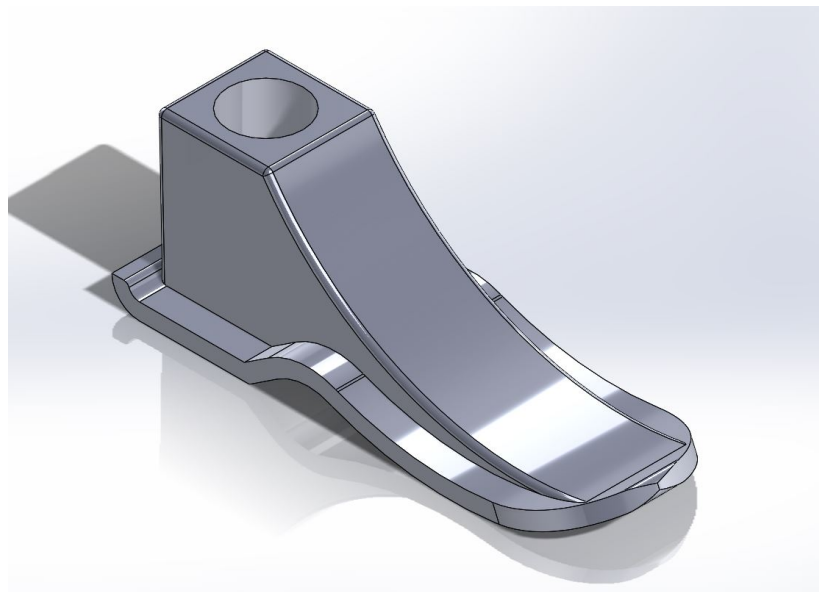


Figure A.2: Foot in CAD