



# Drum Set Assembly

ENGN 1740 Group Final

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# Table of Contents

Assembly model & drawings

Component models & drawings

Computer aided manufacturing instructions

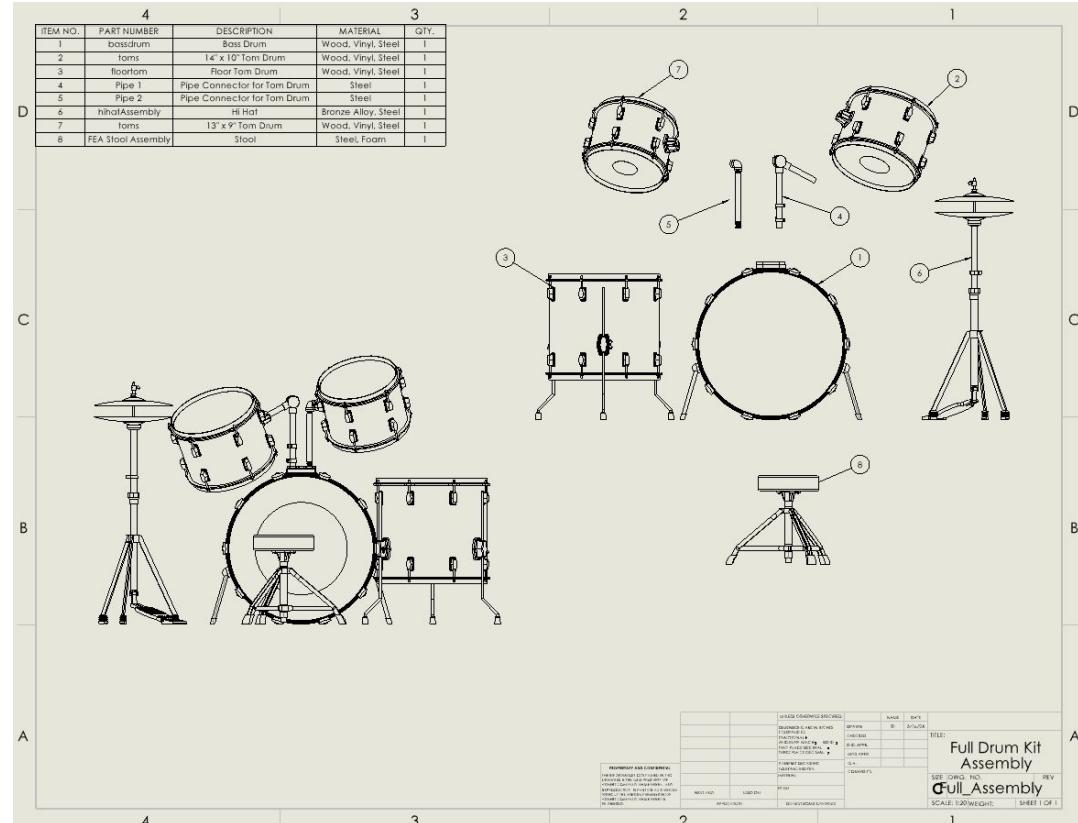
Tolerance analysis study

Motion analysis study

FEA analysis

# Full Assembly

# Full Assembly

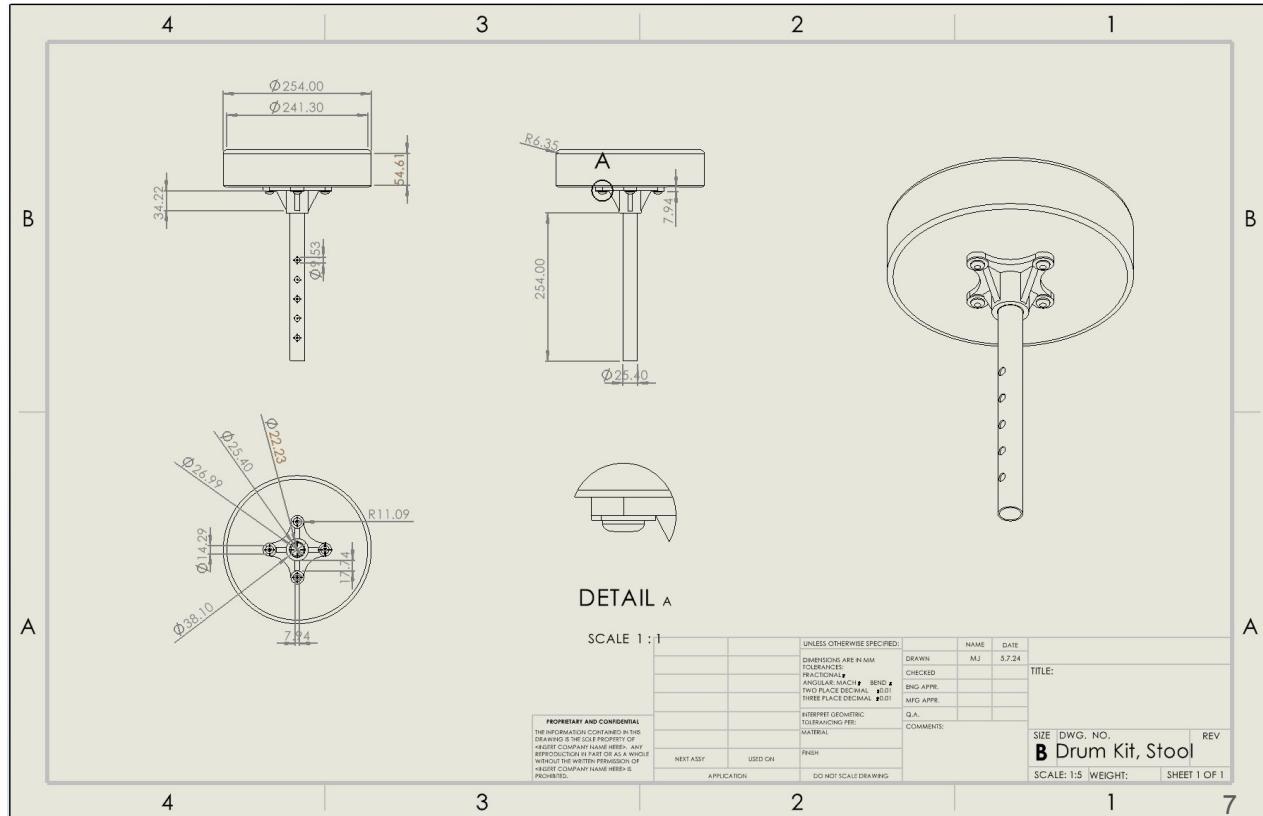
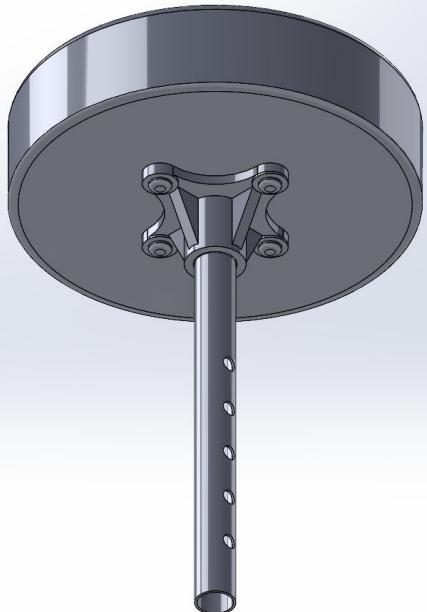


# Index of components & subassemblies

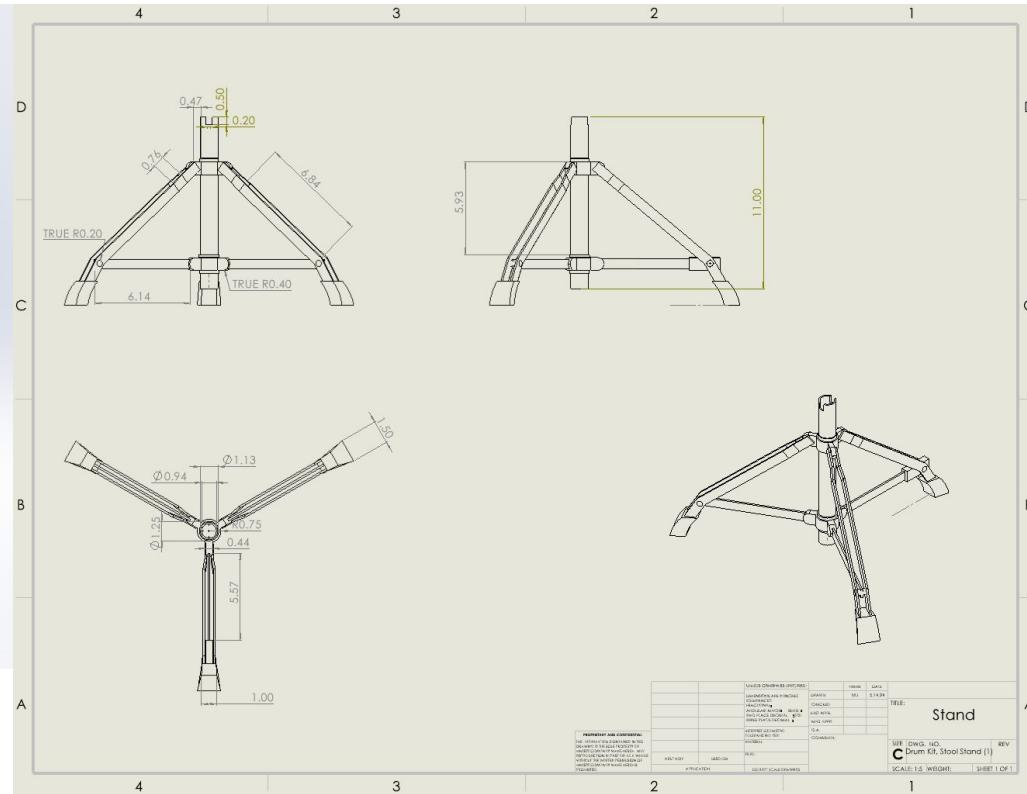
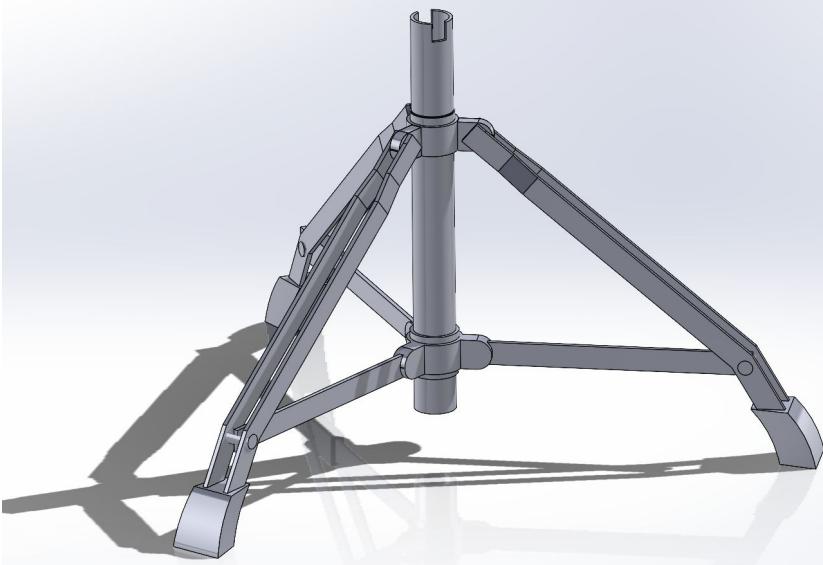
- Stool
- Hi-Hat
- 14" x 10" Tom-tom
- 13" x 9" Tom-tom
- Floor tom
- Bass drum
- Connectors & Hardware

# Stool

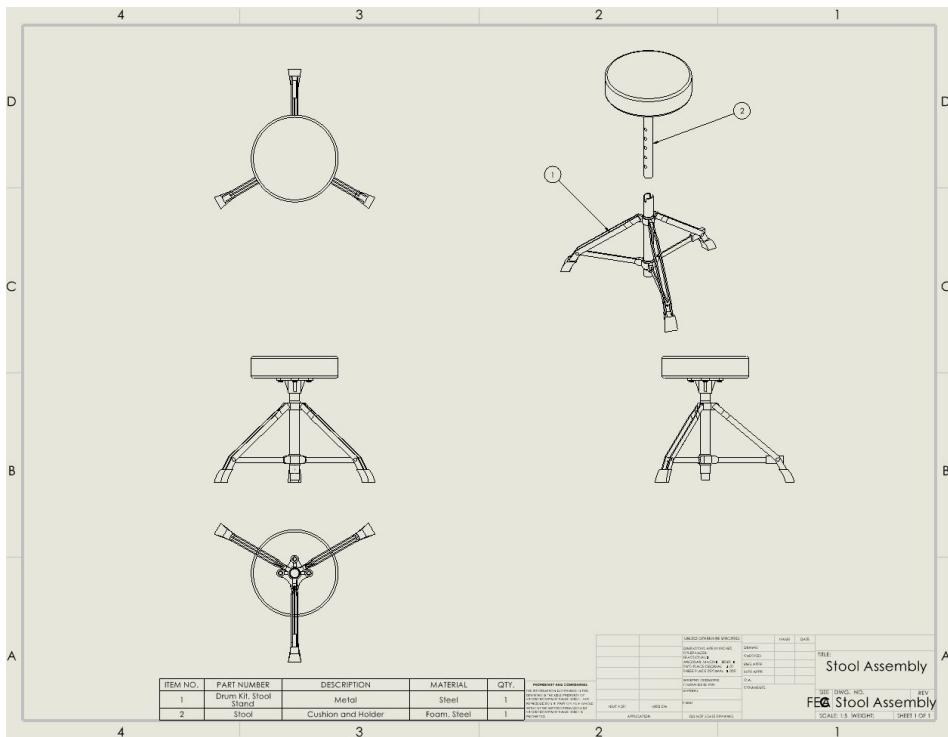
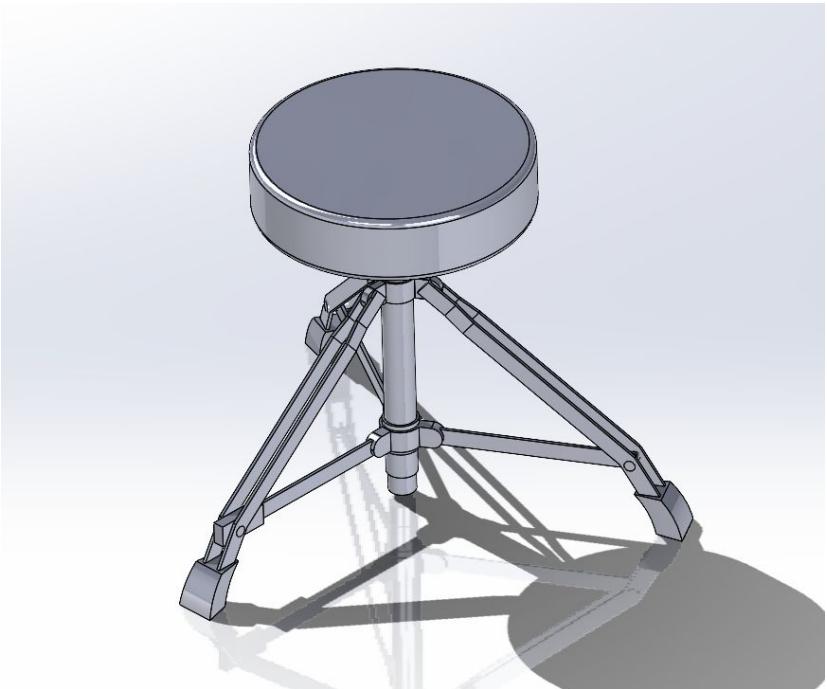
# Stool Seat



# Stool Stand

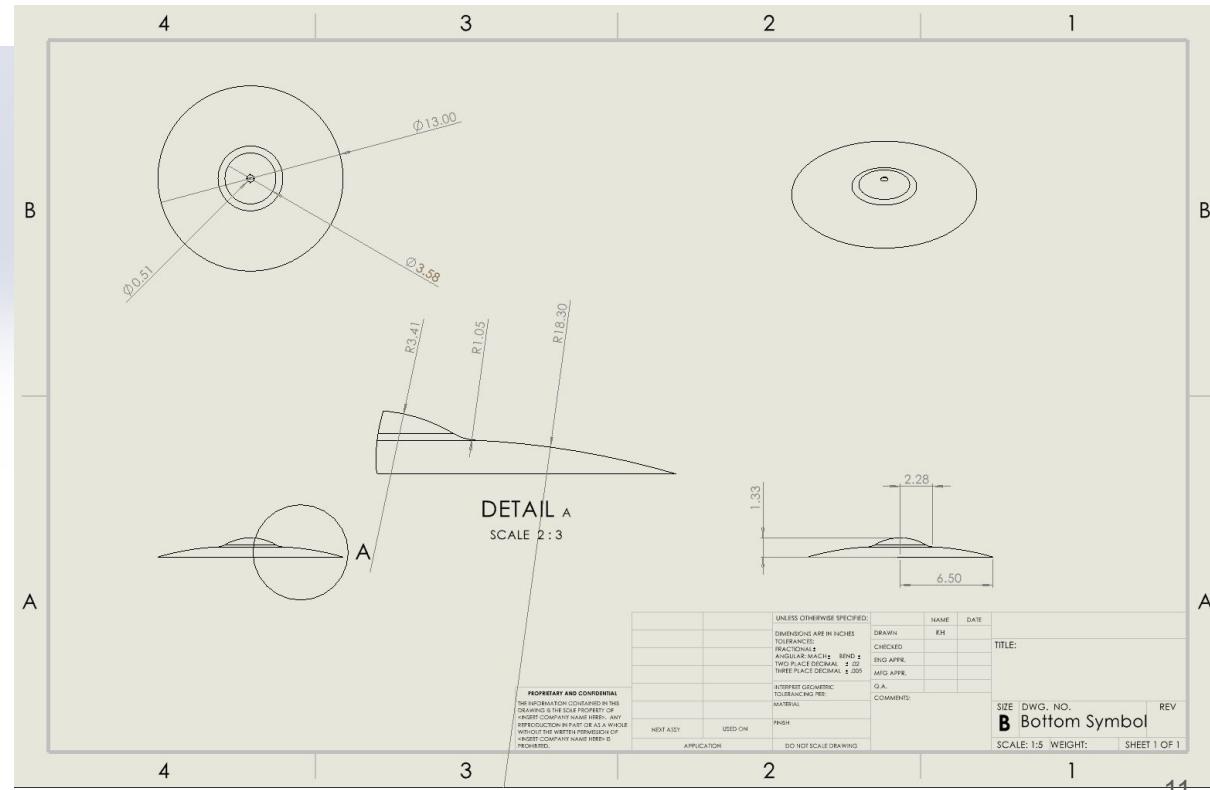
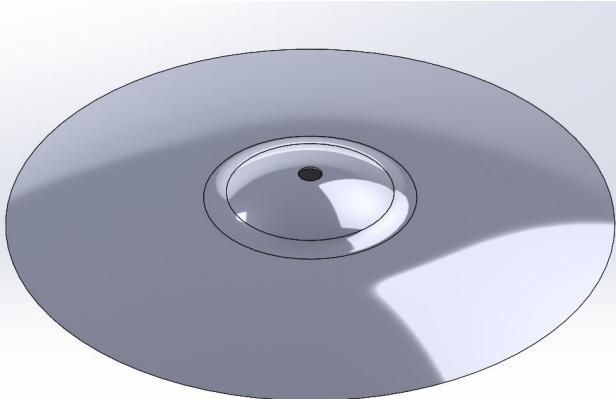


# Stool Assembly

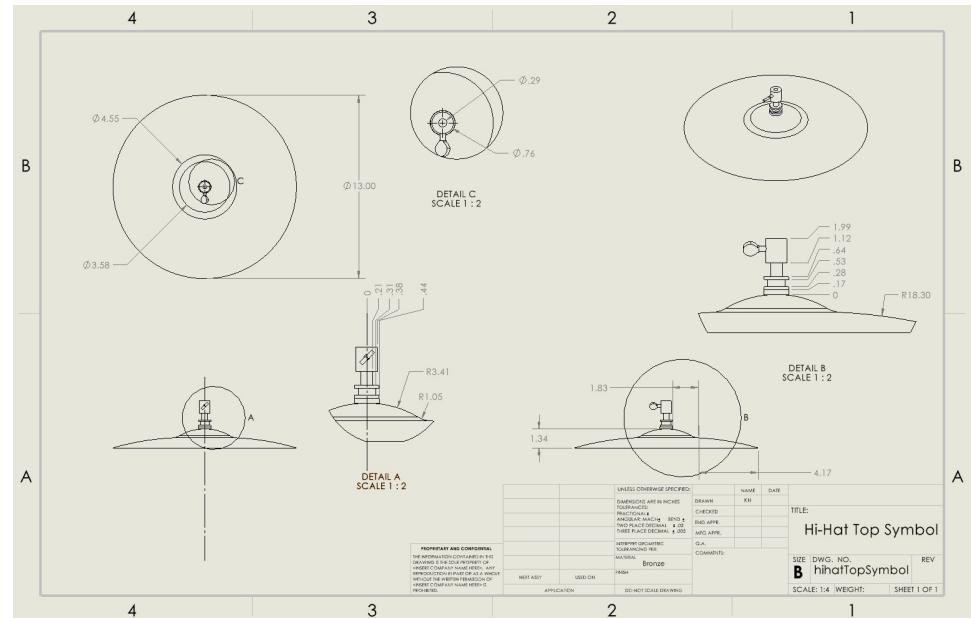
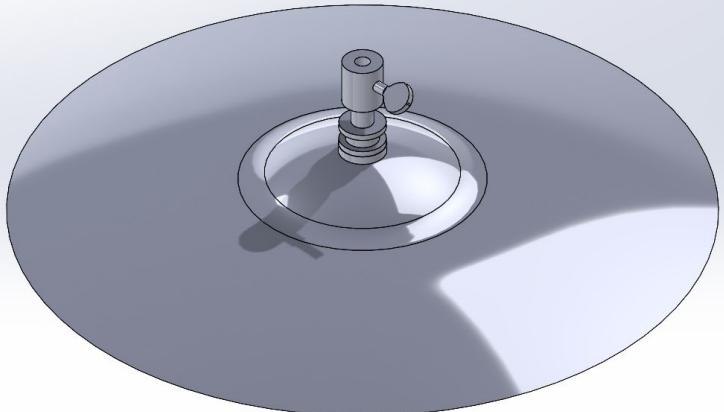


# Hi-Hat

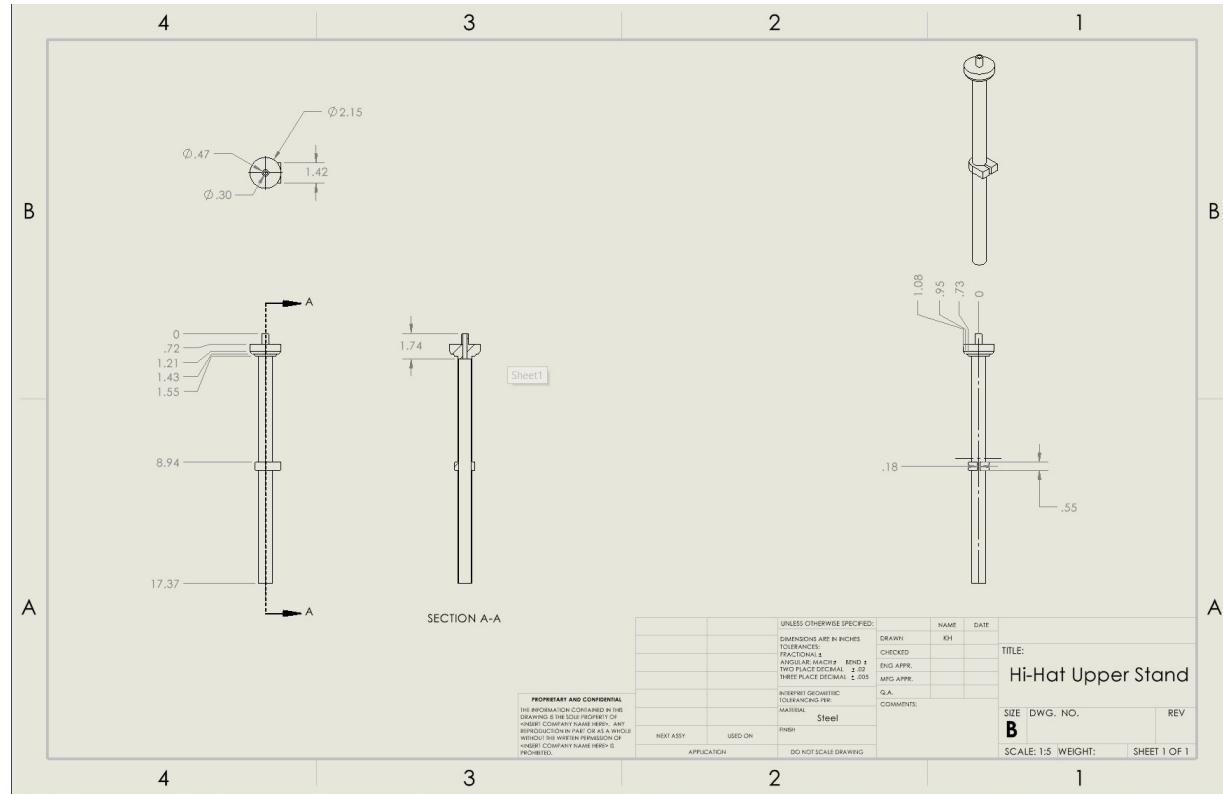
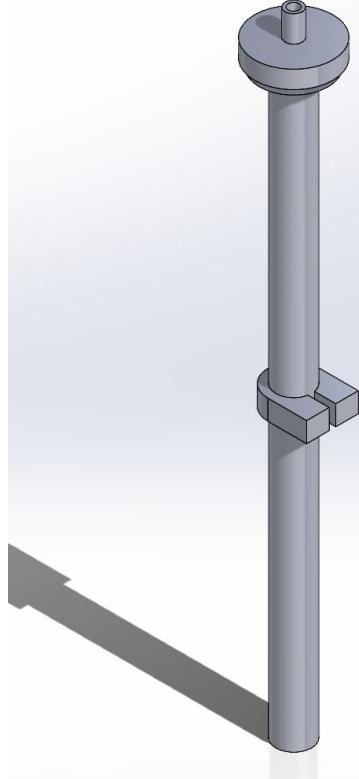
# Bottom Cymbal



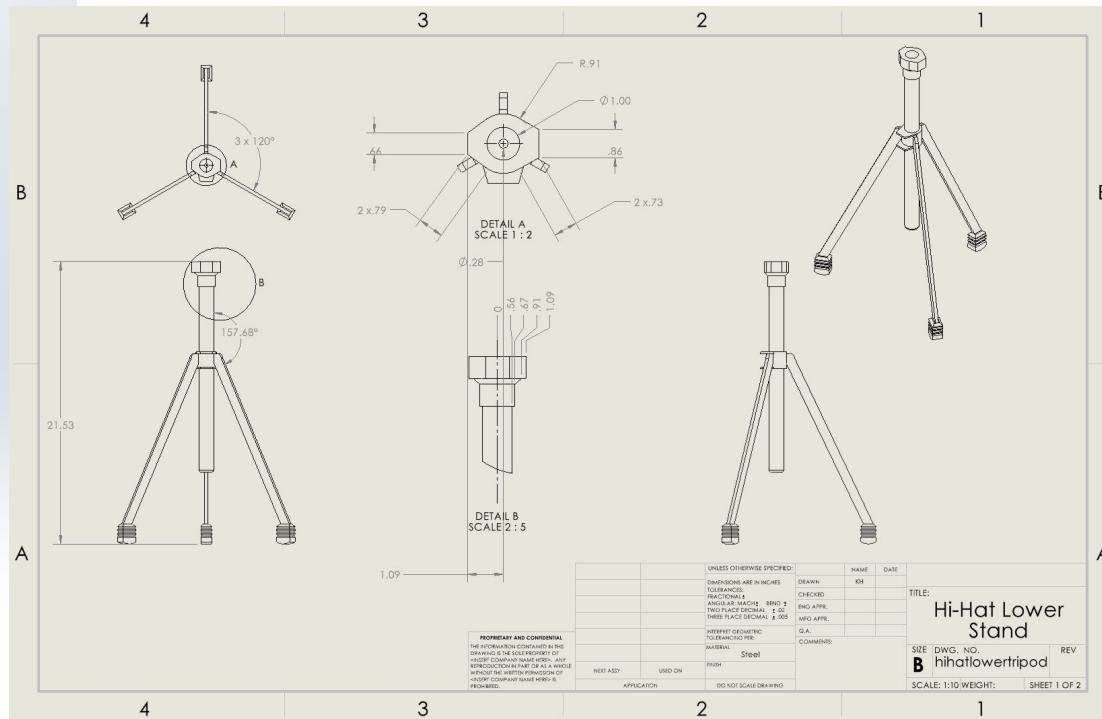
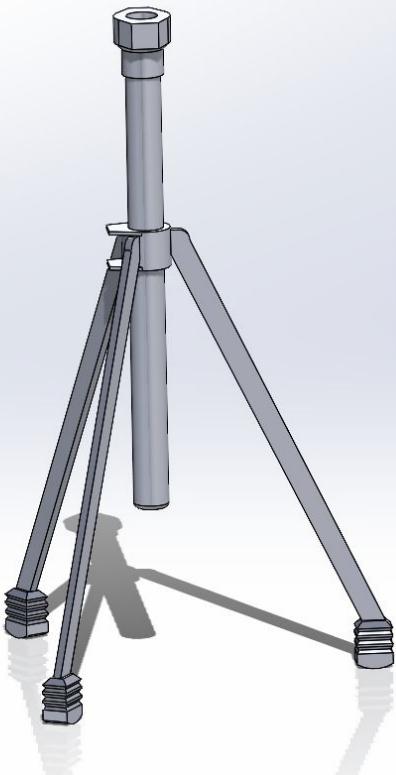
# Top Cymbal



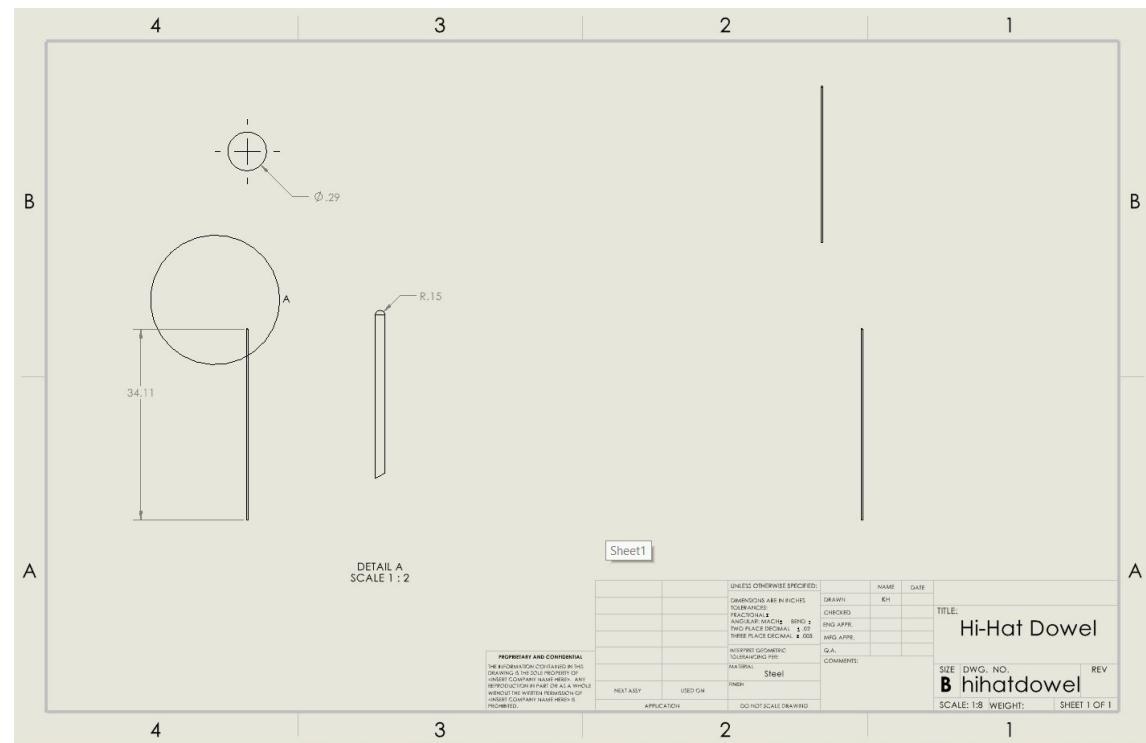
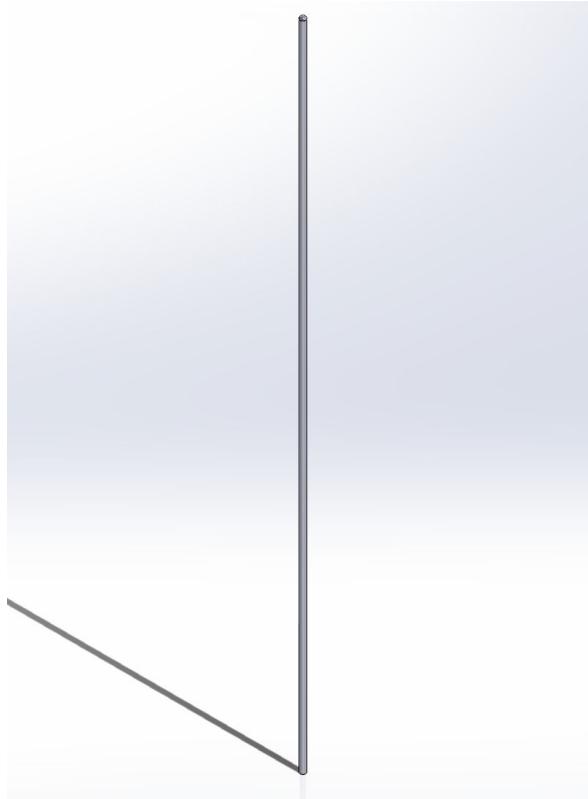
# Upper Stand



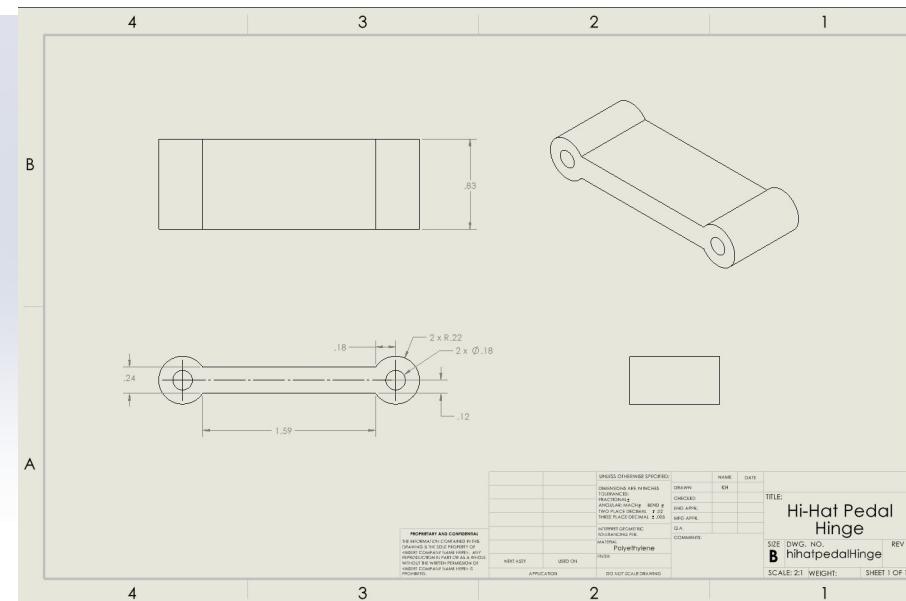
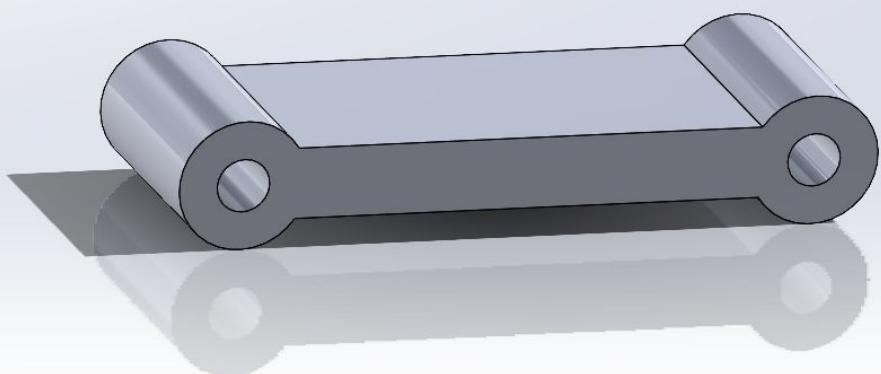
# Lower Stand



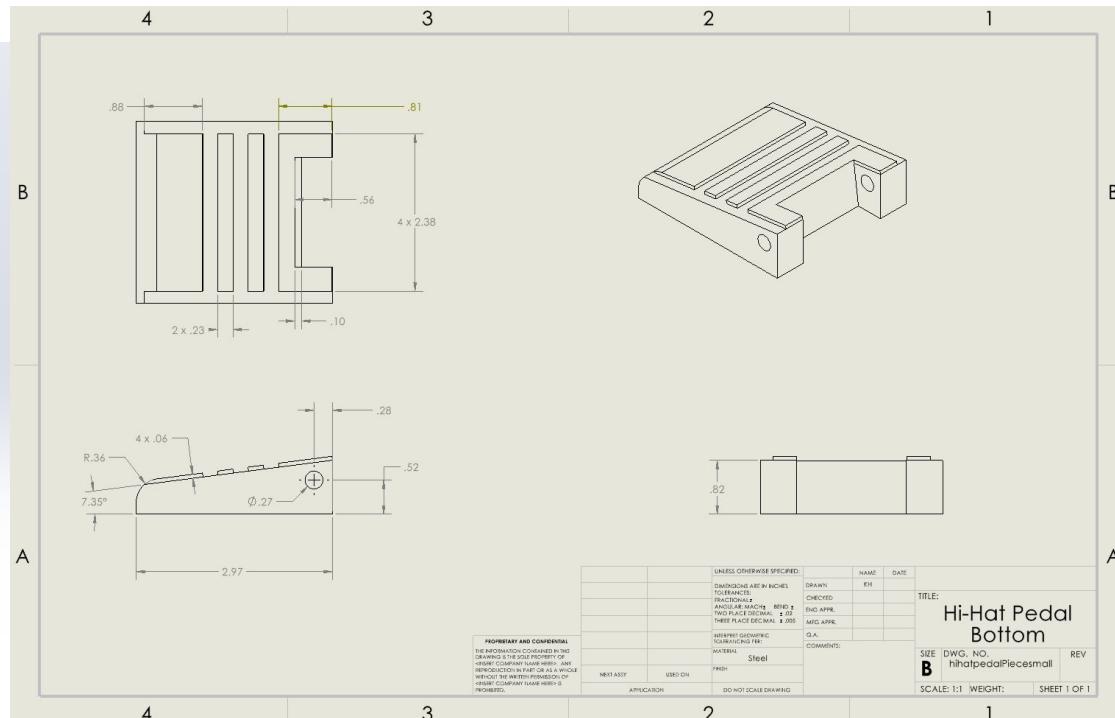
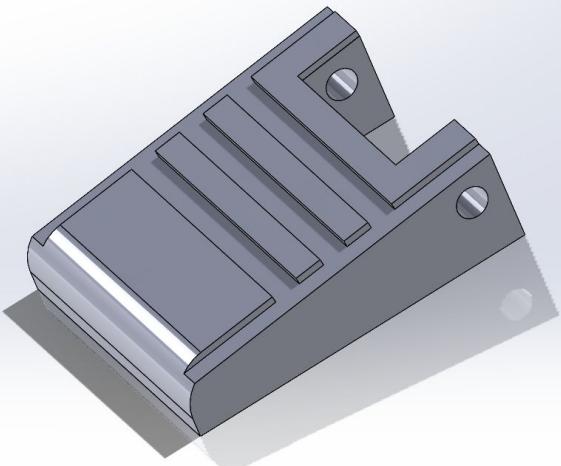
# Dowel



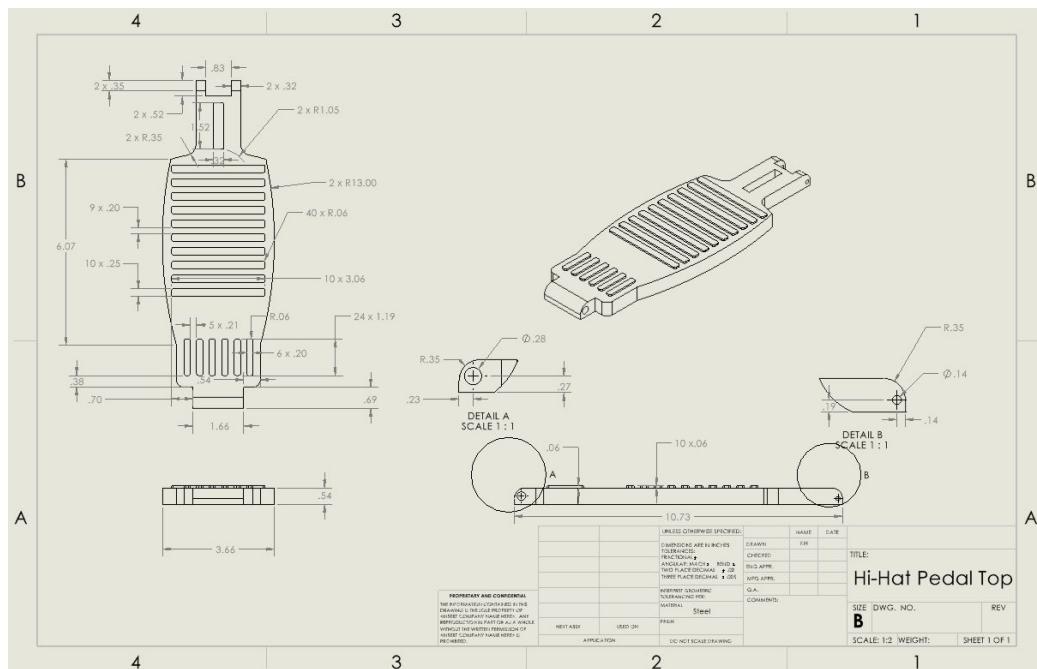
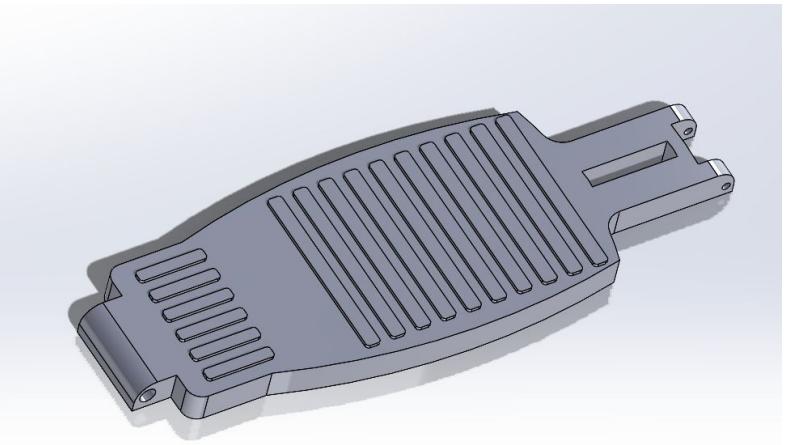
# Dowel to Pedal Hinge



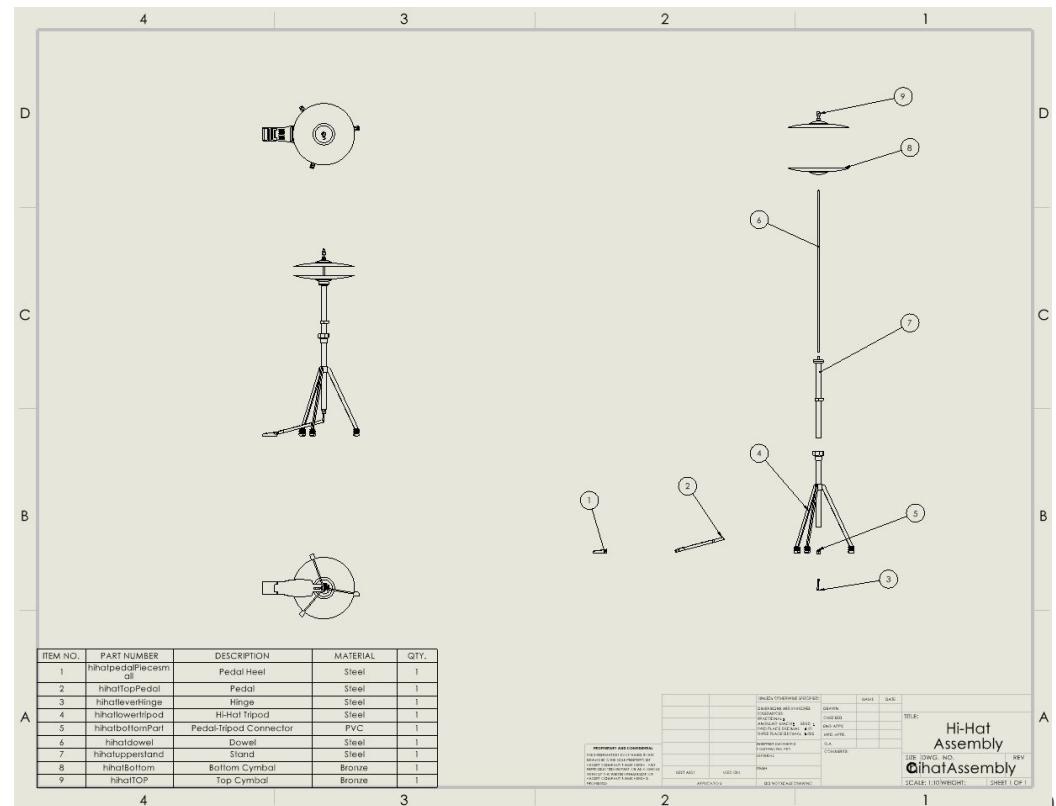
# Pedal Heel



# Pedal

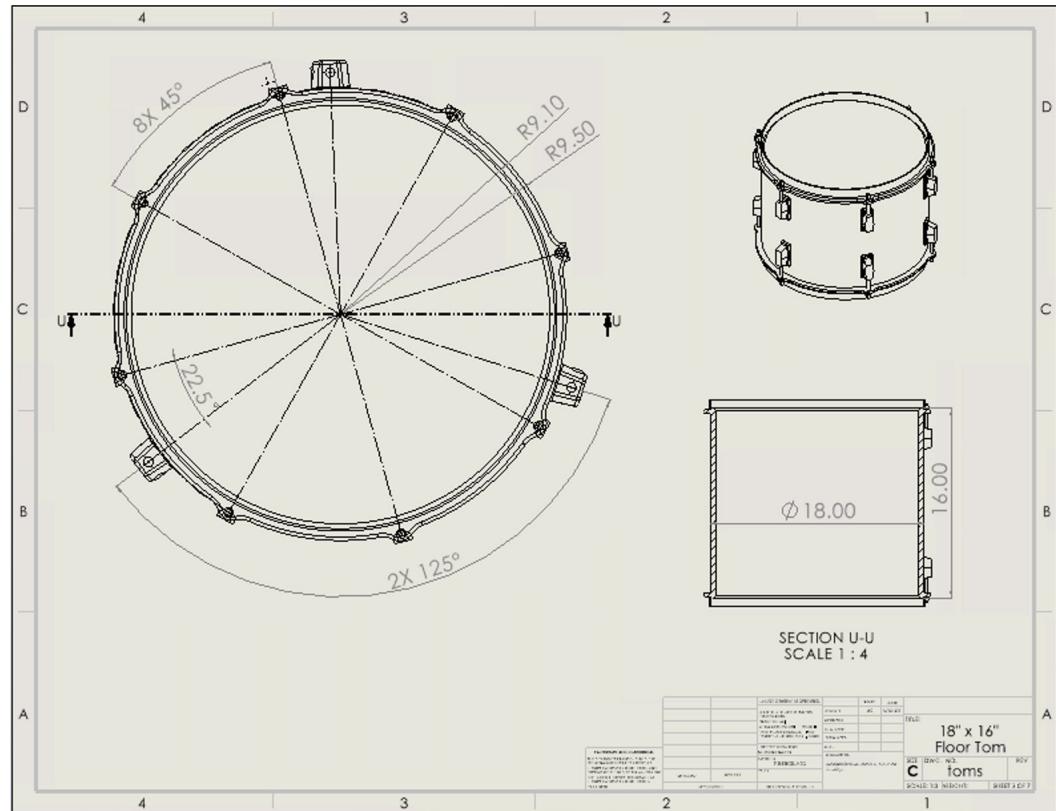


# Hi-Hat Assembly

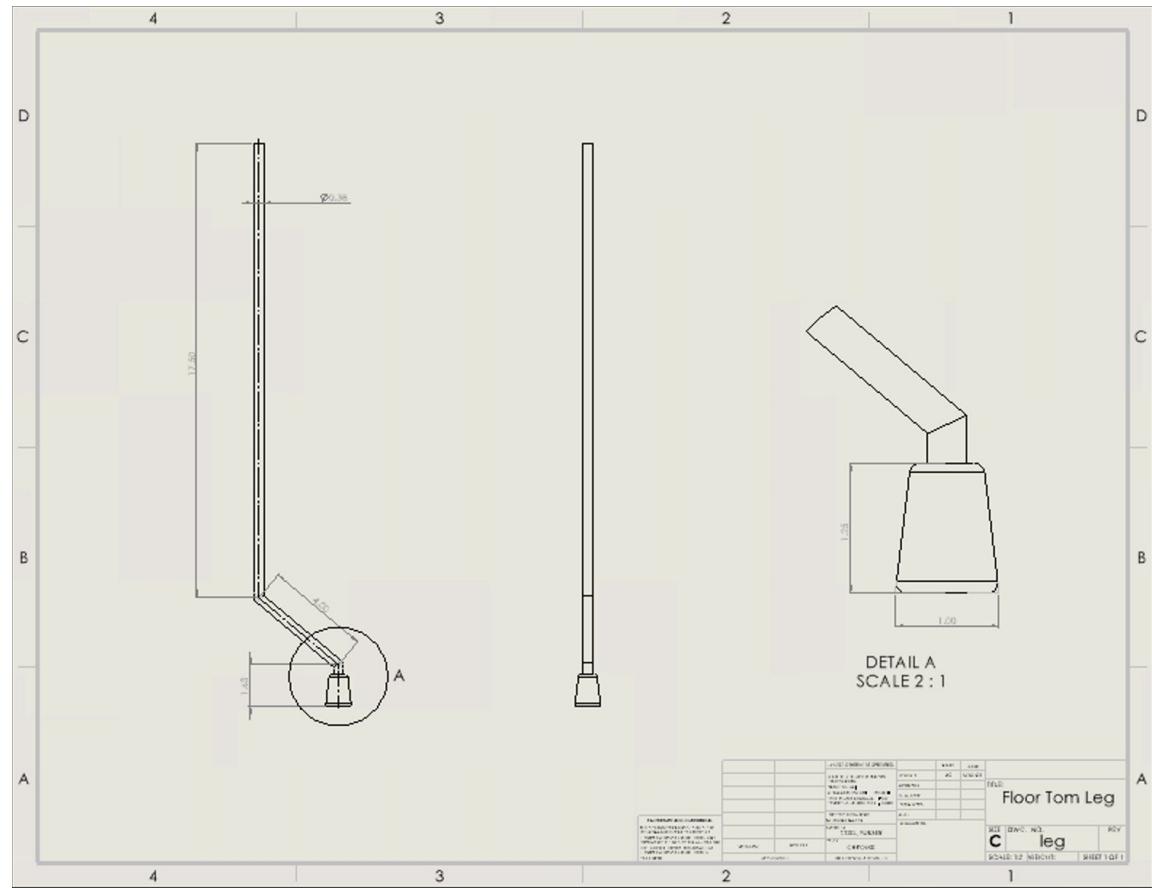


# Drums

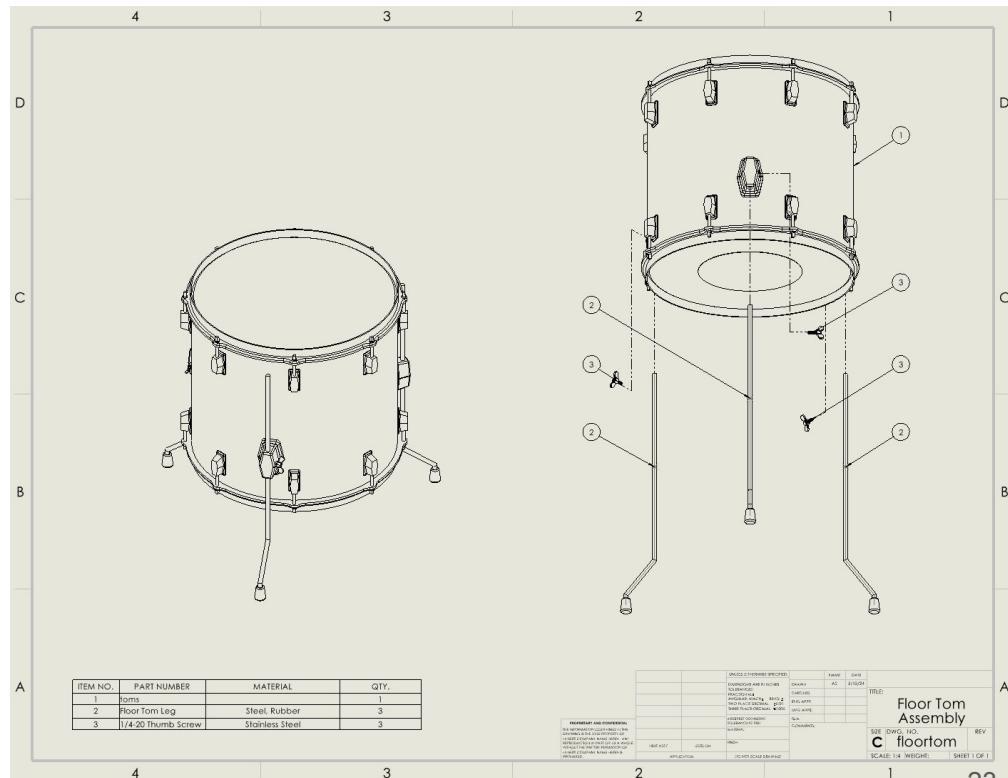
# Floor Tom



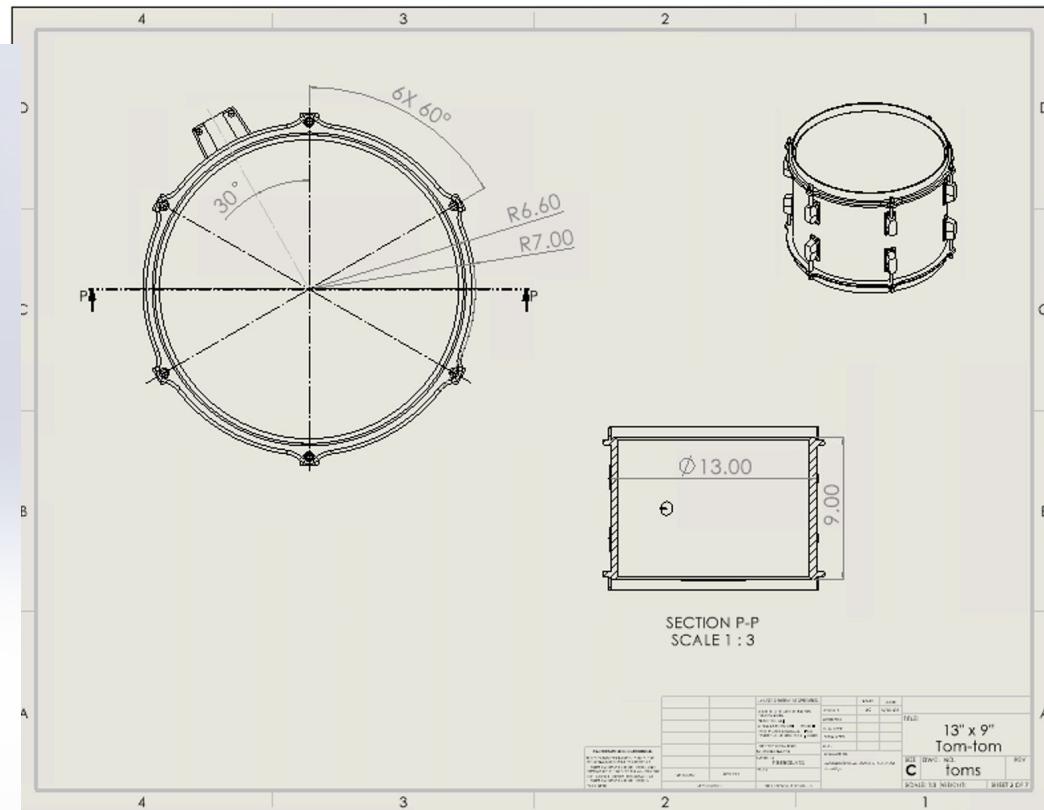
# Floor Tom Legs



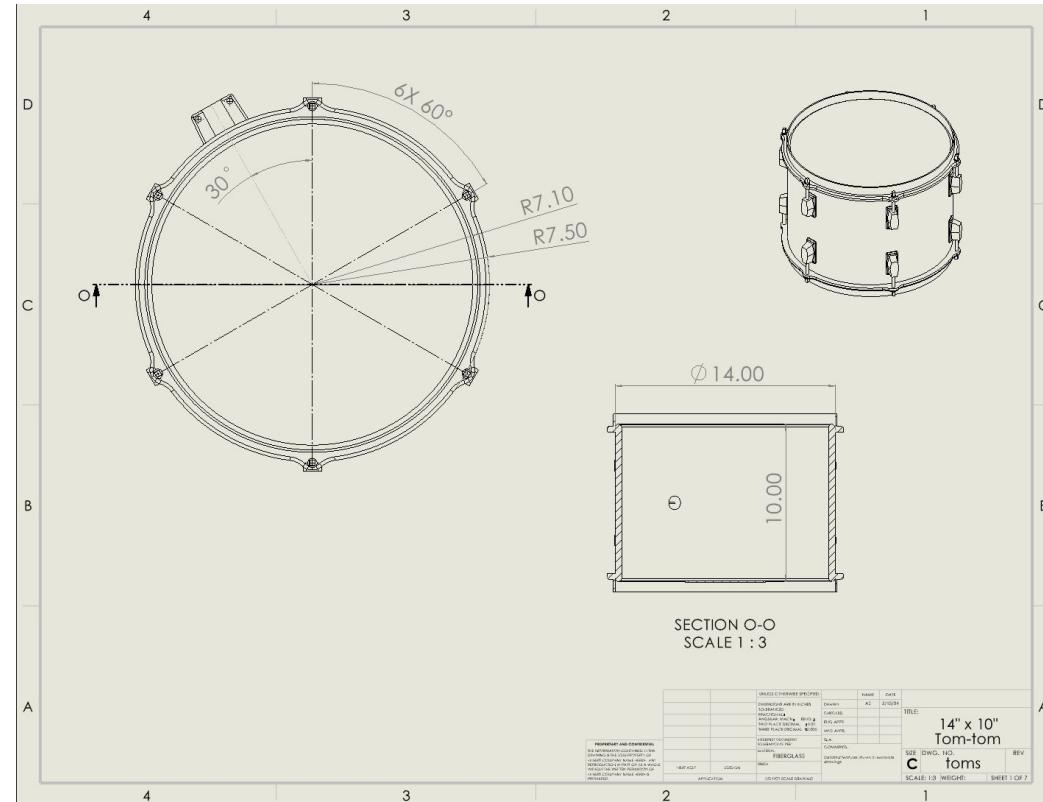
# Floor Tom Assembly



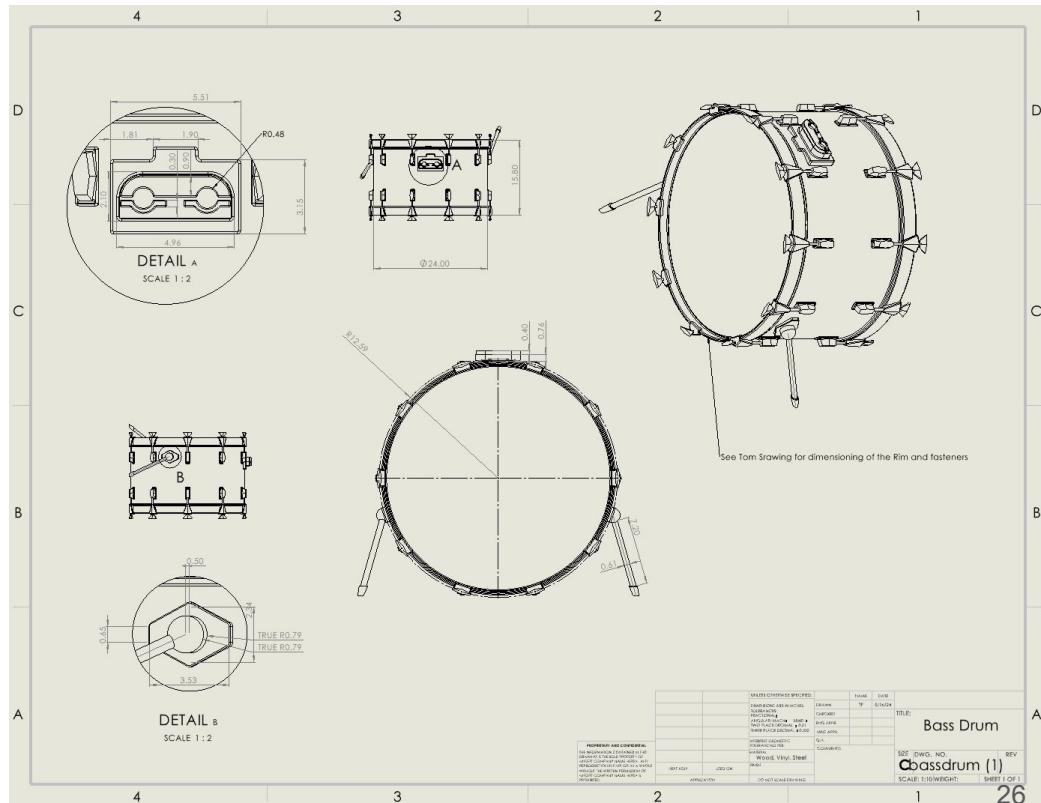
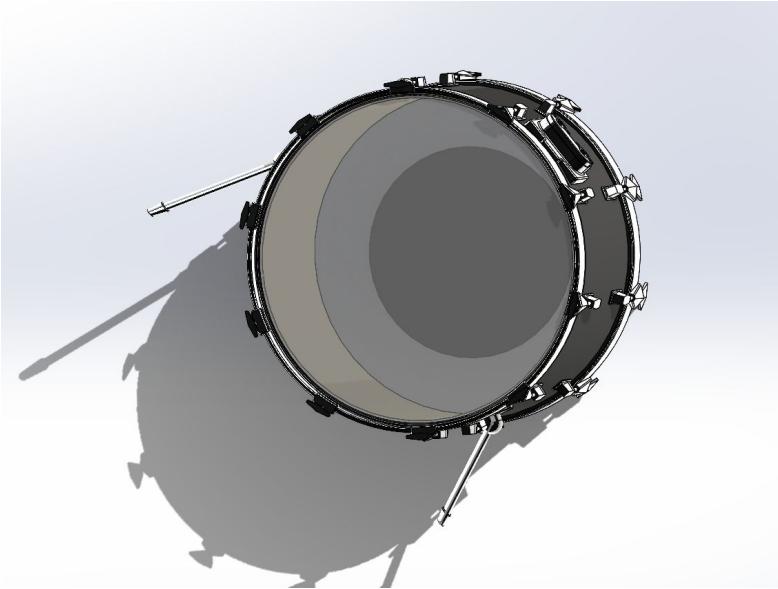
# 13"x 9" Tom-tom



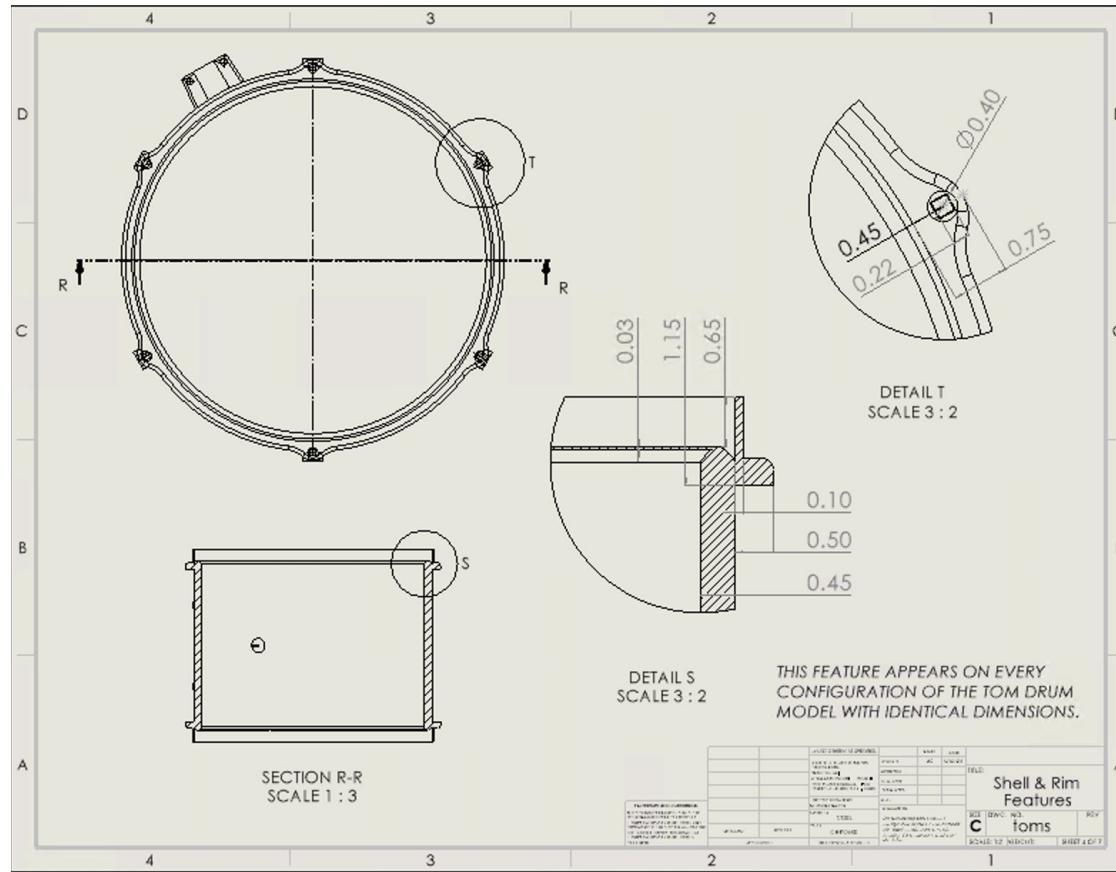
**14" x 10" Tom-tom**



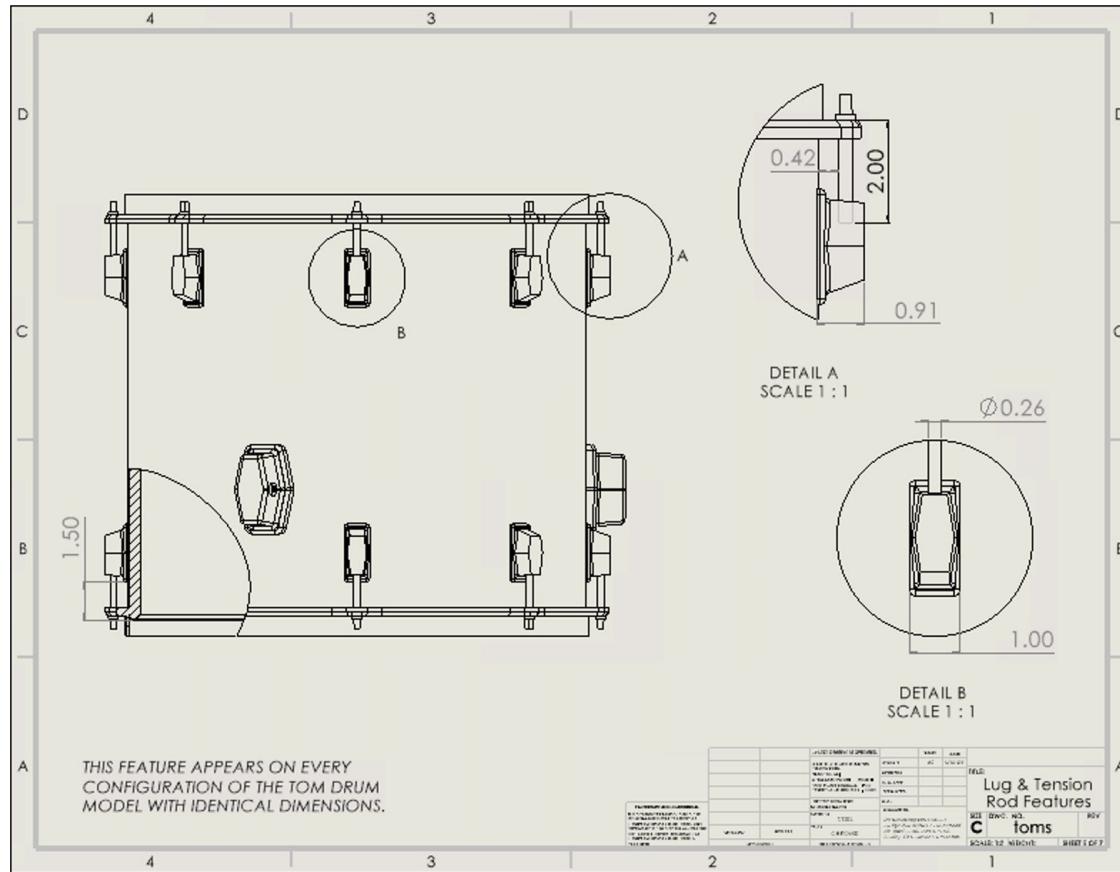
# Bass Drum



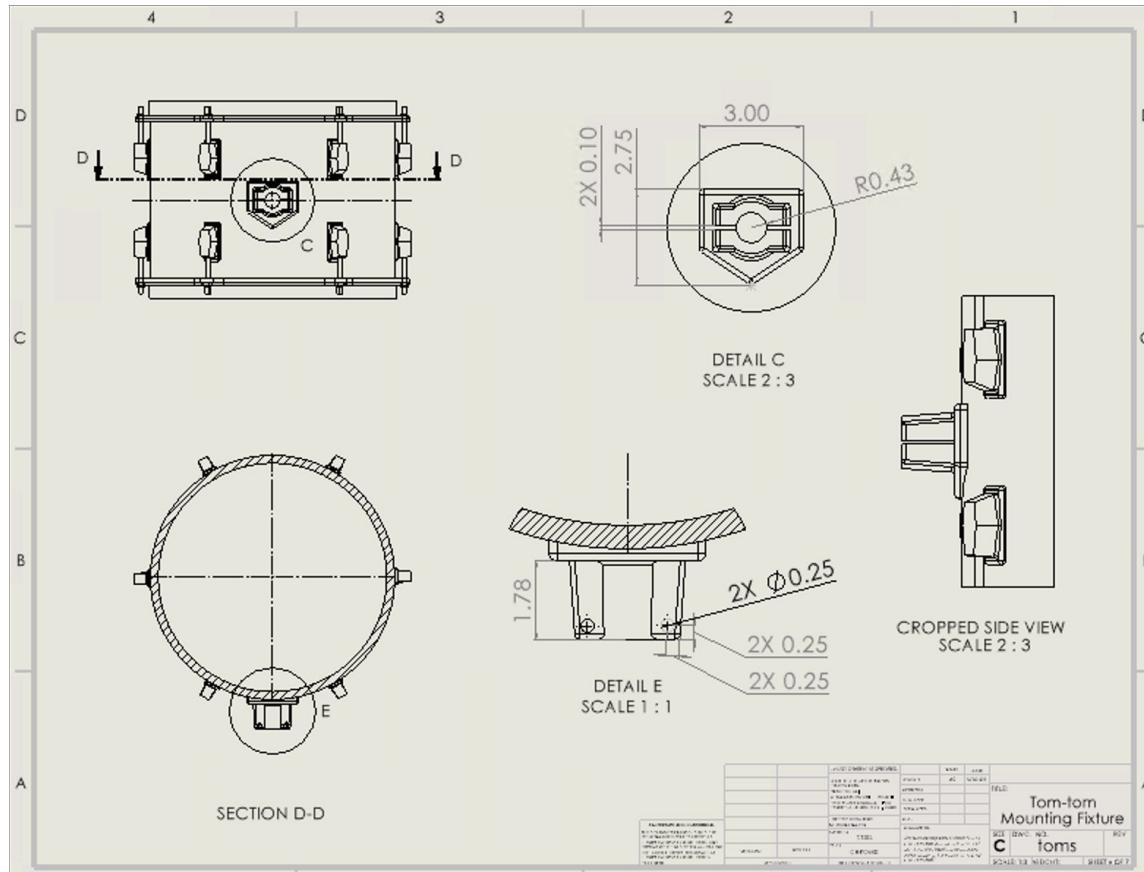
# Shell & Rim



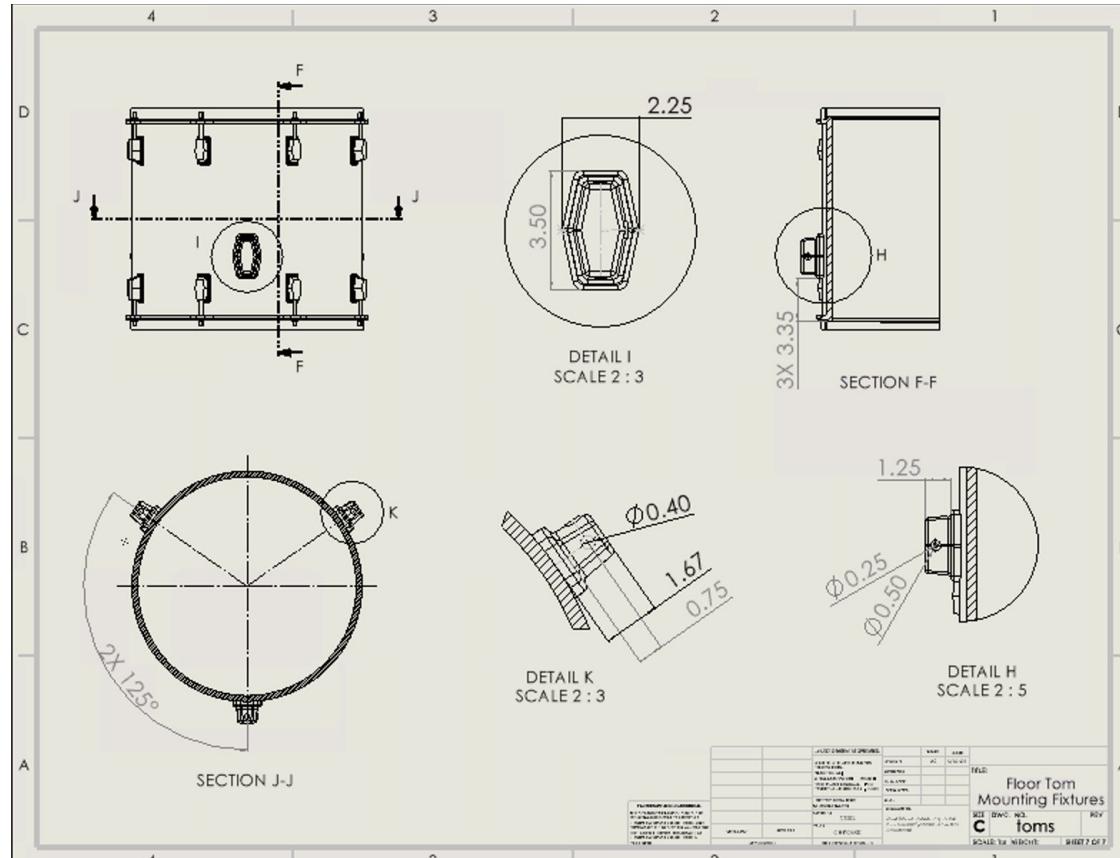
# Lug & Tension Rod



# Tom-tom Mounting Fixture

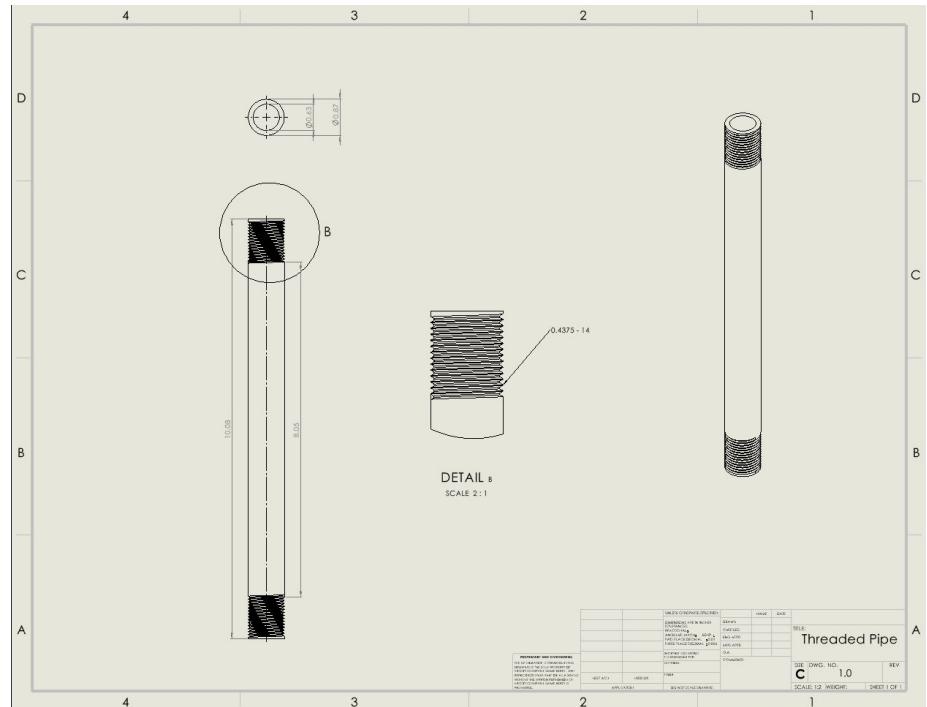


# Floor Tom Mounting Fixtures

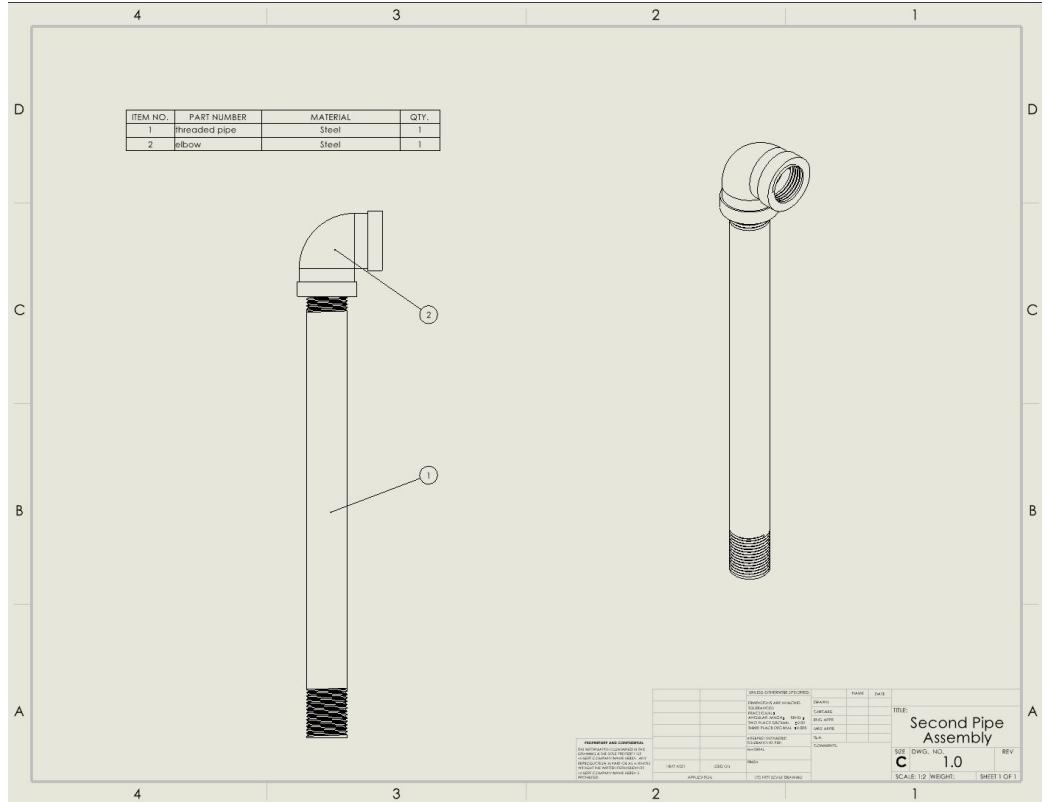


# Connectors & Hardware

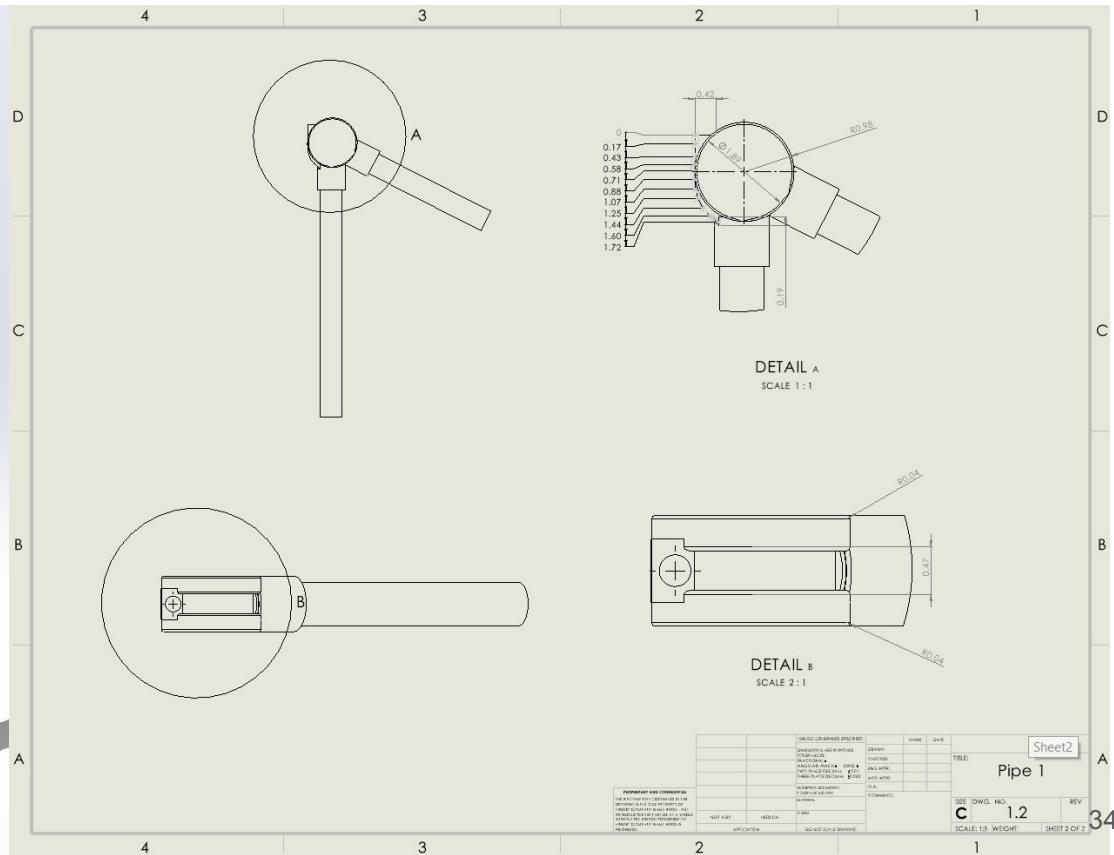
# Threaded Pipe



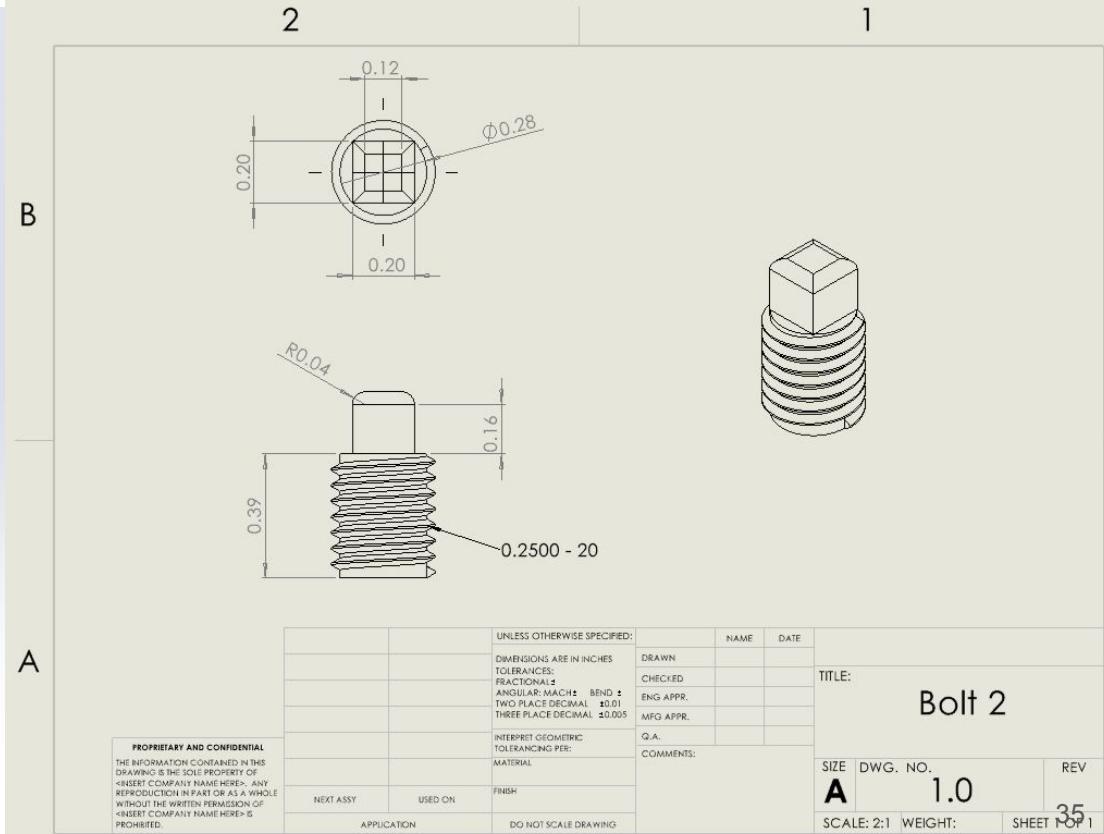
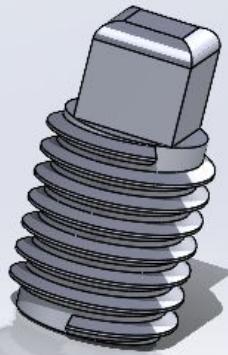
## Pipe 2



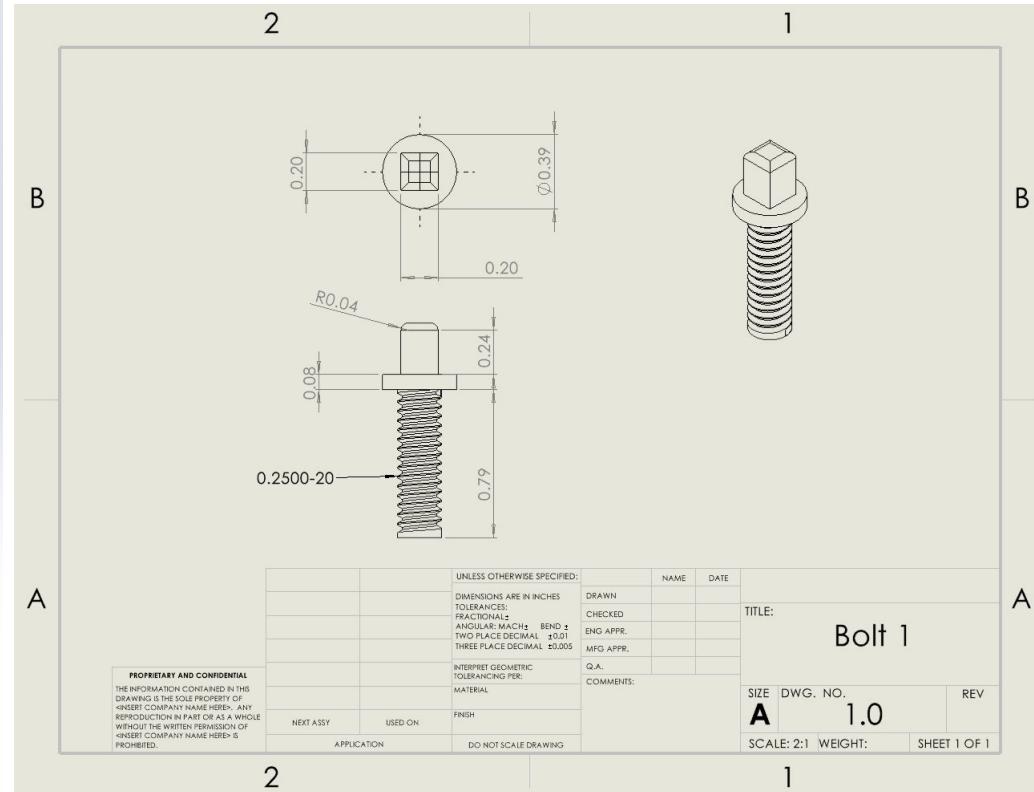
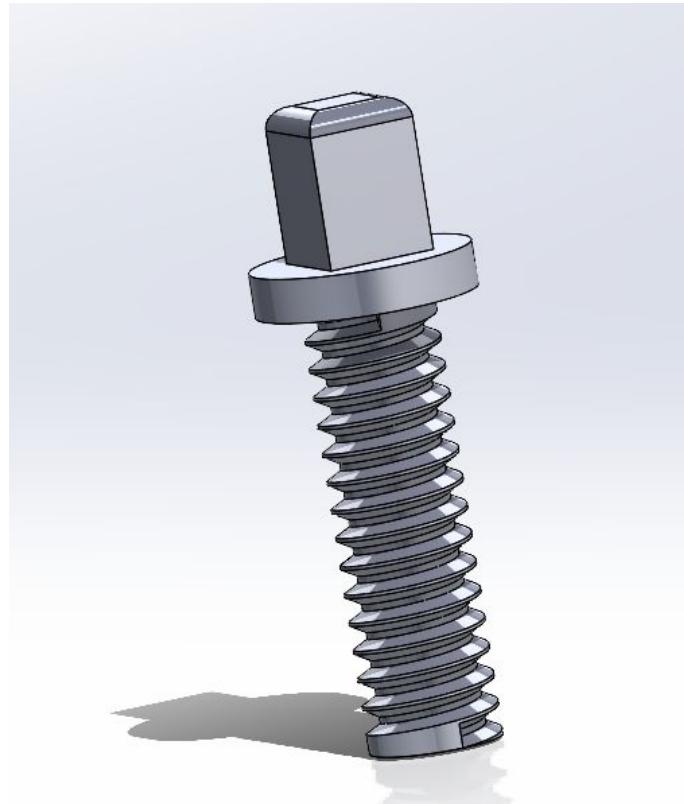
Pipe1



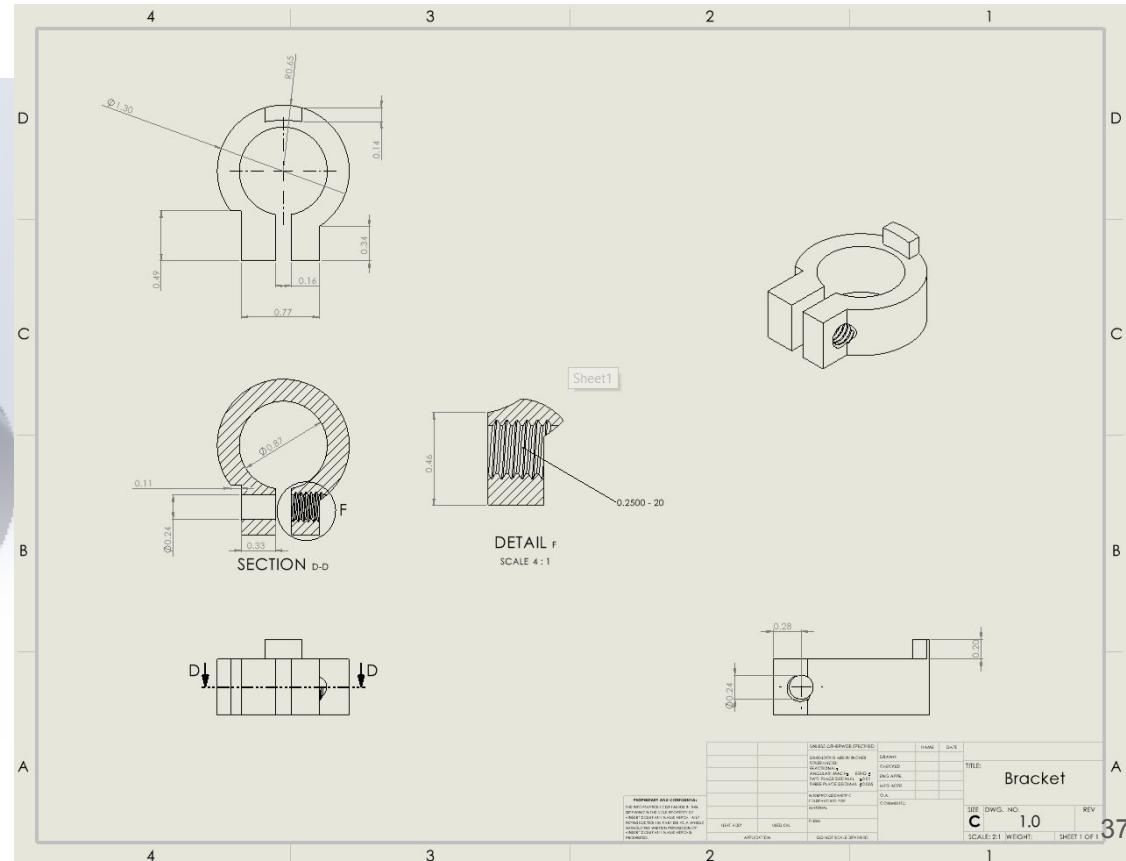
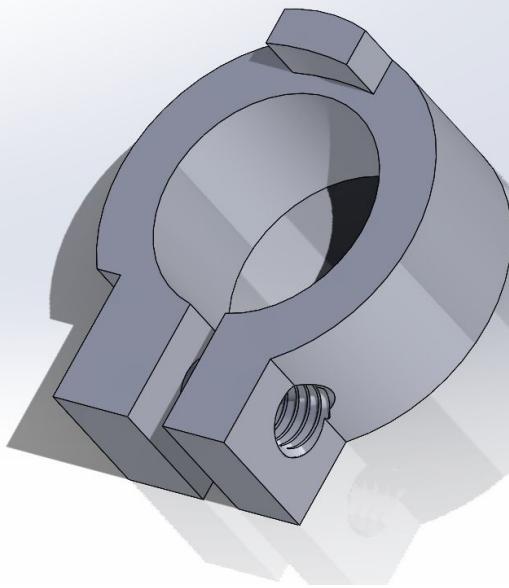
# Pipe 1 Bolt 1



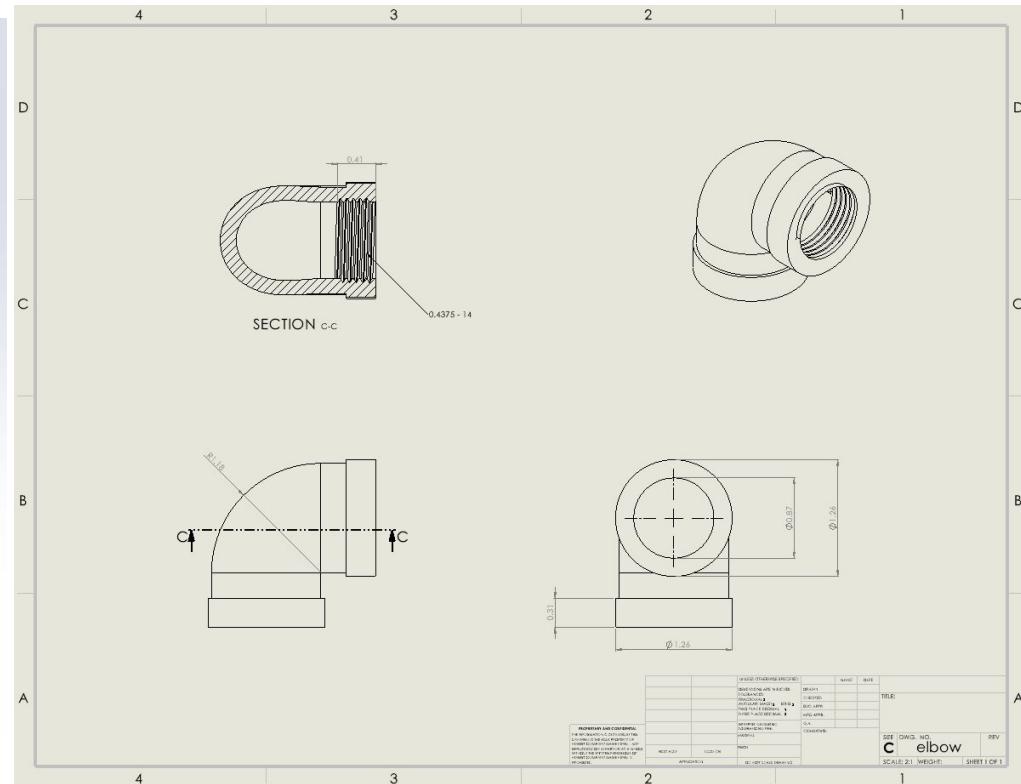
# Pipe 1 Bolt 2



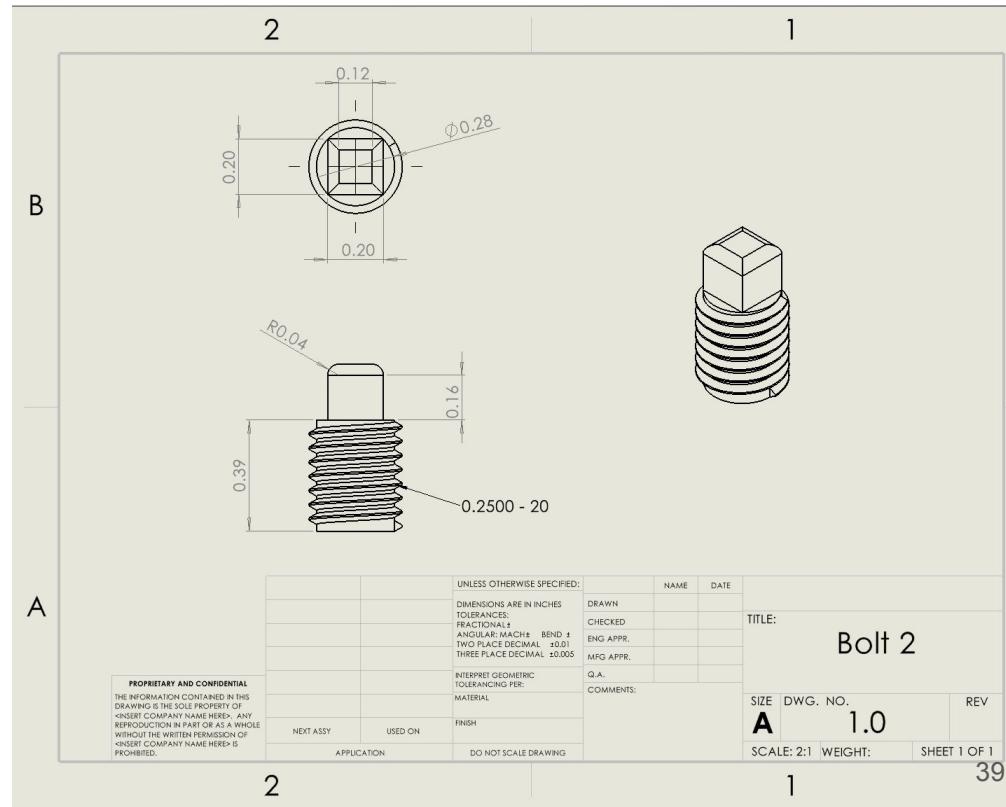
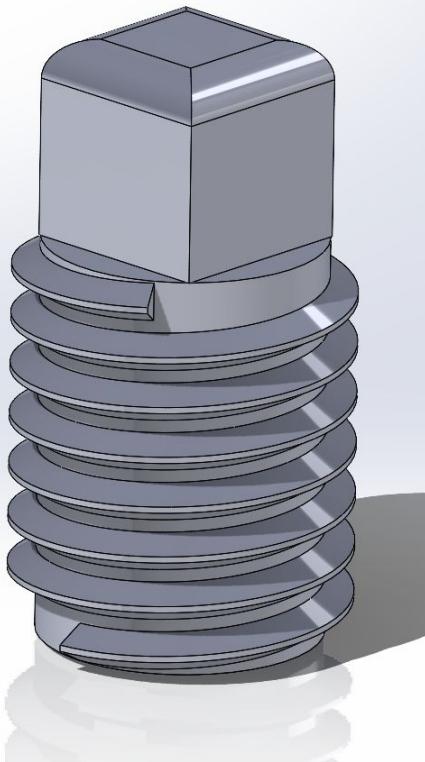
# Pipe 1 Bracket



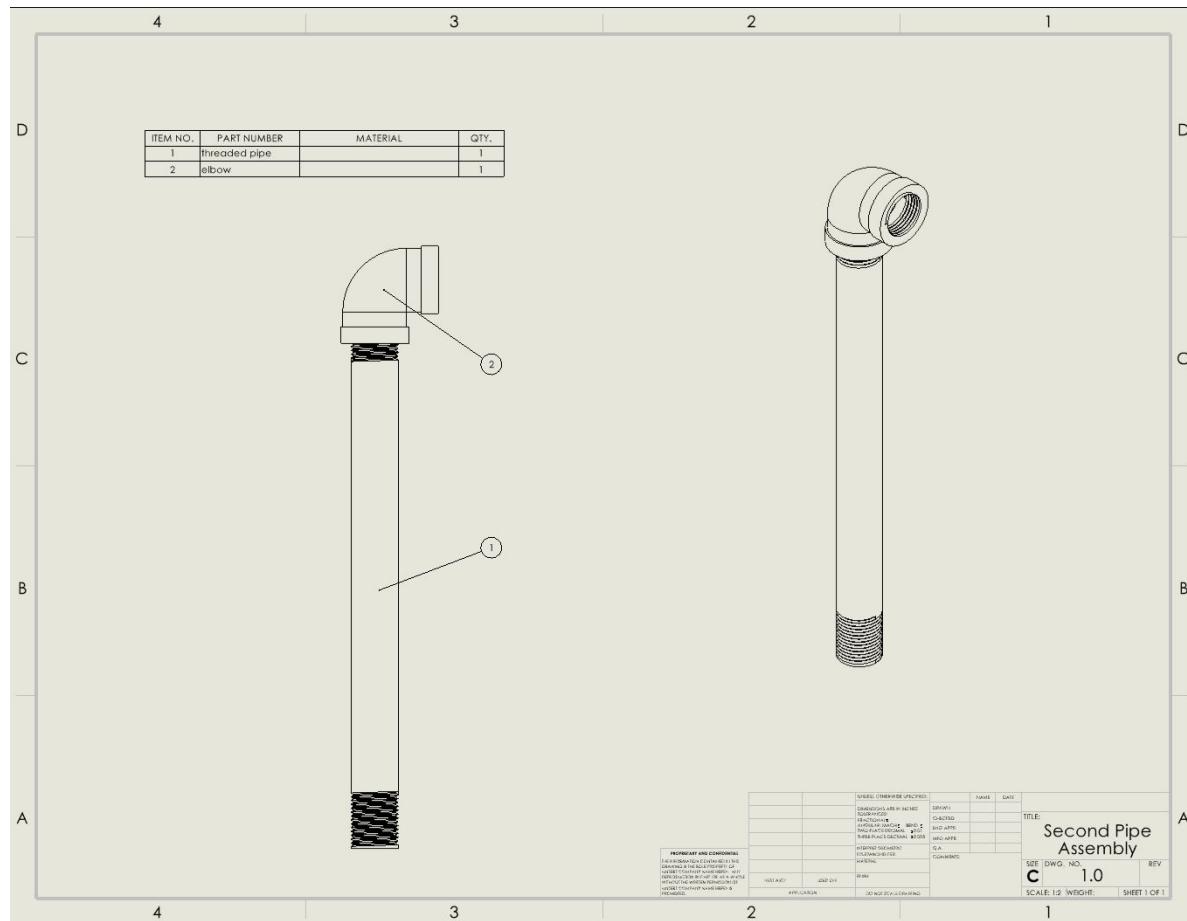
# Pipe 2 Elbow



# Bolt 2

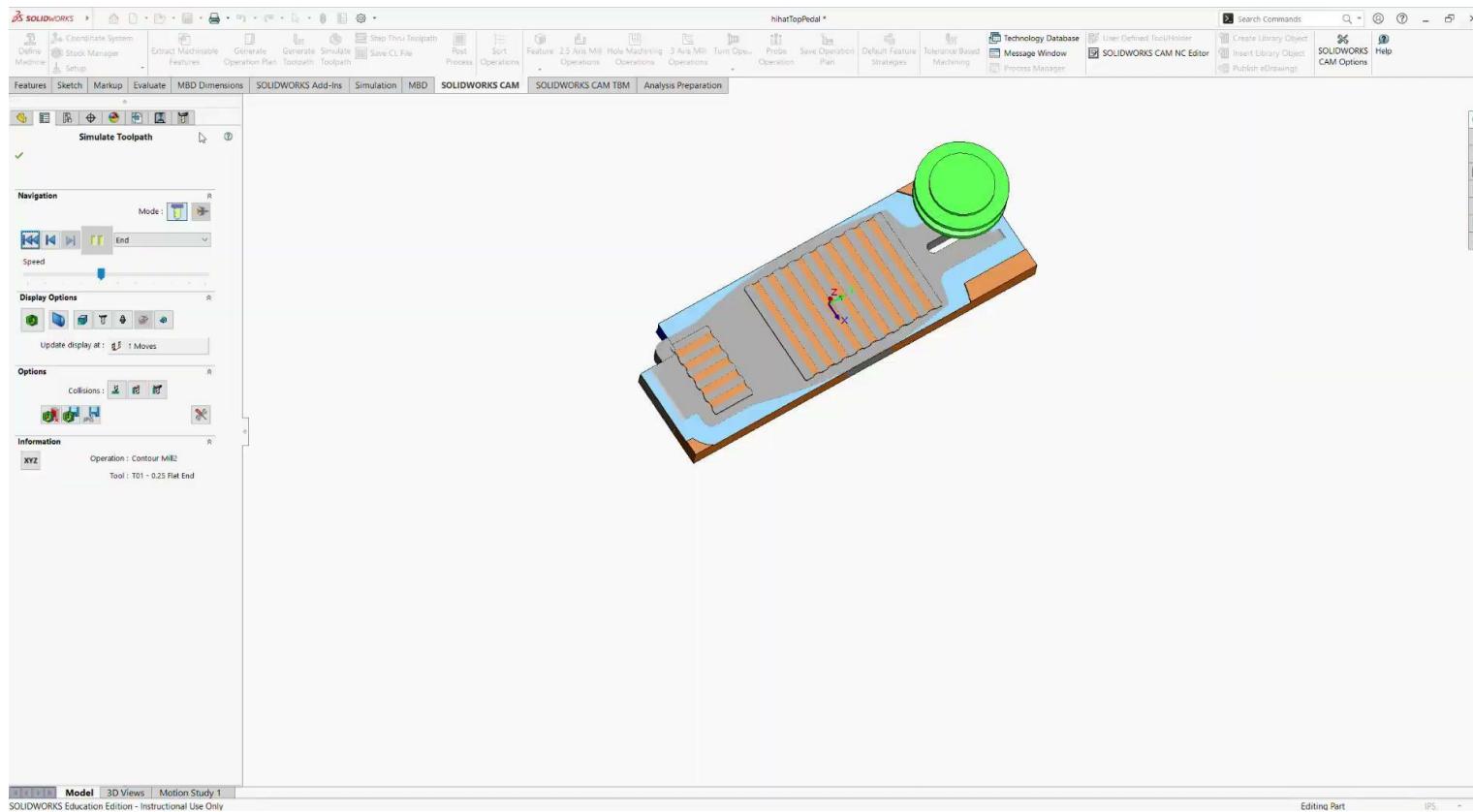


## Pipe 2



# Computer-aided manufacturing

# Pedal CAM



# CAM Instructions

5/17/24, 11:25 PM

hihatTopPedal\_machine\_path.txt

## hihatTopPedal\_machine\_path.txt

```
00001
N1 G20
N2 G91 G28 X0 Y0 Z0

N3 ( Center Drill1 )
N4 (3/8 X 90DEG CBT SPOT DRILL)
N5 T19 M06
N6 S8444 M03
N7 G90 G54 G00 X5.133 Y-.03
N8 G43 Z1. H19 M08
N9 G98 G82 Z-1.1248 P1000 R-.8988 F37.1541
N10 G80 Z1. M09
N11 G91 G28 Z0
```

```
N12 ( Drill1 )
N13 (J SCREW MACH DRILL)
N14 T20 M06
N15 S11434 M03
N16 G90 G54 G00 X5.133 Y-.03
N17 G43 Z1. H20 M08
N18 G98 G83 Z-2.7151 Q.1 R-.8988 F50.2989
N19 G80 Z1. M09
N20 G91 G28 Z0

N21 ( Center Drill12 )
N22 (#3 60DEG HSS CENTERDRILL)
N23 T05 M06
N24 S9075 M03
N25 G90 G54 G00 X-5.223 Y-.11
N26 G43 Z1. H05 M08
N27 G98 G82 Z-1.2194 P1000 R-.9933 F30.8572
N28 G80 Z1. M09
N29 G91 G28 Z0
```

```
N30 ( Drill2 )
N31 (9/64 SCREW MACH DRILL)
```

```
N32 T21 M06
N33 S12000 M03
```

```
N34 G90 G54 G00 X-5.223 Y-.11
N35 G43 Z1. H21 M08
```

```
N36 G98 G83 Z-1.4424 Q.1 R-.9933 F43.2
N37 G80 Z1. M09
N38 G91 G28 Z0
```

```
N39 ( Center Drill3 )
N40 (#3 60DEG HSS CENTERDRILL)
N41 T05 M06
N42 S9075 M03
```

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```
N43 G90 G54 G00 X-5.223 Y-.11
N44 G43 Z1. H05 M08
N45 G98 G82 Z-2.3694 P1000 R-2.1433 F30.8572
N46 G80 Z1. M09
N47 G91 G28 Z0

N48 ( Drill13 )
N49 (9/64 SCREW MACH DRILL)
N50 T21 M06
N51 S12000 M03
N52 G90 G54 G00 X-5.223 Y-.11
N53 G43 Z1. H21 M08
N54 G98 G82 Z-2.5924 Q.1 R-2.1433 F43.2
N55 G80 Z1. M09
N56 G91 G28 Z0
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N57 ( Rough Mill1 )
N58 (3/4 EM CRB 2FL 1-1/2 LOC)
N59 T84 M06
N60 S3677 M03
N61 G90 X.2803 Y5.4898
N62 G43 Z1. H04 M08
N63 G01 Z-.06 F4.0448
N64 G17 X.3351 Y5.548 F16.1793
N65 X.92
N66 Y3.4402
```

```
N67 G03 X1.22 Y3.0647 I.385 J0
N68 G02 X1.5523 Y2.9773 I-1.1003 J-4.8623
N69 G03 X1.47 Y2.985 I-.0823 J-.4373
N70 G01 X.1.47
N71 G03 X-1.5523 Y2.9773 IO J-.445
N72 G02 X-1.22 Y3.0647 I1.4326 J-4.775
N73 G03 X-.92 Y3.4402 I-.085 J.3755
N74 G01 Y5.548
N75 X-.3351
```

```
N76 X-.2803 Y5.4898
N77 G03 X2.8083 I.2803 J.2639
N78 G01 X.462 Y5.248
N79 X.62
N80 Y3.4402
```

```
N81 G03 X.6378 Y3.285 I.685 J0
N82 G01 X-.6378
N83 G03 X-.62 Y3.4402 I-.6672 J.1552
N84 G01 Y5.248
N85 X-.462
```

```
N86 G03 X.462 I.462 J.5057
N87 G01 X.32 Y4.8222
N88 Y3.585
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```
N89 X-.32
N90 Y4.8222
N91 G03 X.32 I.32 J.9316
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```
hihatTopP0e
N92 G01 X.02 Y4.4689
N93 Y3.885
N94 X-.02
N95 Y4.4689
N96 G03 X.02 I.02 J1.2848
N97 G01 X-1.716 Y2.9098
N98 X-1.714 Y2.9271
N99 X-1.649 Y2.9474
N100 G03 X-1.716 Y2.9098 I.179 J-.4074
N101 G00 Z.1
N102 X.2803 Y5.4898
N103 G01 Z-.06 F4.0448
N104 G02 X-.2803 I-.2803 J.2639 F16.1793
N105 G01 X-.3351 Y5.548
N106 X-.92
N107 Y3.4402
```

```
N108 G02 X-1.22 Y3.0647 I-.385 J0
N109 G03 X-1.5523 Y2.9773 I1.1003 J-4.8623
N110 G02 X-1.22 Y2.985 I.0823 J-.4373
N111 G01 X1.47
N112 G01 X1.5523 Y2.9773 IO J-.445
N113 G03 X1.22 Z2.03 Y3.0647 I-1.4326 J-4.775
N114 G02 X.92 Y3.4402 I.085 J.3755
N115 G01 Y5.548
N116 X.3351
N117 X.2803 Y5.4898
N118 G00 Z.1
N119 X-1.9142 Y-1.4825
N120 G01 Z-.06 F4.0448
N121 G02 X-1.9089 Y1.849 I13.0859 J1.6139 F16.1793
N122 G03 X-1.8852 Y1.8 I.4309 J.111
N123 X-1.915 Y1.64 I.4152 J-.16
N124 G01 Y1.51
N125 G03 X-1.8852 Y1.35 I.445 J0
N126 X-1.915 Y1.19 I.4152 J-.16
N127 G01 Y1.06
N128 G03 X-1.8852 Y.9 I.445 J0
N129 X-1.915 Y.74 I.4152 J-.16
N130 G01 Y.61
N131 G03 X-1.8852 Y.45 I.445 J0
N132 X-1.915 Y.29 I.4152 J-.16
N133 G01 Y.16
N134 G03 X-1.8852 Y1.445 J0
N135 X-1.915 Y-.16 I.4152 J-.16
N136 G01 Y-.29
N137 G03 X-1.8852 Y-.45 I.445 J0
N138 X-1.915 Y-.61 I.4152 J-.16
N139 G01 Y-.74
N140 G03 X-1.8852 Y-.9 I.445 J0
N141 X-1.915 Y-1.06 I.4152 J-.16
N142 G01 Y-1.19
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N144 X-1.9142 Y-1.4825 I.4152 J-.16
N145 G00 Z.1
N146 X-1.7176 Y2.9098
N147 Z.04
N148 G01 Z-.06 F4.0448
N149 G02 X-1.649 Y2.9474 I.2476 J-.3698 F16.1793
N150 G01 X-1.714 Y2.9271
N151 X-1.7176 Y2.9098
N152 G00 Z.1
N153 X1.8641 Y-1.8467
N154 G01 Z-.06 F4.0448
N155 G02 X1.568 Y-3.2663 I-13.0358 J1.9781 F16.1793
N156 G03 X1.555 Y-3.3655 I.372 J-.0992
N157 G01 Y-4.42
N158 G02 X1.2683 Y-4.829 I-.435 J0
N159 G03 X1.1473 Y-4.9 I.1312 J-.3619
N160 G01 X.9508 Y-4.6733
N161 G03 X.7145 Y-5.1909 I.4487 J-.5176
N162 G01 Y-5.248
N163 X-.7145
N164 Y-5.1909
N165 G03 X-.9497 Y-4.6742 I-.685 J0
N166 X-.813 Y-4.6441 I-.0263 J.4442
N167 X-.65 Y-4.675 I.163 J.4141
N168 G01 X-.566
N169 G03 X-.403 Y-4.6441 I0 J.445
N170 X-.24 Y-4.675 I.163 J.4141
N171 G01 X-.156
N172 G03 X.007 Y-4.6441 I0 J.445
N173 X.17 Y-4.675 I.163 J.4141
N174 G01 X.254
N175 G03 X.417 Y-4.6441 I0 J.445
N176 X.58 Y-4.675 I.163 J.4141
N177 G01 X.664
N178 G03 X.827 Y-4.6441 I0 J.445
N179 X.9508 Y-4.6733 I.163 J.4141
N180 G01 X1.1473 Y-4.9
N181 G03 X1.0145 Y-5.1909 I.2522 J-.2909
N182 G01 Y-5.548
N183 X-.0145
N184 Y-5.1909
N185 G03 X-1.2683 Y-4.829 I-.385 J0
N186 G02 X-1.555 Y-4.42 I.1483 J.409
N187 G01 Y-3.3655
N188 G03 X-1.568 Y-3.2663 I-.385 J0
N189 G02 X-1.8641 Y-1.8467 I12.7397 J3.3977
N190 G03 X-1.47 Y-2.085 I.3941 J.2067
N191 G01 X1.47
N192 G03 X1.8641 Y-1.8467 I0 J.445
N193 G00 Z.1
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## CAM Instructions (cont.)

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N196 G01 Z\_-06 F4.0448  
N197 G02 X1.3691 Y-2.8269 I12.6369 J2.5164 F16.1793  
N198 G03 X1.074 Y-2.715 I-.2951 J-.3331  
N199 G01 X\_.99  
N200 G03 X.827 Y-2.7459 I0 J-.445  
N201 X.664 Y-2.715 I-.163 J-.4141  
N202 G01 X\_.58  
N203 G03 X.417 Y-2.7459 I0 J-.445  
N204 X.254 Y-2.715 I-.163 J-.4141  
N205 G01 X\_.17  
N206 G03 X.007 Y-2.7459 I0 J-.445  
N207 X\_-.156 Y-2.715 I-.163 J-.4141  
N208 G01 X\_-.24  
N209 G03 X\_-.403 Y-2.7459 I0 J-.445  
N210 X\_-.566 Y-2.715 I-.163 J-.4141  
N211 G01 X\_-.65  
N212 G03 X\_-.813 Y-2.7459 I0 J-.445  
N213 X\_-.976 Y-2.715 I-.163 J-.4141  
N214 G01 X\_-.06  
N215 G03 X\_1.3666 Y-2.8375 I0 J-.445  
N216 G02 X\_1.4652 Y-2.385 I12.5383 J2.9689  
N217 G01 X1.4652  
N218 G02 Z\_1  
N219 X\_1.9142 Y\_1.4825  
N220 Z\_64  
N221 G01 Z\_-.06 F4.0448  
N222 G02 X\_1.8852 Y\_1.35 I4.442 J\_0.8275 F16.1793  
N223 X\_1.915 Y\_1.19 I.4152 J.16  
N224 G01 X\_1.06  
N225 G02 X\_1.8852 Y\_-.9 I\_.445 J0  
N226 X\_1.915 Y\_-.74 I.4152 J.16  
N227 G01 Y\_-.61  
N228 G02 X\_1.8852 Y\_-.45 I\_.445 J0  
N229 X\_1.915 Y\_-.29 I.4152 J.16  
N230 G01 Y\_-.16  
N231 G02 X\_1.8852 Y\_1.445 J0  
N232 X\_1.915 Y\_1.16 I.4152 J.16  
N233 G01 Y\_1.29  
N234 G02 X\_1.8852 Y\_1.45 I\_.445 J0  
N235 X\_1.915 Y\_.61 I.4152 J.16  
N236 G01 Y\_7.4  
N237 G02 X\_1.8852 Y\_9 I\_.445 J0  
N238 X\_1.915 Y\_1.06 I.4152 J.16  
N239 G01 Y\_1.19  
N240 G02 X\_1.8852 Y\_1.35 I\_.445 J0  
N241 X\_1.915 Y\_1.51 I.4152 J.16  
N242 G01 Y\_1.64  
N243 G02 X\_1.8852 Y\_1.8 I\_.445 J0  
N244 X\_1.9089 Y\_1.849 I.4152 J.16

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N243 G03 X-1.9142 Y-1.4825 I13.0726 J-1.7177  
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N247 X1.9009 Y1.849  
N248 G01 Z\_-06 F4.0448  
N249 G02 X1.9142 Y-1.4825 I-13.0726 J-1.7177 F16.1793  
N250 G03 X1.8852 Y-1.35 I\_-4442 J\_-0275  
N251 X1.915 Y-1.19 I\_-4152 J.16  
N252 G01 Y\_1.06  
N253 G03 X1.8852 Y\_-9 I\_-445 J0  
N254 X1.915 Y\_-74 I\_-4152 J.16  
N255 G01 Y\_-61  
N256 G03 X1.8852 Y\_-45 I\_-445 J0  
N257 X1.915 Y\_-29 I\_-4152 J.16  
N258 G01 Y\_-16  
N259 G03 X1.8852 Y0 I\_-445 J0  
N260 X1.915 Y.16 I\_-4152 J.16  
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N262 G03 X1.8852 Y\_.45 I\_-445 J0  
N263 X1.915 Y\_.61 I\_-4152 J.16  
N264 G01 Y\_74  
N265 G03 X1.8852 Y\_.9 I\_-445 J0  
N266 X1.915 Y1.06 I\_-4152 J.16  
N267 G01 Y1.19  
N268 G03 X1.8852 Y1.35 I\_-445 J0  
N269 X1.915 Y1.51 I\_-4152 J.16  
N270 G01 Y1.64  
N271 G03 X1.8852 Y1.8 I\_-445 J0  
N272 X1.9009 Y1.849 I\_-4152 J.16  
N273 G00 Z\_1.  
N274 X1.8641 Y-1.8467  
N275 Z\_04  
N276 G01 Z\_-06 F4.0448  
N277 G02 X1.47 Y-2.085 I\_-3.3941 J.2067 F16.1793  
N278 G01 X-1.47  
N279 G02 X-1.8641 Y-1.8467 I0 J.445  
N280 G03 X-1.568 Y-3.2663 J13.0358 J1.9781  
N281 G02 X-1.555 Y-3.3655 I\_-372 J\_-0992  
N282 G01 Y\_-4.42  
N283 G03 X-1.2683 Y-4.829 I.435 J0  
N284 G02 X-1.0145 Y-5.1909 I\_-1.312 J\_-3619  
N285 G01 Y-5.548  
N286 X1.0145  
N287 Y-5.1909  
N288 G02 X1.2683 Y-4.829 I.385 J0  
N289 G03 X1.555 Y-4.42 I\_-1.483 J.409  
N290 G01 Y-3.3655  
N291 G02 X1.568 Y-3.2663 I.385 J0  
N292 G03 X1.8641 Y-1.8467 I-12.7397 J3.3977  
N293 G00 Z\_1.  
N294 X1.519 Y-4.23  
N295 Z\_04

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 N296 G61 Z-.06 F4.0448  
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 N298 G61 X.99  
 N299 G62 X-.827 Y-4.6441 I0 J-.445  
 N300 X.664 Y-4.675 I-.163 J.4141  
 N301 G61 X.58  
 N302 G62 X.417 Y-4.6441 I0 J-.445  
 N303 X.254 Y-4.675 I-.163 J.4141  
 N304 G61 X.17  
 N305 G62 X.007 Y-4.6441 I0 J-.445  
 N306 X-.156 Y-4.675 I-.163 J.4141  
 N307 G61 X-.24  
 N308 G62 X-.403 Y-4.6441 I0 J-.445  
 N309 X-.566 Y-4.675 I-.163 J.4141  
 N310 G61 X-.65  
 N311 G62 X-.813 Y-4.6441 I0 J-.445  
 N312 X-.976 Y-4.675 I-.163 J.4141  
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 N314 G62 X-1.505 Y-4.23 I0 J-.445  
 N315 G61 Y-3.16  
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 N324 G62 X.007 Y-2.7459 I0 J-.445  
 N325 X-.17 Y-2.715 I.163 J-.4141  
 N326 G61 X.254  
 N327 G62 X.417 Y-2.7459 I0 J-.445  
 N328 X.58 Y-2.715 I.163 J-.4141  
 N329 G61 X.664  
 N330 G62 X.827 Y-2.7459 I0 J-.445  
 N331 X.99 Y-2.715 I.163 J-.4141  
 N332 G61 X.074  
 N333 G62 X1.519 Y-3.16 I0 J-.445  
 N334 G61 Y-4.23  
 N335 G60 Z.1  
 N336 X1.649 Y2.9474  
 N337 G61 Z-.06 F4.0448  
 N338 X1.714 Y2.9271 F16.1793  
 N339 X1.7176 Y2.9098  
 N340 G63 X1.649 Y2.9474 I-.2476 J-.3698  
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 N342 X1.9009 Y1.849  
 N343 Z.04  
 N344 G61 Z-.06 F4.0448  
 N345 G62 X1.8852 Y1.8 Y-1.4389 J.1111 F16.1  
 N346 X1.915 Y1.64 I-.4152 J-.16

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 N349 X.1.915 Y.19 I-.4152 J-.16  
 N350 G01 Y.16  
 N351 G02 X.1.8852 Y.9 I-.445 J0  
 N352 X.1.915 Y.74 I-.4152 J-.16  
 N353 G01 Y.61  
 N354 G02 X.1.8852 Y.45 I-.445 J0  
 N355 X.1.915 Y.29 I-.4152 J-.16  
 N356 G01 Y.16  
 N357 G02 X.1.8852 Y.0 I-.445 J0  
 N358 X.1.915 Y.16 I-.4152 J-.16  
 N359 G01 Y.29  
 N360 G02 X.1.8852 Y.-45 I-.445 J0  
 N361 X.1.915 Y.61 I-.4152 J-.16  
 N362 G01 Y.74  
 N363 G02 X.1.8852 Y.9 I-.445 J0  
 N364 X.1.915 Y.106 I-.4152 J-.16  
 N365 G01 Y.1.19  
 N366 G02 X.1.8852 Y.1-35 I-.445 J0  
 N367 X.1.9142 Y.1-4825 I-.4152 J-.16  
 N368 G03 X.1.9009 Y.1.849 I-.13.0859  
 N369 G00 Z.1  
 N370 Z1. M09  
 N371 G91 G28 Z0  
  
 N372 ( Contour Mill11 )  
 N373 (1/2 EM CRB 2FL 1 LOC)  
 N374 T03 M06  
 N375 S6195 M03  
 N376 G90 G54 G00 X-.2442 Y.3.0485  
 N377 G43 Z.1 H03 M08  
 N378 G01 Z.-06 F6.8151  
 N379 G41 D3 X.-0604 Y.2.8646 F20  
 N380 G03 X.-025 Y.2.85 I.0354 J.03  
 N381 G01 X.1.47 F27.2606  
 N382 G02 X.1.78 Y.2.74 M0 I.0 J-.31  
 N383 G01 Y.2.41  
 N384 G02 X.1.7355 Y.2.25 I-.31 J0  
 N385 X.1.78 Y.2.09 I-.2655 J-.16  
 N386 G01 Y.1.96  
 N387 G02 X.1.7355 Y.1.8 I-.31 J0  
 N388 X.1.78 Y.1.64 I-.2655 J-.16  
 N389 G01 Y.1.51  
 N390 G02 X.1.7355 Y.1.35 I-.31 J0  
 N391 X.1.78 Y.1.19 I-.2655 J-.16  
 N392 G01 Y.1.06  
 N393 G02 X.1.7355 Y.9 I-.31 J0  
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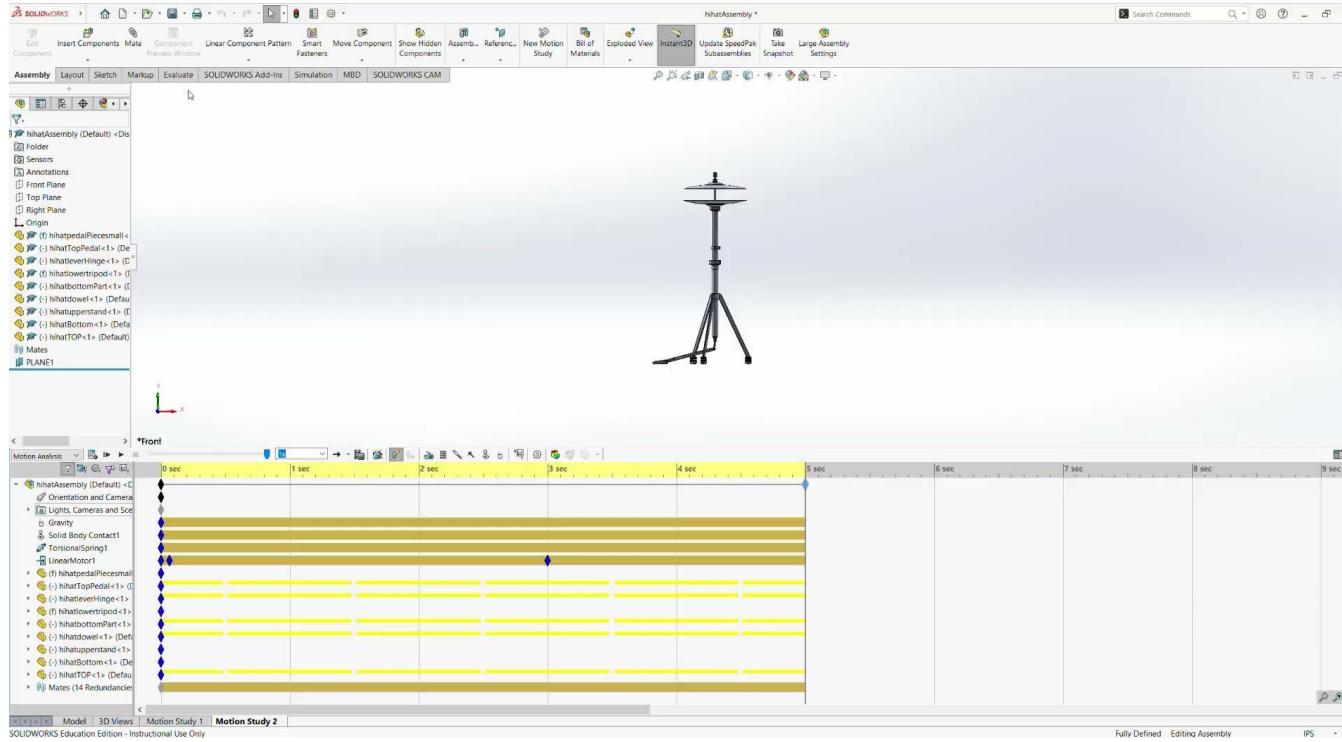
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N401 G61 Y.29  
N402 G62 X1.7355 Y-.45 I-.31 J0  
N403 X1.78 Y.61 I-.2655 J-.16  
N404 G61 Y.74  
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N406 X1.78 Y.106 I-.2655 J-.16  
N407 G61 Y.119  
N408 G62 X1.7355 Y-.15 I-.31 J0  
N409 X1.78 Y.151 I-.2655 J-.16  
N410 G61 Y.164  
N411 G62 X1.47 Y-1.95 I-.31 J0  
N412 G61 X.1.47  
N413 G62 X-1.78 Y-1.64 I0 J.31  
N414 G61 Y.1.51  
N415 G62 X-1.7355 Y-1.35 I.31 J0  
N416 X-1.78 Y-1.19 I.2655 J.16  
N417 G61 Y.1.86  
N418 G62 X-1.7355 Y-.9 I.31 J0  
N419 X-1.78 Y-.74 I.2655 J.16  
N420 G61 Y.-61  
N421 G62 X-1.7355 Y-.45 I.31 J0  
N422 X-1.78 Y-.29 I.2655 J.16  
N423 G61 Y.-16  
N424 G62 X-1.7355 Y0 I.31 J0  
N425 X-1.78 Y.16 I.2655 J.16  
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N427 G62 X-1.7355 Y.45 I.31 J0  
N428 X-1.78 Y.61 I.2655 J.16  
N429 G61 Y.74  
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N431 X-1.78 Y.06 I.2655 J.16  
N432 G61 Y.19  
N433 G62 X-1.7355 Y1.35 I.31 J0  
N434 X-1.78 Y.51 I.2655 J.16  
N435 G61 Y.64  
N436 G62 X-1.7355 Y1.8 I.31 J0  
N437 X-1.78 Y1.96 I.2655 J.16  
N438 G61 Y.09  
N439 G62 X-1.7355 Y2.25 I.31 J0  
N440 X-1.78 Y2.1 I.2655 J.16  
N441 G61 Y2.54  
N442 G62 X-1.47 Y2.85 I.31 J0  
N443 G61 X.025  
N444 G63 X.0064 Y2.8646 I0 J.05  
N445 G49 G60 X.2442 Z.0485  
N446 G60 Z.1  
N447 X.9535 Y-4.7825

# CAM Instruction (cont.)

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N448 G01 Z-.06 F6.8151	N498 T01 M06	N549 G03 X-.025 I-.025 J-.9147	N599 G01 Z-.4963 F16.2	N600 G41 D21 X-.0277 Y3.9009 F48.6	
N449 G41 D23 X.8736 Y-4.5351 F20.4454	N499 S12000 M03	N550 G01 Y3.26	N601 G03 X-.035 Y3.8832 I.0177 J-.0177	N602 G01 Y3.2497 F64.8	
N450 G03 X.8488 Y-4.586 I-.0476 J-.0154	N500 G90 G54 G00 X-.025 Y3.26	N551 G02 X.025 I.025 J-1.1847	N603 G02 X.035 I-.035 J-1.1745	N604 G01 Y4.515	
N451 G02 X.827 Y-4.4937 I.1412 J.276 F27.2606	N501 G43 Z.04 H01 M08	N552 G01 Y4.5053	N605 G03 X-.035 I-.035 J-.9243	N606 G01 Y3.8582	
N452 X.664 Y-4.54 I-.163 J.2637	N502 G01 Z-.185 F16.2	N553 G03 X-.025 I-.025 J-.9147	N607 G03 X-.0277 Y3.8405 I.025 J0	N608 G40 G01 X.0273 Y3.7227	
N453 G01 X.58	N503 G02 X.025 I.025 J-1.1847 F64.8	N554 G01 Y3.26	N609 G00 Z.04	N610 G01 Y4.0187	
N454 G02 X.417 Y-4.4937 I0 J.31	N504 G01 Y4.5053	N555 G00 Z.04	N611 Z-.3963	N612 G01 Z-.6 F16.2	
N455 X.254 Y-4.54 I-.163 J.2637	N505 G03 X-.025 I-.025 J-.9147	N556 Z1.	N613 G41 D21 X-.0277 Y3.9009 F48.6	N614 G03 X-.035 Y3.8832 I.0177 J-.0177	
N456 G01 X.17	N506 G01 Y3.26	N557 ( Contour Mill2 )	N615 G02 X.035 I-.035 J-1.1745	N616 G01 Y4.515	
N457 G02 X.007 Y-4.4937 I0 J.31	N507 G02 X.025 I.025 J-1.1847	N558 X.0273 Y4.0187	N617 G03 X-.035 I-.035 J-.9243	N618 G03 X-.035 I-.035 J-.9243	
N458 X-.156 Y-4.54 I-.163 J.2637	N508 G01 Y4.5053	N559 Z.04	N619 G01 Y3.8582	N620 G03 X-.0277 Y3.8405 I.025 J0	
N459 G01 X-.24	N509 G03 X-.025 I-.025 J-.9147	N560 G01 Z-.185 F16.2	N561 G41 D21 X-.0277 Y3.9009 F48.6	N621 G40 G01 X.0273 Y3.7227	
N460 G02 X-.403 Y-4.4937 I0 J.31	N510 G01 Y3.26	N562 G03 X-.035 Y3.8832 I.0177 J-.0177	N622 G00 Z.04	N623 Z1. M09	
N461 X-.566 Y-4.54 I-.163 J.2637	N511 G00 Z.04	N563 G01 Y3.2497 F64.8	N571 Y4.0187	N624 G91 G28 Z0	
N462 G01 X-.65	N512 Z-.085	N564 G02 X.035 I-.035 J-1.1745	N572 Z-.085	N625 G28 X0 Y0	
N463 G02 X-.813 Y-4.4937 I0 J.31	N513 G01 Z-.2888 F16.2	N565 G01 Y4.515	N573 G01 Z-.2888 F16.2	N626 M30	
N464 X-.976 Y-4.54 I-.163 J.2637	N514 G02 X.025 I.025 J-1.1847 F64.8	N566 G03 X-.035 I-.035 J-.9243	N574 G41 D21 X-.0277 Y3.9009 F48.6		
N465 G01 X-1.06	N515 G01 Y4.5053	N567 G01 Y3.8582	N575 G03 X-.035 Y3.8832 I.0177 J-.0177		
N466 G02 X-1.37 Y-4.23 I0 J.31	N516 G03 X-.025 I-.025 J-.9147	N568 G00 Z.04	N576 G01 Y3.2497 F64.8		
N467 G01 Y-3.16	N517 G01 Y3.26	N569 G40 G01 X.0273 Y3.7227	N577 G02 X.035 I-.035 J-1.1745		
N468 G02 X-2.85 Y-2.85 I.31 J0	N518 G02 X.025 I.025 J-1.1847	N570 G00 Z.04	N578 G01 Y4.515		
N469 G01 X-.976	N519 G01 Y4.5053	N571 Y4.0187	N579 G03 X-.035 I-.035 J-.9243		
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N471 X-.65 Y-2.85 I.163 J.-2637	N521 G01 Y3.26	N573 G01 Z-.2888 F16.2	N581 G03 X-.0277 Y3.8405 I.025 J0		
N472 G01 X-.566	N522 G00 Z.04	N574 G41 D21 X-.0277 Y3.9009 F48.6	N582 G40 G01 X.0273 Y3.7227		
N473 G02 X-.403 Y-2.8963 I0 J-.31	N523 Z-.1888	N575 G00 Z.04	N583 G00 Z.04		
N474 X-.24 Y-2.85 I.163 J.-2637	N524 G01 Z-.3925 F16.2	N576 G01 Z-.2888 F16.2	N584 Y4.0187		
N475 G01 X-.156	N525 G01 X.025 I.025 J-1.1847 F64.8	N577 G02 X.035 I-.035 Y3.8832 I.0177 J-.0177	N585 Z-.1888		
N476 G02 X.007 Y-2.8963 I0 J-.31	N526 G01 Y4.5053	N578 G01 Y3.2497 F64.8	N586 G01 Z-.3925 F16.2		
N477 X-.17 Y-2.85 I.163 J.-2637	N527 G03 X-.025 I-.025 J-.9147	N579 G02 X.035 I-.035 J-1.1745	N587 G41 D21 X-.0277 Y3.9009 F48.6		
N478 G01 X.254	N528 G01 Y3.26	N580 G01 Y4.515	N588 G03 X-.035 Y3.8832 I.0177 J-.0177		
N479 G02 X-417 Y-2.8963 I0 J-.31	N529 G02 X.025 I.025 J-1.1847	N581 G03 X-.035 I-.035 J-.9243	N589 G01 Y3.2497 F64.8		
N480 X.58 Y-2.85 I.163 J.-2637	N530 G01 Y4.5053	N582 G40 G01 X.0273 Y3.7227	N590 G02 X.035 I-.035 J-1.1745		
N481 G01 X.664	N531 G03 X-.025 I-.025 J-.9147	N583 G00 Z.04	N591 G01 Y4.515		
N482 G02 X-827 Y-2.8963 I0 J-.31	N532 G01 Y3.26	N584 Y4.0187	N592 G03 X-.035 I-.035 J-.9243		
N483 X.99 Y-2.85 I.163 J.-2637	N533 G00 Z.04	N585 Z-.1888	N593 G01 Y3.8582		
N484 G01 X.074	N534 Z-.2925	N586 G01 Z-.3925 F16.2	N594 G03 X-.0277 Y3.8405 I.025 J0		
N485 G02 X-1.384 Y-3.16 I0 J-.31	N535 G01 Z-.4963 F16.2	N587 G41 D21 X-.0277 Y3.9009 F48.6	N595 G40 G01 X.0273 Y3.7227		
N486 G01 Y-4.23	N536 G02 X.025 I.025 J-1.1847 F64.8	N588 G03 X-.035 Y3.8832 I.0177 J-.0177	N596 G00 Z.04		
N487 G02 X1.074 Y-4.54 I-.31 J0	N537 G01 Y4.5053	N589 G01 Y3.2497 F64.8	N597 Y4.0187		
N488 G01 X.99	N538 G03 X-.025 I-.025 J-.9147	N590 G02 X.035 I-.035 J-1.1745	N598 Z-.2925		
N489 G02 X-827 Y-4.4937 I0 J.31	N539 G01 Y3.26	N591 G01 Y4.515	N599 G03 X-.0277 Y3.8405 I.025 J0		
N490 X.8052 Y-4.506 I-.163 J.2637	N540 G02 X.025 I.025 J-1.1847	N592 G03 X-.035 I-.035 J-.9243	N600 G40 G01 X.0273 Y3.7227		
N491 G03 X.7808 Y-4.5351 I.0228 J-.0445	N541 G01 Y4.5053	N593 G01 Y3.8582	N601 G03 X-.035 Y3.8832 I.0177 J-.0177		
N492 G40 G01 X.7005 Y-4.7825	N542 G03 X-.025 I-.025 J-.9147	N594 G03 X-.0277 Y3.8405 I.025 J0	N602 G01 Y3.2497 F64.8		
N493 G00 Z.1	N543 G01 Y3.26	N595 G40 G01 X.0273 Y3.7227	N603 G02 X.035 I-.035 J-1.1745		
N494 Z1. M09	N544 G00 Z.04	N596 G00 Z.04	N604 G01 Y4.515		
N495 G91 G28 Z0	N545 Z-.3963	N597 Y4.0187	N605 G03 X-.035 Y3.8832 I.0177 J-.0177		
N496 ( Rough Mill2 )	N546 G01 Z-.6 F16.2	N598 Z-.2925	N606 G01 Y3.8582		
N497 (1/4 EM CRB 2FL 3/4 LOC)	N547 G02 X.025 I.025 J-1.1847 F64.8		N607 G03 X-.0277 Y3.8405 I.025 J0		
	N548 G01 Y4.5053		N608 G40 G01 X.0273 Y3.7227		

# Motion Analysis

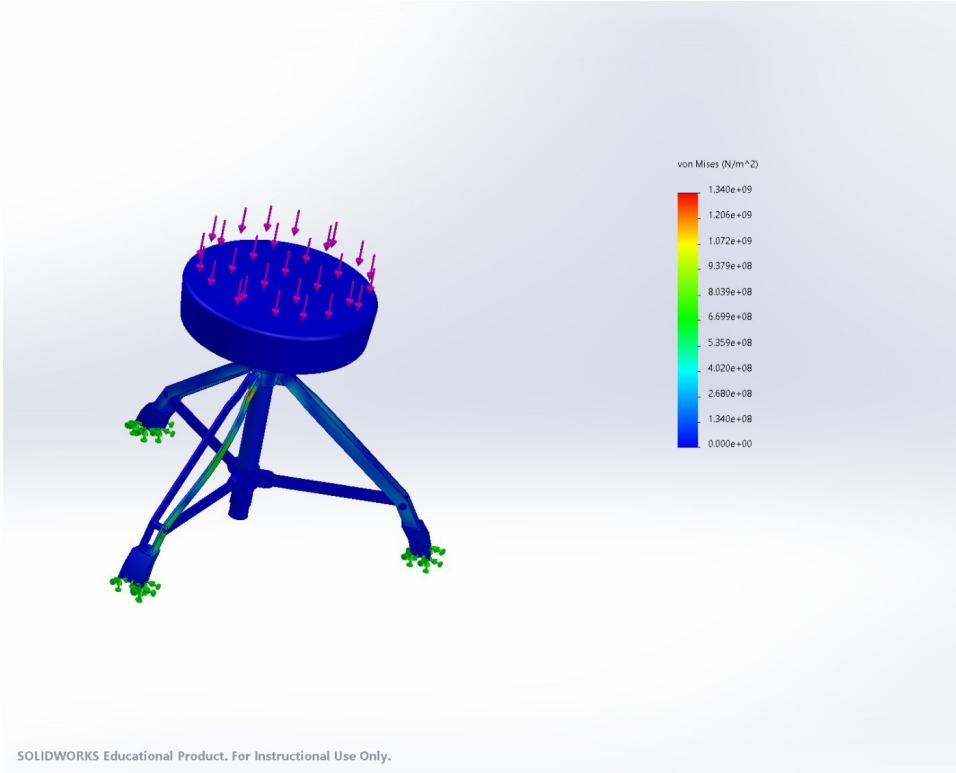
# Hi-Hat Motion Analysis



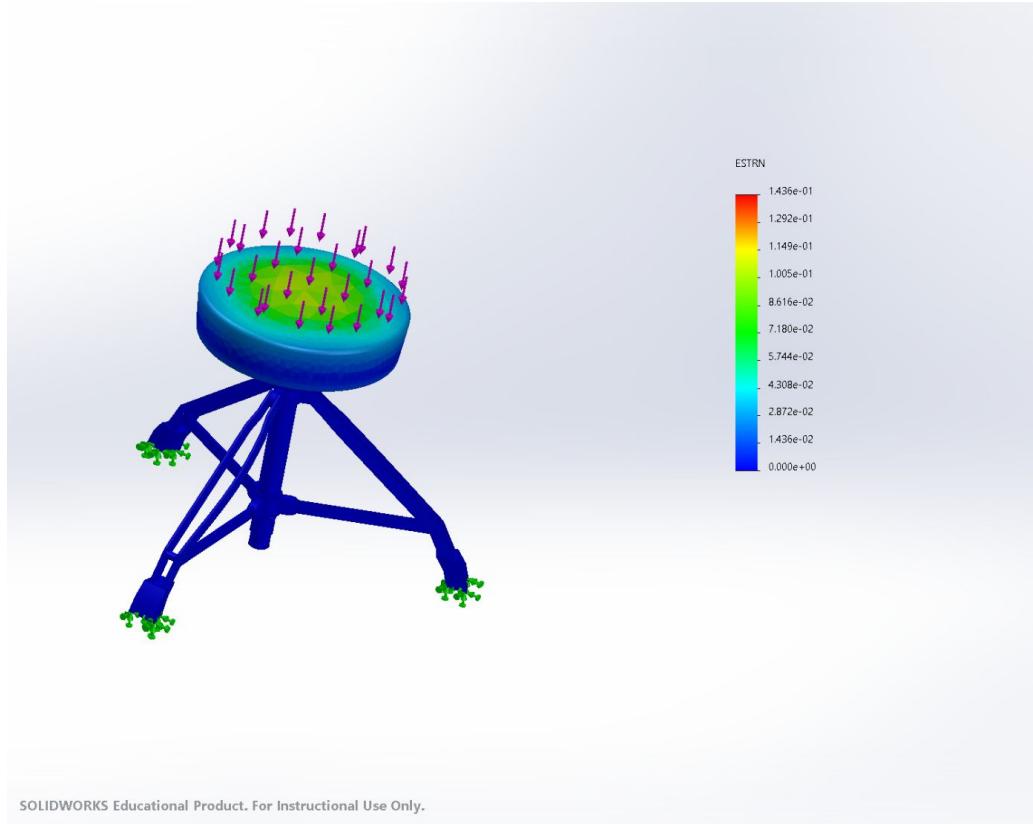
The pedal-cymbal mechanism was analysed with a motion study. A linear oscillating motor was placed on a pedal to a frequency of 1 Hz with a displacement of 1 in.

# Finite element analysis

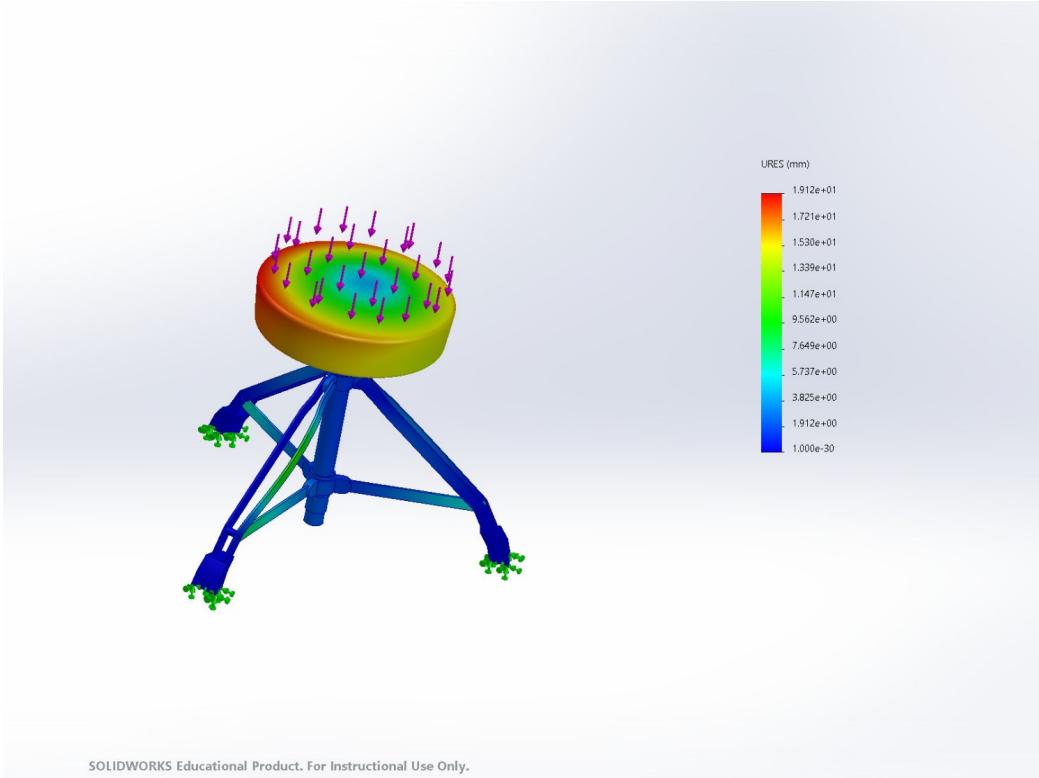
# Stool FEA (Stress)



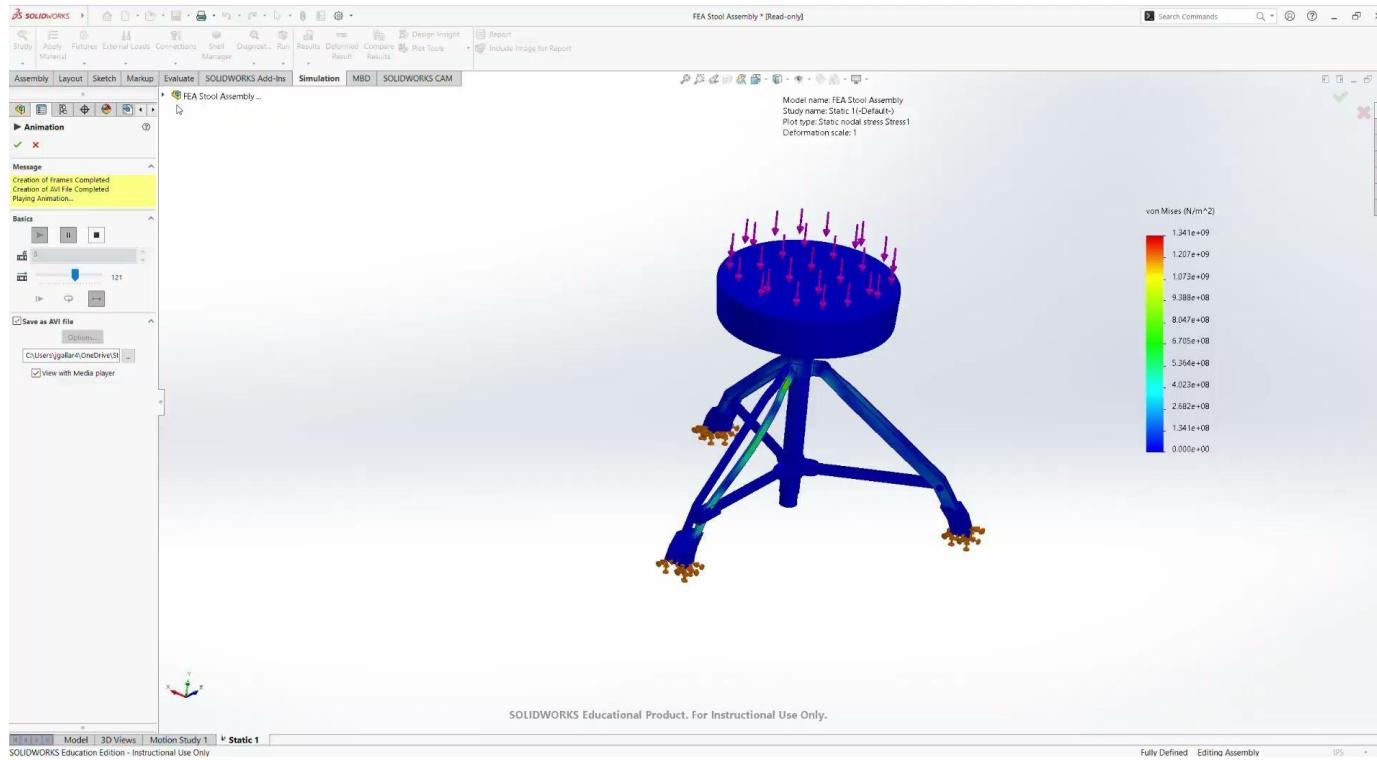
# Stool FEA (Strain)



# Stool FEA (Displacement)

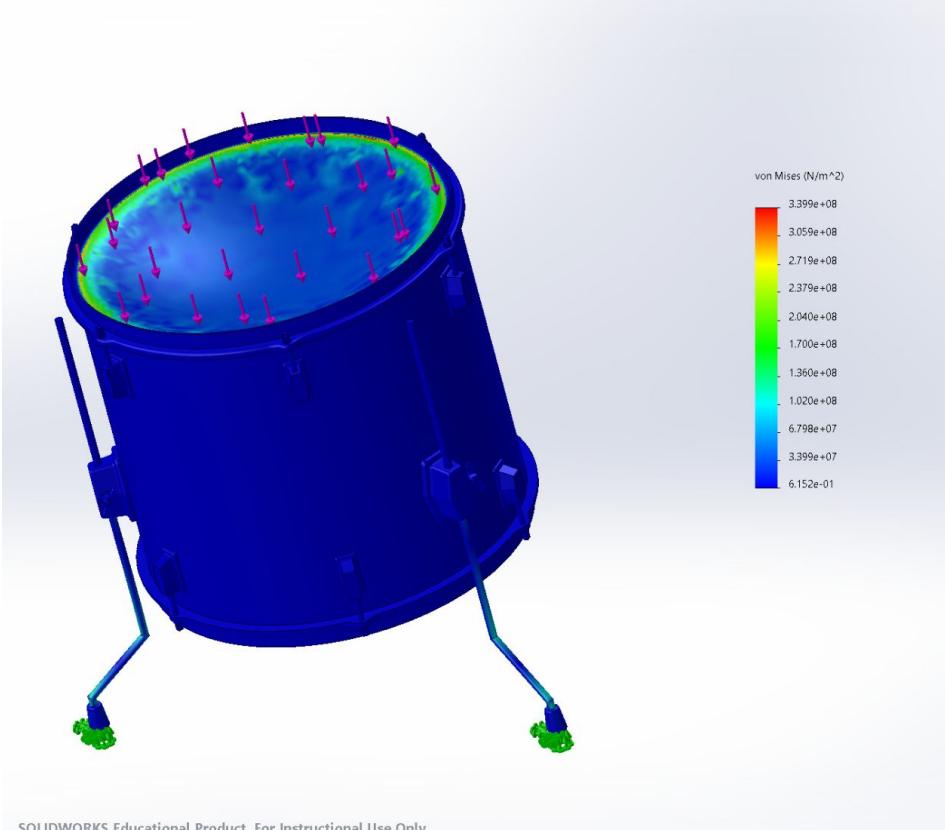


# Animation of Stool FEA



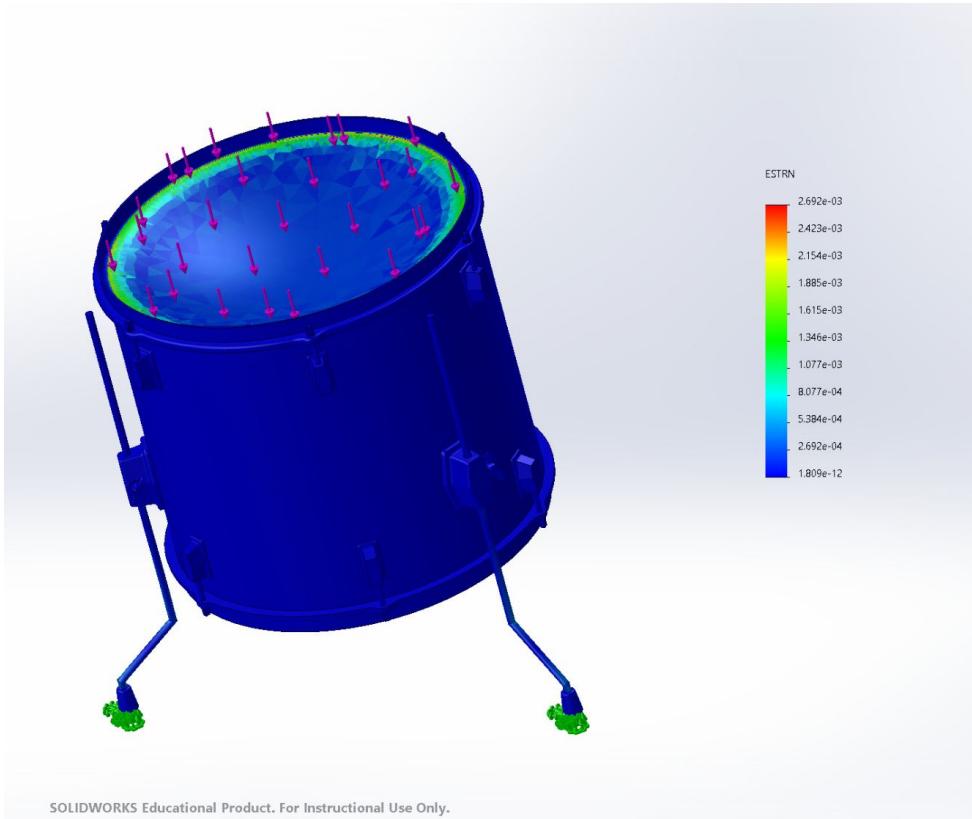
The maximum load of the stool was tested. The max load that we tested was 10000 N, which is well over a metric ton of mass. At this force, the cushion of the stool began to droop down and the metal stand began to buckle. This analysis shows at around what force value the stool will fail.

# Floor Tom FEA (Stress)

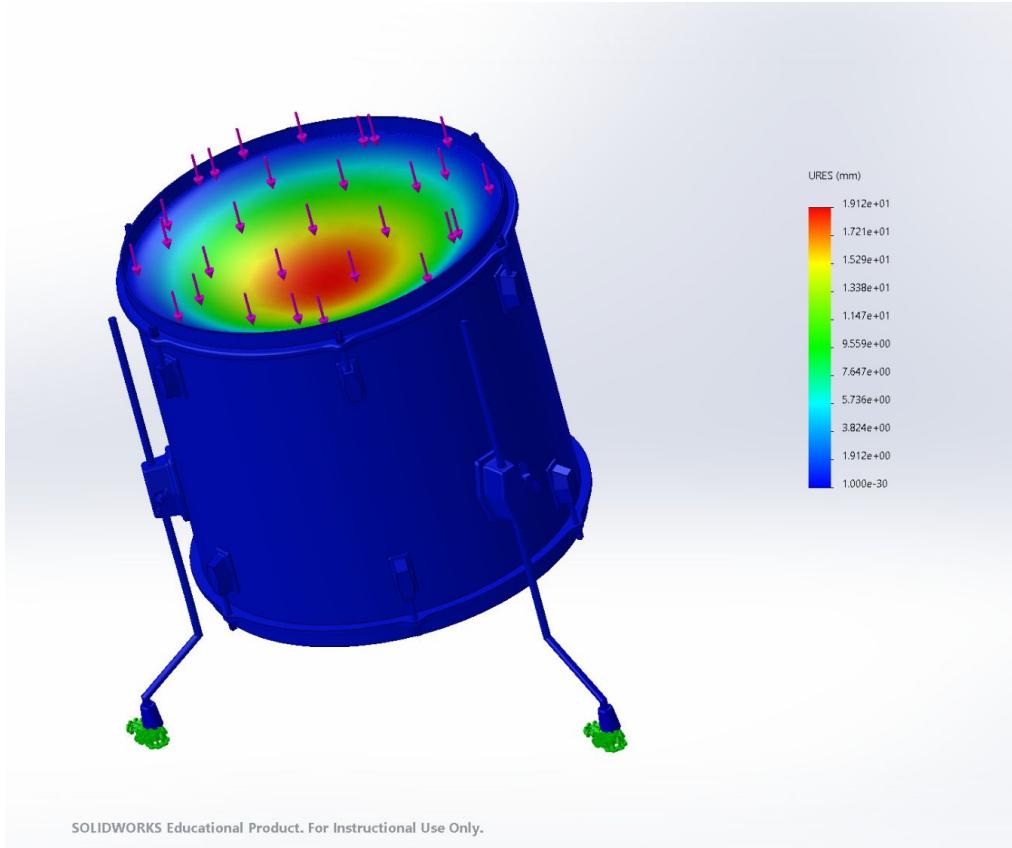


For this analysis, we decided to analyze the displacement of the drum vinyl. With a force of 1000N, we were able to model an accurate displacement, with the center of the vinyl bowing into the drum, all while the rest of the drum remained intact.

# Floor Tom FEA (Strain)



# Floor Tom FEA (Displacement)



*Fin*