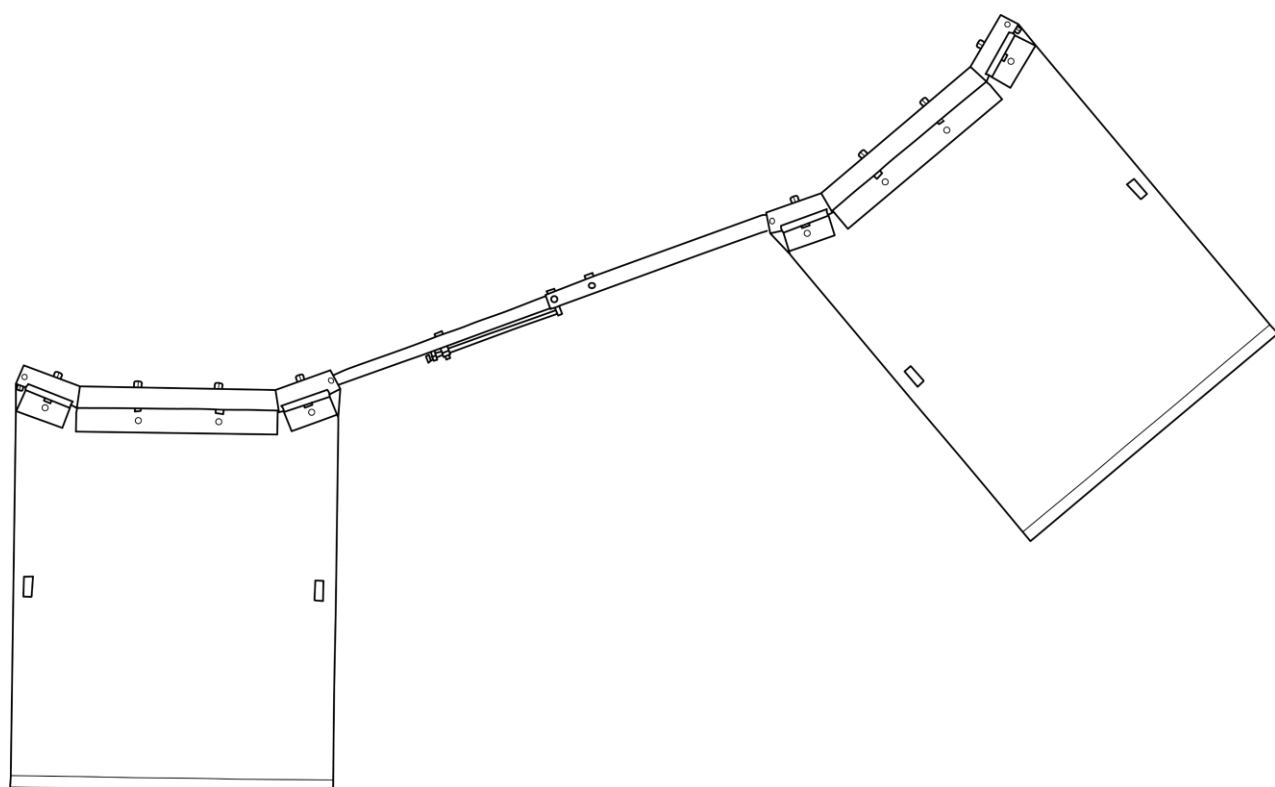


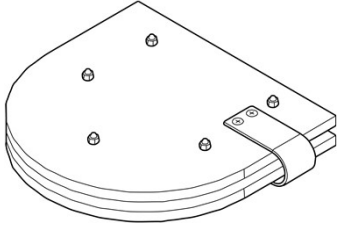
# WHEELCHAIR FENCING FRAME

## INSTRUCTION MANUAL

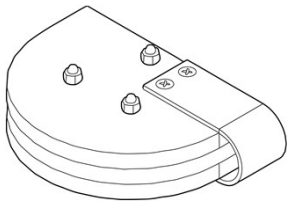


Imperial College  
London

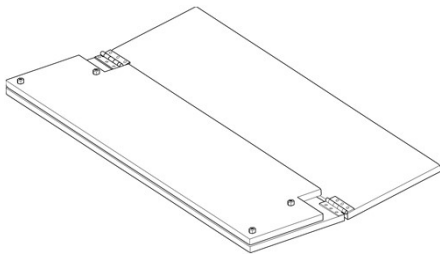
# CONTENTS



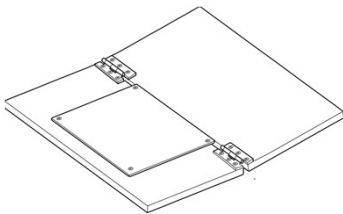
**LARGE ROD BENDING RIG**  
Page 10 - 15



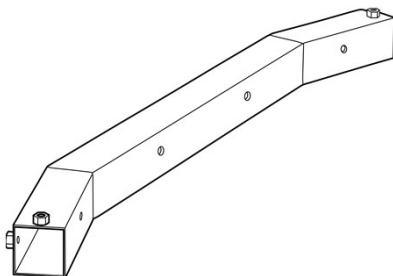
**SMALL ROD BENDING RIG**  
Page 16 - 20



**LARGE SHEET BENDING RIG**  
Page 21 - 24

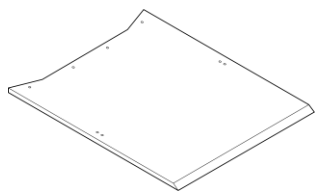


**SMALL SHEET BENDING RIG**  
Page 25 - 28

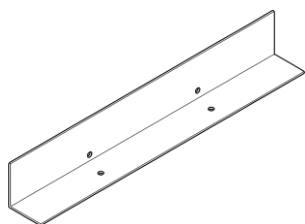


**BRACE**  
Page 30 - 33

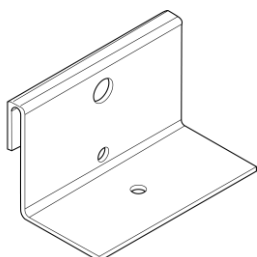
# CONTENTS



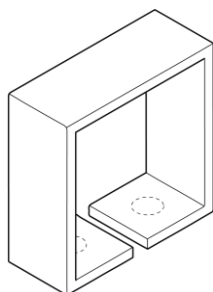
**BOARD PART I**  
Page 34 - 37



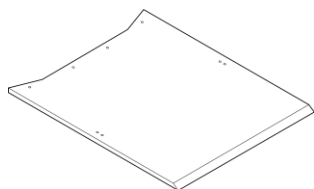
**MAIN BRACKET**  
Page 38 - 42



**SIDE BRACKET**  
Page 43 - 48

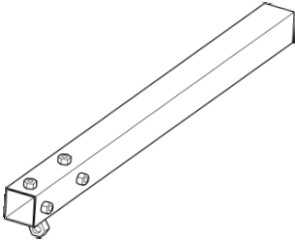


**BOARD HOOK**  
Page 49 - 51

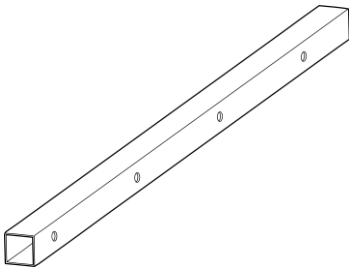


**BOARD PART II**  
Page 52 - 55

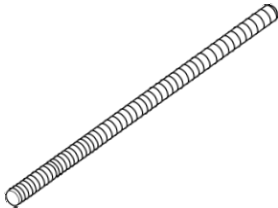
# CONTENTS



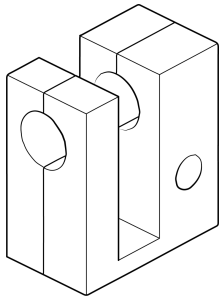
**FEMALE EXTENDING**  
Page 56 - 59



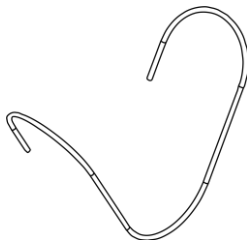
**MALE EXTENDING**  
Page 60 - 62



**STUDDING**  
Page 63 - 66

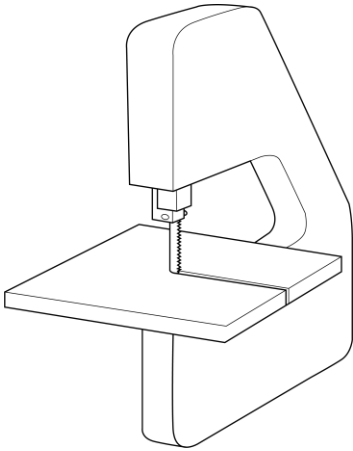


**CONNECTOR**  
Page 67 - 71

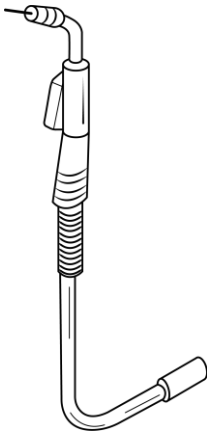


**WHEEL HOOK**  
Page 72 - 74

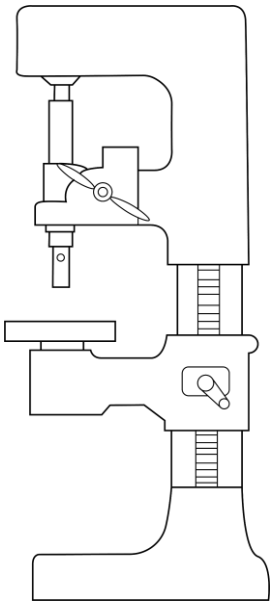
# TOOLS



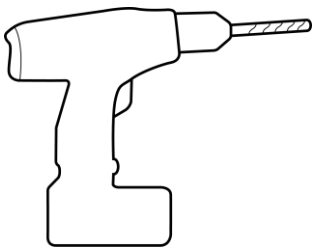
BAND SAW  
OR JIGSAW



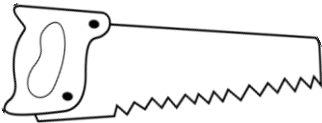
WELDER



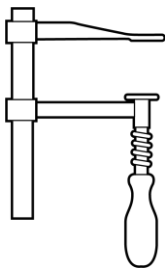
PILLAR DRILL



DRILL



HACK SAW



CLAMPS



CENTER DRILL



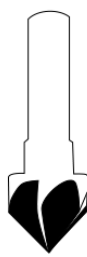
Ø 3 MM  
DRILL



Ø 8 MM  
DRILL

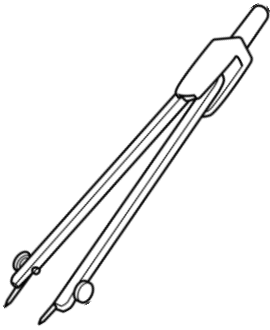


Ø 13 MM  
DRILL

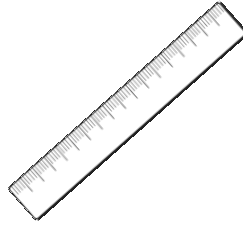


COUNTER SINK

# TOOLS



COMPASS

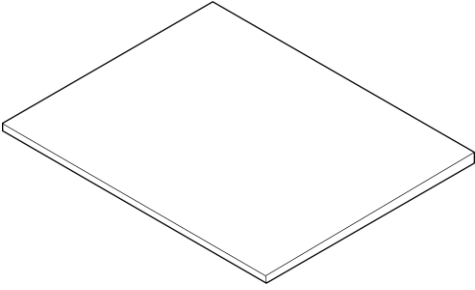


RULER

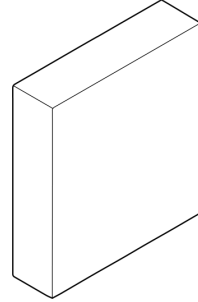


PENCIL

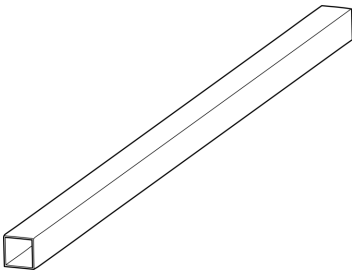
# MATERIALS



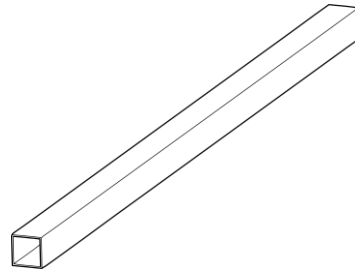
2300 X 1000 X 18 MM  
**PLYWOOD BOARD**



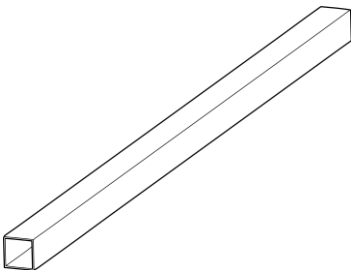
50 X 45 X 26 MM  
**PLYWOOD BLOCK**



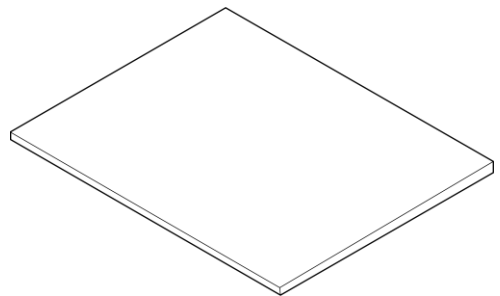
50 MM SQUARE BEAM  
1665 MM LONG, 3 MM THICK  
**MILD STEEL**



40 MM SQUARE BEAM  
610 MM LONG, 3 MM THICK  
**MILD STEEL**

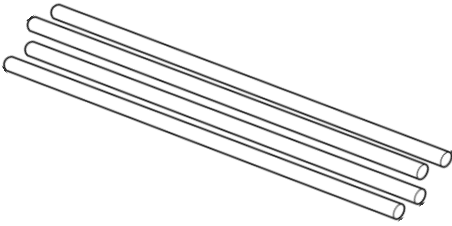


30 MM SQUARE BEAM  
760 MM LONG, 3 MM THICK  
**MILD STEEL**

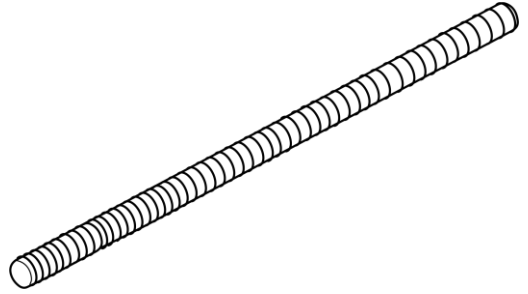


250 X 1000 X 3 MM  
**SHEET METAL**

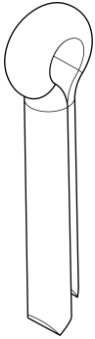
# MATERIALS



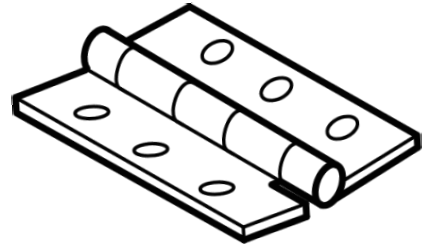
**4 STEEL ROD**  
Ø 12 MM ROD  
1000 M LONG



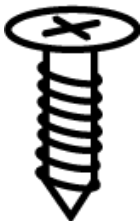
**MILD STEEL STUDDING**  
12 MM DIAMETER  
300 MM LONG



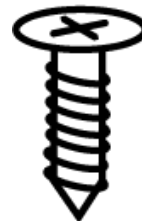
**2 STEEL SPLIT PINS**  
3 MM DIAMETER  
25 MM DIAMETER



**4 HINGES**  
50 MM LONG



**28 SCREWS Ø 3 MM**  
8 MM LONG



**5 SCREWS Ø 6 MM**  
25 MM LONG



# MATERIALS



**24 M8 BOLT**  
30 MM LONG



**8 M8 BOLT**  
70 MM LONG



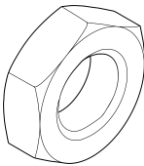
**8 M6 BOLTS**  
40 MM LONG



**1 M12 NUT**  
FULL ZINC



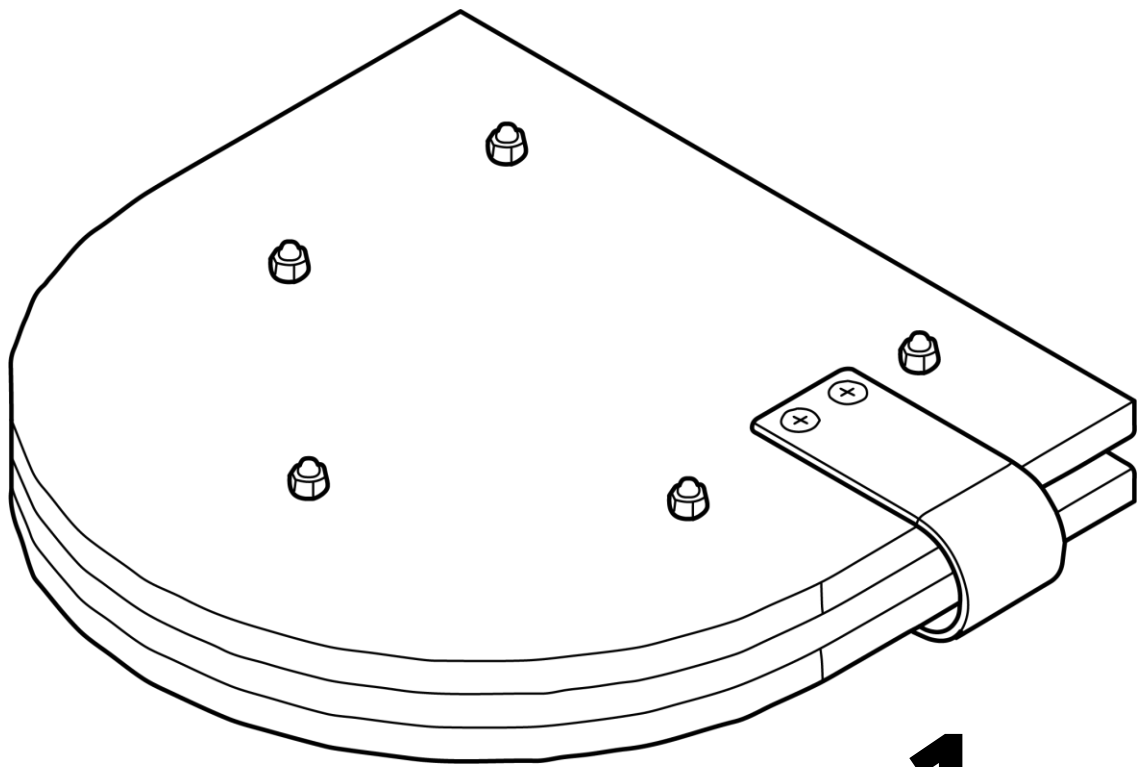
**32 M8 NUT**  
FULL ZINC



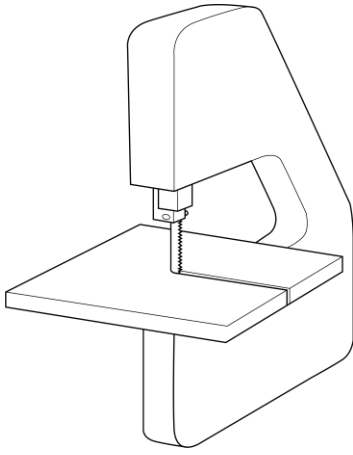
**8 M6 NUTS**  
FULL ZINC

# LARGE ROD BENDING RIG

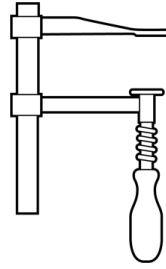
DRAWINGS # 51, #51.1, #51.2 & #53



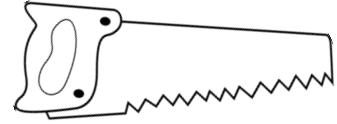
**1x**



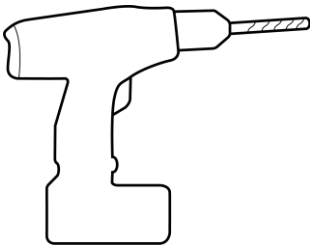
BAND SAW



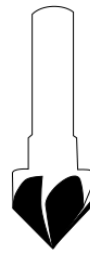
CLAMPS



HACK SAW



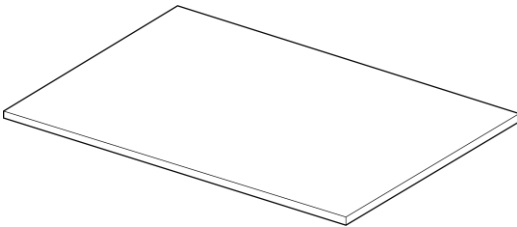
DRILL



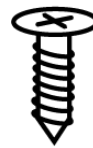
COUNTER SUNK



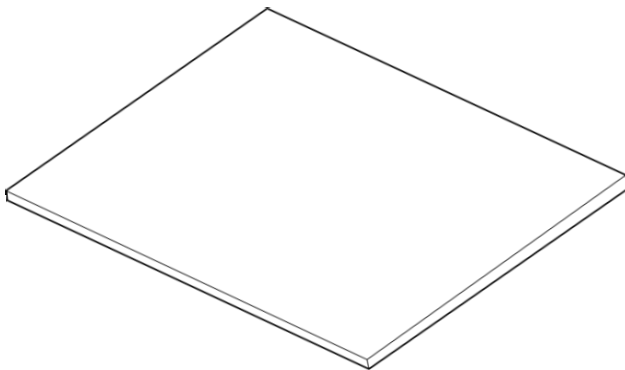
Ø 6 MM DRILL



**1 ×** 200 X 40 X 3 MM  
METAL SHEET



**4 ×** SCREW  
Ø 6 MM  
25 MM LONG



**3 ×** 300 X 300 X 18 MM  
PLYWOOD BOARD



**5 ×** M6 BOLT  
40 MM LONG



**5 ×** M6 NUT

1

DWG.

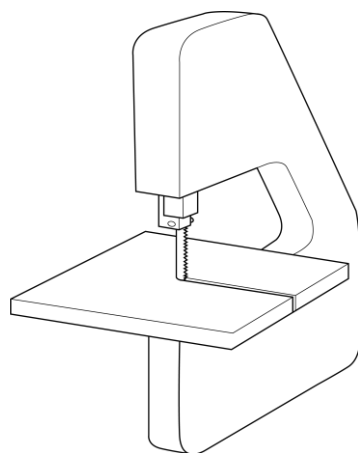
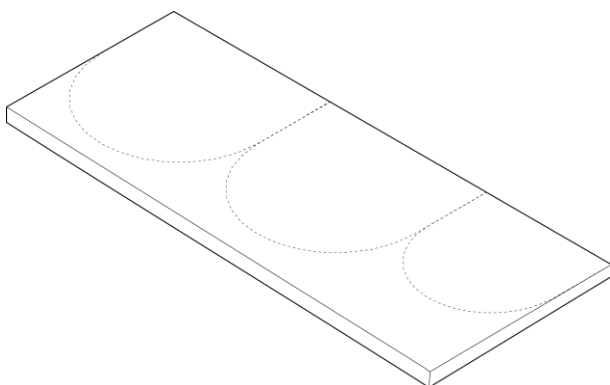
2 X #51.1

1 X #51.2

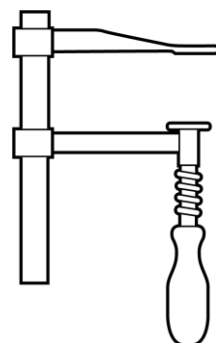
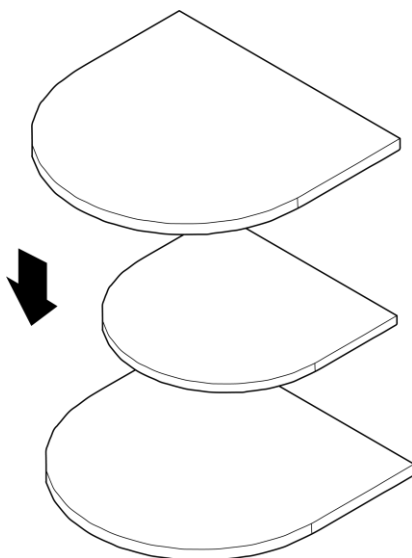
Materials

18MM

PLYWOOD BOARD



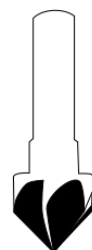
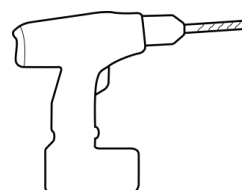
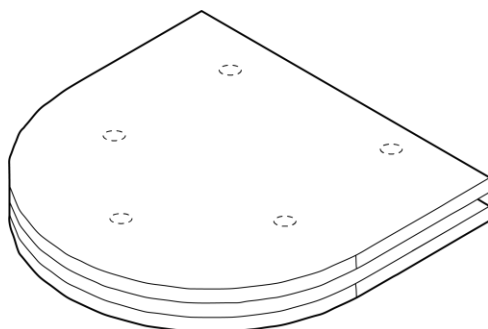
2



3

DWG.

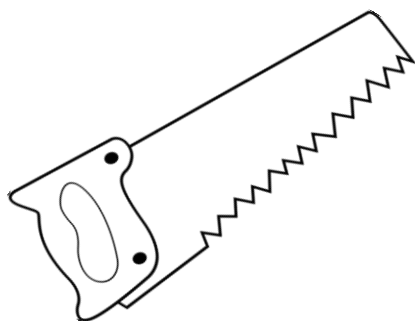
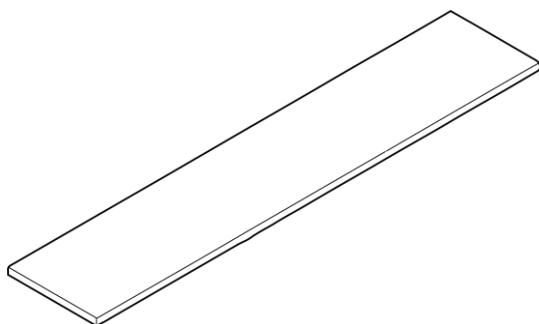
#51



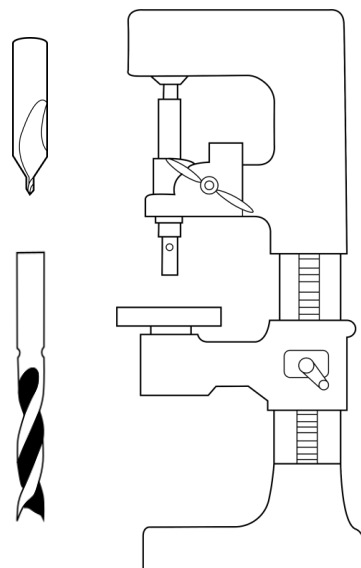
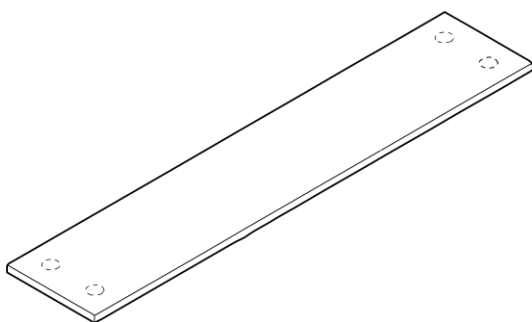
4

DWG.  
#53

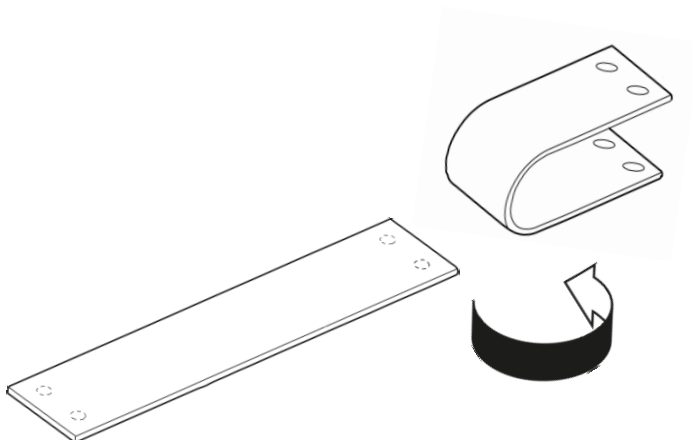
Materials  
3 MM METAL  
SHEET



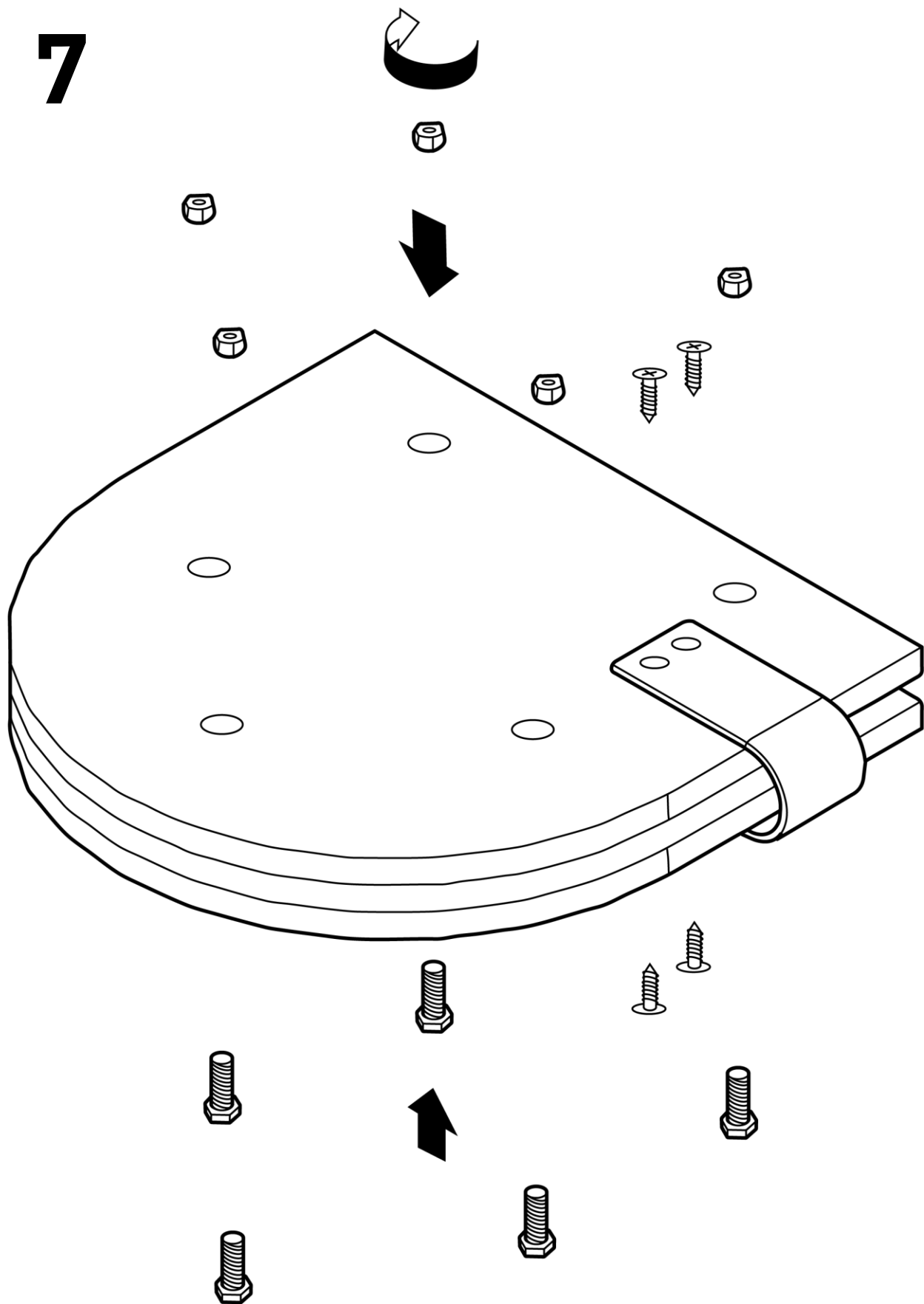
5



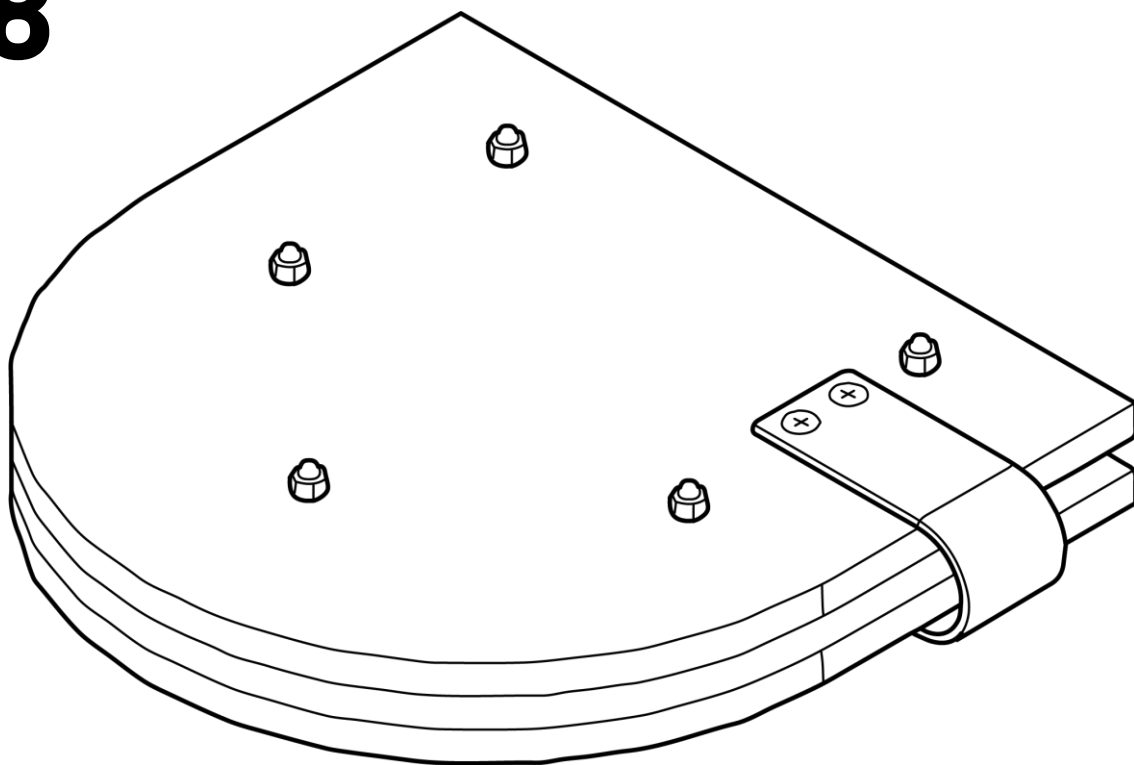
6



7

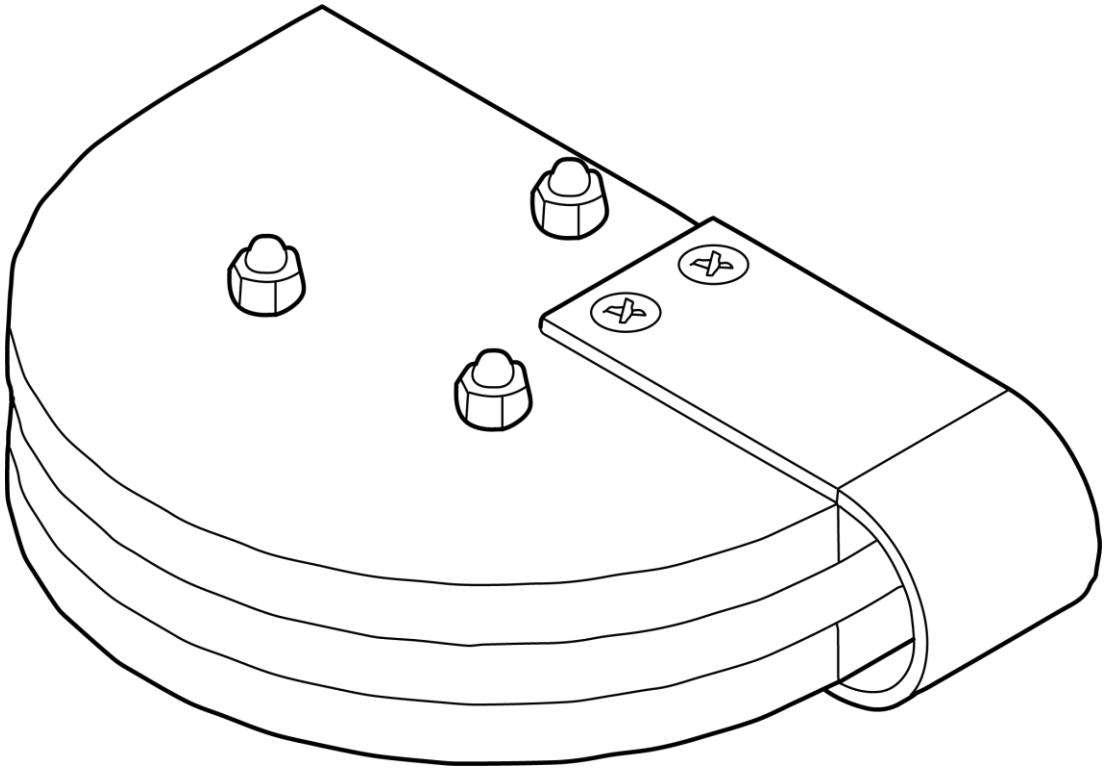


8



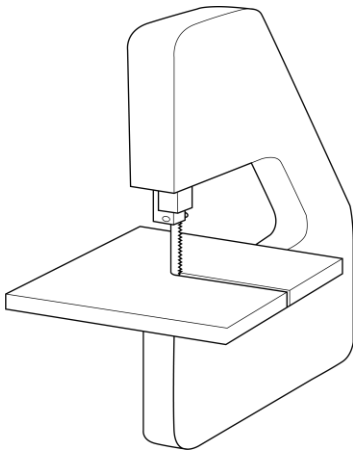
# SMALL ROD BENDING RIG

**DRAWINGS # 52, #52.1, #52.2 & #53**

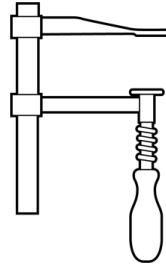


**1x**

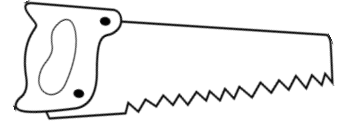




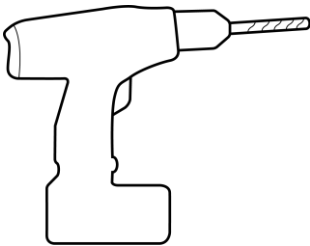
**BAND SAW**



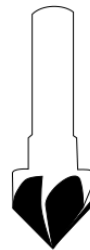
**CLAMPS**



**HACK SAW**



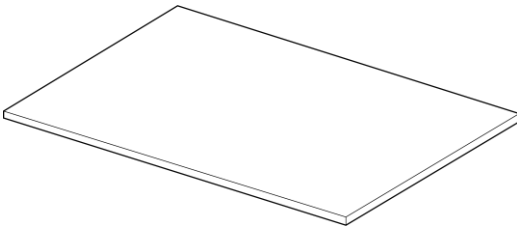
**DRILL**



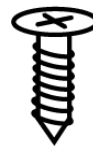
**COUNTER SUNK**



**Ø 6 MM DRILL**



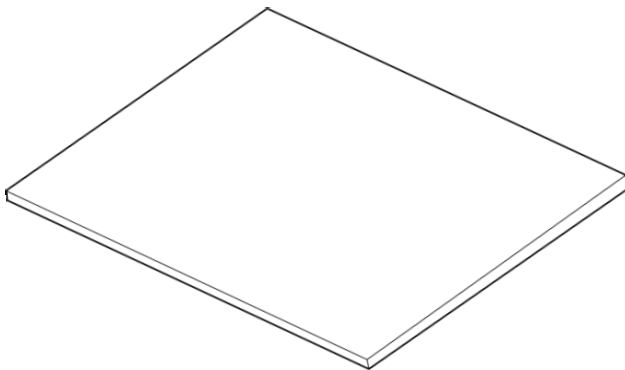
**1 × 200 X 40 X 3 MM  
METAL SHEET**



**4 × SCREW  
Ø 6 MM  
25 MM LONG**



**3 × M6 BOLT  
40 MM LONG**



**3 × 160 X 160 X 18 MM  
PLYWOOD BOARD**



**3 × M6 NUT**

# 1

**DWG.**

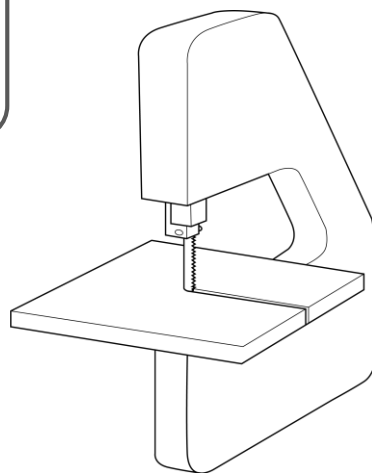
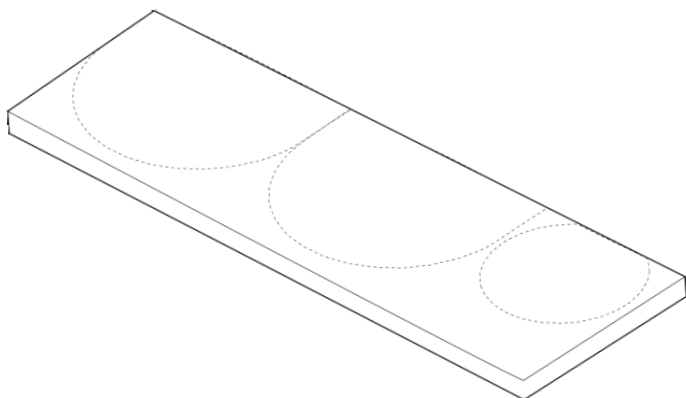
2 X #52.1

1 X #52.2

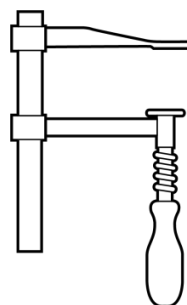
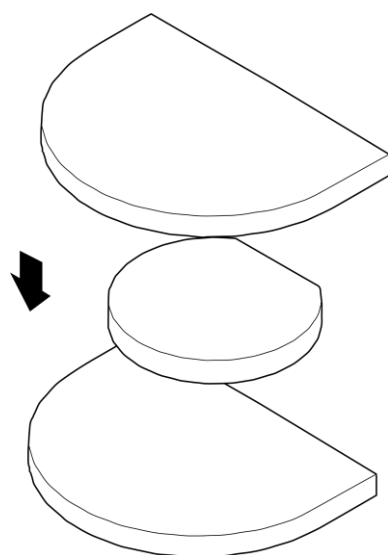
**Materials**

18MM

PLYWOOD BOARD



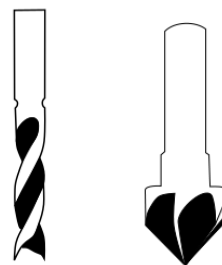
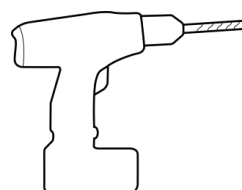
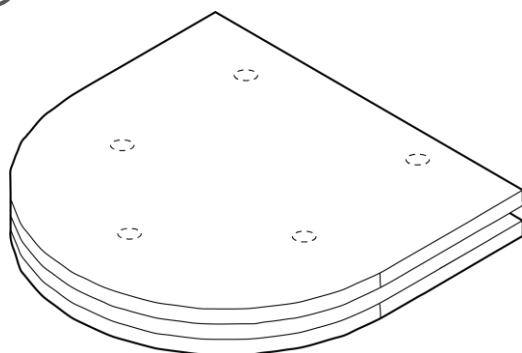
# 2



# 3

**DWG.**

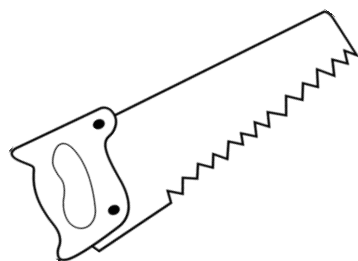
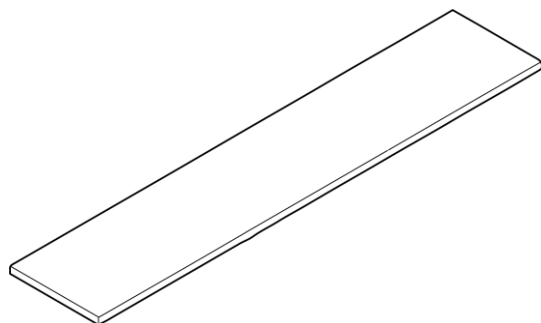
#52



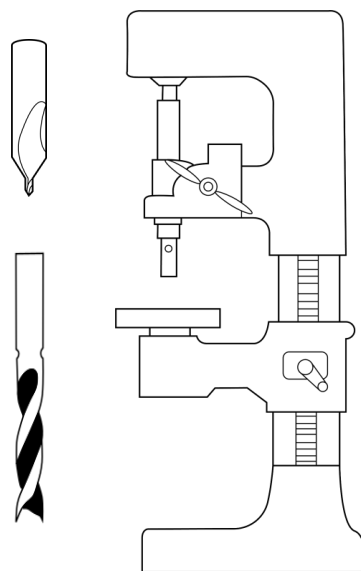
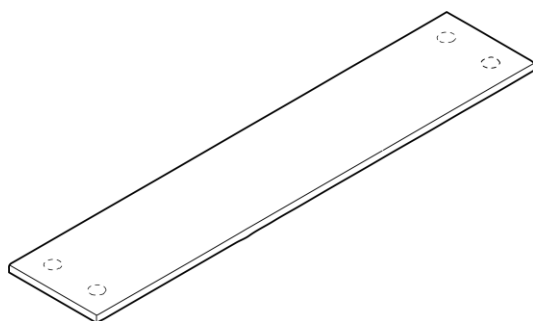
4

DWG.  
#53

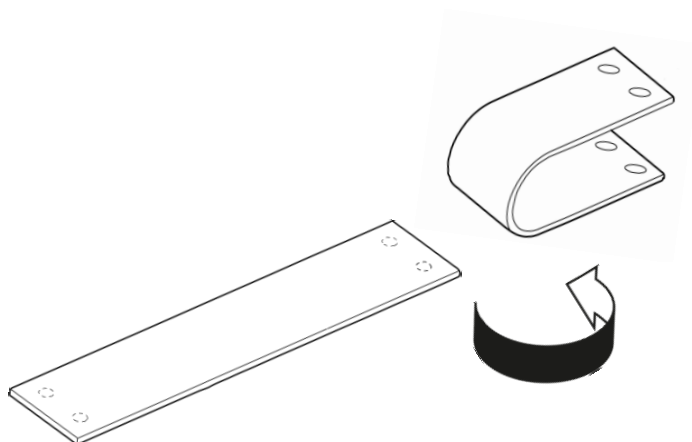
Materials  
3 MM METAL  
SHEET



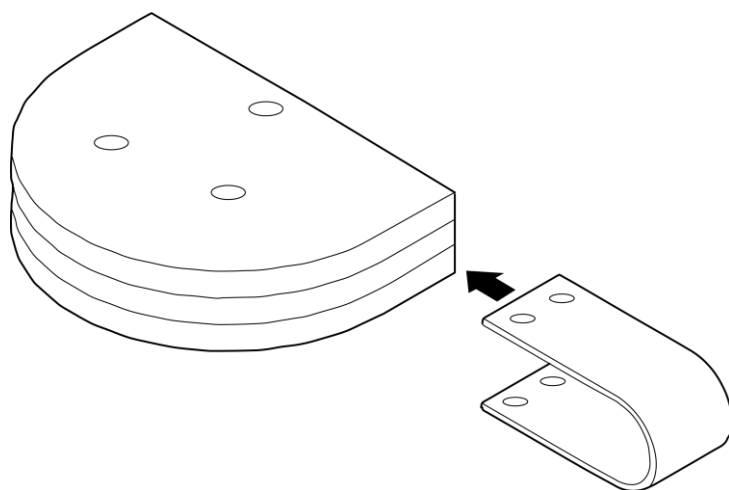
5



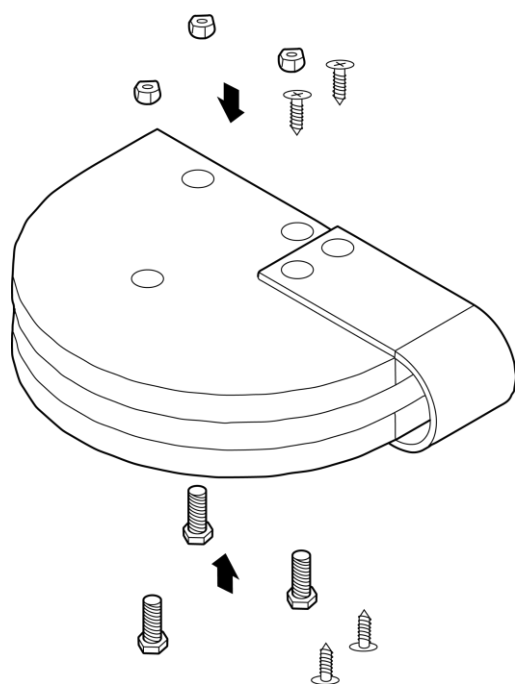
6



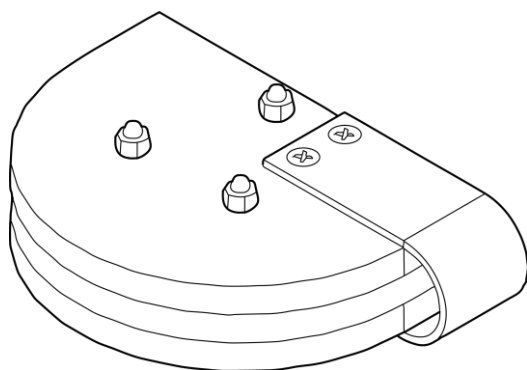
7



8

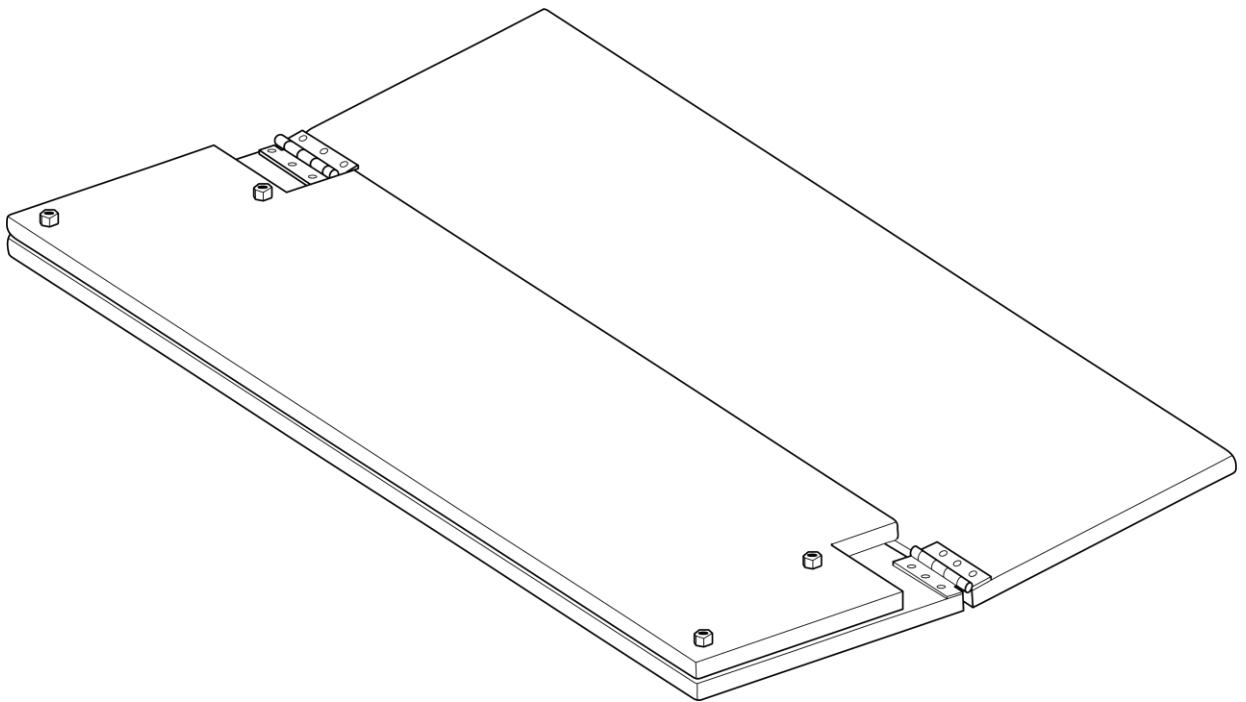


9

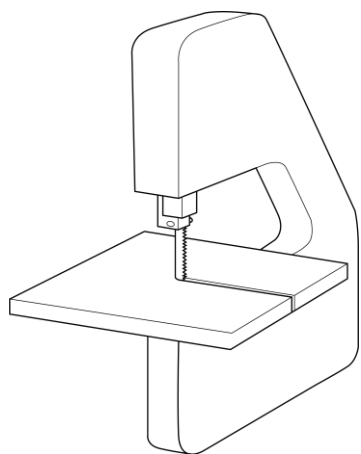


# LARGE SHEET BENDING RIG

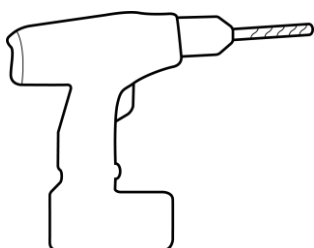
**DRAWINGS # 54**



**1x**



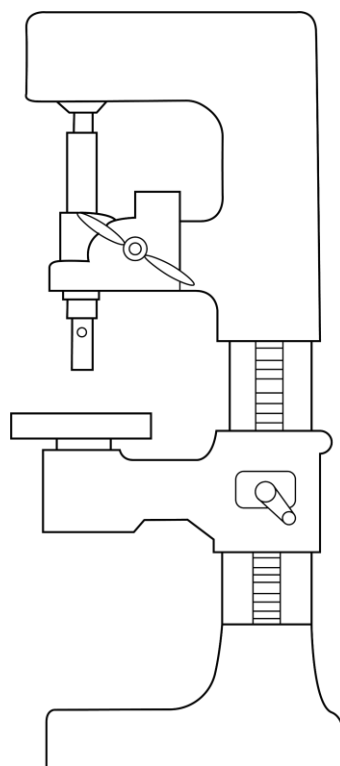
**BAND SAW**



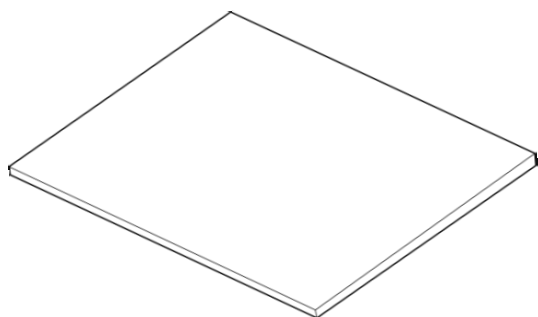
**DRILL**



**Ø 6 MM DRILL**



**PILAR DRILL**



**3 ×** 300 X 300 X  
12 MM  
PLYWOOD BOARD



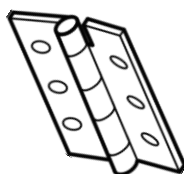
**12 ×** SCREW  
Ø 3 MM  
8 MM LONG



**4 ×** M6 BOLT  
30 MM LONG



**4 ×** M6 BOLT

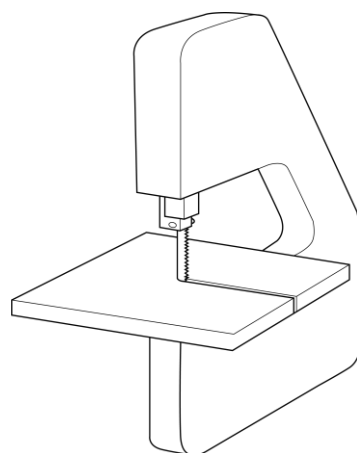


**2 ×** HINGE

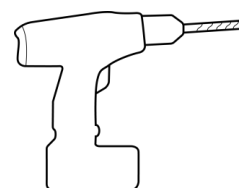
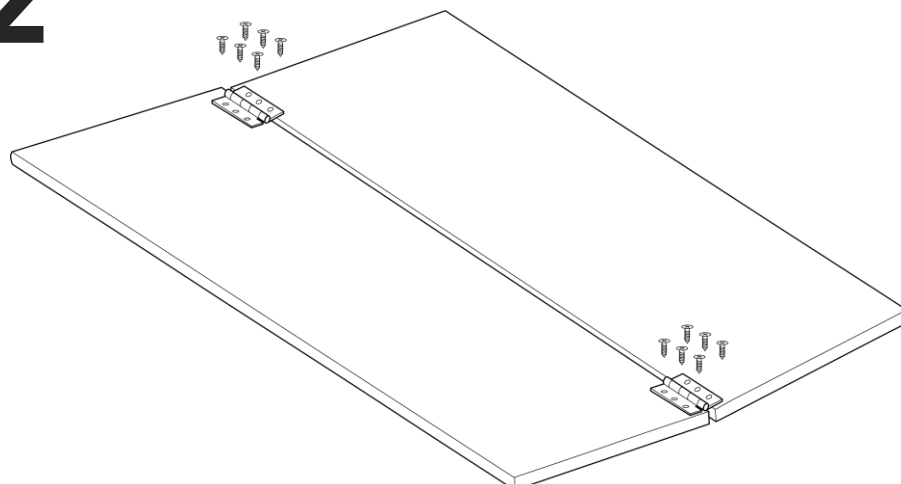
# 1

**DWG.**  
2 X #54

**Materials**  
12 MM  
PLYWOOD BOARD



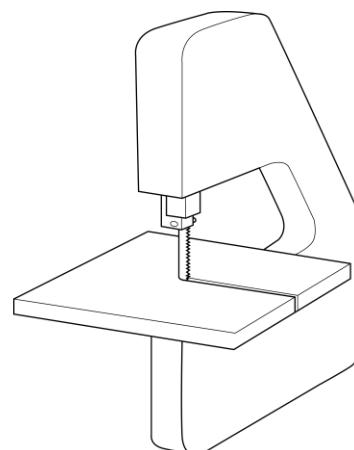
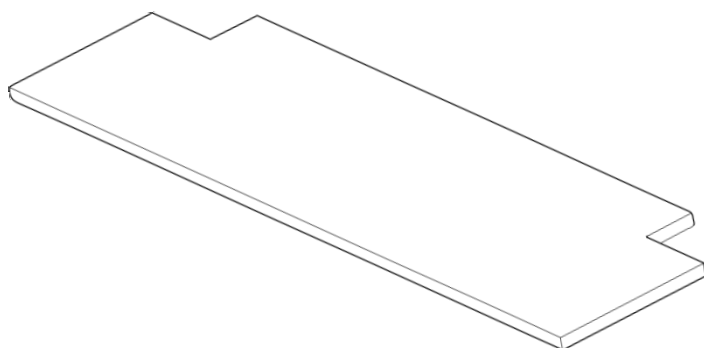
# 2



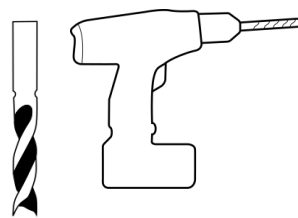
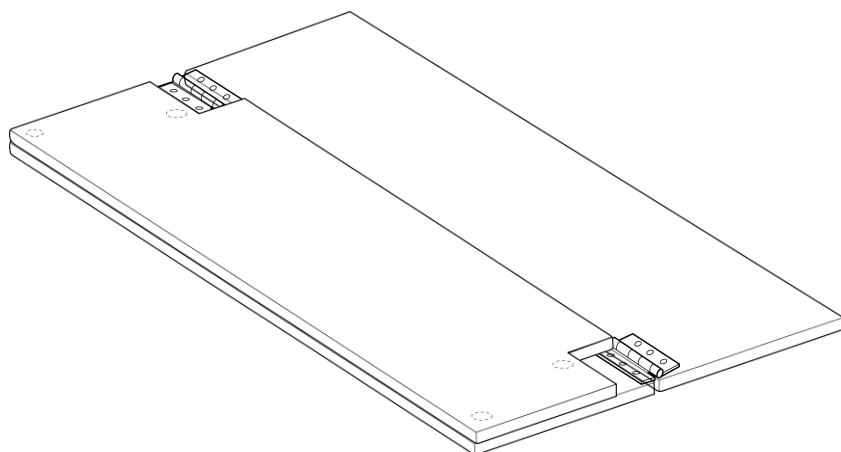
# 3

**DWG.**  
1 X #54.2

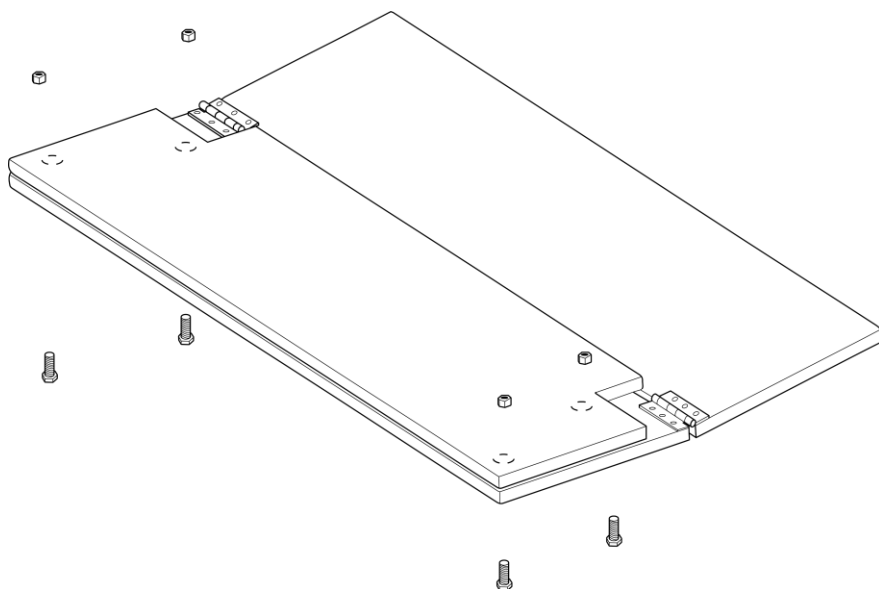
**Materials**  
12 MM  
PLYWOOD BOARD



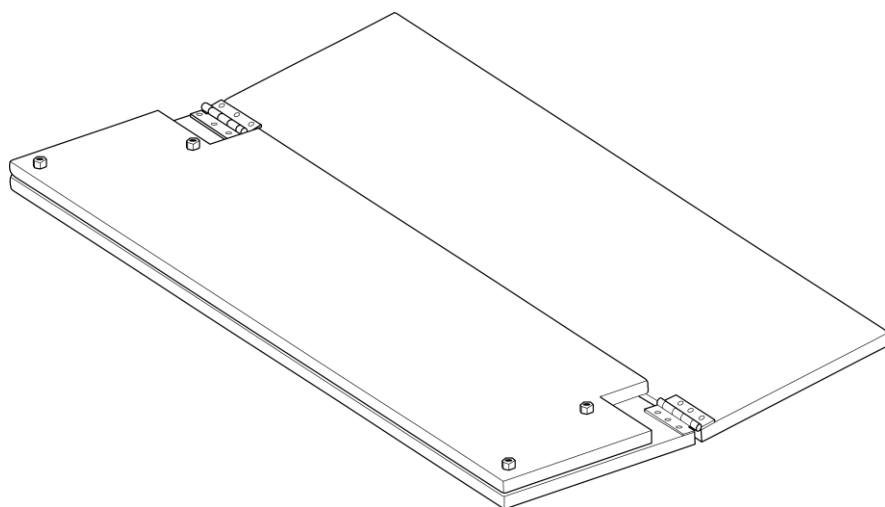
4



5



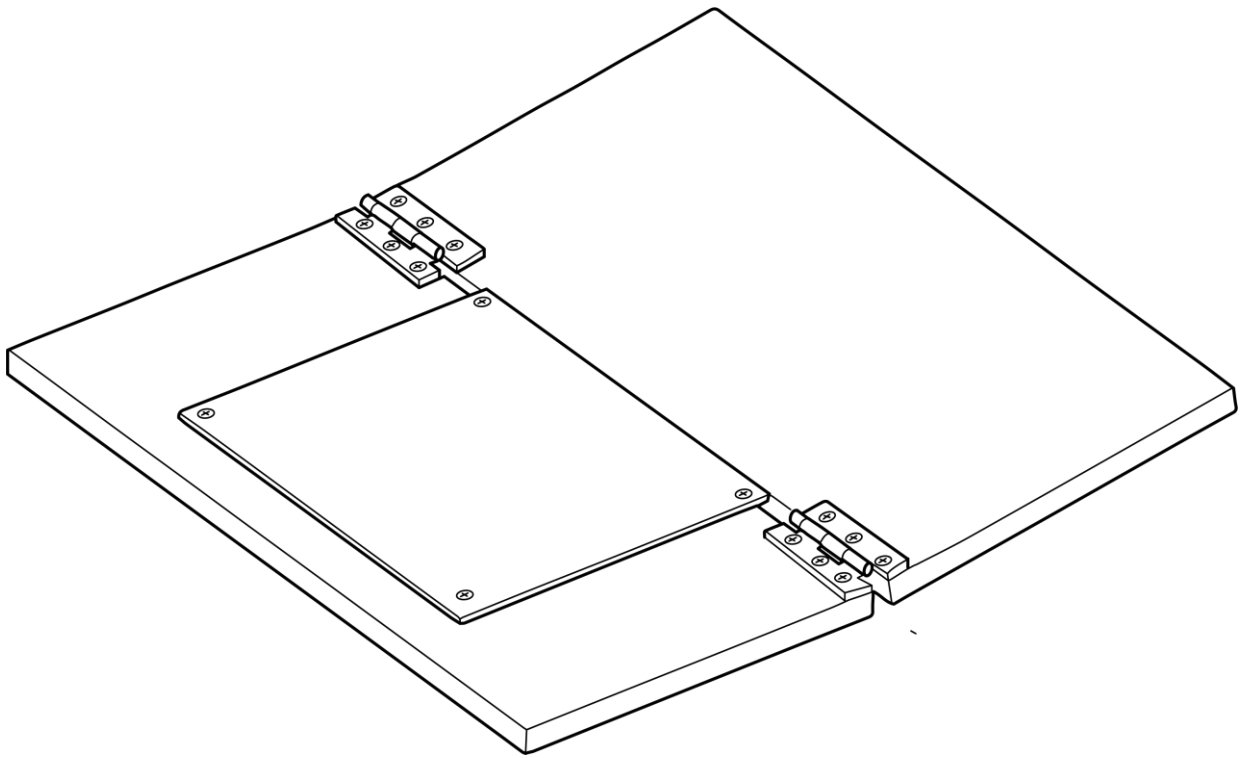
6



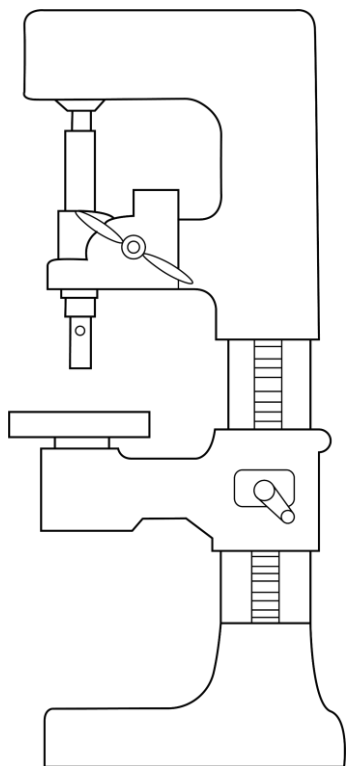


# SMALL SHEET BENDING RIG

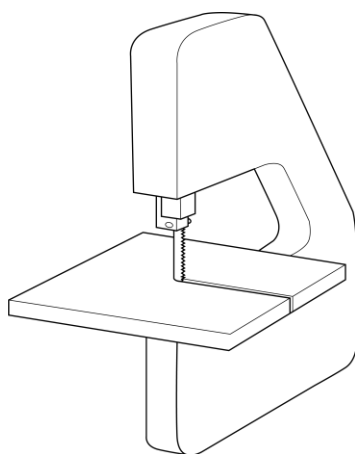
DRAWINGS # 55, 55.1 & 55.2



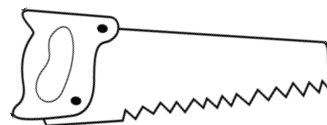
**1x**



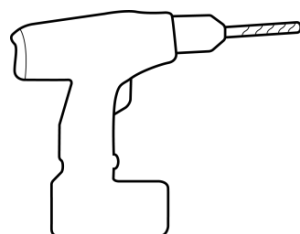
PILAR DRILL



BAND SAW



HACK SAW



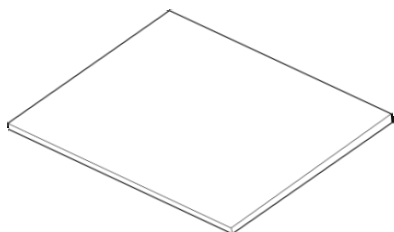
DRILL



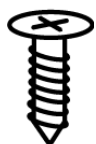
CENTER DRILL



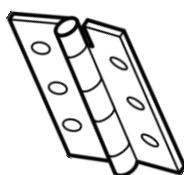
Ø 6 MM  
DRILL



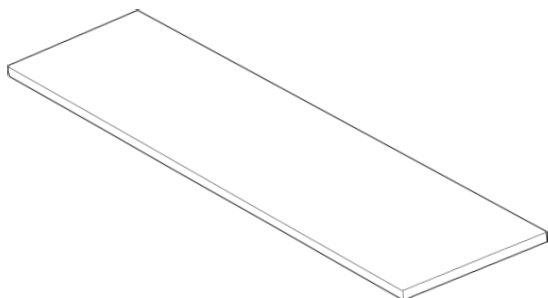
**1 ×** 180 X 160 X 3 MM  
METAL SHEET



**16 ×** M3 SCREW  
8 MM LONG



**2 ×** HINGE



**2 ×** 180 X 350 X 18 MM  
PLYWOOD BOARD

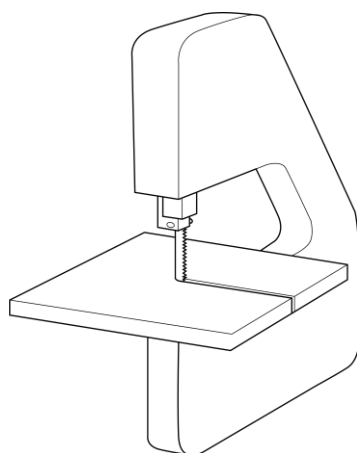
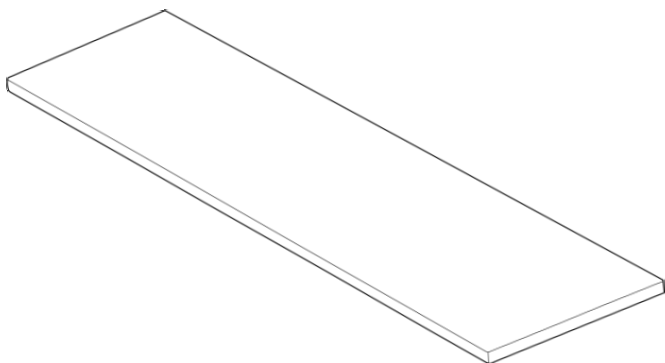
# 1

**DWG.**

2 X #55.1

**Materials**

PLYWOOD BOARD



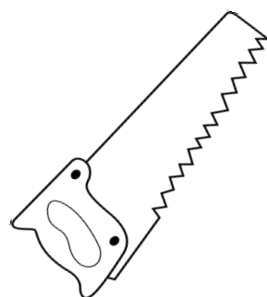
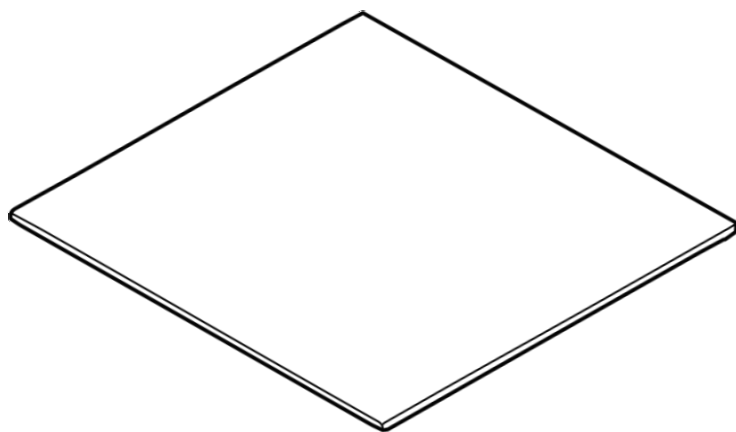
# 2

**DWG.**

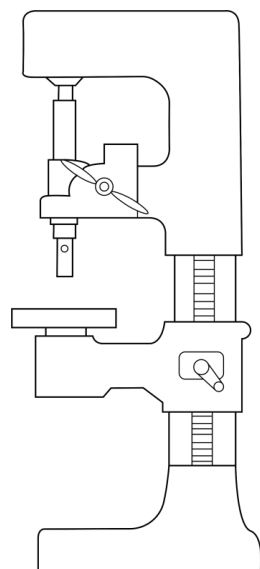
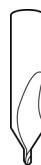
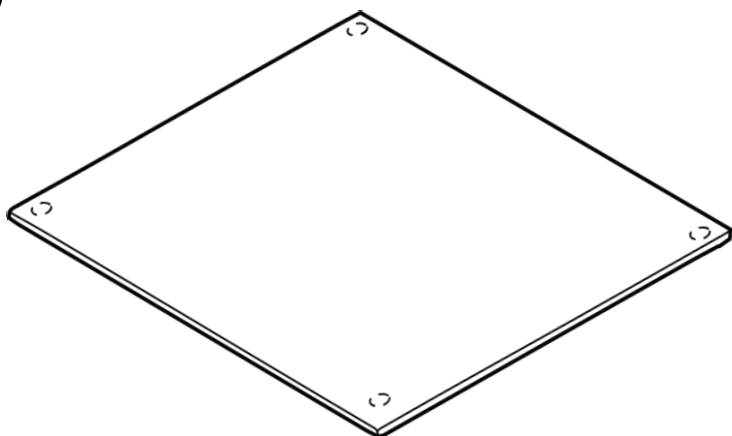
1 X #55.2

**Materials**

METAL SHEET

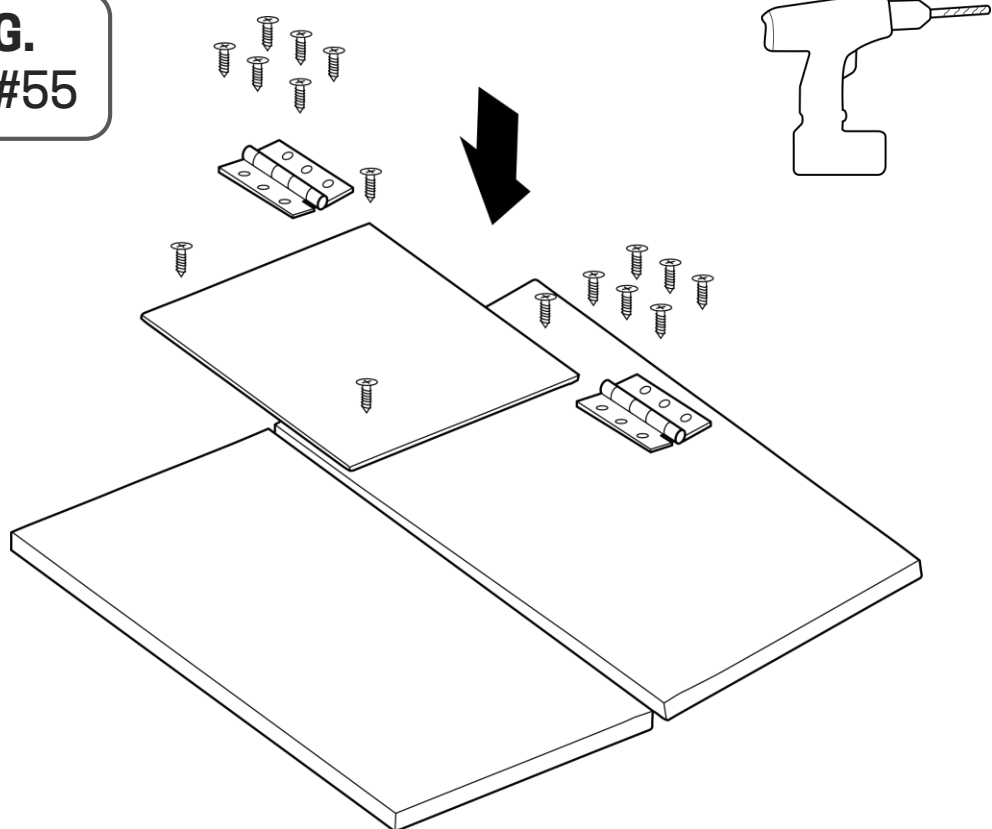


# 3

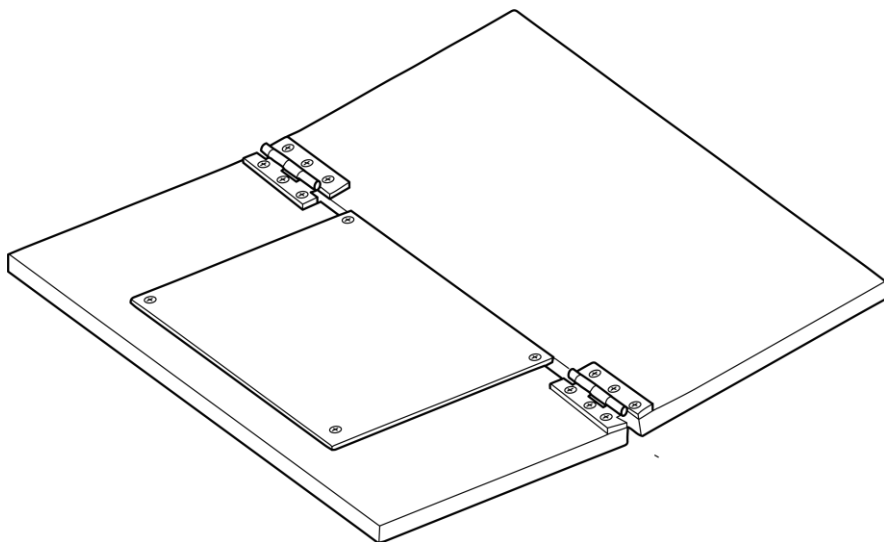


# 4

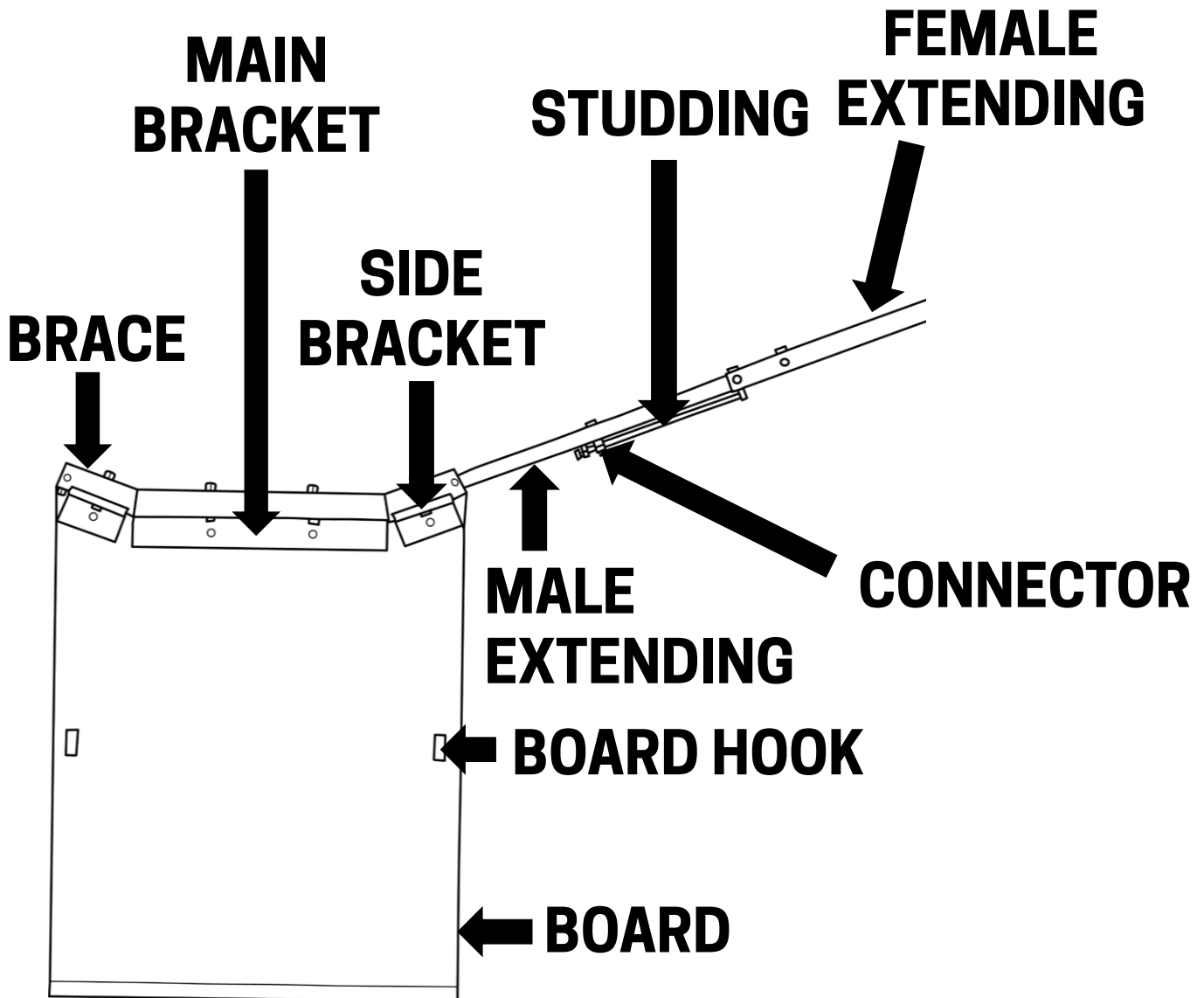
DWG.  
1 X #55



# 5

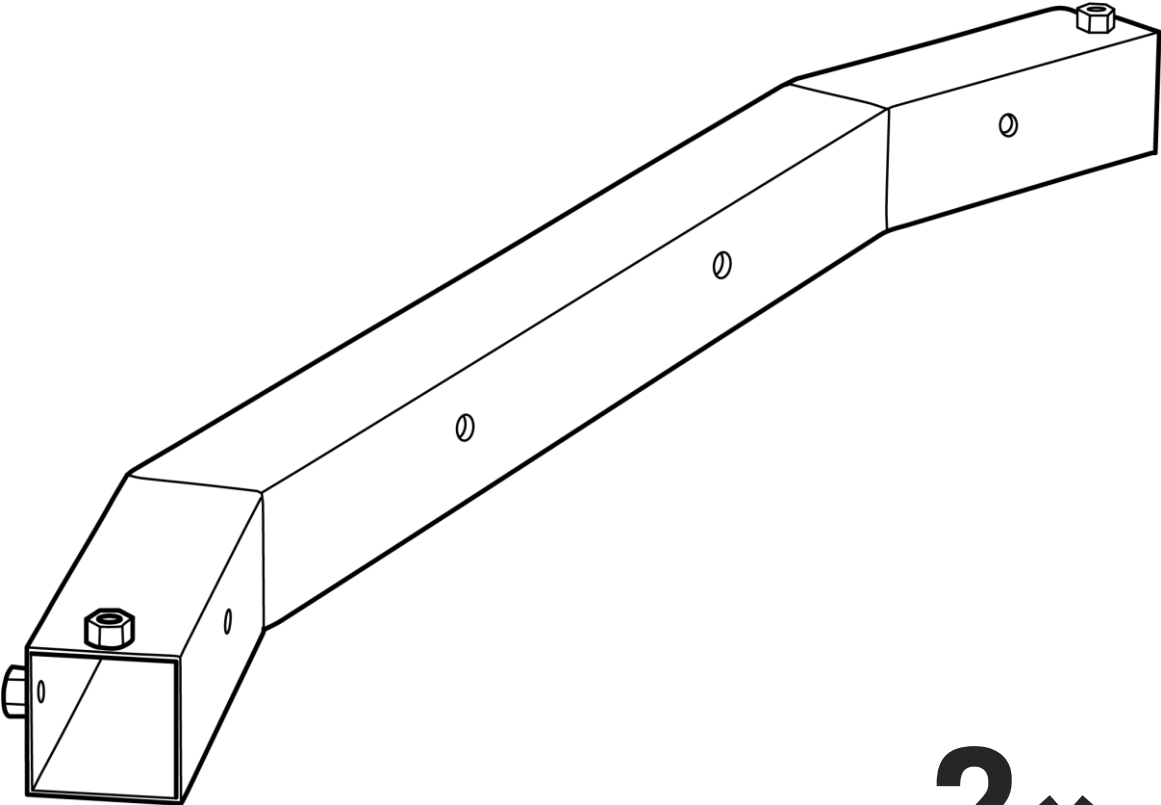


# FRAME KEY COMPONENTS

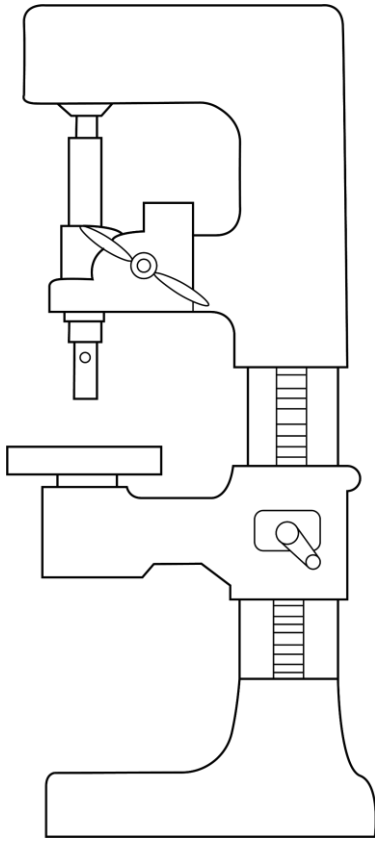


# BRACE

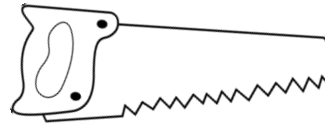
DRAWINGS # 14 & 14.1



2x



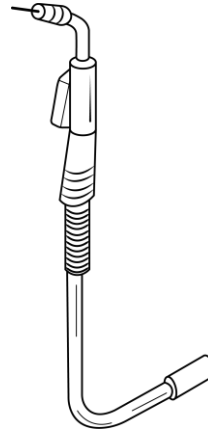
PILLAR DRILL



HACK SAW



CENTER DRILL



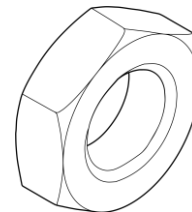
WELDER



Ø 8 MM



**2 ×** 820 MM LONG  
3 MM THICK  
50 MM SQUARE MILD  
STEEL BEAM



**8 ×** M8 NUT

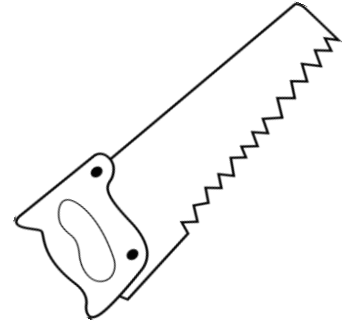
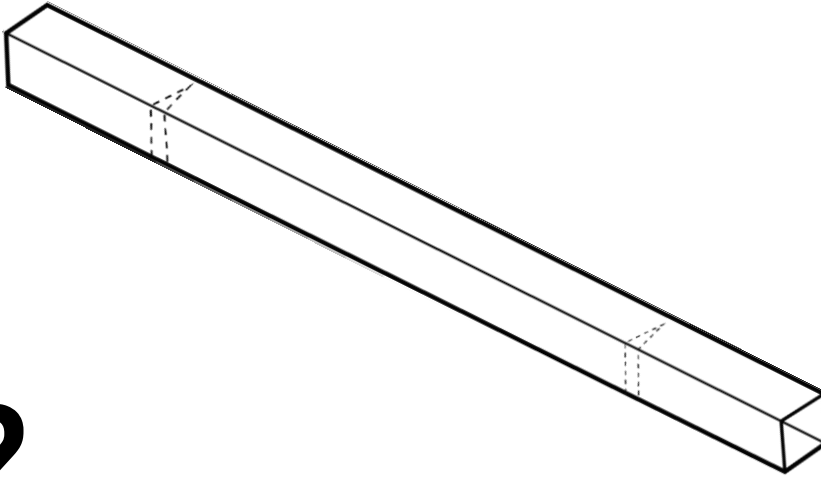
# 1

**DWG.**

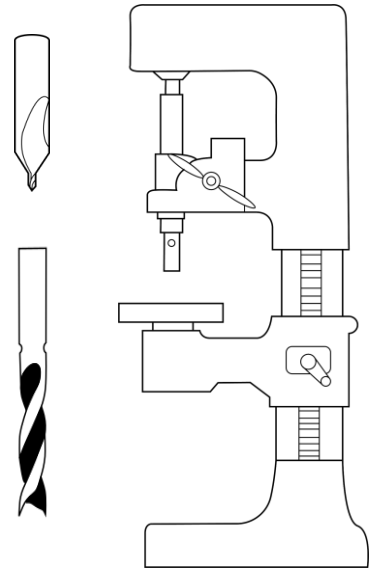
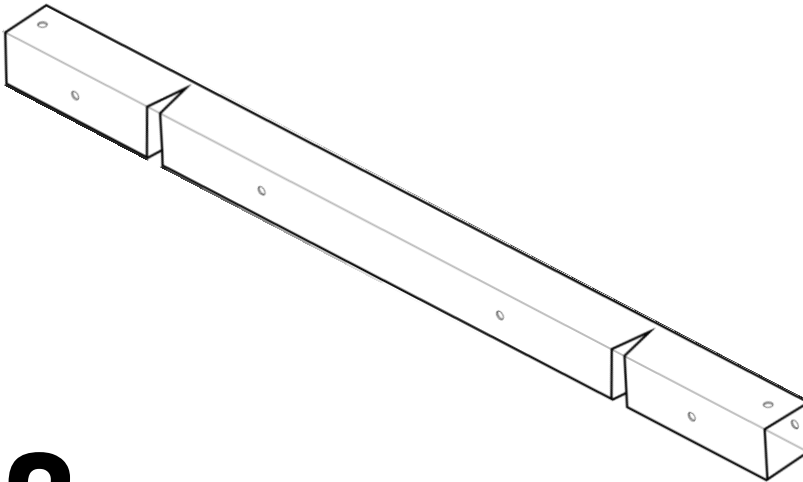
**2 X #14.1**

**Materials**

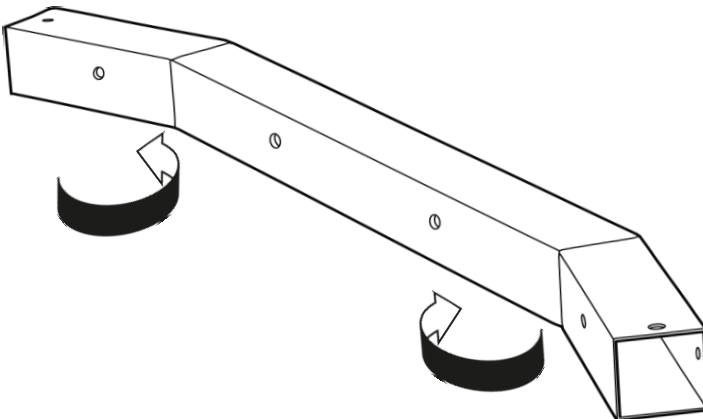
**50 X 50 MILD  
STEEL BEAM**



# 2

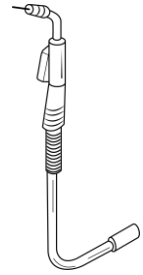
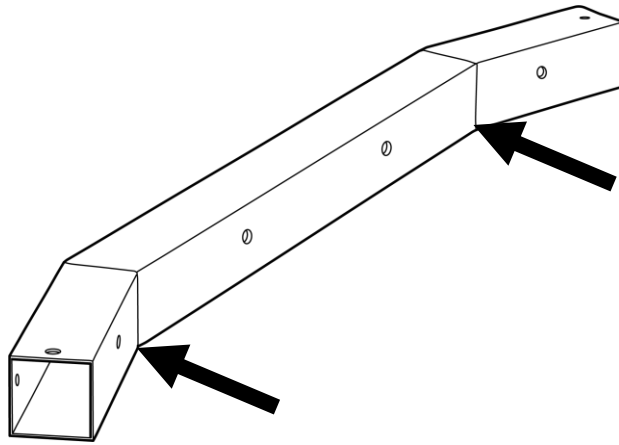


# 3





4



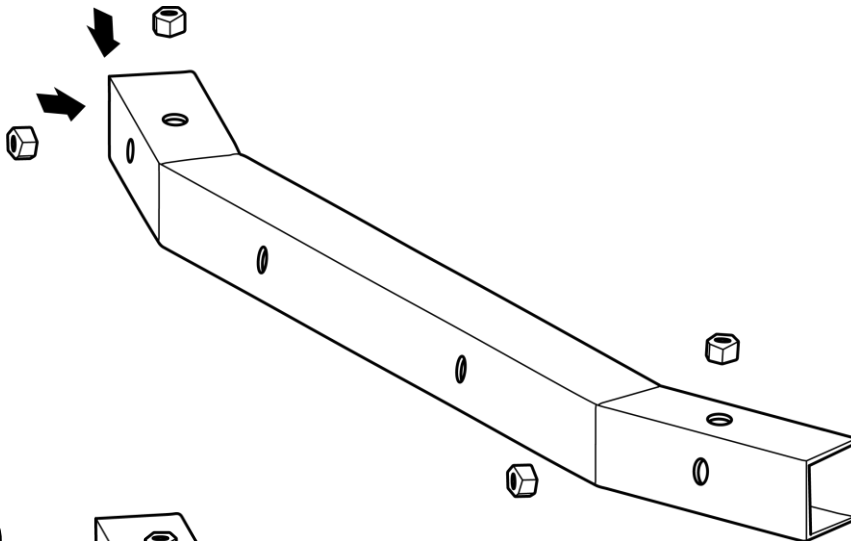
5

DWG.  
2 X #14

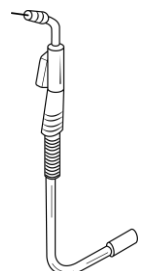
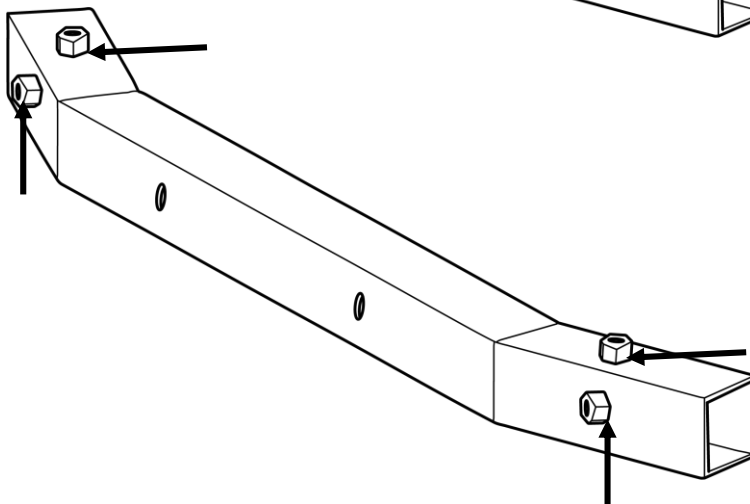
Materials  
M8 NUT



4x

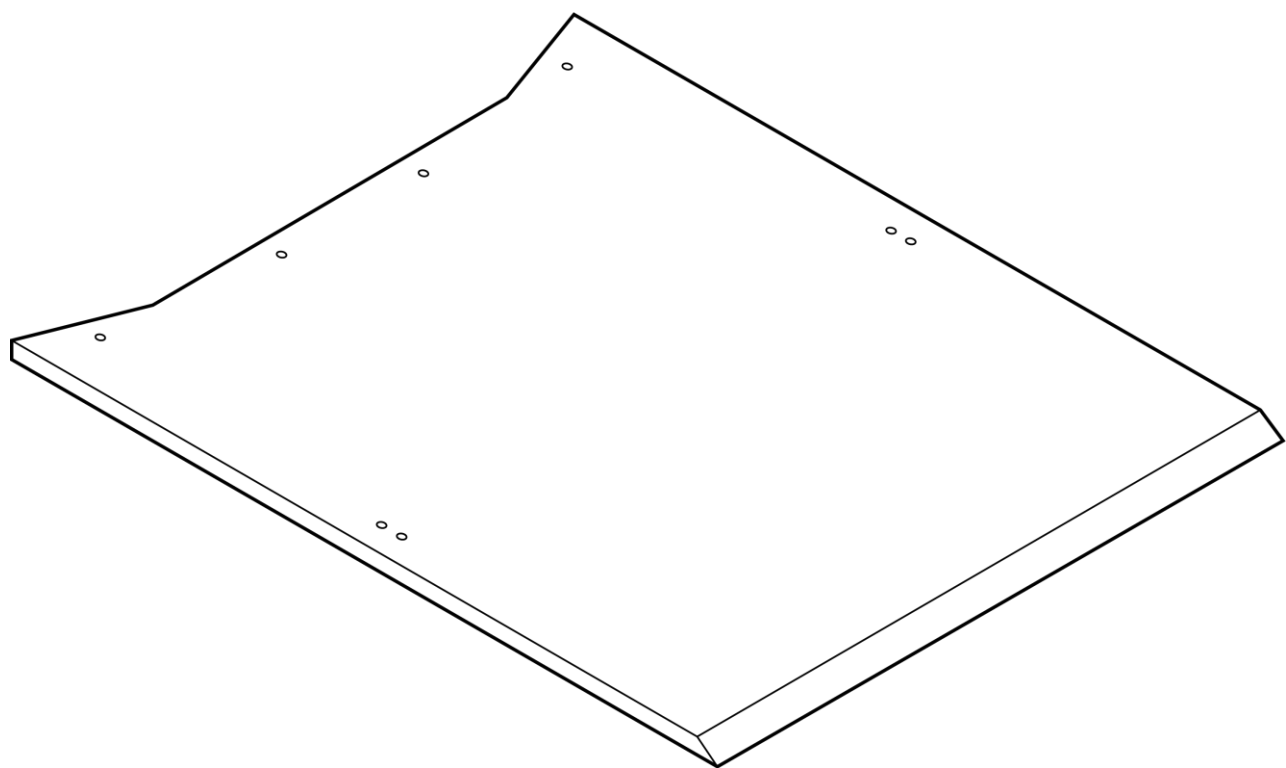


6

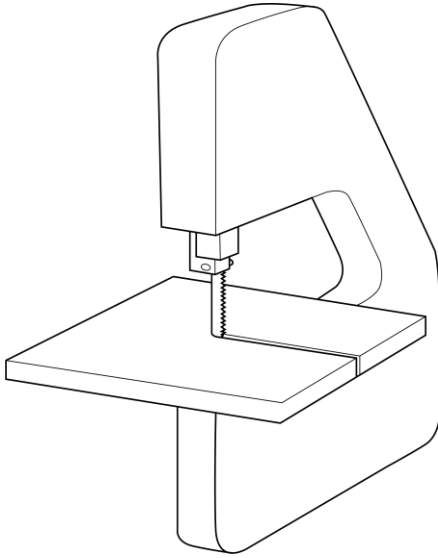


# BOARD PART I

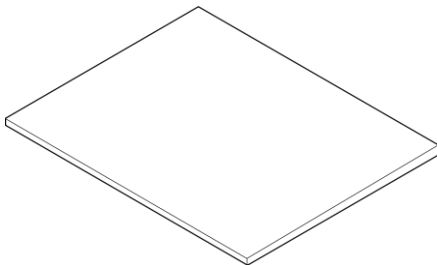
DRAWING # 11



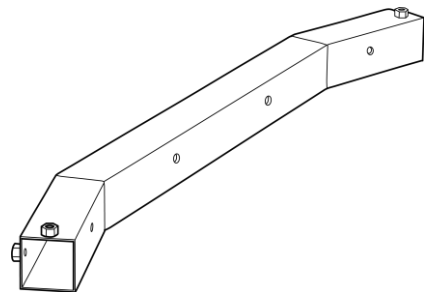
2x



**BAND SAW**



**2 × 1000 X 1000 X 18 MM  
PLYWOOD BOARD**

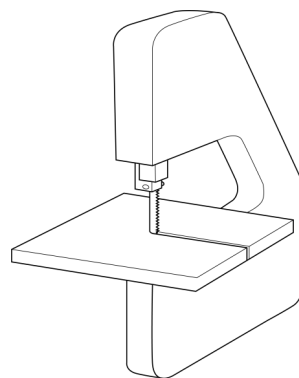
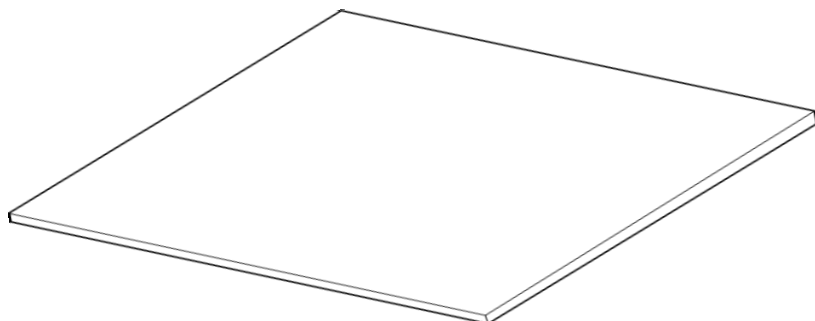


**1 × BRACE**

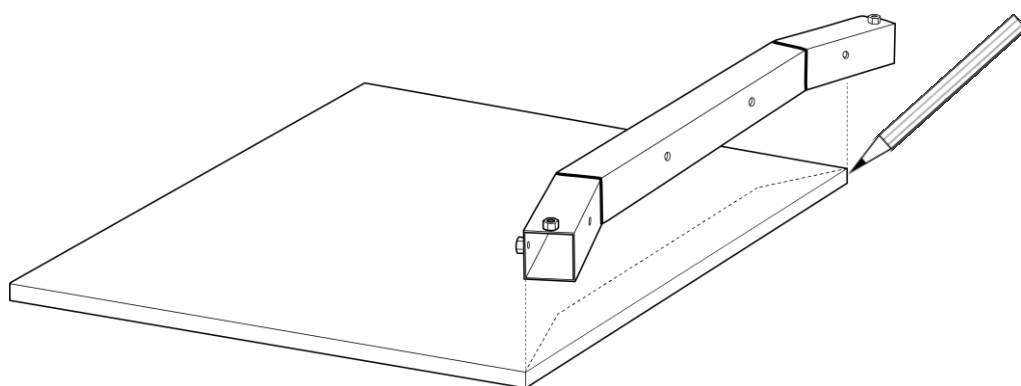
# 1

**DWG.**  
2 X #11

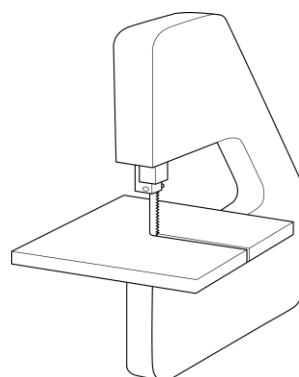
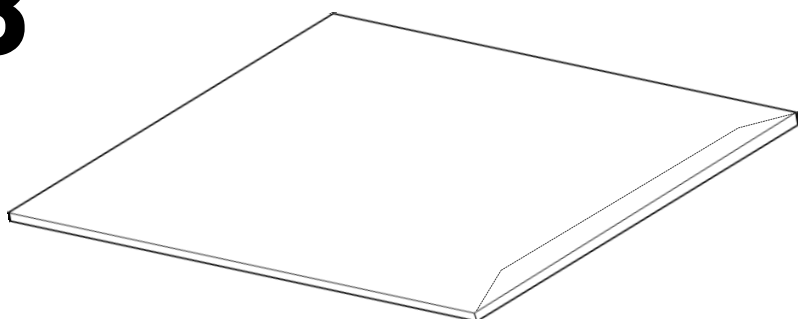
**Materials**  
18 MM PLYWOOD  
BOARD



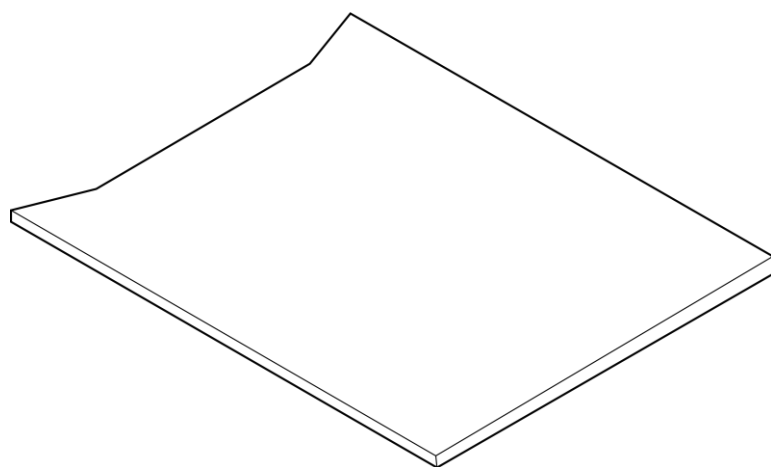
# 2



# 3

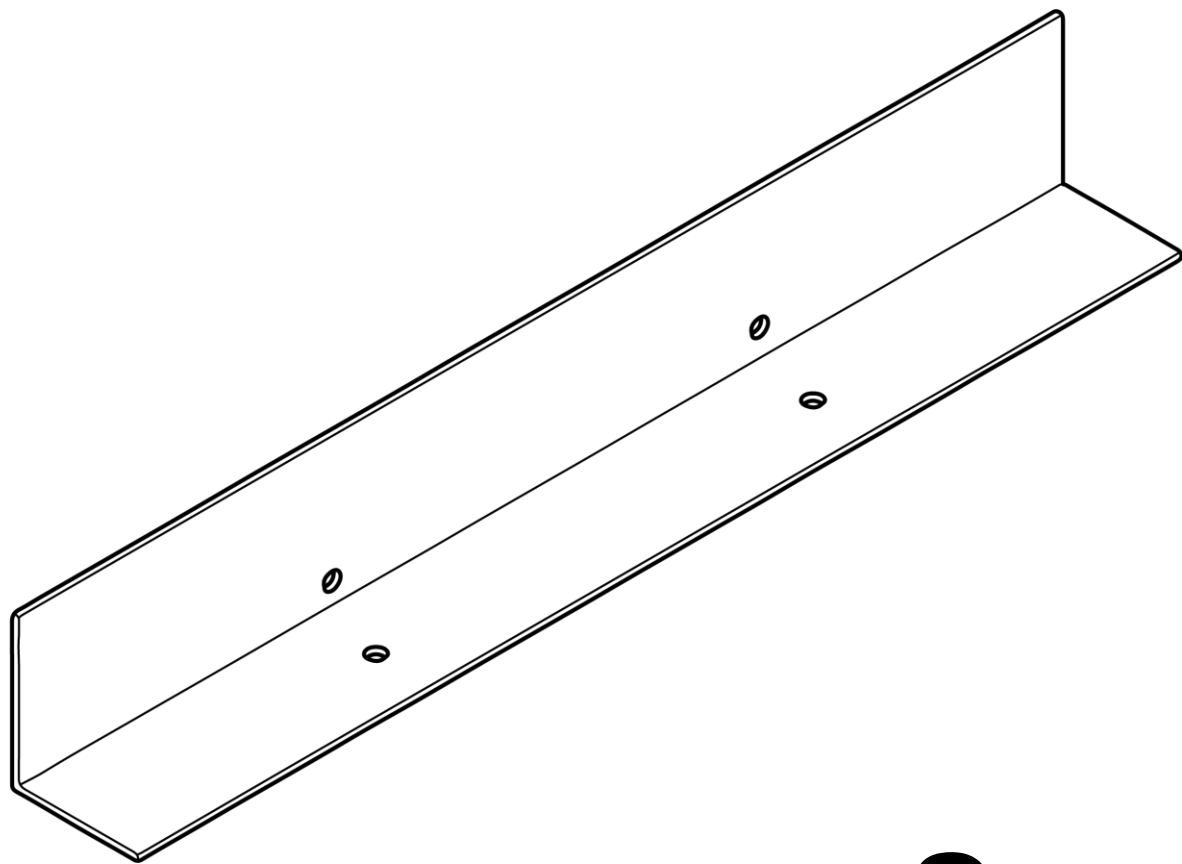


4

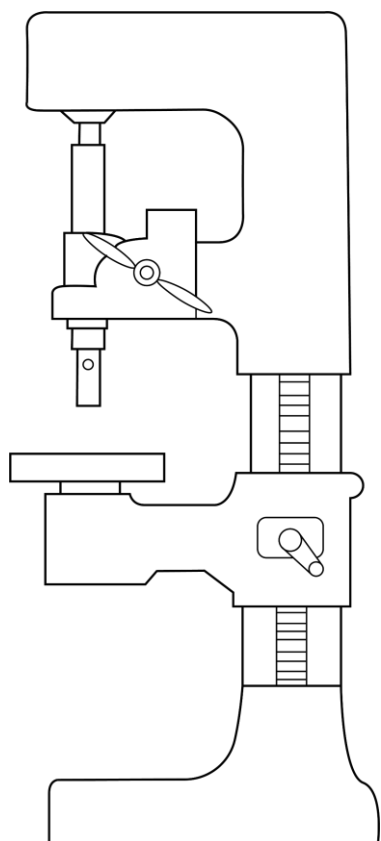


# MAIN BRACKET

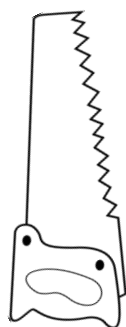
DRAWING # 12.1 & 12.2



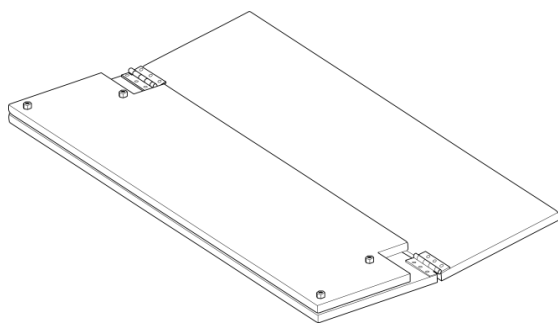
2x



PILLAR DRILL



HACK SAW



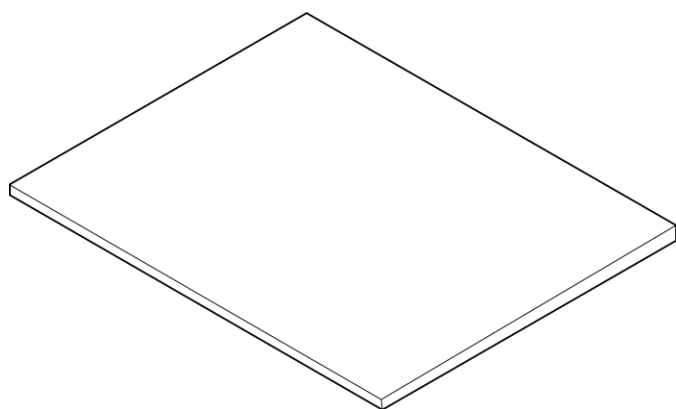
LARGE SHEET  
BENDING RIG



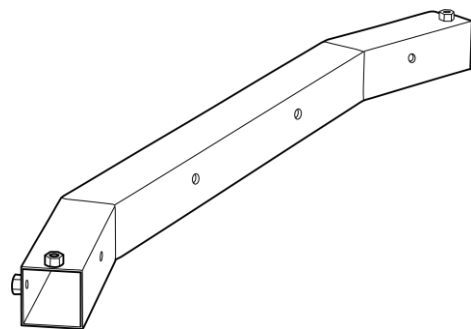
CENTER DRILL



Ø 8 MM



**2 ×** 500 X 130 X 3 MM  
STEEL SHEET

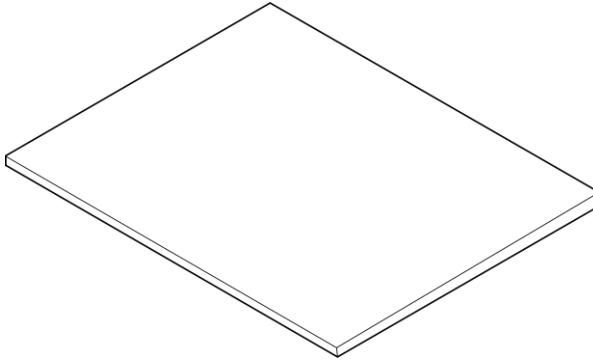
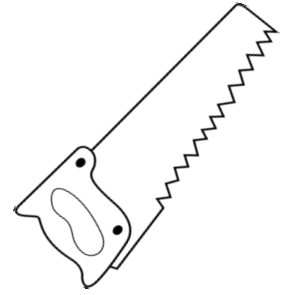


**1 ×** BRACE

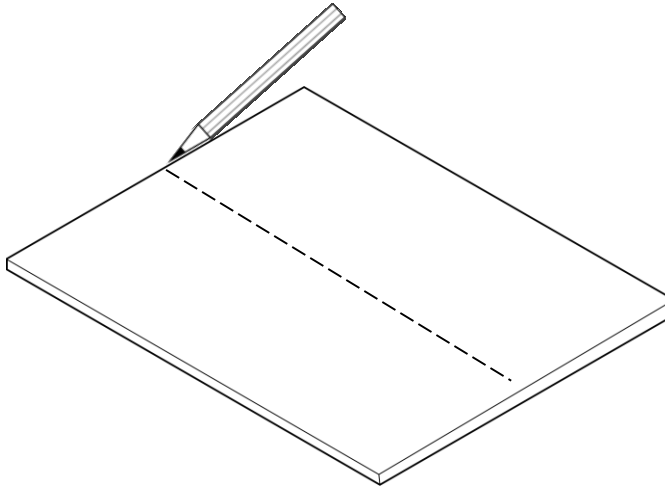
1

DWG.  
2 X #12.1

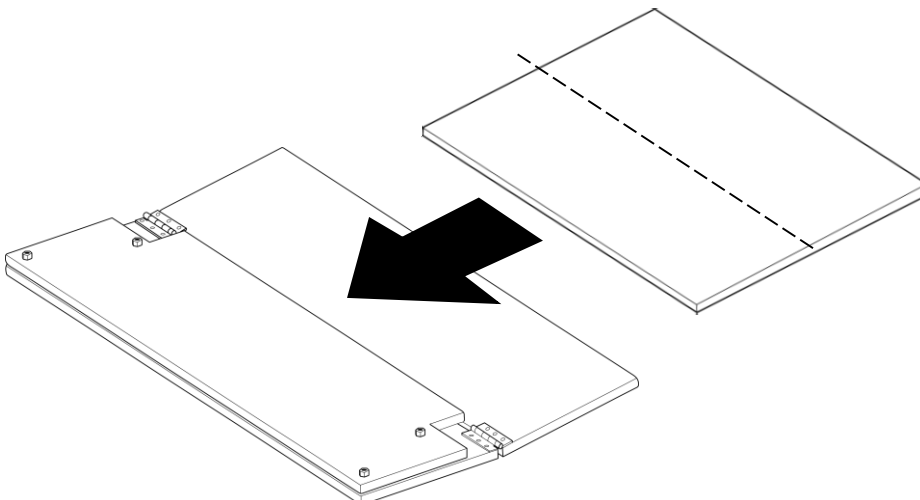
Materials  
3 MM SHEET  
METAL



2

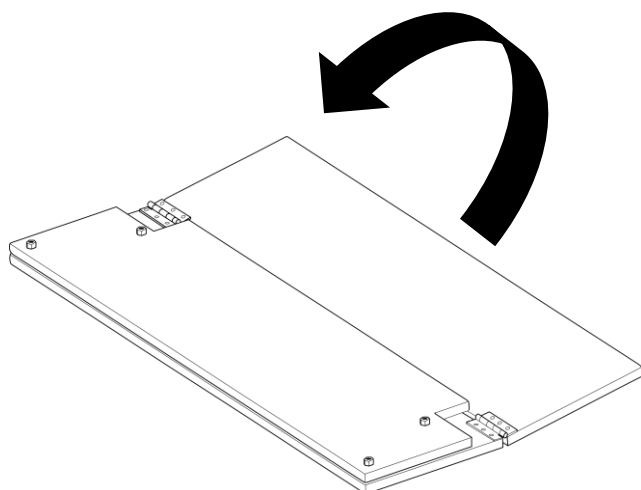


3



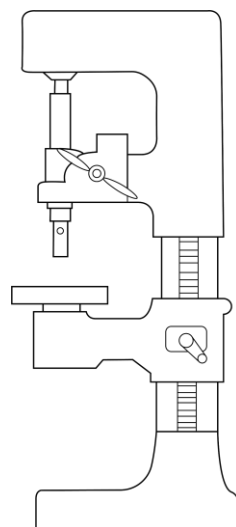
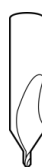
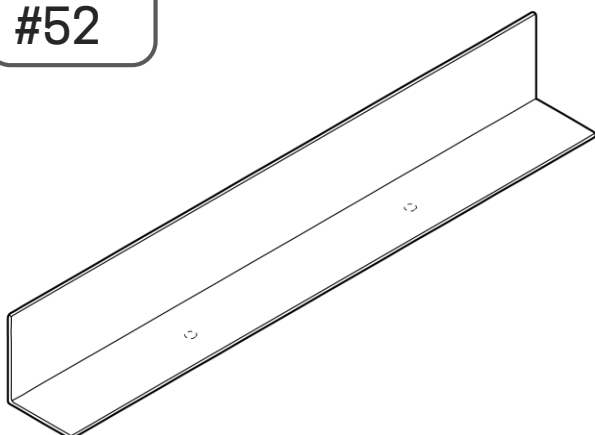


4

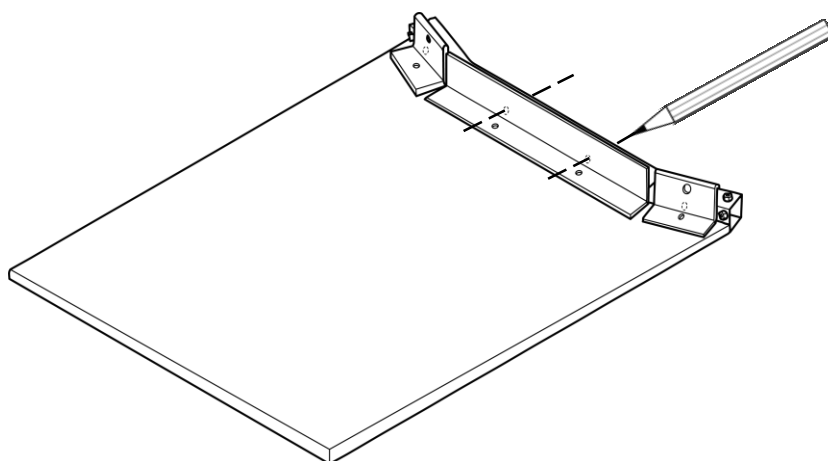


5

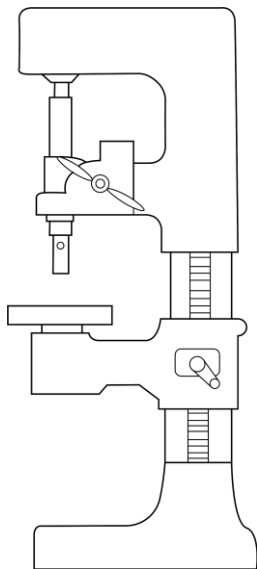
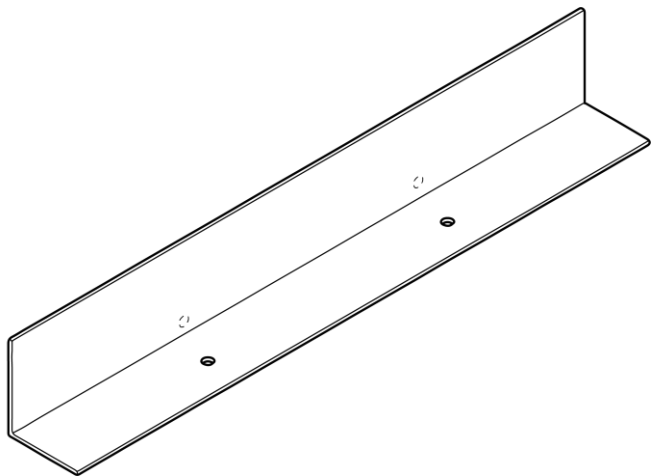
DWG.  
#52



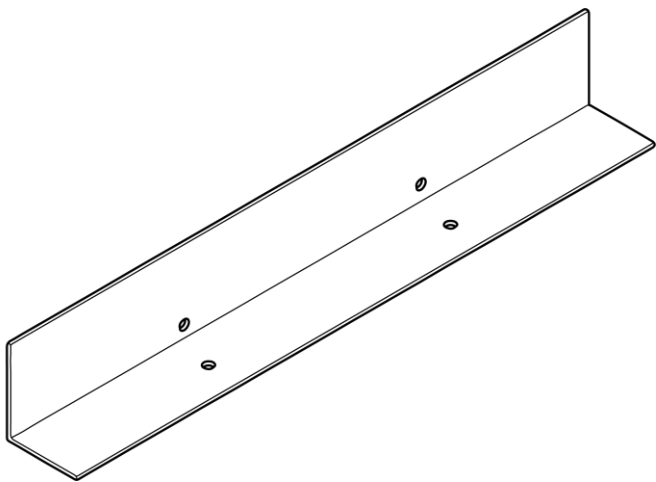
6



7

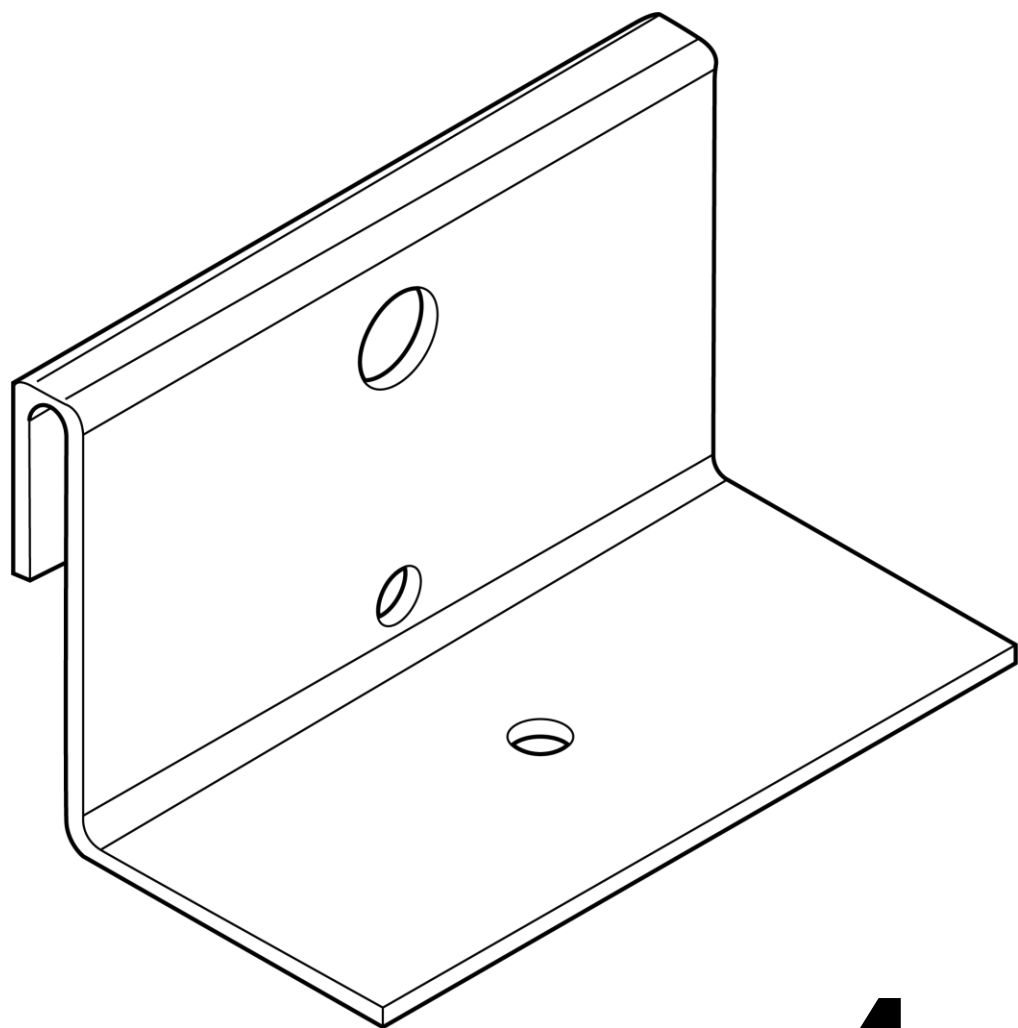


8

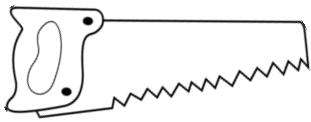


# SIDE BRACKET

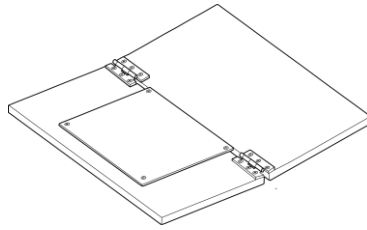
DRAWING # 13.1 & 13.2



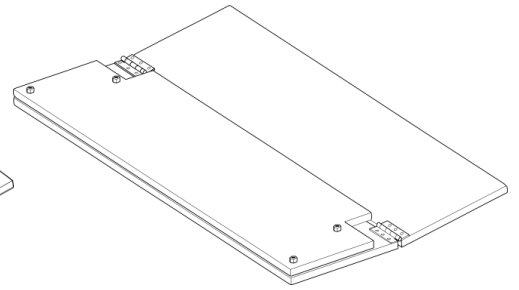
4x



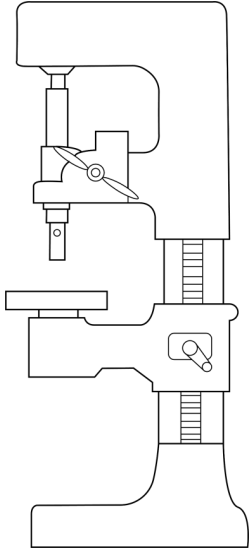
**HACK SAW**



**SMALL SHEET  
BENDING RIG**



**LARGE SHEET  
BENDING RIG**



**PILLAR DRILL**



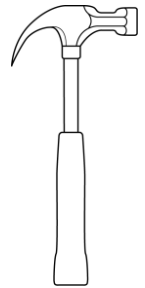
**CENTER  
DRILL**



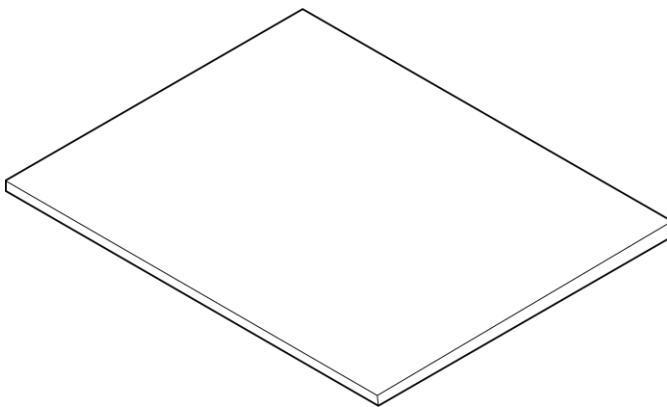
**Ø 8 MM**



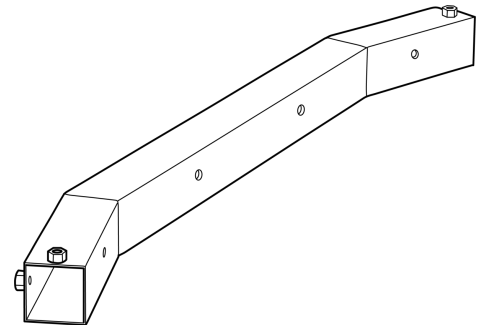
**Ø 12 MM**



**HAMMER**



**4 × 165 X 120 X 3 MM  
STEEL SHEET**

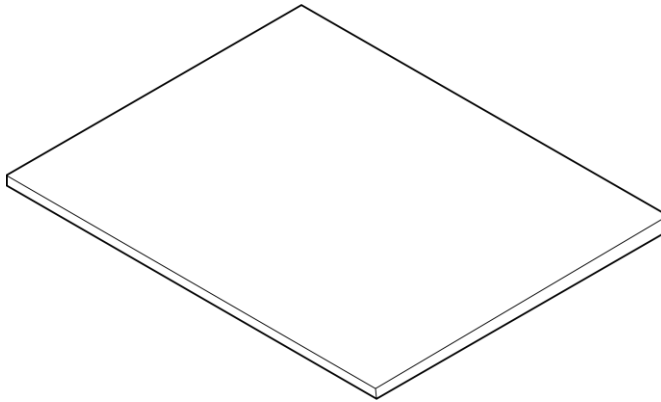
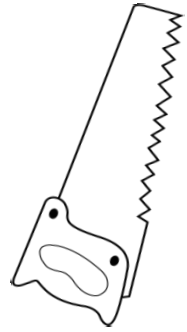


**1 × BRACE**

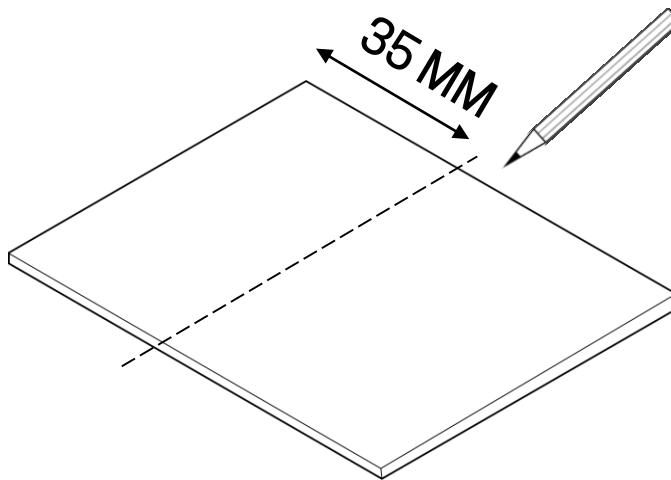
# 1

**DWG.**  
4 X #13.1

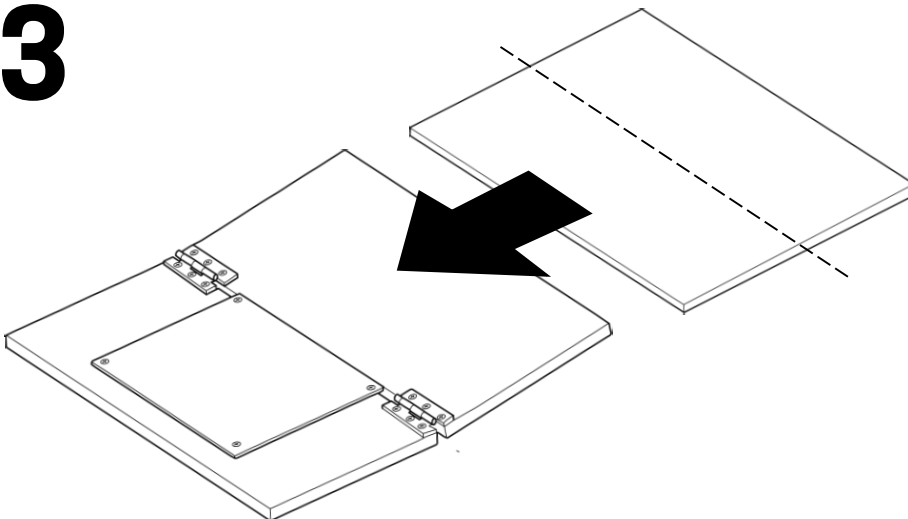
**Materials**  
3 MM SHEET  
METAL



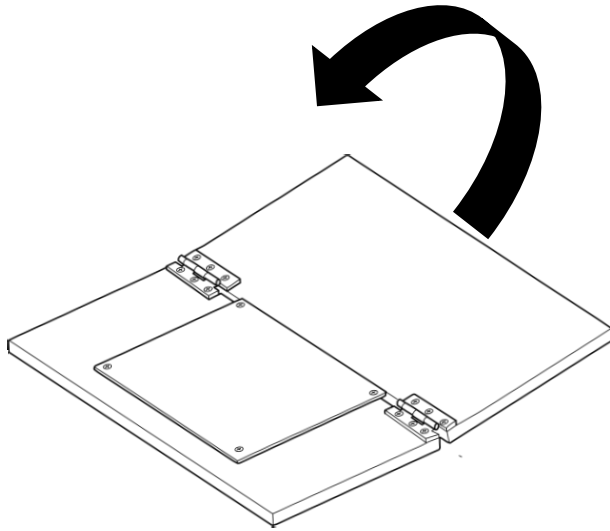
# 2



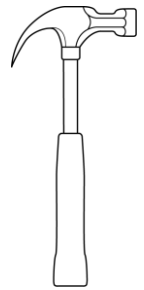
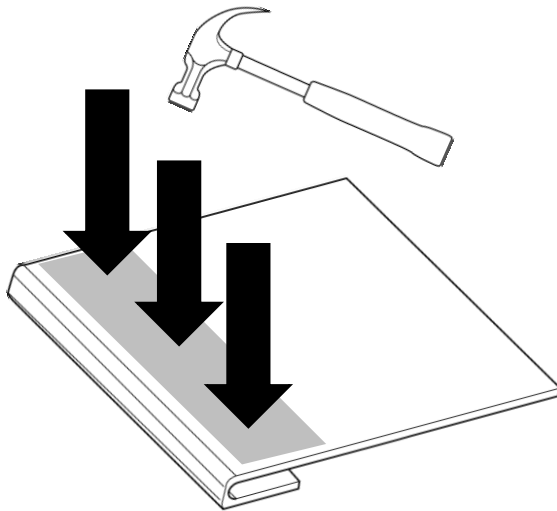
# 3



4

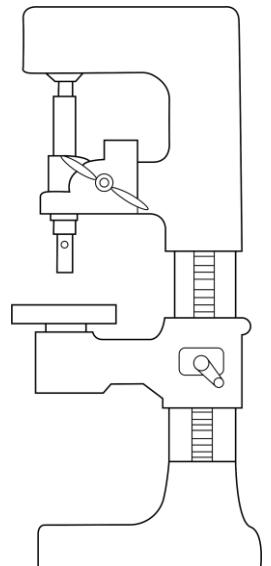
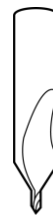
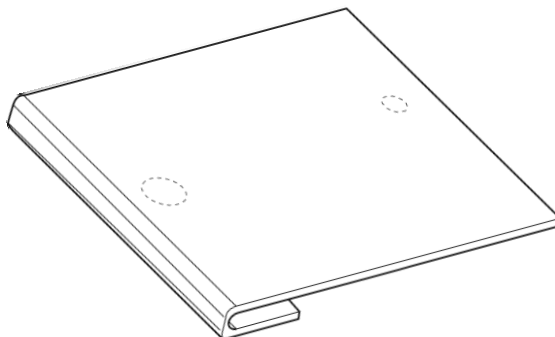


5

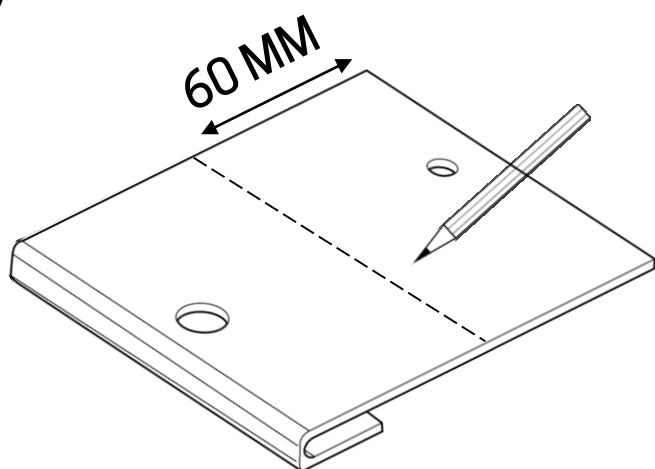


6

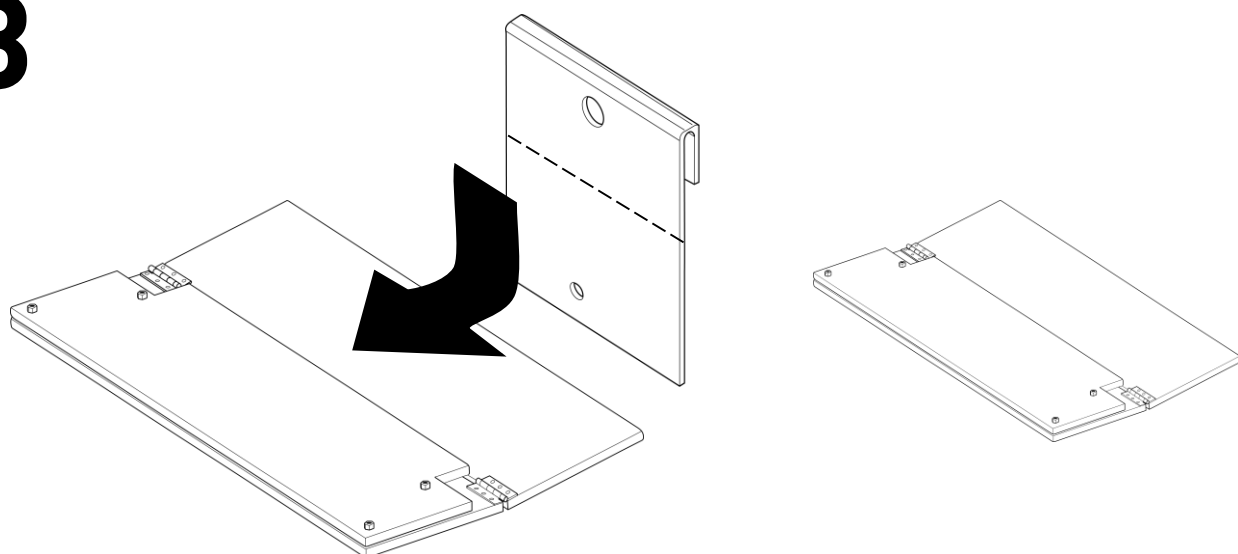
DWG.  
#13.2



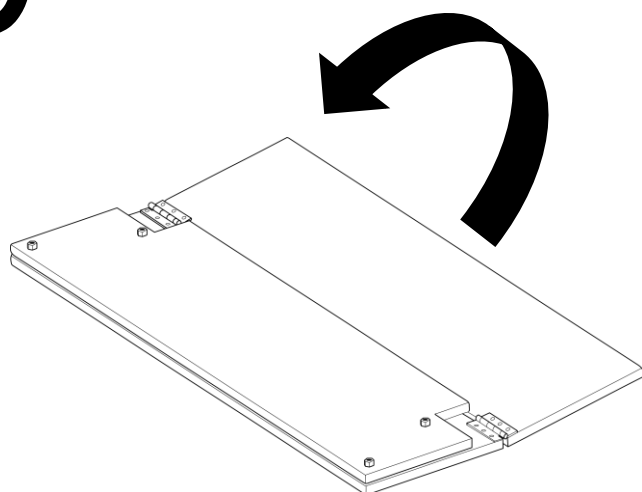
7



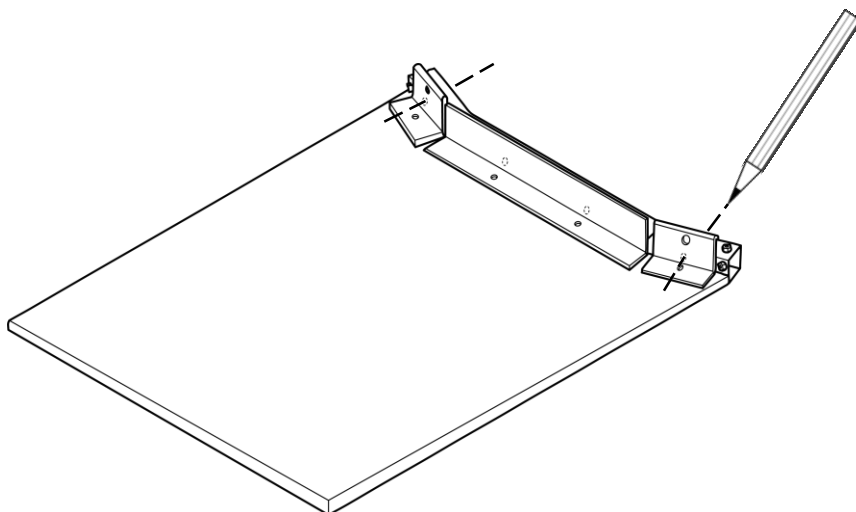
8



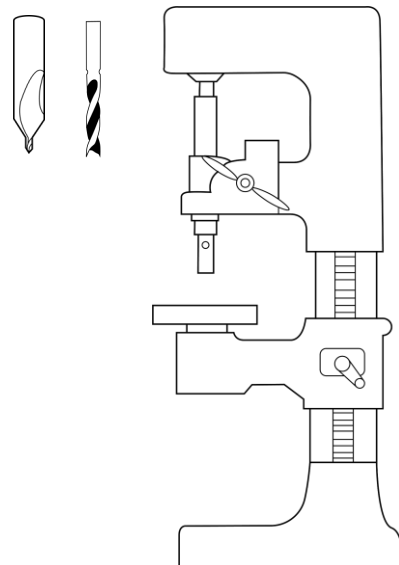
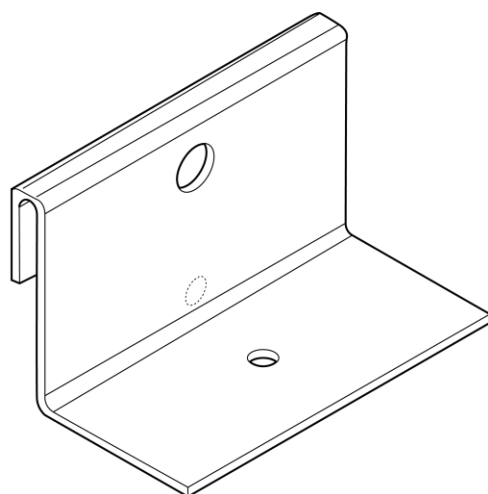
9



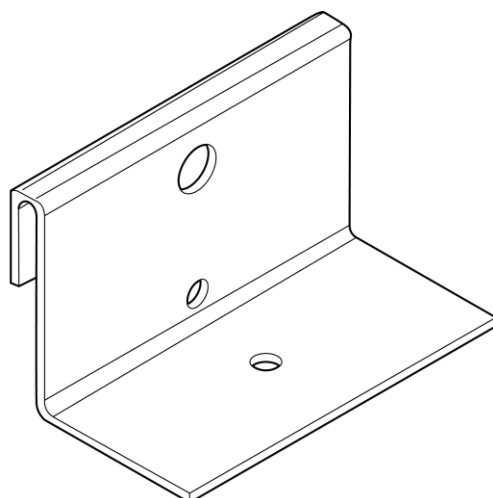
# 10



# 11



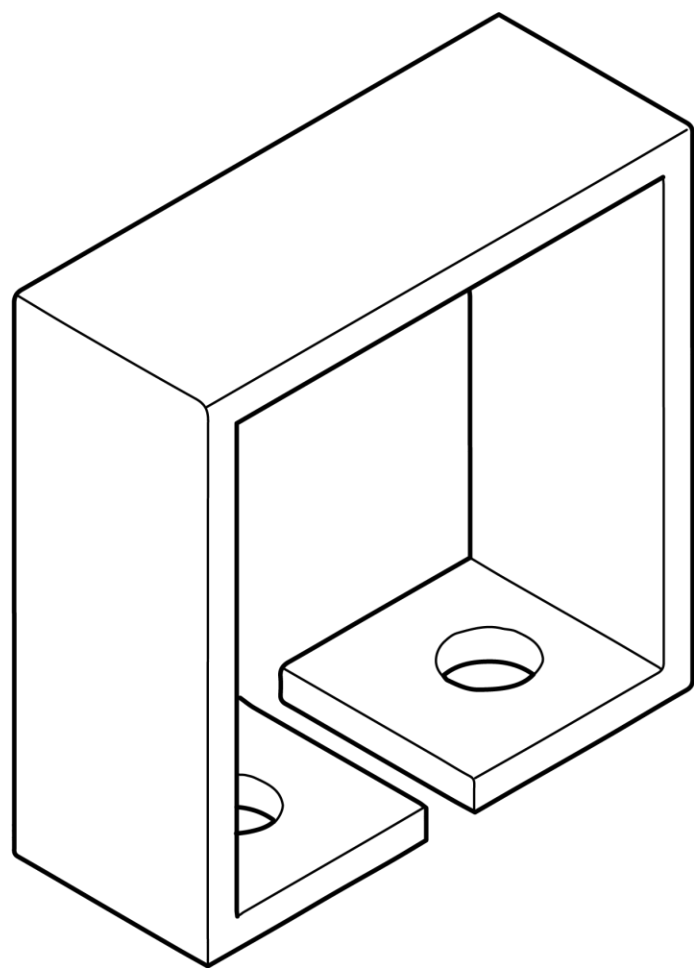
# 12



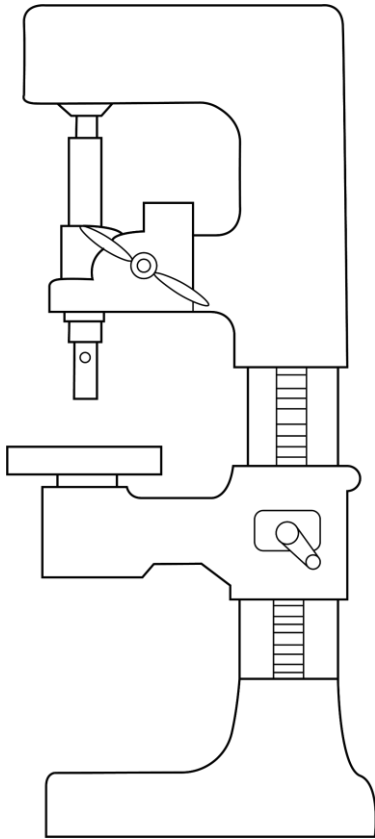


# BOARD HOOK

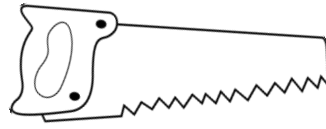
DRAWINGS # 15



4x



PILLAR DRILL



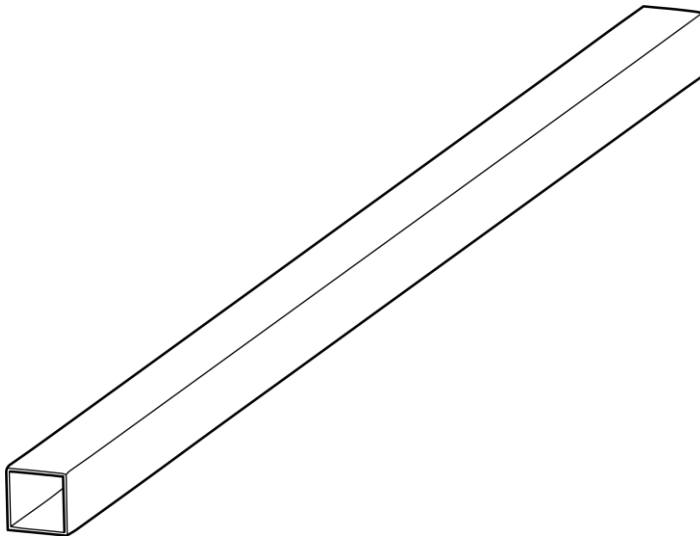
HACK SAW



CENTER DRILL



Ø 8 MM

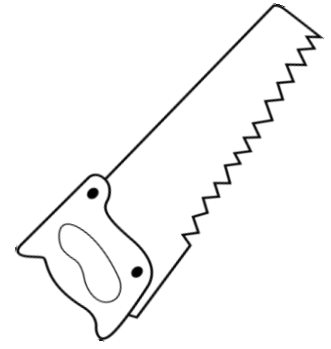


**4 ×** 50 MM SQUARE BEAM  
25 MM LONG, 3 MM THICK

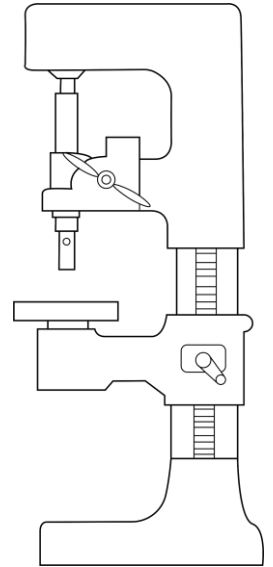
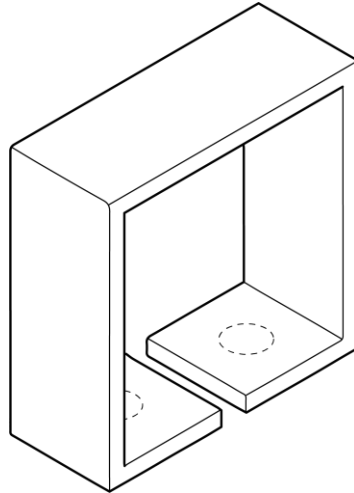
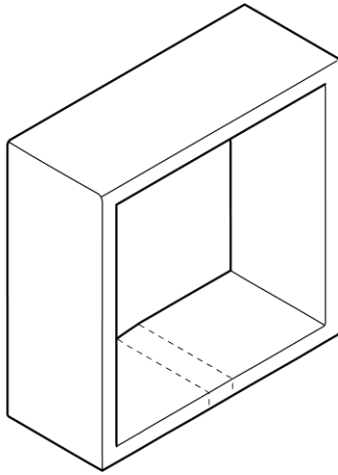
1

**DWG.**  
4 X #15

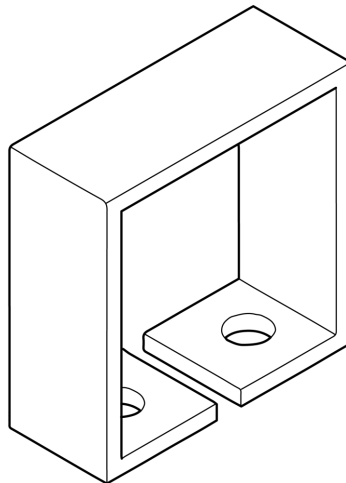
**Materials**  
50 X 50 MM MILD  
STEEL BAR



2

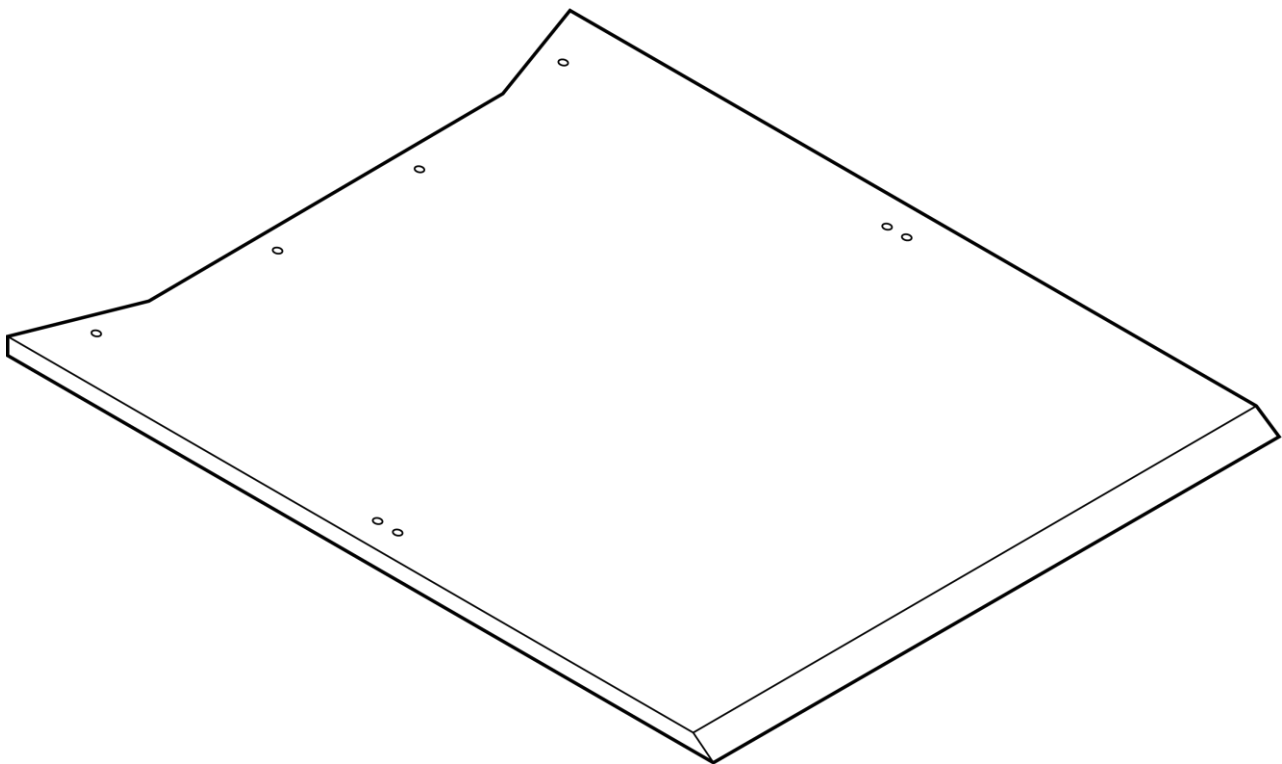


3

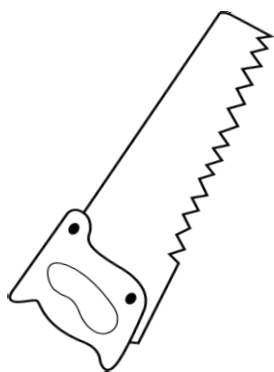


# BOARD PART II

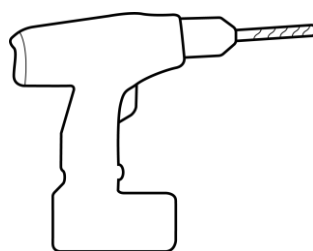
DRAWING # 11



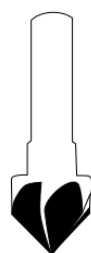
2x



HACK SAW



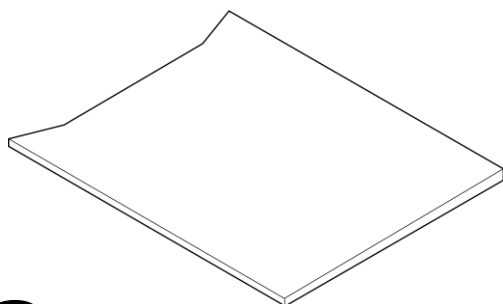
DRILL



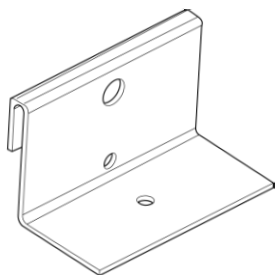
COUNTER SUNK



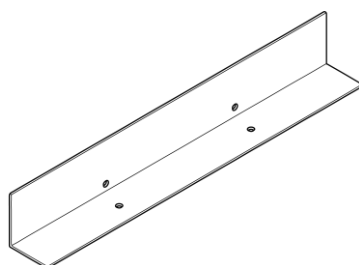
Ø 8 MM



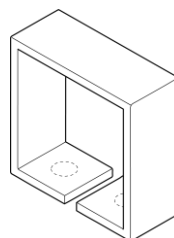
**2 ×** BOARD PART I



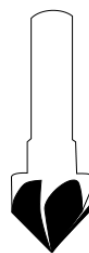
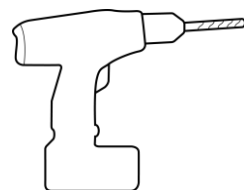
**2 ×** SIDE  
BRACKET



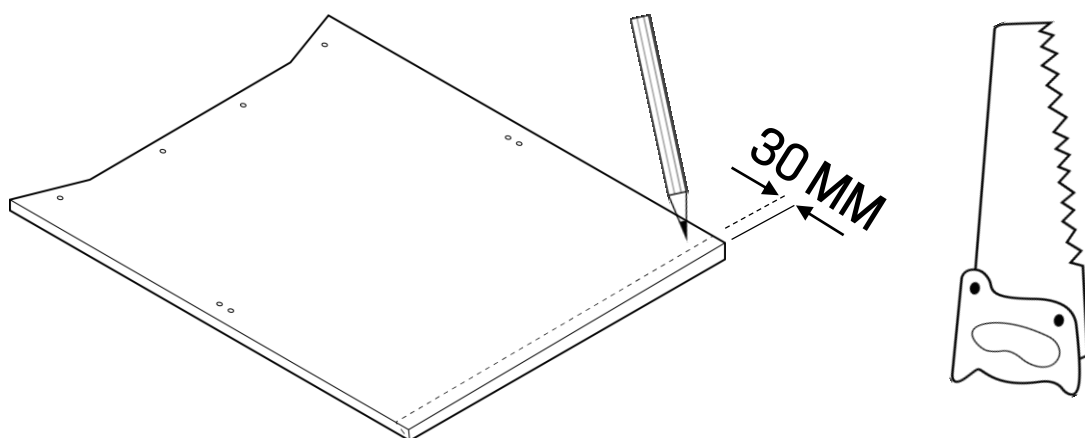
**1 ×** MAIN  
BRACKET



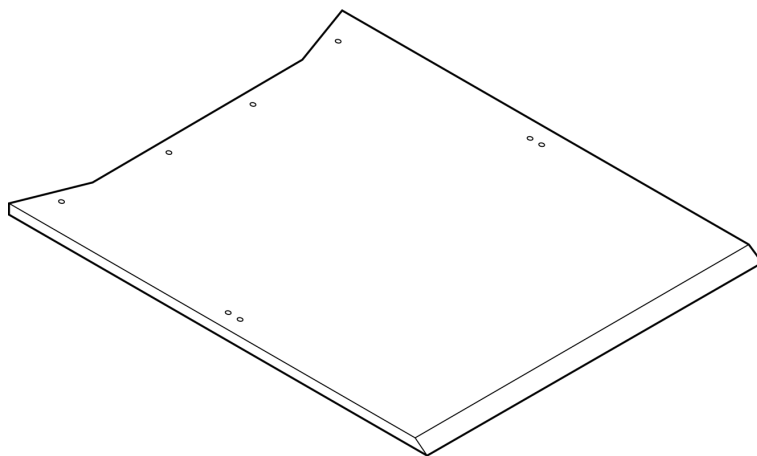
**2 ×** BOARD  
HOOK



7

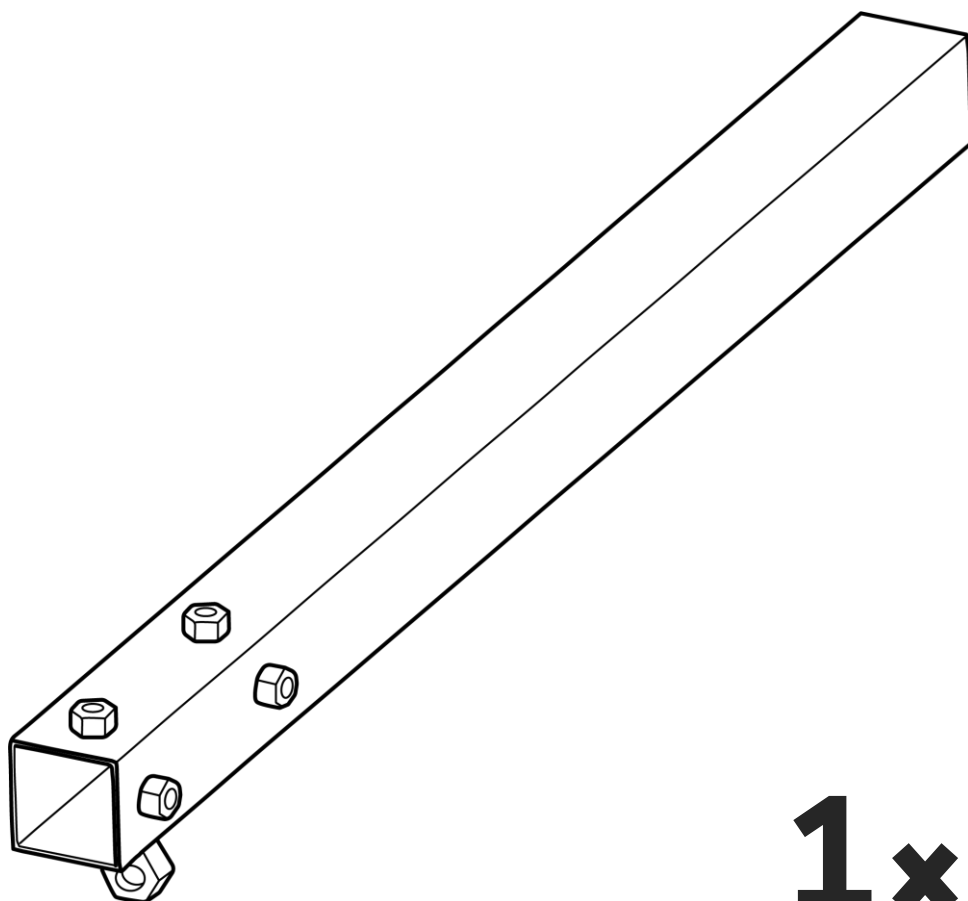


8



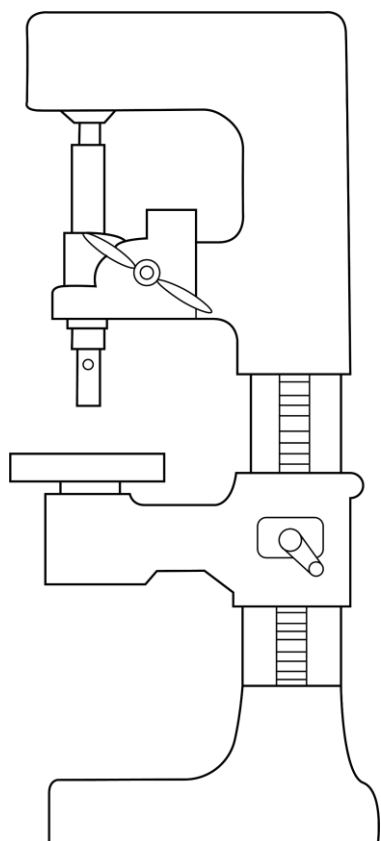
# FEMALE EXTENDING

**DRAWINGS # 21.1 & 21.2**

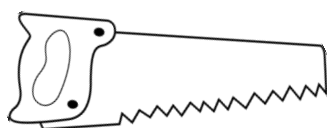


**1x**





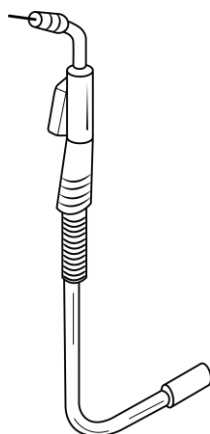
PILLAR DRILL



HACK SAW



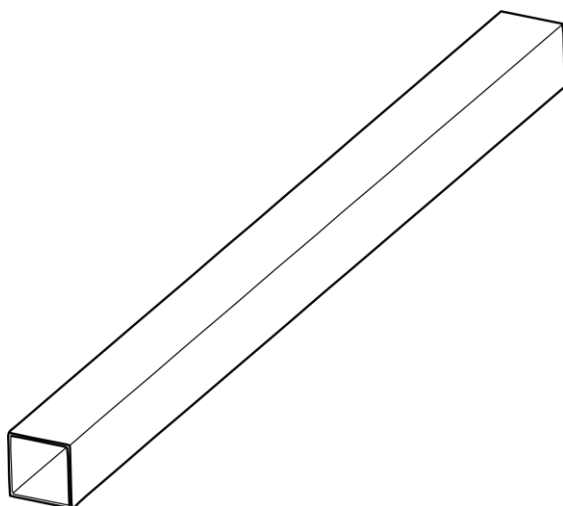
CENTER DRILL



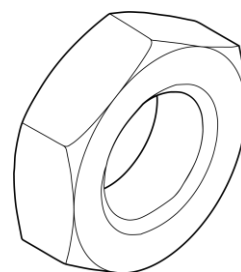
WELDER



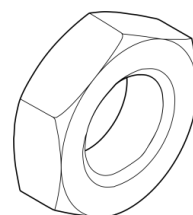
Ø 8 MM



**1 ×** 610 MM LONG  
3 MM THICK  
40 MM SQUARE BEAM



**1 ×** M12 NUT



**4 ×** M8 NUT

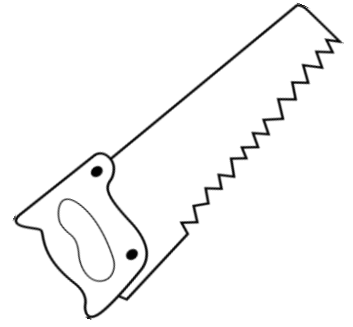
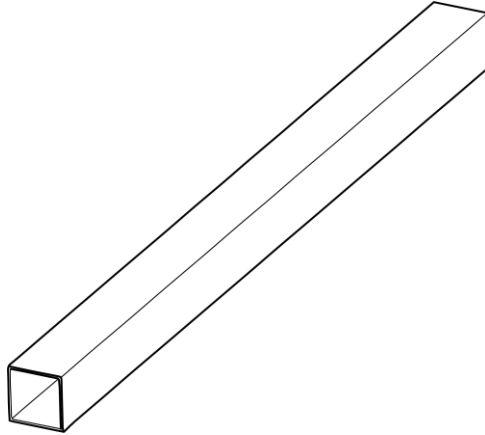
# 1

**DWG.**

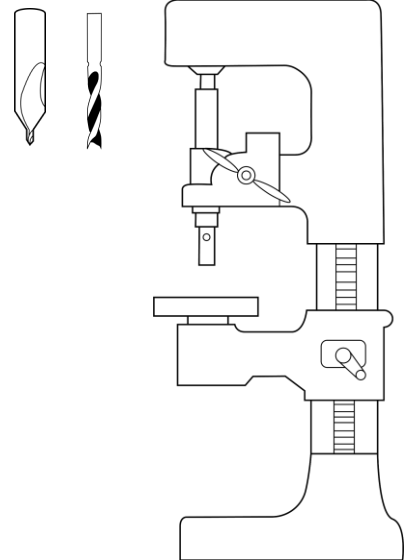
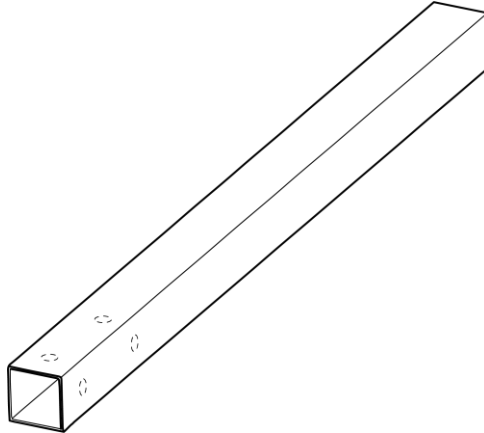
**1 X #21.1**

**Materials**

**40 X 40 MM MILD  
STEEL BAR**



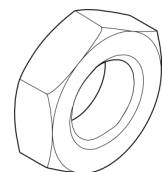
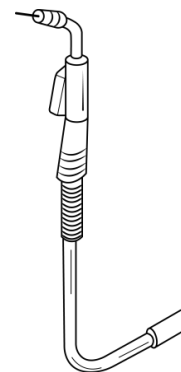
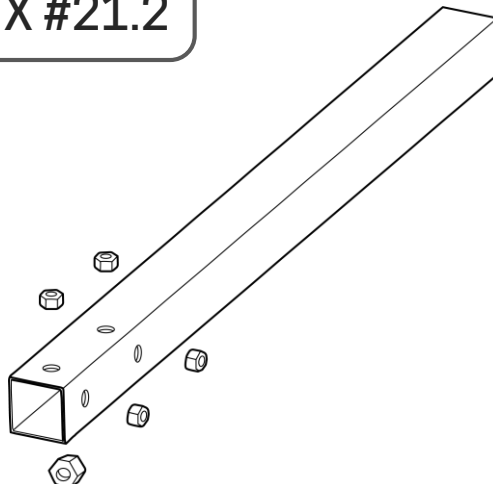
# 2



# 3

**DWG.**

**1 X #21.2**

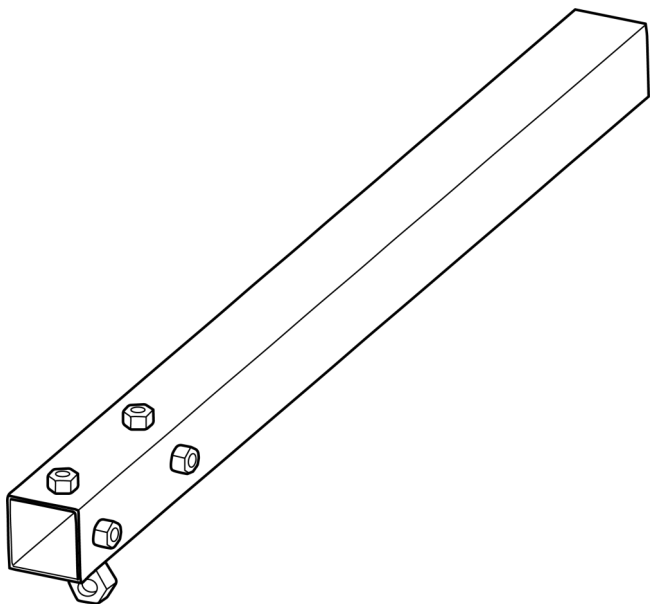


**1×**



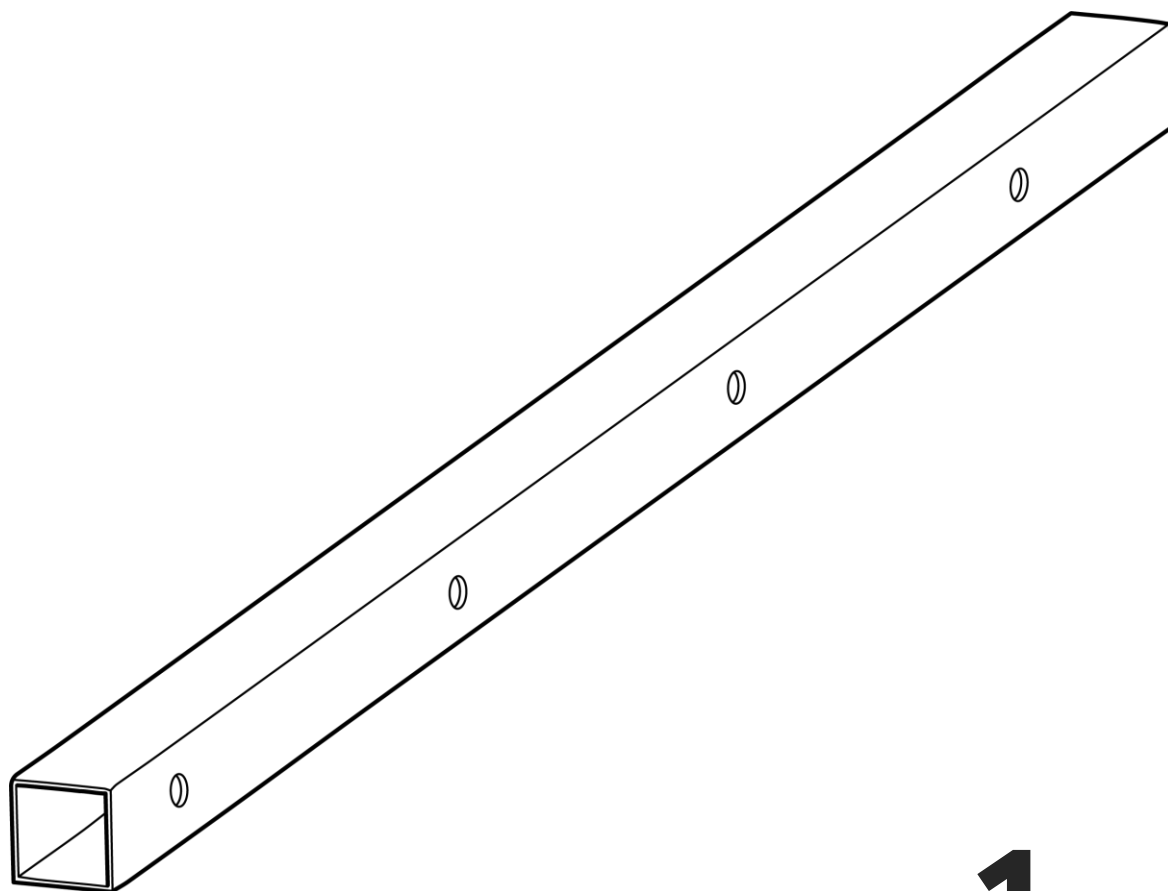
**4×**

4

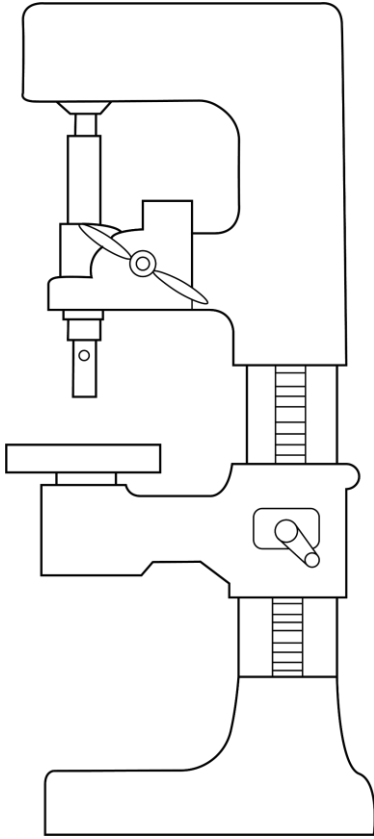


# MALE EXTENDING

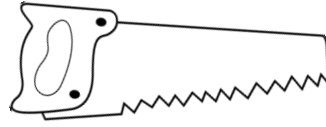
DRAWINGS # 22



**1x**



PILLAR DRILL



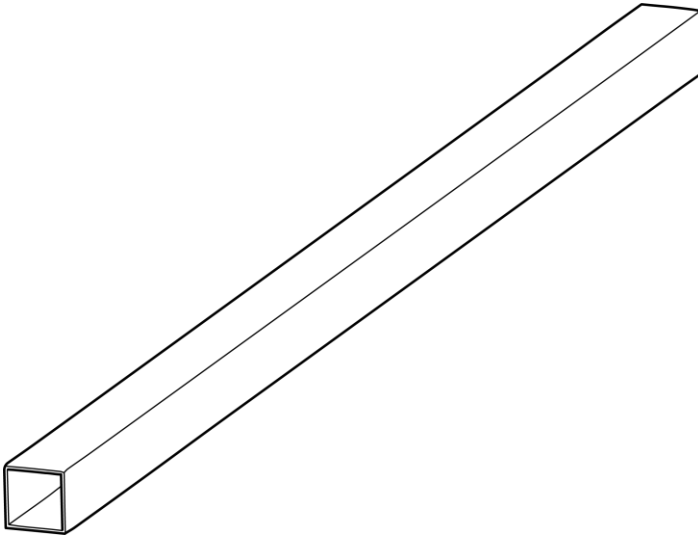
HACK SAW



CENTER DRILL



Ø 8 MM

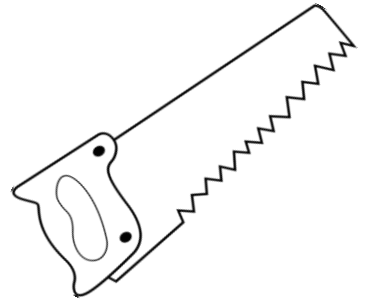
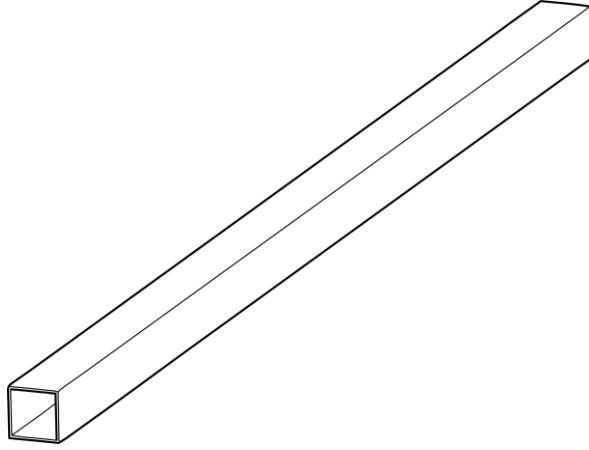


**1 ×** 760 MM LONG  
3 MM THICK  
30 MM SQUARE BEAM

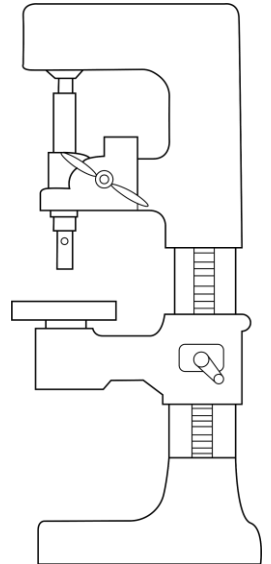
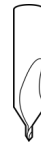
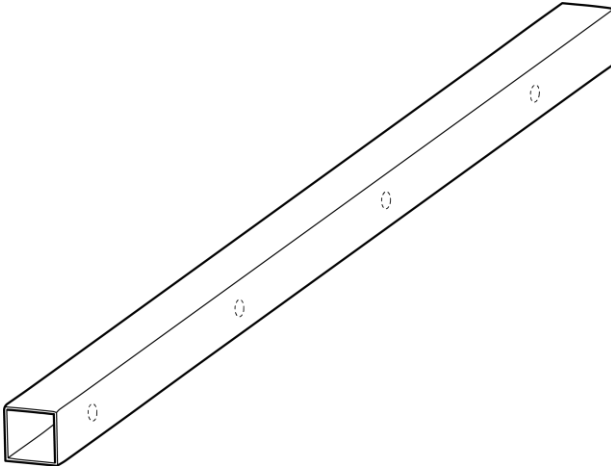
1

DWG.  
1 X #22

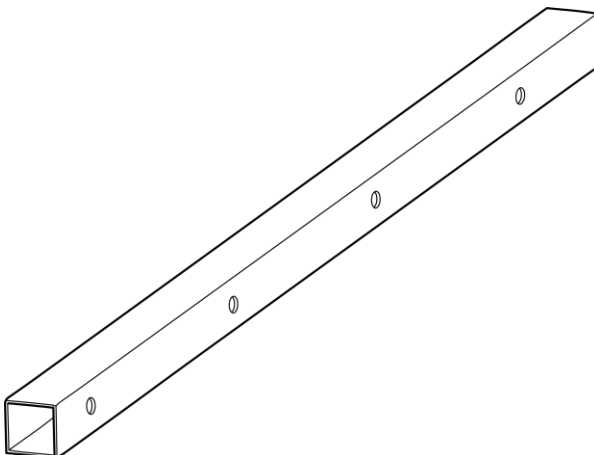
Materials  
30 X 30 MM MILD  
STEEL BAR



2

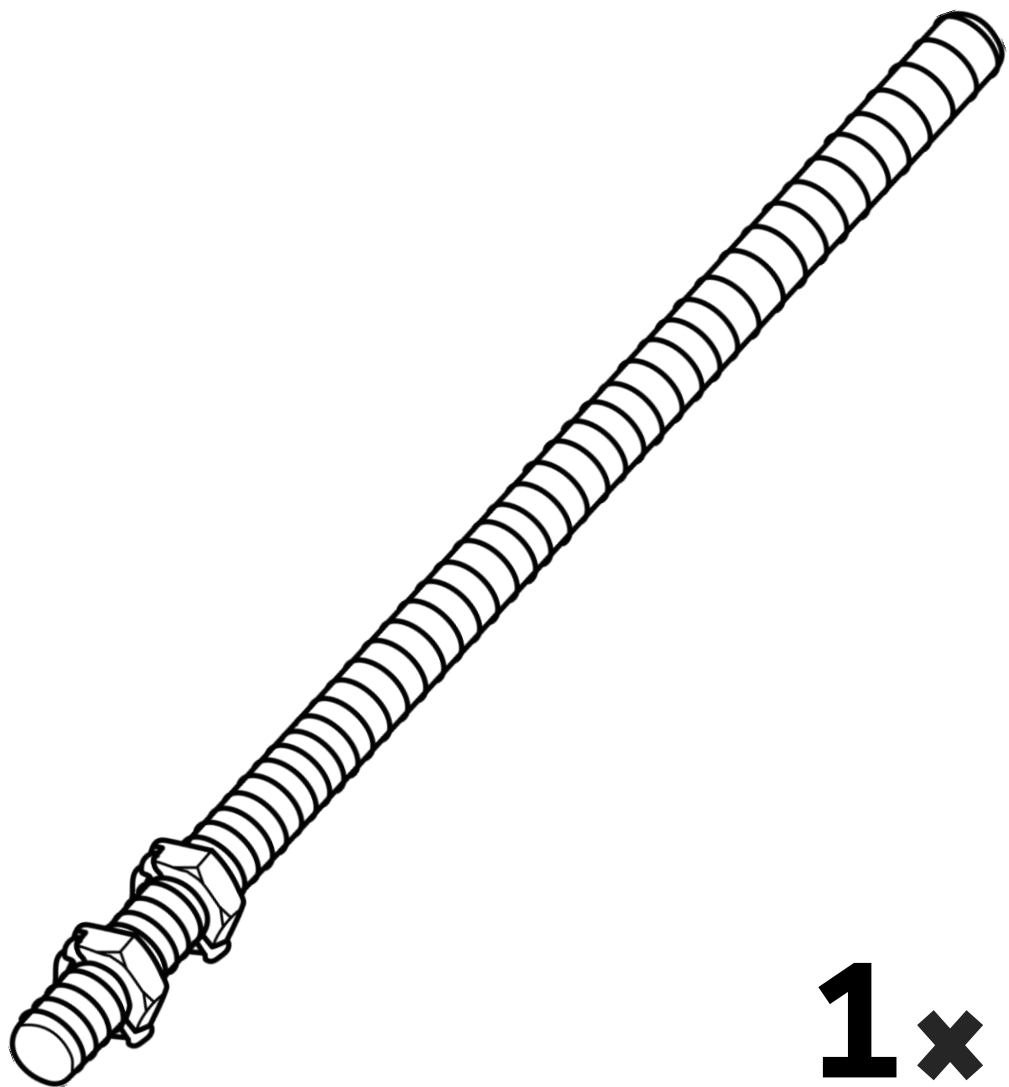


3

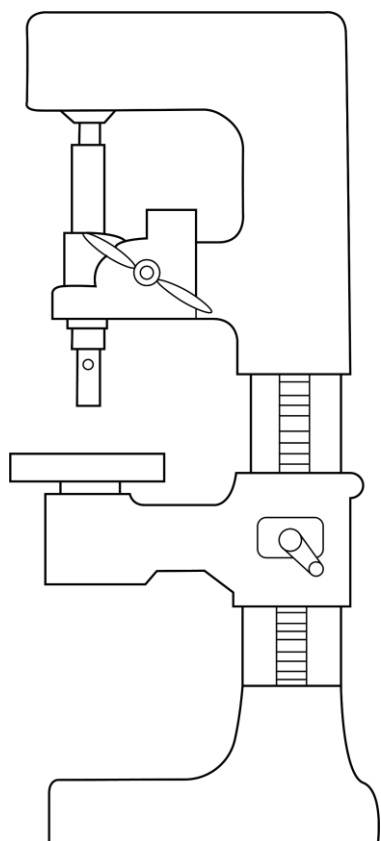


# STUDDING

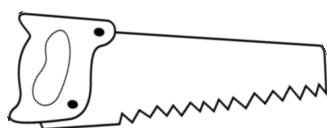
DRAWINGS # 23 & 24



1x



PILLAR DRILL



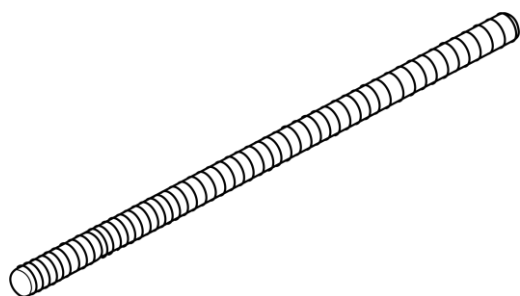
HACK SAW



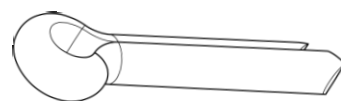
CENTER DRILL



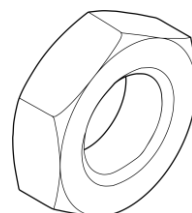
Ø 3 MM



**1 ×** M12 STUDDING  
300 MM LONG



**2 ×** SPLIT PIN



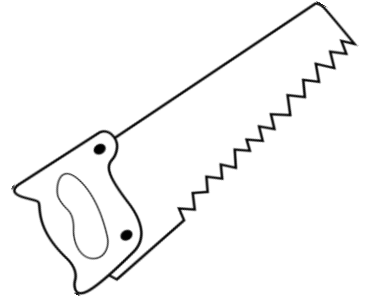
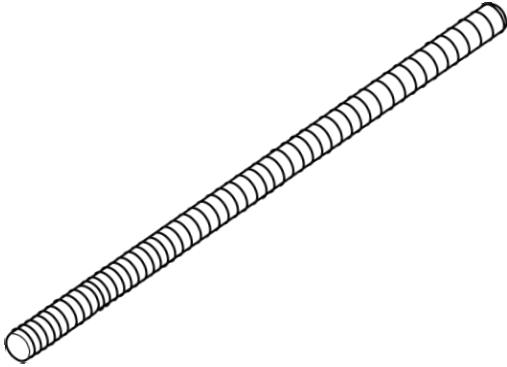
**2 ×** M12 NUT



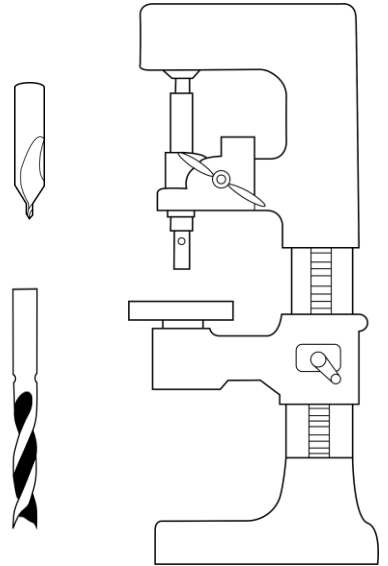
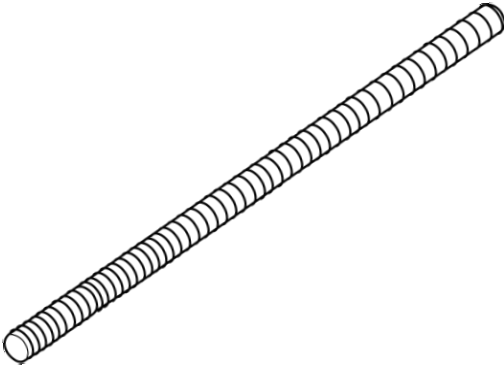
1

DWG.  
1 X #23

Materials  
M12 STUDDING



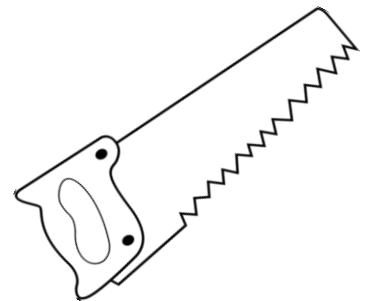
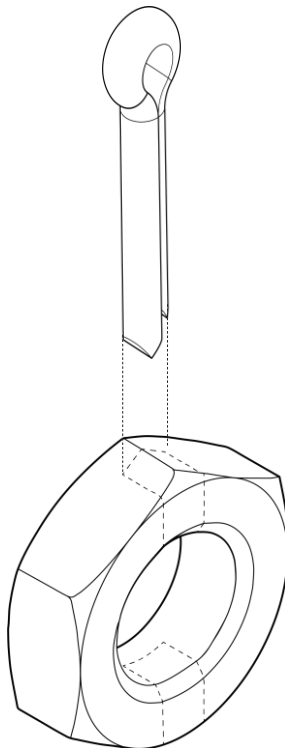
2



3

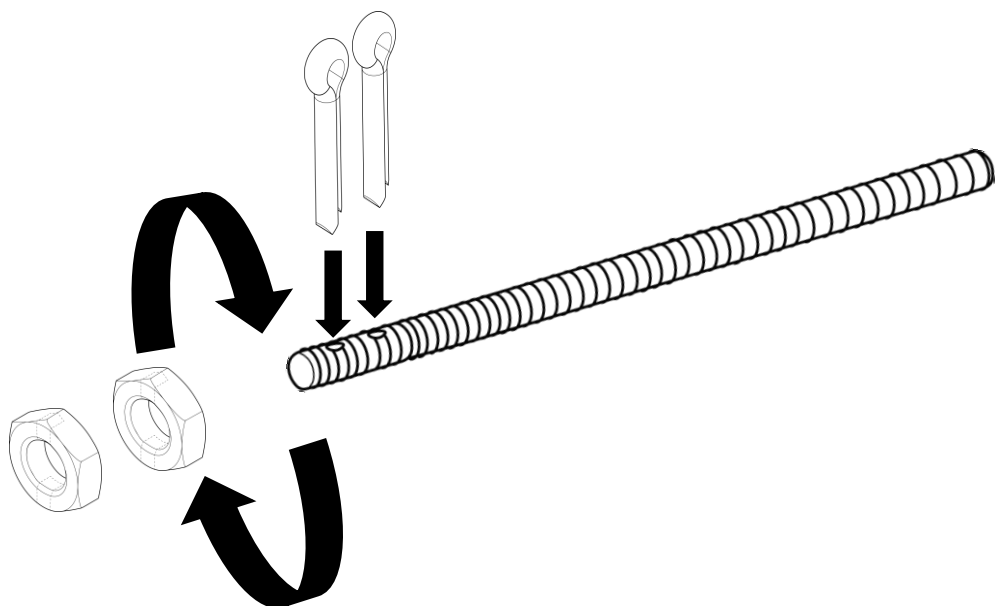
DWG.  
1 X #24

Materials  
M12 NUT

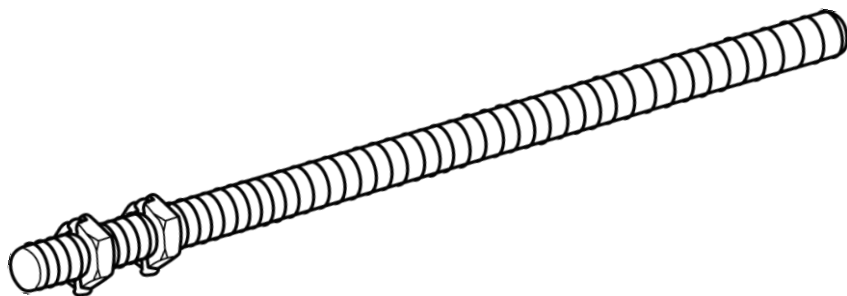


2x

4

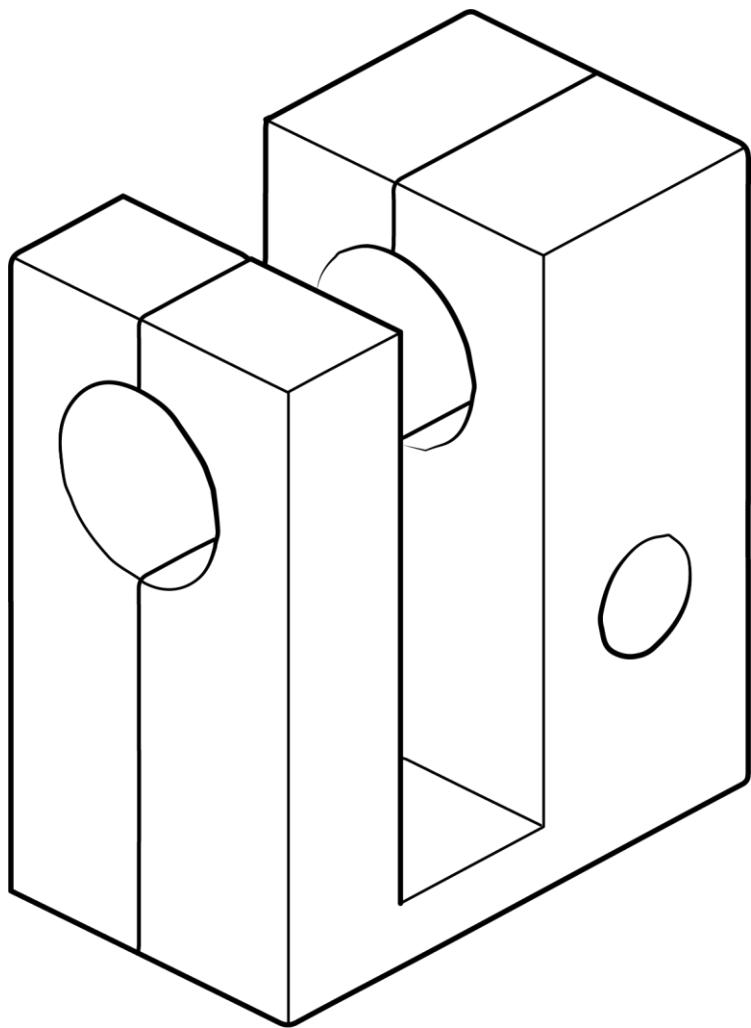


5

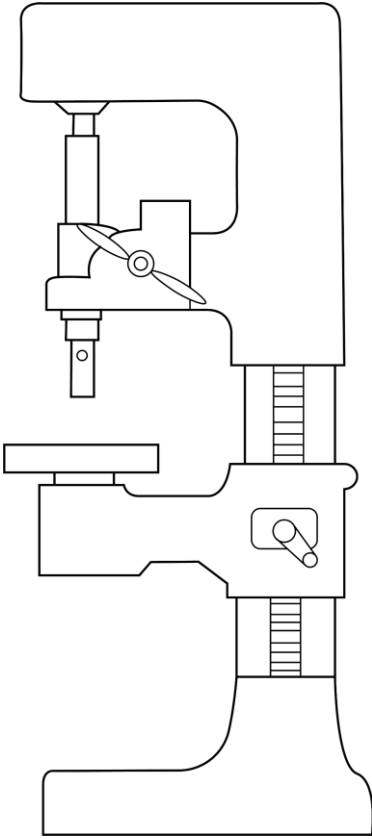


# CONNECTOR

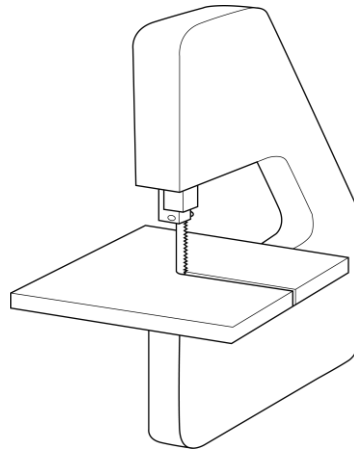
DRAWINGS # 25.1 & 25.2



**1x**



PILLAR DRILL



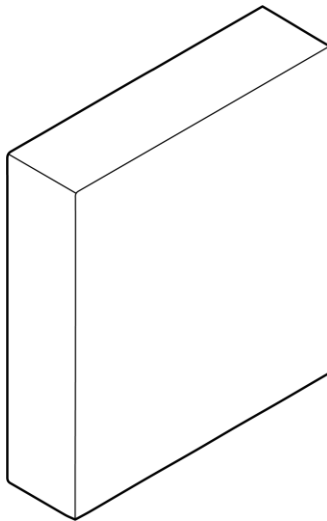
BAND SAW



Ø 3 MM



Ø 13 MM



**1 ×** 50 X 45 X 26 MM  
PLYWOOD BLOCK

# 1

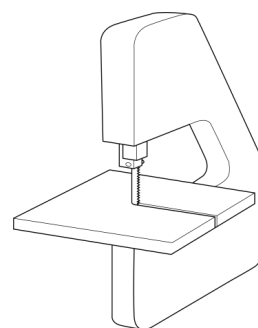
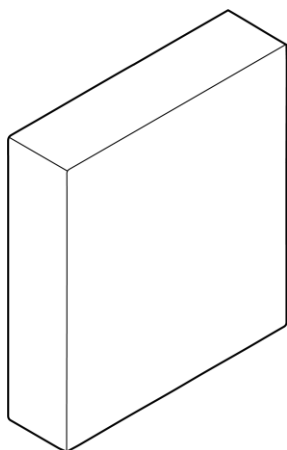
**DWG.**

1 X #25.1

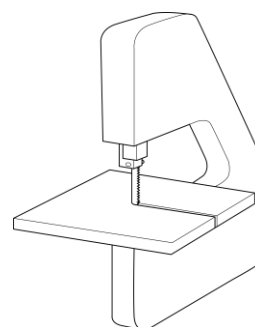
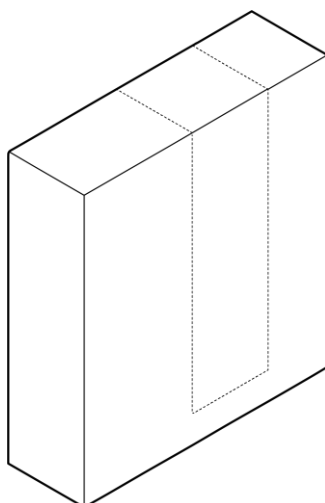
1 X #25.2

**Materials**

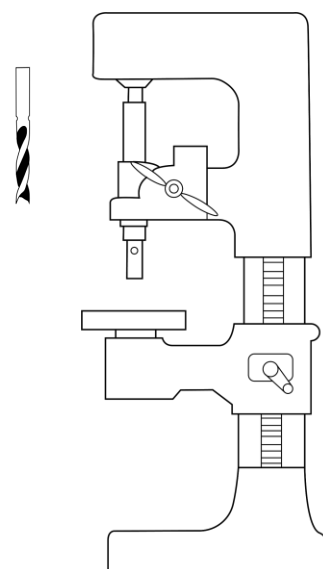
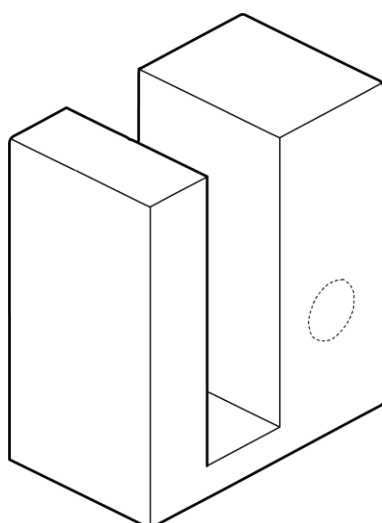
PLYWOOD



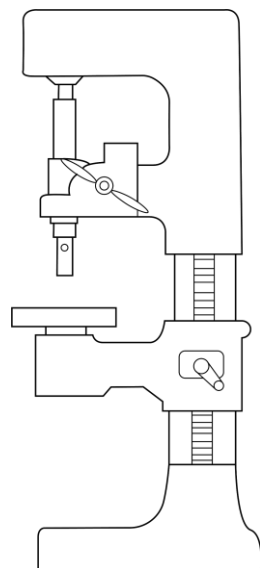
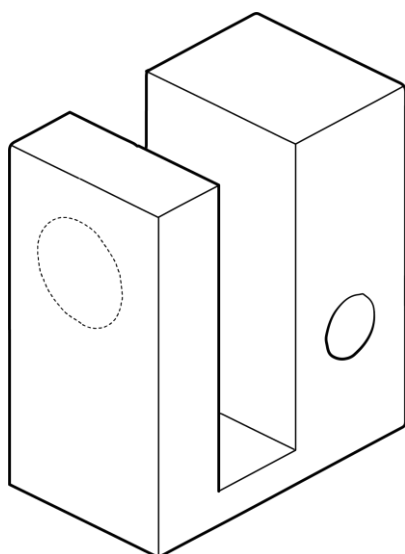
# 2



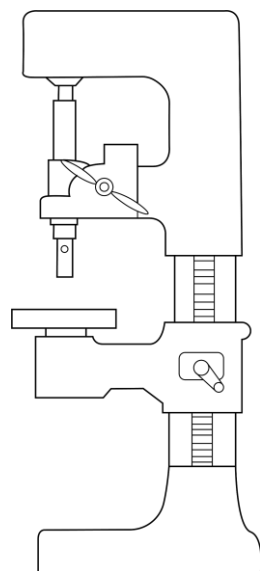
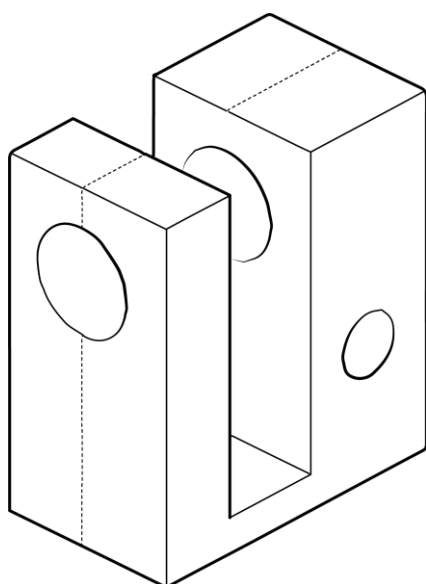
# 3



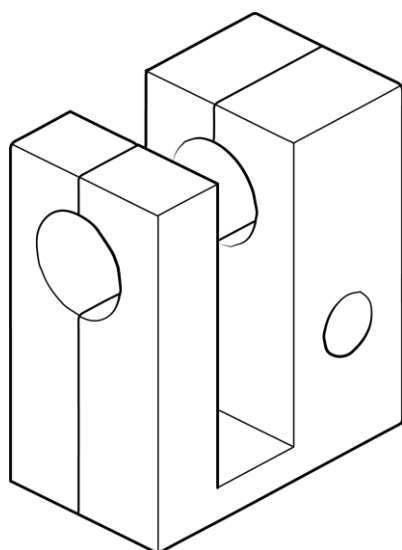
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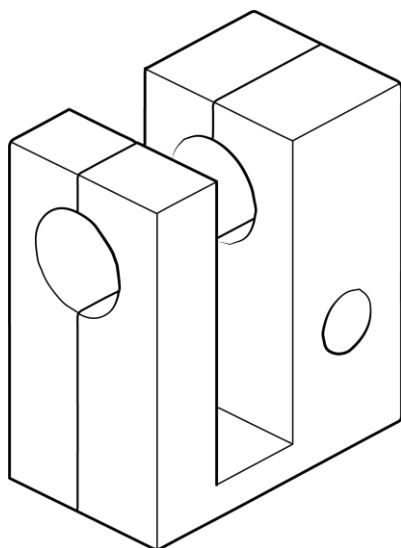
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6

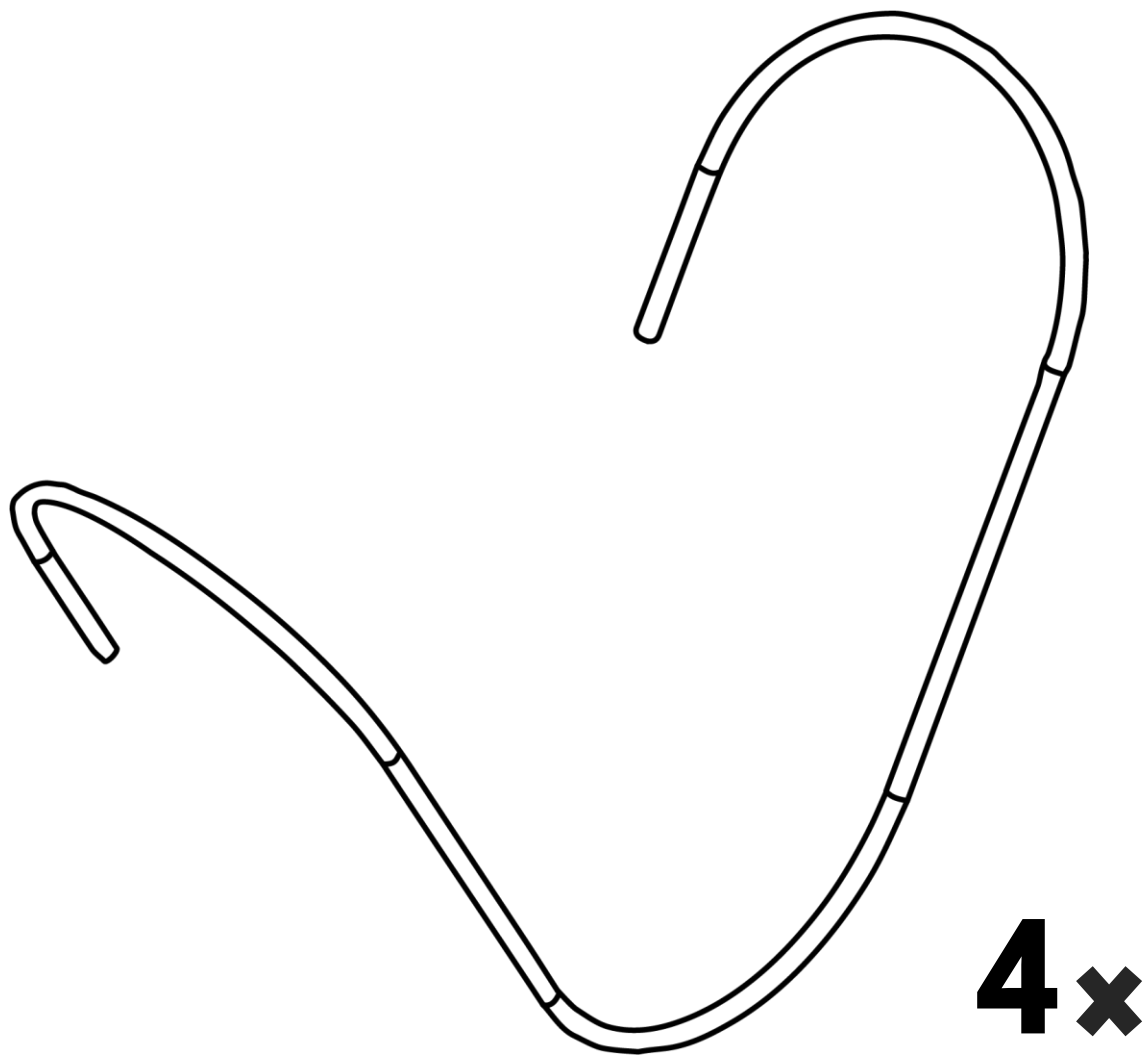


7

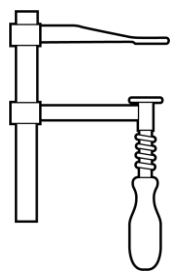


# WHEEL HOOK

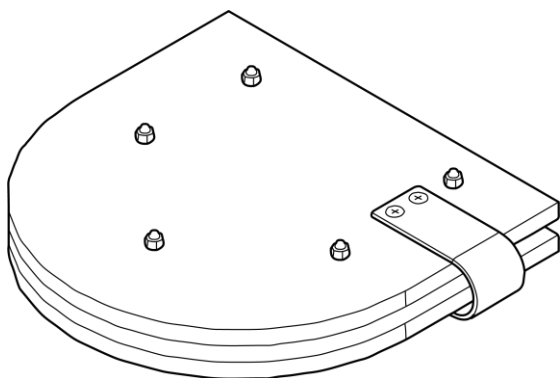
DRAWINGS # 31



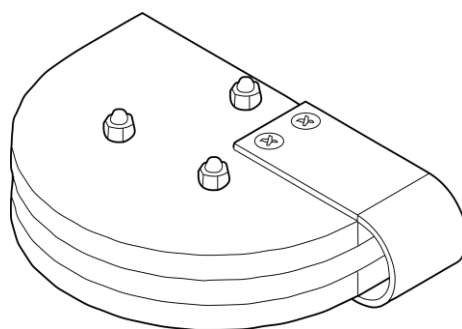




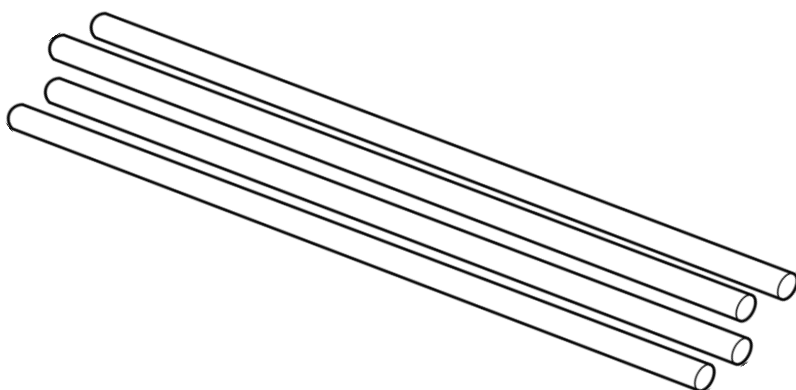
CLAMP



LARGE BENDING RIG



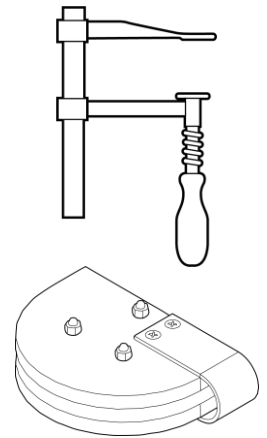
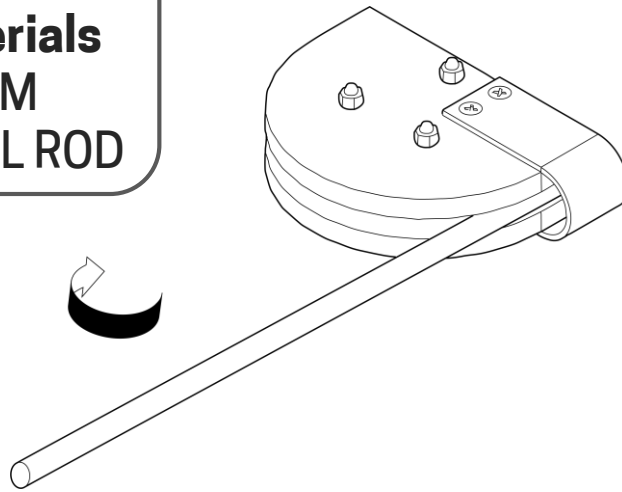
SMALL BENDING RIG



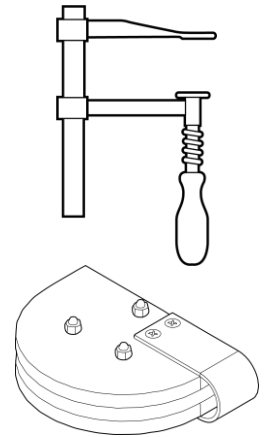
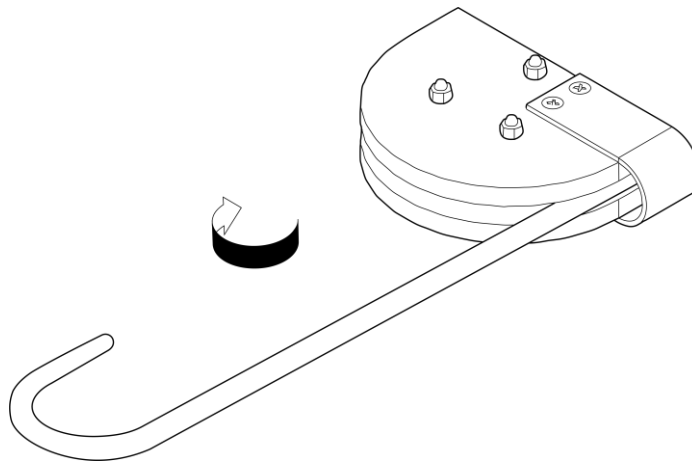
**4 ×** Ø 12 MM ROD  
1000 M LONG

1

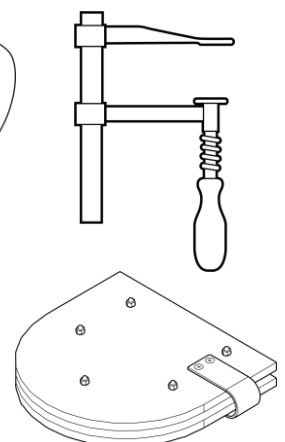
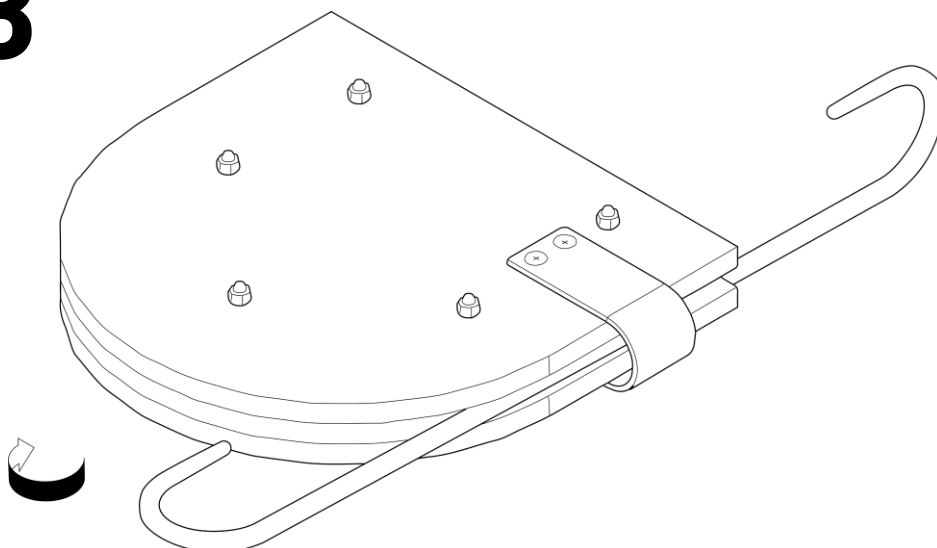
DWG.  
1 X #31  
Materials  
12 MM  
STEEL ROD

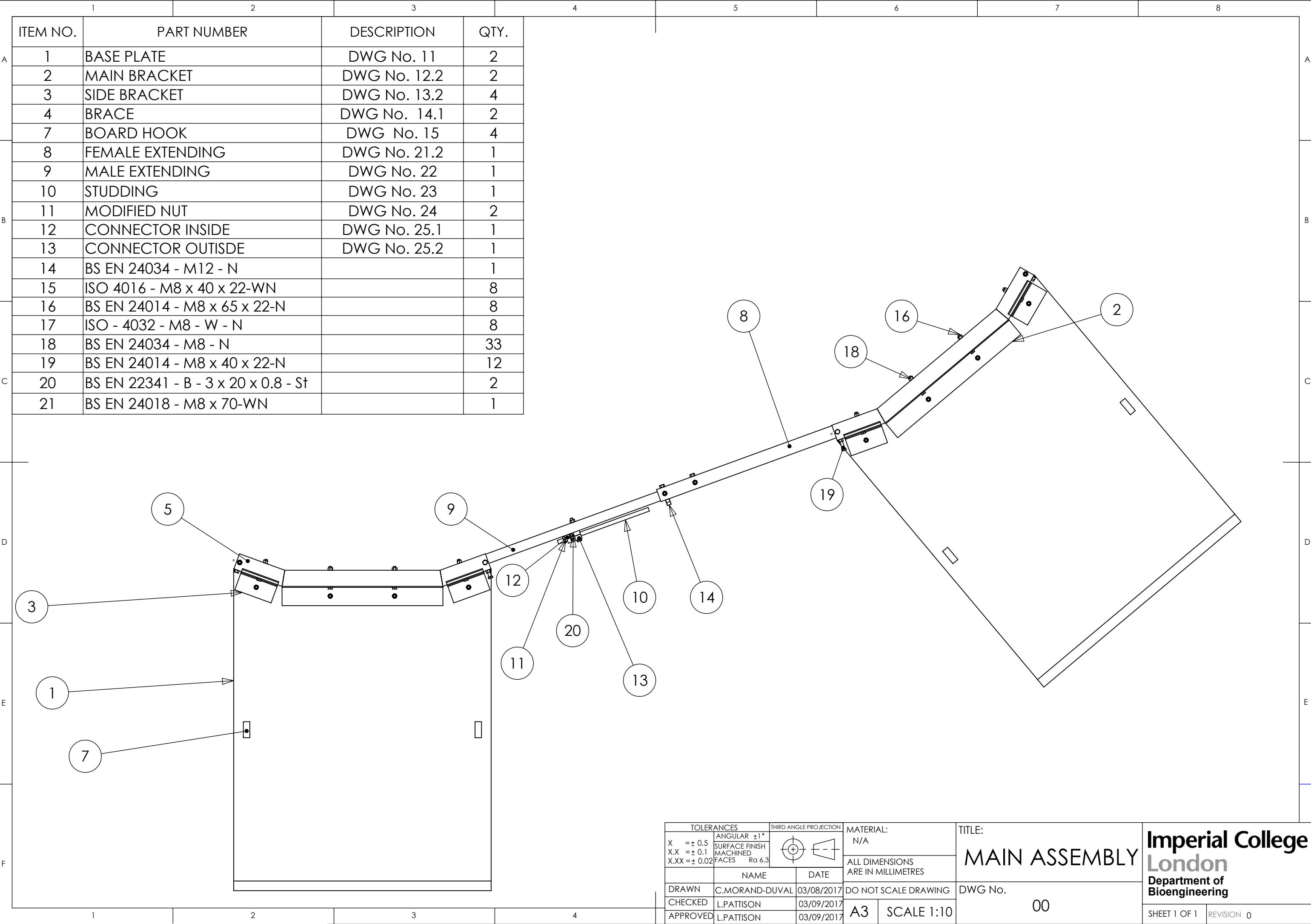


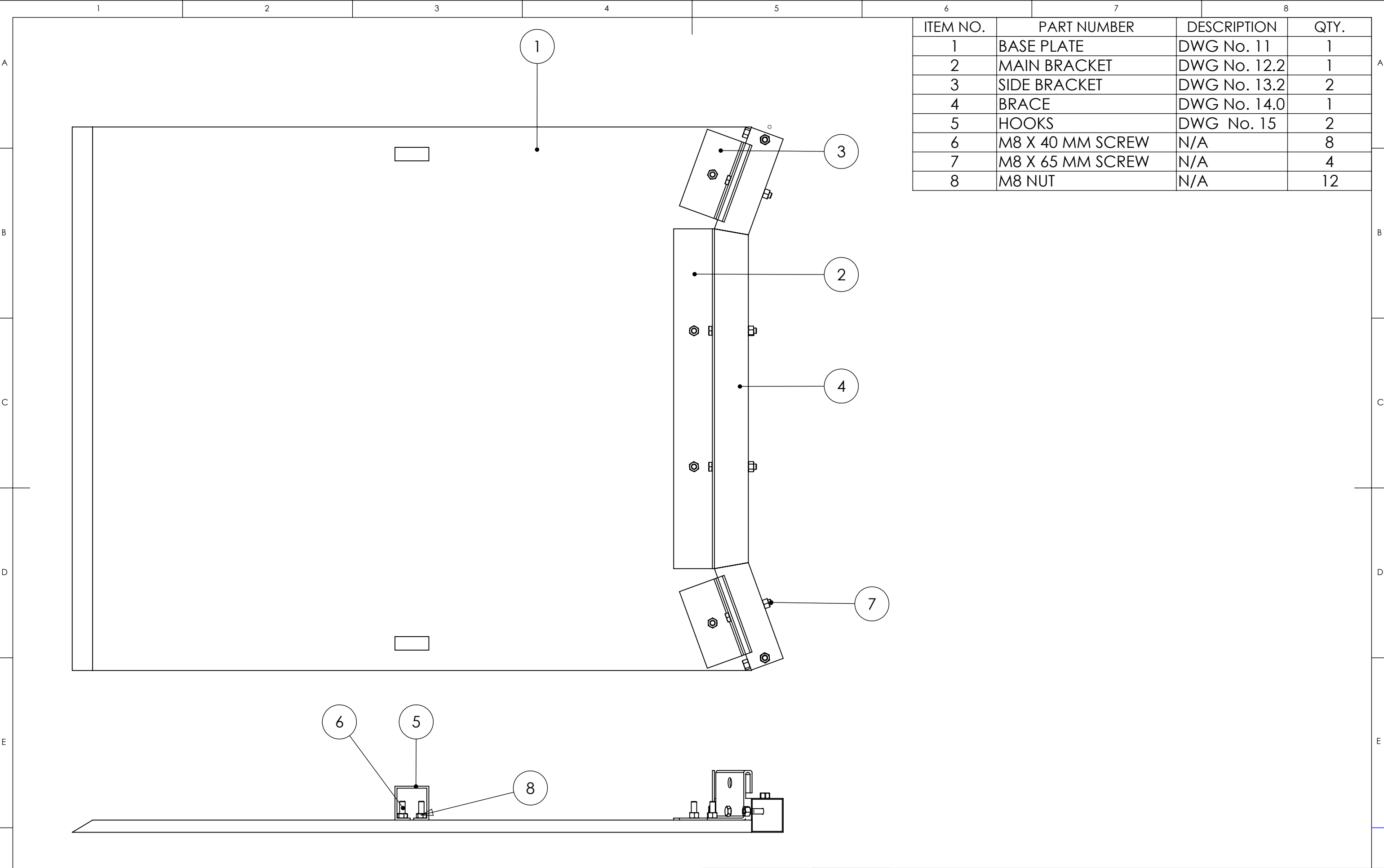
2



3

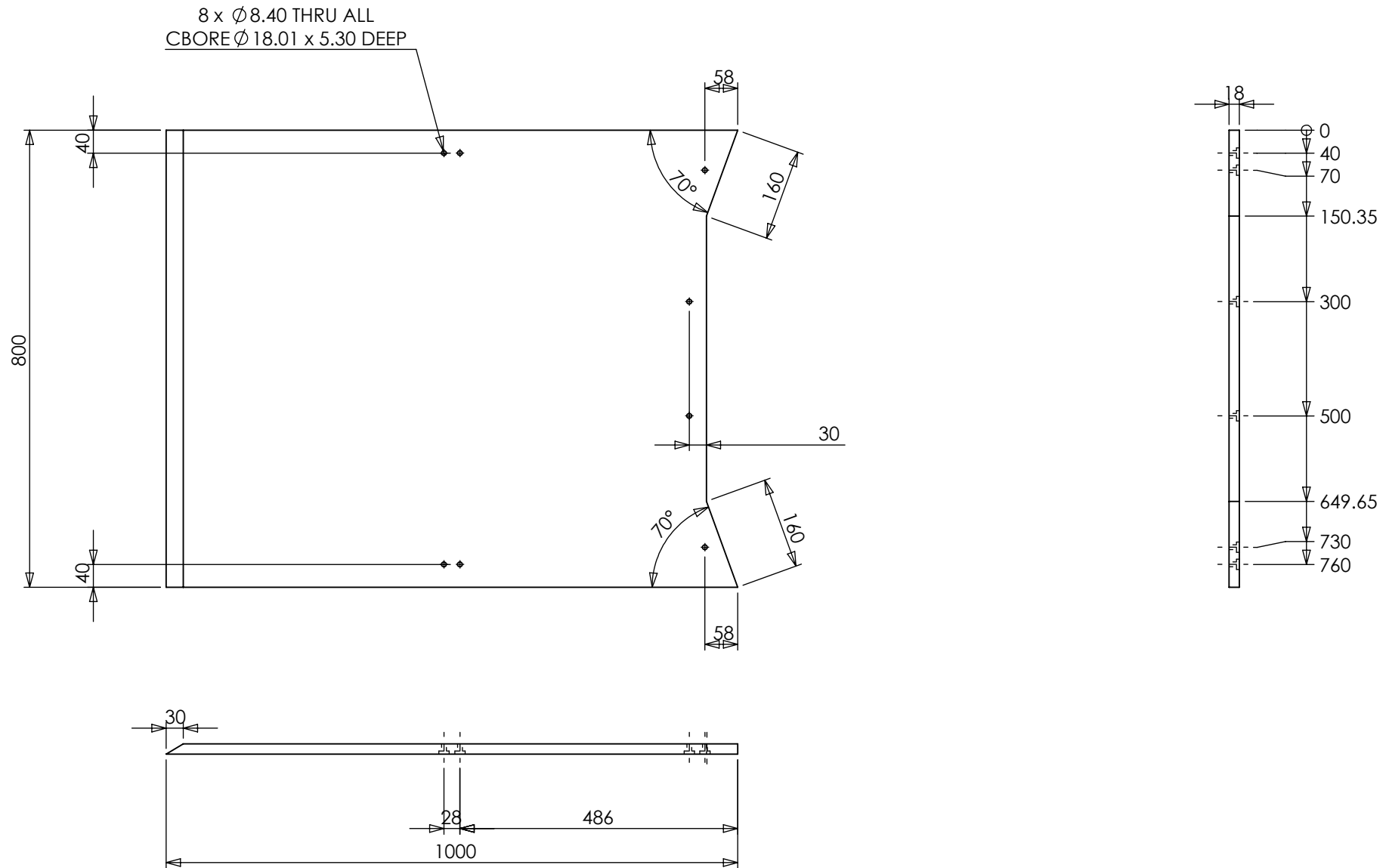


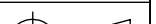


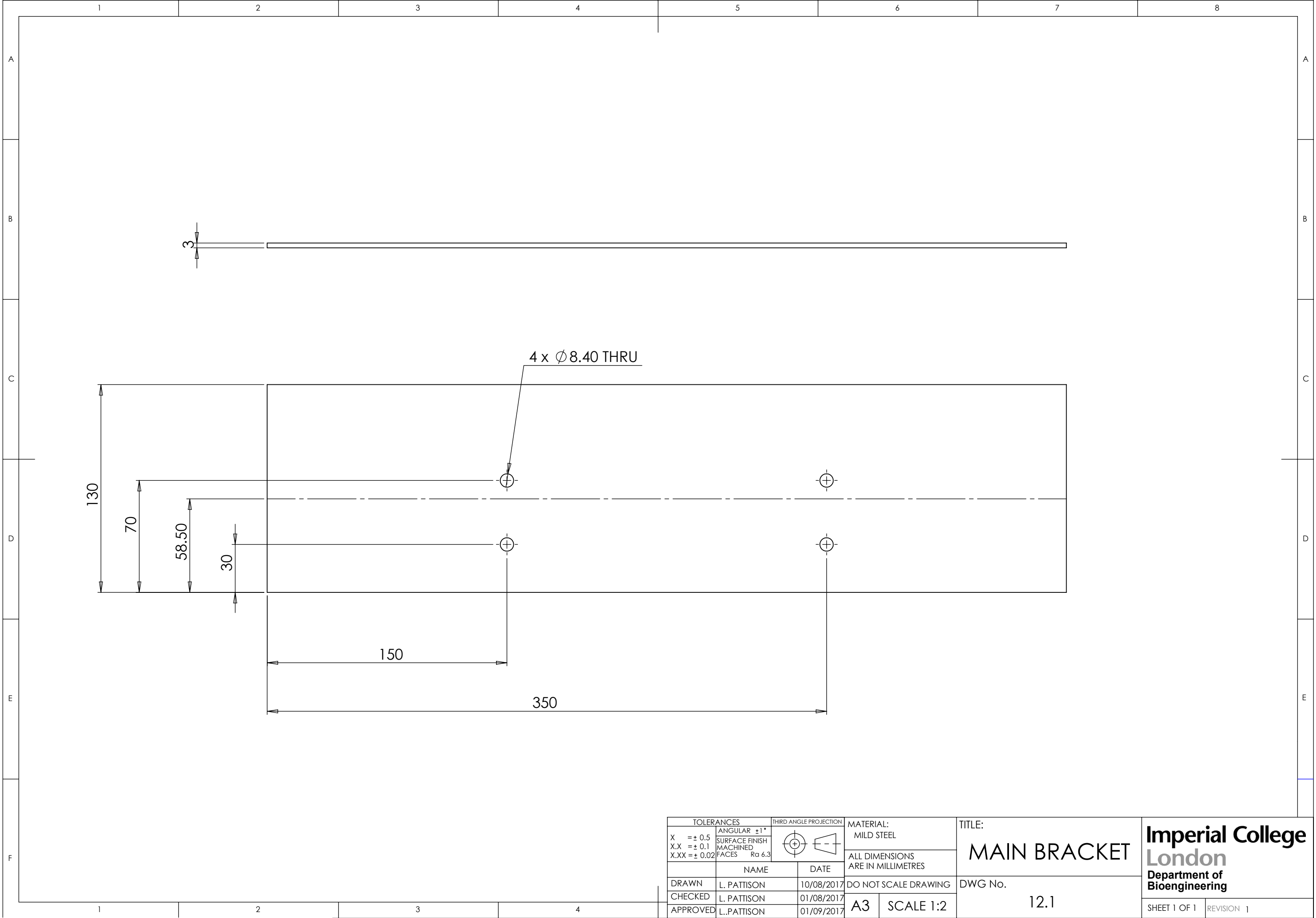


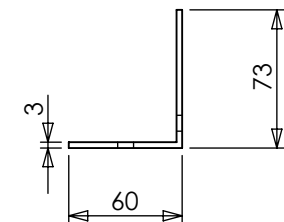
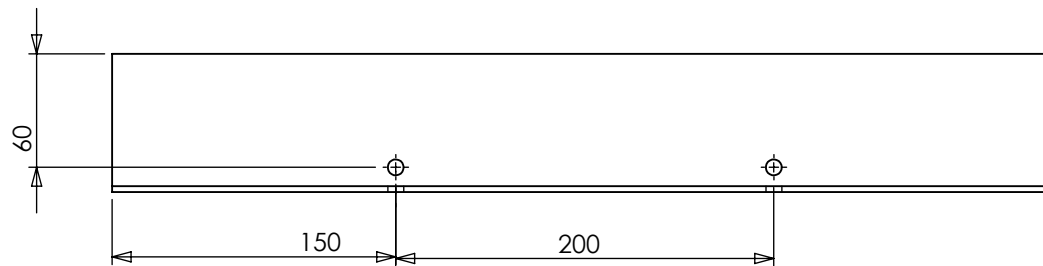
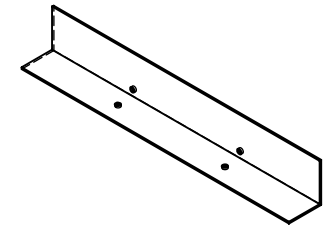
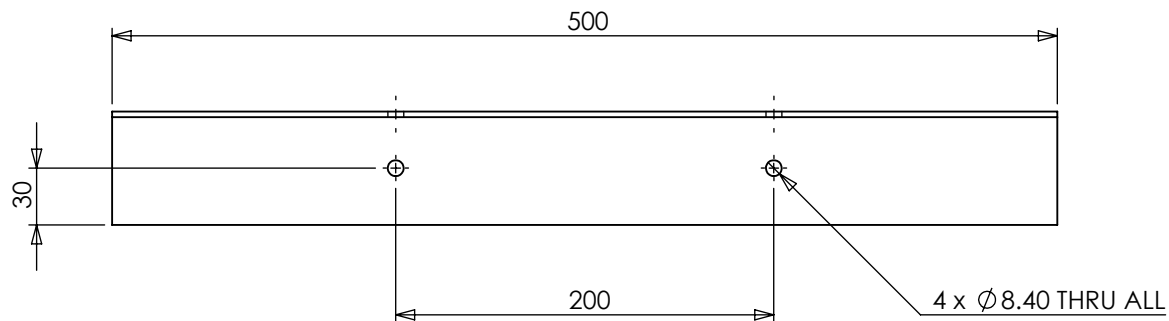
| ITEM NO. | PART NUMBER      | DESCRIPTION  | QTY. |
|----------|------------------|--------------|------|
| 1        | BASE PLATE       | DWG No. 11   | 1    |
| 2        | MAIN BRACKET     | DWG No. 12.2 | 1    |
| 3        | SIDE BRACKET     | DWG No. 13.2 | 2    |
| 4        | BRACE            | DWG No. 14.0 | 1    |
| 5        | HOOKS            | DWG No. 15   | 2    |
| 6        | M8 X 40 MM SCREW | N/A          | 8    |
| 7        | M8 X 65 MM SCREW | N/A          | 4    |
| 8        | M8 NUT           | N/A          | 12   |

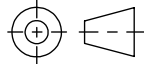
| TOLERANCES    |                | THIRD ANGLE PROJECTION                                                                |                      | MATERIAL:<br>N/A |                   | TITLE:<br><br>BOARD<br>ASSEMBLY |                            | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|---------------|----------------|---------------------------------------------------------------------------------------|----------------------|------------------|-------------------|---------------------------------|----------------------------|---------------------------------------------------------------|--|
| X = ± 0.5     | ANGULAR ± 1°   |  |                      |                  |                   |                                 |                            |                                                               |  |
| X.X = ± 0.1   | SURFACE FINISH |                                                                                       |                      |                  |                   |                                 |                            |                                                               |  |
| X.XX = ± 0.02 | FACES Ra 6.3   |                                                                                       |                      |                  |                   |                                 |                            |                                                               |  |
|               | NAME           | DATE                                                                                  |                      |                  | DWG No.<br><br>10 |                                 | SHEET 1 OF 1<br>REVISION 0 |                                                               |  |
| DRAWN         | C.MORAND-DUVAL | 03/08/2017                                                                            | DO NOT SCALE DRAWING |                  |                   |                                 |                            |                                                               |  |
| CHECKED       | L.PATTISON     | 01/09/2017                                                                            | A3                   |                  |                   |                                 |                            |                                                               |  |
| APPROVED      | L.PATTISON     | 01/09/2017                                                                            | SCALE 1:5            |                  |                   |                                 |                            |                                                               |  |

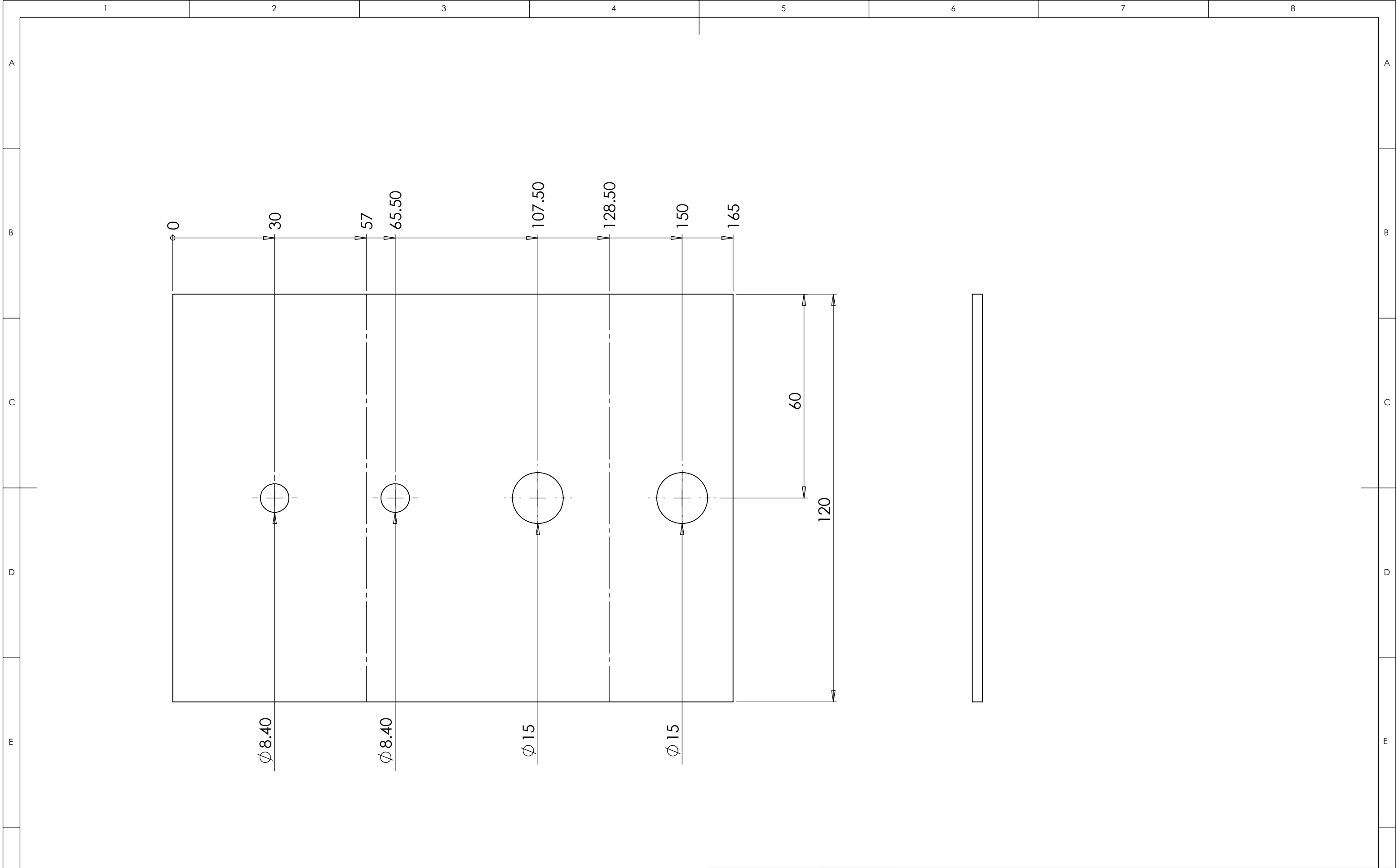


| TOLERANCES |          | THIRD ANGLE PROJECTION                                                               |      | MATERIAL:<br>PLYWOOD                 |  | TITLE:               |  | <div>Imperial College<br/>London<br/>Department of<br/>Bioengineering</div> |  |
|------------|----------|--------------------------------------------------------------------------------------|------|--------------------------------------|--|----------------------|--|-----------------------------------------------------------------------------|--|
| X          | = ± 0.5  | ANGULAR                                                                              | ± 1° | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  | BASE PLATE           |  |                                                                             |  |
| X.X        | = ± 0.1  |  |      |                                      |  |                      |  |                                                                             |  |
| X.XX       | = ± 0.02 |                                                                                      |      |                                      |  |                      |  |                                                                             |  |
|            |          | NAME                                                                                 |      | DATE                                 |  | DO NOT SCALE DRAWING |  | DWG No.                                                                     |  |
| DRAWN      |          | C.MORAND-DUVAL                                                                       |      | 04/08/2017                           |  | A4                   |  | SCALE 1:10                                                                  |  |
| CHECKED    |          | L. PATTISON                                                                          |      | 01/09/2017                           |  |                      |  |                                                                             |  |
| APPROVED   |          | L. PATTISON                                                                          |      | 01/09/2017                           |  |                      |  |                                                                             |  |
|            |          |                                                                                      |      |                                      |  |                      |  | SHEET 1 OF 1                                                                |  |
|            |          |                                                                                      |      |                                      |  |                      |  | REVISION 4                                                                  |  |



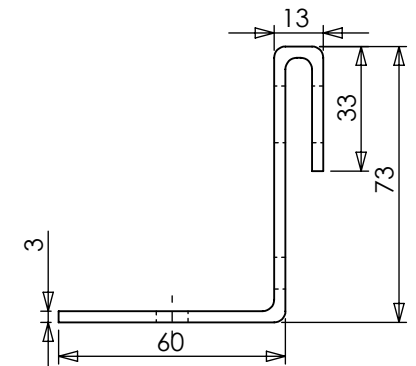
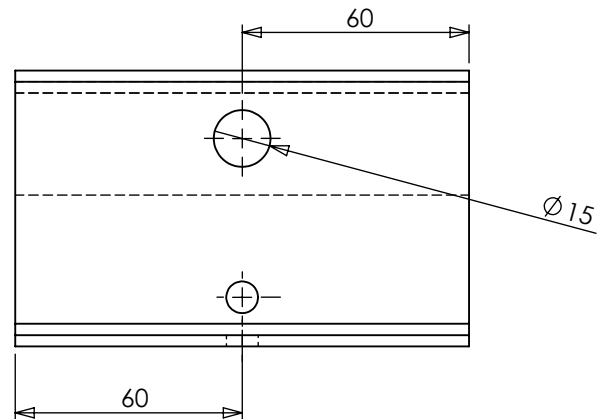
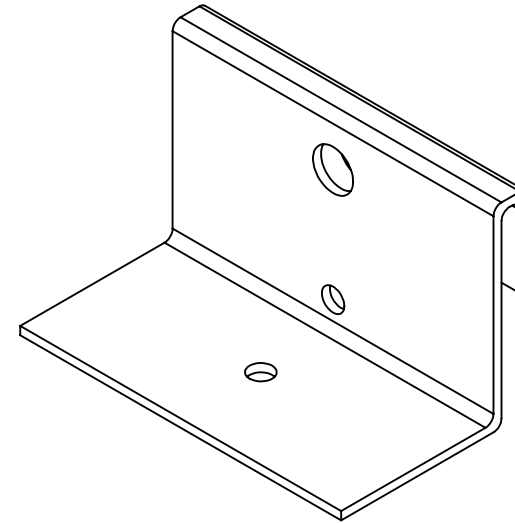
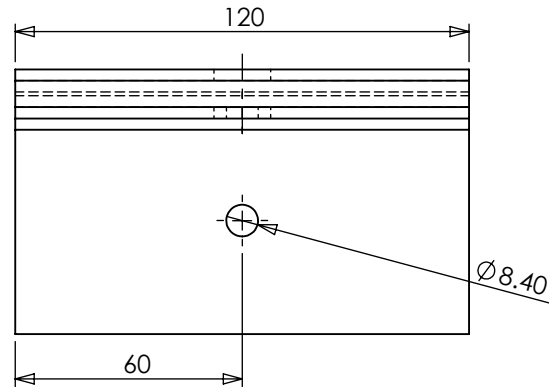


| TOLERANCES |                 | THIRD ANGLE PROJECTION |            | MATERIAL:<br>MILD STEEL                                                              |                      | TITLE:<br><br>MAIN BRACKET           |                     | <div>Imperial College<br/>London<br/>Department of<br/>Bioengineering</div> |              |  |
|------------|-----------------|------------------------|------------|--------------------------------------------------------------------------------------|----------------------|--------------------------------------|---------------------|-----------------------------------------------------------------------------|--------------|--|
| X          | = ± 0.5         | ANGULAR                | ± 1°       |  |                      | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                     |                                                                             |              |  |
| X.X        | = ± 0.1         | SURFACE FINISH         | MACHINED   |                                                                                      |                      |                                      |                     |                                                                             |              |  |
| X.XX       | = ± 0.02        | FACES                  | Ra 6.3     |                                                                                      |                      |                                      |                     |                                                                             |              |  |
|            | NAME            |                        | DATE       |                                                                                      | DO NOT SCALE DRAWING |                                      | DWG No.<br><br>12.2 |                                                                             |              |  |
| DRAWN      | C. MORAND-DUVAL |                        | 02/08/2017 |                                                                                      | A4                   |                                      | SCALE 1:5           |                                                                             | SHEET 1 OF 1 |  |
| CHECKED    | L.PATTISON      |                        | 01/09/2017 |                                                                                      |                      |                                      |                     |                                                                             | REVISION 0   |  |
| APPROVED   | L.PATTISON      |                        | 01/09/2017 |                                                                                      |                      |                                      |                     |                                                                             |              |  |



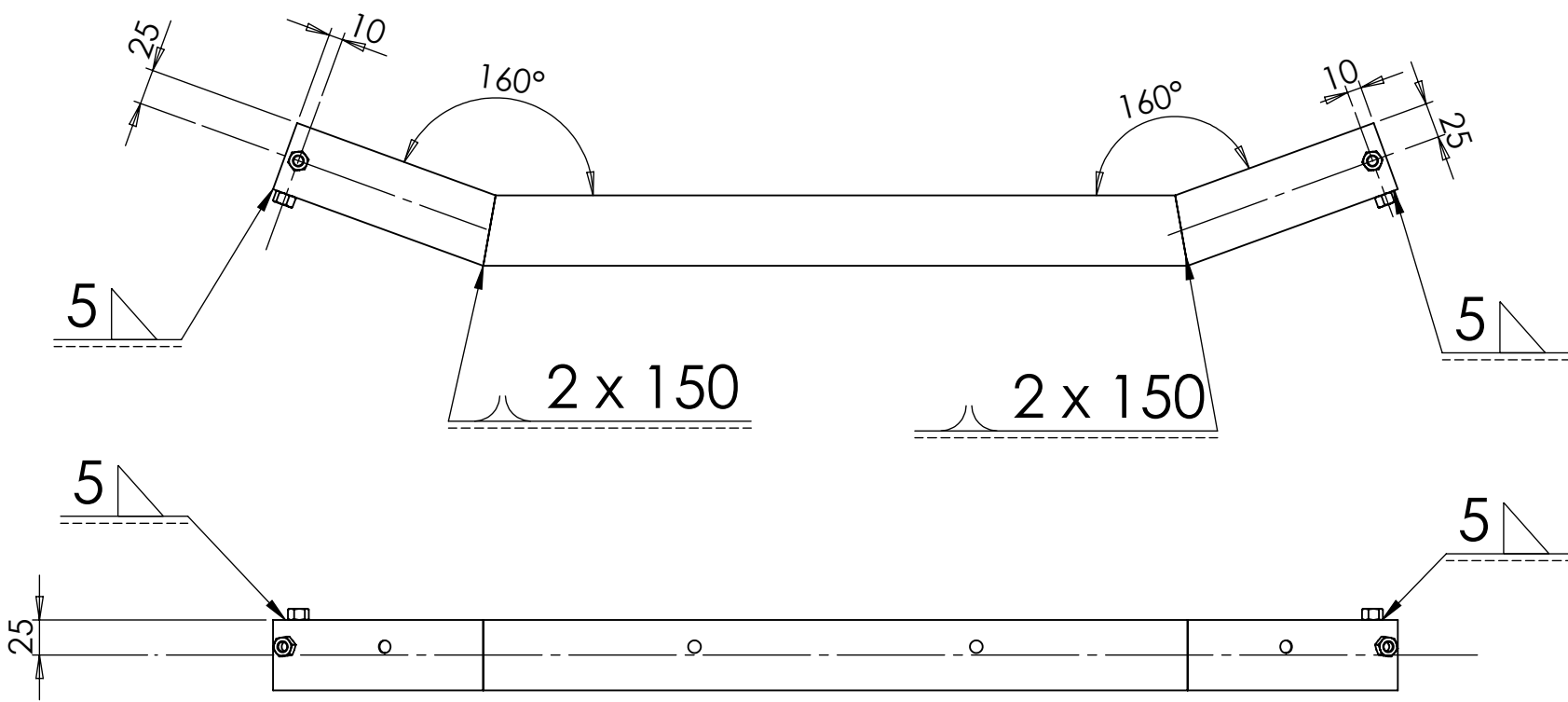
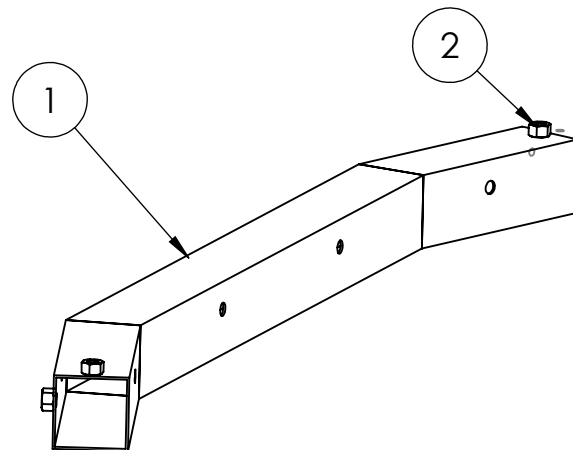
| TOLERANCES    |                   |            | THIRD ANGLE PROJECTION |  | MATERIAL:<br>MILD STEEL              |              | TITLE:<br><br>SIDE BRACKET |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|---------------|-------------------|------------|------------------------|--|--------------------------------------|--------------|----------------------------|--|---------------------------------------------------------------|--|
| X    = ± 0.5  | ANGULAR           | ±1 °       |                        |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |              | DWG No.<br><br>13.1        |  |                                                               |  |
| X.X   = ± 0.1 | SURFACE FINISH    |            |                        |  | DO NOT SCALE DRAWING                 |              |                            |  |                                                               |  |
| X.XX = ± 0.02 | MACHINED<br>FACES | Ra 6.3     |                        |  |                                      |              |                            |  |                                                               |  |
|               | NAME              | DATE       | A3                     |  | SCALE 1:1                            | SHEET 1 OF 1 | REVISION   1               |  |                                                               |  |
| DRAWN         | L.PATTISON        | 10/08/2017 |                        |  |                                      |              |                            |  |                                                               |  |
| CHECKED       | L.PATTISON        | 01/09/2017 |                        |  |                                      |              |                            |  |                                                               |  |
| APPROVED      | L.PATTISON        | 01/09/2017 |                        |  |                                      |              |                            |  |                                                               |  |



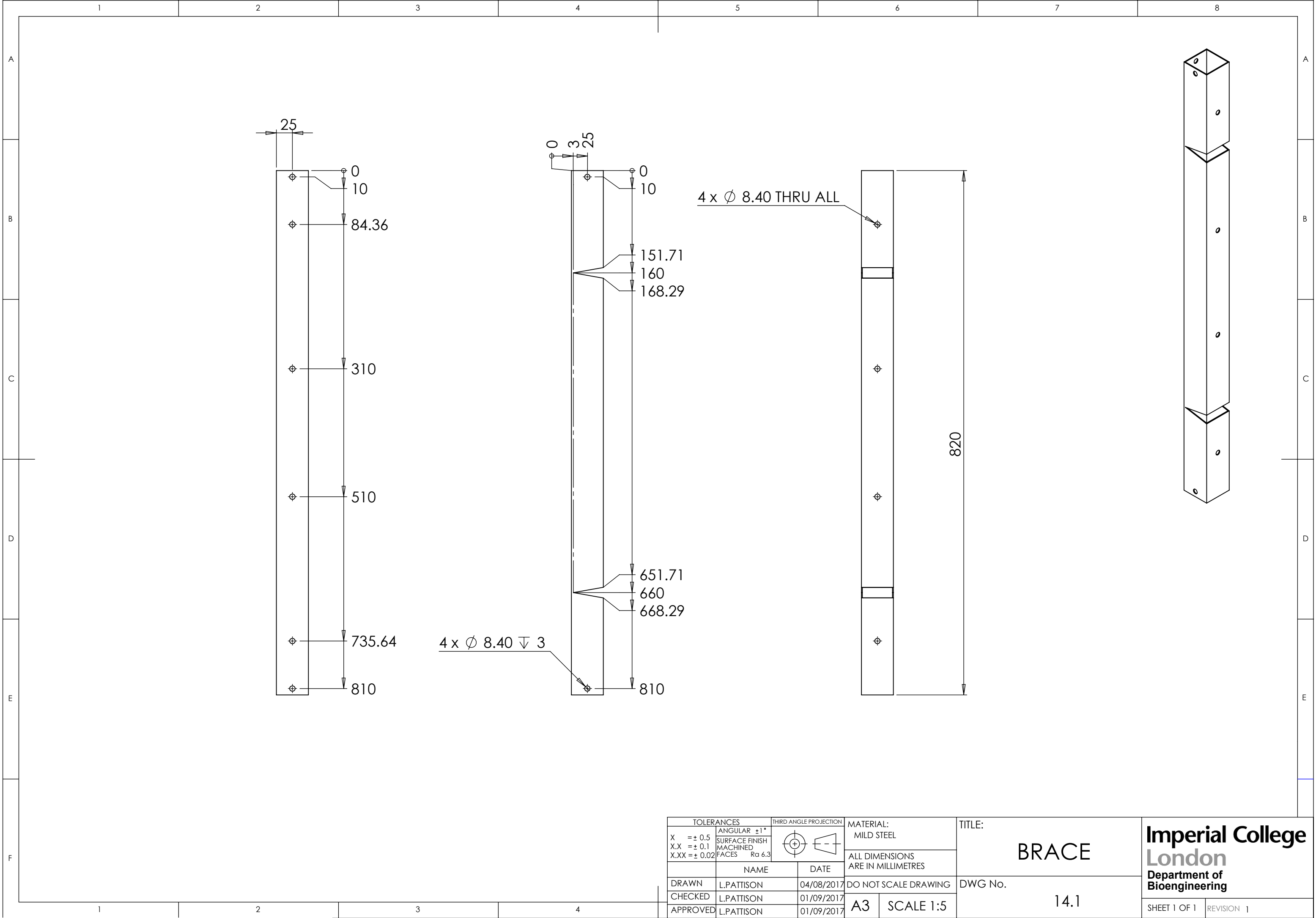


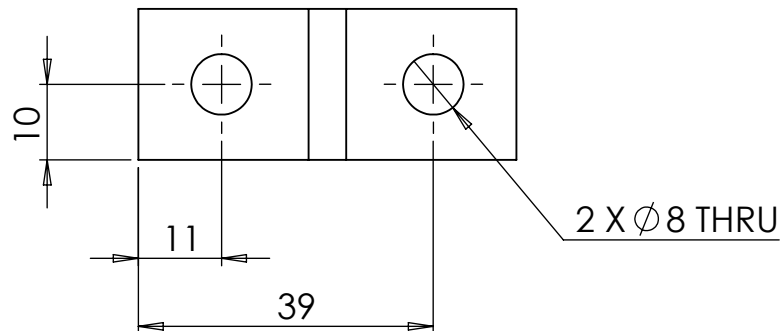
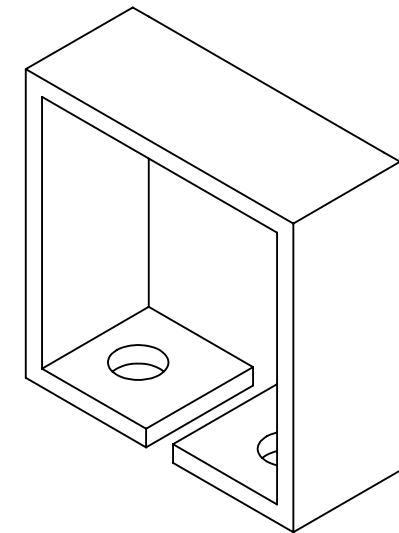
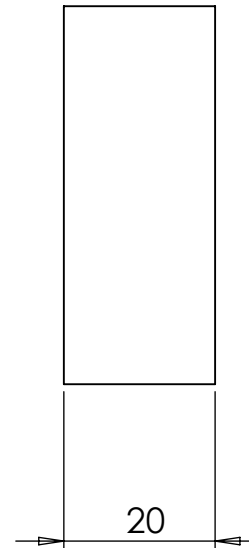
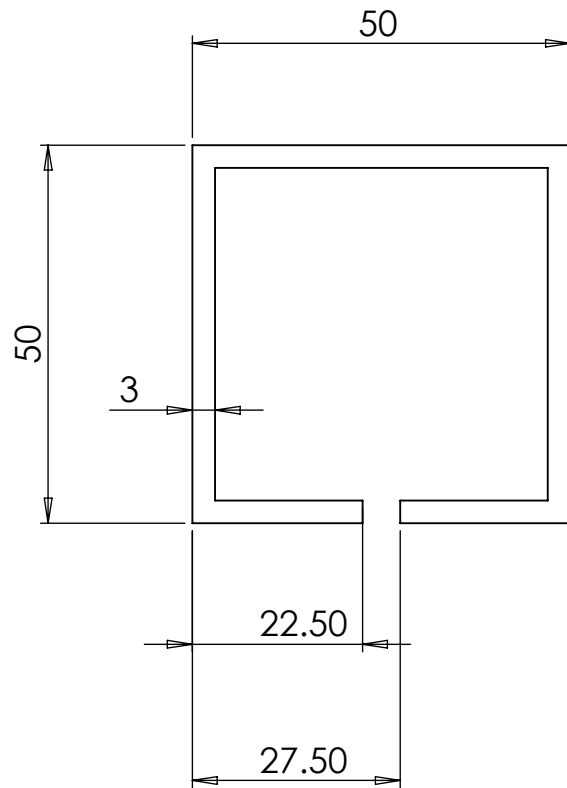
| TOLERANCES |                 | THIRD ANGLE PROJECTION                                                               |      | MATERIAL:<br>MILD STEEL              |  | TITLE:<br><br>SIDE BRACKET |  | <div>Imperial College<br/>London<br/>Department of<br/>Bioengineering</div> |  |
|------------|-----------------|--------------------------------------------------------------------------------------|------|--------------------------------------|--|----------------------------|--|-----------------------------------------------------------------------------|--|
| X          | = ± 0.5         | ANGULAR                                                                              | ± 1° | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                            |  |                                                                             |  |
| X.X        | = ± 0.1         | SURFACE FINISH<br>MACHINED                                                           |      |                                      |  |                            |  |                                                                             |  |
| X.XX       | = ± 0.02        | FACES Ra 6.3                                                                         |      |                                      |  |                            |  |                                                                             |  |
|            |                 |  |      |                                      |  |                            |  |                                                                             |  |
|            |                 | NAME                                                                                 |      | DATE                                 |  | DO NOT SCALE DRAWING       |  | DWG No.                                                                     |  |
| DRAWN      | C. MORAND-DUVAL | 02/08/2017                                                                           |      | DO NOT SCALE DRAWING                 |  | 13.2                       |  | SHEET 1 OF 1                                                                |  |
| CHECKED    | L.PATTISON      | 01/09/2017                                                                           |      | A4                                   |  | SCALE 1:2                  |  | REVISION 0                                                                  |  |
| APPROVED   | L.PATTISON      | 01/09/2017                                                                           |      |                                      |  |                            |  |                                                                             |  |

| ITEM NO. | PART NUMBER          | DESCRIPTION  | QTY. |
|----------|----------------------|--------------|------|
| 1        | BRACE                | DWG No. 14.1 | 1    |
| 2        | BS EN 24034 - M8 - N |              | 4    |

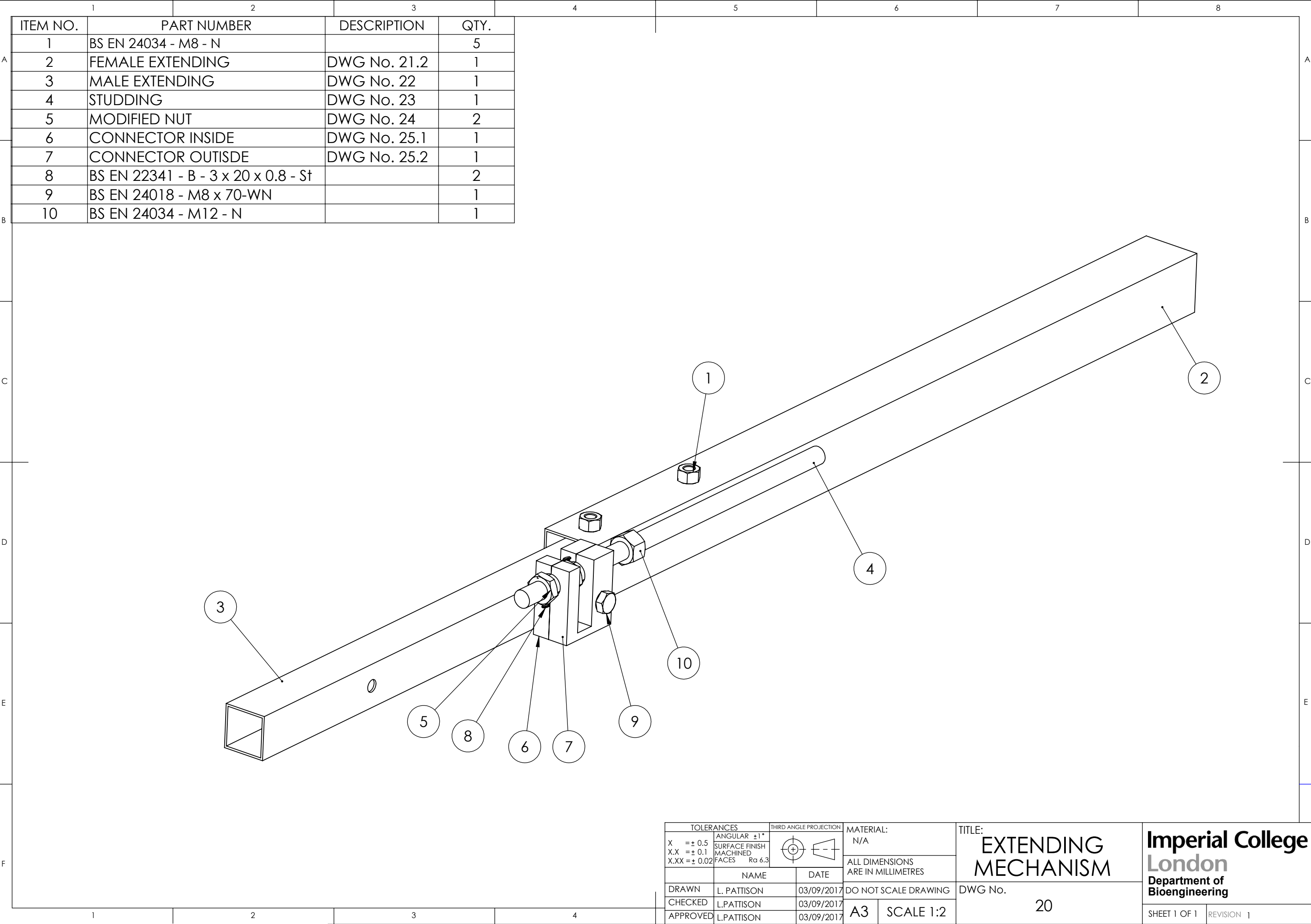


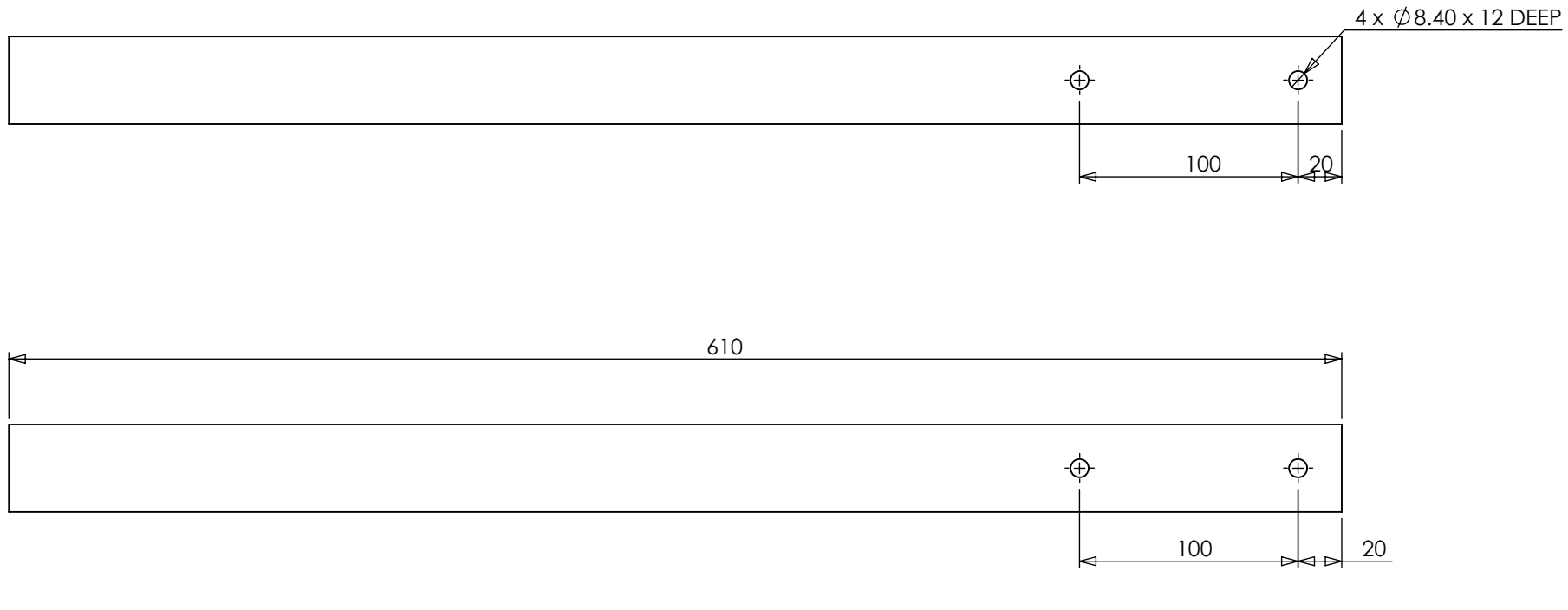
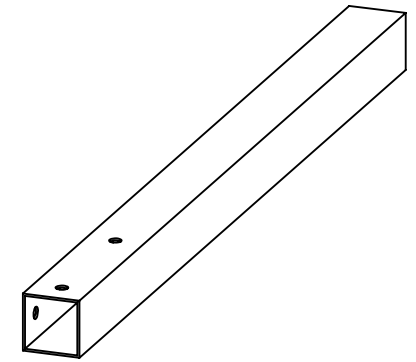
| TOLERANCES |            | THIRD ANGLE PROJECTION |        | MATERIAL:<br>MILD STEEL              |           | TITLE:<br><br>BRACE<br>ASSEMBLY |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|------------|------------------------|--------|--------------------------------------|-----------|---------------------------------|--|---------------------------------------------------------------|--|
| X          | ± 0.5      | ANGULAR                | ± 1°   | ALL DIMENSIONS<br>ARE IN MILLIMETRES |           |                                 |  |                                                               |  |
| X.X        | ± 0.1      | SURFACE FINISH         |        |                                      |           |                                 |  |                                                               |  |
| X.XX       | ± 0.02     | MACHINED<br>FACES      | Ra 6.3 |                                      |           |                                 |  |                                                               |  |
| NAME       |            | DATE                   |        | DO NOT SCALE DRAWING                 |           | DWG No.<br><br>14.0             |  | SHEET 1 OF 1   REVISION 2                                     |  |
| DRAWN      | L.PATTISON | 04/08/2017             |        |                                      |           |                                 |  |                                                               |  |
| CHECKED    | L.PATTISON | 01/09/2017             |        |                                      |           |                                 |  |                                                               |  |
| APPROVED   | L.PATTISON | 01/09/2017             |        |                                      |           |                                 |  |                                                               |  |
|            |            |                        |        | A3                                   | SCALE 1:5 |                                 |  |                                                               |  |



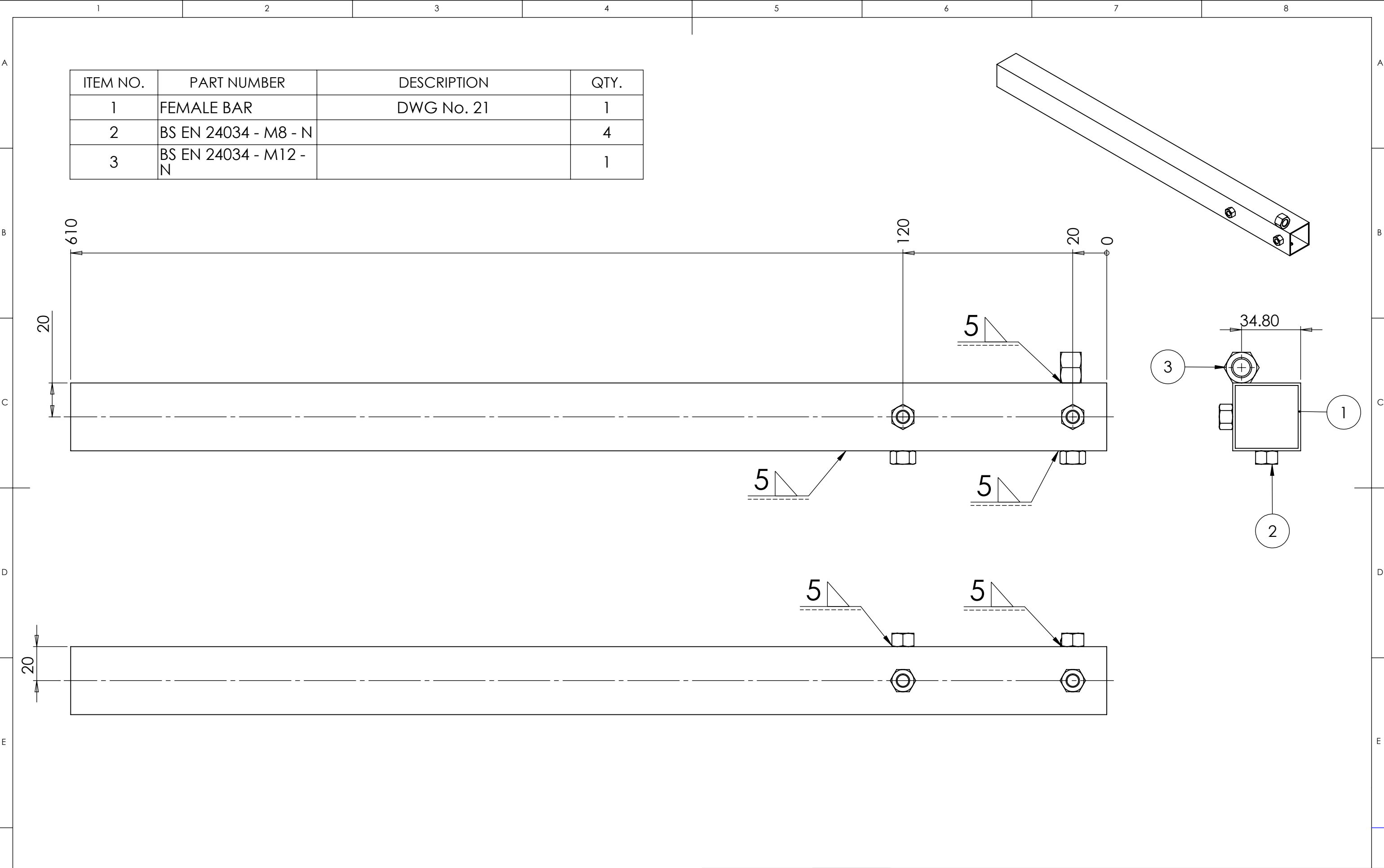


| TOLERANCES |            | THIRD ANGLE PROJECTION     |            | MATERIAL:<br>MILD STEEL              |                      | TITLE:<br><br>BOARD HOOK |                   | Imperial College<br>London<br>Department of<br>Bioengineering |            |  |
|------------|------------|----------------------------|------------|--------------------------------------|----------------------|--------------------------|-------------------|---------------------------------------------------------------|------------|--|
| X          | =± 0.5     | ANGULAR ±1°                |            | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                      |                          |                   |                                                               |            |  |
| X.X        | =± 0.1     | SURFACE FINISH<br>MACHINED |            |                                      |                      |                          |                   |                                                               |            |  |
| X.XX       | =± 0.02    | FACES Ra 6.3               |            |                                      |                      |                          |                   |                                                               |            |  |
|            | NAME       |                            | DATE       |                                      | DO NOT SCALE DRAWING |                          | DWG No.<br><br>15 |                                                               |            |  |
| DRAWN      | L.PATTISON |                            | 01/09/2017 |                                      |                      |                          |                   |                                                               |            |  |
| CHECKED    | L.PATTISON |                            | 01/09/2017 |                                      |                      |                          |                   |                                                               |            |  |
| APPROVED   | L.PATTISON |                            | 01/09/2017 |                                      | A4                   | SCALE 1:1                | SHEET 1 OF 1      |                                                               | REVISION 1 |  |



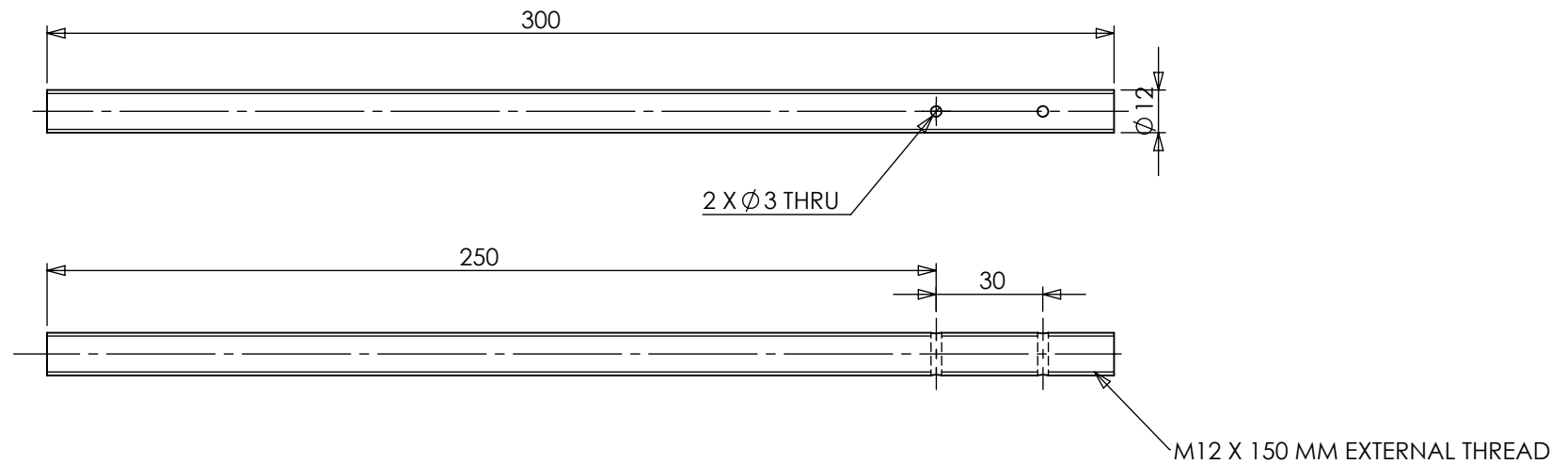
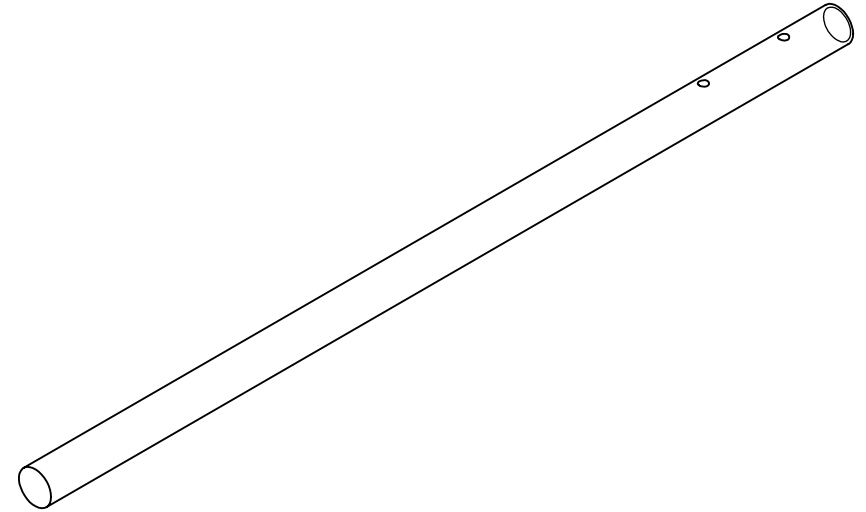


| TOLERANCES |                | THIRD ANGLE PROJECTION     |  | MATERIAL:<br>MILD STEEL |  | TITLE:<br><br>FEMALE<br>EXTENDING    |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------------|----------------------------|--|-------------------------|--|--------------------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5        | ANGULAR ±1°                |  |                         |  |                                      |  |                                                               |  |
| X.X        | = ± 0.1        | SURFACE FINISH<br>MACHINED |  |                         |  |                                      |  |                                                               |  |
| X.XX       | = ± 0.02       | FACES Ra 6.3               |  |                         |  |                                      |  |                                                               |  |
|            |                | NAME                       |  | DATE                    |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                                                               |  |
| DRAWN      | C.MORAND-DUVAL | 02/08/17                   |  | DO NOT SCALE DRAWING    |  | DWG No.<br><br>21.1                  |  |                                                               |  |
| CHECKED    | L.PATTISON     | 01/09/2017                 |  | A4    SCALE 1:3         |  |                                      |  |                                                               |  |
| APPROVED   | L.PATTISON     | 01/09/2017                 |  |                         |  |                                      |  |                                                               |  |
|            |                |                            |  |                         |  | SHEET 1 OF 1                         |  | REVISION 1                                                    |  |



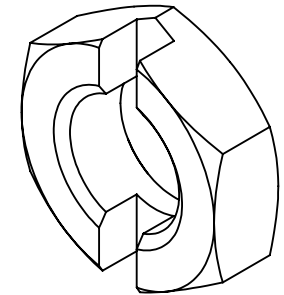
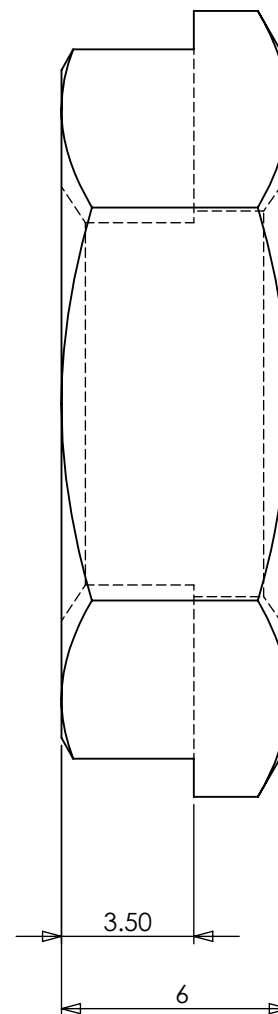
| ITEM NO. | PART NUMBER           | DESCRIPTION | QTY. |
|----------|-----------------------|-------------|------|
| 1        | FEMALE BAR            | DWG No. 21  | 1    |
| 2        | BS EN 24034 - M8 - N  |             | 4    |
| 3        | BS EN 24034 - M12 - N |             | 1    |

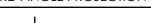
| TOLERANCES   |            | THIRD ANGLE PROJECTION                                                                |            | MATERIAL:<br>ALUMINIUM               |                      | TITLE:<br><br>FEMALE<br>EXTENDING WELD |           | Imperial College<br>London<br>Department of<br>Bioengineering |      |  |
|--------------|------------|---------------------------------------------------------------------------------------|------------|--------------------------------------|----------------------|----------------------------------------|-----------|---------------------------------------------------------------|------|--|
| X            | = ± 0.5    | ANGULAR                                                                               | ± 1°       |                                      |                      |                                        |           |                                                               |      |  |
| X.X          | = ± 0.1    |  |            | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                      |                                        |           |                                                               |      |  |
| X.XX         | = ± 0.02   |                                                                                       |            |                                      |                      | MACHINED<br>FACES                      | Ra 6.3    |                                                               |      |  |
|              |            | NAME                                                                                  |            | DATE                                 |                      |                                        |           |                                                               |      |  |
| DRAWN        | L.PATTISON |                                                                                       | 03/08/2017 |                                      | DO NOT SCALE DRAWING |                                        | DWG No.   |                                                               |      |  |
| CHECKED      | L.PATTISON |                                                                                       | 01/09/2017 |                                      | A3                   |                                        | SCALE 1:2 |                                                               | 21.2 |  |
| APPROVED     | L.PATTISON |                                                                                       | 01/09/2017 |                                      |                      |                                        |           |                                                               |      |  |
| SHEET 1 OF 1 |            |                                                                                       |            | REVISION 2                           |                      |                                        |           |                                                               |      |  |

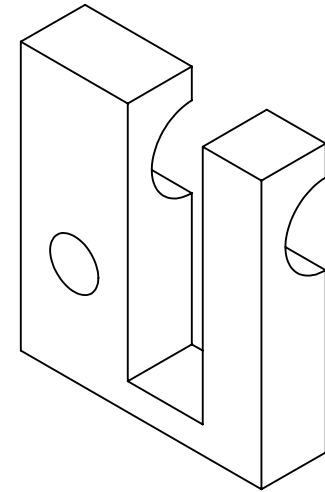
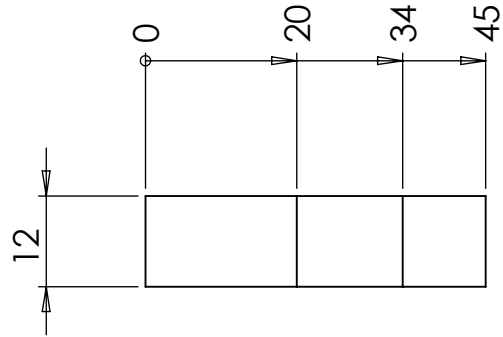
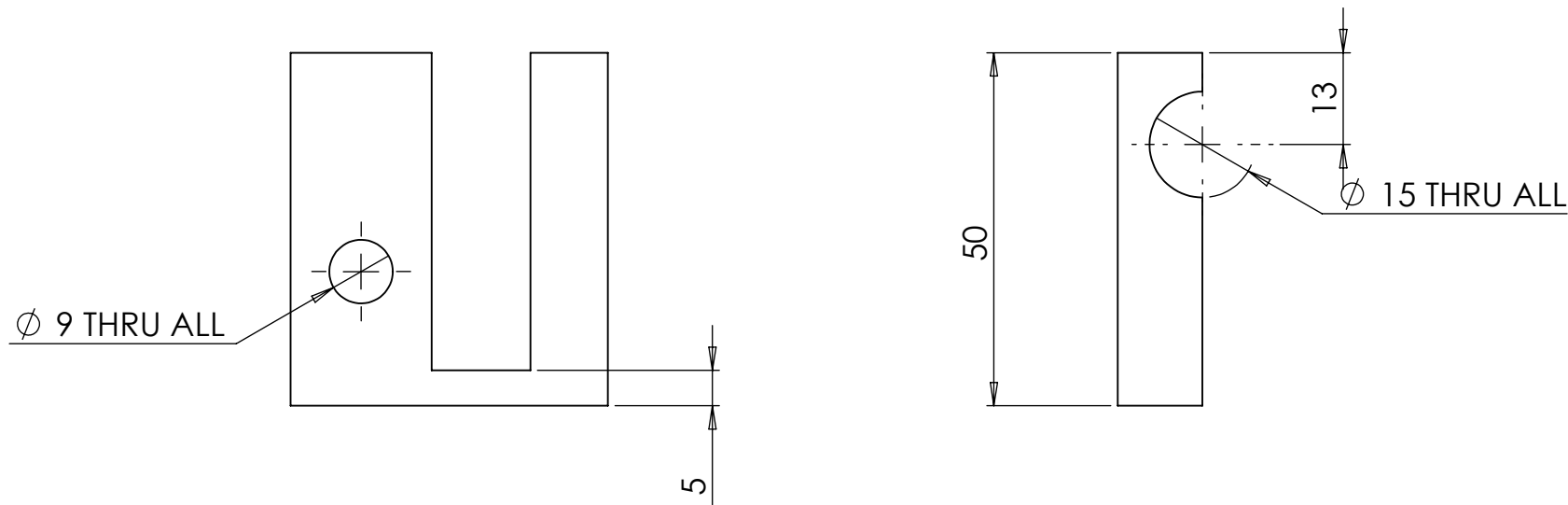


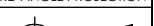
| TOLERANCES |                | THIRD ANGLE PROJECTION                                                               |     | MATERIAL:                            |  | TITLE:               |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------------|--------------------------------------------------------------------------------------|-----|--------------------------------------|--|----------------------|--|---------------------------------------------------------------|--|
| X          | =± 0.5         | ANGULAR                                                                              | ±1° | MILD STEEL STUDDING                  |  |                      |  |                                                               |  |
| X.X        | =± 0.1         |  |     |                                      |  |                      |  |                                                               |  |
| X.XX       | =± 0.02        |                                                                                      |     |                                      |  |                      |  |                                                               |  |
|            |                | SURFACE FINISH<br>MACHINED<br>FACES Ra 6.3                                           |     | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                      |  |                                                               |  |
|            |                | NAME                                                                                 |     | DATE                                 |  | DO NOT SCALE DRAWING |  | DWG No.                                                       |  |
| DRAWN      | C.MORAND-DUVAL | 02/08/2017                                                                           |     | DO NOT SCALE DRAWING                 |  | 23                   |  | SHEET 1 OF 1                                                  |  |
| CHECKED    | L.PATTISON     | 01/09/2017                                                                           |     | A4                                   |  | SCALE 1:2            |  | REVISION 0                                                    |  |
| APPROVED   | L.PATTISON     | 01/09/2017                                                                           |     |                                      |  |                      |  |                                                               |  |

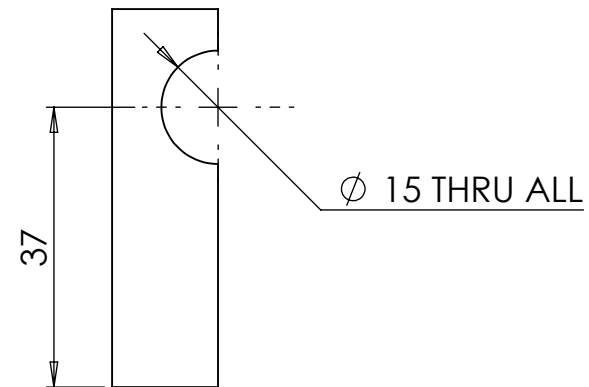
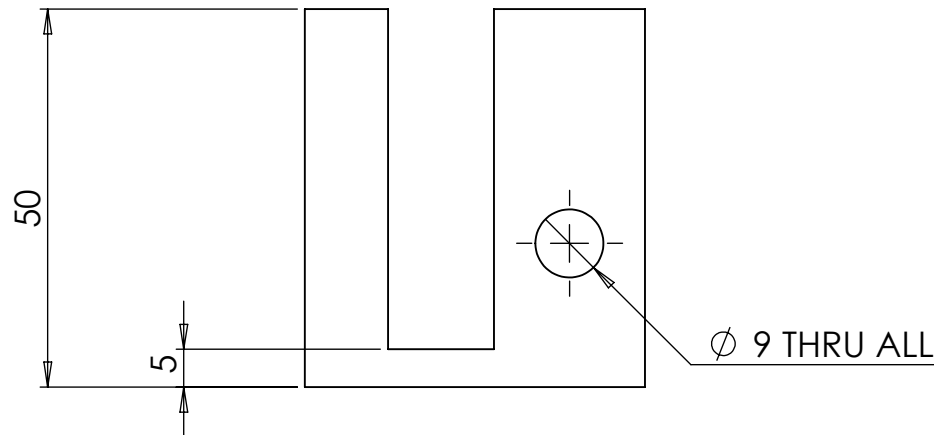
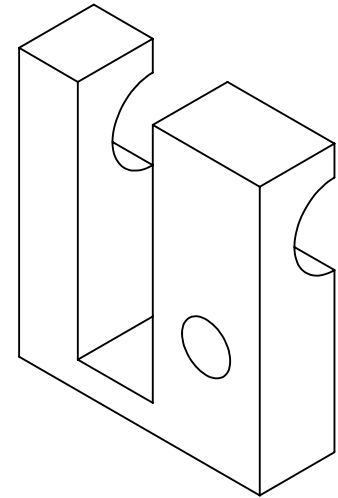
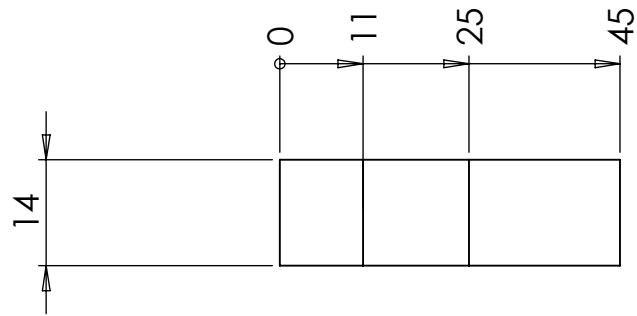




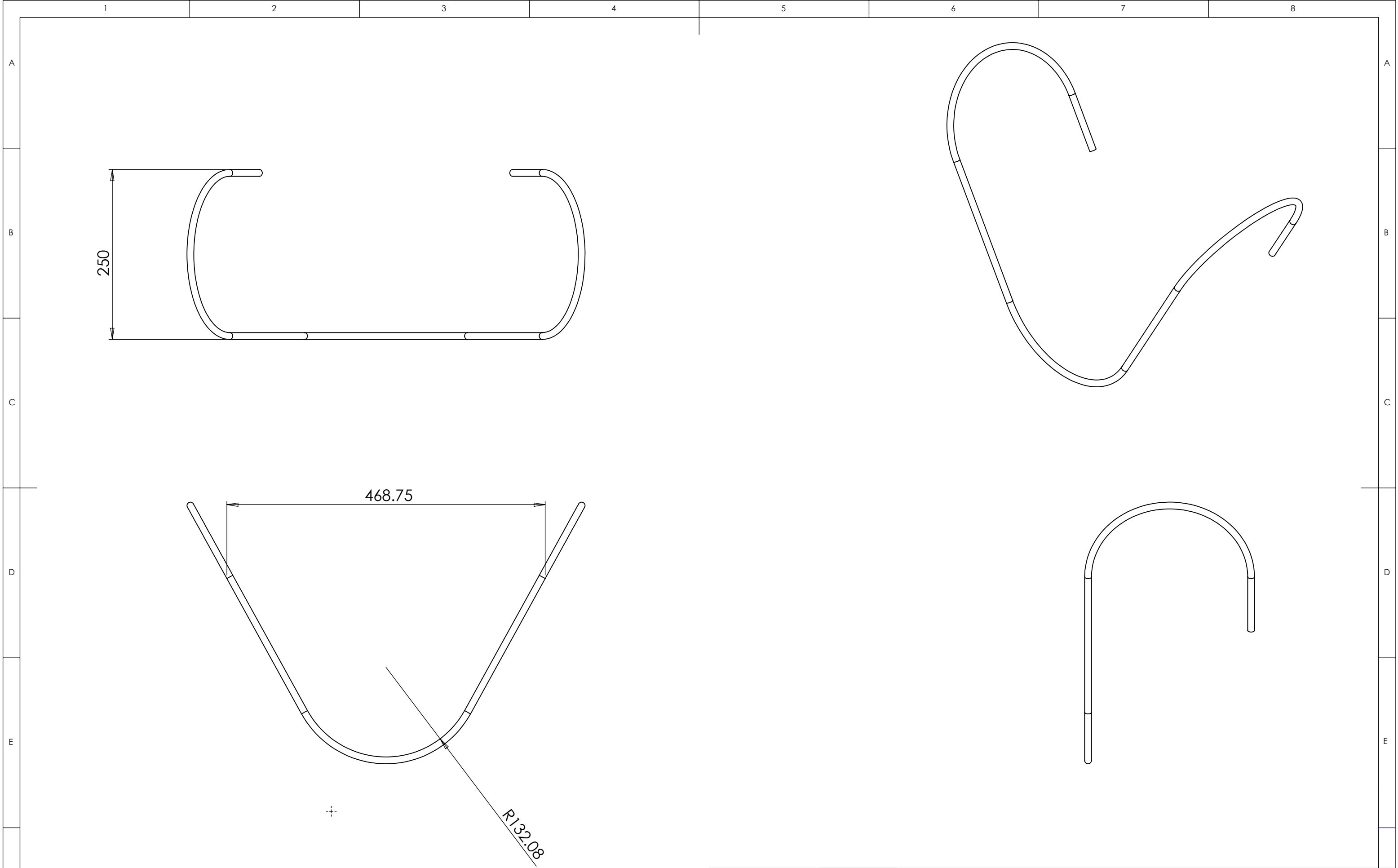
| TOLERANCES    |                              | THIRD ANGLE PROJECTION                                                               |  | MATERIAL:<br>M12 STEEL NUT |  | TITLE:<br><br>MODIFIED NUT           |  | <div>Imperial College<br/>London<br/>Department of<br/>Bioengineering</div> |  |
|---------------|------------------------------|--------------------------------------------------------------------------------------|--|----------------------------|--|--------------------------------------|--|-----------------------------------------------------------------------------|--|
| X     = ± 0.5 | ANGULAR   ±1°                |  |  |                            |  |                                      |  |                                                                             |  |
| X.X   = ± 0.1 | SURFACE FINISH               |                                                                                      |  |                            |  |                                      |  |                                                                             |  |
| X.XX = ± 0.02 | MACHINED<br>FACES     Ra 6.3 |                                                                                      |  |                            |  |                                      |  |                                                                             |  |
|               |                              | NAME                                                                                 |  | DATE                       |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                                                                             |  |
| DRAWN         | C.MORAND-DUVAL               | 07/08/2017                                                                           |  | DO NOT SCALE DRAWING       |  | DWG No.                              |  |                                                                             |  |
| CHECKED       | L.PATTISON                   | 01/08/2017                                                                           |  | A4                         |  | SCALE 5:1                            |  |                                                                             |  |
| APPROVED      | L.PATTISON                   | 01/08/2017                                                                           |  |                            |  |                                      |  |                                                                             |  |
|               |                              |                                                                                      |  |                            |  |                                      |  | SHEET 1 OF 1                                                                |  |
|               |                              |                                                                                      |  |                            |  |                                      |  | REVISION   1                                                                |  |



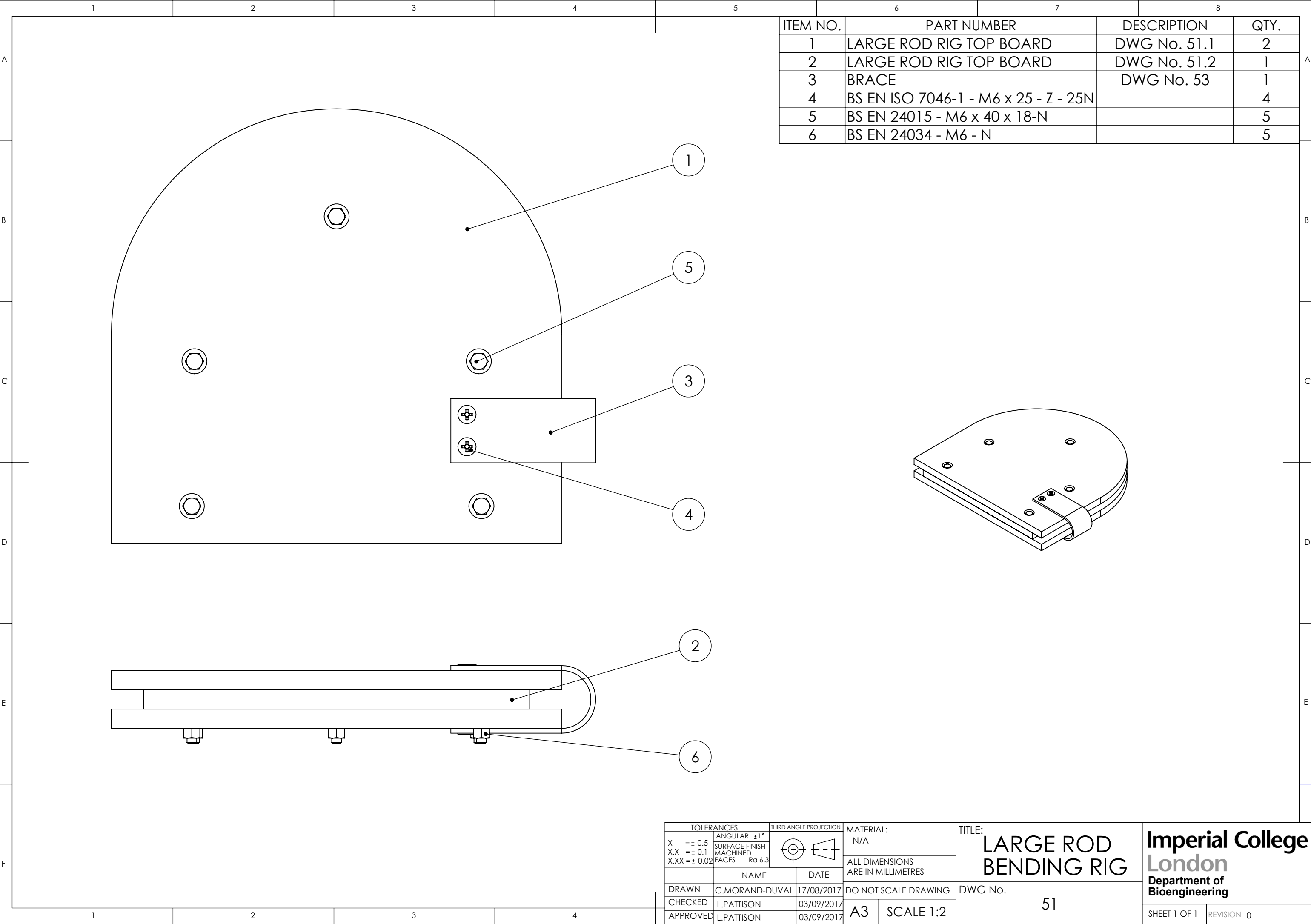
| TOLERANCES    |                            | THIRD ANGLE PROJECTION                                                               |  | MATERIAL:<br>PLYWOOD                 |                  | TITLE:<br><div>CONNECTOR<br/>INSIDE</div> |                               | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|---------------|----------------------------|--------------------------------------------------------------------------------------|--|--------------------------------------|------------------|-------------------------------------------|-------------------------------|---------------------------------------------------------------|--|
| X     = ± 0.5 | ANGULAR   ± 1°             |  |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                  |                                           |                               |                                                               |  |
| X.X   = ± 0.1 | SURFACE FINISH<br>MACHINED |                                                                                      |  | DO NOT SCALE DRAWING                 |                  | DWG No.<br><br>25.1                       |                               |                                                               |  |
| X.XX = ± 0.02 | FACES     Ra 6.3           |                                                                                      |  |                                      |                  |                                           |                               |                                                               |  |
|               | NAME                       | DATE                                                                                 |  |                                      | A4     SCALE 1:1 |                                           | SHEET 1 OF 1     REVISION   1 |                                                               |  |
| DRAWN         | L.PATTISON                 | 01/09/2017                                                                           |  |                                      |                  |                                           |                               |                                                               |  |
| CHECKED       | L.PATTISON                 | 01/09/2017                                                                           |  |                                      |                  |                                           |                               |                                                               |  |
| APPROVED      | L.PATTISON                 | 01/09/2017                                                                           |  |                                      |                  |                                           |                               |                                                               |  |



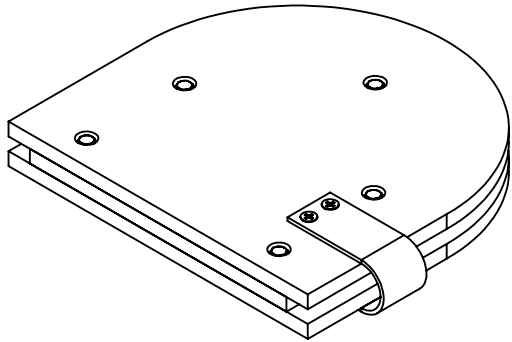
| TOLERANCES |          |                            | THIRD ANGLE PROJECTION |                                                                                      | MATERIAL:<br>PLYWOOD |  | TITLE:<br>CONNECTOR<br>OUTSIDE       |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------|----------------------------|------------------------|--------------------------------------------------------------------------------------|----------------------|--|--------------------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5  | ANGULAR                    | ± 1°                   |  |                      |  |                                      |  |                                                               |  |
| X.X        | = ± 0.1  | SURFACE FINISH<br>MACHINED |                        |                                                                                      |                      |  |                                      |  |                                                               |  |
| X.XX       | = ± 0.02 | FACES Ra 6.3               |                        |                                                                                      |                      |  |                                      |  |                                                               |  |
|            |          |                            | NAME                   |                                                                                      | DATE                 |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                                                               |  |
| DRAWN      |          |                            | L.PATTISON             |                                                                                      | 01/09/2017           |  | DO NOT SCALE DRAWING                 |  | DWG No.<br>25.2                                               |  |
| CHECKED    |          |                            | L.PATTISON             |                                                                                      | 01/09/2017           |  | A4                                   |  | SCALE 1:1                                                     |  |
| APPROVED   |          |                            | L.PATTISON             |                                                                                      | 01/09/2017           |  |                                      |  |                                                               |  |
|            |          |                            |                        |                                                                                      |                      |  |                                      |  | SHEET 1 OF 1                                                  |  |
|            |          |                            |                        |                                                                                      |                      |  |                                      |  | REVISION 1                                                    |  |

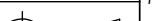


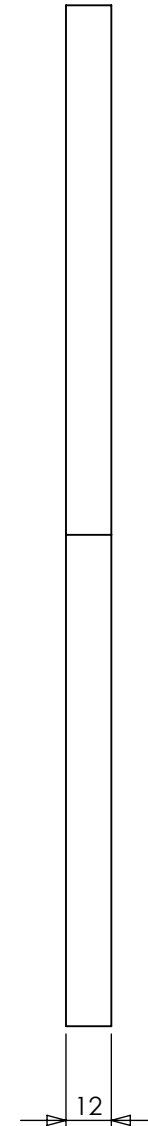
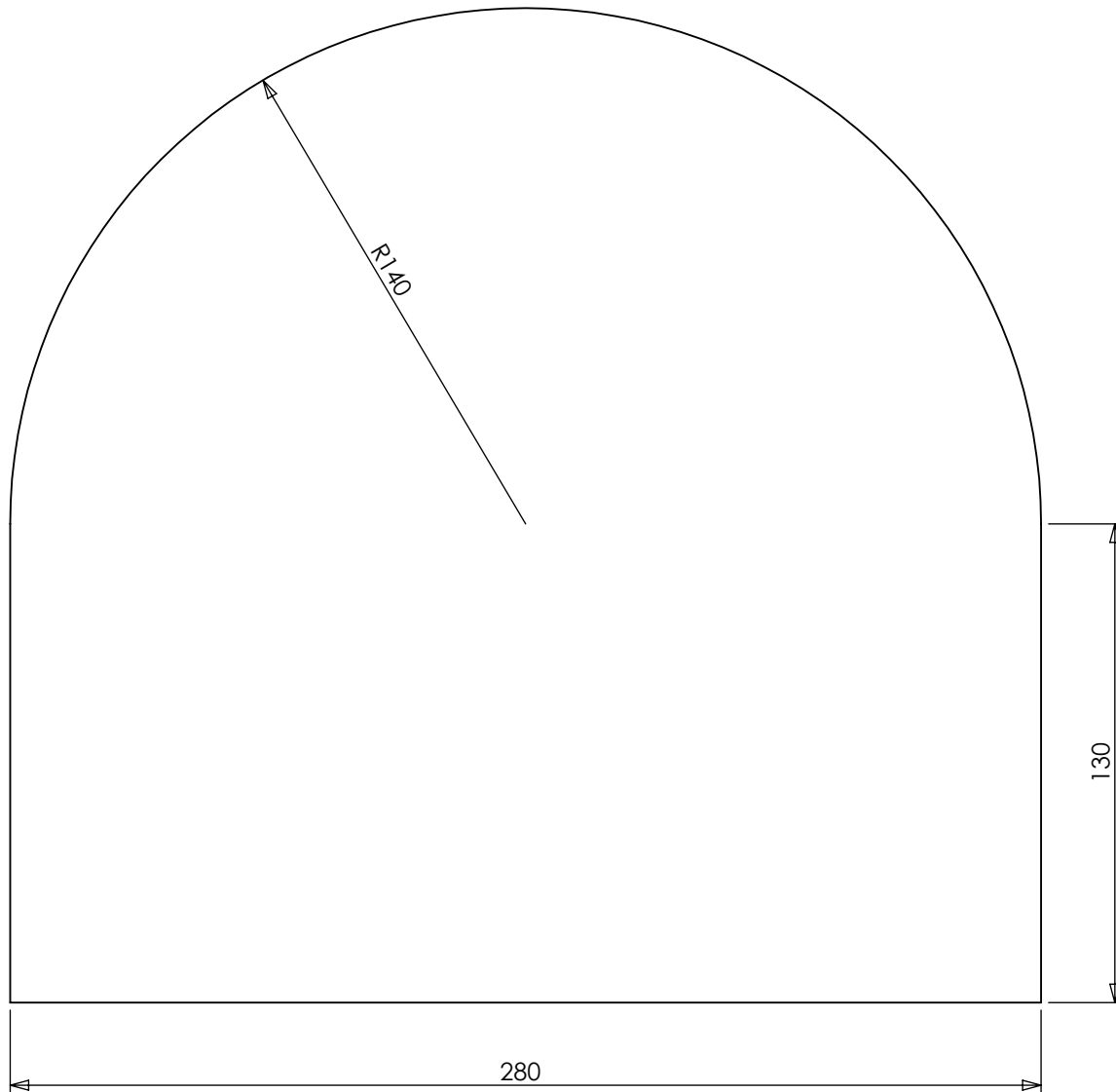
| TOLERANCES |            | THIRD ANGLE PROJECTION   |            | MATERIAL:<br>ALUMINIUM               |           | TITLE:<br><br>WHEEL HOOK |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|------------|--------------------------|------------|--------------------------------------|-----------|--------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5    | ANGULAR                  | ± 1°       |                                      |           |                          |  |                                                               |  |
| X.X        | = ± 0.1    | SURFACE FINISH           |            |                                      |           |                          |  |                                                               |  |
| X.XX       | = ± 0.02   | MACHINED<br>FACES Ra 6.3 |            |                                      |           |                          |  |                                                               |  |
|            |            | NAME                     | DATE       | ALL DIMENSIONS<br>ARE IN MILLIMETRES |           | DWG No.<br><br>31        |  | SHEET 1 OF 1   REVISION 1                                     |  |
| DRAWN      | L.PATTISON |                          | 03/08/2017 | DO NOT SCALE DRAWING                 |           |                          |  |                                                               |  |
| CHECKED    | L.PATTISON |                          | 01/08/2017 |                                      |           |                          |  |                                                               |  |
| APPROVED   | L.PATTISON |                          | 01/08/2017 | A3                                   | SCALE 1:5 |                          |  |                                                               |  |

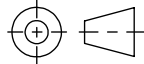


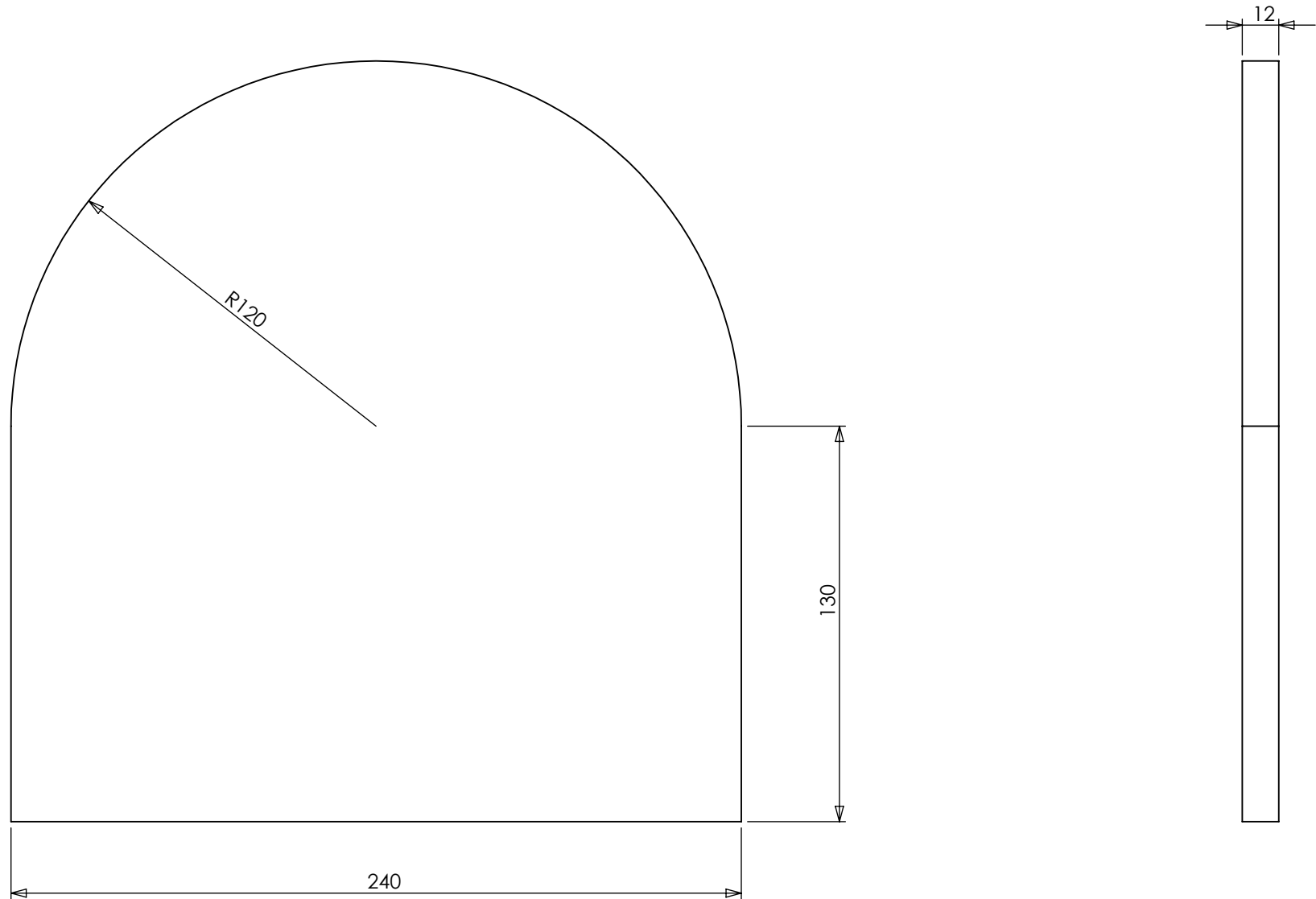
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|----------|--------------------------------------|--------------|------|
| 1        | LARGE ROD RIG TOP BOARD              | DWG No. 51.1 | 2    |
| 2        | LARGE ROD RIG TOP BOARD              | DWG No. 51.2 | 1    |
| 3        | BRACE                                | DWG No. 53   | 1    |
| 4        | BS EN ISO 7046-1 - M6 x 25 - Z - 25N |              | 4    |
| 5        | BS EN 24015 - M6 x 40 x 18-N         |              | 5    |
| 6        | BS EN 24034 - M6 - N                 |              | 5    |

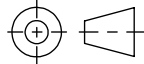


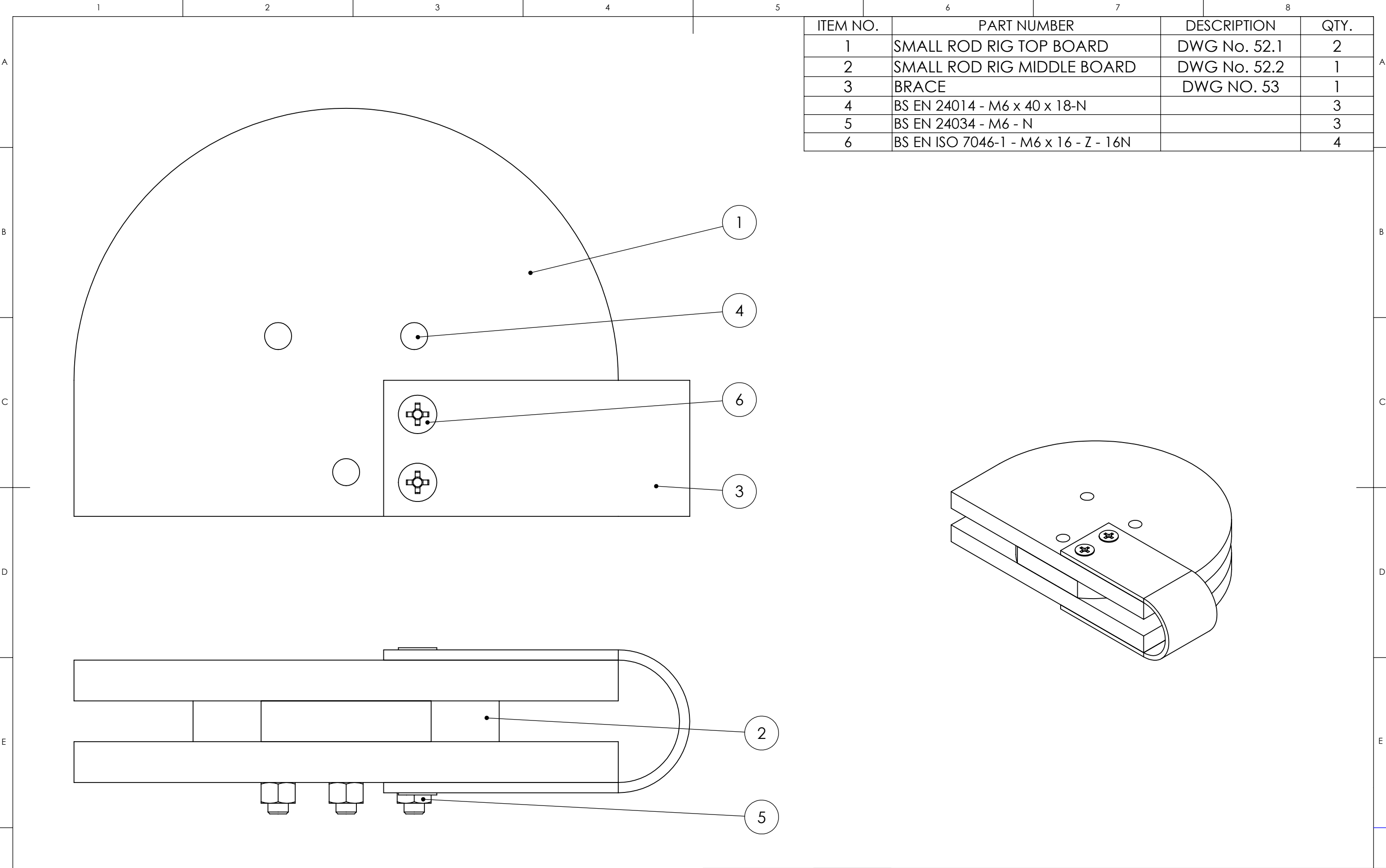
| TOLERANCES   |                | THIRD ANGLE PROJECTION                                                                |  | MATERIAL:<br>N/A                     |  | TITLE:<br><br>LARGE ROD<br>BENDING RIG |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|--------------|----------------|---------------------------------------------------------------------------------------|--|--------------------------------------|--|----------------------------------------|--|---------------------------------------------------------------|--|
| X            | = ± 0.5        | ANGULAR ±1°                                                                           |  |                                      |  |                                        |  |                                                               |  |
| X.X          | = ± 0.1        |  |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                                        |  |                                                               |  |
| X.XX         | = ± 0.02       |                                                                                       |  |                                      |  |                                        |  |                                                               |  |
|              |                | NAME                                                                                  |  | DATE                                 |  |                                        |  |                                                               |  |
| DRAWN        | C.MORAND-DUVAL | 17/08/2017                                                                            |  | DO NOT SCALE DRAWING                 |  | DWG No.<br><br>51                      |  |                                                               |  |
| CHECKED      | L.PATTISON     | 03/09/2017                                                                            |  | A3                                   |  |                                        |  |                                                               |  |
| APPROVED     | L.PATTISON     | 03/09/2017                                                                            |  | SCALE 1:2                            |  |                                        |  |                                                               |  |
| SHEET 1 OF 1 |                | REVISION                                                                              |  | 0                                    |  |                                        |  |                                                               |  |



| TOLERANCES |          | THIRD ANGLE PROJECTION   |  | MATERIAL:<br>PLYWOOD                                                                 |  | TITLE:<br>LARGE ROD RIG<br>TOP BOARD |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------|--------------------------|--|--------------------------------------------------------------------------------------|--|--------------------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5  | ANGULAR ±1°              |  |  |  |                                      |  |                                                               |  |
| X.X        | = ± 0.1  | SURFACE FINISH           |  |                                                                                      |  |                                      |  |                                                               |  |
| X.XX       | = ± 0.02 | MACHINED<br>FACES Ra 6.3 |  |                                                                                      |  |                                      |  |                                                               |  |
|            |          | NAME                     |  | DATE                                                                                 |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                                                               |  |
| DRAWN      |          | C.MORAND-DUVAL           |  | 17/08/2017                                                                           |  | DO NOT SCALE DRAWING                 |  | DWG No.                                                       |  |
| CHECKED    |          | L.PATTISON               |  | 03/09/2017                                                                           |  | A4    SCALE 1:2                      |  | 51.1                                                          |  |
| APPROVED   |          | L.PATTISON               |  | 03/09/2017                                                                           |  |                                      |  | SHEET 1 OF 1    REVISION 0                                    |  |

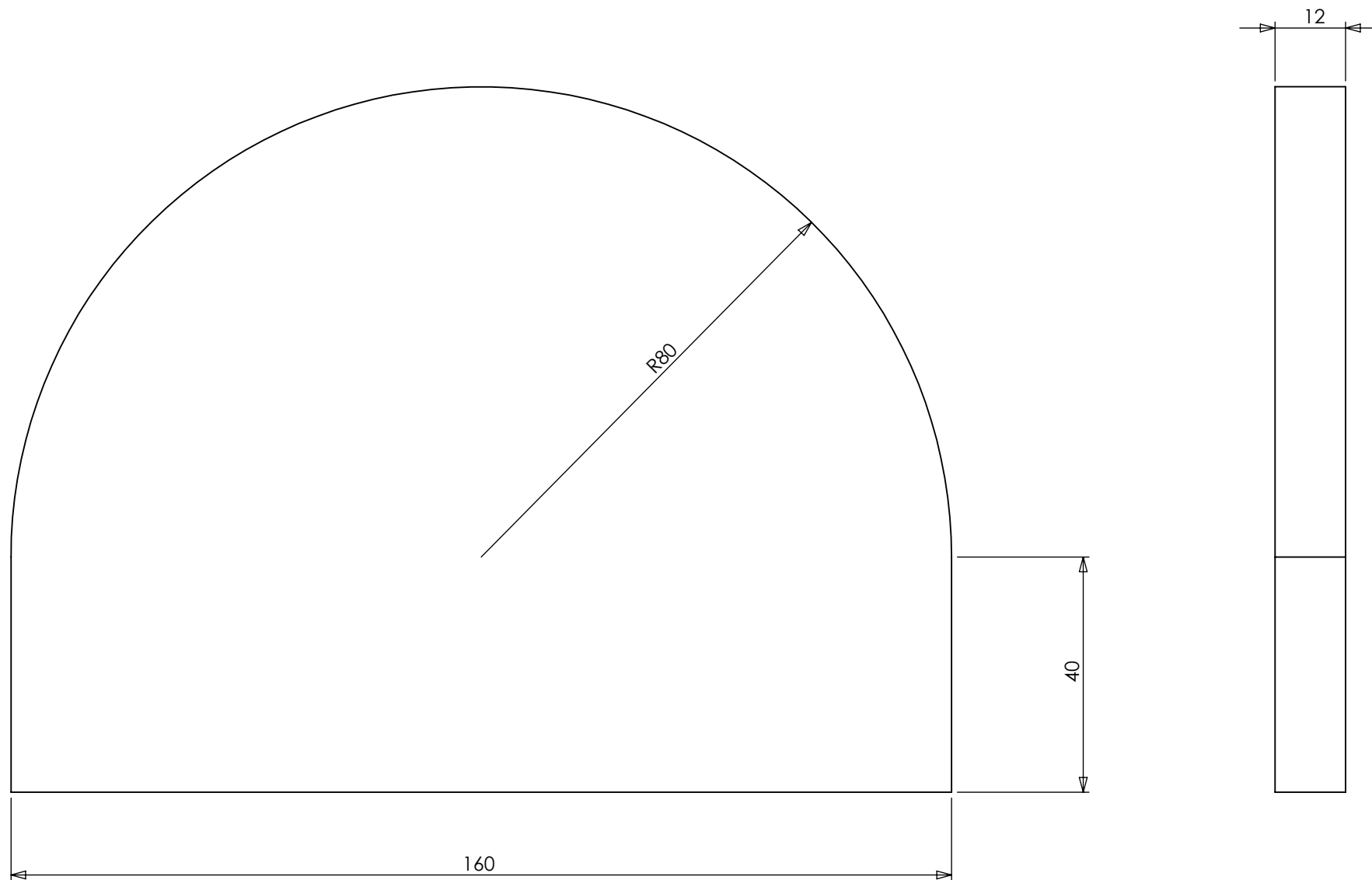


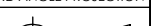
| TOLERANCES |                | THIRD ANGLE PROJECTION   |            | MATERIAL:<br>PLYWOOD                                                                 |           | TITLE:<br>LARGE ROD RIG<br>MIDDLE BOARD |  | <div>Imperial College<br/>London<br/>Department of<br/>Bioengineering</div> |  |                     |  |
|------------|----------------|--------------------------|------------|--------------------------------------------------------------------------------------|-----------|-----------------------------------------|--|-----------------------------------------------------------------------------|--|---------------------|--|
| X          | = ± 0.5        | ANGULAR                  | ± 1°       |  |           | ALL DIMENSIONS<br>ARE IN MILLIMETRES    |  |                                                                             |  | DWG No.<br><br>51.2 |  |
| X.X        | = ± 0.1        | SURFACE FINISH           |            |                                                                                      |           |                                         |  |                                                                             |  |                     |  |
| X.XX       | = ± 0.02       | MACHINED<br>FACES Ra 6.3 |            |                                                                                      |           |                                         |  |                                                                             |  |                     |  |
|            | NAME           |                          | DATE       | DO NOT SCALE DRAWING                                                                 |           |                                         |  |                                                                             |  |                     |  |
| DRAWN      | C.MORAND-DUVAL |                          | 17/08/2017 |                                                                                      |           |                                         |  |                                                                             |  |                     |  |
| CHECKED    | L.PATTISON     |                          | 03/09/2017 |                                                                                      |           |                                         |  |                                                                             |  |                     |  |
| APPROVED   | L.PATTISON     |                          | 03/09/2017 | A4                                                                                   | SCALE 1:2 |                                         |  | SHEET 1 OF 1    REVISION 0                                                  |  |                     |  |

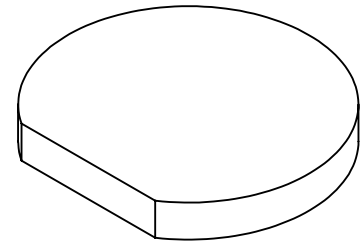
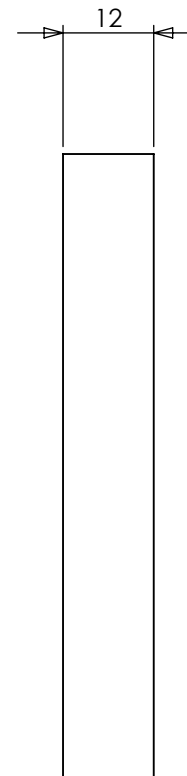
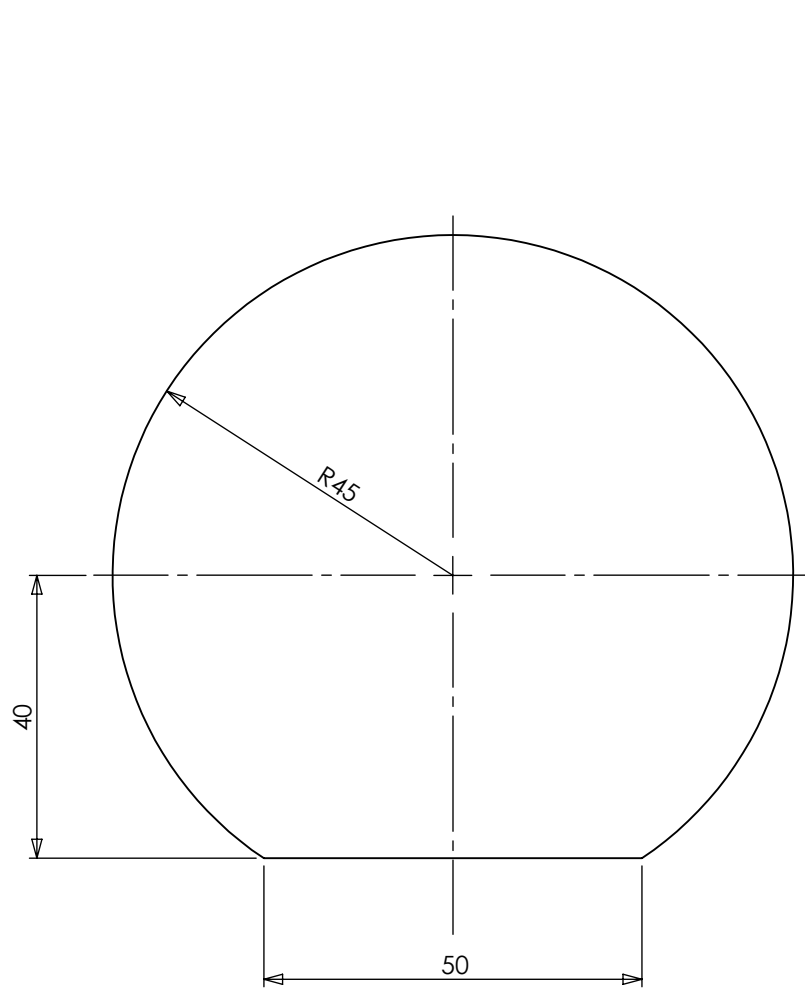


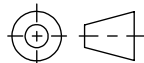
|          |  |                |  |                 |                             |                                                                                       |                                      |           |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
|----------|--|----------------|--|-----------------|-----------------------------|---------------------------------------------------------------------------------------|--------------------------------------|-----------|--|----------------------------------------|--|---------------------------------------------------------------|--|-------------------|--|--|--|--|--|
|          |  |                |  | TOLERANCES      |                             | THIRD ANGLE PROJECTION                                                                |                                      | MATERIAL: |  | TITLE:<br><br>SMALL ROD<br>BENDING RIG |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |                   |  |  |  |  |  |
|          |  |                |  | X    = ± 0.5    | ANGULAR   ±1°               |  | N/A                                  |           |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
|          |  |                |  | X.X   = ± 0.1   | SURFACE FINISH              |                                                                                       | ALL DIMENSIONS<br>ARE IN MILLIMETRES |           |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
|          |  |                |  | X.XX   = ± 0.02 | MACHINED<br>FACES    Ra 6.3 |                                                                                       |                                      |           |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
|          |  |                |  |                 |                             | NAME                                                                                  |                                      | DATE      |  | DO NOT SCALE DRAWING                   |  |                                                               |  | DWG No.<br><br>52 |  |  |  |  |  |
| DRAWN    |  | C.MORAND-DUVAL |  | 17/08/2017      |                             |                                                                                       |                                      |           |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
| CHECKED  |  | L.PATTISON     |  | 03/09/2017      |                             | A3                                                                                    |                                      | SCALE 1:1 |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
| APPROVED |  | L.PATTISON     |  | 03/09/2017      |                             |                                                                                       |                                      |           |  |                                        |  |                                                               |  |                   |  |  |  |  |  |
| 1        |  |                |  | 2               |                             |                                                                                       |                                      | 3         |  |                                        |  | 4                                                             |  |                   |  |  |  |  |  |

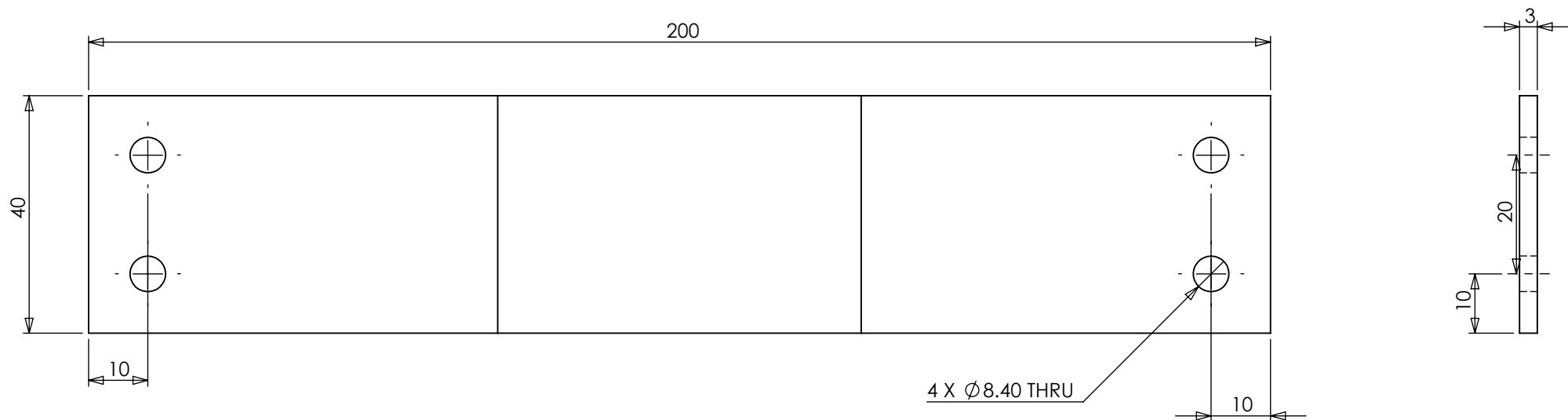


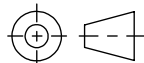


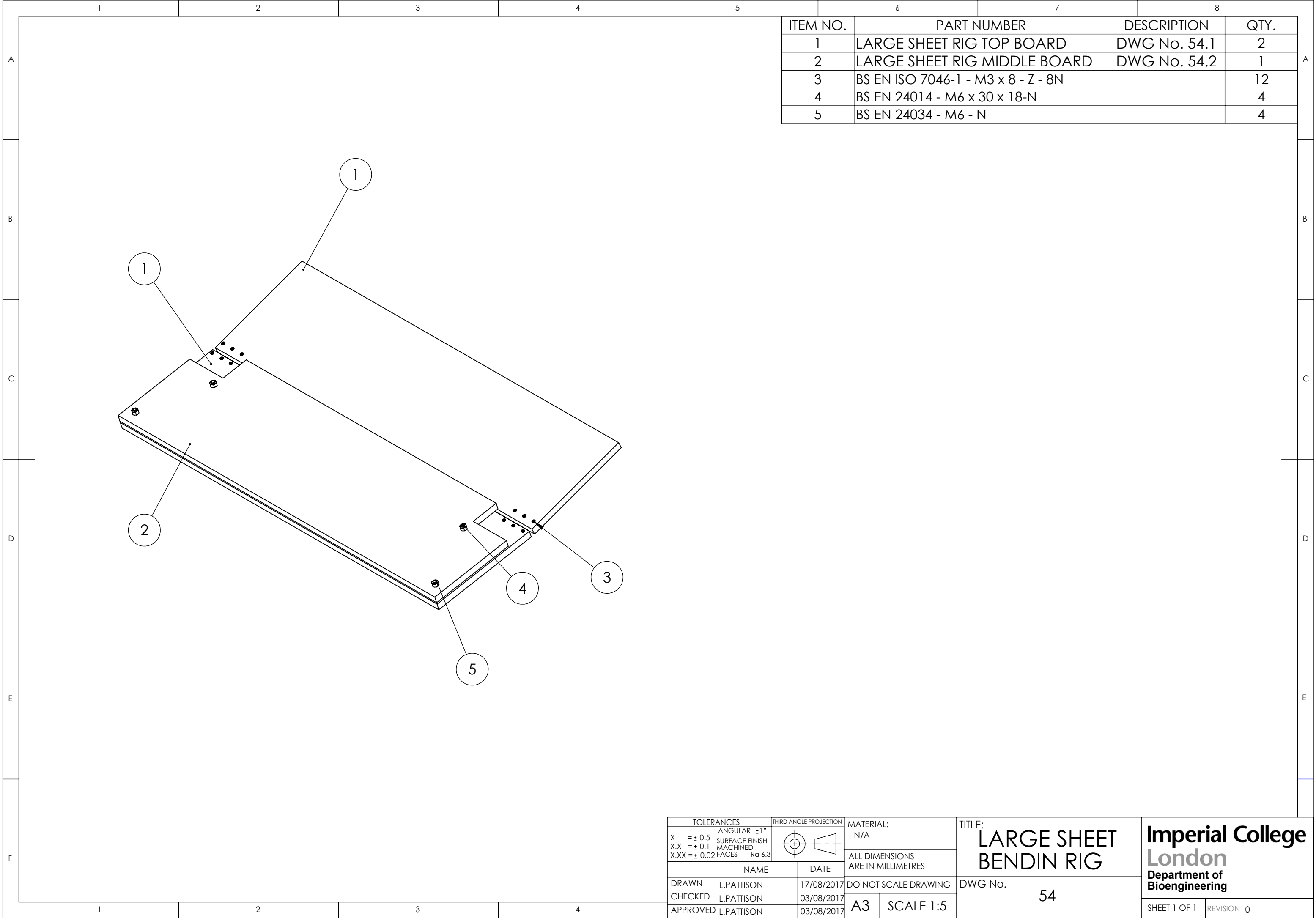
| TOLERANCES    |                            | THIRD ANGLE PROJECTION                                                               |  | MATERIAL:<br>PLYWOOD                 |                 | TITLE:<br>SMALL ROD RIG<br>TOP BOARD |                              | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|---------------|----------------------------|--------------------------------------------------------------------------------------|--|--------------------------------------|-----------------|--------------------------------------|------------------------------|---------------------------------------------------------------|--|
| X    = ± 0.5  | ANGULAR   ± 1°             |  |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                 |                                      |                              |                                                               |  |
| X.X   = ± 0.1 | SURFACE FINISH<br>MACHINED |                                                                                      |  | DO NOT SCALE DRAWING                 |                 | DWG No.<br><br>52.1                  |                              |                                                               |  |
| X.XX = ± 0.02 | FACES    Ra 6.3            |                                                                                      |  |                                      |                 |                                      |                              |                                                               |  |
|               | NAME                       | DATE                                                                                 |  |                                      | A4    SCALE 1:1 |                                      | SHEET 1 OF 1    REVISION   0 |                                                               |  |
| DRAWN         | C.MORAND-DUVAL             | 17/08/2017                                                                           |  |                                      |                 |                                      |                              |                                                               |  |
| CHECKED       | L.PATTISON                 | 03/09/2017                                                                           |  |                                      |                 |                                      |                              |                                                               |  |
| APPROVED      | L.PATTISON                 | 03/09/2017                                                                           |  |                                      |                 |                                      |                              |                                                               |  |



| TOLERANCES |                | THIRD ANGLE PROJECTION                                                               |  | MATERIAL:<br>PLYWOOD |  | TITLE:<br>SMALL ROD RIG<br>MIDDLE BOARD |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------------|--------------------------------------------------------------------------------------|--|----------------------|--|-----------------------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5        | ANGULAR ±1°                                                                          |  |                      |  |                                         |  |                                                               |  |
| X.X        | = ± 0.1        |  |  |                      |  |                                         |  |                                                               |  |
| X.XX       | = ± 0.02       |                                                                                      |  |                      |  |                                         |  |                                                               |  |
|            |                | NAME                                                                                 |  | DATE                 |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES    |  |                                                               |  |
| DRAWN      | C.MORAND-DUVAL | 17/08/2017                                                                           |  | DO NOT SCALE DRAWING |  | DWG No.                                 |  |                                                               |  |
| CHECKED    | L.PATTISON     | 03/09/2017                                                                           |  | A4                   |  | SCALE 1:1                               |  | 52.2                                                          |  |
| APPROVED   | L.PATTISON     | 03/09/2017                                                                           |  |                      |  |                                         |  | SHEET 1 OF 1                                                  |  |
|            |                |                                                                                      |  |                      |  |                                         |  | REVISION 0                                                    |  |

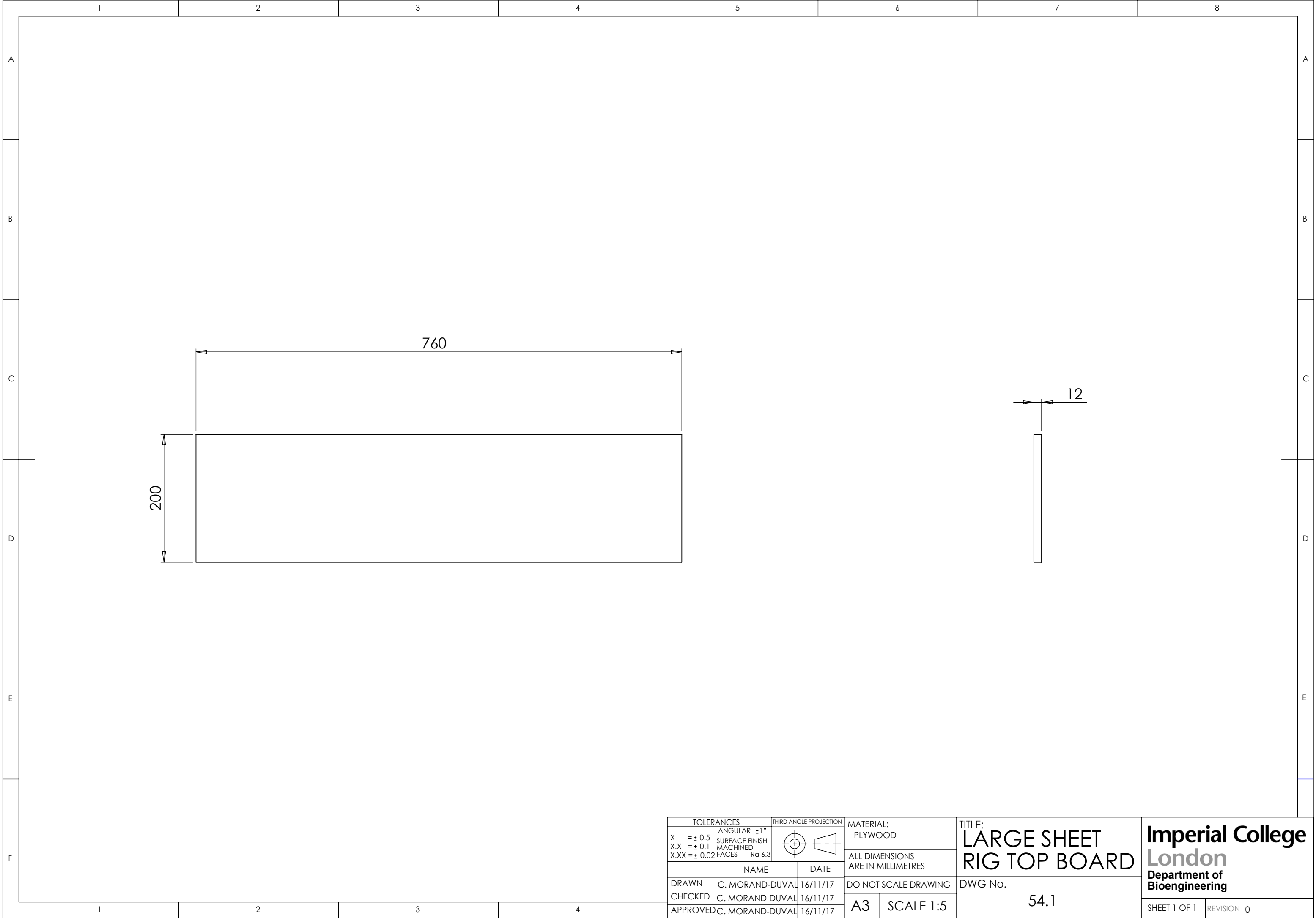


| TOLERANCES |          | THIRD ANGLE PROJECTION                                                               |  | MATERIAL:                            |  | TITLE:                                     |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------|--------------------------------------------------------------------------------------|--|--------------------------------------|--|--------------------------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5  | ANGULAR ±1°                                                                          |  | STAINLESS STEEL                      |  |                                            |  |                                                               |  |
| X.X        | = ± 0.1  |  |  | ALL DIMENSIONS<br>ARE IN MILLIMETRES |  |                                            |  |                                                               |  |
| X.XX       | = ± 0.02 |                                                                                      |  |                                      |  | SURFACE FINISH<br>MACHINED<br>FACES Ra 6.3 |  |                                                               |  |
|            |          | NAME                                                                                 |  | DATE                                 |  | DO NOT SCALE DRAWING                       |  |                                                               |  |
| DRAWN      |          | C.MORAND-DUVAL                                                                       |  | 17/08/2017                           |  |                                            |  |                                                               |  |
| CHECKED    |          | L.PATTISON                                                                           |  | 03/09/2017                           |  | A4                                         |  | SCALE 1:1                                                     |  |
| APPROVED   |          | L.PATTISON                                                                           |  | 03/09/2017                           |  |                                            |  |                                                               |  |
|            |          |                                                                                      |  |                                      |  |                                            |  | SHEET 1 OF 1                                                  |  |
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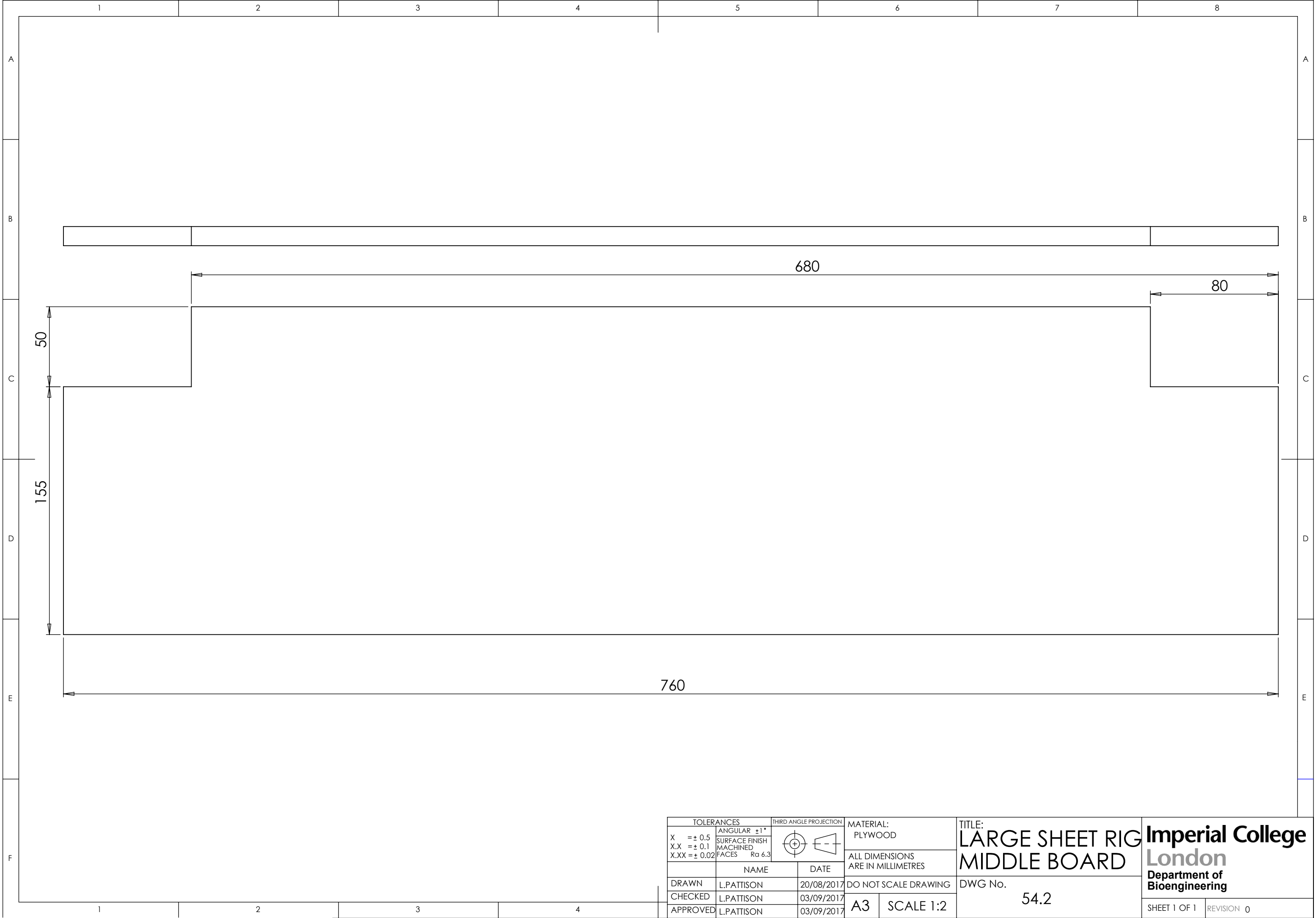


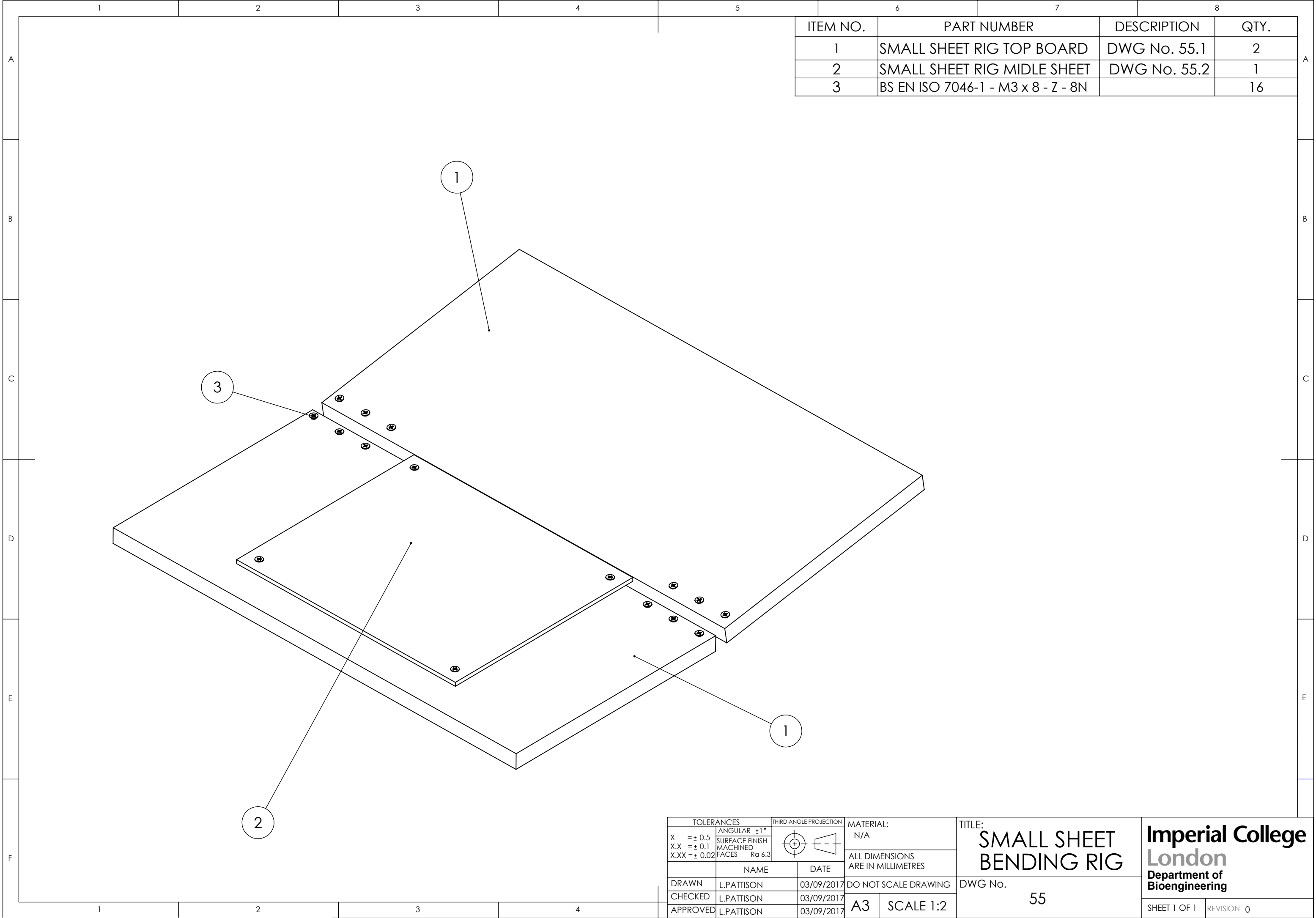
| ITEM NO. | PART NUMBER                        | DESCRIPTION  | QTY. |
|----------|------------------------------------|--------------|------|
| 1        | LARGE SHEET RIG TOP BOARD          | DWG No. 54.1 | 2    |
| 2        | LARGE SHEET RIG MIDDLE BOARD       | DWG No. 54.2 | 1    |
| 3        | BS EN ISO 7046-1 - M3 x 8 - Z - 8N |              | 12   |
| 4        | BS EN 24014 - M6 x 30 x 18-N       |              | 4    |
| 5        | BS EN 24034 - M6 - N               |              | 4    |

| TOLERANCES |            | THIRD ANGLE PROJECTION                                                                |            | MATERIAL:<br>N/A                     |                      | TITLE:<br>LARGE SHEET<br>BENDIN RIG |           | Imperial College<br>London<br>Department of<br>Bioengineering |    |  |
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| X          | ± 0.5      | ANGULAR                                                                               | ± 1°       |                                      |                      |                                     |           |                                                               |    |  |
| X.X        | ± 0.1      | SURFACE FINISH<br>MACHINED<br>FACES<br>Ra 6.3                                         |            |                                      |                      |                                     |           |                                                               |    |  |
| X.XX       | ± 0.02     |                                                                                       |            |                                      |                      |                                     |           |                                                               |    |  |
|            |            |  |            | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                      |                                     |           |                                                               |    |  |
|            |            | NAME                                                                                  |            | DATE                                 |                      |                                     |           |                                                               |    |  |
| DRAWN      | L.PATTISON |                                                                                       | 17/08/2017 |                                      | DO NOT SCALE DRAWING |                                     | DWG No.   |                                                               |    |  |
| CHECKED    | L.PATTISON |                                                                                       | 03/08/2017 |                                      | A3                   |                                     | SCALE 1:5 |                                                               | 54 |  |
| APPROVED   | L.PATTISON |                                                                                       | 03/08/2017 |                                      |                      |                                     |           |                                                               |    |  |
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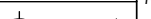


| TOLERANCES |                 | THIRD ANGLE PROJECTION                                                                |                      | MATERIAL:<br>PLYWOOD                       |           | TITLE:<br>LARGE SHEET<br>RIG TOP BOARD |      | <div>Imperial College<br/>London<br/>Department of<br/>Bioengineering</div> |  |
|------------|-----------------|---------------------------------------------------------------------------------------|----------------------|--------------------------------------------|-----------|----------------------------------------|------|-----------------------------------------------------------------------------|--|
| X          | = ± 0.5         | ANGULAR                                                                               | ± 1°                 |                                            |           |                                        |      |                                                                             |  |
| X.X        | = ± 0.1         |  |                      |                                            |           |                                        |      |                                                                             |  |
| X.XX       | = ± 0.02        |                                                                                       |                      | SURFACE FINISH<br>MACHINED<br>FACES Ra 6.3 |           |                                        |      |                                                                             |  |
|            |                 | NAME                                                                                  |                      | DATE                                       |           | ALL DIMENSIONS<br>ARE IN MILLIMETRES   |      |                                                                             |  |
| DRAWN      | C. MORAND-DUVAL | 16/11/17                                                                              | DO NOT SCALE DRAWING |                                            | DWG No.   |                                        |      |                                                                             |  |
| CHECKED    | C. MORAND-DUVAL | 16/11/17                                                                              | A3                   |                                            | SCALE 1:5 |                                        | 54.1 |                                                                             |  |
| APPROVED   | C. MORAND-DUVAL | 16/11/17                                                                              |                      |                                            |           |                                        |      |                                                                             |  |
|            |                 |                                                                                       |                      |                                            |           | SHEET 1 OF 1                           |      | REVISION 0                                                                  |  |

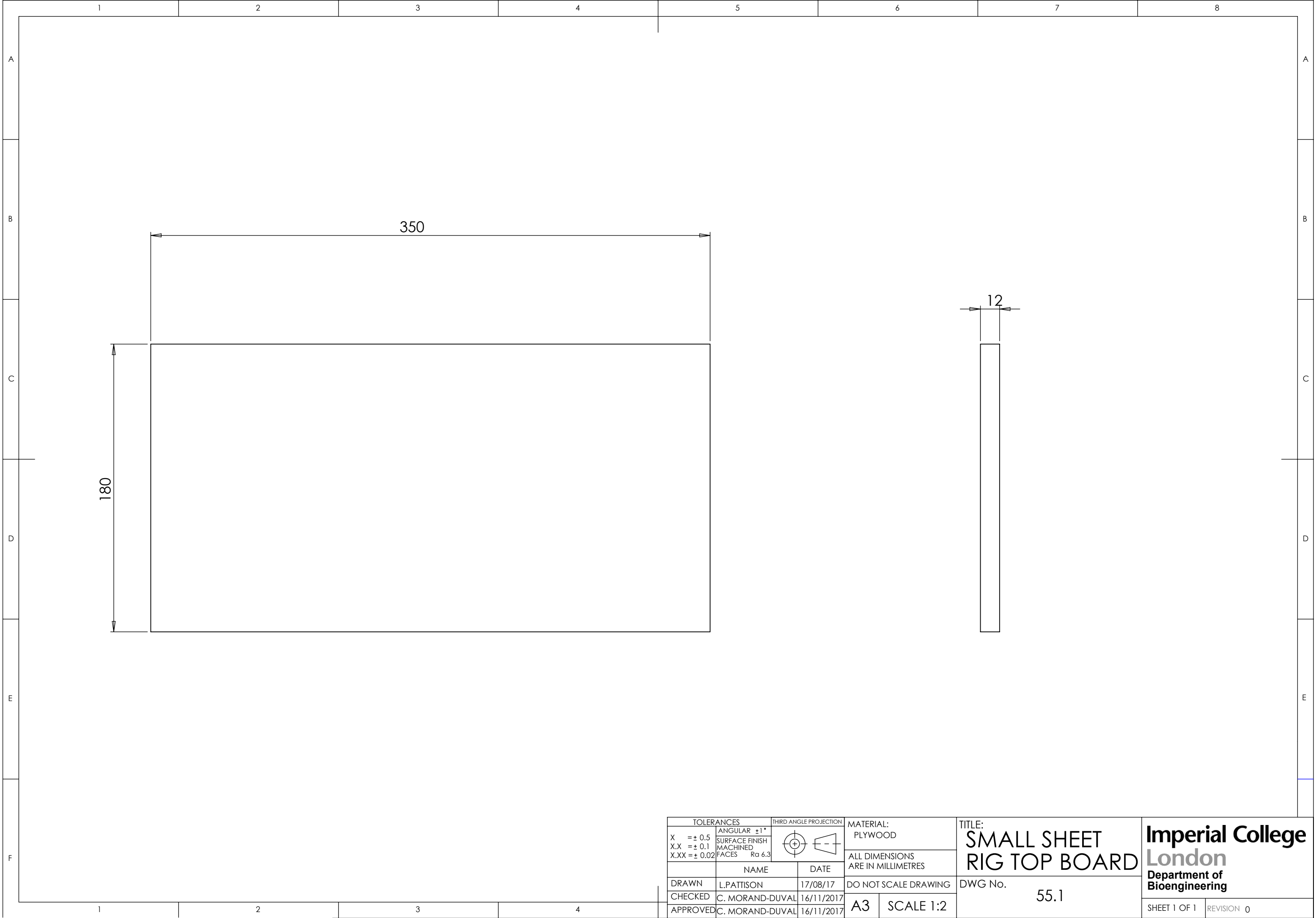




| ITEM NO. | PART NUMBER                        | DESCRIPTION  | QTY. |
|----------|------------------------------------|--------------|------|
| 1        | SMALL SHEET RIG TOP BOARD          | DWG No. 55.1 | 2    |
| 2        | SMALL SHEET RIG MIDLE SHEET        | DWG No. 55.2 | 1    |
| 3        | BS EN ISO 7046-1 - M3 x 8 - Z - 8N |              | 16   |

| TOLERANCES |            | THIRD ANGLE PROJECTION                                                                |            | MATERIAL:<br>N/A                     |                      | TITLE:<br>SMALL SHEET<br>BENDING RIG |           | Imperial College<br>London<br>Department of<br>Bioengineering |    |  |
|------------|------------|---------------------------------------------------------------------------------------|------------|--------------------------------------|----------------------|--------------------------------------|-----------|---------------------------------------------------------------|----|--|
| X          | =± 0.5     | ANGULAR ±1°                                                                           |            |                                      |                      |                                      |           |                                                               |    |  |
| X.X        | =± 0.1     |  |            |                                      |                      |                                      |           |                                                               |    |  |
| X.XX       | =± 0.02    |                                                                                       |            |                                      |                      |                                      |           |                                                               |    |  |
|            |            | SURFACE FINISH<br>MACHINED<br>FACES Ra 6.3                                            |            | ALL DIMENSIONS<br>ARE IN MILLIMETRES |                      |                                      |           |                                                               |    |  |
|            |            | NAME                                                                                  |            | DATE                                 |                      |                                      |           |                                                               |    |  |
| DRAWN      | L.PATTISON |                                                                                       | 03/09/2017 |                                      | DO NOT SCALE DRAWING |                                      | DWG No.   |                                                               |    |  |
| CHECKED    | L.PATTISON |                                                                                       | 03/09/2017 |                                      | A3                   |                                      | SCALE 1:2 |                                                               | 55 |  |
| APPROVED   | L.PATTISON |                                                                                       | 03/09/2017 |                                      |                      |                                      |           |                                                               |    |  |
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|            |            |                                                                                       |            |                                      |                      |                                      |           |                                                               |    |  |





| TOLERANCES |          |                                            | THIRD ANGLE PROJECTION |            | MATERIAL:<br>PLYWOOD                 |           | TITLE:<br>SMALL SHEET<br>RIG TOP BOARD |  | Imperial College<br>London<br>Department of<br>Bioengineering |  |
|------------|----------|--------------------------------------------|------------------------|------------|--------------------------------------|-----------|----------------------------------------|--|---------------------------------------------------------------|--|
| X          | = ± 0.5  | ANGULAR ±1°                                |                        |            | ALL DIMENSIONS<br>ARE IN MILLIMETRES |           | DWG No.<br><br>55.1                    |  |                                                               |  |
| X.X        | = ± 0.1  | SURFACE FINISH<br>MACHINED<br>FACES Ra 6.3 |                        |            |                                      |           |                                        |  |                                                               |  |
| X.XX       | = ± 0.02 |                                            |                        |            |                                      |           |                                        |  |                                                               |  |
| NAME       |          |                                            | DATE                   |            | DO NOT SCALE DRAWING                 |           | 55.1                                   |  | SHEET 1 OF 1    REVISION 0                                    |  |
| DRAWN      |          | L.PATTISON                                 |                        | 17/08/17   |                                      |           |                                        |  |                                                               |  |
| CHECKED    |          | C. MORAND-DUVAL                            |                        | 16/11/2017 |                                      |           |                                        |  |                                                               |  |
| APPROVED   |          | C. MORAND-DUVAL                            |                        | 16/11/2017 |                                      |           |                                        |  |                                                               |  |
|            |          |                                            |                        | A3         |                                      | SCALE 1:2 |                                        |  |                                                               |  |



