Appendix A. The 4-inch Filter Test Device

A.1.Device Assembly and Sample Preparations

The procedure used to assemble the device and prepare the specimen for testing is shown in this appendix. The figure labeled Step 1 shows the aluminum base that forms the shell of the first filter device. Step 2 shows the shell with threaded rods inserted, and Step 3 shows the side panel bolted to the aluminum base to complete the first filter device. The void forming plate is attached to the aluminum side panel but is inside and not visible in Step 3. Step 4 shows addition of the compaction spacer to the end of the first filter device. Step 5 shows the bottom plate in place. Step 6 shows the assembly rods which will secure the top plate to the first filter device during compaction. Step 7 shows the location pins used to position the top plate, and Step 8 shows the top plate bolted in place. Step 9 shows the assembly rotated upright and ready to receive the specimen for compaction. Step 10 shows a cross section through the device ready for compaction.

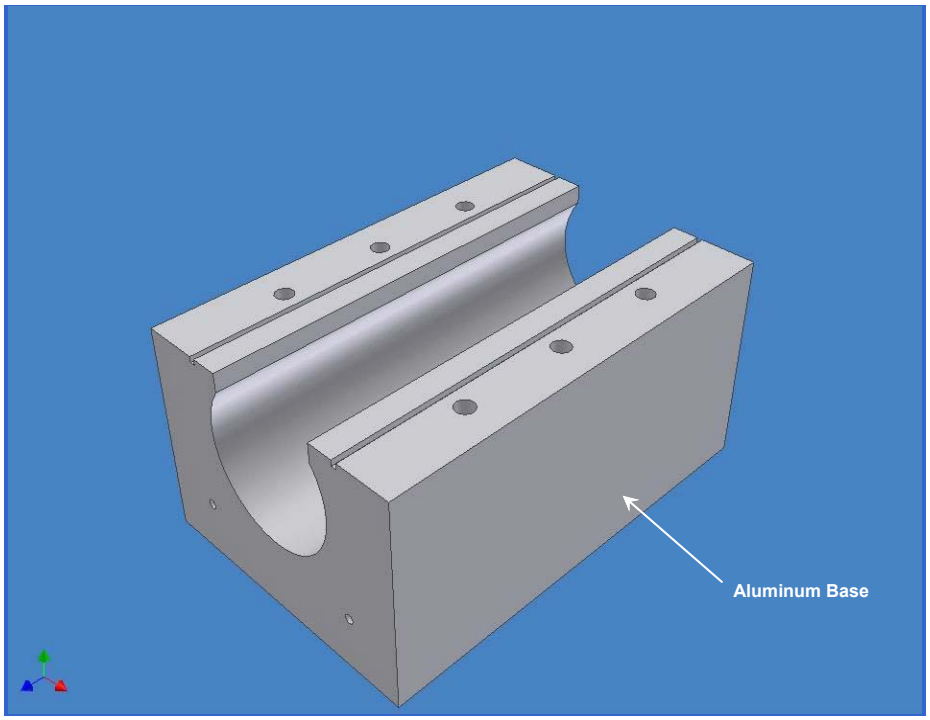


Figure A.1 Step 1 (aluminum base)

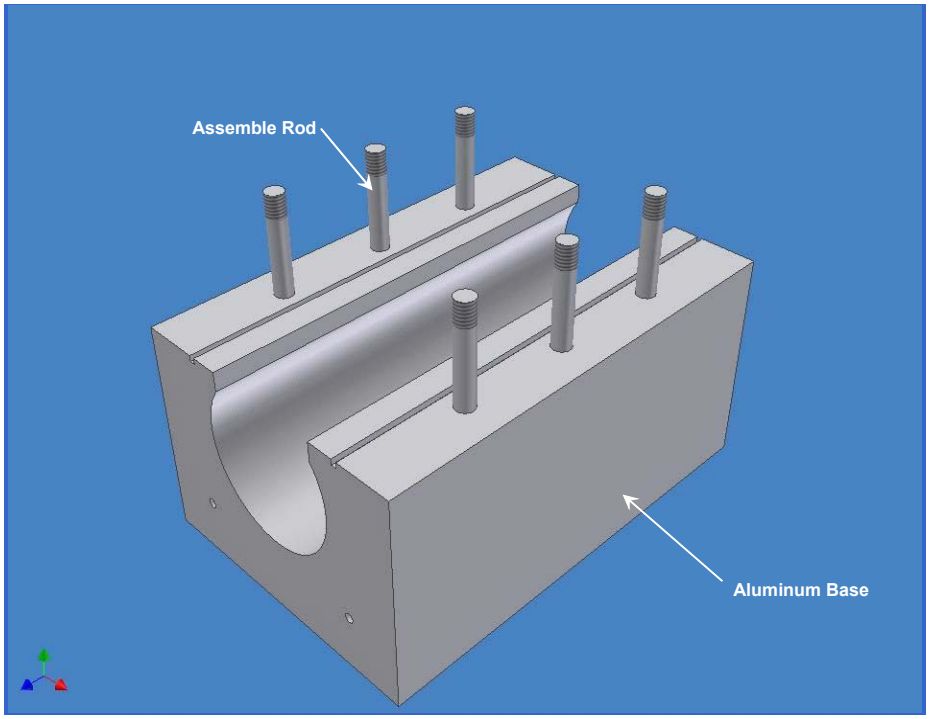


Figure A.2 Step 2 (install assembly rods)

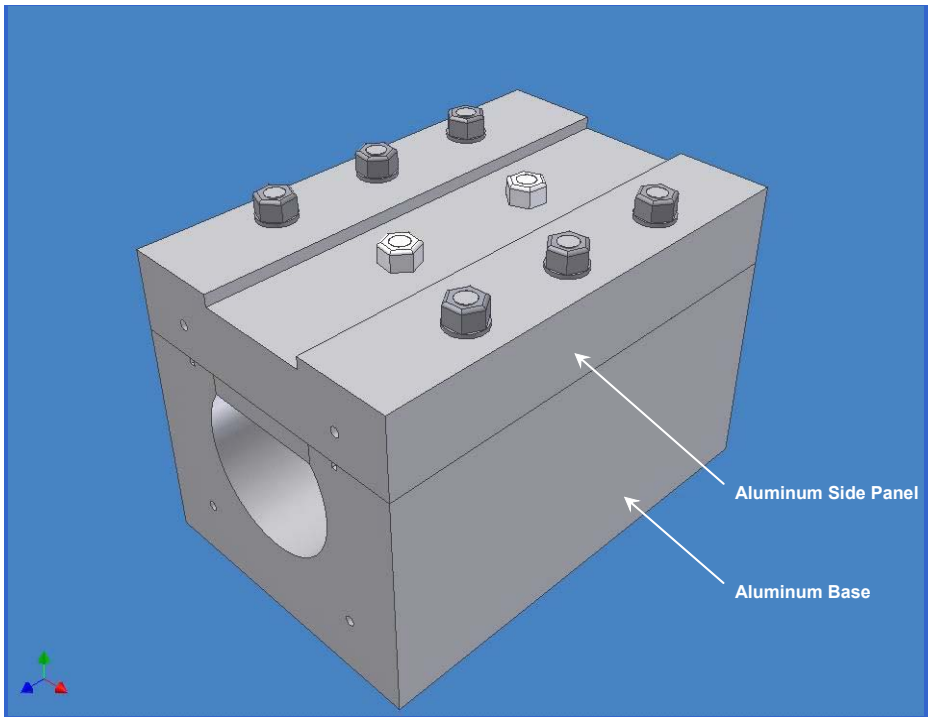


Figure A.3 Step 3 (install aluminum side compaction panel)

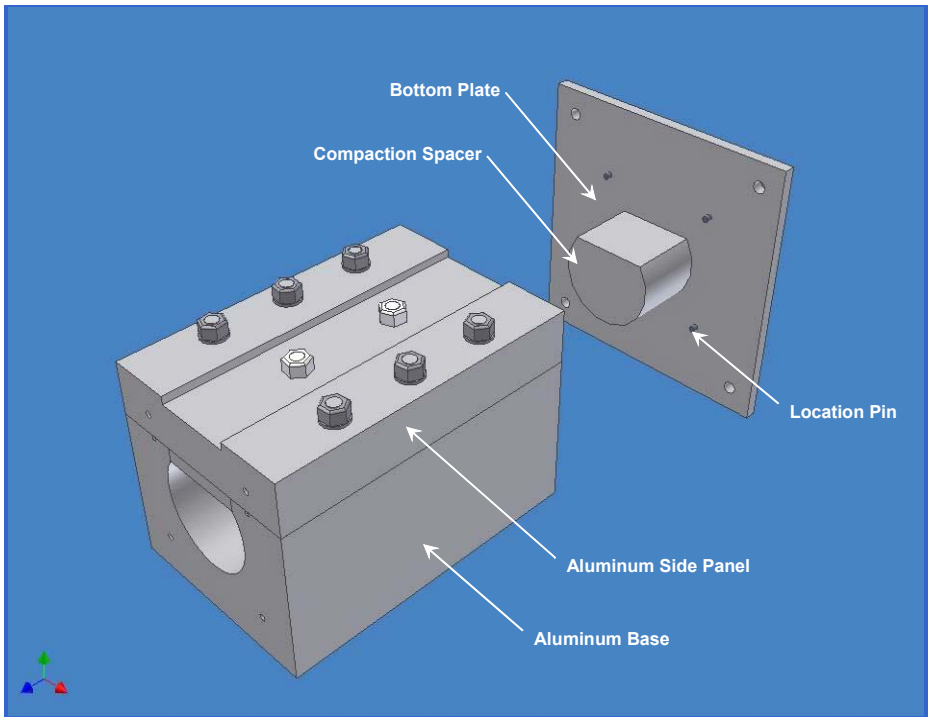


Figure A.4 Step 4 (place the compaction spacer and bottom plate)

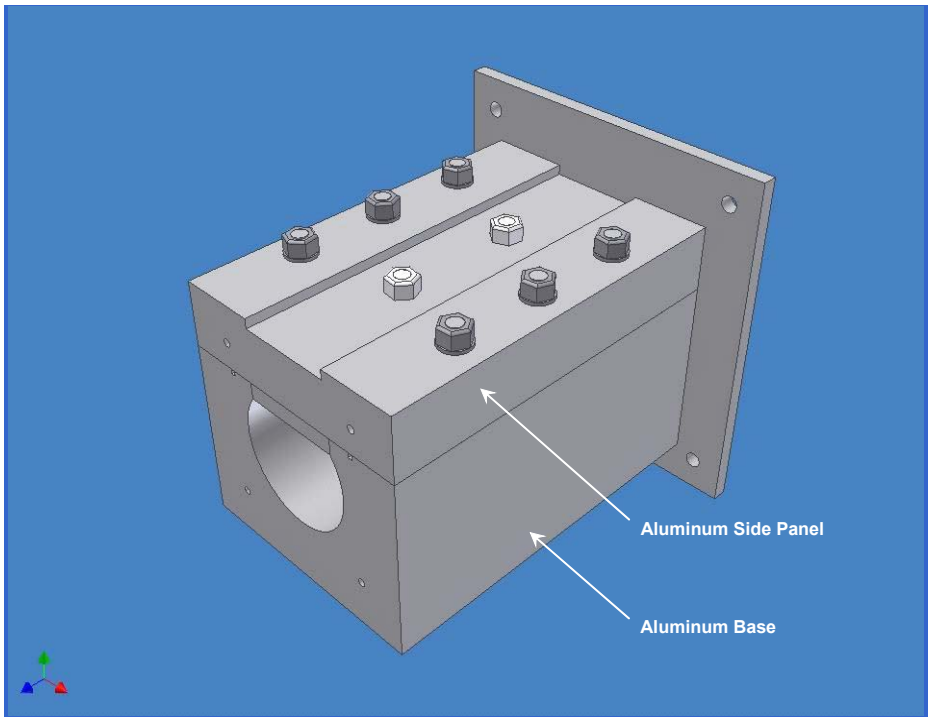


Figure A.5 Step 5 (locate the bottom panel)

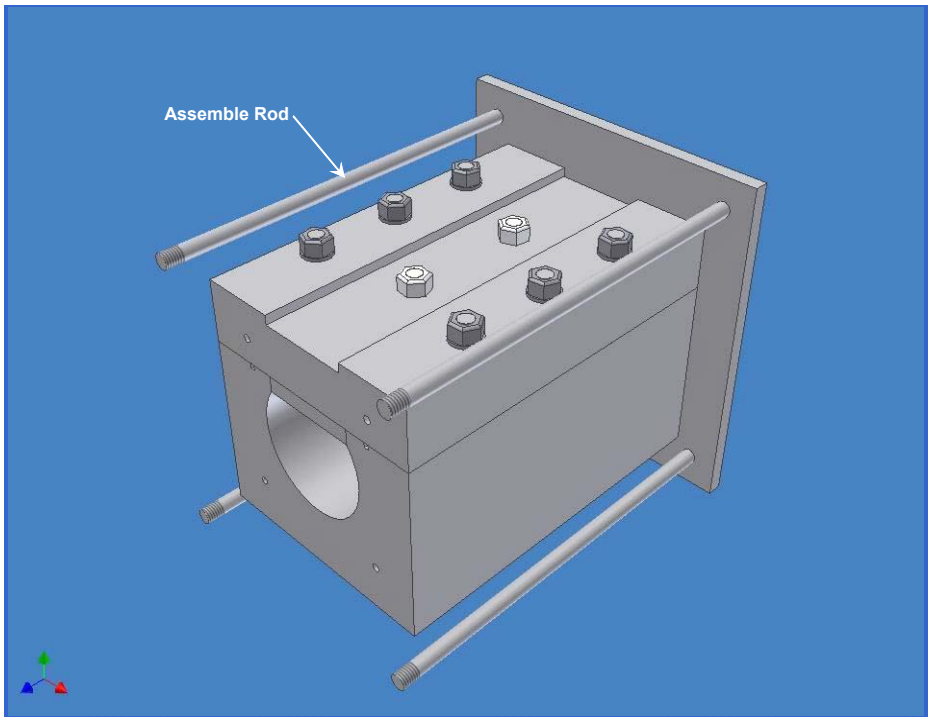


Figure A.6 Step 6 (install assembly rods)

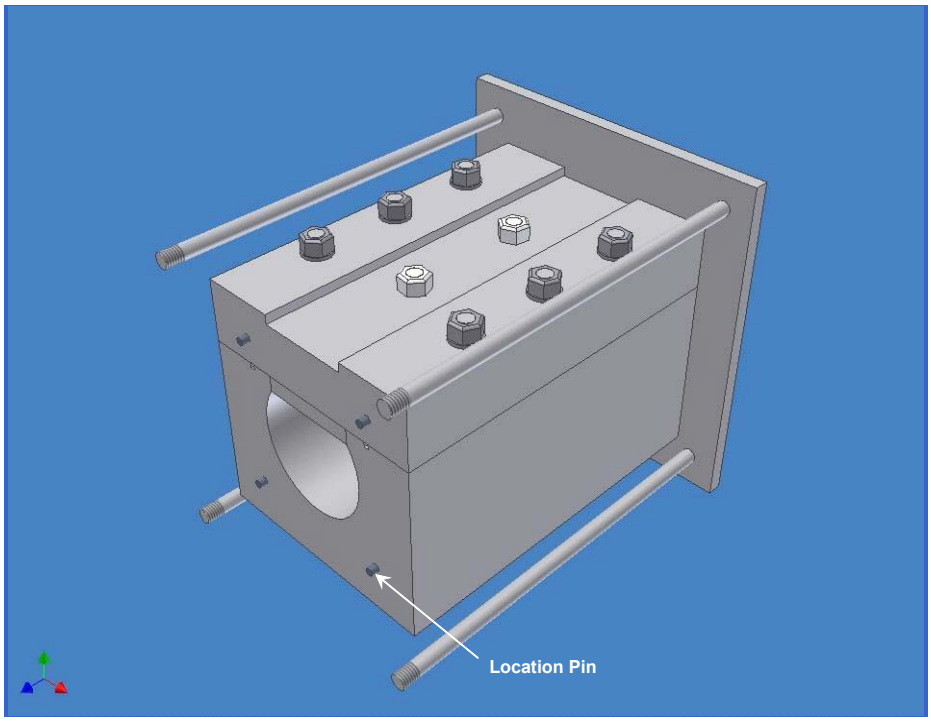


Figure A.7 Step 7 (install the location pins)

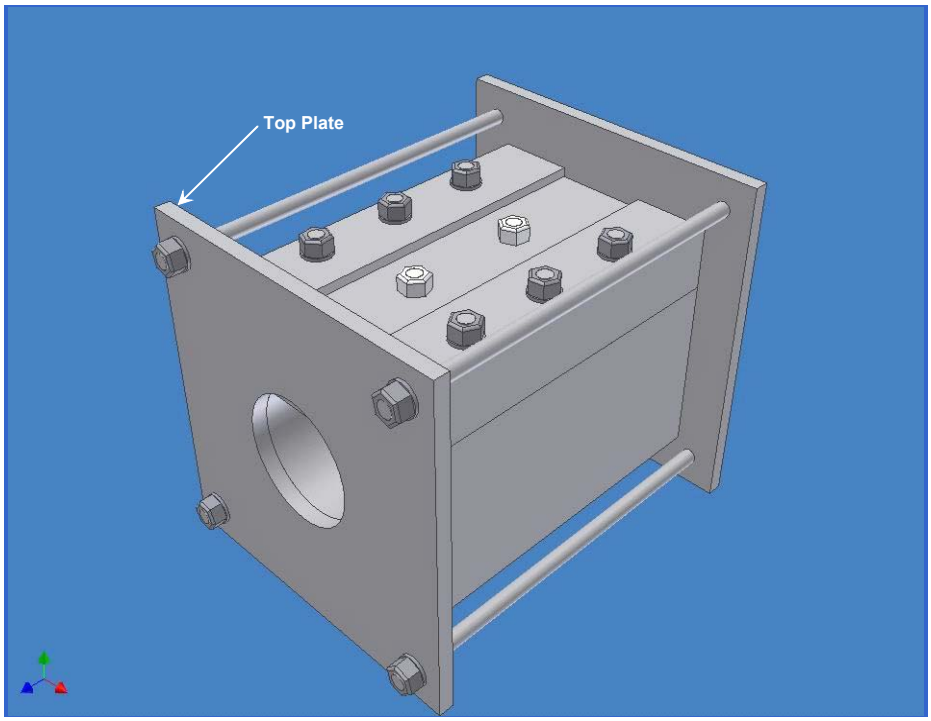


Figure A.8 Step 8 (install the top plate)

Figure A.9 Step 9 (ready to compact)

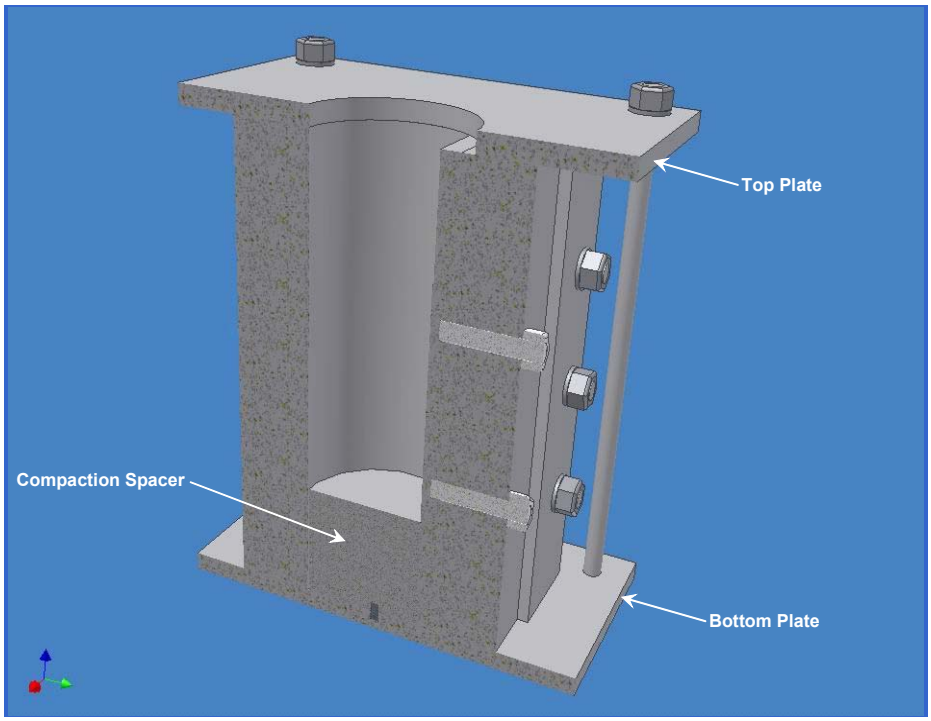


Figure A.10 Step 10 (cross section to compact)

Step 11 shows a photograph of a specimen being compacted in the device using the Standard Proctor compaction hammer. Step 12 shows a cross section through the device with the base material having been compacted on the compaction spacer, and Step 13 shows the filter material compacted on top of the base. Step 14 shows the pea gravel compacted on top of the filter material and step 15 shows the addition of the porous plate that retains the pea gravel. Step 16 shows the spring that was used to apply pressure to the porous plate and keep it snug against the pea gravel.

In Step 17, the top plate used during compaction is removed and replaced, as shown in Step 18, with a different top plate used during testing. This top plate has a smaller hole for attachment of the tubing used to flow water through the specimen. Step 19 shows the apparatus and the specimen rotated 180 degrees, upside down from the previous picture, and ready for assembly of the remainder of the specimen.

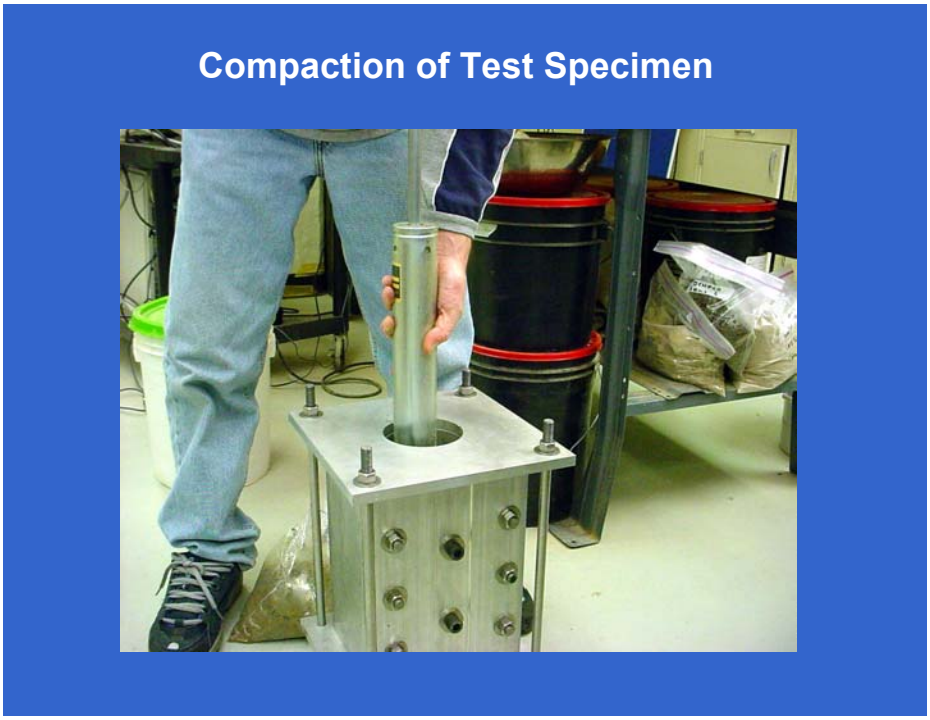


Figure A.11 Step 11 (compaction of test specimen)

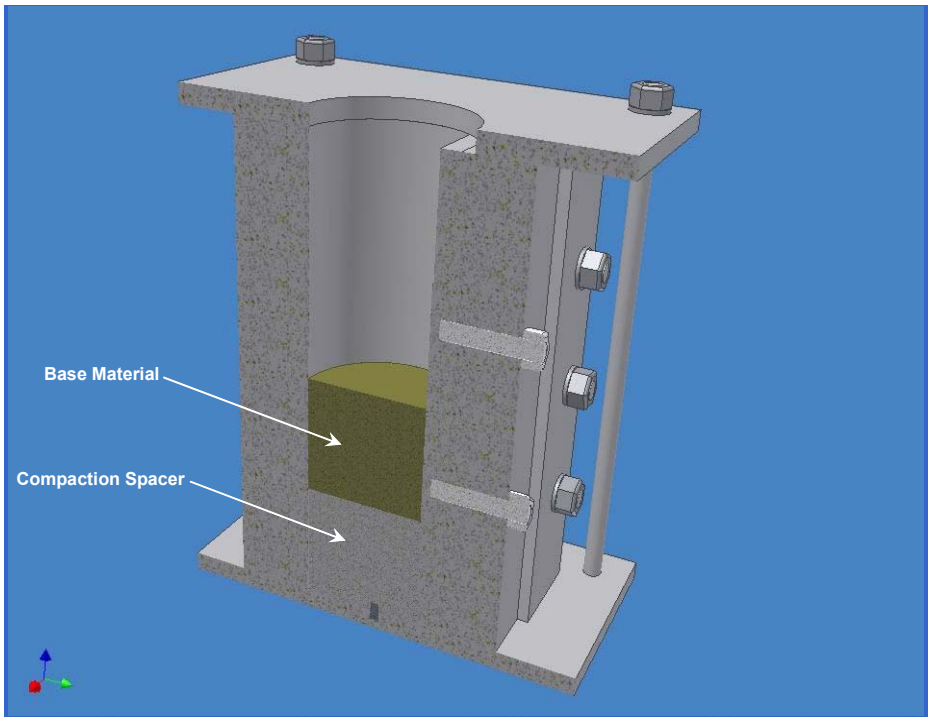


Figure A.12 Step 12 (compact base material)

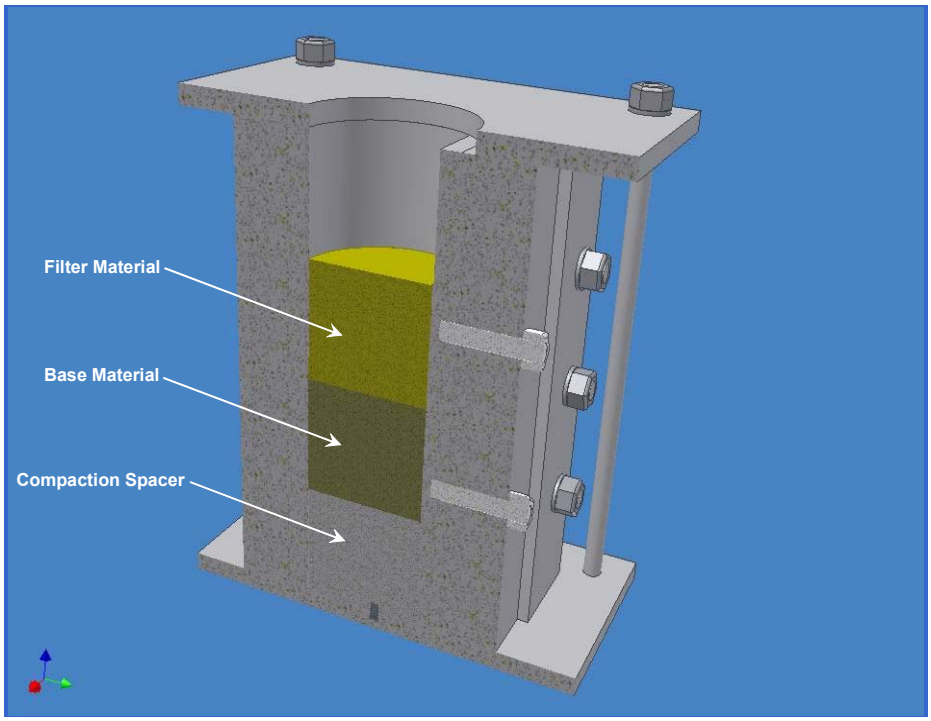


Figure A.13 Step 13 (compact filter material)

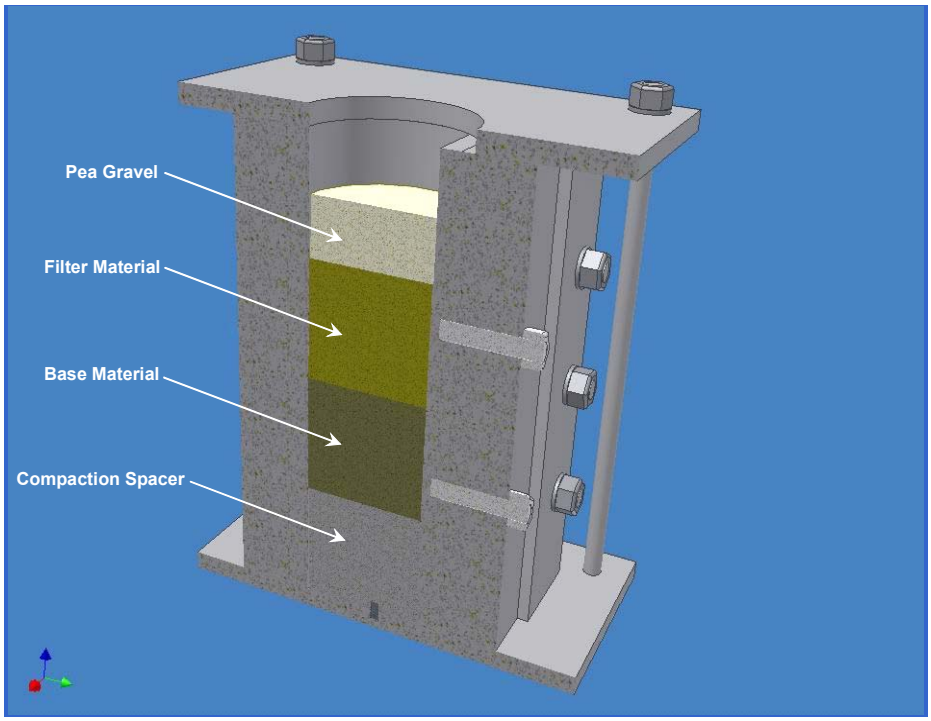


Figure A.14 Step 14 (compact pea gravel)

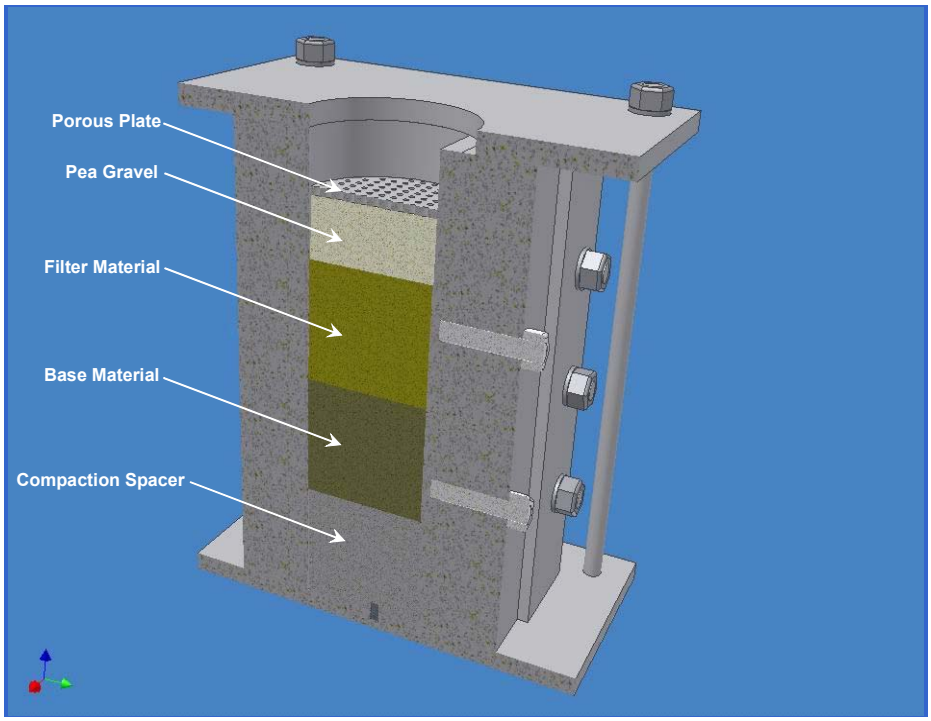


Figure A.15 Step 15 (install porous plate)

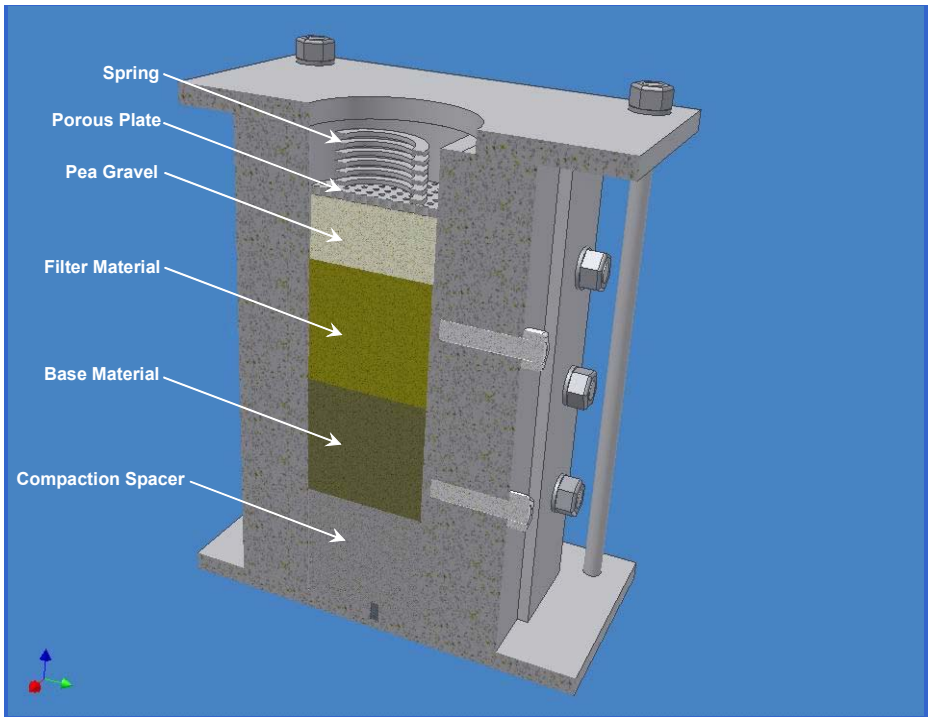


Figure A.16 Step 16 (install spring)

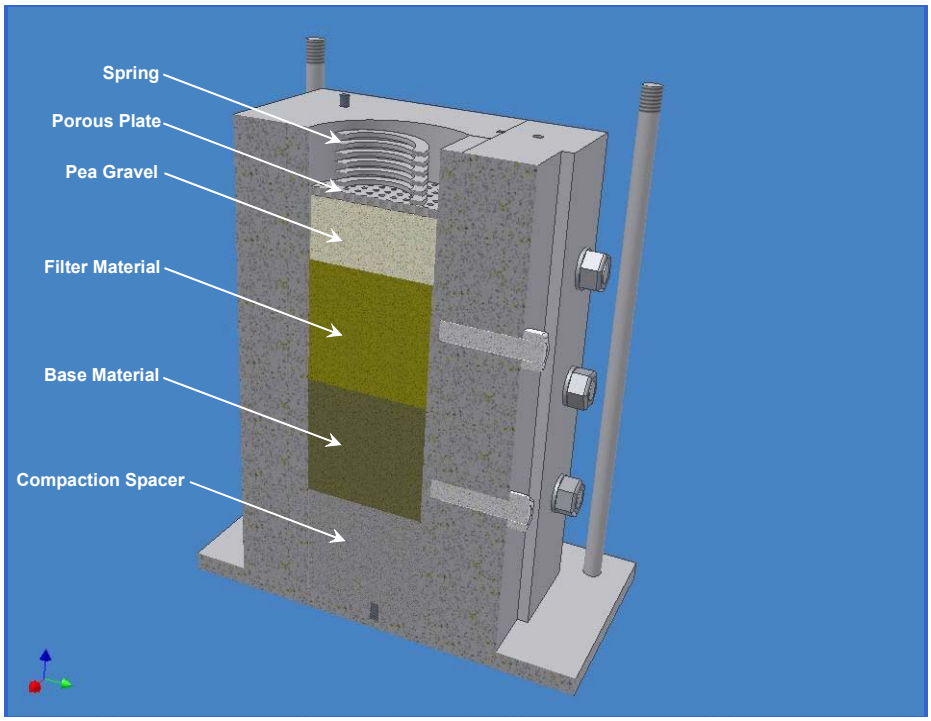


Figure A.17 Step 17 (remove the top plate)

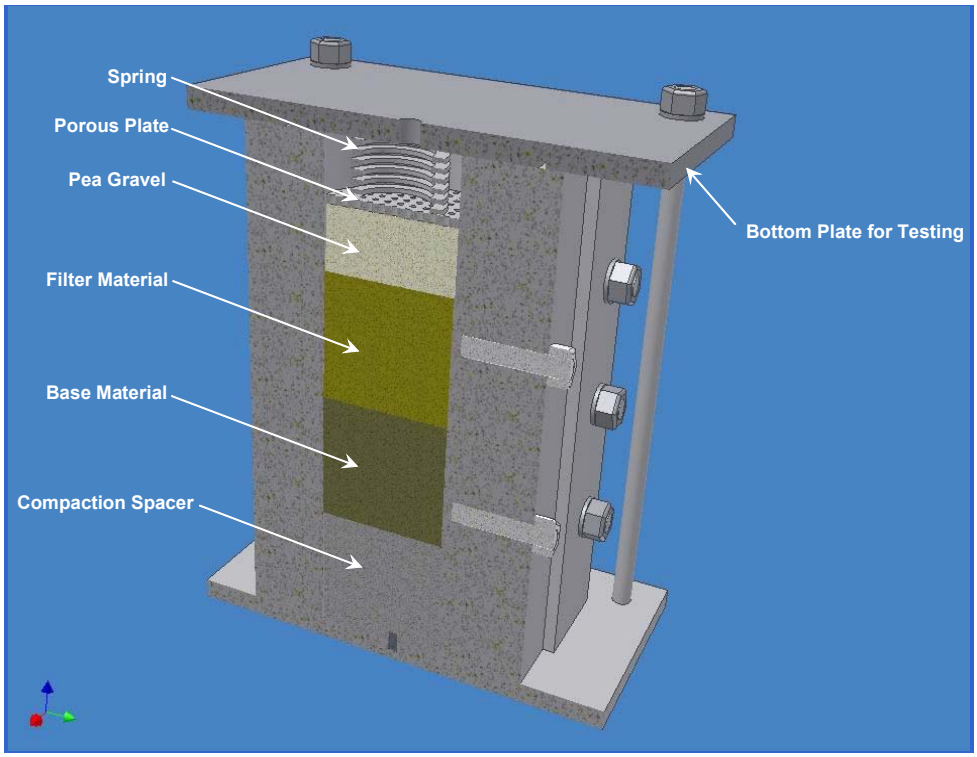


Figure A.18 Step 18 (assemble the bottom plate for testing)

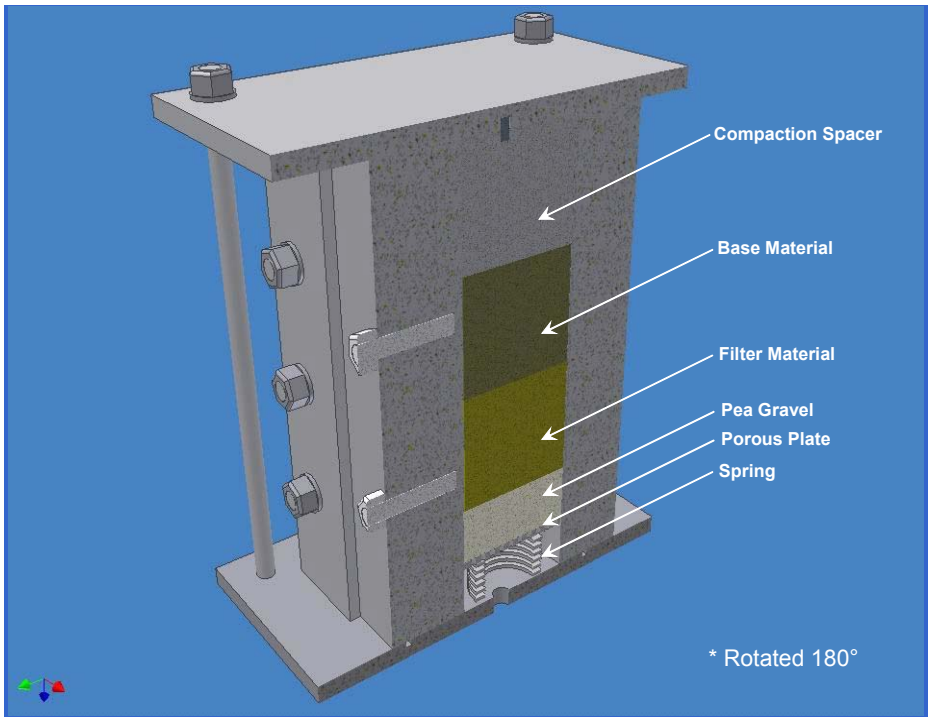


Figure A.19 Step 19 (rotate 180 degree)

Step 20 shows the plate removed from what is now the upper end of the specimen and the compaction spacer still in place. In Step 21 the compaction spacer has been removed and in Step 22 pea gravel has been compacted against the base coarse material. In Step 23, a porous plate has been placed on top of the compacted pea gravel, and in Step 24 a spring has been placed on top of the porous plate to keep it in snug contact with the underlying pea gravel.

In Step 25, an end plate called the top plate for testing has been bolted onto the device using the tie rods. Step 26 shows the apparatus rotated through 90 degrees and Step 27 shows the side plate used during compaction having been removed. The void that was formed by the spacer plate during compaction is revealed when this side plate is removed. In Step 28 the side plate used during compaction has been replaced by a Lucite side panel. The purpose of this Lucite panel is to make it possible to monitor the progress of erosion and clogging during the test. Step shows the Lucite panel bolted into place and ready for testing. Step 30 shows the composite specimen after compaction and assembly, with the specimen rotated so that the crack plane (void plane) is vertical.

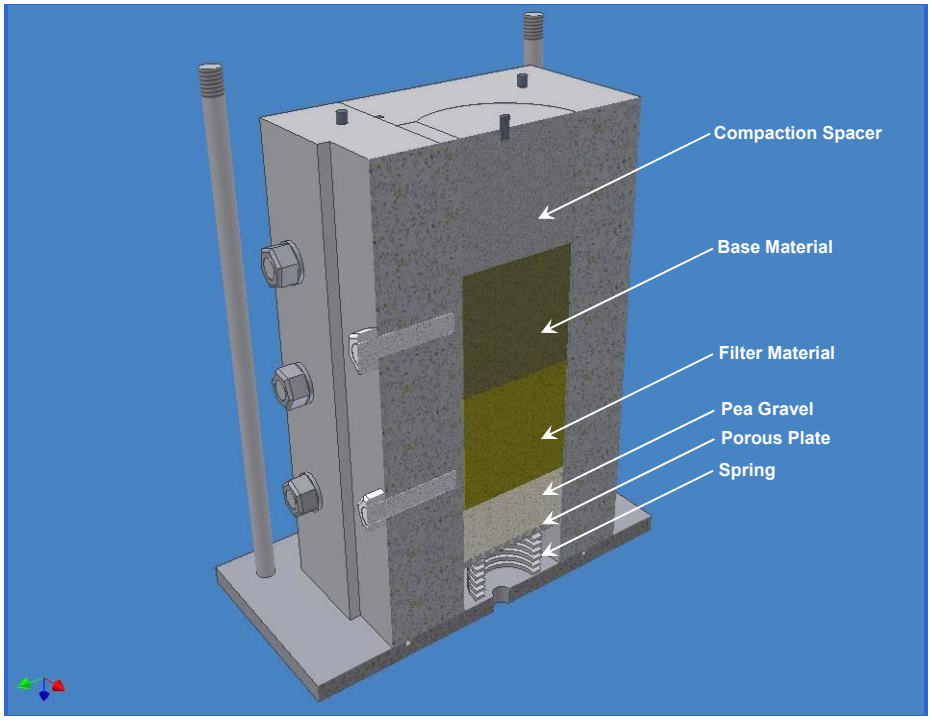


Figure A.20 Step 20 (remove the bottom plate)

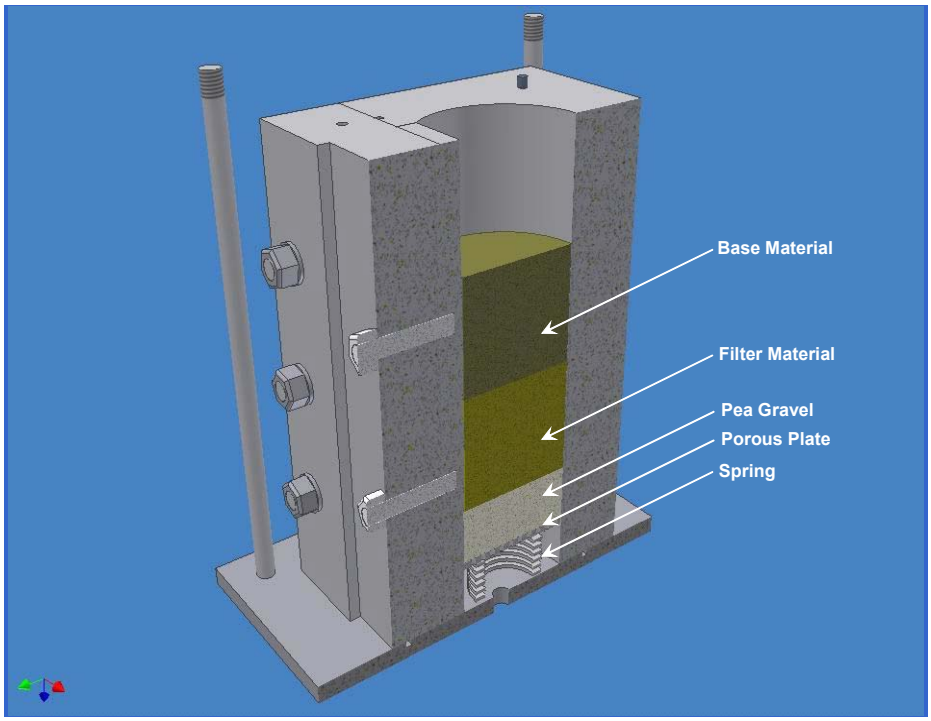


Figure A.21 Step 21 (remove the compaction spacer)

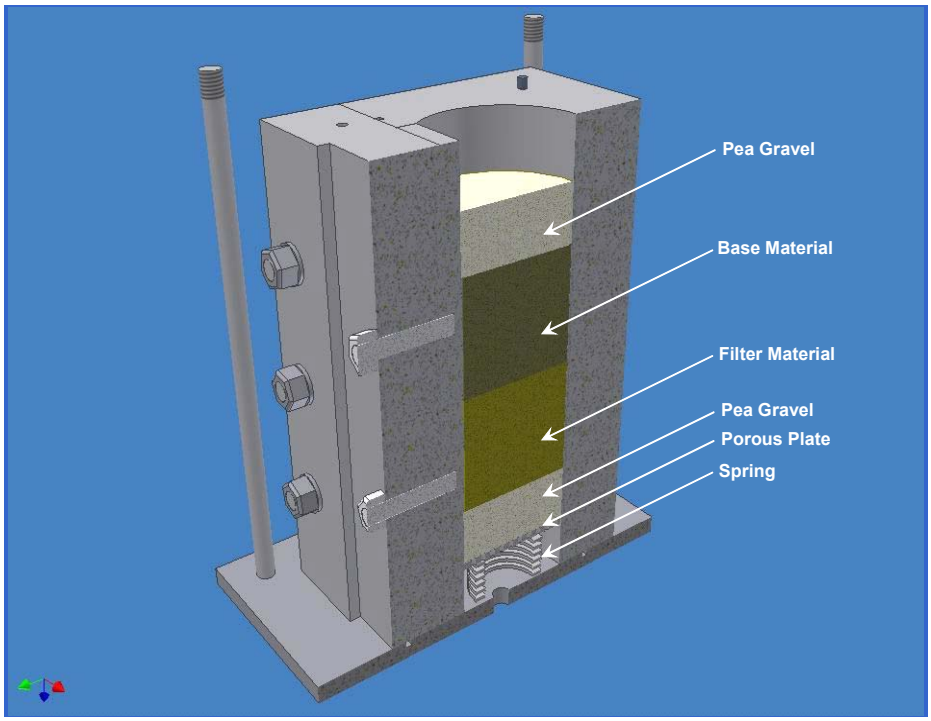


Figure A.22 Step 22 (install pea gravel)

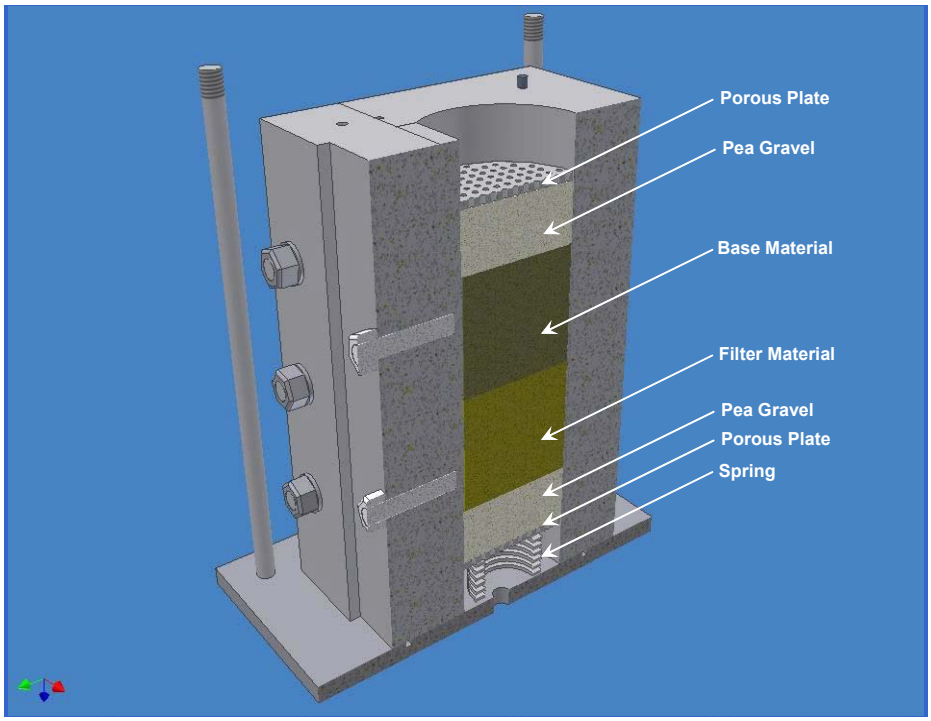


Figure A.23 Step 23 (install the porous plate)

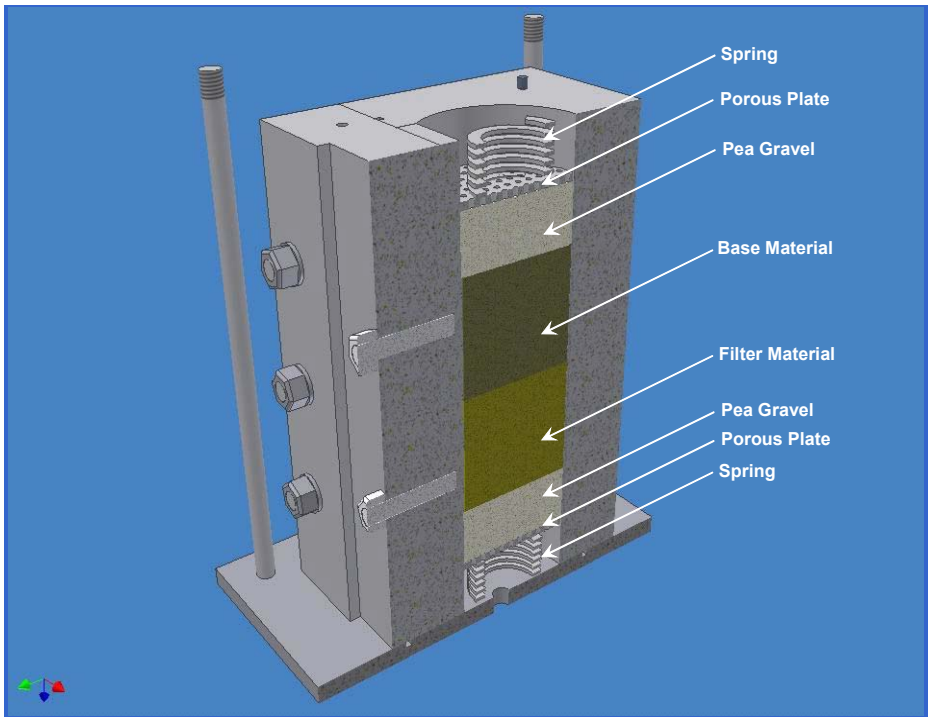


Figure A.24 Step 24 (install the spring)

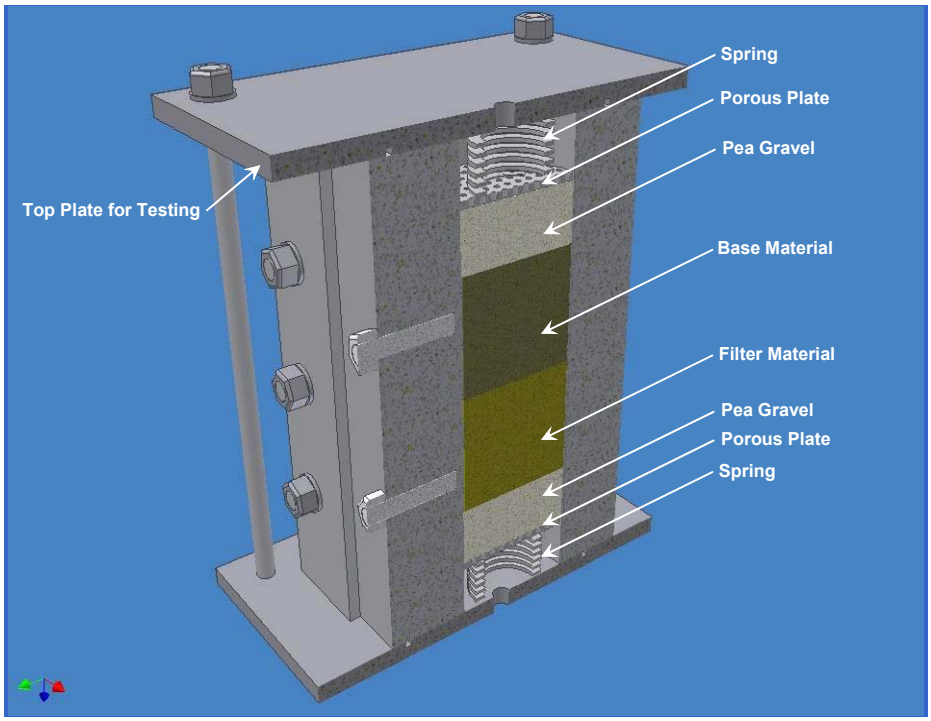


Figure A.25 Step 25 (install the top plate for testing)

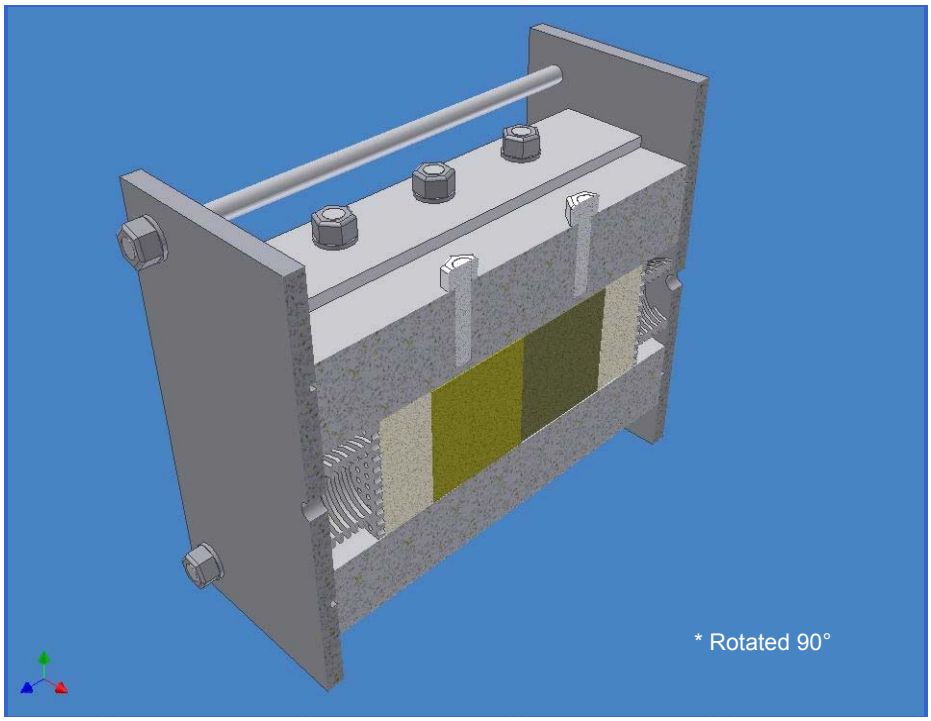


Figure A.26 Test 26 (rotate 90 degree)

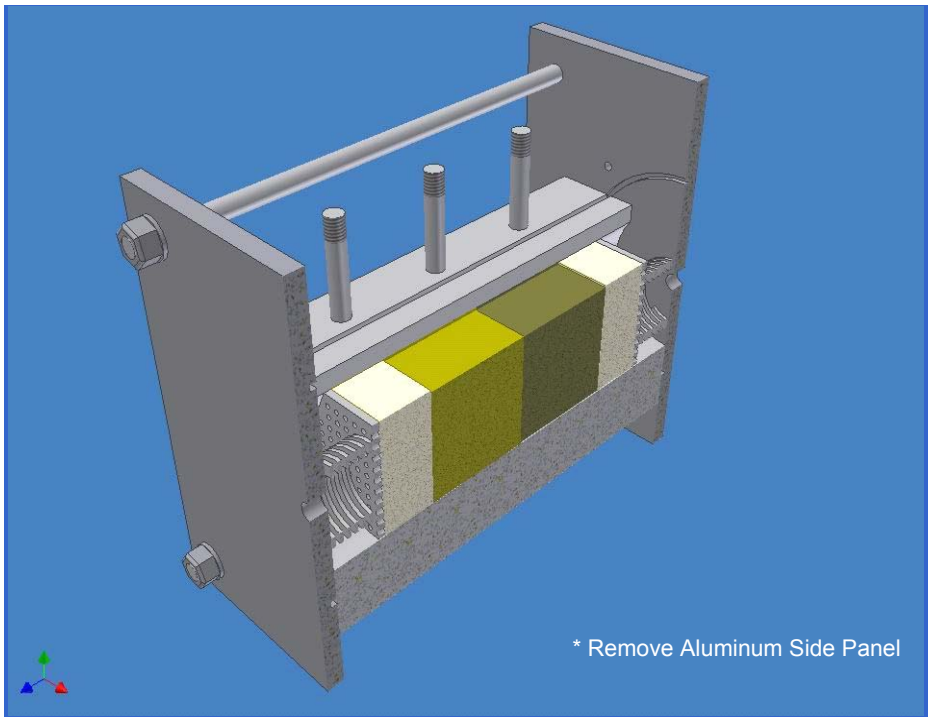


Figure A.27 Step 27 (remove the aluminum side panel)

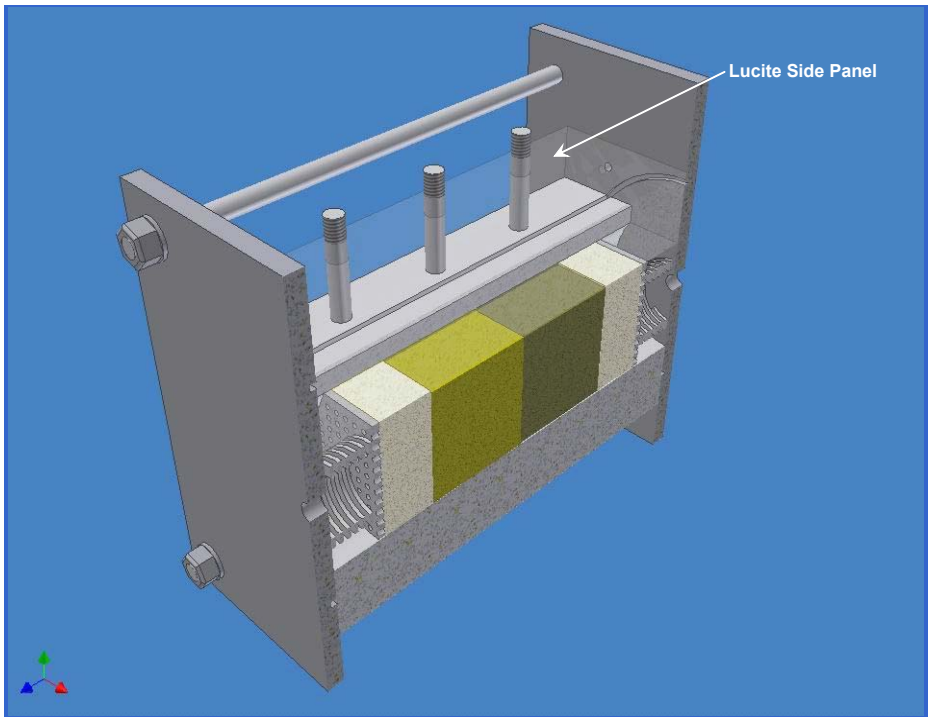


Figure A.28 Step 28 (place the Lucite side panel)

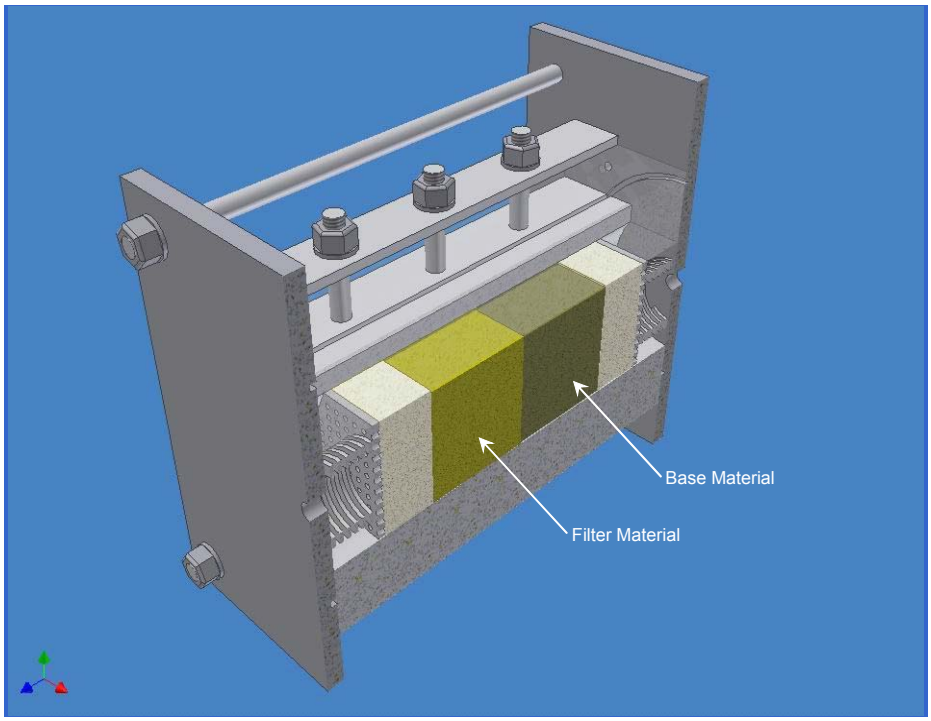


Figure A.29 Step 29 (secure the Lucite side panel)

A.2. Shop Drawings for the 4-inch diameter filter test device

The shop drawings for the 4-inch diameter filter test device are shown in Figure A.30 through Figure A.38. All of parts were aluminum except for the Lucite side panel shown in Figure A.33.

Aluminum Base

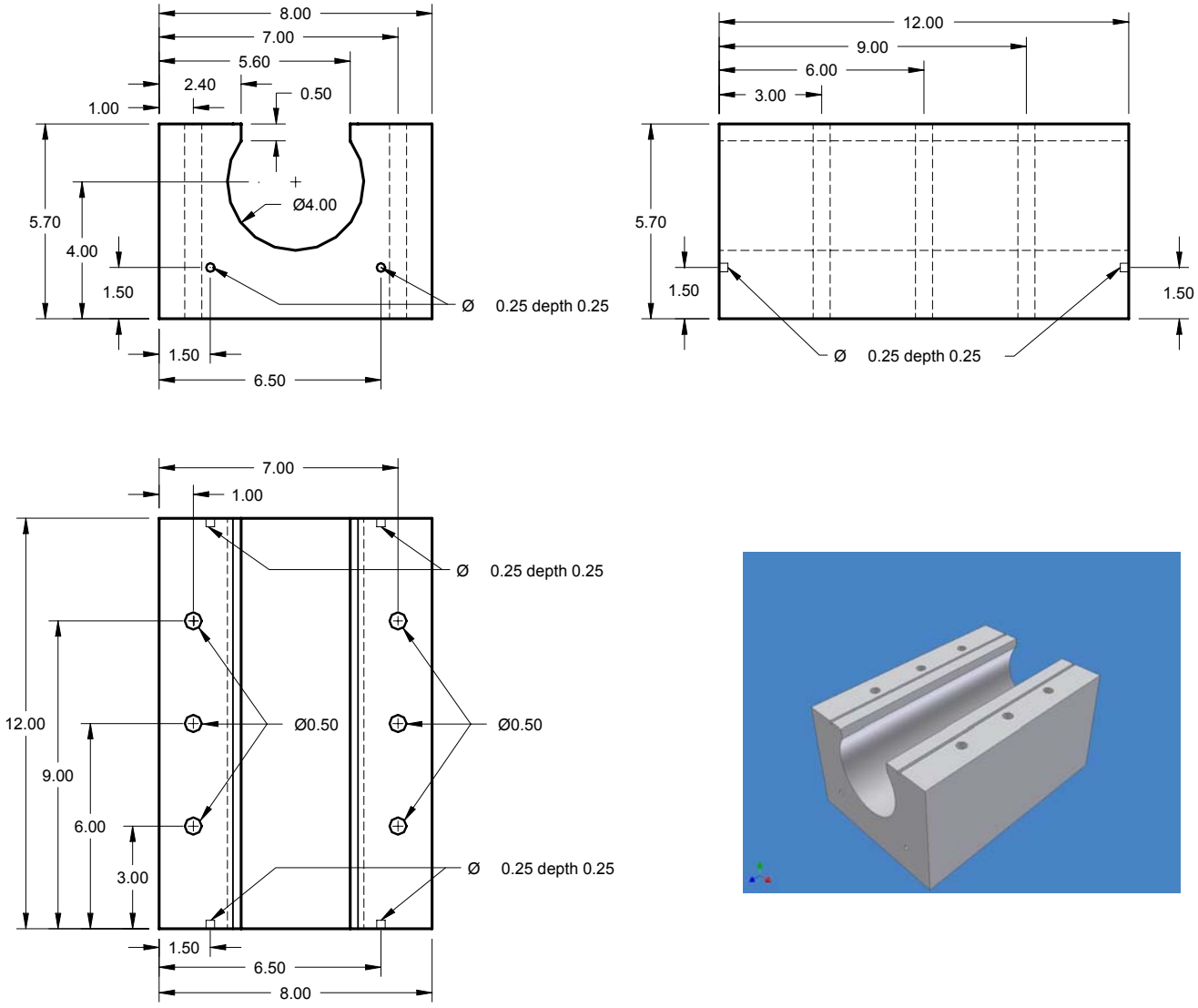


Figure A.30 Aluminum base

Aluminum Side Panel (for Compaction)

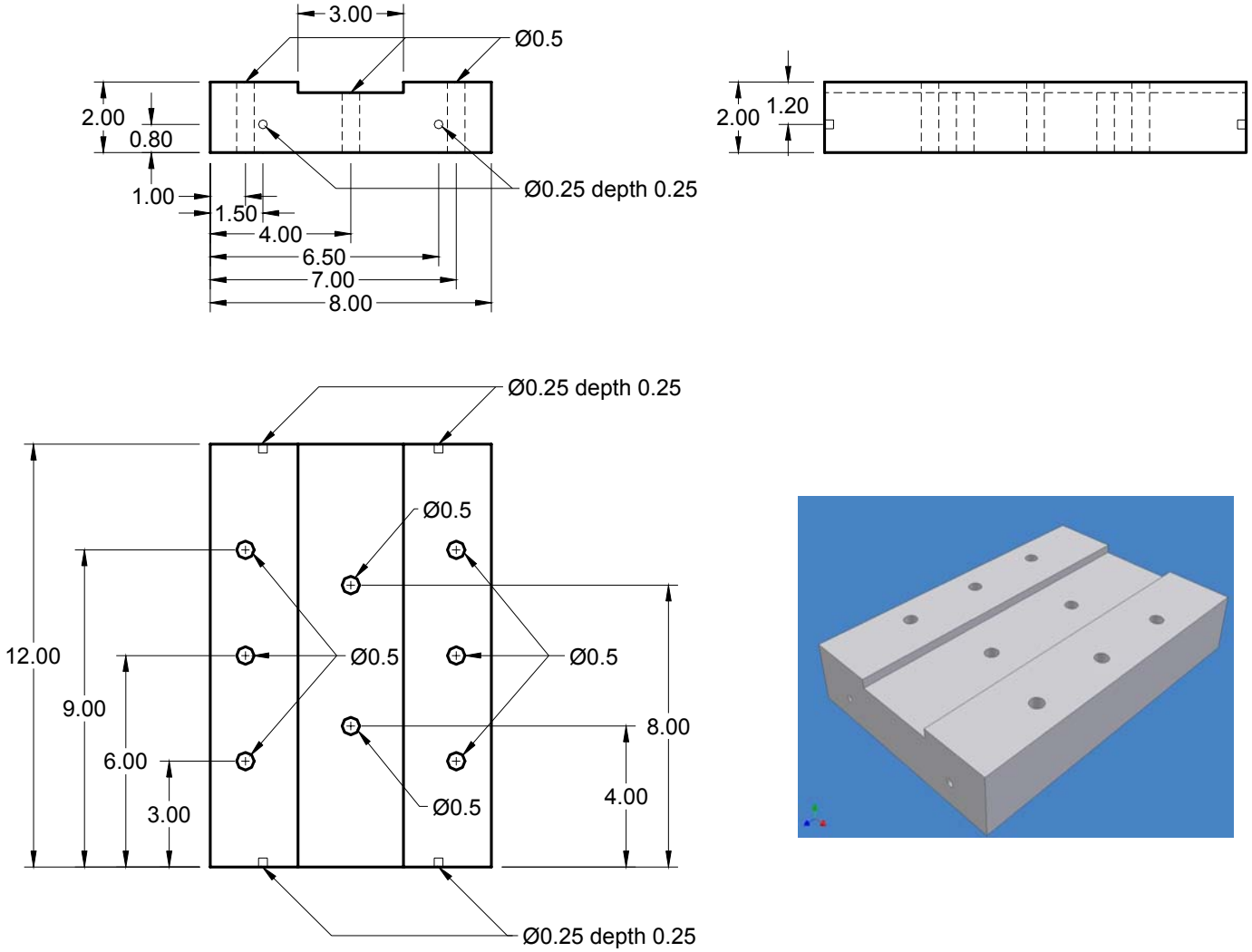
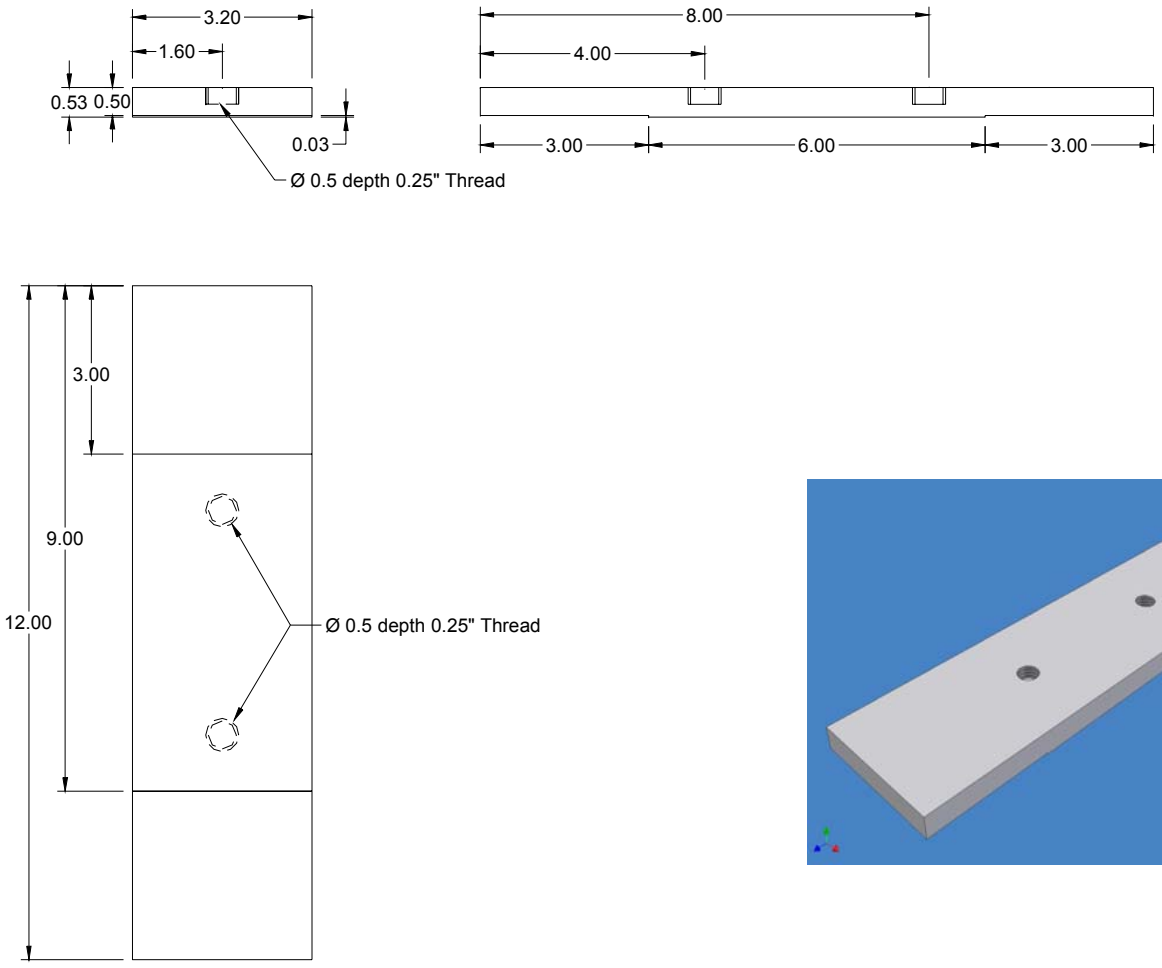


Figure A.31 Aluminum side panel for compaction

Void-forming Plate



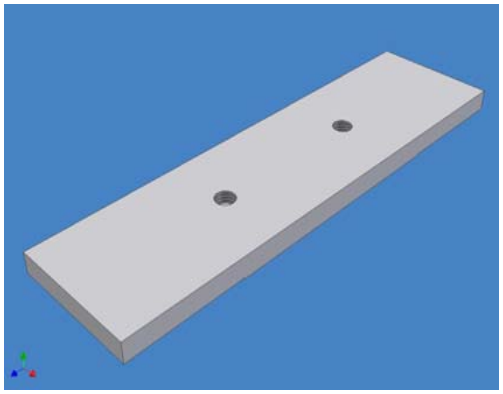


Figure A.32 Void-forming plate

Lucite Side Panel

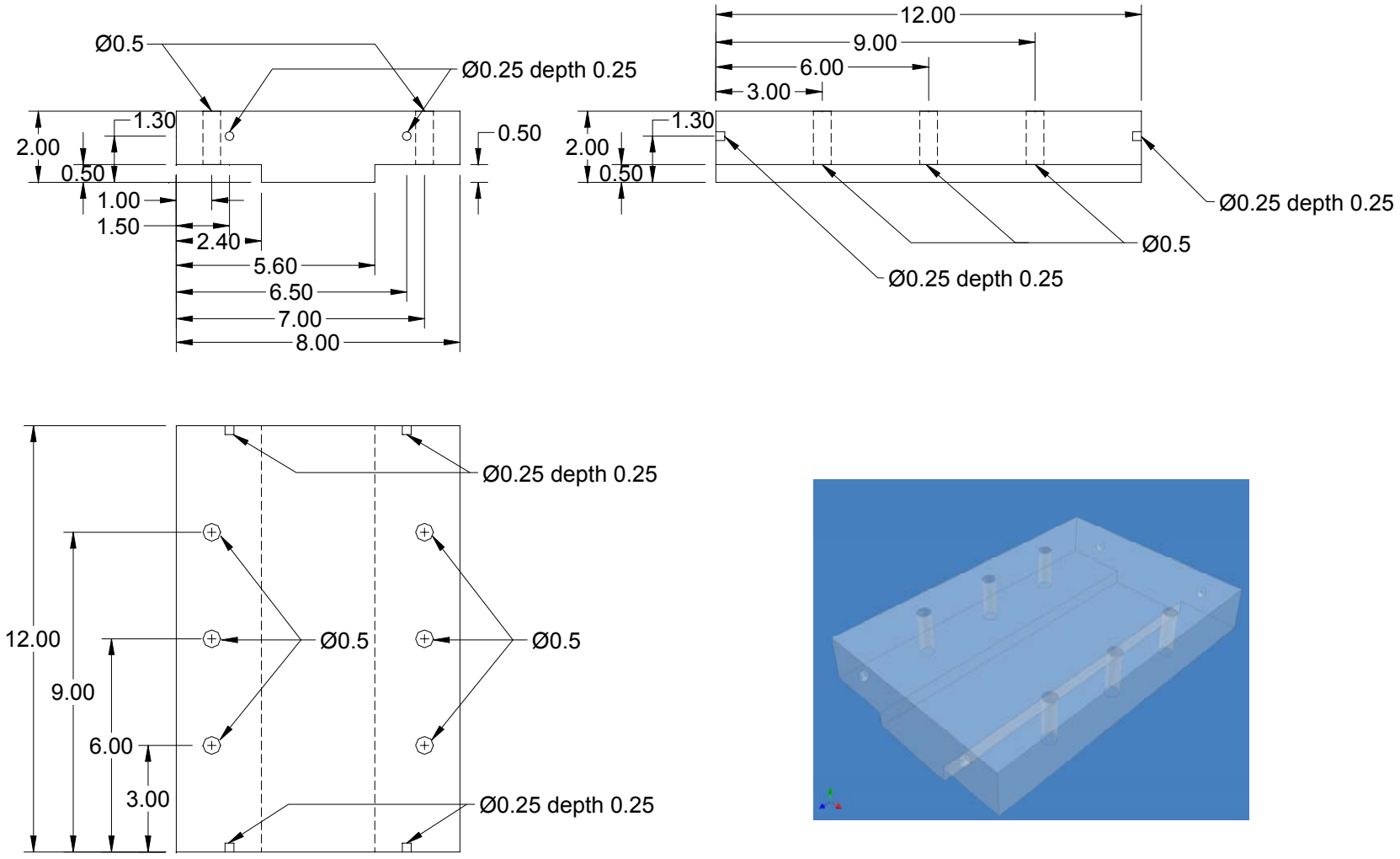


Figure A.33 Lucite side panel

Compaction Spacer

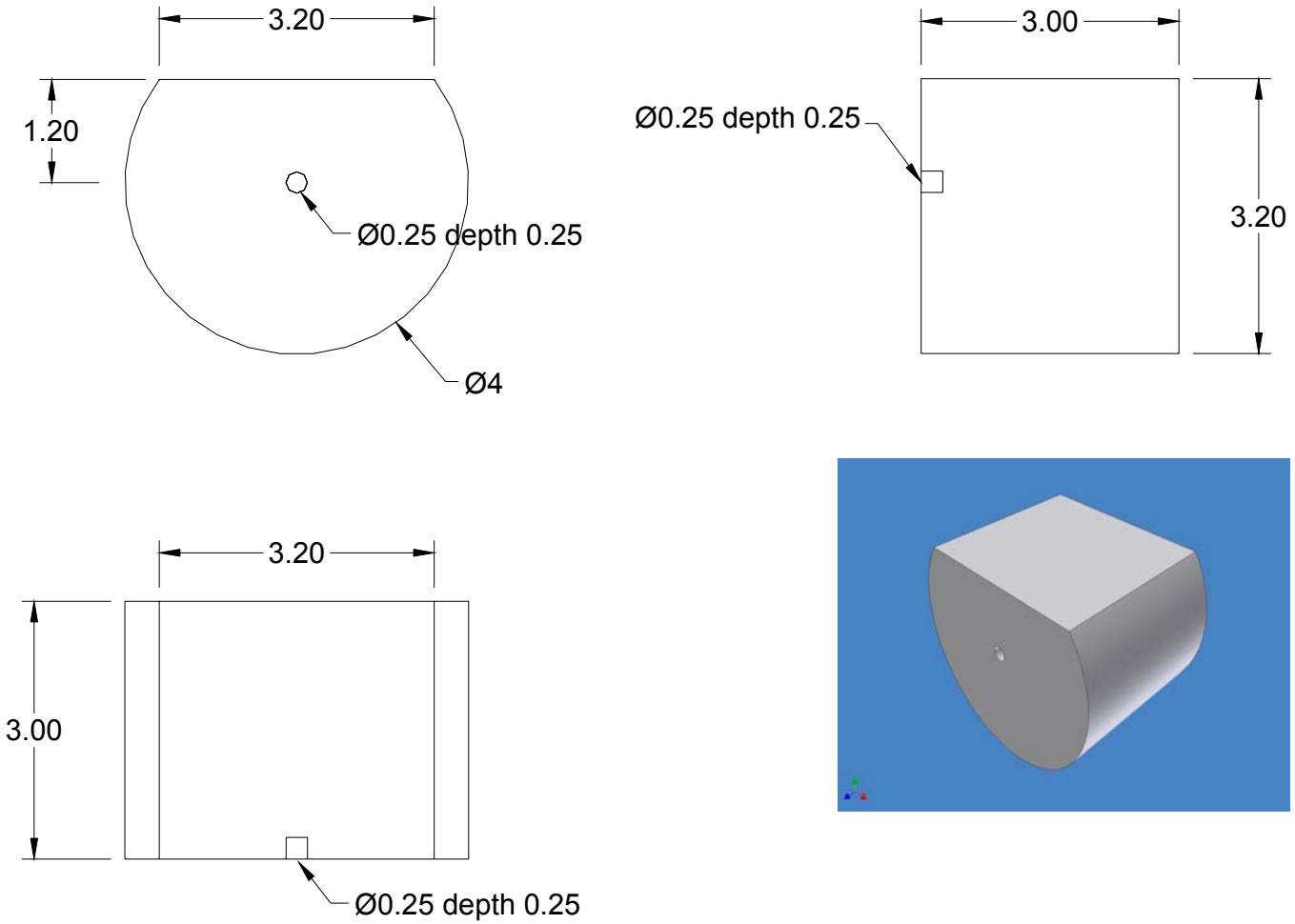


Figure A.34 Compaction spacer

Bottom Plate for Compaction

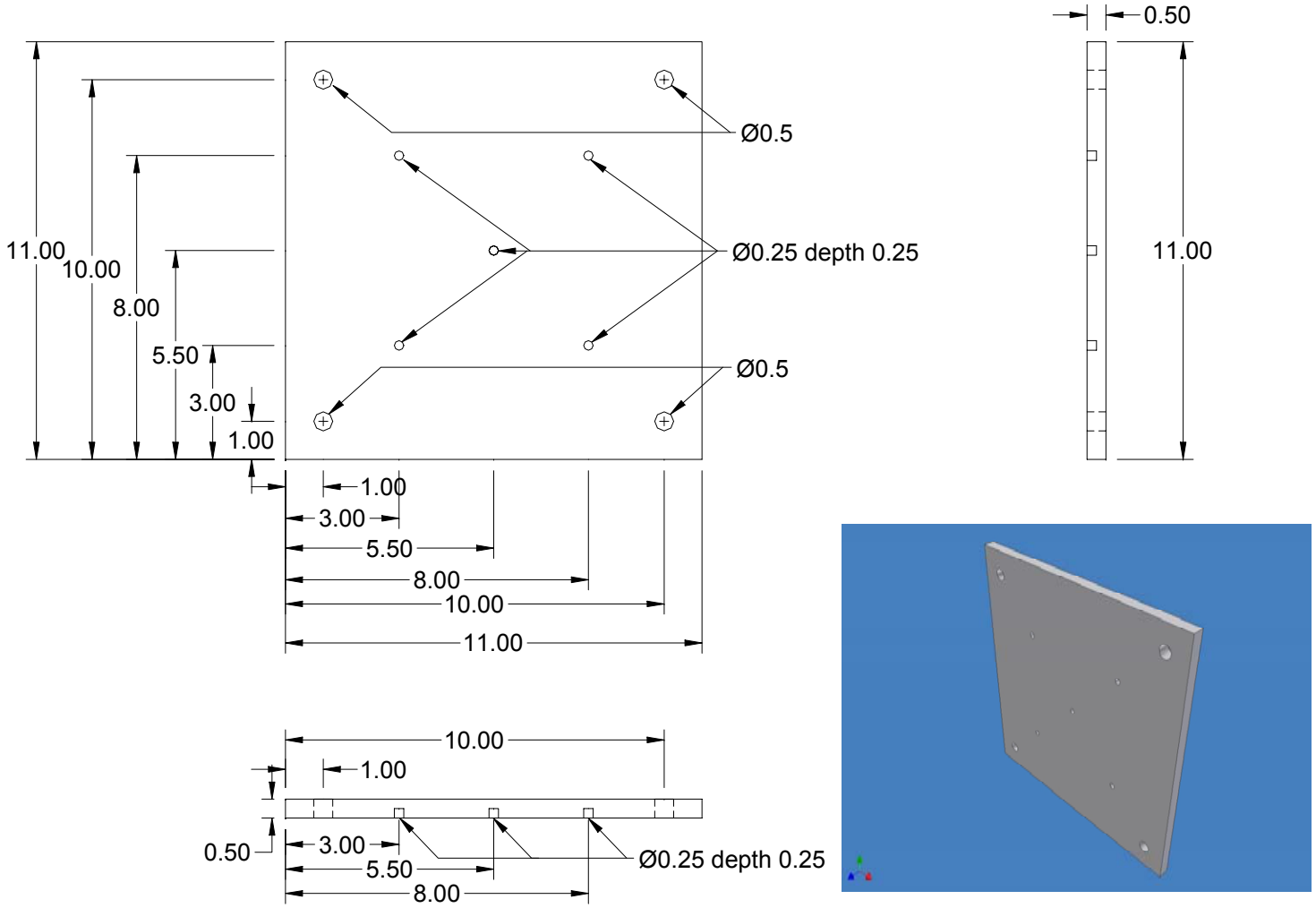
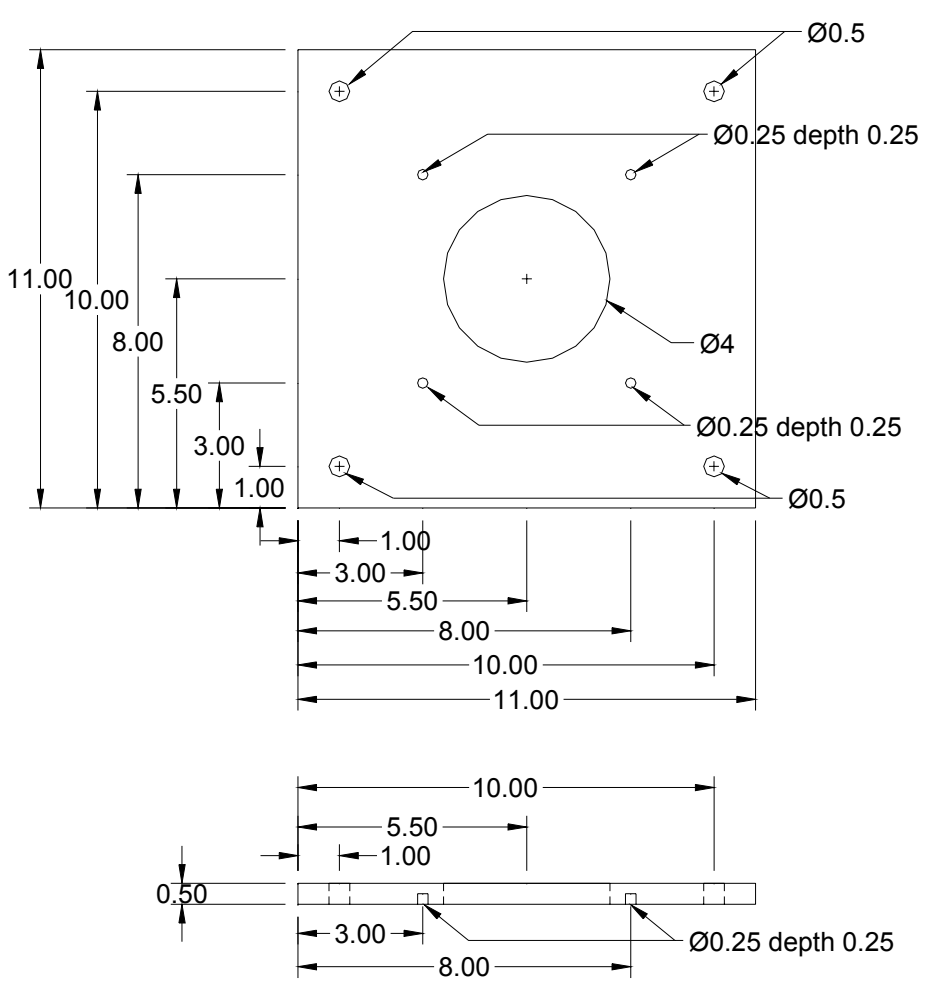
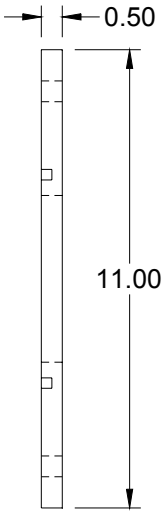


Figure A.35 Bottom plate for compaction

Top Plate for Compaction





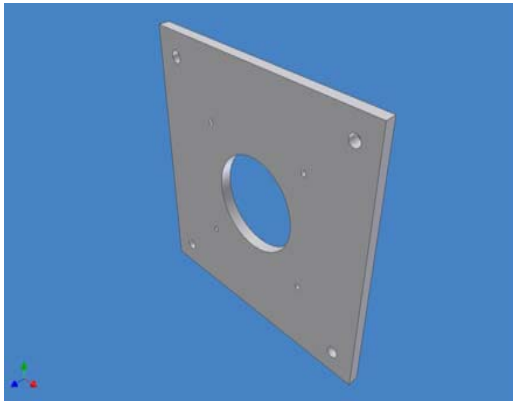


Figure A.36 Top plate for compaction

Top and Bottom Plate for Testing

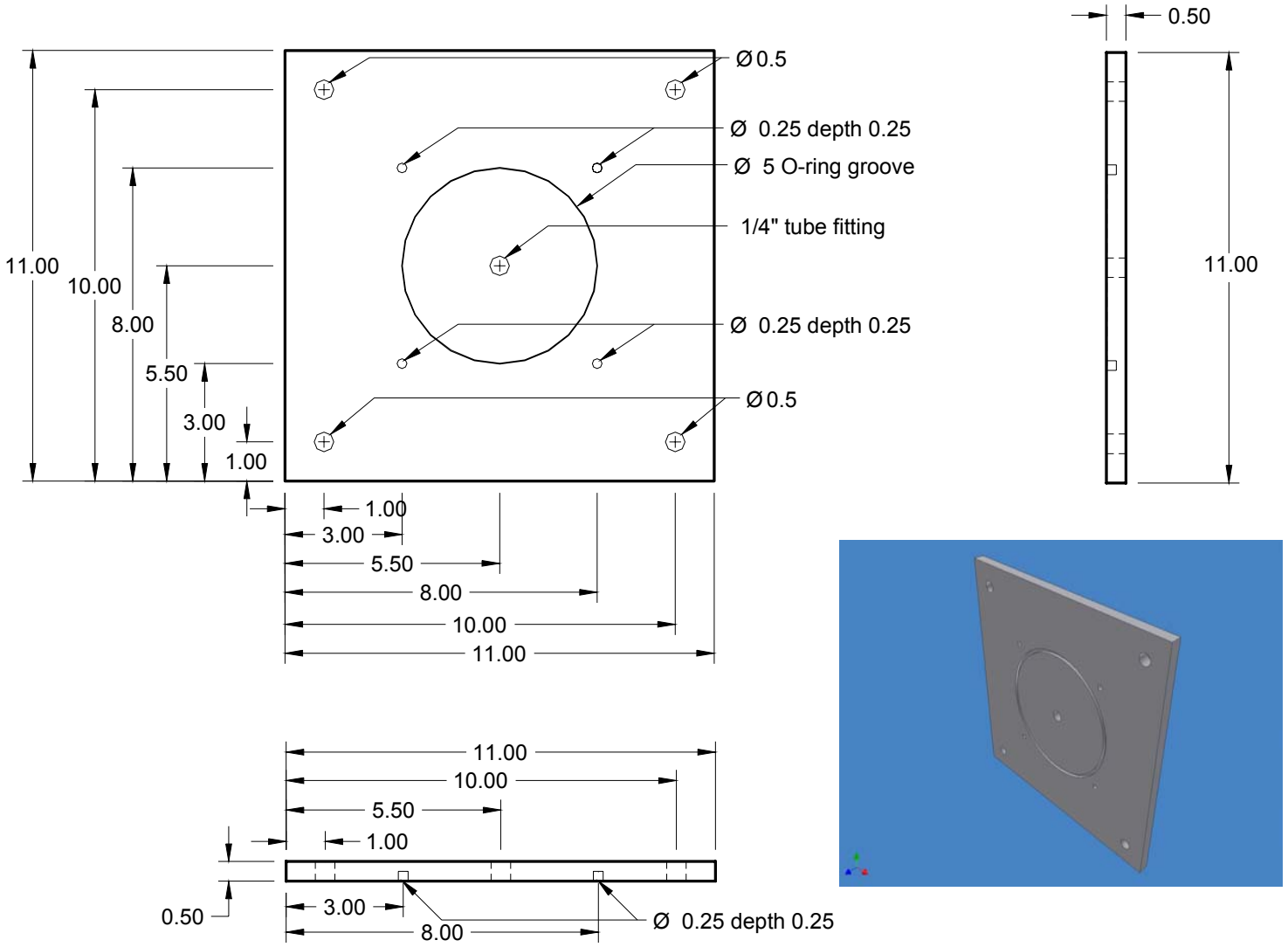


Figure A.37 Top and bottom plate for testing

Porous Plate

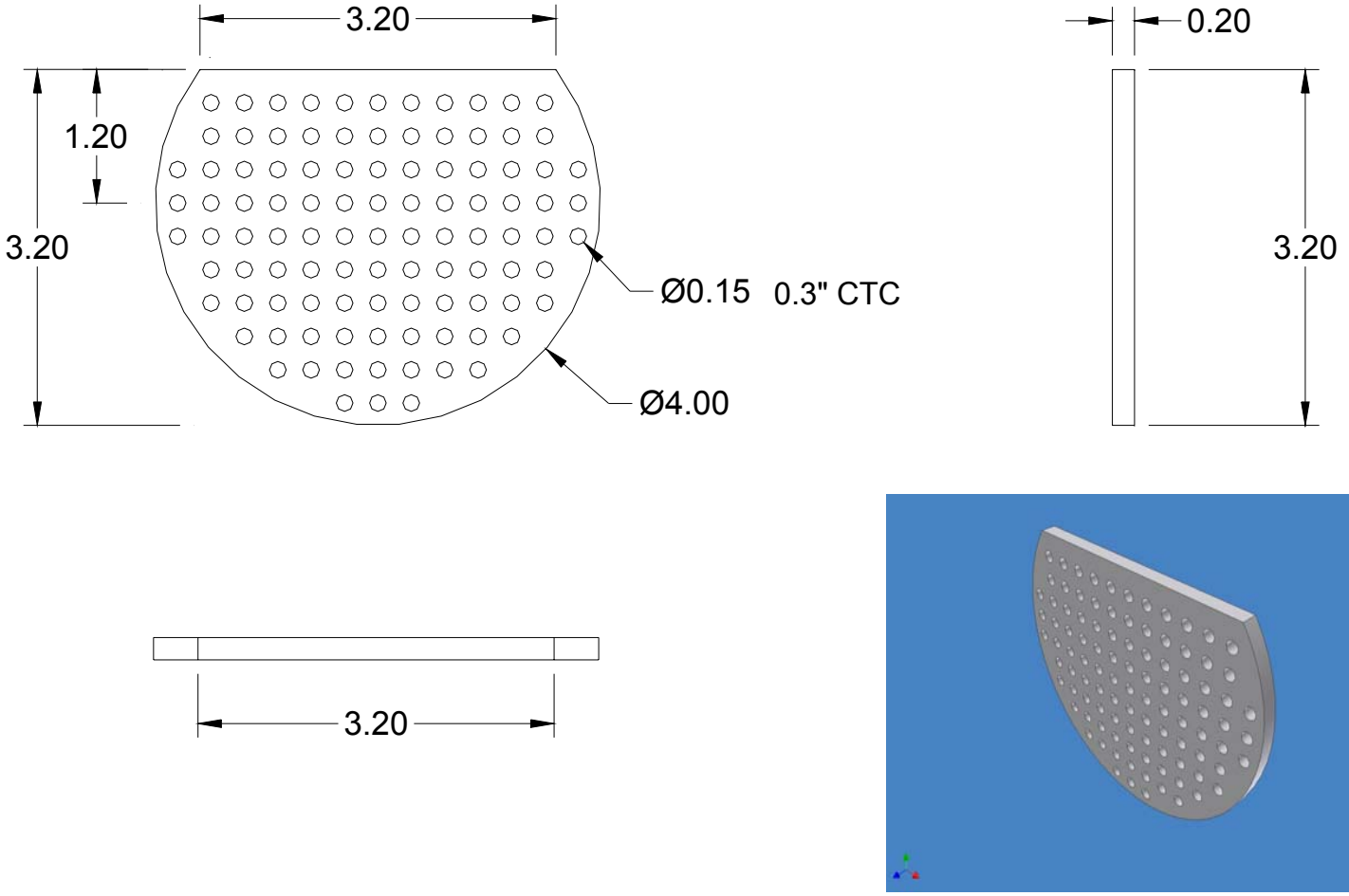


Figure A.38 Porous plate