

anya ♡

blood pressure monitor designed for
pregnant & preeclamptic women



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introduction

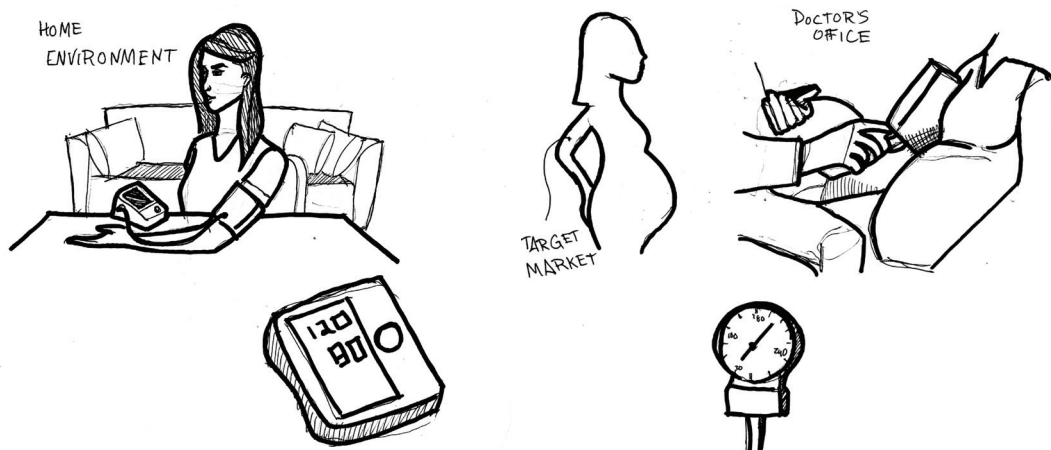
The home blood pressure monitor is a vital health management tool for many. It is essential that these devices are consistent, easy to use, clear to read, and comfortable for a variety of arm sizes.

Blood pressure monitors function by inflating and releasing a cuff in a controlled manner to occlude an artery, then a meter is used to measure the pressure. They are used to measure the users' systolic and diastolic pressure, and often display their heart rate as well. There are two main types of monitors available on the market with digital being the most prevalent.

Manual monitors involve squeezing a bulb to inflate the cuff on the upper arm, reading a pressure gauge, and using a stethoscope to auscultate. They are typically used by trained practitioners because of the complexity of use.

Digital monitors involve inflating a cuff with an electronic pump, using electronic calculations to gather readings, and displaying the results on a screen. The cuffs may be designed for the upper arm, wrist, or finger, but the upper arm cuff is typically deemed the most accurate. These monitors require minimal training to operate and are generally the most convenient for home users.

The aim of this project is to innovate the blood pressure monitor to accommodate an untapped market; in this case, pregnant women with a focus on those suffering from preeclampsia. There is ample opportunity to improve the blood pressure for this user group in terms of aesthetics, portability, ease of use, symptom tracking, and information sharing with healthcare providers.



design brief

Problem Statement

Preeclampsia is a pregnancy complication characterized by developing high blood pressure and other signs of organ damage. In severe cases, it can be harmful, and even deadly to the mother and fetus. This condition affects 5-7% of pregnancies, and monitoring blood pressure and other symptoms is an important part of prenatal and postpartum care. Some pregnant and postpartum women may have preeclampsia, but are unaware of their condition until it is severe. Most of the blood pressure monitors currently available are not designed to be transported, or for the specific needs of pregnant women.

Solution

The anya is a portable blood pressure monitor created to help monitor and manage blood pressure and other preeclampsia symptoms in pregnant and postpartum women. It is meant to work in conjunction with regular care from medical practitioners, and may prevent unnecessary visits through its ability to share patient data. The device may be paired through an app with any smart device to share blood pressure readings and symptom tracking with the patient's doctor; the user may also receive information from her doctor.

The compact design allows for multiple readings to easily be taken throughout the day. The anya assembles into one piece, allowing it to be simply and discretely transported in a bag. Additionally, The built-in display gives the user freedom to use the device without their phone. The aesthetics of the device reflect the femininity and softness of mothers, qualities that are currently missing from other blood pressure monitors on the market.

preliminary ideation

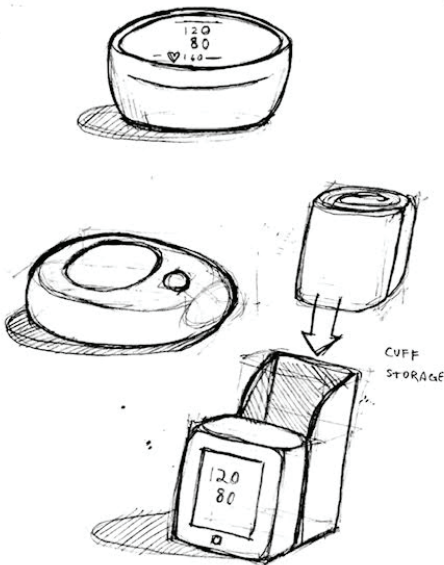
From the beginning of the design process, I knew I wanted the display, cuff, and charging system to be stored as a single unit.

Initially, I designed a system in which the user rolls the cuff and stores it in a slot attached to the display screen.

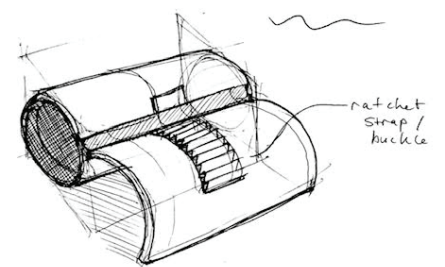
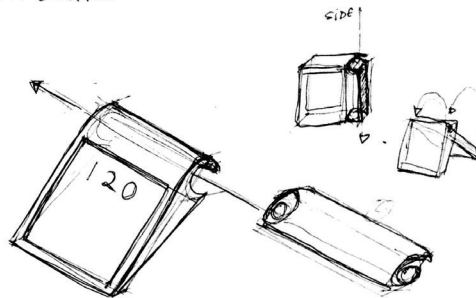
The compactness and portability were right, but it was tedious to have to roll the cuff, and the form was not feminine enough.



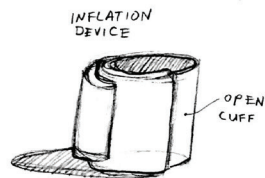
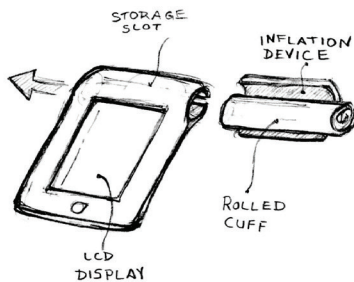
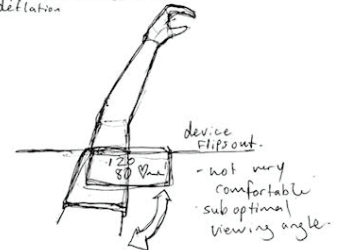
BODY INSPO



CUFF STORAGE



- measure on inflation
↳ most inflate all the way, then measure on deflation

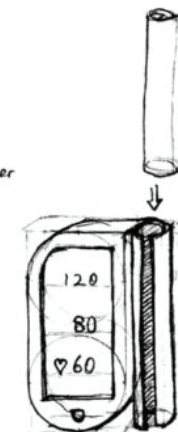
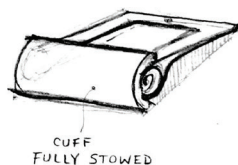


pushing buttons to screen smaller in packaging, to cover screen?

- roundness / femininity / softness

alignment of the cuff

soft shell on wood product
tamigalchi



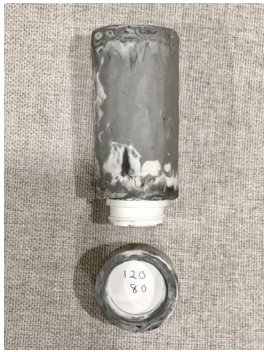
CUFF
• air pump
• battery
• solenoid
• bladder
• pcb

IDEAL CUFF BLADDER
L = ≥ 80% of arm circumference
W = ≥ 40% of arm circumference

DISPLAY
• PCB
• BATTERY

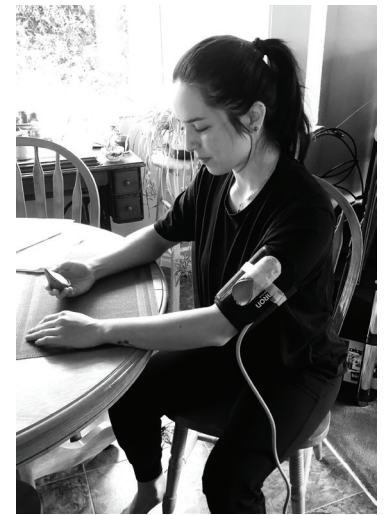


user testing

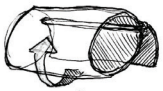


screen test

For the user testing, I wanted to evaluate the use of a removable screen feature. I made two models, one with a twist-off screen and one with a pull-off cap screen. I looked at the ease of attachment and the ergonomics of the screen in the user's hand.



① Clockwise ring inside arm



notes:
very awkward

② Clockwise ring outside arm



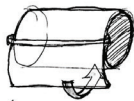
notes:
have to move arm away from body to wrap the cuff around

③ counter clockwise ring inside arm



notes:
- easy to get on (squish against side)
- had to reach under b/c cuff was so long & winner.

④ counter clockwise ring outside arm



notes:
- ring wants to naturally fall to tricep when.

cuff test

I also wanted to test the most ergonomic orientation of the cuff, so I looked at four different positions:

- clockwise with the hinge on the inside of the arm
- clockwise with the hinge on the outside of the arm
- counterclockwise with the hinge on the inside of the arm
- counterclockwise with the hinge on the outside of the arm

Lastly, I tested a standard fabric cuff without a support versus a firm cuff with a flexible cylindrical support.



results

screen test

It was found that the pull-off screen was the easiest to remove and reattach to the main body. The rounded teardrop/egg shape was also the most comfortable in the hand.

It was also discovered that the screen should have a flat bottom to rest on the table in case the user does not want to hold it for the entire duration of the reading. Since the model was made of plasticine, the user was able to mould it to her desired shape. This would be the screen shape moving forward.



cuff test

It was found that the most comfortable way to put on the cuff (when on the left arm) was to wrap the band counterclockwise, away from the body, with the hinge on the inside of the arm.

The standard fabric cuff was more difficult to fasten and adjust because it slipped when being tightened; the user had to pin the cuff between her bicep and ribs to keep it from sliding.

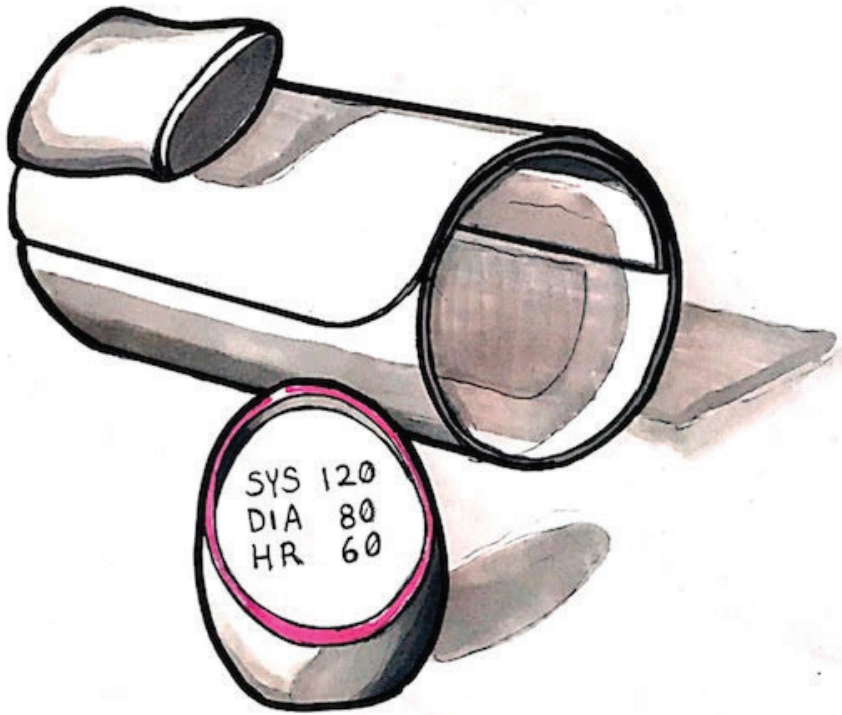
The supported cuff was easier to slide up the arm and it stayed in place when tightening and adjusting. This would be the cuff style moving forward.



mood board & inspiration



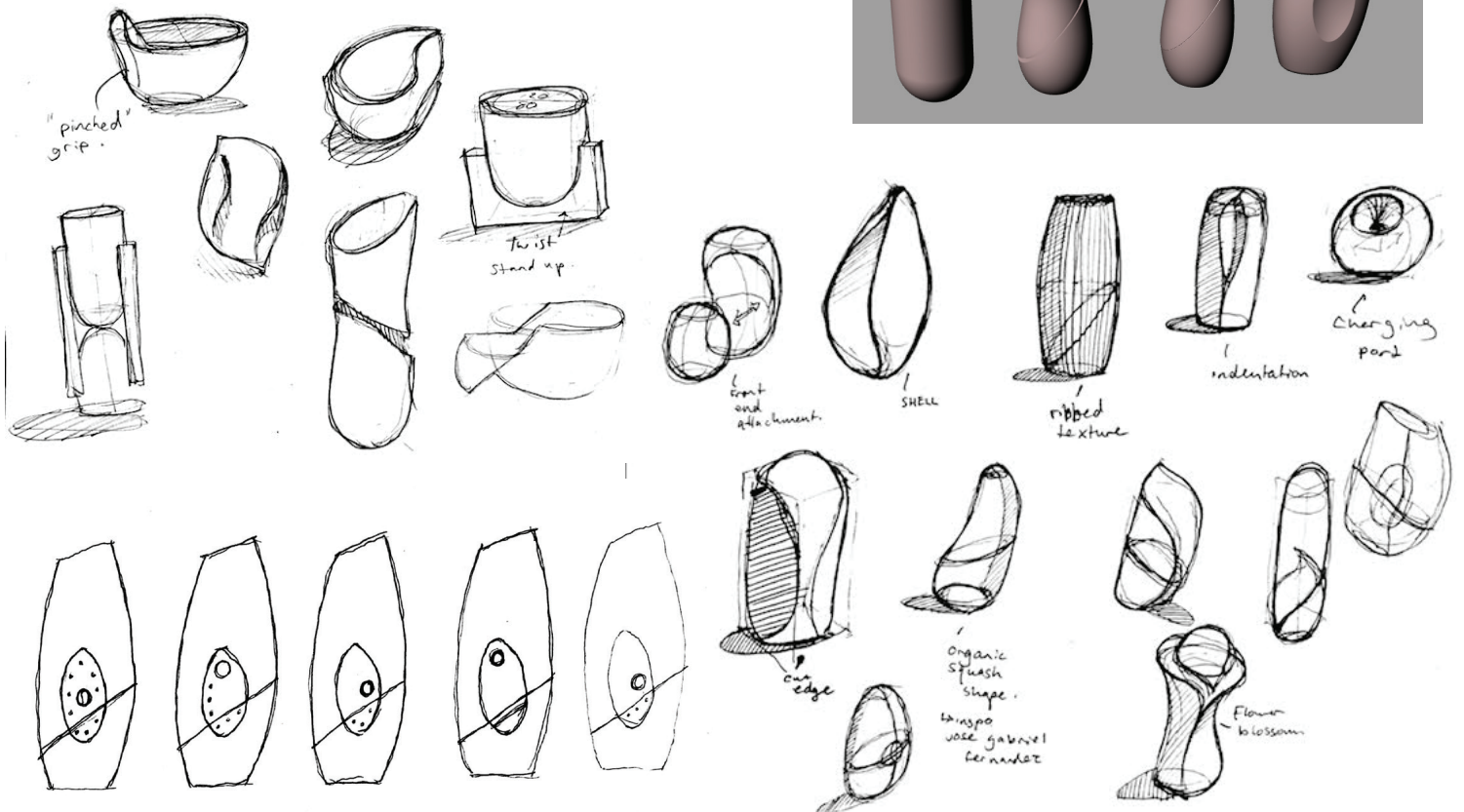
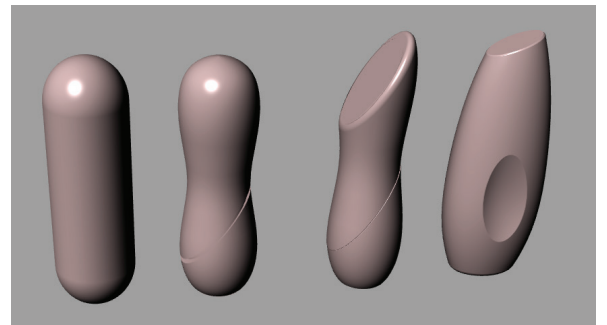
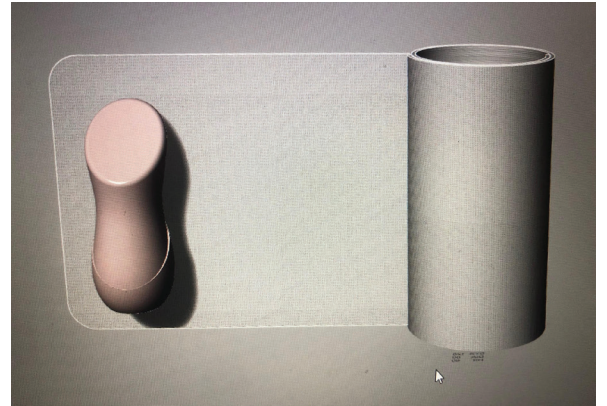
concept iteration



After the user testing, I iterated the design further and focused on the form of the pump housing and screen. I looked to sculpture and pottery as inspiration.

Once I landed on the oblong shape with diagonal cuts, I focused on smaller details.

I iterated various button placements, cut angles, air intake holes, light placements, and mount systems.



definitive design



The final design takes on a sculptural and feminine form while also being compact and portable.

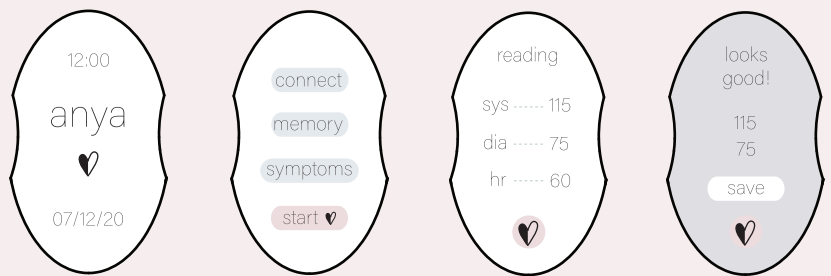
The screen, pump, cuff, and charger combine as a single unit, making the monitor easy to store and transport.

The cuff exterior is made of a durable and wipeable nylon. The colour blocking matches the angle between the pump housing and screen.

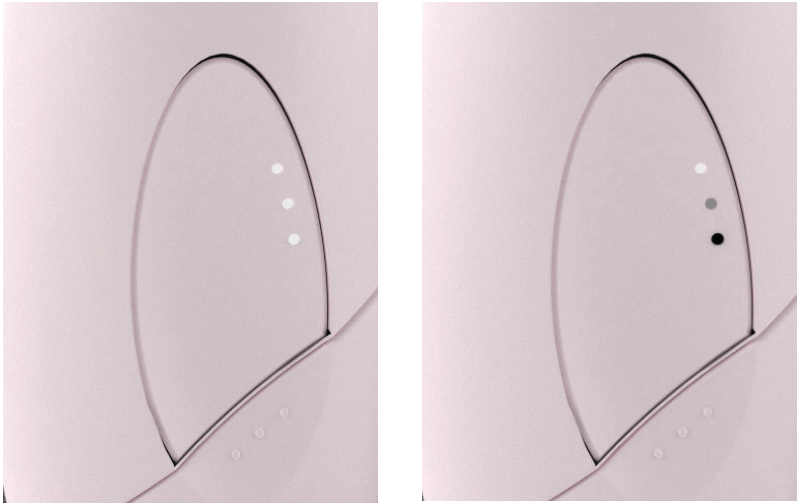
The pump and screen housing are made of glossy ABS plastic because of its ability to withstand use and to be injection moulded.

The detachable screen is touch sensitive and shows basic readings, memory, and symptom logging. The user has the option to connect to a mobile app for more in depth tracking and data sharing with healthcare providers.

display screens

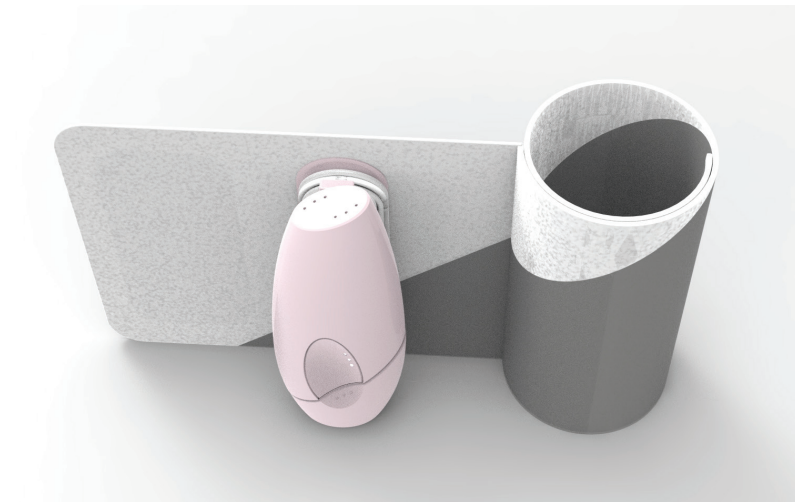


design features



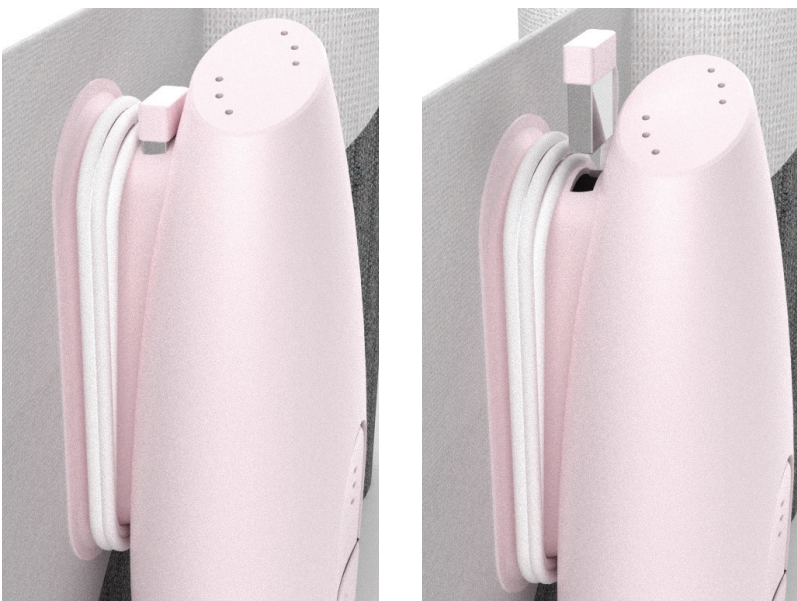
charge & pairing indicator lights

The main button has three dimmable LED lights that show the charge level of the monitor. They also flash to indicate when pairing with smart devices.



pre-formed expandable cuff support

The fabric cuff has a firm and flexible PVC support sewn into it. The support wraps firmly around the user's arm to keep the cuff in place while the user is adjusting the velcro. Since the support is flexible, it accommodates most arm sizes from 22 - 43 cm circumference.

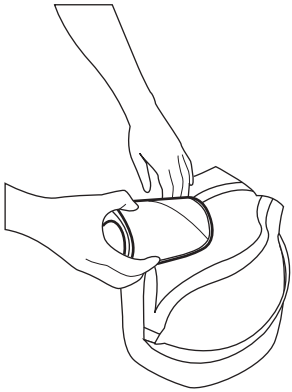


self-stowing USB charging cable

The pump and screen are both charged via USB cable. 100 cm of cable is stored around the pump mount with an integrated holder for the USB connector.

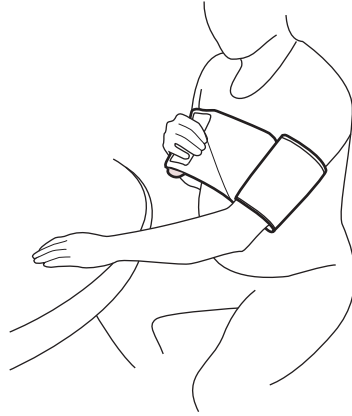
use cycle

1



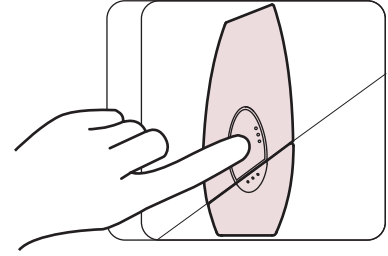
grab
anya stores as
a single unit

2



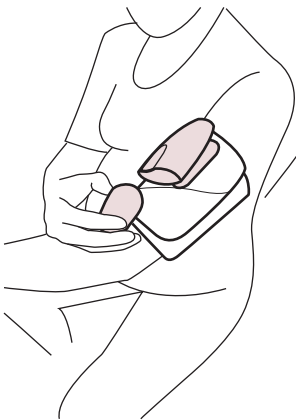
slip on
supported cuff makes
for easy placement

3



turn on
press button to
power or pair anya

4



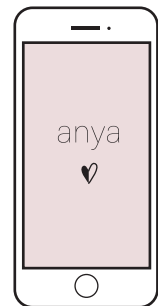
start reading
remove screen and
choose to start reading

5



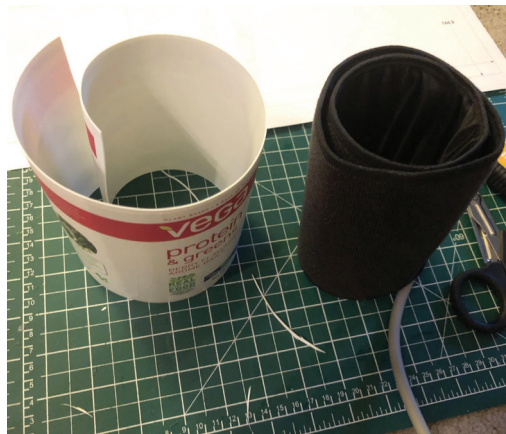
view results
choose to save results, view
memory, or track symptoms

6



connect
use app to share data
& view more tracking

model making



For the cuff, I created a pattern based on my 3D model and cut the fabric accordingly. I chose a grey and white cotton lined with felt, and repurposed a plastic PET container as the support insert. I sewed the cuff inside out to hide the seams, and finished the edges with a decorative top stitch.



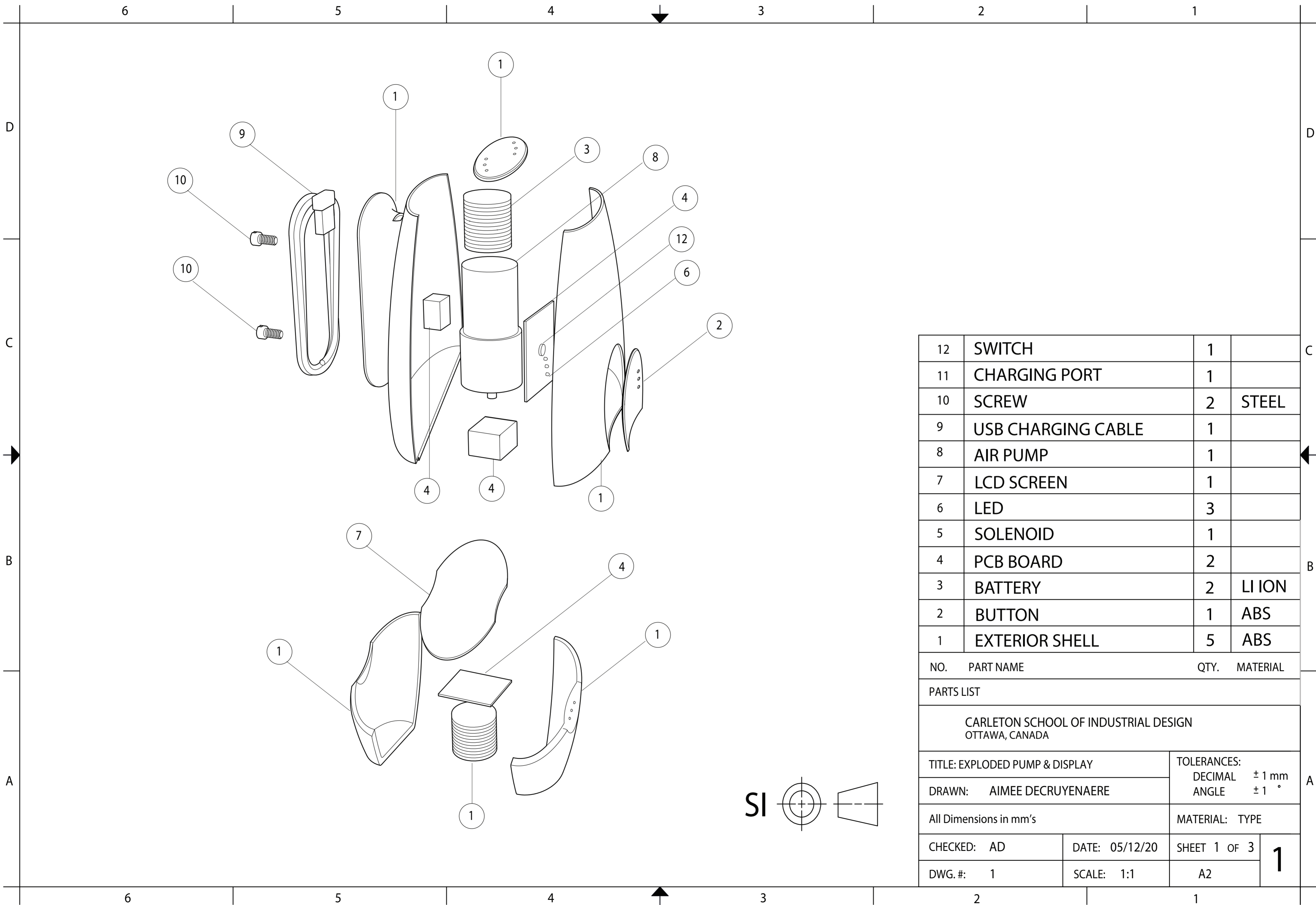
For the pump housing and screen, I ordered a cylindrical piece of polyurethane foam the shop. I hand-carved the foam according to my 3D model with sand paper and a jig saw. I had the button 3D printed for added definition and glued it to the piece. I primed the piece with multiple layers of gesso, then added layers of acrylic paint. I finished the surface with a metallic/satin rose paint for added shine and lustre.



I finished the model by gluing the pump housing to the cuff and adding velcro. I created the grips on the screen by priming and painting sewing pins, and inserting them into the foam.

model in use





12	SWITCH	1	
11	CHARGING PORT	1	
10	SCREW	2	STEEL
9	USB CHARGING CABLE	1	
8	AIR PUMP	1	
7	LCD SCREEN	1	
6	LED	3	
5	SOLENOID	1	
4	PCB BOARD	2	
3	BATTERY	2	LI ION
2	BUTTON	1	ABS
1	EXTERIOR SHELL	5	ABS

NO.	PART NAME	QTY.	MATERIAL
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PARTS LIST

CARLETON SCHOOL OF INDUSTRIAL DESIGN
OTTAWA, CANADA

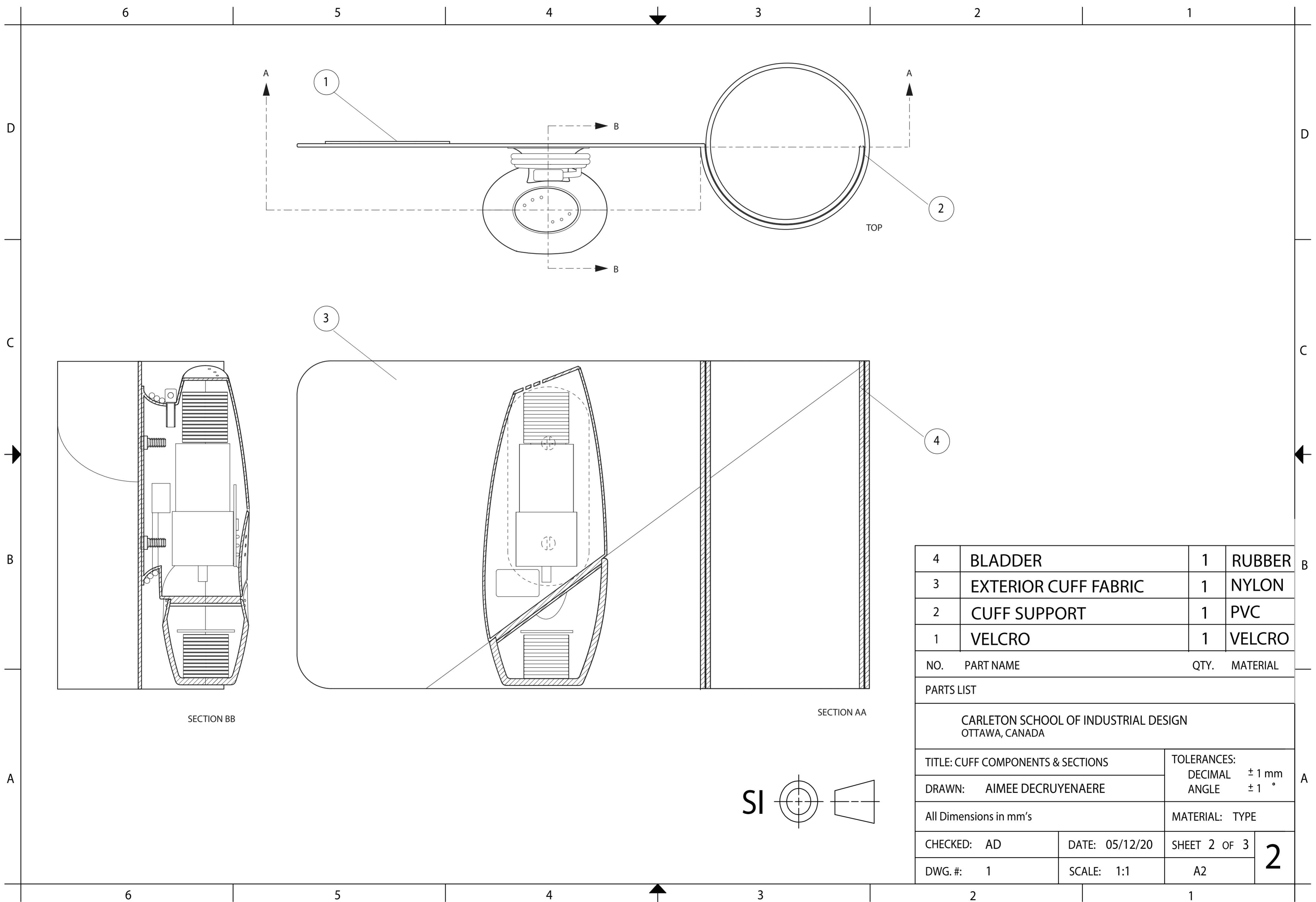
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DRAWN: AIMEE DECRUYENAERE	
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All Dimensions in mm's	MATERIAL: TYPE
------------------------	----------------

CHECKED: AD	DATE: 05/12/20	SHEET 1 OF 3	1
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DWG. #: 1	SCALE: 1:1	A2
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4	BLADDER	1	RUBBER
3	EXTERIOR CUFF FABRIC	1	NYLON
2	CUFF SUPPORT	1	PVC
1	VELCRO	1	VELCRO

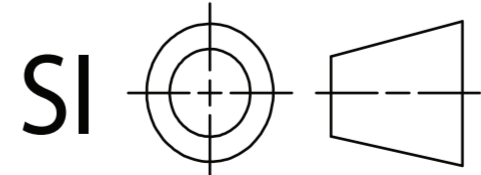
NO.	PART NAME	QTY.	MATERIAL
PARTS LIST			

CARLETON SCHOOL OF INDUSTRIAL DESIGN
OTTAWA, CANADA

TITLE: CUFF COMPONENTS & SECTIONS	TOLERANCES: DECIMAL ± 1 mm ANGLE ± 1 °
DRAWN: AIMEE DECRUYENAERE	

All Dimensions in mm's

CHECKED: AD	DATE: 05/12/20	SHEET 2 OF 3	2
DWG. #: 1	SCALE: 1:1	A2	



6 5 4 3 2 1

D

D

C

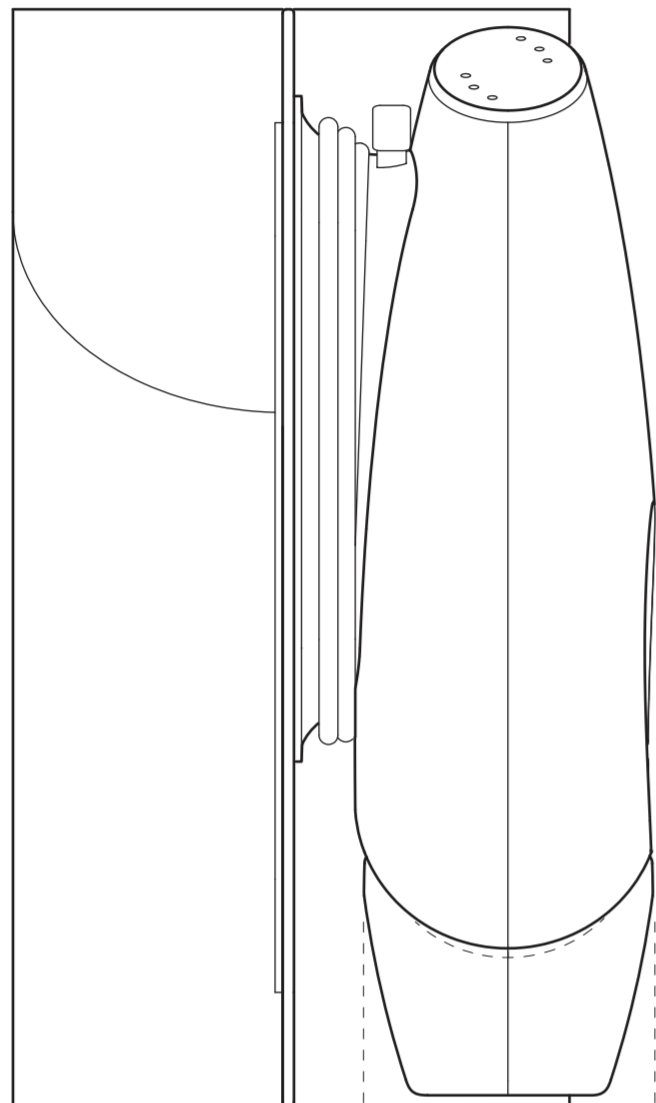
C

B

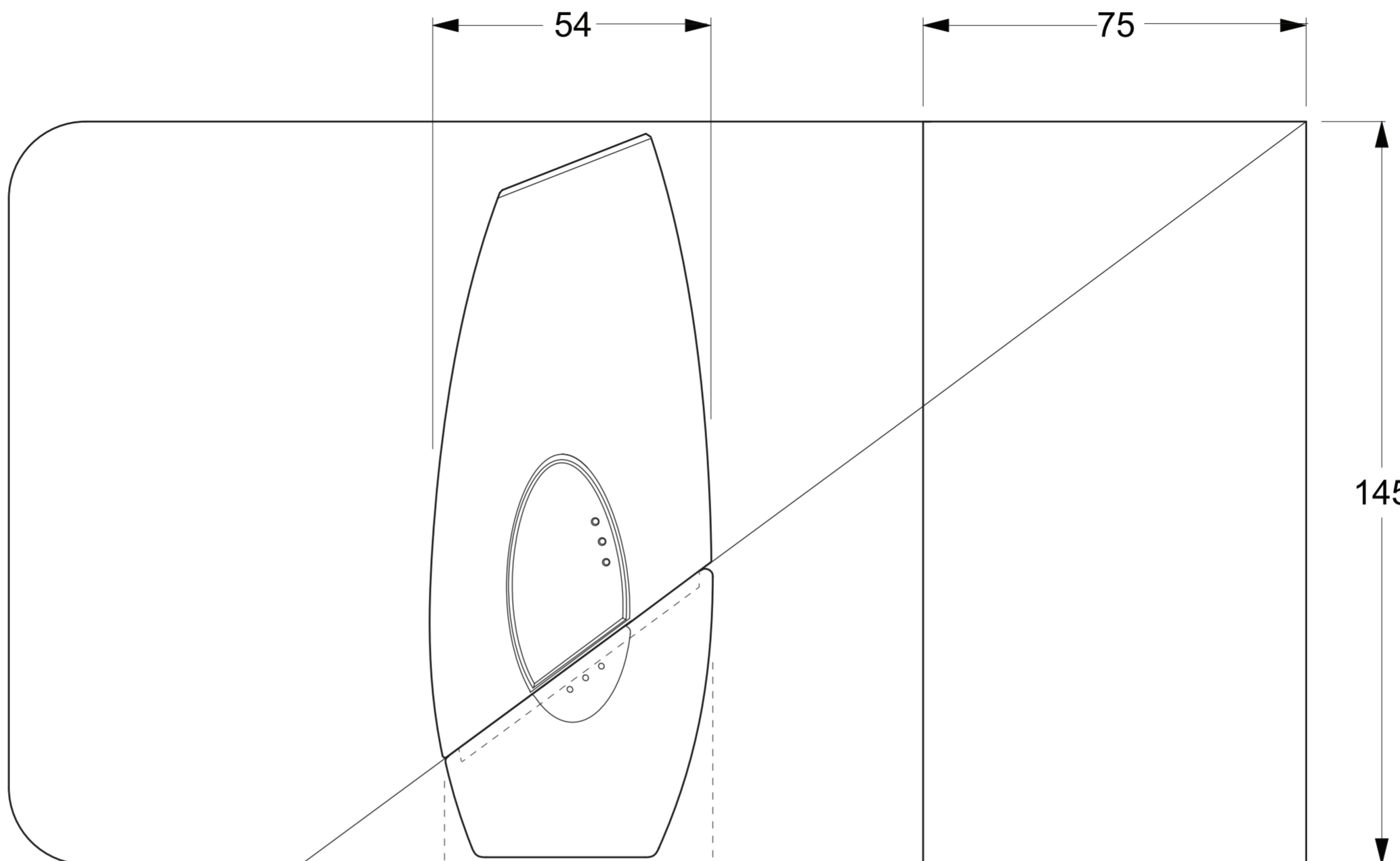
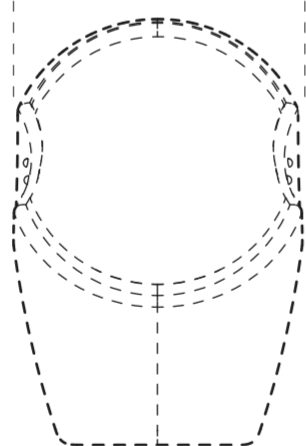
B

A

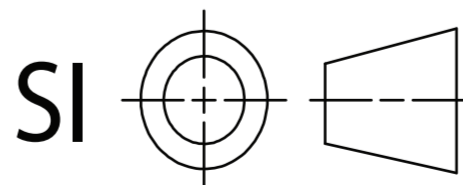
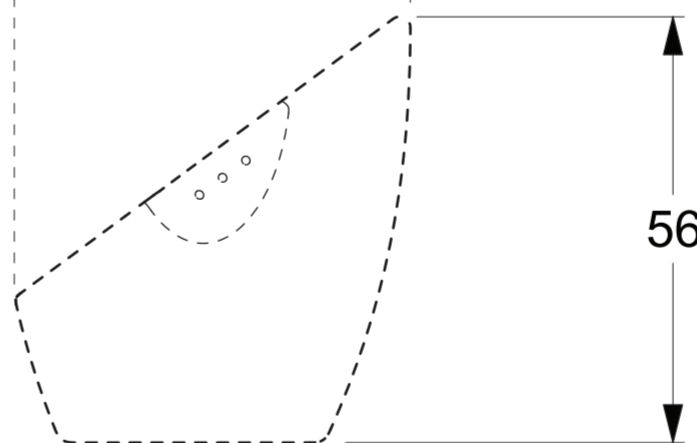
A



LEFT



FRONT



CARLETON SCHOOL OF INDUSTRIAL DESIGN OTTAWA, CANADA			
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DRAWN: AIMEE DECRUYENAERE		MATERIAL: TYPE	
All Dimensions in mm's		SHEET 3 OF 3	
CHECKED: AD	DATE: 05/12/20	A2	3
DWG. #: 1	SCALE: 1:1		

6 5 4 3 2 1