

Team 15

Fernanda Espinoza Irina Barzykina Elyse Marshall Tim Leferve





Product Opportunity

One of the main sources of physical and mental exhaustion for new parents is the need to constantly maintain a clean and safe environment for their child. We aim to design a solution that will ease the process of cleaning and sanitisation, focused on reducing the time and energy required to clean in one of the key problem situations that we have been identified.

The key situation we are going to focus on is whenever the parent is not at home. This is the most critical area since parents always want to prepared for the unexpected outside the home. This means that we are targeting the on-the-go need of new parents to clean or sanitise baby products.

Developing Concept

Comparative study of initial concepts

To begin our project we decided to analyse our four individual concepts aimed to help parents sanitise baby items. We compared their key features, advantages and disadvantages and how well they targeted the main insights from our previous research. With this process we chose the **CAPSULE CLEANER** to analyse further.



Main Insights



Parents struggle to clean because they have to constantly watch after their kid or are interrupted by them.

Parents have to regularly clean what their kids play with because it is often in contact with dirty surfaces, and they tend to put things in their mouth.

Parents tend to become negligent with cleaning when their child annoys them by dropping the same item multiple times in a row.

Parents have to improvise ways to loosely clean items that have been dropped on the ground because they lack proper portable equipment.

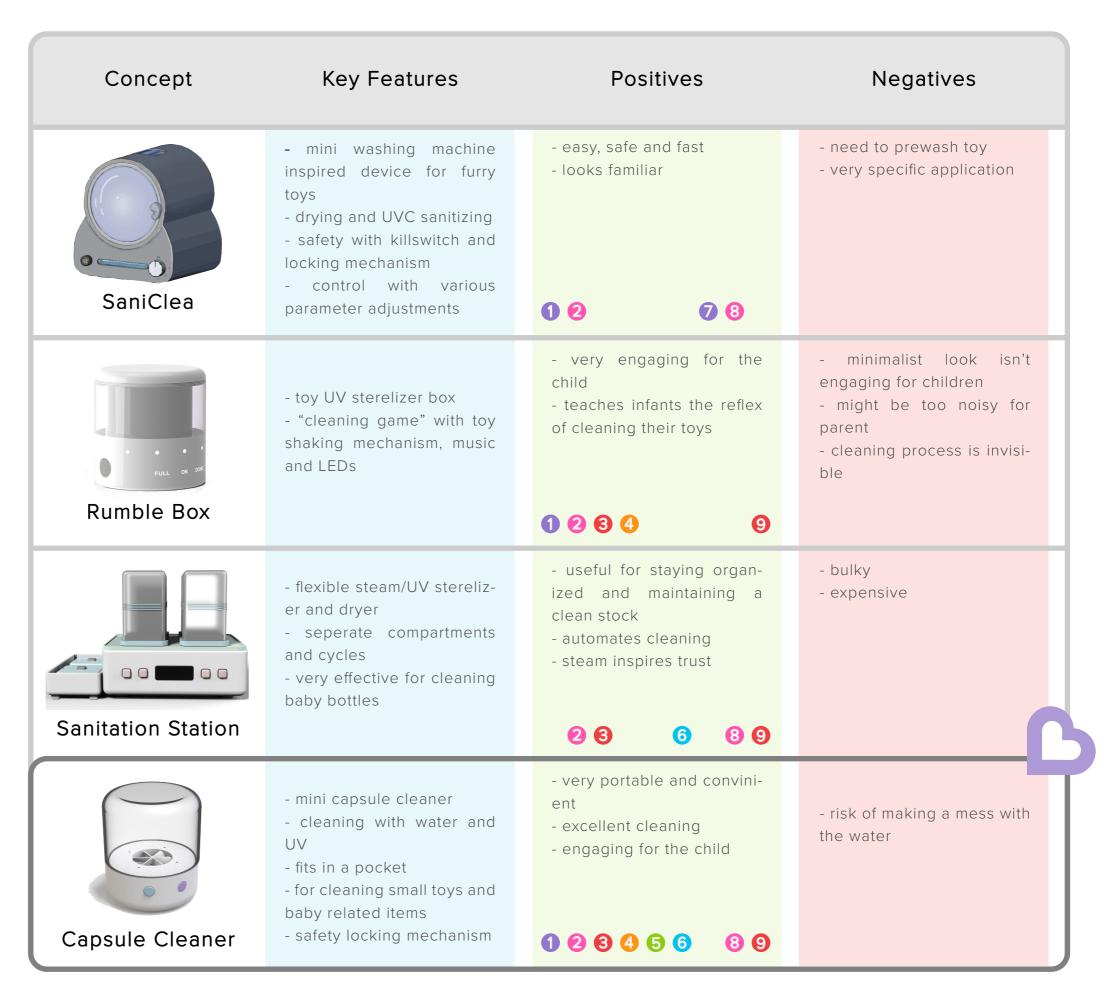
Parents find it hard to clean items on-the-move, because they often multitask or have to focus on manoeuvering the stroller.

Parents struggle with maintaining a clean stock at all times.

Fabric and plush toys are especially hard to clean as they can be easily stained and are hard to rub.

Parents trust cleaning methods that they are familiar with.

Parents mainly put off doing chores because they are repetitive, boring, or tiring.



We chose to develop the 'CAPSULE CLEANER' concept further since it covered most of our insights. To do this we analyzed the concept to identify its possible issues and therefore areas to improve and develop further.

Aspects we want to KEEP



Portability



To keep this aspect we aim to minimize the size and weight of the product. This will make it easier to carry and use on the go.

Easy to use



This means we should focus on convenience and ergonomics to ensure our product is intuitive and effortless to use for the parents.

Simple aestheitc



To keep this aspect we aim to for the size and weight of the product to be as small as possible. This will make it easier to carry and use on the go.

Area to develop: HANDLE

In the initial concept, there is a **SLOT** at the back to place a string or strap to the sterilizer so it can be **attached to the guardrail** of a stroller. This is an area of the product where further development could take place to **EXPLORE** and **ITERATE** on different types of handle.

By developing a handle we would ADD VALUE and CONVENIENCE to the product therefore it is an area worth developing. The handle could also affect the SAFETY of the product since it could secure it in place to avoid accidents or misuse by a baby or child.

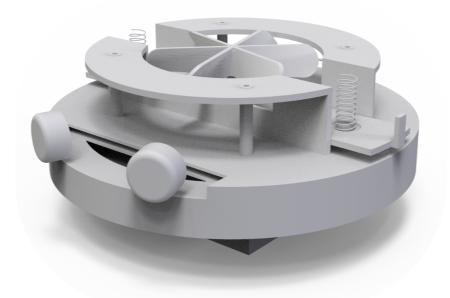
Developing Concept

Improving initial concept



CAPSULE CLEANER

We chose the concept of our product to be the same as this one; a small, portable cleaning device that would incorporate water and UVC cleaning.





Possible ISSUES



User Interaction

Currently, the items inside the product remain wet when the sanitising cycle finishes so the parent's hand would have to submerge in water to retrieve them. This is very inconvenient and shows that user experience could be improved.

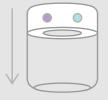






Current Mechanism

The product needs to be in upright position for the water to be in contact with the propeller. The incorrect position can lead to water spills or malfunction.









when un/screwed

when in use

Limited Function

The product cleans the items with water and UV but the water creates an inconvenience for the user. The product could give the user a choice between different modes: one with water, one with UV and one with both.







Developing Concept

Initial Concept Development

We developed three concepts based on the capsule cleaner aiming to solve the issues we identified and also iterated on different handle options. We evaluated the ideas based on users **NEEDS** and **WANTS**. We chose to develop the Cage & Spin-Dry concept as its portability does not compromise simplicity and function.

How would we be efficient, simple and portable?

With UVC we can make cycles powerful and fast to increase efficiency. Simplicity comes from the options that the parent has for water disposal: adapting to their lifestyle, and mobility is achieved with its size and the strap/handle.

Parents NEED to...

- Minimize the time spent sanitising
- Constantly clean baby/child items
- Overcome lethargy or fatigue

Parents WANT to...

- Keep their hands free
- Avoid hysterics from a missing item
- Make minimum effort on tasks

Handles









- secure
- clunky

unappealing

strict length

not durable

- universal
- standard
- not kid-safe



- stable
- hands-free snapping
- foldable
- dangling



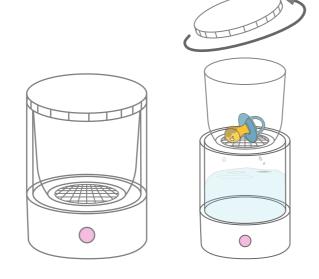
- minimalistill-balanced
 - weak
- baby-safe
- portable
- adjustablehands-on laborious secure familiar bulky

Sieve Storage





Here a sieve was implemented. The sieve would be screwed into the lid, and shaking would remove excess water. The mesh also a protects the item from the propeller.



PROS

- matryoshka-style storage; familiar
- protects the item inside
- simple mechanism

Cage & Spin-Dry











The wash cycle starts with water in, inner tray spins to create vortex and wash dummy. For draining, a bottle is screwed, then its flipped to drain and replaced. The dry cycle begins and water spins off dummy onto walls.



PROS

- of electronics
- less proofing required
- minimalist
- simplificationfeatures popular with parents
 - parent has usage options
 - compact

Power of Torque



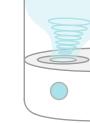






An impeller and propeller mechanism could be used to pump in and out the water used to clean the items. Water storage would be added and also a division between the mechanism and the main electronics components.





PROS

- protects electronics from water
- minimised spillage risk
- sleek and internalised

Developing concept

Final concept design

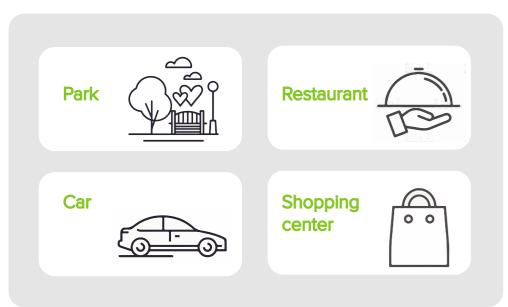
We want to make it easier for parents to clean and sterilise their baby's items on the go.

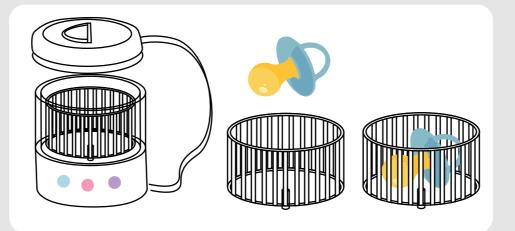
Existing portable sterilisers only use UV to kill bacteria. Our users said they found it hard to trust this was working and were concerned about small pieces of dirt.

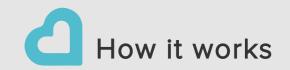
Therefore we decided to design a product that will wash items in UV sterilised water and dry them after to ensure no more dirt is picked up.

We also designed an additional water bottle feature for users to decant and store the water when they are in environments where emptying is not possible.

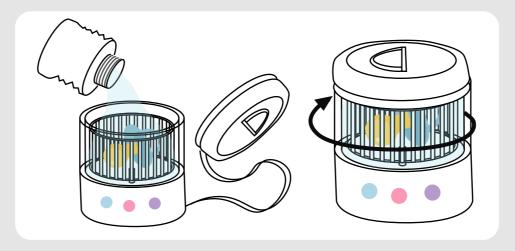
Possible use environments



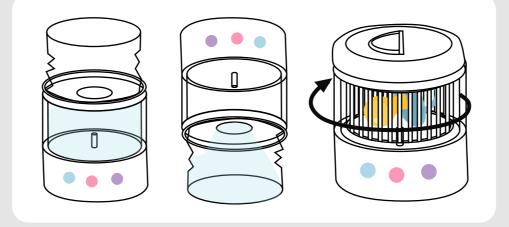




Pop the top lid off and insert the dummy or small item into the inner nest.



Fill the clear section 3/4 full with water, close the lid and press the blue button for wash, the UV lights will turn on and the inner nest will start spinning. The UV sterilies the water and the water removes dirt from the dummy.



Drain the water by either opening up the lid again, or, by pulling the second part of the lid to expand the water bottle and decant it into there. You can then remove the water bottle, seal it, and dispose of the water later.

Then, press the red button for dry, this time the nest will spin and push all remaining water off the dummy onto the walls of the container.

Remvoe the dry, clean and sterilised dummy.

Developing concept

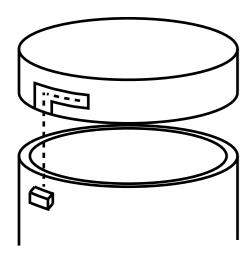
Final concept specifics

This page explains the specifics of the product such as how features will work and how key components fit together. This gives us a good basis to begin prototyping and detail design for the finished product.

Top lid section

The top section has an **expandable bottle** with a standard plastic water bottle size screw bottle top. Most of the time this is collapsed, with the **screw top** holding the two parts of the lid together tightly.

This also has a **small handle** to expand the water bottle with the **bottle cap** attached.



Main Lid section

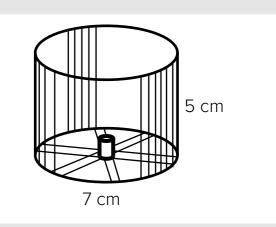
This is the main lid to keep the water in.

The inner part slides inside the clear section of the capsule and has **thin plastic fins** that ensure **water tightness**.

The outer section slides outside the clear section, extrusions on the side of the clear section correspond to the holes in the lid. The user has to line these up, push down, then twist to lock the lid in place, this ensures the lid is not removed accidentally or done a child.



The nest

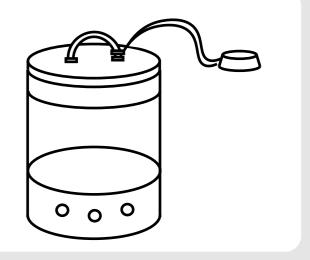


The inner nest has a solid section in the middle that slides onto the **exposed motor tip** to enable it to spin.

The Electronics

The motor, UVC LEDs, rechargable battery and Micro USB slot all sit in the **bottom** waterproof casing. This casing will be

specifically designed to be injection moulded (likely with ABS) in order to make it lightweight, low cost but durable enough for use.



Button 1: Just UV

Button 2: UV and slow spin (wash) Button 3: UV and fast spin (dry)



We decided to research and analyze four brands in the baby cleaning market. We chose a bigger corporate brand **NEWELL**, a sustainable brand **NIMBLE**, and two brands that focus only on baby-care products TOMMEE TIPPEE and MUNCHKIN. In this comparison our aim was to find the brand that would represent our concept and product the best. This meant looking at different elements that make up a brand including their VALUES, BRANDING, PACKAGING, PUBLIC IMAGE, CONCEPT, etc. All of this would influence our product so it was important for us to analyze all of them in the same detail.

Brand Elements









About

A feeding bottle and childcare brand based in the UK. Fifth largest childcare company in the world.

Consider themselves a family. They

want to make a difference through

Simple and intuitive products;

'fuss-free'. Aim to help parents with

and

multi-billion-dollar American manufacturer, marketer and distributor of consumer products.

A company that produces and sells plant-based cleaning products that are also 100% vegan and cruelty-free. American company that develops credible products to make parents' lives easier and more enjoyable.

Parents and babies

Target User

New parents

innovation

family life.

sustainability.

bringing up a baby.

Families

Parents concerned about safety

They believe in simplicity in design and creating inviting experiences to delight parents and babies. They promote a carefree and happy life.

Brand Values

Puts the consumer first and trusts on their collaboration to meet their needs. Believes in continuous improveement and innovation.

They are centered around the user so

they prioritize their needs and wants.

They want to provide child-friendly cleaning products powered by plant-based ingredients.

Their values are to be vegan and

ethical. They are concerned with how

harmful current cleaning products are

and want to provide and alternative.

They are passionate about finding functional, relevant and clever solutions for a carefree life.

Concept

Brand their products as inventive and innovative that will transform

promote

Brand themselves as a support for young and new parents by catering to their needs.

They brand themselves as a friendly and conscious brand in terms of the environment and ethics.

They brand themselves as a brand that careas about their consumers who puts them first.

Public View

Branding

They are very well known and They have highly rated products due trusted in the UK. to their quality and trust from users.

Consumers trust their products to have value worth their price.

They are very well known and trusted by consumers worlwide.

Packaging









FINAL IMPRESSION: conclusion of the brand

This brands' CONCEPT and TARGET USER aligns with ours, however, their values differ to ours. Their main VALUES regard sustainability, global community and driving difference which is not the main focus for our concept. Therefore, this brand is NOT IDEAL for our product.

Even though this brands' VALUES align with ours in terms of INNOVATION, they are still percieved as a big corporate brand which is not ideal for our product. They lack a personal connection with their consumers which would make it hard for them to trust our product.

This brand's TARGET USER matches with ours. However, their products range is LIMTED to only cleaning so our product wouldn't fit as part of their brand. Also, their main FOCUS is sustainability and that is not the case for our product therefore this wouldn't be a good brand for ourproduct.

This brand's VALUES CONCEPT perfectly aligns with ours as they want to provide a solution to problems faced by parents in a convenient and inventive way. They promote innovation and are always improving their products. Our product would fit into this brand.



Munchkin was the selected brand for our project because their core values aligns perfectly with ours. The brand has a wide range of baby-related items, assisting parents in all areas of their baby's life. We will focus in the **HYGENE** sub category. Here we analyse further the **KEY ASPECTS** of the brand that would affect our work.



Why Munchkin?

Every since it was founded in 1990, the brand has cultivated a clear ambition to innovate within the baby products industry. Munchkin's goals align perfectly with ours as they develop modern and credible products for babies and children that make parents' lives easier and more enjoyable by thinking of "the little things."

The company has been growing fast due to its success amongs parents. To date, the brand has 300 employees, 288 patents, and has set itself a mission to be the most loved baby lifestyle brand in the world.



Core Values

Munchkin has clear values, which we share when developing useful products.



INNOVATIVE

Munchkin is powered by INNOVATION designed to make parents' lives easier and more enjoyable.

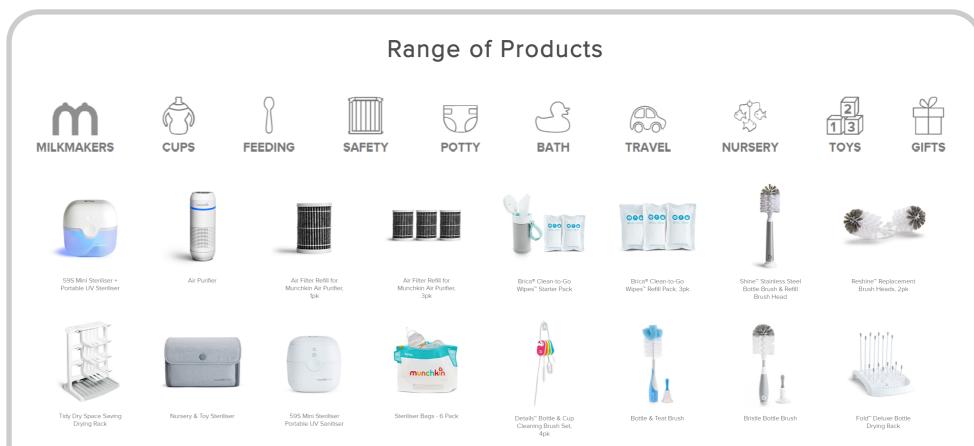


MODERN

Munchkin is powered by SIMPLICITY IN DESIGN and creating INVITING EXPERIENCES to delight babies and parents.



Munchkin is powered by a NEVER-ENDING PASSION to find relevant, functional, and clever solutions for living a carefree and happy life.



Their Mini Sterilisers were part of the inspiration we used when exploring product ideas. We have tested and reverse engineered this type of device to analyse its flaws and determine how we could improve such products. Thus, our final design includes some aspects of these mini sterliser type boxes, while offering better functionnality.

Visual Identity

Munchkin has two different product aesthetics. The ones that are designed to be used by children are very colorful, while the ones that are to be used by aldults have minimal designs, that are mainly white.



Packaging

The brand has partnerships with multiple environmental charities such as the International Fund for Animal Welfare, which is somtetimes featured on the packaging. Overall, Munchkin uses minimal packaging with recyclable carboard, which aligns with our desire to minimize the environmental impact of our product.









The "59S Mini Portable UV Sanitiser Plus" is a similar product already available for sale on Munchkin's website, but we have identified problematic areas which would be covered by our product propostion. This would achieve a **PERFECT FIT** between Munchkin and its customer while also enhancing their business's value.

A larger version of the steriliser is able to hold larger items, and fits in a nursery due to soft fabric exterior.

Products & Services



A compact steriliser with UV technology is able to sanitise dummies, teats, and small personal items.

- Munchkin partenered with UV tech brand (59S) increasing sanitisers' reliability
- The UV auto turns off when opened making it child safe
- Sterilisers eradicate odour-casuing bacteria
- The device can also clean personal items
- The cycle is quick, only 1 minute long

Gain Creators

Pain Relievers

- Reduces worry over cleanliness of items because the sanitiser is always available
- Portable items are able to fit into storage on a pram allowing on the go cleaning
- A strap allows the parents to attach the steriliser to anything - nappy bag, pram, etc.
- UV sterilisation is proven to be highly effective in killing bacteria









Our response to customer's concerns

How much DAMAGE can the interior sustain?

We will conduct tests to identify the optimal material able to sustain the highest levels of damage. Also, the nest serves as a barrier for the outer casing.

The sanitiser does not get rid of DIRT!

The sanitiser also uses water, so dirt would be removed from the object. Then, the post-cycle draining completely removes the dirt particles.

What do I do while it's WORKING? Just watch it?

The outer casing is transparent because skepticism is natural. The customers can observe the cleaning cycle to have control and confidence.

How strong is the **STRAP** provided? Can it snap?

Our strap would be made of a highly durable and elastic material which would allow for extensive and intense use, perfect for on the go.

Auto-shut off is great but why is there no child-safe LOCK?

A locking mechanism would increase the size of the product and introduce irregular form. Instead we use elastic rims on the inside of the lid.

What if the sanitiser is **DROPPED** accidentaly?

FEA simulations will be used to determine our final design and also to validate its ability to sustain a drop or mishandling. This will also test its snap fits.



This concludes and summarises our brand research of Munchkin by considering how this will affect the branding of our product. We analysed how our **BRANDING CHOICES** will fit with the market and needs of target users as well as how we will **IMPLEMENT** the key branding features of Munckin into our work.

Branding choices



MUNCHKIN

Munchkin is established and trusted by parents, choosing to partner with them allows our users to trust that our product is high quality and truly made to help them.



OUR USERS

From our constant contact with our user group, we know that they value friendly brands (usually with fun names) that create straight-forward and easy to use products.



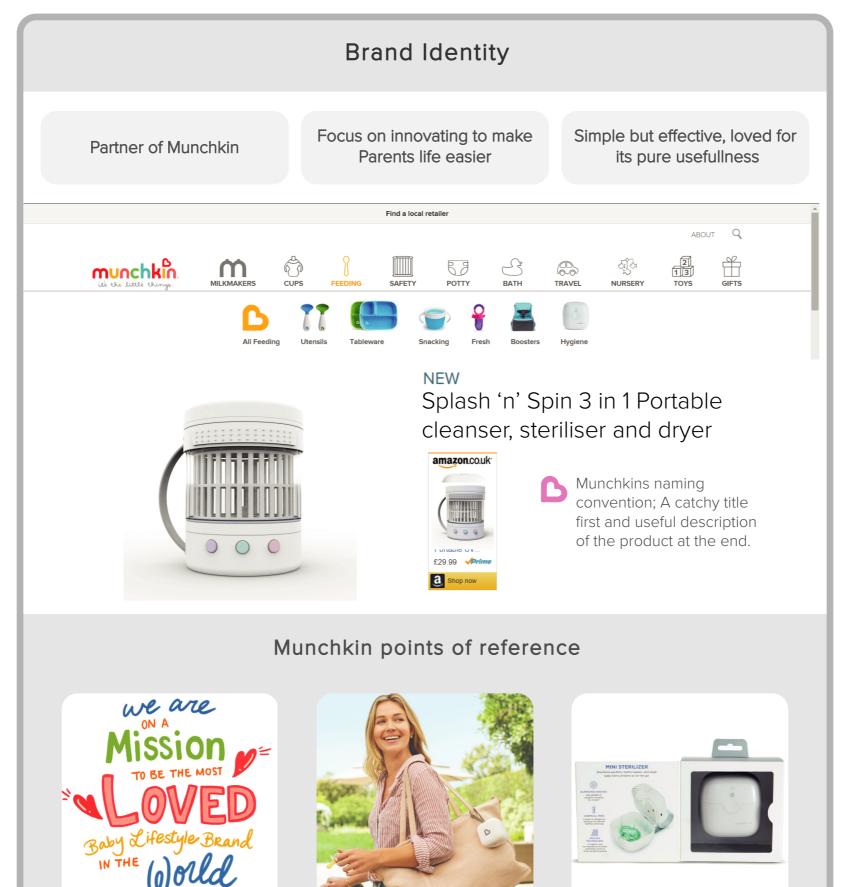
We have analysed similar existing products on the market and found why they just don't work for our users. With Munchkin we can improve and replace these options on their website with a product that users can recognise as better.



Our product concept insights were developed from the users themselves and we have recognised that this friendly connection is what the baby product market calls for.



We felt the need to consider the product landscape as whole, therefore we ensured to find a brand with a motivation for sustainability.



Brand Implementation



PRODUCT

'Simple but effective', adopting the style Munckins product range for adults with minimal colours, smooth edges, and the Munchkin heart, our products pure use-fullness will shine through.



PACKAGING

Munchkin opts for a small amount of packaging that really shows off the product. We admire their sustainable recycled cardboard packaging range and will be sure to design to fit with this.



MARKETING

'Lets keep it friendly', our marketing will not be over the top, we will focus on our connection with people through easy communication, showing why our users should love our product as much as we do.



PRESENTATION AND VIDEO

'Clarity is key', we will keep to the brand in all ways possible, whether that's through the styling of the slides or the way we talk about them. We chose this brand as we genuinely believe in it.



Throughout our presentation boards, we have adopted this clear approach, displaying our information with a few pops of Munchkin's colours and a some graphics to keep you involved, but mainly with concise text and the important stuff at center stage.



Plan and Research

After developing the concept to its fullest we had to ensure that it would work and start designing details. To do this, we divided the concept up into parts and made a plan for how we can validate this part. We planned three steps to achieve this.



Validation and decision making from research

By researching exsisting products with similar parts and functions, we can validate our design and take inspiration.



Prototyping and iterating through CAD modelling

Making a first prototype of the concept in CAD will help identify any problems with dimensions, aesthetics, working parts, etc.



Testing and validating with FEA

Certain features of our product are unique and require full digital testing to ensure their success.



Validation and decision making from research

Fundamental concept features

Dry mechanism





The dry mechanism is inspired by a salad spinner which uses the centrifugal force to push the water to the edges. The inner nest tends to be quite flimsy, our nest may need to be stronger due to heavier weight of items and the addition of water.

Lid lock





This Tommee Tippee blender shows how the same twist lock mechanism is used for **safety** on blenders **for kids** food.

Wash mechanism



*I didn't buy this for lettuce, I use it as a mini

This salad spinner is amazing. No more losing masks in the wash! I bought this hoping I could use it as a mini washing machine. Originally I wanted it for small laundry items. I figured it could at least wash a single dress if I needed it to. You just toos in the clothing item/items, fill it up with water, add your detergent, pop the lid on, and press the button. It stays spinning by itself at a nice speed for around 60 seconds when them's water in it. If the file seconds as

During research, we found that Salad Spinners were also used by some users as mini washing machines which validates our wash concept.

Sterilisation of water with UV is often used for drinking water.

Waterproof lid





Many blenders and storage lids use the same silicone fins as in our design for keeping their products waterproof.

Materials

Materials were found from items with similar functions, then, CES Edupak was used to evaluate these materials to see if they fit the functions of parts in our concept.

ABS

Used in Munchkin portable steriliser and many similar device casings.

Price	Density
1.52-1.79	1030 - 1060
GBP/kg	kg/m^3

- Highest impact strength of all polymers
- Stabilisers easily added for UV resistance and anti-yellow in sun

Will be used for injection moulded base casing and lid casing.

sun

Will be used for central clear section which holds water.

Optical transparency and high

Although not the primary process,

injection moulding is possible.

Poly-carbonate

Density

1190 - 1210

kg/m^3

Used in many blender jugs.

impact resistance

Price

1.79-2.49 GBP/kg

Polypropylene

Used often for kids toys.

Price	Density
1.03-1.06	895 - 909
GBP/kg	kg/m^3

- Inexpensive, light, ductile but with low strength
- Excellent durability in water, easily moulded

Will be used for inner nest as its cheaper and more flexible for removal.

Silicone

Used for collapsible water bottles, handles and seals.

Price	Density
2.9-3.28	1020 - 1220
GBP/kg	kg/m^3

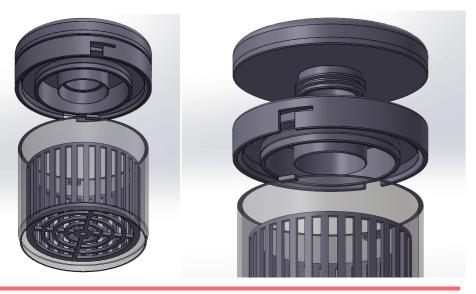
 Expensive but most commonly used for all our necessary parts: Water bottle, O-rings, and straps.

Grips on side of lid would likely be overmoulded with TPE instead.



Creating a prototype of the product in CAD before creating the final version allowed us to check that certain concepts were successful, ensure dimensions were realistic, add necessary parts that were not yet thought about and overall make sure the product looked and worked as expected.

Lid design and screw bottle concepts



The curve of the case impacted the tightness of our locking mechanism, so **shape and size of the extrusions** on the clear middle were adjusted to better align. The **thread and screw** section were designed to fit standard water bottle dimensions and the **thin waterproof seal fins** were modelled to check that the geometry would be realistic.

Assembled product

Once each part was created and assembled, overall dimensions were checked to ensure it was within our concepts specifications, The product stood at 110 mm tall and 84 mm wide at the widest section (Lid) which works perfectly for our portable concept.

Aesthetic wise the product looked proportionally correct and attractive for the inital concept (detail aesthetic design can be seen later in the slides.)





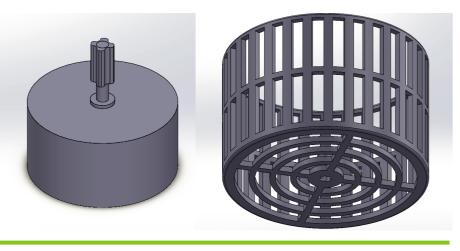






After modelling the cap as drawn in the original concept (attached to top handle), we found that the **attachment** would have to be long to reach the screw top, this would get in the way of the **main product function**. Therefore, the cap was made to be its **own component** that could **attach to anything** (not just the product) with its loop design.





Modelling the nest enabled us to consider its specific design fully, we aimed to create the most simple cut-out design to reduce manufacture cost, however this needed to be tested with FEA to ensure it was fully functional. It was also decided that a gear attachment to the motor with a male form corresponding to the female nest shape should be used to ensure the nest would be stable and spin reliably with the motor.



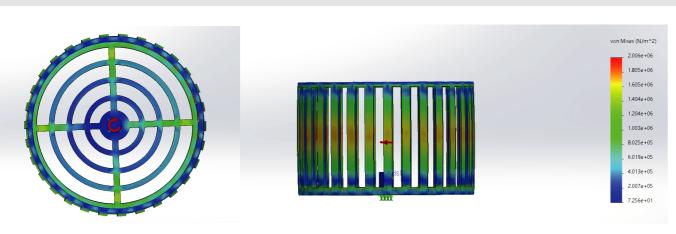


The cross section view tool was used to ensure **geometries** were realistic and successful. A wall thickness of 2 mm was chosen as this is a common size and worked well in the design. There were some problems with interferences of the clear middle with the other parts due to the exact diameter dimensions being used when a small gap would need to be present in the physical product.



For the components and functions custom to our product, FEA digital testing was completed to ensure they would be successful. The nest structure was simulated spinning in water and design iterations were made. The casing was analysed with a drop test and the snap fit designs were tested to ensure the material would not fail at any point.

Nest in water simulation



The initial nest design was simulated spinning with the maximum motor speed. Water was modelled as pressure pushing on the beams.

Stress

2.01 MPa

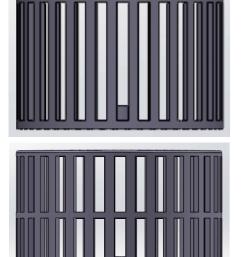
Results were acceptable compared to Polypropylene's yield strength of 23 MPa.

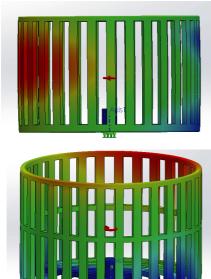
Displacement

0.68 mm

Results were acceptable but displacement should be as low as possible due to the risk of ruining the drying function if the nest touches the sides.

The model was tested again with ABS which decresed displacement to 0.38 mm. However, Polypropylene would fit the parts function better and is less expensive, so the design was changed slightly to increase strength in areas of maximum displacement.





After iteration the displacement and stress were lowered to acceptable values.

Stress

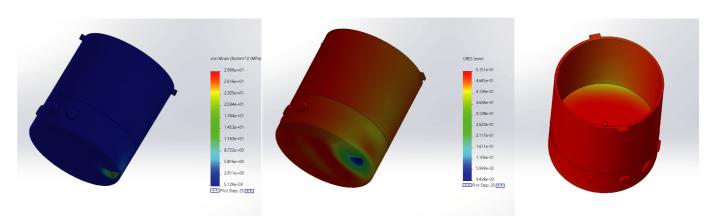
< 1 MPa

Displacement

0.33 mm

Drop test simulation

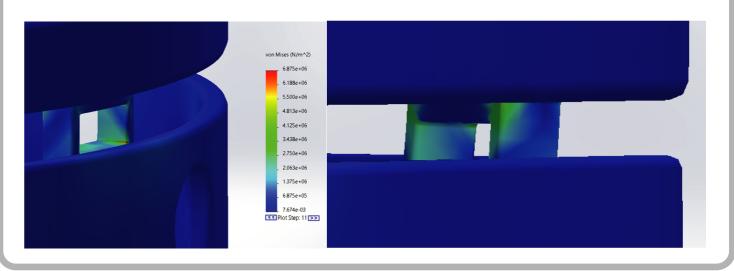
A drop test was performed from a height of 2 m as this is higher than the likely common dropping height. It was dropped on an edge as this would be the weakest area.



The casing experienced a maximum stress of 29 MPa which is close to its yield strength of 29.6 - 48 MPa but as this is a worst case scenario, the product will be able to withstand general use.

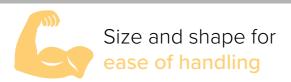
Snap fit simulation

The snap fittings in the base were simulated and tested to ensure they would withstand assembly consditions. The maximum stress of **6.9 MPa** was acceptable for our design.





The first step in designing the details of our product is to ensure the product meets all functional needs. We evaluated key functional parts against these points:





Form and positioning for ease of use



The base

General handling

The diameter of the casing was roughly the same size as the water bottle shown. This was used to model the device and consider the ergonomics of the casing.



The size was perfect for holding the majortiy of the device while still having a clear view of one side when needing to push buttons.

The cylindrical shape and common diameter provides connotations to water bottles so users will expect liquid inside and treat it with care (familiar that the lid should be secure and held upright)

The smooth cyclindrical shape could make it prone to sliding. This can be solved with: the strap supporting the hand, a change of diameter at the lid, and a more matte surface finish.

The handle positioning should be towards the back of the device supporting the hand like the handle of a mug, this will be soft silicone so users can slide their hand in for easy use.

A circular button shape allows for larger spaces between adjacent buttons for less accidental pressing. A diameter of 8 mm and spacing of at least 12 mm from centers would allow for average finger widths of 1.6 - 2 cm. [1]

There should be positive feedback for the users after pressing the buttons: the buttons will have a clear click feeling and the see through plastic will show the device in action.

The buttons should be **colour coded** to their function.

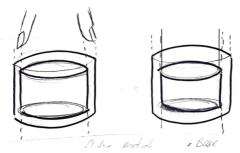
Just UV button: Purple due to UV light colour. Wash cycle: Blue due to water connotations. Dry cycle: Red or Pink due to heat connotations.

The inside nest should have a smaller diameter than planned to allow for easy removal, this should also be a more flexible material to allow some bending.

Ease of use with buttons and nest



The interior of Munchkins steriliser is 63.6 mm x 63.5 mm so ours must be at least this size.



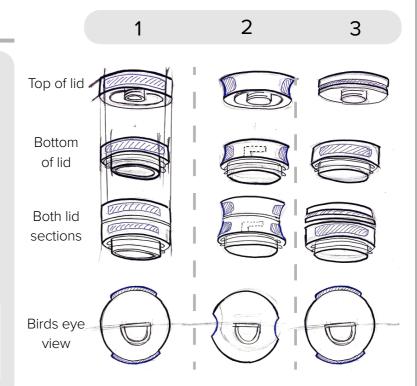
The lid

Grip on lid

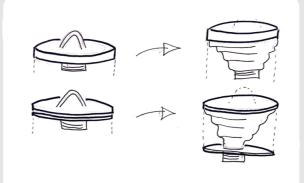
As the lid is in two parts where the top lid needs to be screwed in, then expanded, and the bottom needs to be pushed into the clear middle and then twisted, different grip options were considered in terms of positioning and form:

- 1) Overmoulded TPE grip on both sections
- 2) Indented grip sections on both
- 3) Overmoulded grip on bottom, top casing made shorter to show other layer

Option 3 was chosen as users should only grip bottom for main function, the users should have access to the other layer of the top section for screwing function.



Water bottle expansion



The way in which users expand the water bottle in the top lid section was considered in terms of the handle shape and size, and the bottles form.

It was decided the **stiff ring** for the screw top should be the **same diameter** to make it **less flimsy** and easier for screwing.

The handle was made to be a **small hinged loop** just big enough for one or too fingers in the center of the lid so when pulled the water bottle would **expand evenly and smoothly**.

Making the handle only big enough for one or two fingers means that users are less likely to carry the whole product by this feature which is only meant for the water bottle expansion.



Design for Assembly

We can separate the base of our product in three parts:



CLEAR CONTAINER

EXTERNAL PLATFORM

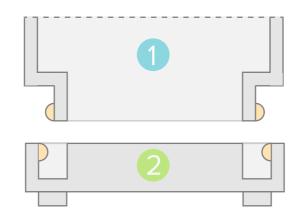
LOWER BASE

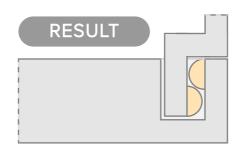
Advantages of **SNAP FITS**

- No additional components
- Hidden from external view
- Makes faster assembly easier
- Done when injection moulded

Attaching the container to the platform

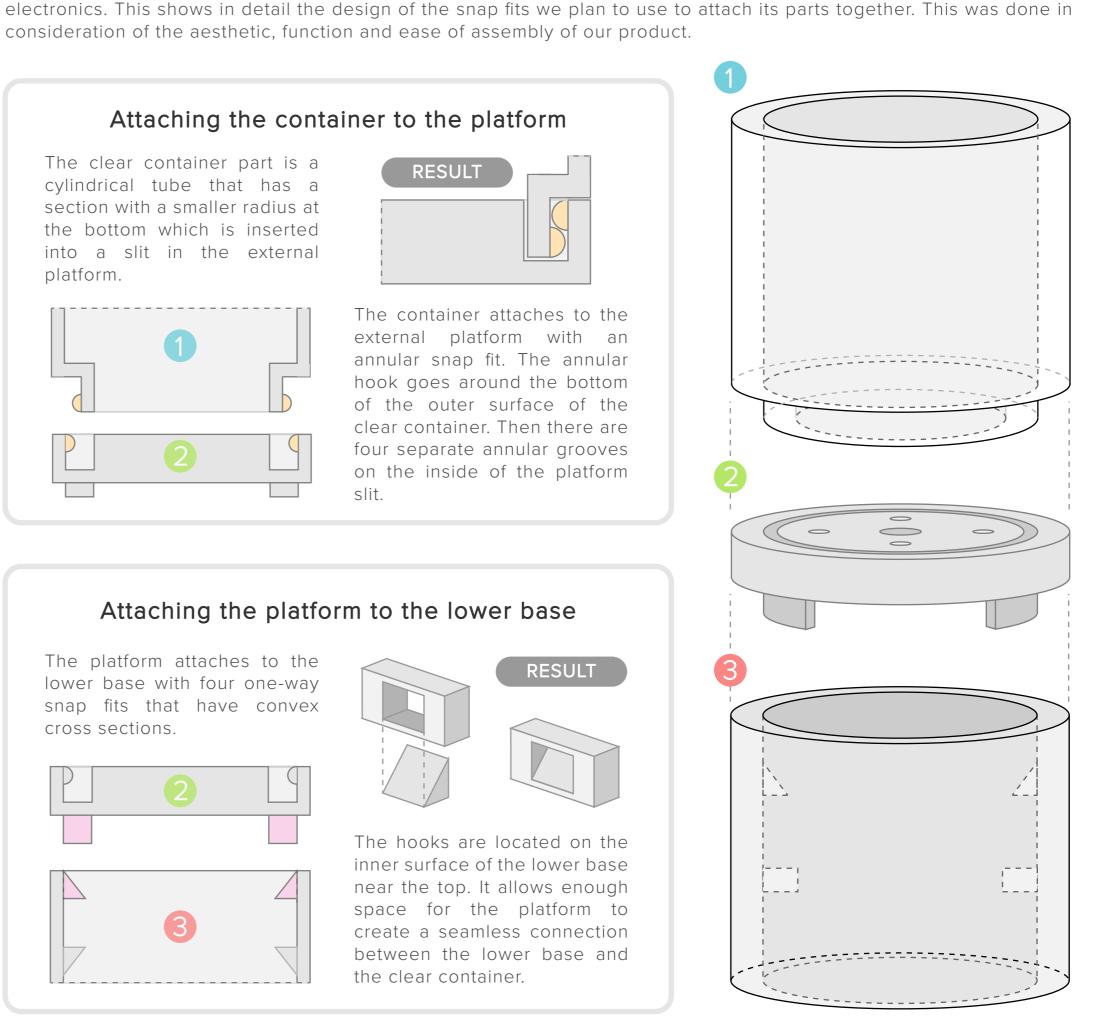
The clear container part is a cylindrical tube that has a section with a smaller radius at the bottom which is inserted into a slit in the external platform.





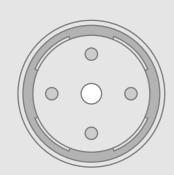
We decided to focus closely on the base of our product since it is the main part of the product and contains all of the

The container attaches to the external platform with an annular snap fit. The annular hook goes around the bottom of the outer surface of the clear container. Then there are four separate annular grooves on the inside of the platform slit.



Details of the PLATFORM

The external platform is used to attach the container to the lower base and to provide a waterproof seal between the two.



It has a hole in the middle to allow the motor to connect to the nest component with a silicon ring to seal the gap.

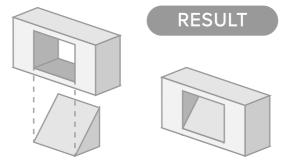
The four holes in the surface for the UV LED's which will have a thin waterproof seal.

Attaching the platform to the lower base

The platform attaches to the lower base with four one-way snap fits that have convex cross sections.







The hooks are located on the inner surface of the lower base near the top. It allows enough space for the platform to create a seamless connection between the lower base and the clear container.

Detail Design

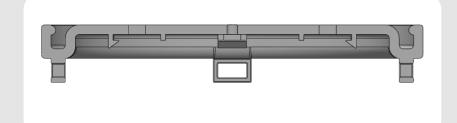
Designing for injection moulding

The two parts that we designed specifically for injection moulding are the **LID** and the **BASE**. To do this we followed design rules for the **WALL THICKNESS**, the **CORNERS**, and the **RIBS** in these parts. We aim to show the detail from these two parts that make them easier to manufacture and assemble.

Wall Thickness

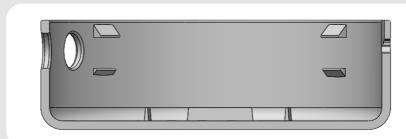
Wall thickness variation was minimized by only excluding ribs and snap fits from the uniform wall thickness of 2mm. Those areas needed a thinner wall for function. We ensured these variations occurred in a gradual transition.

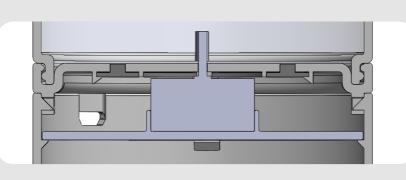




Corners

Sharp corners were avoided, and corner wall thickness was kept at 2mm. The internal radius of corners was kept at 0.5 times the wall thickness (1mm).





(3)

Ribs

Ribs were added at the inner bottom surface to provide support and keep the internal electrical components in place. The ribs are tapered, have a thickness of 50% of the wall thickness and a depth of less than 5 times its thickness.



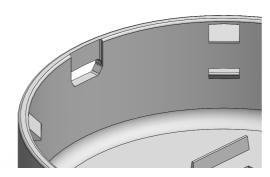
Details of the LID



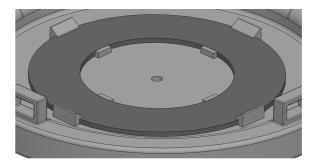
The lid is a single piece containing the additional water bottle. Injection moulding the lid allows for the TPE grips to be over moulded.

Details of the BASE

The path for the micro-USB slot has half wall thickness so



Four snap fits are being used to hold the LED PCB in place tight against the top of the base.



There is an **internal platform** inside the base to hold the motor and the main PCB in place.



It is asymmetrical and has a finger hole on one side to allow easier handling during assembly.

Detail Design

Aesthetics



Finishes

To choose the finish of the material for our product we compared how they were percieved in terms of **VALUE**, **STRENGTH** and **QUALITY**.

Matte	Textured
	06365650
	\$35000E
8 / 10	6 / 10
7 / 10	8 / 10
8 / 10	7 / 10
	8 / 10 7 / 10

We chose **MATTE** finish because it is the material finish with the best balance between its perceieved value, quality and strength.

for Parents

To appeal to our target user we considered how details in the product would convey to parents that it is **SAFE** and **TRUSTWORTHY**.

General Form



- Its form and aesthetic makes it be percieved as friendly and inviting.
- The round corners make it safe to have around children or babies.

Seals

- We use sillicone rings to make it waterproof.
- They are also used in tupperwares making it familiar for parents.









Motor Selection

Early on in our iterative deisgn process, we looked for a suitable motor to fit whithin our small casing. There where five main requirements that guided our research:

- sufficient RPM
- sufficient torque
- very small size
- appropriate voltage
- 6 low price

Torque Evaluation

Considering that the small spinning basket in the device would be submerged in water (viscosity of 1 mPa.s at ambient temperature), we calculated the minimum torque required to spin it against the opposite viscous torque of the water:

$$\vec{\tau}_{viscous} = -8\pi R^3 \eta \vec{\Omega}$$

$$\vec{\tau}_{viscous} = -8\pi 0.035^3 * 0.001 * 290.85$$

$$\vec{\tau}_{viscous} = -0.0003 \ Nm$$

If we assume that the viscous torque is linear in the instantaneous angular velocity, then the basket under the influence of a constant external torque τ reaches terminal angular velocity when the external torque and viscous torque are equal in magnitude but opposite in direction.

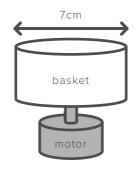
Thus, the minimum torque required for the motor is:

$$\vec{\tau}_{motor} = 0.0003 Nm$$

RPM Evaluation

As the main element of comparison for our centrifugal based cleaning and drying system, we looked at salad spinners. They usually work with a pump mechanism that spins the salad fast enough that the water is ejected due to centrifugal force.

With constant manual pumping, the inner basket in a common salad spinner rotates at an average of 600 rpm (62.83 rad/s). The baskets of salad spinners typically have a diameter of about 25cm and weigh about 50g, while a wet salad weighs about 250g.



While our design relies on the same principles, our product would be much smaller with a diameter of 7cm. Therefore, it would require a higher angular velocity to achieve the same centrifugal force with a motor.

To equate the centrigugal force achieved by the salad spinner, we calculated the following:

$$F_{cleaner} = F_{salad}$$

$$m_c \omega_c^2 R_c = m_s \omega_s^2 R_s$$

$$\omega_c = \sqrt{m_s \omega_s^2 r_s m_c r_c}$$

$$\omega_c = \sqrt{\frac{0.3 * 62.83^2 * 0.125}{0.05 * 0.035}}$$

$$\omega_c = 290.85 \ rad. \ s^{-1}$$

Thus, the minimum angular velocity of the motor should be 290.85 rad/s or 2777 rpm.

Selected Motor



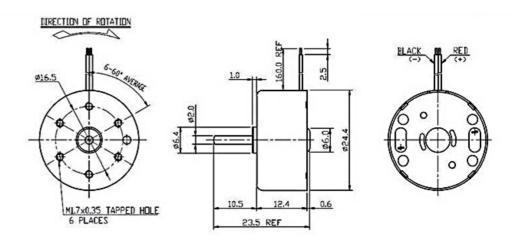
Product Details	
Brand	Haoxin
Continuous Current (A)	0.02-0.04
Voltage (V)	3.0-6.0
Output Power (W)	0.11-0.25
Speed (RPM)	3000-5500
Torque (G.CM)	18-23
Efficiency (IE)	1
Weight (g)	20.5
Certification	ce, RoHS, EMC
Price (\$)	0.39







RF-300				4							
	VOLTAGE		NO LOAD		AT MAX EFFICIENCY				STALL		
MODEL	OPERATING RANGE	NOMINAL	SPEED	CURRENT	SPEED	CURRENT	TORQUE	OUTPUT	EFF	TORQUE	CURRENT
	(V)	(V)	(rpm)	(A)	(rpm)	(A)	(g.cm)	(W)	(%)	(g.cm)	(A)
RF-300CA-11440	2.0-5.0	3.0	3000	0.015	2400	0.065	4.30	0.11	56.4	23	0.28
RF-300CA-14270	1.0-4.0	1.9	3500	0.032	2700	0.120	3.80	0.11	48.2	18	0.42
RF-300CA-10370	1.5-4.5	3.5	5490	0.035	4156	0.109	4.13	0.18	47.2	17	0.34
RF-300CA-13390	3.0-6.0	3.0	5140	0.038	4062	0.143	6.08	0.25	58.3	29	0.54



Both the speed and torque rating of the mother are well above our established requirements:

5500 rpm > 2777 rpm and 0.0023 Nm > 0.0003 Nm

The size and shape are ideal to fit within the casing of the device and the operating voltage of the motor is low enough. This component is very cheap and is marketed to be bought in bulk, which makes its suitable for mass production.

Power & Load Calculations Technical Evalution of UV-C LEDs, Battery & Electrical Components

Selected UV-C LEDs

The choice of UV-C LEDs was straightforward as we decided to use the same as Munchkin for their 59S Mini Portable UV-C Steriliser Plus. The company partnered with 59S, the leader in UV LED technology. They manufacture high quality gold-plated UV LED lights which are mercury and ozone free.

Although for the most part they work the same as regular LEDS, they have much larger forward voltage (4.5V) due to the high bandgap energy associated with their much smaller wavelength.

We settled on using 4 of them, similarly to the Munchkin design.



Additional Electrical Components

We needed a circular circuit board to fit in the casing of the device. On the board would be a microcontroller, 3 buttons and a micro-USB port to charge the battery.

Four resistors would be needed for the UV-C LEDs and one for the motor, to avoid damaging it. There ideal resistance being:

 $R = \frac{(V_{src} - V_{LED})}{I_{LED}}$

for UV-C LEDs

 $R = \frac{(7.4 - 4.5)}{0.02}$

 $R = 145 \Omega$, so standard 150 Ω

for motor

 $R = \frac{(V_{src} - V_{mtr})}{I_{mtr}}$

 $R = \frac{(7.4 - 6)}{0.03}$

 $R = 47 \Omega$

A potentiometer would be required to control the speed of the motor as well.

Additionaly, the motor, battery and LED's would all be connected via cables to the circuit board.

circuit board & microcontroller



micro USB port



buttons





UV-C LEDs



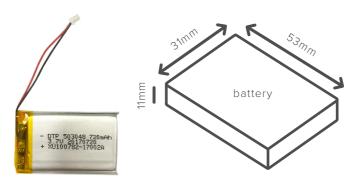


Battery Selection

We searched for Lithium-ion polymer rechargeable batteries because they are smaller and more robust than traditional Lithium-ion batteries. There where three main requirements that guided our research:

- sufficient voltage
- very small size
- 3 provides over a 100 uses on a full charge (same as the Munchkin device)

Since the motor uses 6V and the UV-C LEDs uses 4.5V, the battery needed to provided a minimum of 6V. Li-on cells have a nominal voltage of 3.7V, so we had to use a 2S battery of 7.4V.



Product Details	
Brand	DATAPOWER
Battery Type	Li-ion polymer
Capacity (mAh)	720
Voltage (V)	7.4
Approximated Current (A)	0.02
C-rating	1C
Price (\$)	3.2

This battery has an ideal size to fit in the casing and the shape can be altered on demand according to the seller.

Finally, we estimated the number of cleaning cycles (1 minute long) that the battery would be able to power on a full charge, using Peukert's equation. We assumed the Peukert exponent to be 1.25, which is a default value. We also estimated the total load current needed to power the motor (0.03 Ah) and 4 UV-C LEDs (0.02 Ah):

$$C_p = R\left(\frac{C}{R}\right)^n$$
 $t = \frac{C_p}{I^n}$ $t = 0.03 + 0.02 * 4 = 0.11 A$ $t = \frac{0.66}{0.11^{1.25}}$ $C_p = 0.66$ $t = 10.4 \ hours$

Li-on batteries have an efficiency of 99% and this one has a cut-off voltage of 6V. Therefore, the real discharge time would be:

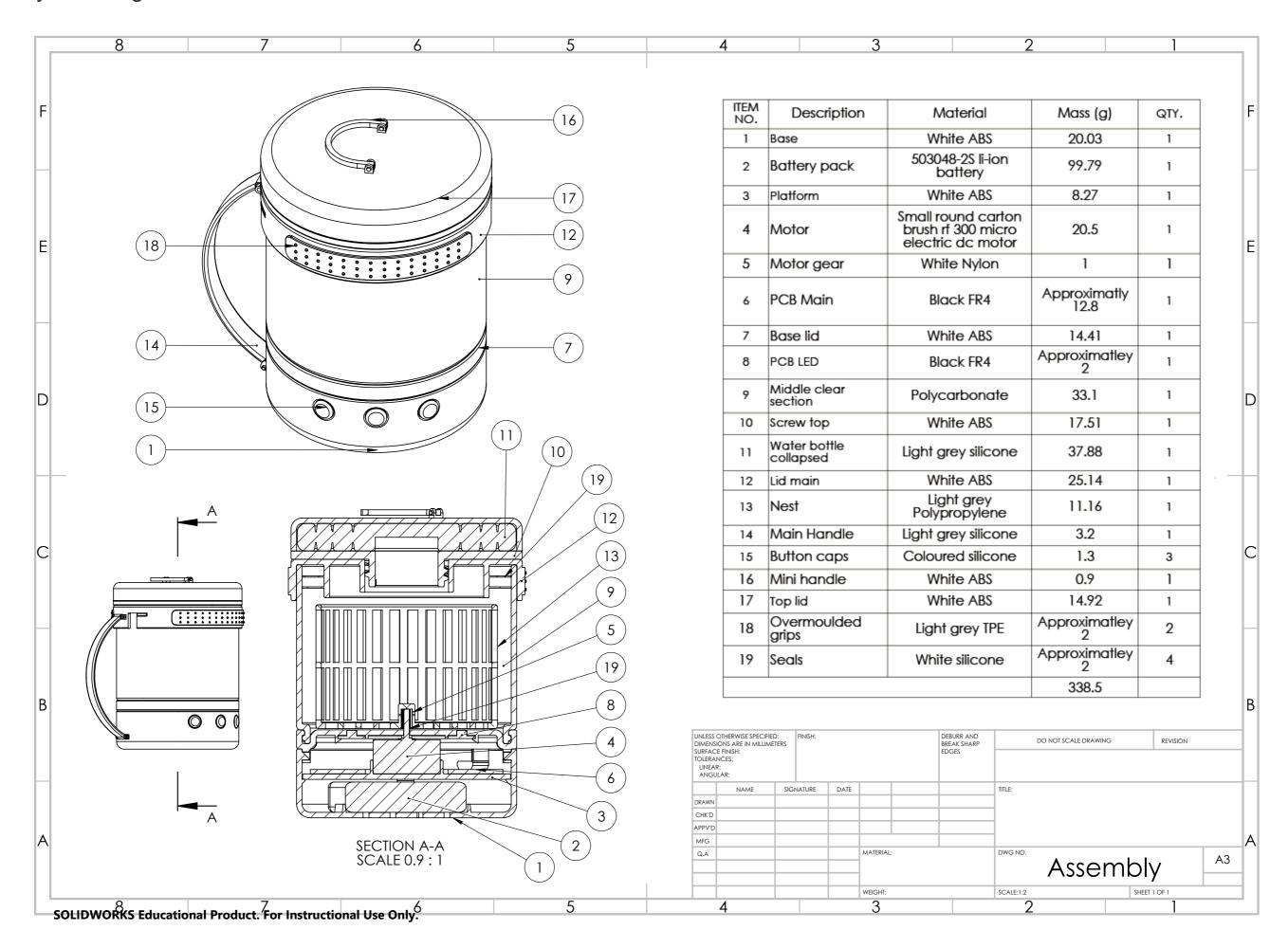
$$10.4 * 60 * \left(1 - \frac{6}{7.4}\right) * 0.99 = 117 \text{ minutes} = 117 \text{ cleaning cycles per full charge}$$

Assembly solid bodies

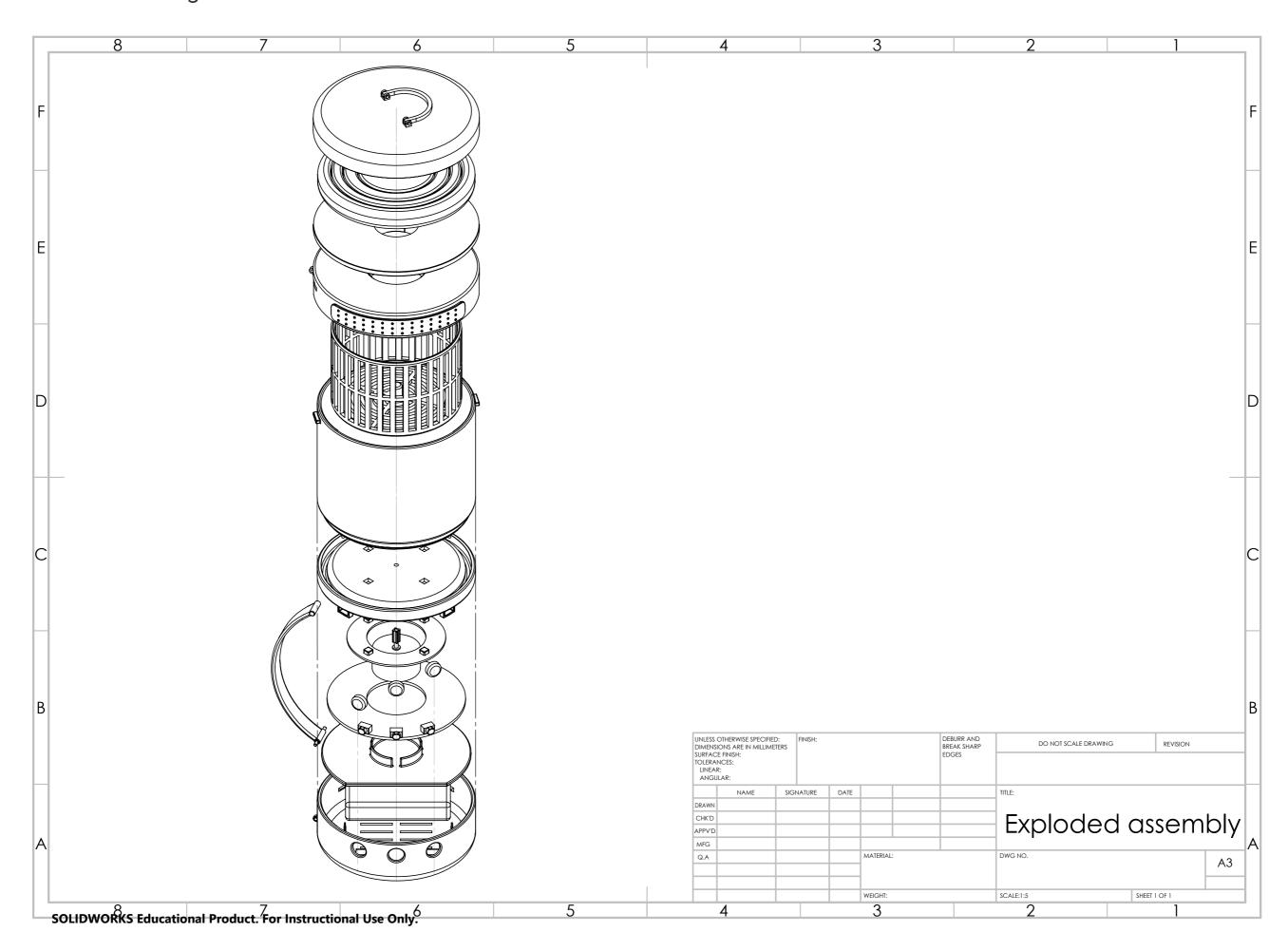




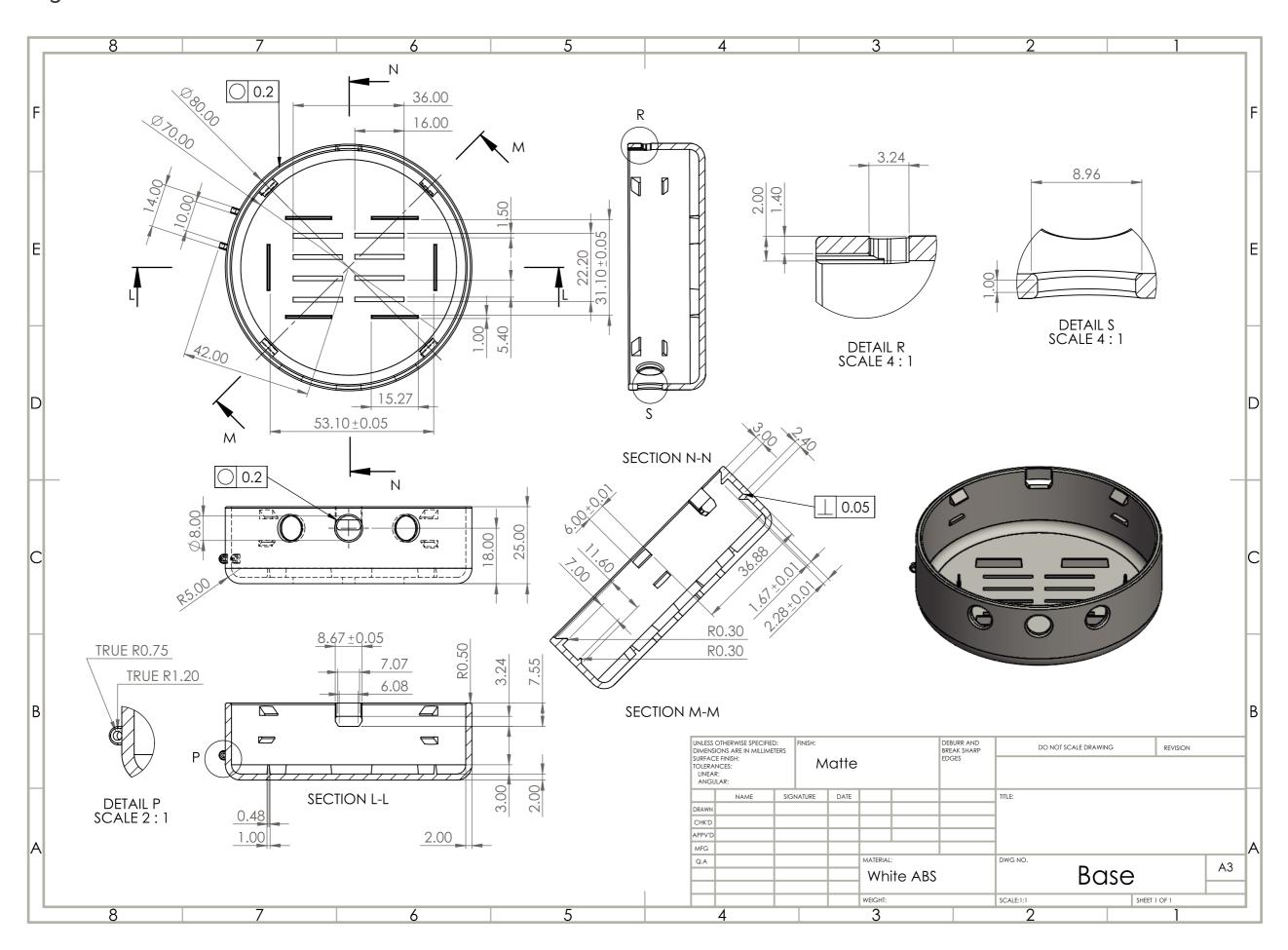
Assembly drawing



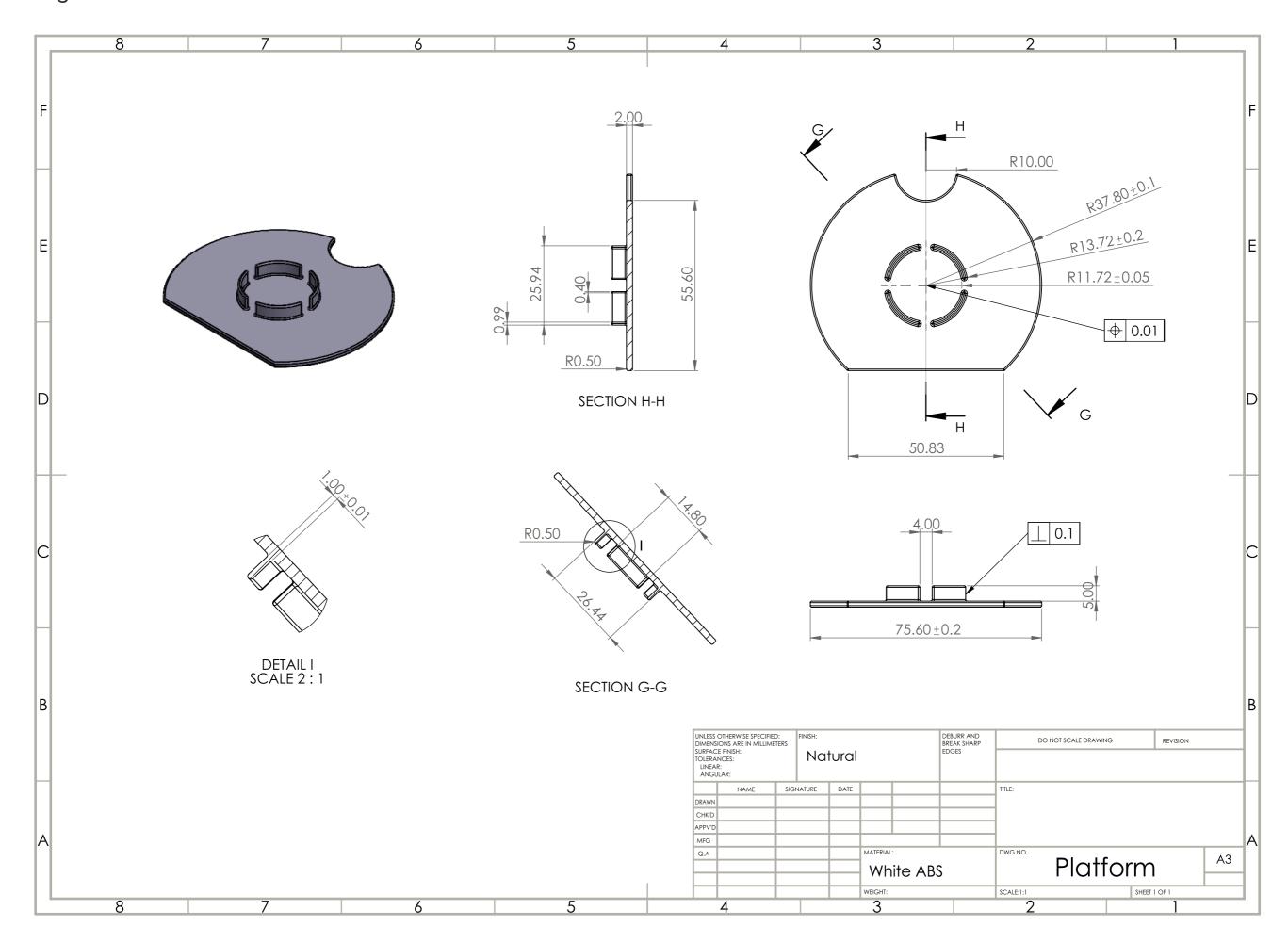
Exploded view drawing



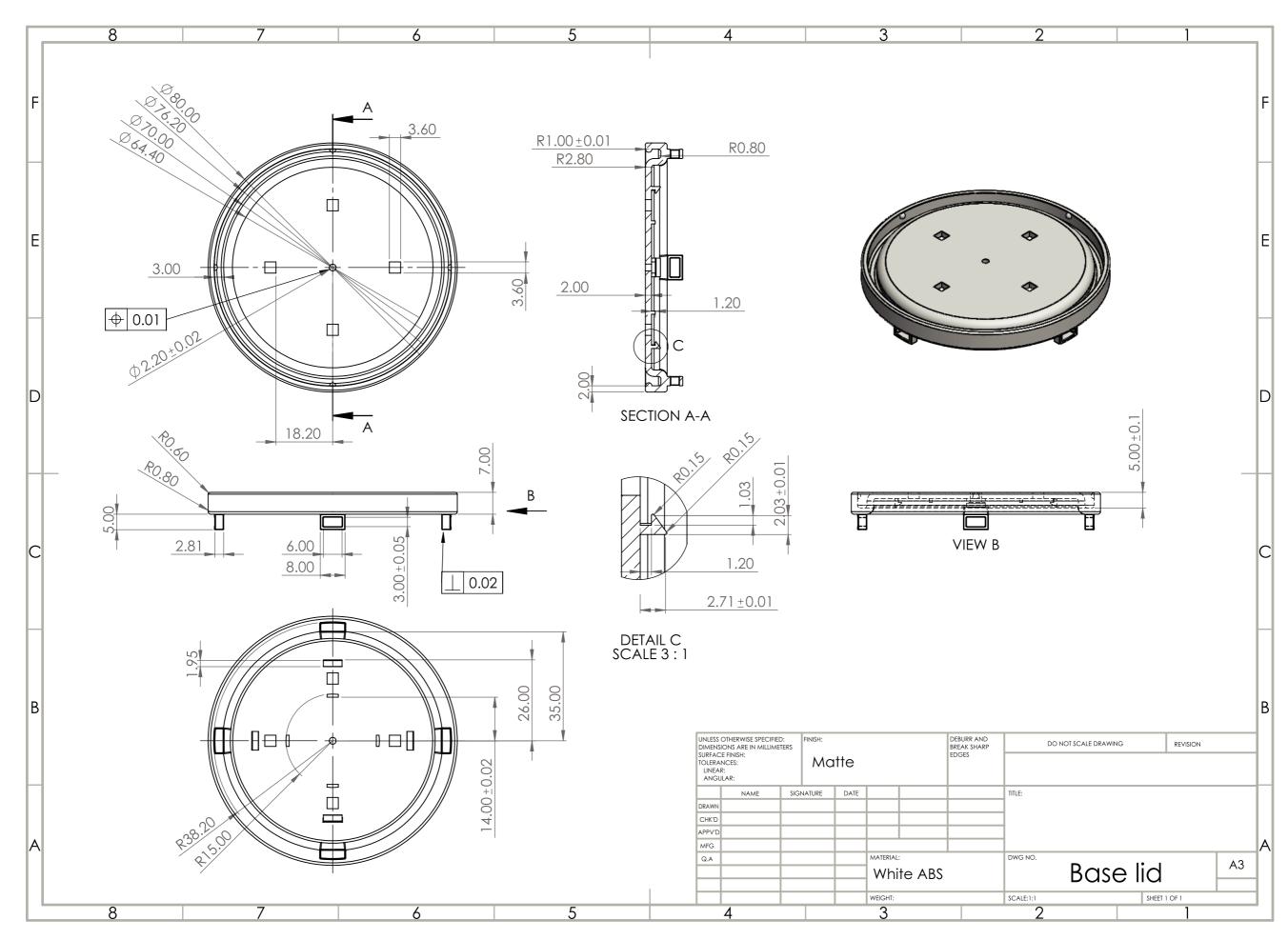
Part drawing: Base



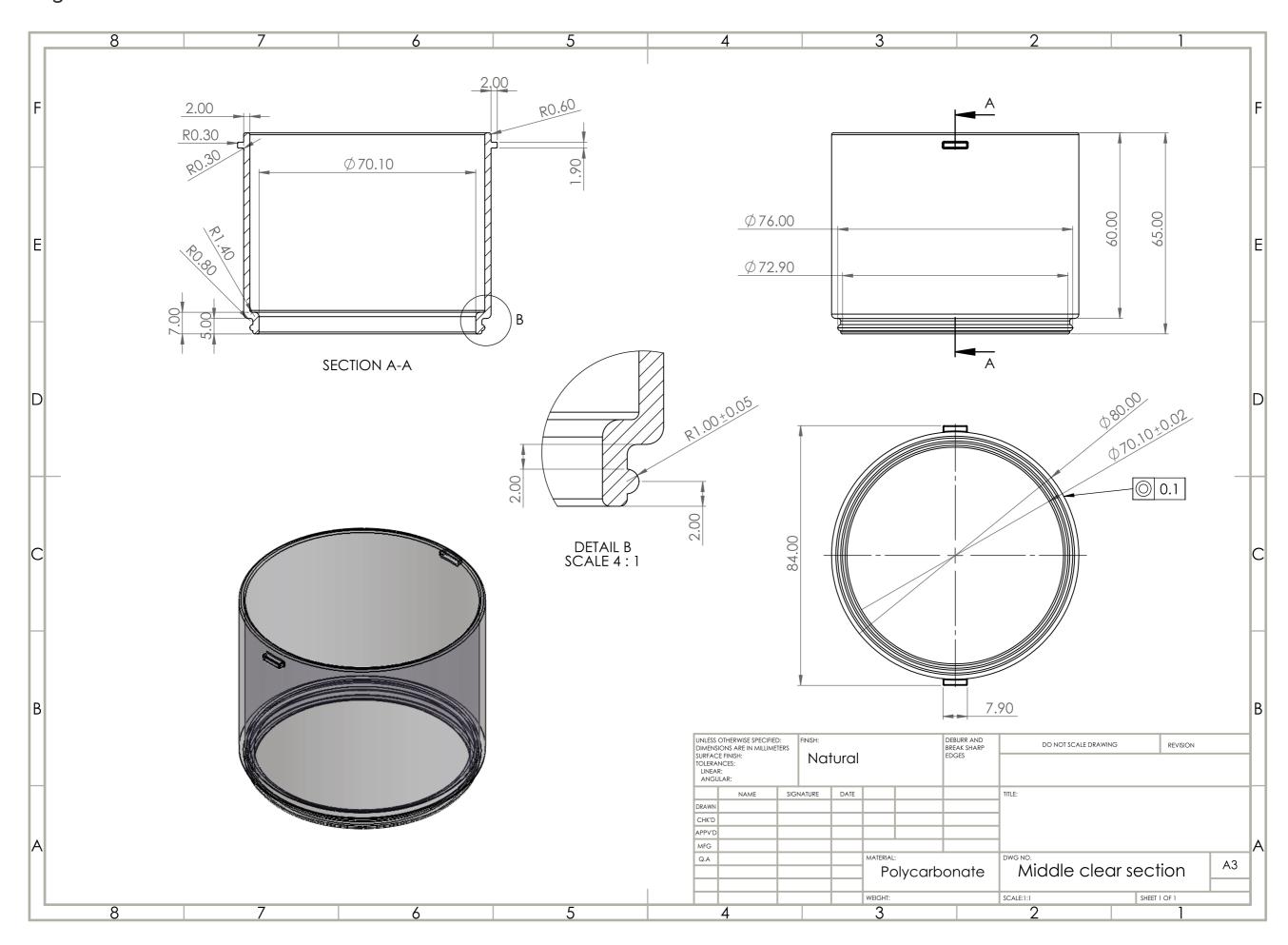
Part drawing: Platform



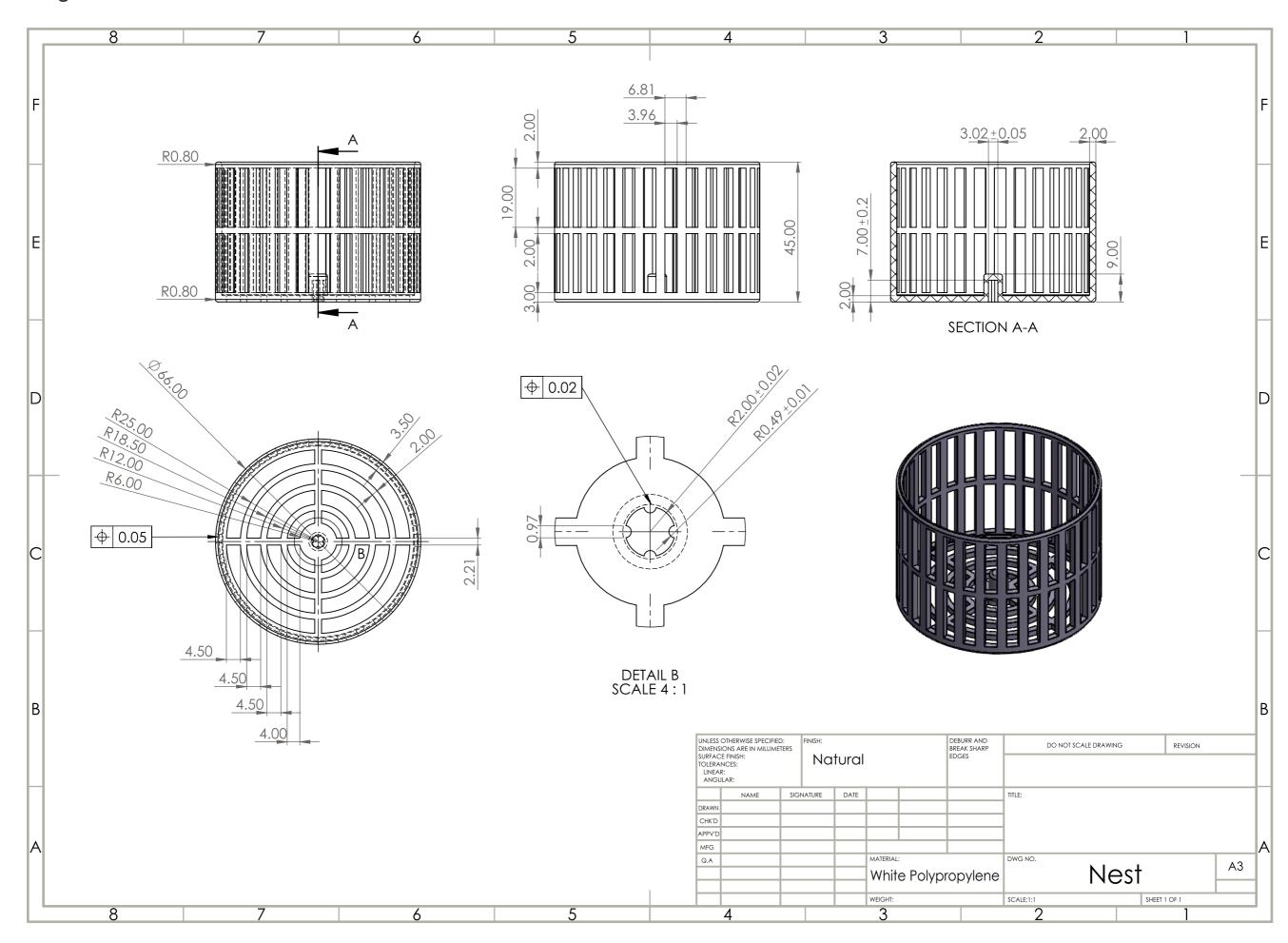
Part drawing: Base lid



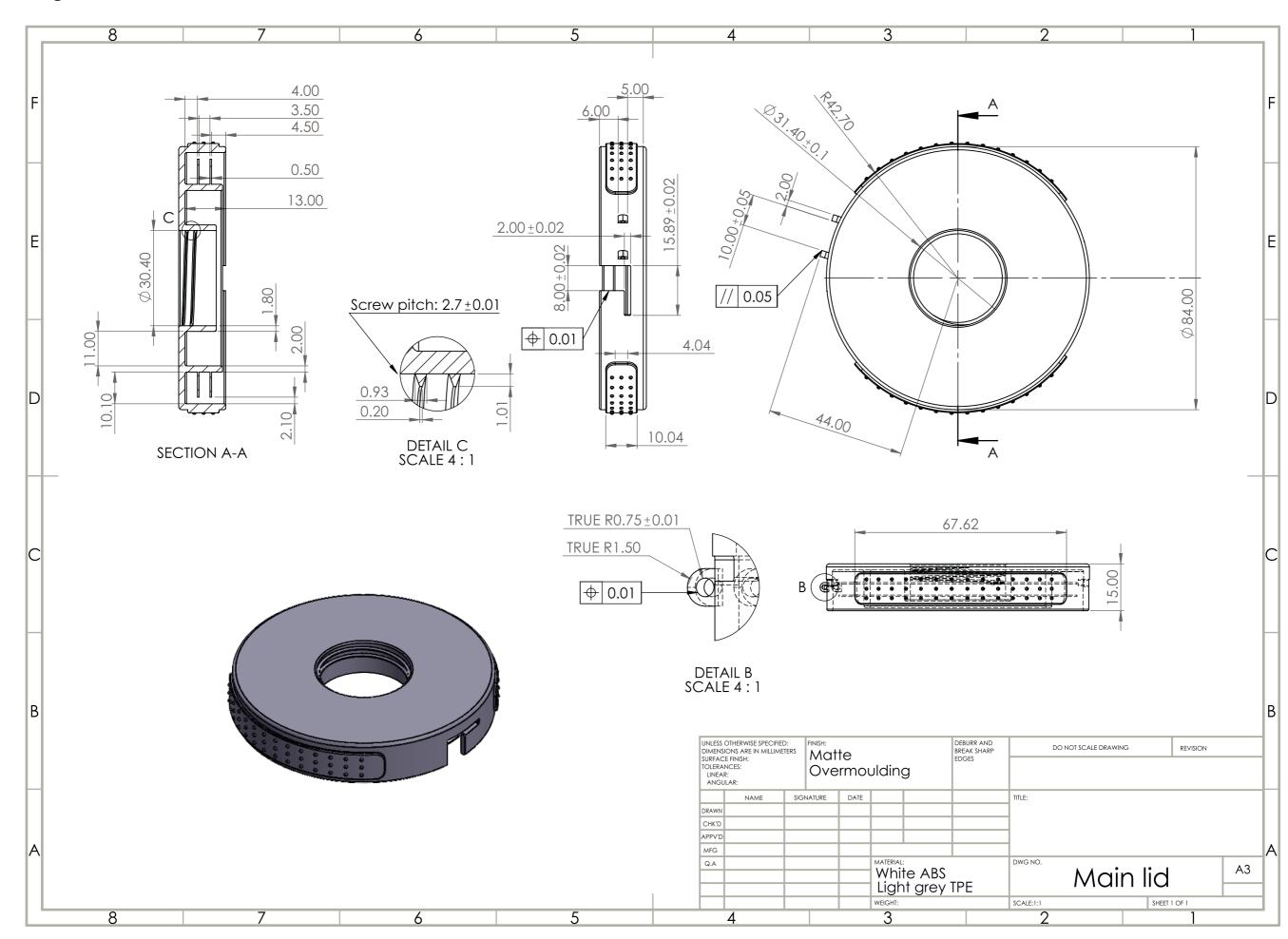
Part drawing: Middle clear section



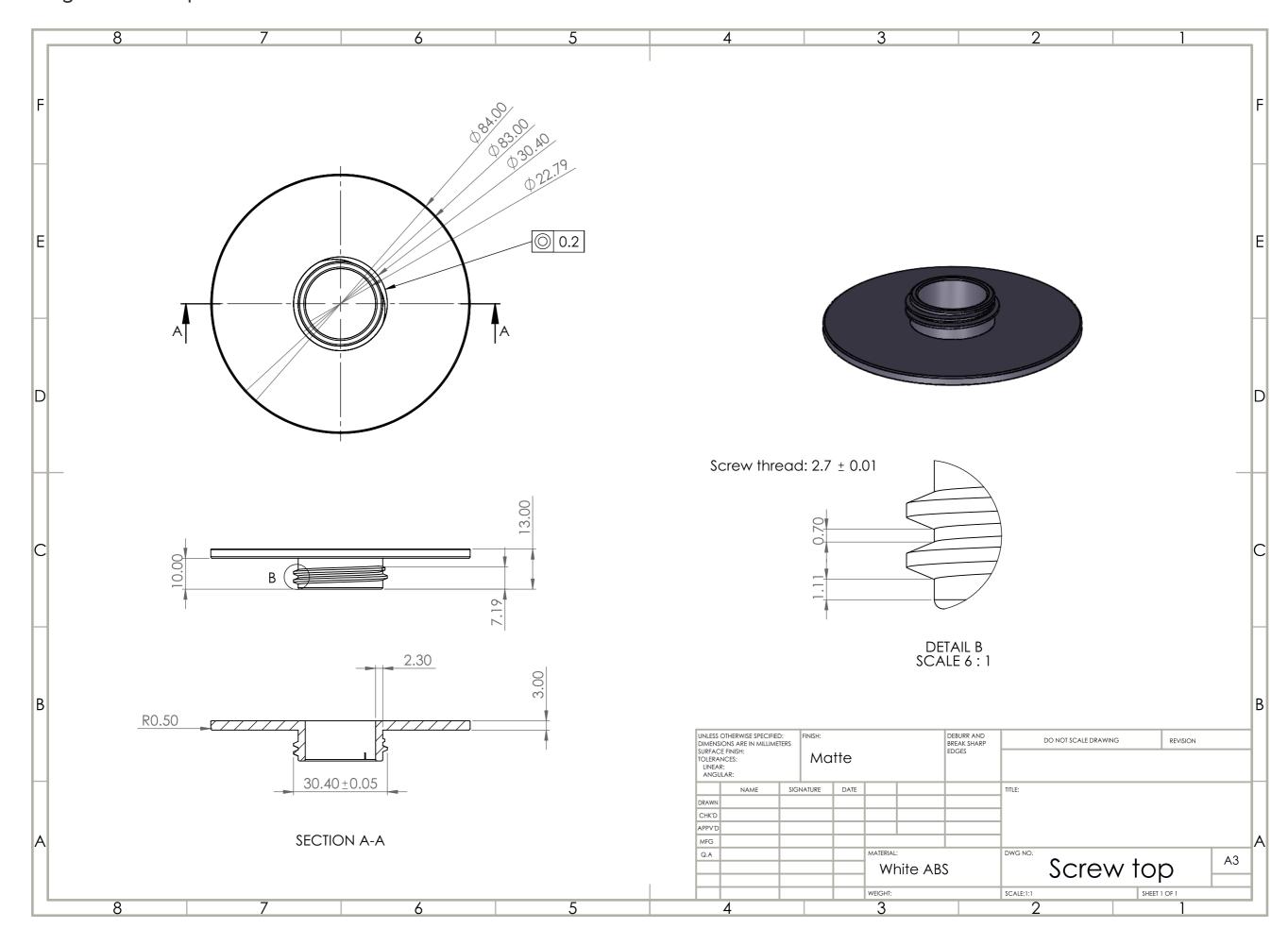
Part drawing: Nest



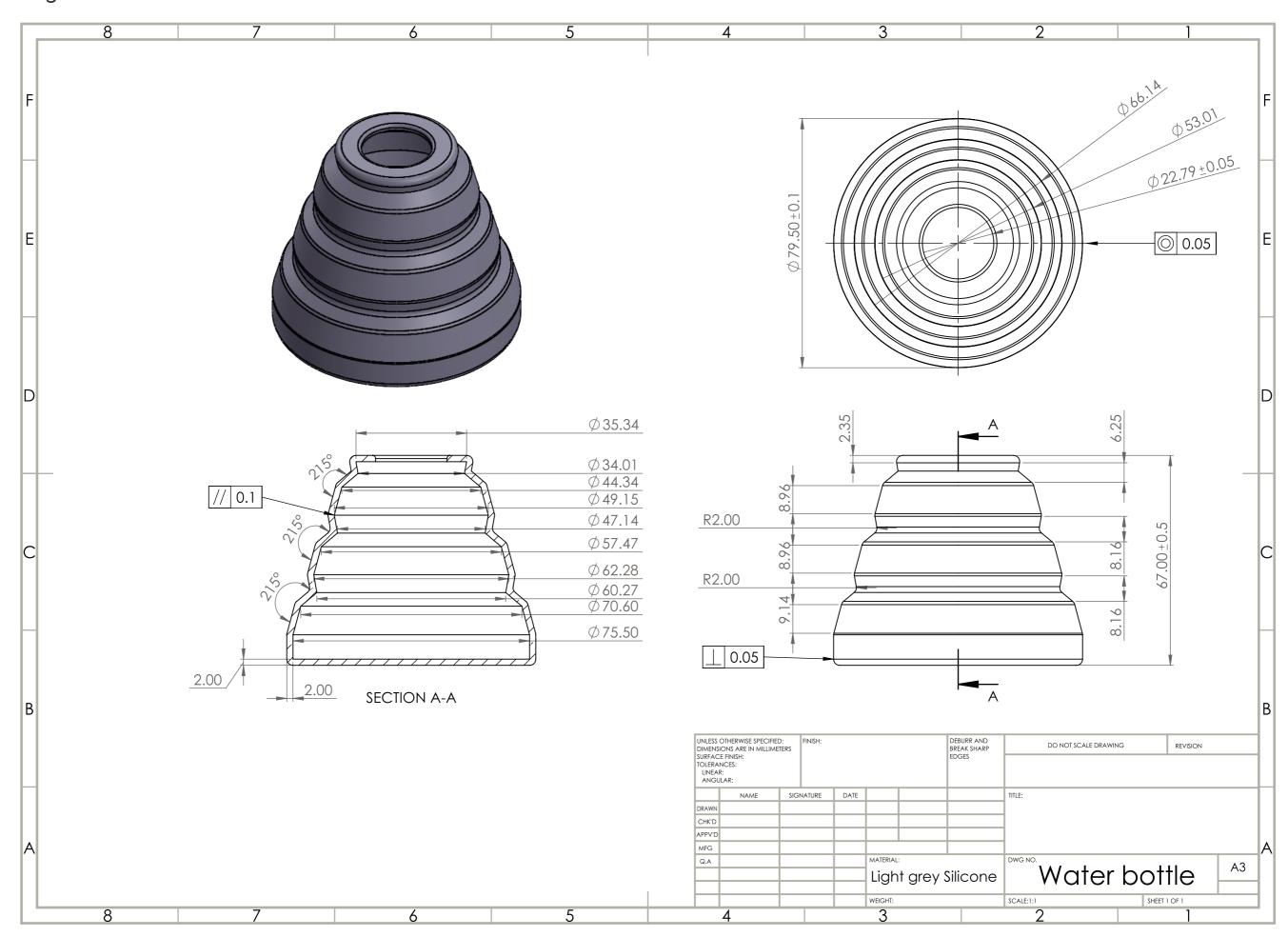
Part drawing: Main lid



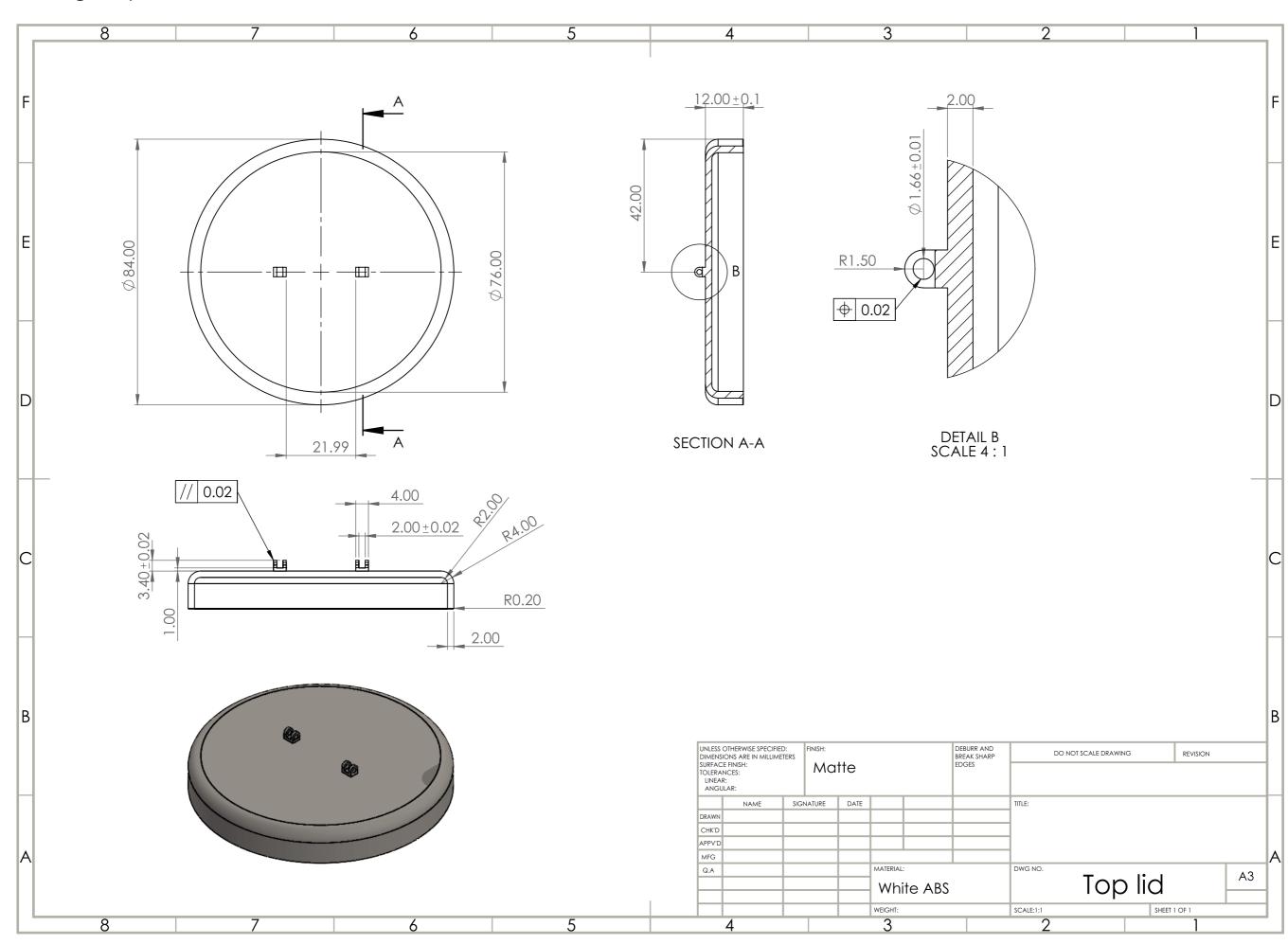
Part drawing: Screw top



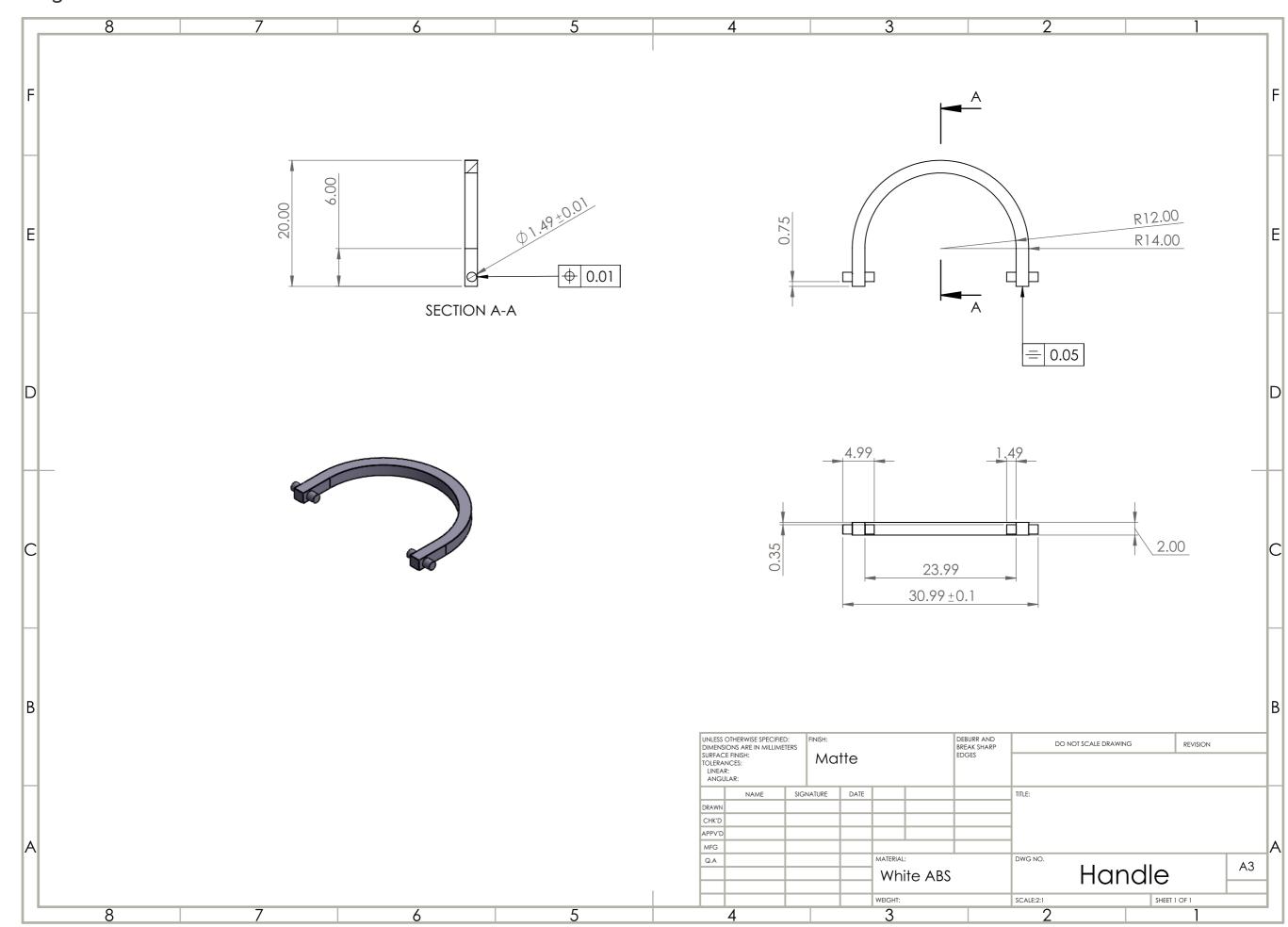
Part drawing: Water bottle



Part drawing: Top lid



Part drawing: Handle



Product assembly **b**

Part production

Before assembly process was considered, each brought-in and custom manufactured part were evaluated in terms of production process and part cost.

Costs for custom manufacture parts were estimated using the solidworks costing tool. As Munchkin is a large company, it was assumed that our product would be mass produced with a quantity of 10,000 parts, labour rates were assumed to be 7 USD/hr and mould cost was estimated with an online quote generator. [9]



Brought-in components

Finished	d part	Website reference		Cost pe	er part	Quantity
	Motor	[1]	Alibaba	\$	0.25	1
- UTC 98/3/46 720 min - 37/3/3/3/2016 720 min - 37/3/3/3/2016 720 24	Battery pack	[2]	Made in China	\$	2.68	1
	Main PCB	[3]	All PCB, PCB quote generator	\$	0.55	1
	LED PCB	[4]	All PCB, PCB quote generator	\$	0.57	1
40	Motor gear	[5]	Alibaba	\$	0.03	1
	J	[6]	Motor seal: AliExpre	ess	0.61	1
	Sllicon	[7]	Outer ring: AliExpre	ss \$	0.19	1
	seals Silicone	[8]	Lid fins: Mould cost estimator	Ť	0.60	2
	handle and button caps	[9]	Mould cost estimate	or \$	0.80 0.60	1 3
	Bottle cap	[10]	Mould cost estimate	or \$	0.80	1



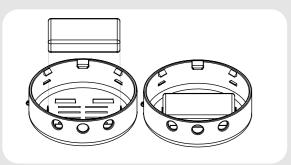
Material	Mould estimate	Cos	t per part	Finished part		
White ABS	\$ 15,000	\$	2.15	Base		
White ABS	\$ 5,000	\$	1.12	Platform		
White ABS	\$ 10,000	\$	1.68	Base lid		
Polycarbonate	\$ 10,000	\$	1.64	Clear middle		
White Polypropylene	\$ 10,000	\$	1.69	Nest		
White ABS TPE overmoulding	\$ 25,000	\$	3.16	Main lid		
White ABS	\$ 5,000	\$	1.13	Screw top		
Ligth grey Silicone	\$ 8,000	\$	1.50	Water bottle		
White ABS	\$ 5,000	\$	1.12	Top lid		
White ABS	\$ 3,000	\$	0.90	Small handle		

Total Cost: \$ 25.57 \$ 9.48

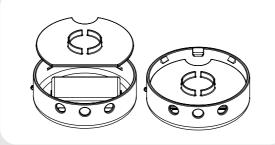
£ 18.12

Product assembly **b**

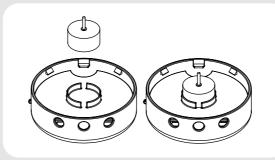
Product assembly process



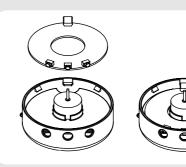
1 Place battery pack in base ribs



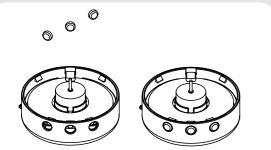
Place platform on lower shelves with flat face at front



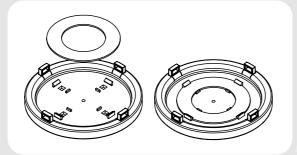
Place motor in platforms circular ribs



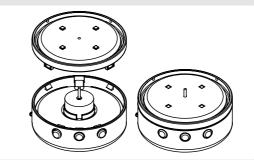
Place PCB on platform aligning all components with their slots



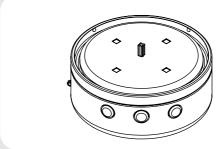
5 Place button caps on buttons



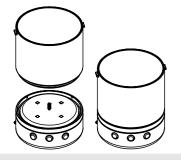
Place PCB in underside of base lid by clipping into snap fittings



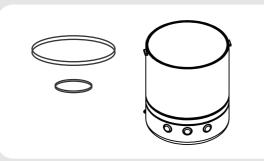
Place base lid on base by aligning snap fittings and pushing down



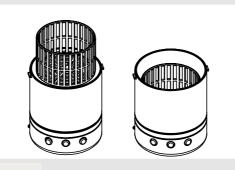
8 Place motor gear on motor tip



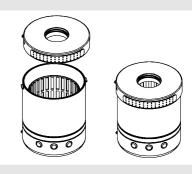
9 Apply adhesive to base lid groove and push clear middle into snap fittings



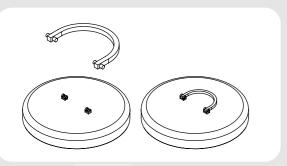
10 Insert silicon o-rings around motor hole and inside seam



11 Place nest on motor gear



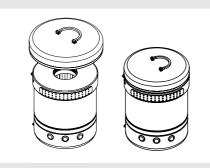
12 Attach main lid



13 Assemble small handle on top lid



Assemble water bottle with top lid and screw top components.



15 Screw top lid into main lid

Attach silicone handle and complete assembly



Product Compliance

Researching Regulations and Assurance

To successfully rollout a product onto the market, it is essential to attain relevant certifications for distribution globally. Initially, we research important regulatory powers in areas of interest, as well as **STANDARDS**, directives and **REGULATIONS** in categories possibly pertaining to the designed product.

Key aspects of regulations

Location

Regulatory bodies who certify consumption goods vary within a given nation. For our product, we will focus on the US and UK.



CPSC



OPSS

□ Blanket Legislations

Any product that is manufactured and/or distributed in the UK must follow the General Product Safety Regulations 2005 (GPSR). It also outlines risk assessments.

In the US, Liability law varies in each state but checks are made by the same federal agency.

User Group

Third party testing is required to certify the product is meant exclusively for adults. This is determined by the CPSC and OPSS.

Medical vs Biocidal

Our disinfecting product is meant for general purpose so it classifies as a biocidal device, regulated by the GB Biocidal Products Regulation.

In the US, UVC devices need FCC authorisation and a Supplier's Declaration of Conformity.

Conformity and assurance

These assessments determine if a product can be sold in a specific economic area. The UK Conformity Assessed (UKCA) marking would be required in our product.

Electronics

In the UK, devices with electronic component follow the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (No. 3032).

In the US, The FCC and CPSC regulate electronics.

Standards

Consumer goods must comply by design, engineering and manufacturing standards detailed by organisations like ISO, BSI, etc.

The **UL1642 standard** applies to our use ofrechargeable Li-ion batteries. Others may apply to the micro-USB cable of the product.



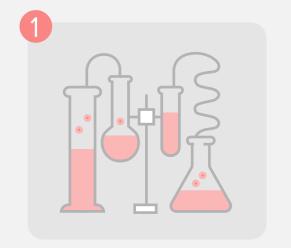
The British Standards Institute certifies the guidelines to follow in manufacture. The ISO certifies organisations, not products.



The standard for **Restriction of Hazardous Substances** (RoHS)
applies to our use of materials in
the manufacture of electronics.



Process of certifying consumer goods



Lab testing



Application



Evaluation



Decision



Surveillance

Product Compliance

Munchkin Compliance

We studied **REGULATIONS**, **STANDARDS** and their **ASSESSMENTS** by looking at the ones followed by MUNCHKIN and its products, divided as **ORGANISATIONAL** or **PRODUCT-related**. We also studied the compliance followed by **59S**, the company that partenered with munckin for the UV sterilisers.

Organisational regulations and assesments

△ 16CFRPART820

'Current Good Manufacturing Practice' regulations include all stages of a product from design to packaging to labelling and installation.



CAPA

Corrective-And-Preventati ve-Actions evaluates FDA organisational regulations. Looks into systemic issues and hazards concers.





Quality Audit

A systematic evaluation of business processes related to FDA QSR and ISO9001. Looks for guarantees of health and safety.



□ ISO9001 QMS

L ISO134985:2016

An organization's ability to

produce goods that meet

applicable requirements.

An organization's ability to meet legislative and consumer requirements. There are 6 mandatory procedures for this.



ECR→ECO→ECN

Engineering changes that would be flagged by regulators; eg altering BOM.



Product-related regulations and standards

CE mark

Shows the product can be sold in EEA as it conformts to health and safety regulations.



▶ FC compliant

Part 15 of FCC Rules; no harmful interference and any received must be accepted



▶ WEEE

Waste-Electrical-Electronic-E quipment-Directive; labelling of electronics for recycling.



L UL STD. UL1431

Standard for Personal Hygiene and Health Care Appliances in the US.



RCM (general)

Regulatory Conformity Mark; for electronic goods about electrical safety rules.



CSA STD. CSA 22.2 N°224

Radiant Heaters and Ingrared and Ultraviolet Lamp Assemblies for Cosmetic or Hygienic Purposes in Nonmedical Applications in Canada.



ETL mark

Proof of product compliance to safety standards in North America.



59S Compliance

59S's regulations differ from Munckin because of their technology and their operations also taking place outside the US. The regulators for their product-based testing are:



SGS S.A

Société Générale de Surveillance



Environmental Protection Agency

They also quote compliance with a Foreign Trade Association initiative, the Business Social Compliance Initiave.



Product Compliance

Product Risk Assessment

Matrix RISK Assessment

The probability of an event is rated on a scale of **1-5** (5 is most frequent) and its severity of impact from **A-E** (A is most severe). This determines how dangerous a defect in the product could be and its fragility.

Event	Probability	Impact
Lid handle breaks	3	D
Water spills	4	Е
Breaks from a drop	2	В
Strap snaps	1	С
Nest gets stuck	2	D
Internal water leaks	1	Α
Battery overheats	1	Α
Bottle is punctured	2	D
Moulding inside	2	С
UVC bulbs crack	1	Α
Locking mech. fails	1	В
Motor malfunctions	1	Α
Defective grip	1	С
Faulty threading	1	С

The product can be considered **SAFE TO USE** because of the general **INVERSE** relationship between **Probability** and **Impact**.

We conducted a **RISK** assessment considering possible events that would impact the product to compare their proability to their impact. To complete the assessment we also considered all the **MISUSES** and **HAZARDS** that could occur when using or interacting with our product. This will inform our labels and warnings.

Misuse and Hazards

Ingestion of dirty water by mistaking bottle for a drinking water bottle.

Attempt to dismantle the product entirely - could result in breakage.

Application of excessive stress on the strap: stretching, biting, cutting etc., resulting in snapping.

Infant accessing product, resulting in possible entrapment of extremities.

Trapping of a child's finger in the USB port, could result in cuts, bruising or emotional trauma.

Attempt to insert a larger item into the sanitiser, resulting in damage of item or of sanitiser.

Dropping of item resulting in possible injury of handler.



No disposal of water, and lack of hand cleaning - instant recontamination.

Introduction of micro plastics into interior through repeated damage.

Dirt build up in container due to failure to properly clean the product.

Putting food items or other liquids in the product, contaminating or damaging the product.

Putting electronic items into the product, resulting in damage, possible electrocution.

Ingestion of plastic pieces by child due to uncontrolled chewing behaviours.

Attempt to use the wrong kind of battery due to Li-ion battery size being similar to AA.















Product Compliance

Synthesis

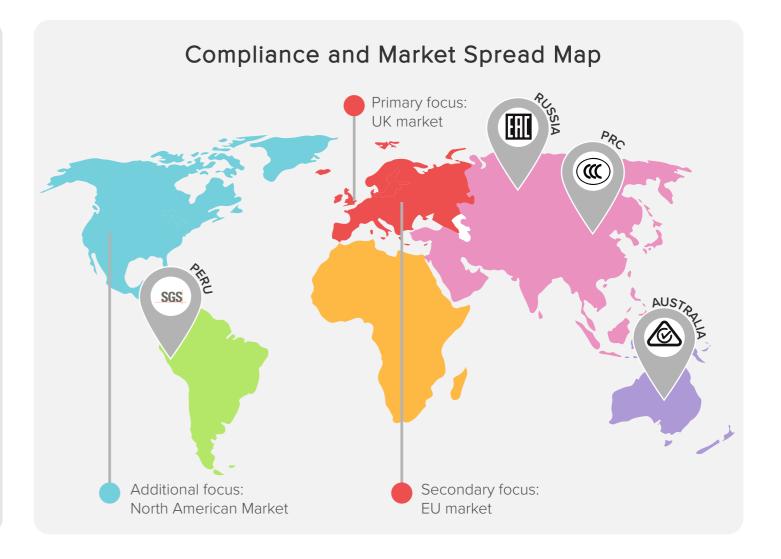
These are our final conclusions regarding **REGULATIONS**, **STANDARDS** and **COMPLIANCE** that would apply to our product considering itself, its brand as Munchkin and taking into account the global market. We also outlined how this research will inform our future user guide **WARNINGS** and labels.

Regulations

- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (No3032).
- RoHS Directive 2011/65/EU
- ISO9001 QMS: Does NOT apply
- General Product Safety Directive 2001/95/EC
- General Product Safety Regulations 2005 No. 1803
- Biocidal Products Regulation - PT02

Standards

- UL STD. UL1642 (Lithium Batteries) OR BS FN IFC 61960-4:2020 (Secondary lithium batteries for portable applications)
- BS ISO 15727:2020 (UV-C devices. Measurement of the output of a UV-C lamp)
- UL STD. UL1431 (Standard for Personal Hygiene and Health Care Appliances)
- BS EN IEC 63000:2018 (RoHS compliance)
- BS EN 50564:2011



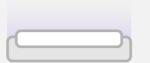
Plans for Warnings

The risk assessment and identification of misues and hazards set a foundation for the warnings of product-related hazards that we should communicate to the user through our packaging and user guide. Essential areas that need warnings are:

Battery safety and treatment



UVC safety and interferences



Reduce risk of injury (electrocution, burns,



To guarantee minimal standards, the micro-USB cable used with this product must follow IEC 62680-2-2:2015 standards.

Compliance Marking

These markings are nation specific. 1 applies to the EEA, 2 applies to the UK and the 4 applies to the North American markets. 3 is accepted in the EU and UK, it specifies specialised recycling compliance.







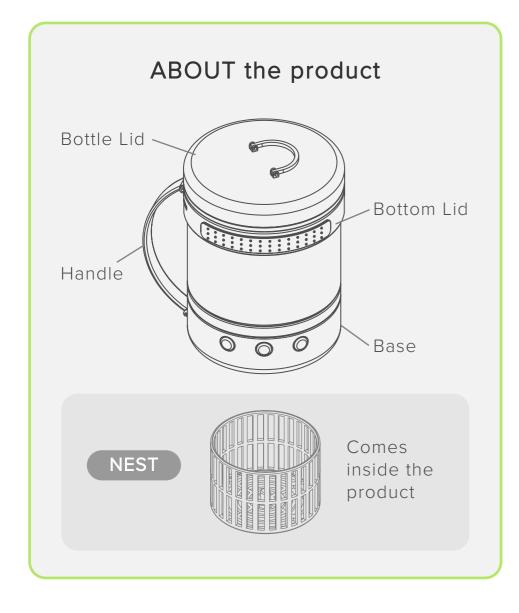


FCC compliance is essential for distribution in the US, where the frequency of the UVC emitted is tested, and any resonance or interference. With UVC technology being used, the product falls into Part 15 of the FCC Rules.

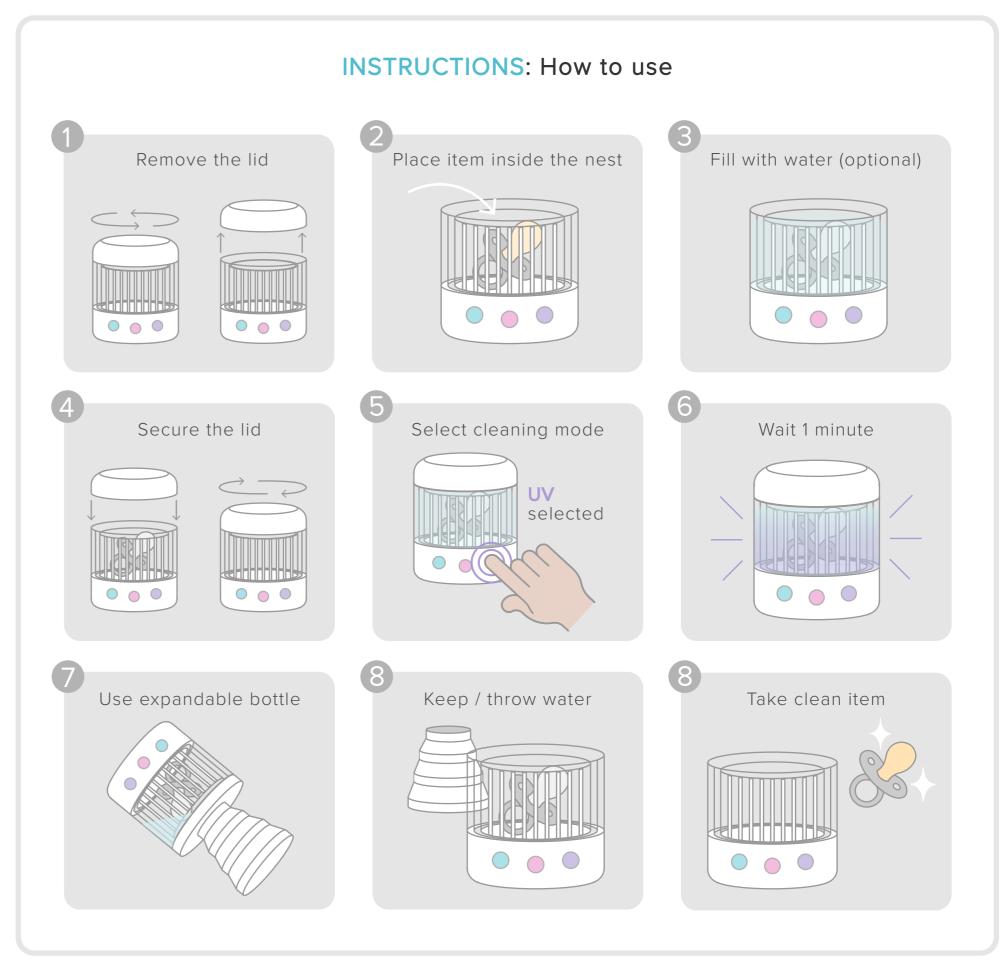
User Guide Design

Information and Instructions

The product will include a user guide aimed to inform and instruct users about the use of our product. Our goal for this design was to be clear, concise and minimalist to fit in with munchkin's visuals. Our user guide can be separated in three parts: **INFORMATION** about the product, **INSTRUCTIONS** on use and **WARNINGS**.

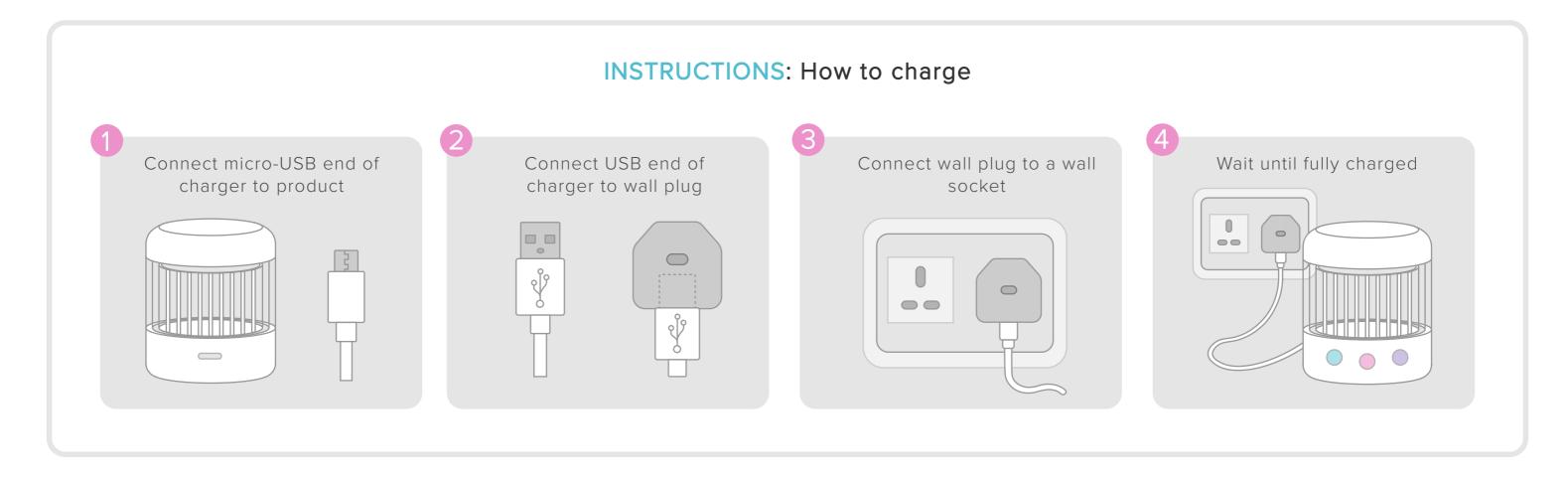








These are additional instructions for the user that go into further detail about the **CHARGING** of the battery and **HYGENE** of the product. This gives the user enough information to be able to use the product properly. It also helps them feel more comfortable and familiar with the product.







Labels and Warnings

Within the user guide, WARNINGS must be included to indicate the possible hazards to which a user is exposed when in possession of the product. This shows an example of the labels our product would have and our **RATIONALE** behind key features of it.

Important Safeguards

DANGER: reducing electrocution risk

- Always ensure device is turned off before rinsing.
- Do not use while swimming or bathing.
- Do not place or store product where it can fall or be pulled into a tub or sink.
- Do not place in or drop into water or other liquid.

WARNING: reducing risk of electrocution, electric shock, fire, injury to persons or burns

- UVC radiation may cause serious injury to the skin and irreversible eye damage.
- UV light exposure can degrade certain materials over time: fabric, rubber, plastic.
- Do not stare at the UVC light emisison source.
- Do not leave the device when plugged in. Unplug before use, when not in use and when servicing.
- · Never use this on food or pets.
- · Never fully submerge device in water.
- Do not tamper with cage mechanism, intentionally dismantling it or blocking it.
- Do not carry the device by the small handle on the lid it id design exclusively for opening support.
- Do not carry device by the cord, pull on cord, close a door on cord or drag over sharp edges.
- · Have servicing performed by a qualified repair professional using only identical parts for repair.
- Do not poke holes in or otherwise intentionally damage the foldable bottle, e.g. by burning.
- Device can be used by children 8 and above as well as individuals with reduced sensory, mental and physical capabilities or lack of experience only under close supervision or training for use of appliance. Only after hazards are understood can it be used.
- Do not allow children to play with the appliance, nor clean and maintain the device.
- Do not tamper the lid or crack the clear plastic to prevent UV exposure.
- Do not use any unapproved attachments or extensions; use only as instructed in the guide.
- Never operate this product if it has damaged electronics components, e.g. micro USB port, cable; return to Munchkin for inspection and repair.
- Keep away from very hot surfaces.
- · Only use batteries included in the device, and never insert non-rechargeable batteries into the
- If the device is to be left for storage for an extended period of time, the batteries must be removed.
- The supply terminals are not to be short-circuited.
- Never block the air openings of the product, be it by placing on a soft surface or with hair, lint etc.
- Never drop or insert any object into the vents or the micro USB port.
- Never use the product if drowsy or sleepy.
- UVC batteries are not to be tampered with, and user replacement must not be attempted.
- To be used together with a IEC 62680-2-2:2015 certified cable only.

WARNING: THE LID HAS A LOCK TO PREVENT EXCESSIVE UV EXPOSURE. DO NO DEFEAT ITS PURPOSE BY INTENTIONALLY BREAKING.

Customer Service

NOTE: This warranty does not cover misuse, abuse, abnormal wear & tear, negligence, environmental exposure, alteration or accident. Any alteration or removal of the product date code invalidates all claims against the manufacture.

TECHNICAL SPECIFICATIONS

Product name: Splash 'n' Spin UVC steriliser Model: XXX-XXXX Rev1

Power input:

- Battery Life:
- Input connector: Micro-USB
- Rated input:
- · Dimensions:
- Net weight:
- UVC LED bulb life:
- Working temperature: 0-40 °C
- Storage temperature: 20-55 °C





CONTACT US

If you have any questions or wish to provide comments about this product please visit our website at www.munchkin.com.

By UK law contactability must be established by the brand, for and client security communication. Also for the encouraged registration of a product for a warranty - this also serves as a safety step.

The compliance markings are clearly presented together with other product information.

This note is a disclaimer related to the legislative framework of the warranty. It implies that any intentional damage would breach any agreements between Munchkin and the customer, and any claims would be invalid. This protects the brand against staging accidents for material gain.

UV exposure is the incident with the highest probability of Although occurrence. preventative measures have been taken and UVC is not as harmful as UV-A or UV-B, the 'consumer phase' maintenance of safety is required to ensure no damage to skin or eyes by direct exposure.

IEC/IEEE 82079-1-2019 Standard for Information for Use is followed to present information clearly and

accurately. Considering the globalisation of distribution, OSHA and ANSI standards were studied too, specifically in relation to defining Danger, Warning, Caution and designing for usability.

It is essential for the warnings to include guidelines detailing use around children, since it is estimated that over 2.34 million families in the UK have 2 children. The average age gap between children is 2 years, which suggests that the older child would be able to gain access to the item if precautions are not taken.



Packaging Research

This is the research we conducted to inform the packaging design of our product. We focused on analysing Munchkin's packaging and branding in terms of design and material. We also had to look into the necessary compliance markings.

Specification of Materials

🗅 Following Munchkin's values and our own, we wanted to develop a sustainable packaging that conveyed our simplistic and functional approach to design.

We chose recycled cardboard as the main material for packaging since it has a low carbon footprint and can be part of a circular loop of consumption.

After being recycled, the carboard follows a standard manufacturing process where it is cut into a patron and assembled.



Branding

First, we analysed Munchkin's current packaging for their 59S Mini Portable UV-C Steriliser Plus. The exterior of the box was quite generic and the interior of the gave an impression of high-end technology. We found it to be slightly excessive and not very visually attractive.



We found that Munchkin doesn't use a consistent style of packaging, but rather makes each one different with some looking better than others. Our preferred packaging style was the bare cardboard one for their plastic cups as we thought it was more creative, simpler and sustainable.











Our product would have to use the same logo of the collaboration between Munchkin and 59S. We change the colour of the heart to a bluish purple, as a reference to the water and UV colors.



Compliance Markings

One of Munchkin's goals is to be a sustainable brand, which can be observed through its tree planting achievements. For our packaging, recycled cardboard will be used. The recyclability must be indicated clearly, and is done by the famous Mobius Strip symbol.





The package could also include the Forest Stewardship Certification, which can be attained through proof of use of recycled cardboard and contribution to forest preservation.

To place emphasis on Munchkin's investments into the recycling operations involving their products the Green Dot could also be introducted to the packaging of the product.



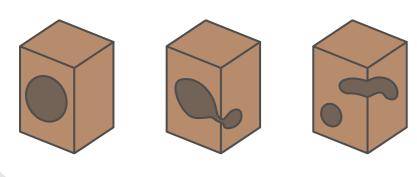


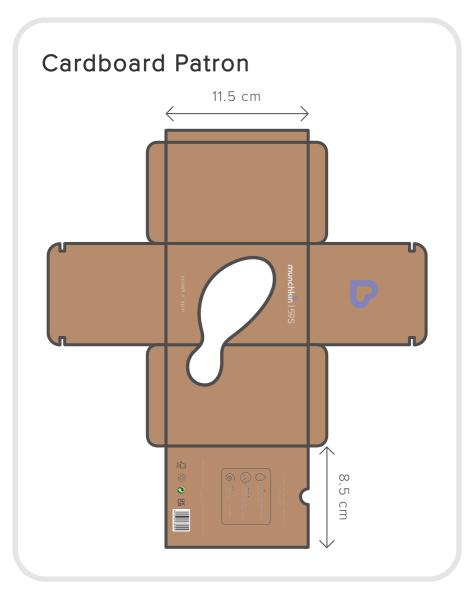
Similarly to product labelling, the packaging must show compliance markings relevant to the region where the product, thus the packaging, is being distributed. In the case of post-Brexit UK, the UKCA mark is used.

Product Packaging Design

Design Iteration

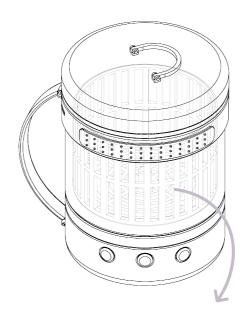
Our intention was to make the box simple and original at the same time. We had the idea to have a hole at the front of the box to display a sneek peak of the product. We tried different cut-outs that would emulate the shape of water.





Inside the Box





Inside the basket of the Splash N' Spin is a small recyclable plastic sachet with the USB to micro-USB cable and the cap for the foldable water bottle.



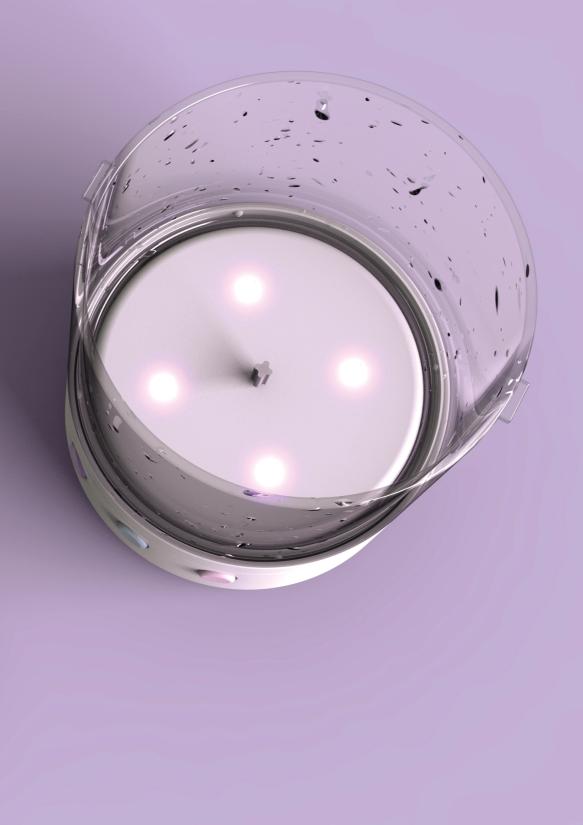






Product Packaging Visualisation













weekly calendar

8 - 8 1

Fernanda

Motorised

iteration -

design

mechanical

2





5

Project Plan 🗅

Discussion of the concepts and decision over what concept to carry forward. Identification of areas of improvement as well as the parts which are well liked by the users and the team. Selection of possible brands for research and exploration.

Research into Research into Research into Research into Tommee Tippee nimble Munchkin Newell Brands Exploration Brainstorming Ideation on Begin project for mechanism of design simplification of plan and writeup redesian combinations mechanism Selection of **munchkin**, as parent brand.

Simplifying

mechanism -

sieve design

Straps

design

iterations and

Finalisation of concept development ideation, moving onto the detailing and pre-modelling stage. Finalisation of brand value proposition for Munchkin, with explanation and evidencing

Bottle

incorporation

of how our product will elevate the brand.

and cage

spin drying

Brand alignment Evaluation of 4 Munchkin Brand value and brands and business proposition selection researched strategy reasoning Pros and cons of Detailed concept Initial concepts Rough concept study and chosen concept development development evaluation

Insights from Meetings

In the first meeting we evaluated the work we had previously done, as a group and individually. We evaluated our concepts based on user needs and wants an chose the basis for our final concept by seeing which one aligned the best with our product insights and opportunities.

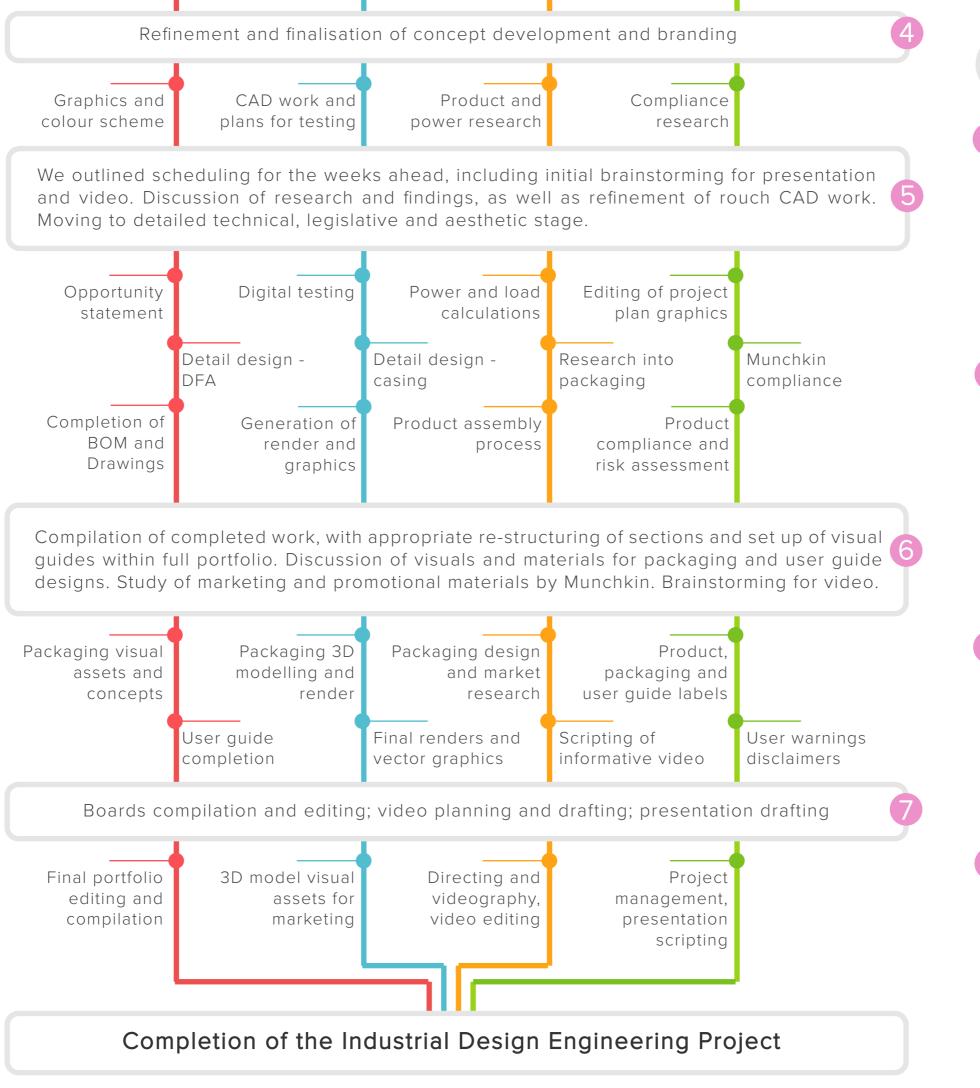
For our product to be truly helpful, we had to go through various iterations to address potential issues of the initial concept. This led to concept development resulting in changes to the mechanism to successfully incorporate a drying cycle.

Even though Tommee Tippee and Nimble have baby care products they were too specialised and established, SO our integration into their product lines would feel too out of place. Whereas Munchkin already operates on a wider baby-market.

6

8 8 7

8



Insights from Meetings

- Throughout the project we altered our concept to integrate into Munchkin. We changed our graphics to incorporate branding labels that tied us to Munchkin.
- We found a distinction in Munchkin's products.
 Adult-oriented products have a much more neutral, gray-scale colour scheme whereas children's products are colourful, playful and more voluminous.
- We chose to manage our work together with constant updates to always know where along the product dvelopment line each person is.
- It was fascinating to see the progression of details in our product from the first CAD model to the final one and how this was affected by load caulcations and legislative measures.

References

Product Assembly

[1]

https://www.alibaba.com/product-detail/Home-appliance-use-24-4mm-small_62225827255.html?spm=a2700.7724857.normal_offer.d_title.499e ed80ZE9IvH

- [2] https://dtpbattery.en.made-in-china.com/product/aCmxPhHkbwWb/China-7-4V-2s-720mAh-Rechargeable-Battery-Packs-with-Wires.html
- [3] https://www.allpcb.com/online_pcb_quote.html
- [4] https://www.allpcb.com/online_pcb_quote.html

[5]

https://www.alibaba.com/product-detail/China-gear-manufacturer-high-precision-custom_60813327932.html?spm=a2700.galleryofferlist.normal_offer.d_title.33c2412fOSRzU6

[6]

 $https://www.aliexpress.com/item/1005002789767199.html?spm=a2g0o.productlist. 0.0.24815447M9NU4l\&algo_pvid=d446fc4f-2d9d-4e28-96af-8e97a5afb712\&algo_exp_id=d446fc4f-2d9d-4e28-96af-8e97a5afb712-7$

 $[7] https://www.aliexpress.com/item/32972923340.html?spm=a2g0o.detail.1000060.1.7c53489czS9jLQ\&gps-id=pcDetailBottomMoreThisSeller\&s cm=1007.13339.169870.0\&scm_id=1007.13339.169870.0\&scm_url=1007.13339.169870.0\&pvid=22dfb388-96a7-4ba5-a0b0-74ebfe1fef7b\&_t=gps-id:pcDetailBottomMoreThisSeller,scm-url:1007.13339.169870.0,pvid:22dfb388-96a7-4ba5-a0b0-74ebfe1fef7b,tpp_buckets:668%230%23131923%2388_668%230%23131923%2388_668%23888%233325%238_668%23888%233325%238_668%232846%238115%232000_668%2328115%232000_668%232717%237563%23505_668%231000066058%230_668%233468%2315612%23340_668%232846%238115%232000_668%232717%237563%237563%23505_668%233164%239976%23621_668%233468%2315612%23340$

[9]https://www.custompartnet.com/estimate/injection-molding/

[8]https://www.custompartnet.com/estimate/injection-molding/

[10]https://www.custompartnet.com/estimate/injection-molding/

DISCLAIMER*

Munchkin were not engaged in any consultancy or collaborative capacity with this project and the outcome is in no way endorsed by them. Any publicity is limited to personal and academic use