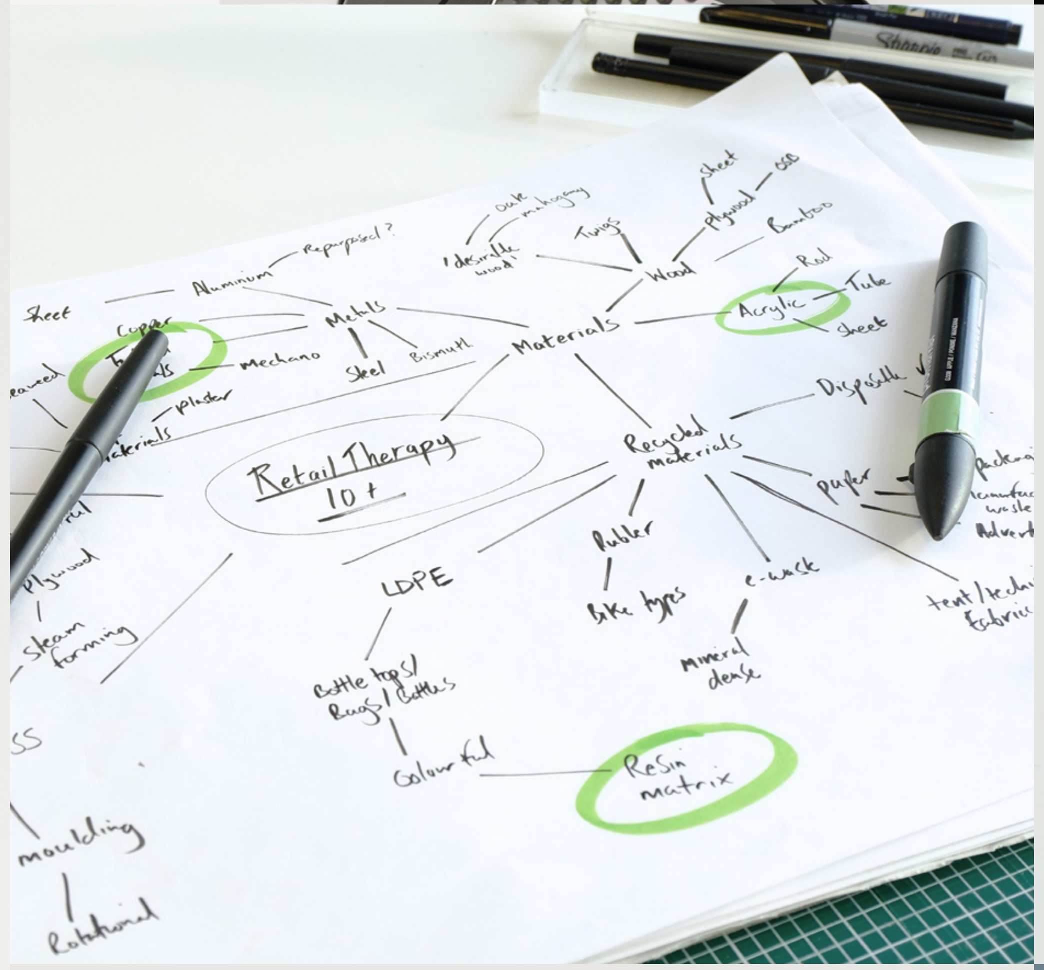
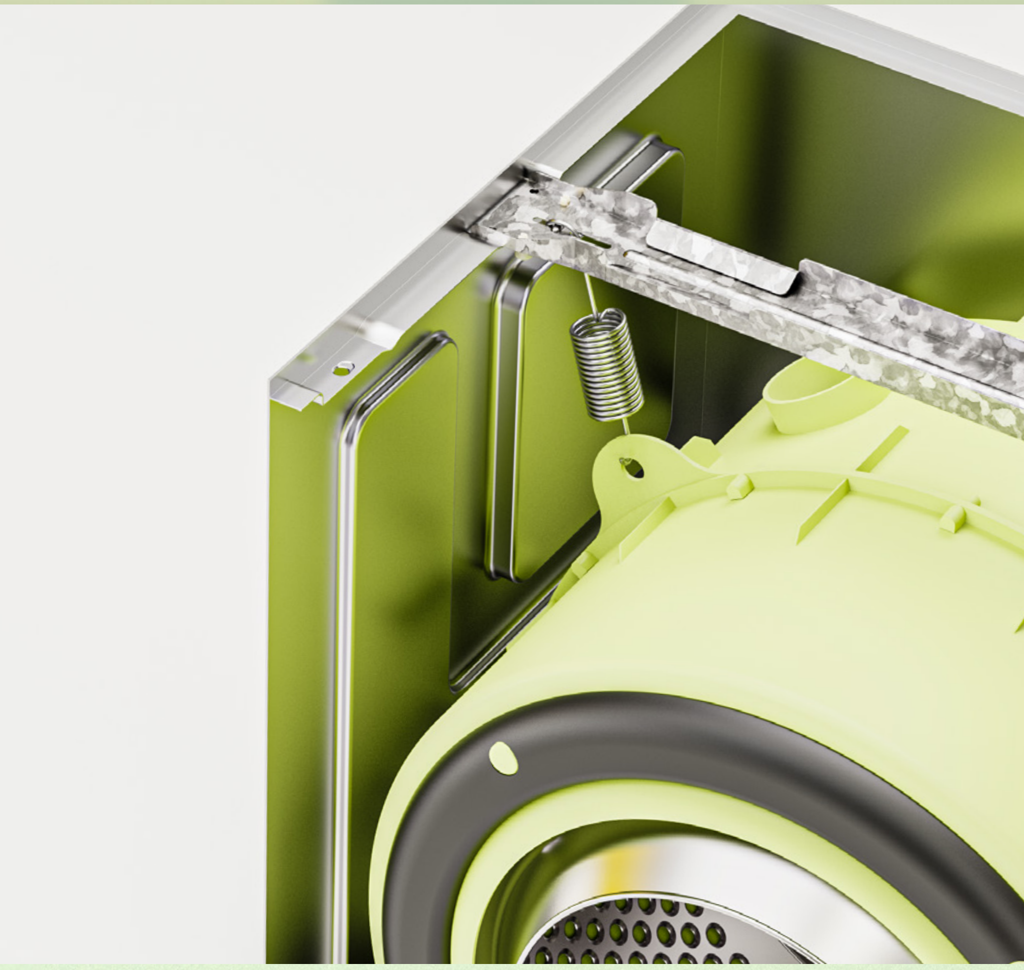
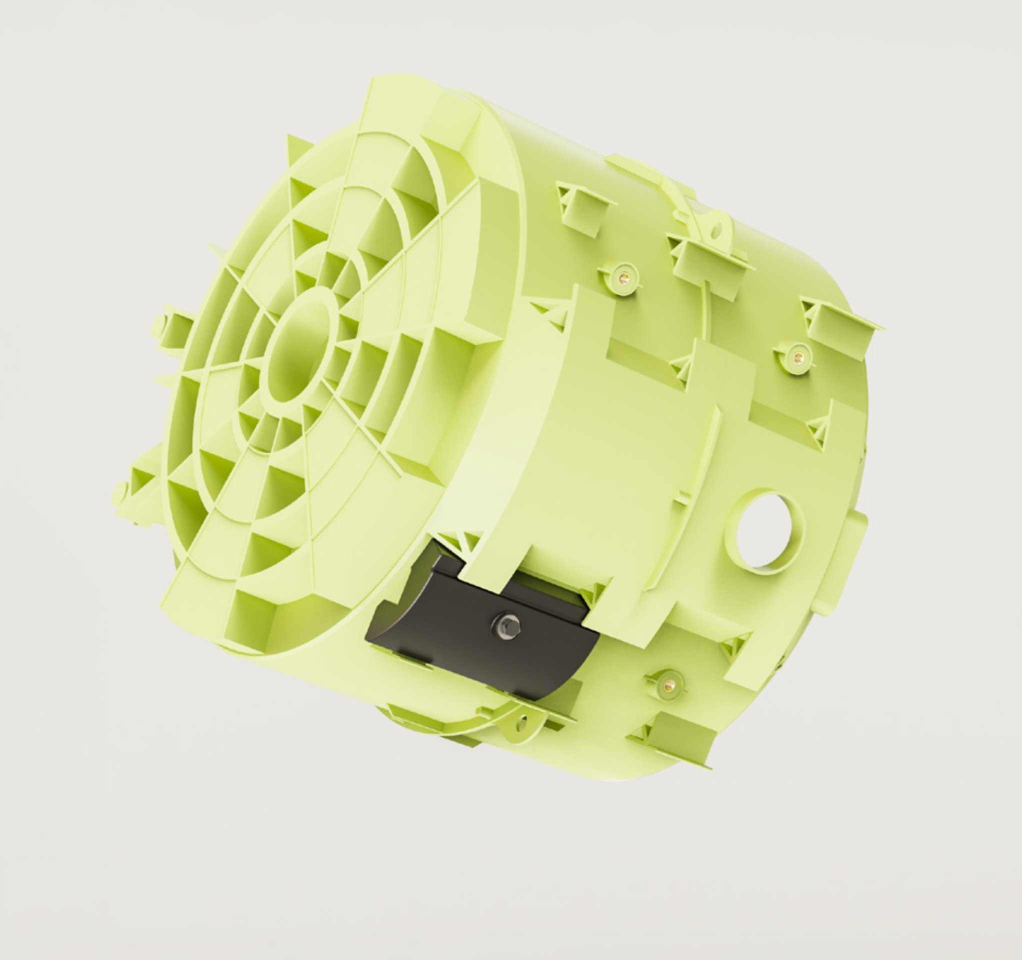
Louis Deane

2026 Portfolio

Mob	(+44) 7860 610072
Email	Louisdeanedesign@outlook.com
Linkedin	www.linkedin.com/in/louisdeane123







Contents

Series W

Repairable Washing Machine

Series W is a project that addresses a fundamental issue within sustainable design: we are constrained by the economic and political systems we operate within. Capitalist linear models drive rapid product turnover, shortening lifespans and reinforcing a culture of replacement. In domestic appliances this is increasingly evident, with a surge in non-repairable sealed components and inaccessible assemblies making repair difficult and uneconomical.

Submission Year	2026
Duration	6 Months
Role	Design Engineer

KeyShot · AUTODESK Fusion 360 · MATLAB

AUTODESK INDUSTRY AWARD

GSofA Newbery Medal Nominee

Series W

Framed through the lens of Walter Stahel's performance economic theory, the project challenges linear models by proposing an alternative centred around service life extension. Consumers, rather than purchasing ownership, purchase a product's performance. This incentivises manufacturers to design around circular values, making extended service life more profitable than linear models.

This is explored through the redesign of a washing machine, one of the highest contributors to climate impact within the domestic product category. It targets bearing failure as a key limitation. The design focuses on disassembly, access and component architecture, enabling efficient repair through a modular ballast system, guided drum removal and a simplified disassembly process. It demonstrates how mechanical design can support extended service life while remaining grounded in manufacturing reality.

Our Economic Model Prioritises Product Turnover Over Longevity.

Value is driven by unit sales, directly linking revenue to material consumption and reduced service life. Durability, repair, and upgrade become economically unattractive, reinforcing cycles of replacement.

The performance economy proposes a shift. By retaining ownership and selling function, value is linked to performance over time, not consumption.

WEEE Processing is Designed to Handle Volume. Not Recover Value.

CCL North Site Visit

Observations from WEEE processing facilities visits show that only desirable products, typically audio and computing equipment, are selected for reuse, while others are shredded and separated into material streams. This results in systematic value loss, despite components retaining their functionality.

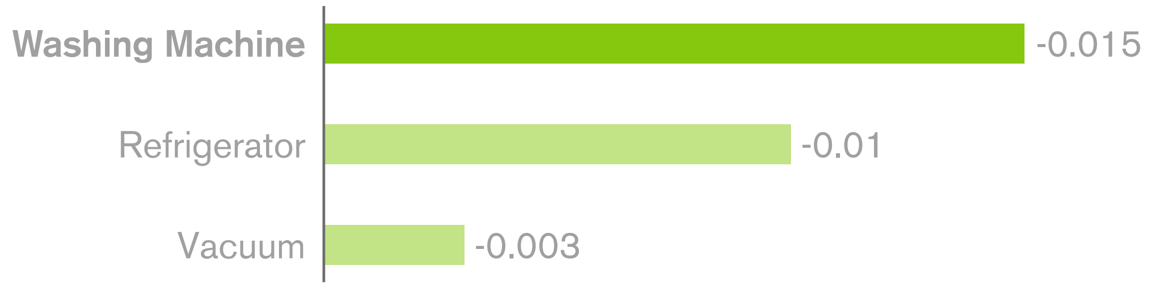
Economically Unfeasible.

To replace bearings, repair agents must fully disassemble the machine, a time intensive process made worse by complex assemblies and sealed drum units. When call out charges, labour, and parts are combined, costs can reach £250, often approaching the price of a replacement machine.

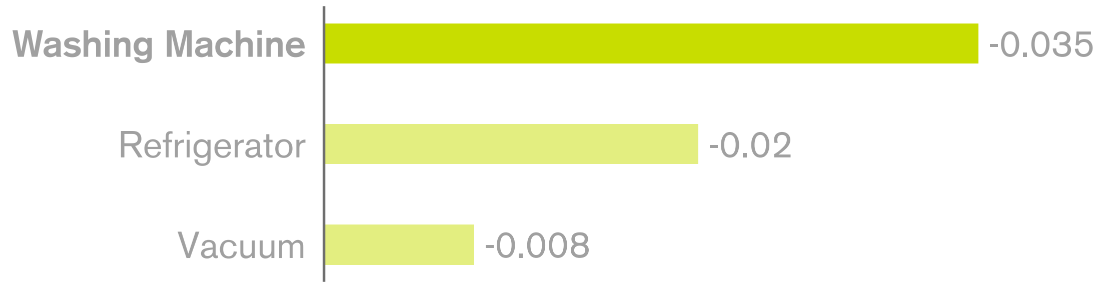
Model: BEKO BW1O3821W 8 Kg
Price: £249
Expected Life: 6-8 Years
Drum Replacement: £150 - 250

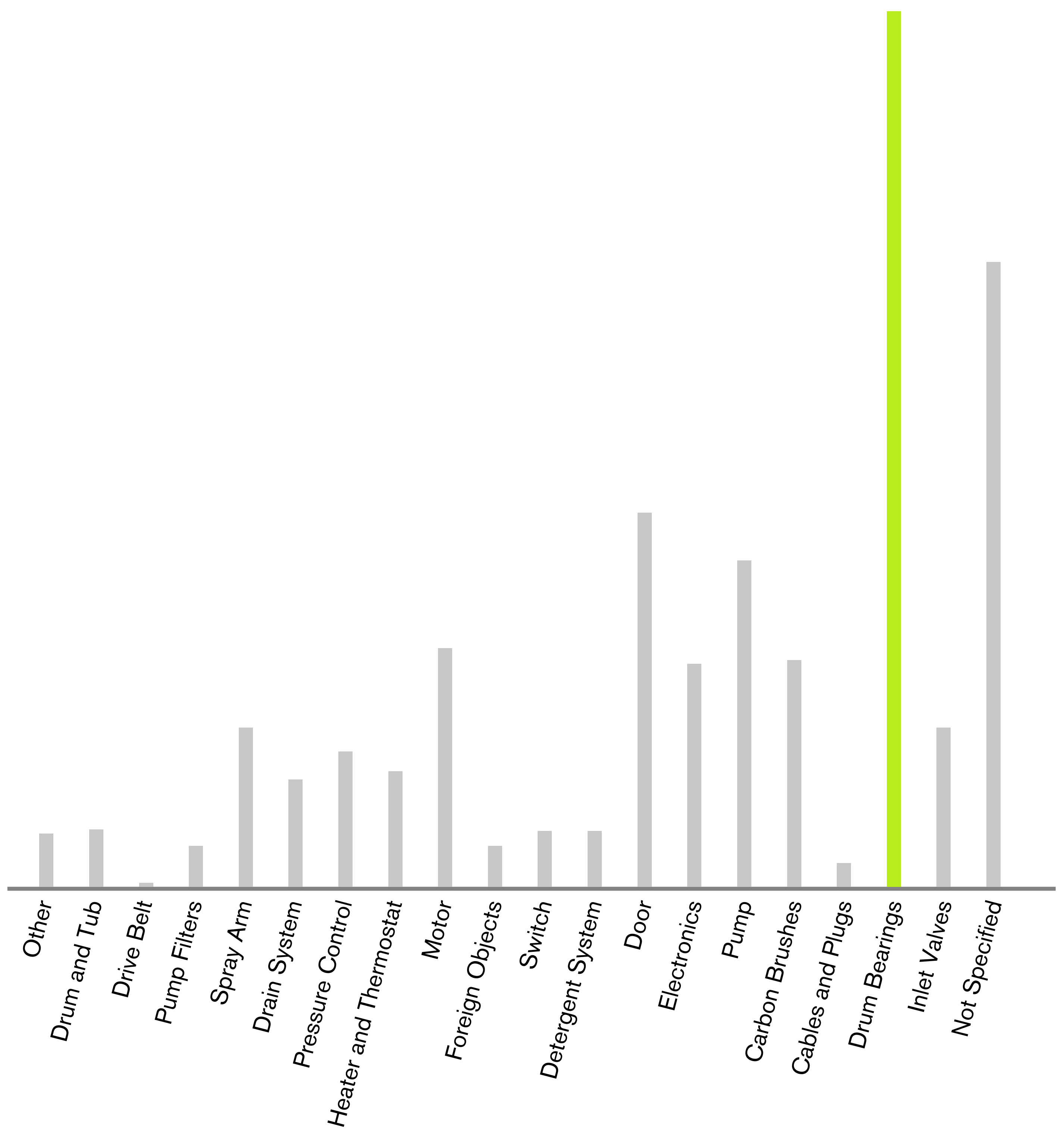
01 - Climate Indicator
Kg CO_2 Eq Avoided

02 - Particulate Emissions
Kg PM2.5 - Eq Avoided



03 - Resource Depletion
Kg Sb - Eq Avoided





Environmental Findings

Using ADEME's Environmental Modelling and Assessment of Consumer Products and Equipment, the environmental benefits of extending product service life were assessed across three key sustainability metrics: climate impact, particulate emissions, and resource depletion. Impacts were evaluated at different points of a product's life, with 7 kg standard washing machines emerging as the greatest contributor across the broad range of assessed domestic products.

Stakeholder Investigation

Visits with repair agents, WEEE and specialist recycling facilities, community repair cafés, council waste centres, and circular business leaders revealed the practical challenges of extending product life. Insights highlighted how difficult modern electronics are to repair and recover, with valuable components often lost during recycling, while circular businesses face commercial challenges competing with lower-cost manufacturers.

Failure Mode Analysis

A European Commission study on washing machine and dishwasher failures identified bearings and shock absorbers as primary failure points. Bearing failure alone accounted for 22% of breakdowns, based on data from Vienna domestic repair company RZSU. Repair agents validated this, consistently identifying bearings as both the most common and most labour intensive failure to fix, requiring full disassembly and rendering repair uneconomical.

1. Modular Ballast

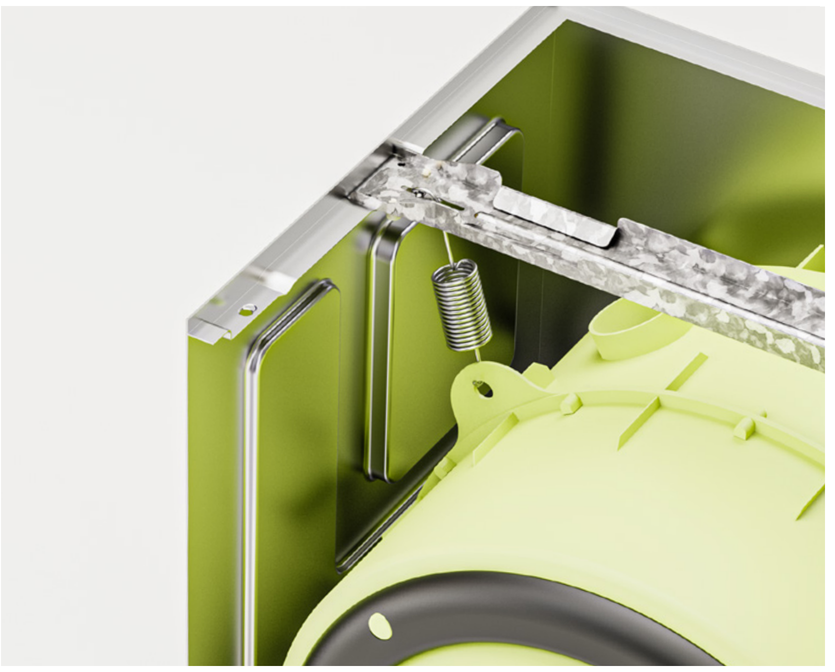
The modular ballast system
Improves access to the top-mounted motor while enabling controlled disassembly. The mass is split into four 3kg cast iron units for improved handling, guided by polypropylene rails as the M8 fastener is released. A moulded-in brass insert ensures structural integrity under load.

2. Component Storage

Indentations in the side panels provide structural stiffness while acting as storage zones during disassembly. Tethered components such as the control panel and detergent drawer are magnetically secured to the chassis, preventing movement and keeping them clear of the working area.

3. Counterweight Load Path

A - Brass Threaded Insert
B - 2kg Cast Iron Counterweight
C - 22 mm Galvanised Steel Penny Washer
D - 33 mm M8 ISO x 1.25 Bolt



Drum Removal System

The drum removal mechanism is a low cycle system designed to aid disassembly. A galvanised steel structural member with folded hand grips supports the spring mounted drum assembly, sliding along a profiled track to locate in operation or service positions. In service mode, the motor and ballast are exposed for removal, reducing system weight by around 28kg and enabling controlled manual lifting.

Nylon Guide

The recycled nylon guide is snap fitted into the galvanised steel structural member, stabilising movement during disassembly and keeping the member parallel as it is pulled across the chassis profile. Its slightly concave outer edge engages with a chassis flange as it transitions from operation to service position, preventing pivot and ensuring controlled, aligned motion.

Disassembly UI

The disassembly UI guides both novice and experienced repairers through a clear, structured process. A QR-based instruction system pairs with colour-coded and labelled components, reducing ambiguity during teardown and guiding the repairer step by step. It makes the sequence visible, helping users understand what to remove, where to act and how components relate.

Hierarchy Task Analysis

A Hierarchy Task Analysis and SHERPA method were used to evaluate the disassembly of front-loading washing machines. 10 teardowns were analysed to identify common processes and repeat failure points.

These were mapped into a structured task sequence, with each step assessed for error likelihood and severity. This approach was used to systematically understand where disassembly breaks down, and to highlight the physical, technical and behavioural challenges that define repair in practice.

Simulated Teardown

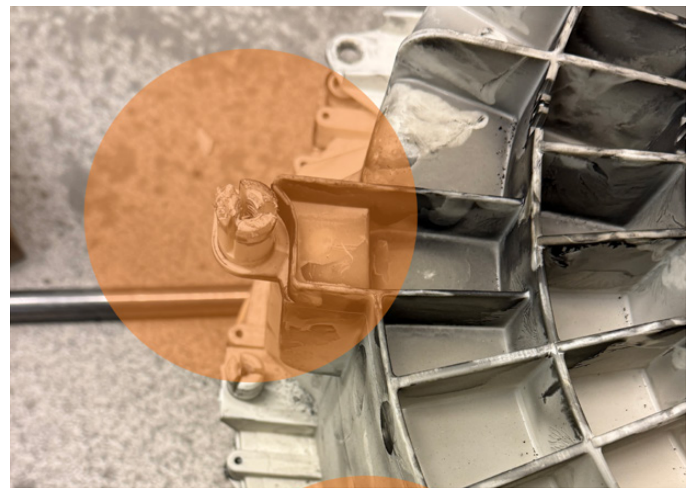
A simulated teardown was conducted to evaluate disassembly in realistic conditions. Set within a mock kitchen representing the smallest 5% of UK homes, the environment constrained reach, posture, visibility and manoeuvrability.

Repair Agent Interviews

One repair agent highlighted systemic issues surrounding sealed drums and lack of part standardisation. This was valuable, however their work is carried out within a fully equipped workshop

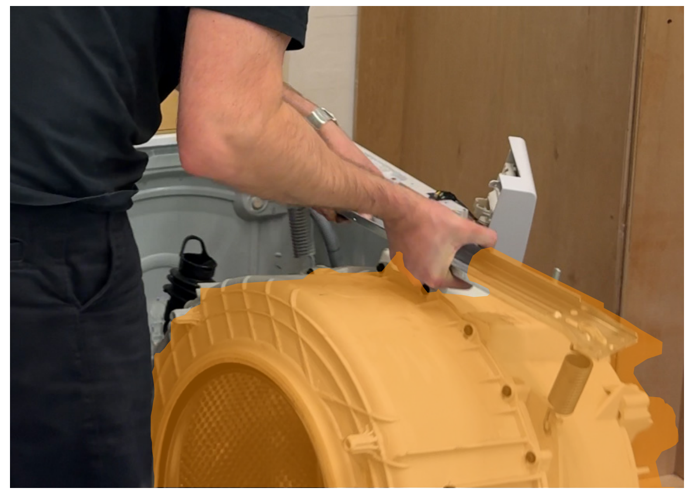
1 - Tethered Components

Tethered components such as control panels are hung over the chassis during disassembly. They are poorly supported and unstable, easily knocked off during the repair process, creating risk of damage and disrupting workflow.



2 - Motor-Drum Coupling

A hard to reach motor location makes uncoupling from the drum awkward, particularly due to rear facing mounting lugs. Over time, these lugs plastically deform, further increasing removal difficulty and reducing serviceability.



3 - Cumbersome Removal

The drum removal is a significant barrier in the disassembly process. Its size, weight and integration with multiple components make removal physically demanding, time consuming and unnecessarily complex.

PROCESS

KEY FINDINGS

1. Opening Up

Access is created through a sequence of removable external assemblies: the top panel, control panel, front panel, door and detergent assembly. Tethered components are magnetically stored on the side of the machine during repair, keeping the workspace clear. A single M5 fastener is used throughout.

2. Damper Removal

The damper shock absorbers are released through M5 fasteners, disengaging compression plugs that secure the dampers to the chassis and drum. The galvanised steel structural member then slides across the top chassis into a service position, while nylon guides prevent rotation and keeping the movement controlled.

3. Motor Movement

With the outer drum in its service position, the 3-phase induction motor is accessible from above. This top mounted position improves ergonomics and provides clearance for a hand drill, making the M3 fasteners easier to remove. The motor is then pulled from the polypropylene lugs and lifted out.

4. Counterweight Extraction

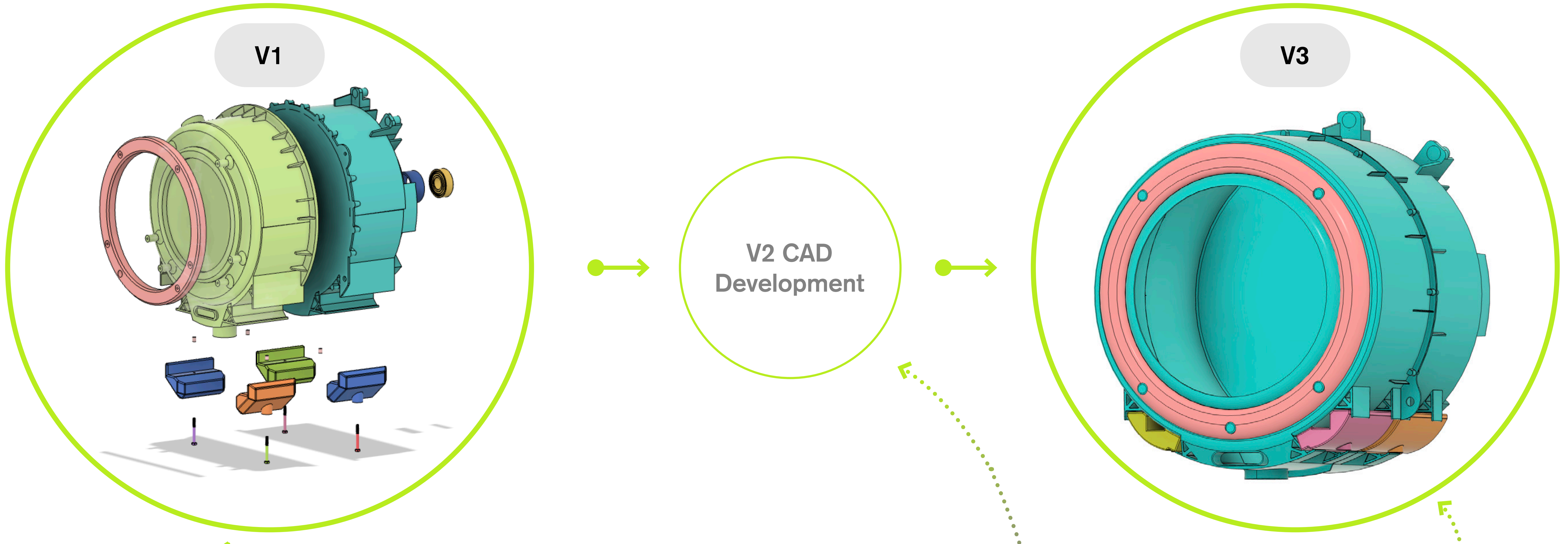
Modular cast iron ballasts are divided into 3kg segments to improve handling and reduce strain, and are removed alongside the front ballast. An M8 fastener is removed from a brass threaded insert in the drum, releasing the ballast, while Polypropylene rails carry the load to prevent sudden drop. Each segment is then slid out in a controlled manner.

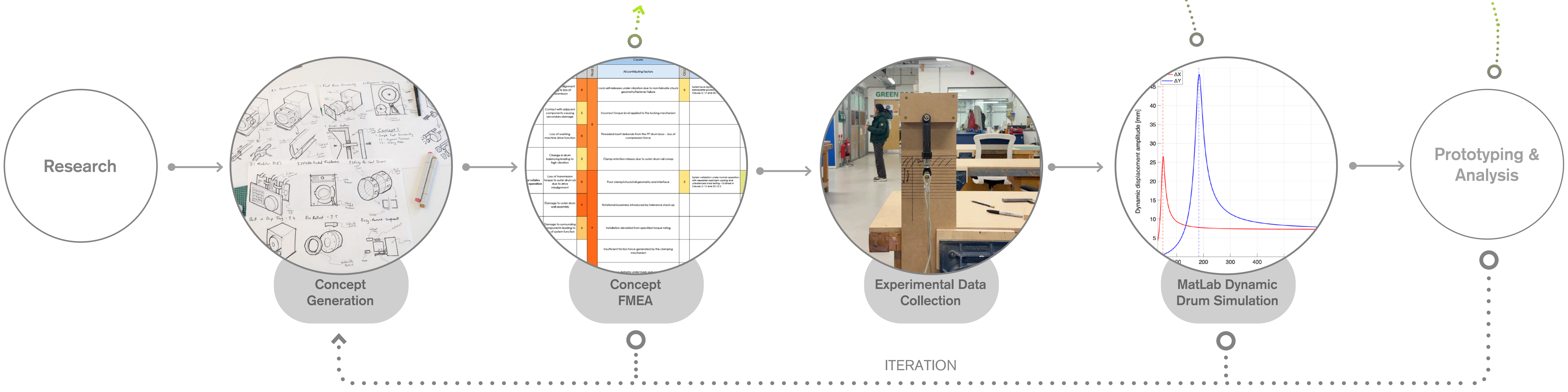
5. Drum Removal

With 28 kg removed, the outer drum assembly becomes significantly more manageable. The repair agent lifts the structural member and attached drum with both hands, moving it from its service position onto the floor to begin bearing replacement.

Iteration informed through FMEA, Dynamic Modelling & Prototyping.

The development progressed from research and concept generation through FMEA, dynamic simulation and physical prototyping, with each stage informing the next. Two initial concepts were evaluated through FMEA, identifying the motor-on-rails approach as higher risk due to alignment, retention and dynamic loading, while the modular counterweight system offered a more manageable architecture. This informed the selection and refinement of the concept through three iterative CAD developments.





Modelled 1:1 Using Standardised Components.

A 1:1 plywood washing machine prototype was developed to evaluate the novel aspects of the design, including the ballast system, disassembly UI and drum removal mechanism. Using a disassembled machine as a base was considered, however its steel construction limited adaptability and made iterative testing difficult.

The plywood approach enabled rapid modification and allowed sub prototypes, such as 3D printed ballast system and nylon guides to be attached. The prototype enabled detailed assessment of the disassembly human factors, including ergonomic strain, component access and tool clearance.

Testing the service experience.

Human factors testing was recorded using a predefined set of service tasks, covering chassis disassembly, drum movement, motor removal and ballast removal. Each task was assessed for sequence, accessibility, tool use, handling and serviceability, with observations capturing completion time, tools used, awkward postures, resistance and areas for improvement.

Observation to Insight.

The drum movement test evaluated the human factors of pulling the loaded drum assembly into its service position. The task required two hands due to the weight of the system, with the user needing to brace the machine to prevent forward movement while pulling the assembly across the chassis.

During operation the drum showed a tendency to twist laterally rather than move in a straight path. The mass of the system also introduced forward momentum, creating a slight tipping motion, although the machine remained stable. These findings highlighted the need for guided motion, defined hand grips and a controlled stopping mechanism to stabilise movement.

1 - Radial Reinforcement

Reinforced radial polypropylene extrusions to resist drum deformation due to loading.

2 - Counterweight Boss

A boss with a recessed interface and threaded insert to locate and secure the ballast.

3 - Concealed Fastener

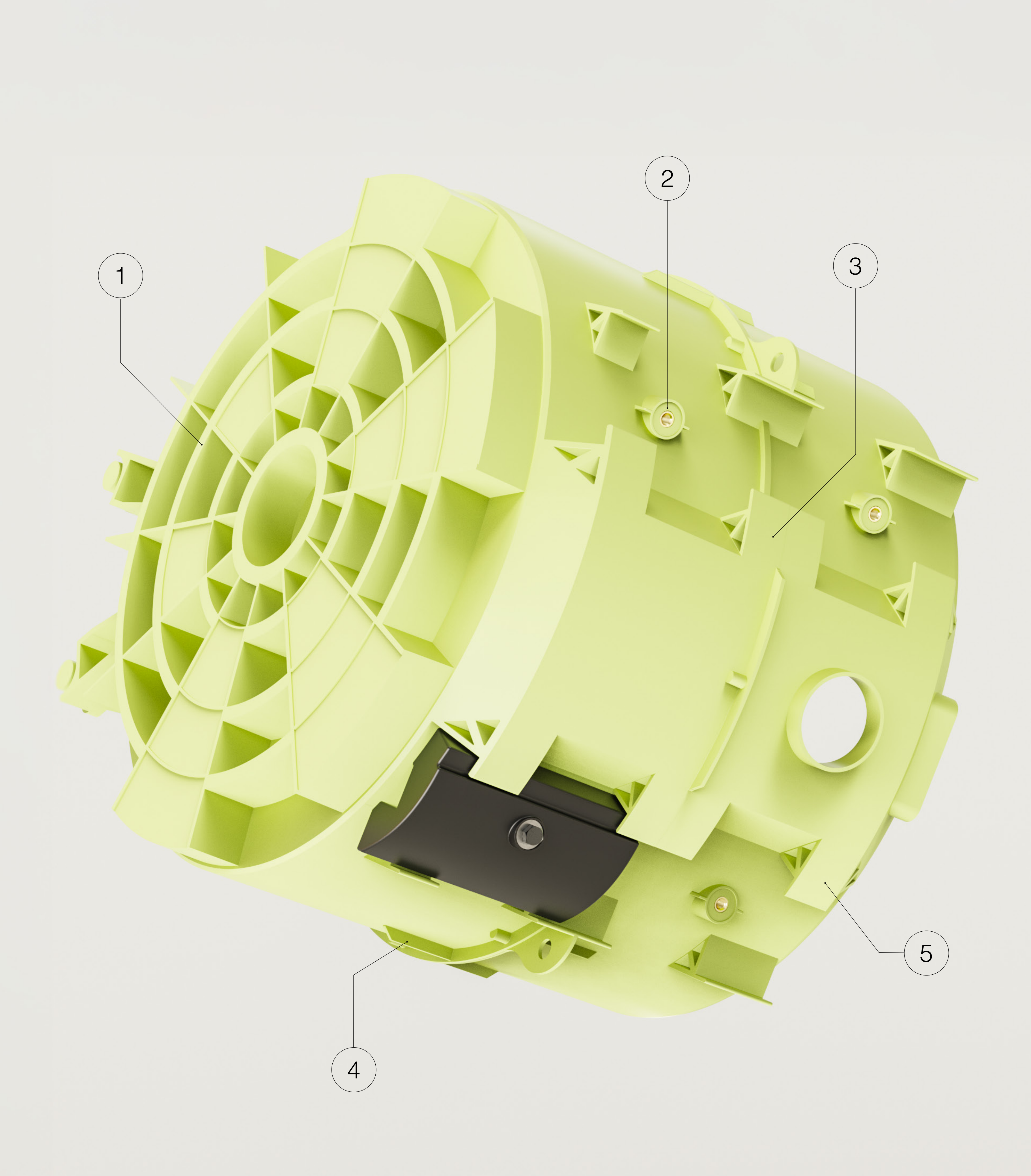
A concealed fastener ensures even clamping force across the circumference of the drum seal.

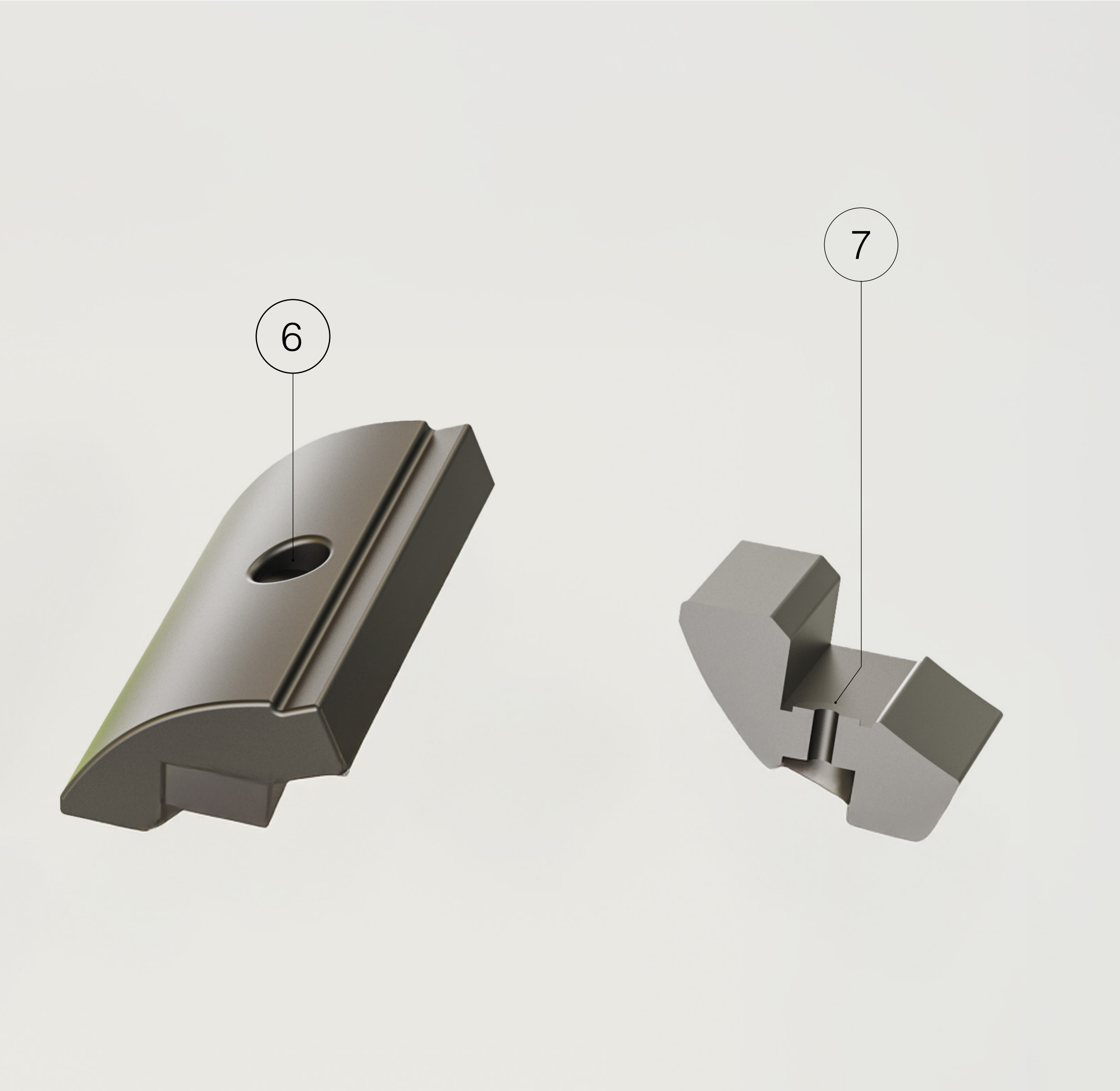
4 - Drum Seal

The drum seal houses a silicon gusset and multiple structural ribs and fastener bosses.

5 - Rail Extrusions

Shortened rail extrusions reduce warping during injection moulding and provide the holding structure during counterweight removal.





Designed to Mould

The outer drum was designed around a six-part injection mould, enabling the integrated features and complex geometries required without compromising the overall design. Early concepts were constrained to a two-part tool with multiple side actions, creating restrictive parting lines and forcing unnecessary design compromises.

The six-part tool introduces multiple parting surfaces and side actions to form undercuts, inlets and structural features within a single moulding process, eliminating the need for secondary operations. Side actions form lateral features such as ribs, fixing points and internal channels before retracting to allow clean ejection.

6 - Sunken Interface

A reinforced boss with ribbing sized at 2.2× the diameter of the M8 fastener

7 - Manufacturing

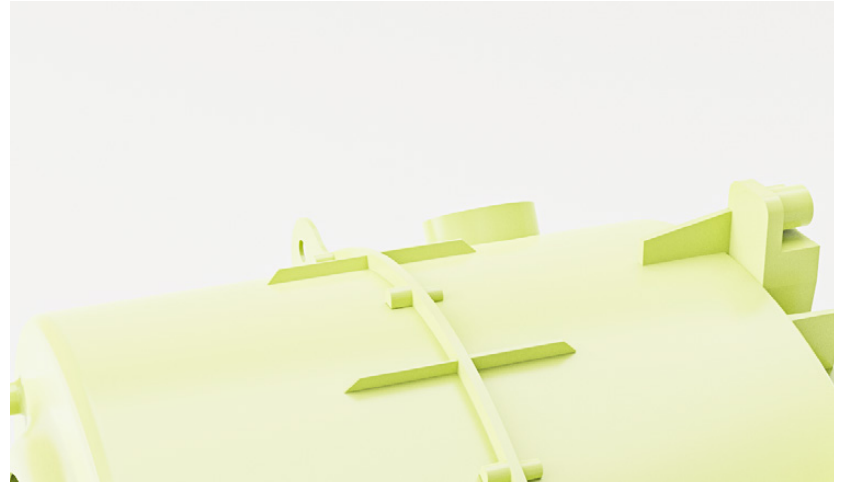
Cast iron counterweights are sand-cast for durability and mass efficiency, enabling consistent geometry, integrated features and cost effective production at scale.

Bead Blasted Stainless Steel

Bead blasted stainless steel was selected for its physical and aesthetic durability, maintaining performance and finish over time. It resists corrosion and wear, retains strength across cycles, and preserves high material value through recycling.

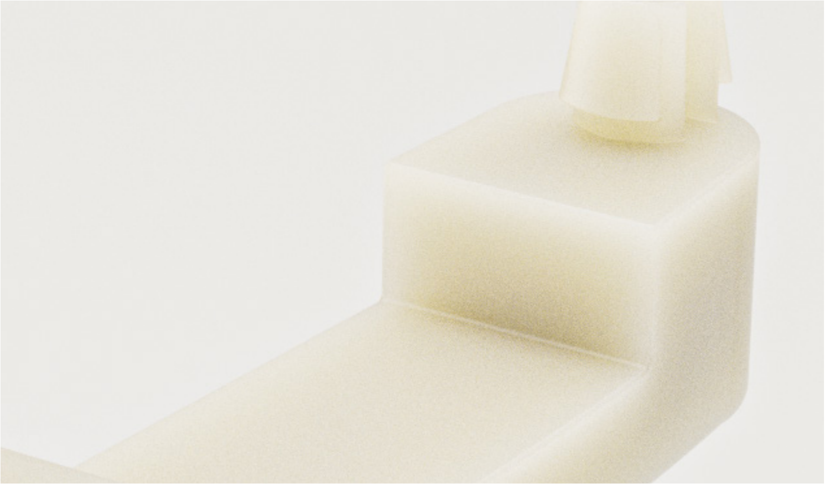
Galvanised Steel

Galvanised steel was selected for the structural member for its strength under repeated loading. The coating provides corrosion resistance, ensuring durability in a demanding environment while maintaining structural integrity and reliable long term performance.



Recycled Polypropylene

Polypropylene (PP) was selected for its ability to withstand cyclic loading and resist wear, while maintaining performance in moist, chemically active environments. It enables complex injection moulded geometries, supporting efficient manufacture.



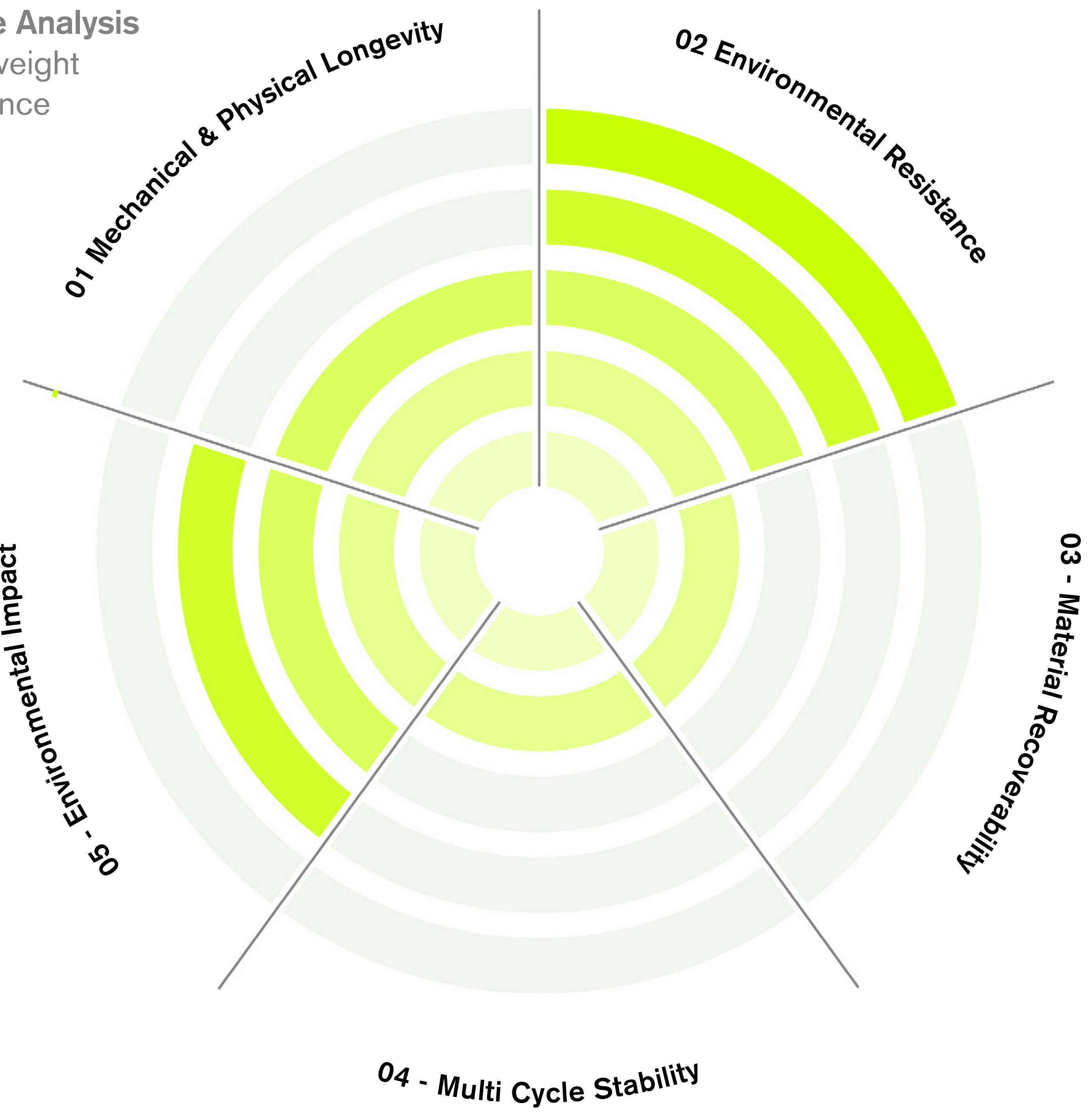
Recycled Nylon

Recycled nylon was selected for the guides for its low friction and wear resistance, enabling smooth movement. It offers sufficient strength and durability under repeated use, while maintaining performance across cycles and supporting material recovery.

Cast Iron

Cast iron was selected for the ballast for its high density and durability, providing stable mass in a compact form. It resists wear and deformation over time, maintains performance across cycles, and retains material value through established recycling processes.

Concrete Analysis
Counterweight
Performance



Material Ranking

01 – Resistance to fatigue, wear, deformation and fracture under repeated loading.

02 – Maintaining performance under moisture, corrosion, UV and temperature variation.

03 – Suitability for reuse, remanufacture and recycling while retaining material value.

04 – Maintaining properties across multiple use and recovery cycles, minimising down-cycling.

05 – Minimising embodied energy, carbon emissions and environmental impact across extraction, processing and manufacture.

Chip

A Bedside Personal Safety Alarm

Chip explores a more human approach to telecare, responding to the limitations of existing devices where complex interfaces, poor audio and impersonal interactions can create distance between the user and the technology. The project reframes telecare around clearer communication, intuitive interaction and a greater sense of companionship, creating a device that feels more naturally integrated into everyday life.

Submission Year	2026
Duration	6 Months
Role	Industrial Design / Audio

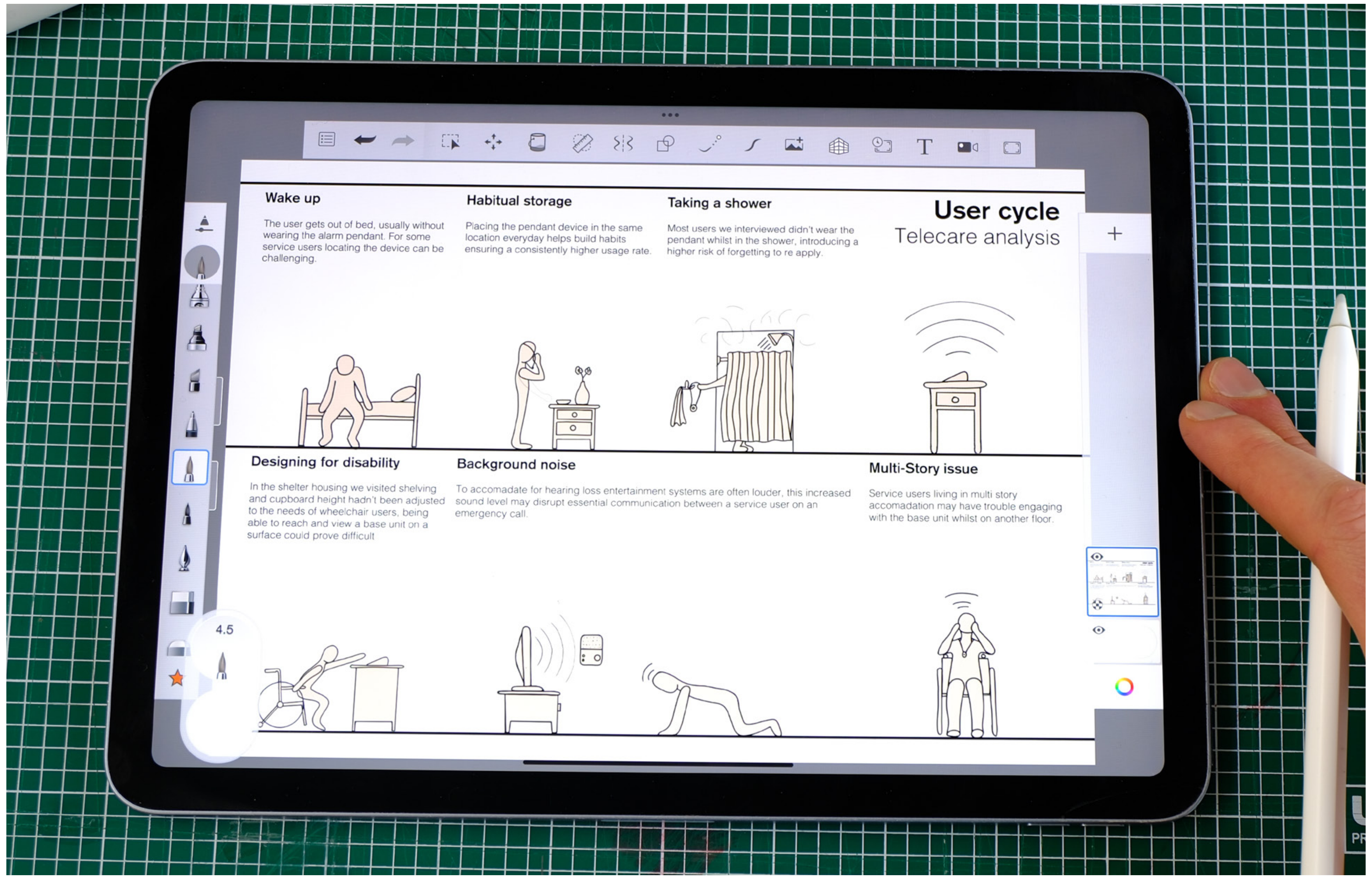
KeyShot
AUTODESK Fusion 360

Gaining Insights.
Animating Voices.

Immersive research across assisted living sites in Glasgow, supported by medical literature reviews, competitor analysis and two focus groups, uncovered the realities of the telecare experience and the needs often overlooked by existing products.

Testing Ideas.
Shaping Interaction.

Rapid prototyping explored the physical interaction points, product layout and accessibility, allowing concepts to be tested and refined through hands-on interaction.



From Insight to Opportunity
Mapping the User Journey.

The research revealed a clear opportunity to move beyond the clinical aesthetic of traditional telecare, prioritising discreet design, improved accessibility and the potential for AI companionship. These insights shaped the design direction and were distilled into a 2D user-cycle visualisation, mapping the key interactions and experiences across the telecare journey.

From Collective Thinking to Individual Exploration.

Through group brainstorming, we explored how user-product interaction could be made more human, desirable and accessible. Building on this, I developed a range of concepts focused on core functional areas: audio performance, physical button affordance, and overall form factor.

To improve the quality and reduce background noise, I explored using beamforming microphone arrays and DSP algorithms, and researched the mechanical design of acoustic ports, focusing on resonance reduction.

1 - Conical Scallops

A visual cue which houses the acoustic port for the PCB microphone array.

2 - Contrasting Fascia

A contrasting fascia helps identify the primary and secondary button clusters.

3 - Pronounced Button

Large tactile button graphics to aid the identification of button function.

4 - Mic Acoustic Channel

Conical acoustic channels tuned above the resonant frequency improve beamforming performance.

5 - LED Light Ring

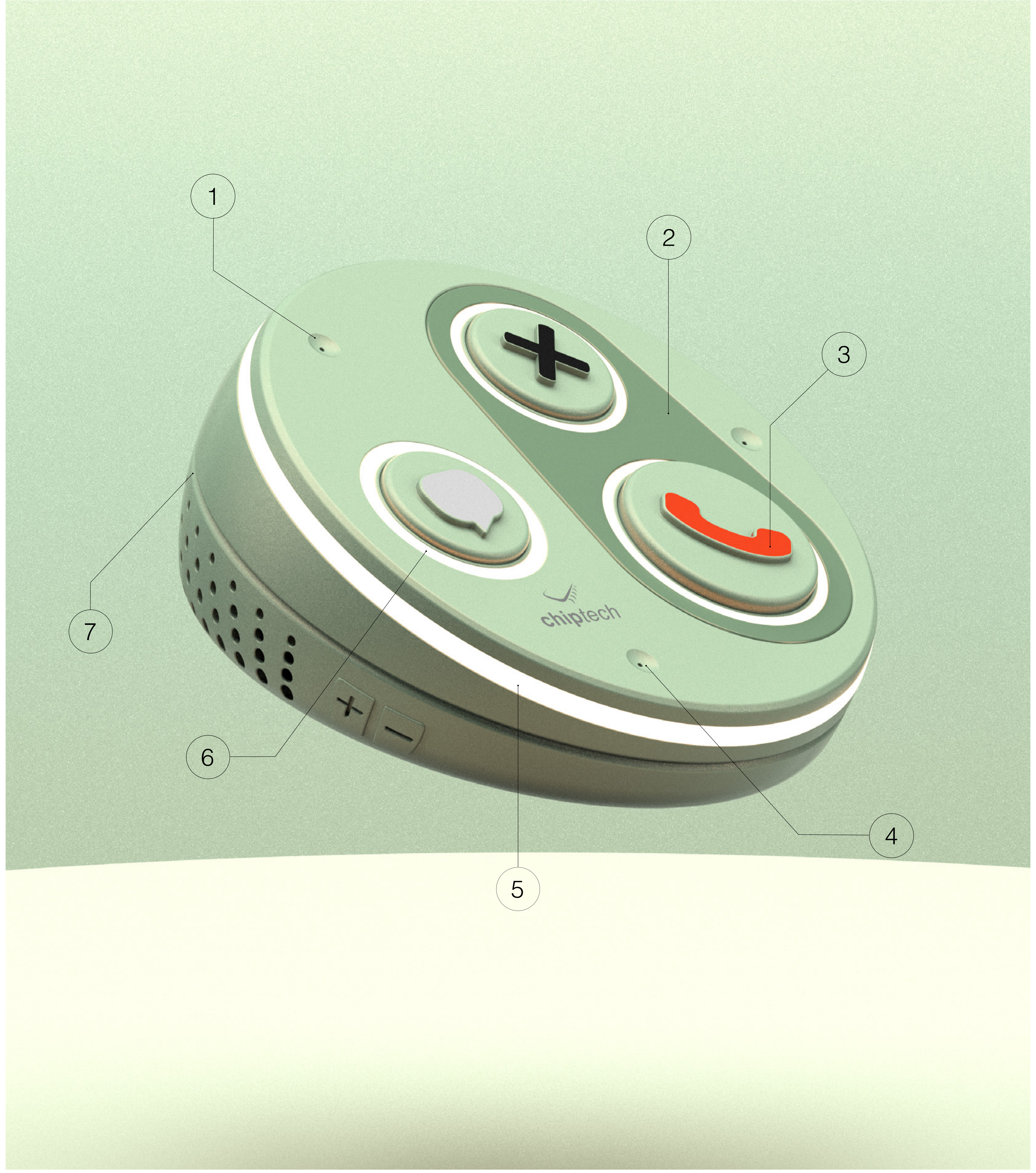
An LED light ring modulates with the AI companion's voice humanising the interaction.

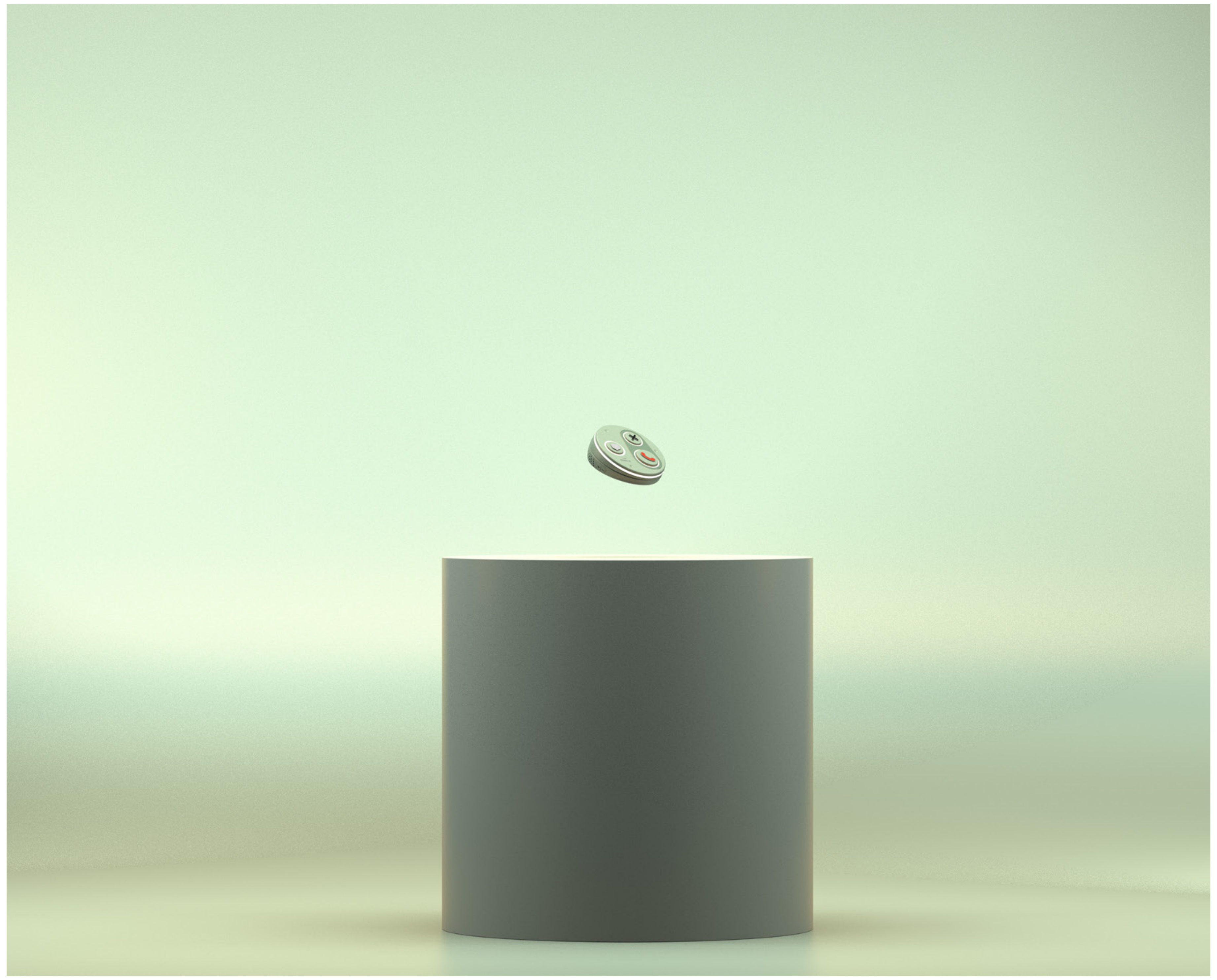
6 - Button LED

LED rings around the buttons act as a light-based interlock, highlighting potential interactions with flashing sequences.

7 - Transformable Form

Twisting top half of the device 180° changes the top face angle between 0° and 15° , ideal for wall mounting or table top.





Engineering a More Human Telecare Experience.

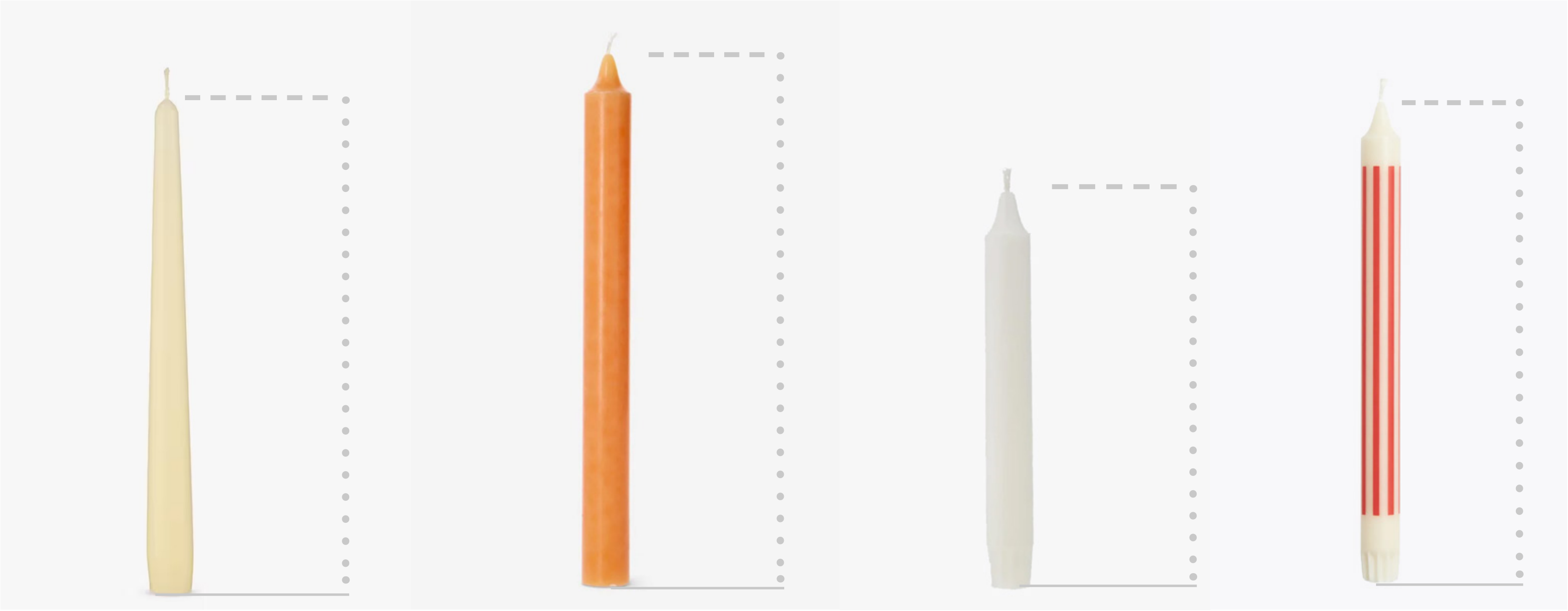
Chip is a telecare base unit that integrates AI voice communication with advanced audio capture and processing. Its form and mechanically isolated architecture reduce background noise, while an adaptive geometry allows the device to sit naturally in a range of domestic environments.

Conic

A Precision Engineered Candlestick Holder

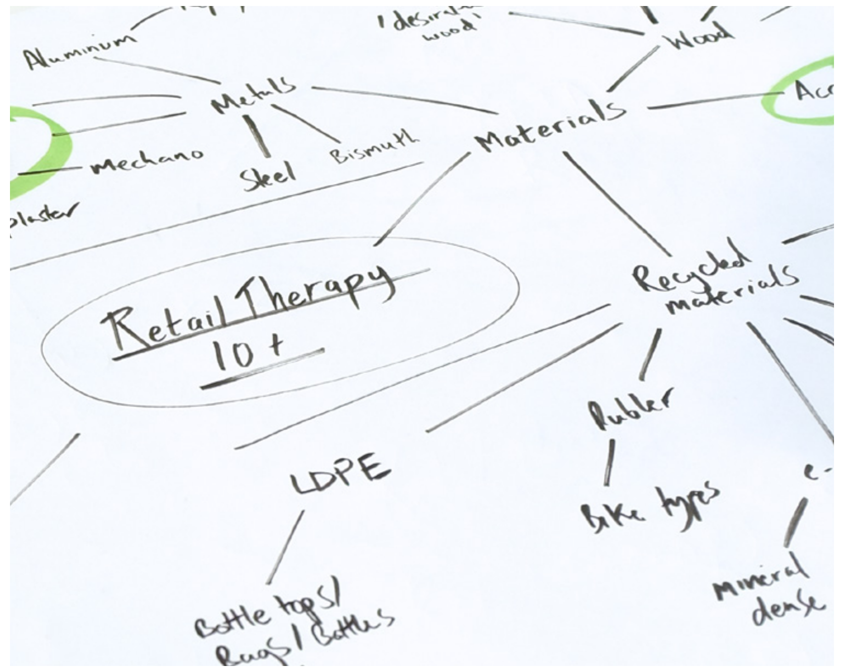
Conic explores durability as both a physical and emotional quality, creating a gift designed to withstand its environment while remaining relevant over time. Its restrained proportions and subtle detailing give the object a quiet permanence, while precision machining and robust materials provide the physical resilience expected of an object made to be kept.

Submission Year	2024
Duration	3 Months
Role	Designer / Maker



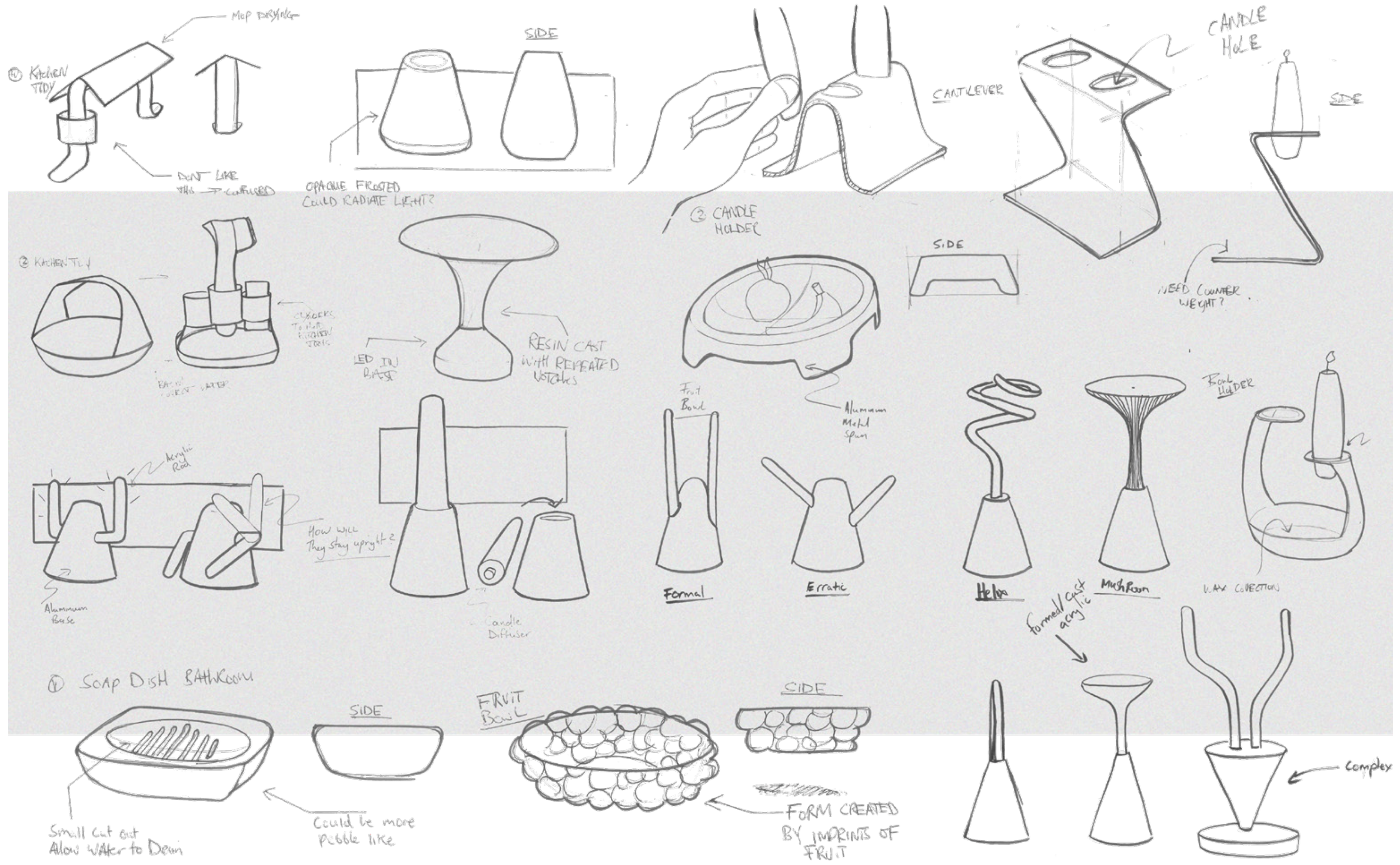
Sizing for Compatibility.

I examined taper and pillar candles from widely available retailers to establish a baseline for their dimensions, construction and materials. Comparing the range of sizes informed a representative mean dimension for the candle interface, helping establish a universal holder diameter that could accommodate commonly available candles.



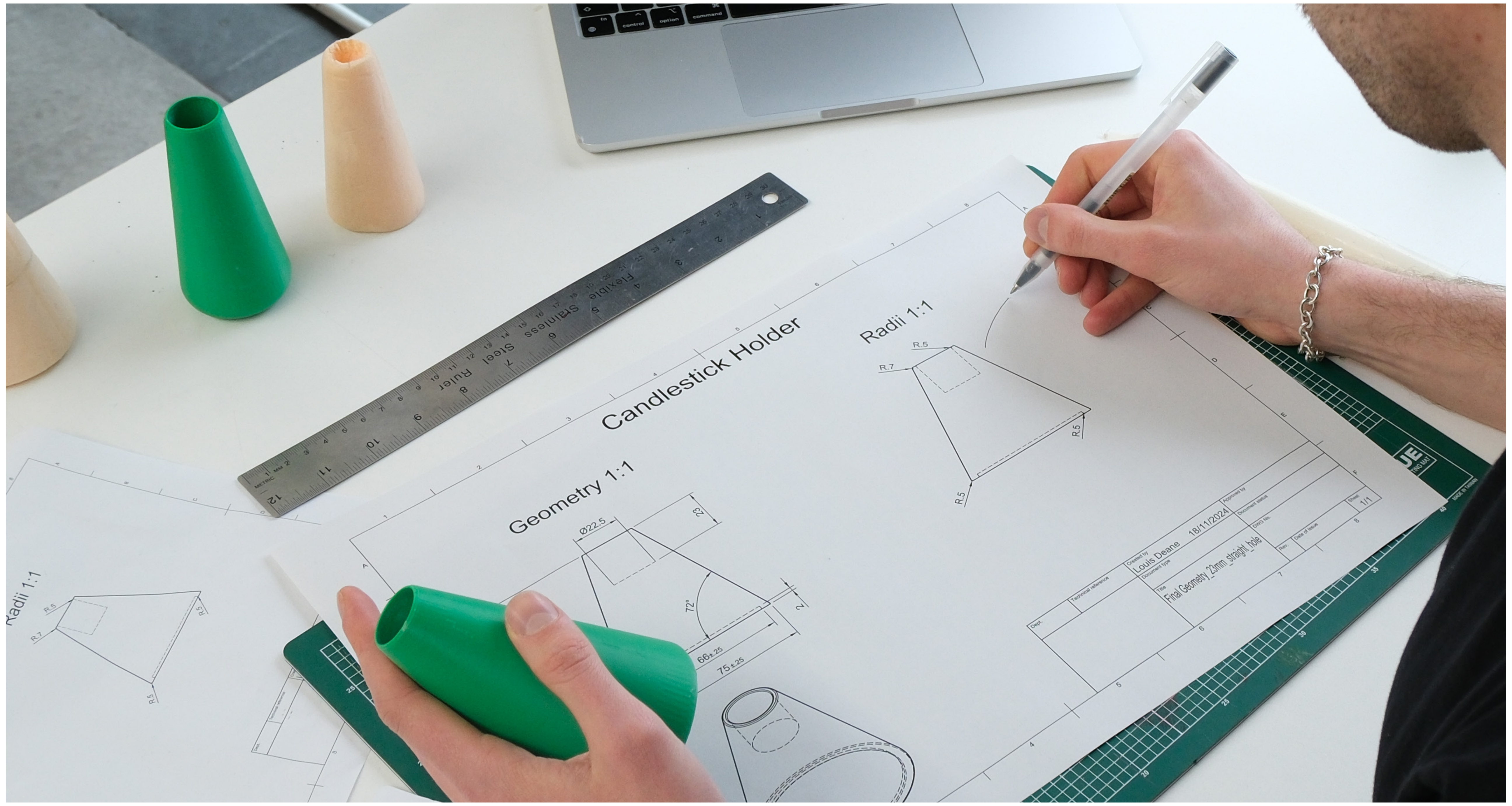
Finding Opportunity in the Familiar.

To begin, I researched existing giftware focusing on products with long-term relevance, commercial success, and manufacturability, using a maximum of two materials and processes. Glassware - particularly tumblers, candlestick holders, and soap dishes - emerged as key opportunities.



Designing for Lasting Value.

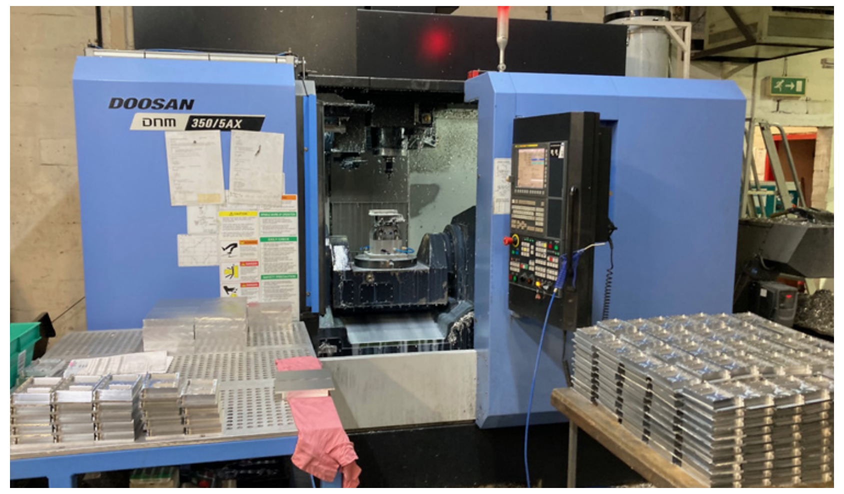
I knew from research I wanted to design a product that had physical and emotional longevity; taking this into account, I began ideating product types, exploring different processing, forming, and finishing methods.



Proportioned for Conversation.
Refined Through Iteration.

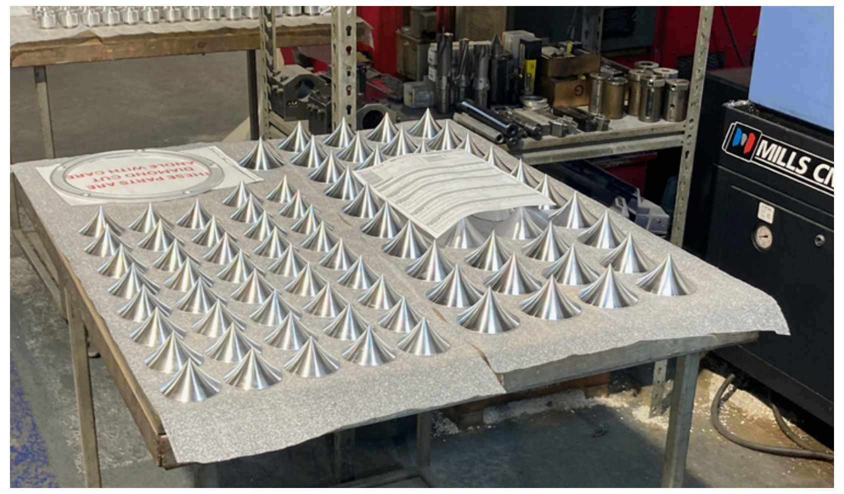
Considering various use cases and user product interactions highlighted the importance of the product facilitating conversation and not obstructing diners' faces. Therefore, I referenced average seated eye height and taper candle sizes to proportion both the holder and the taper candle accordingly.

3D prototyping allowed me to explore the form in detail, producing and evaluating over 20 variants adjusting conical edge angle, fillet transitions, and overall height. Once the optimal form was identified, detailed engineering drawings were produced and sent to manufacturing partner NPI.



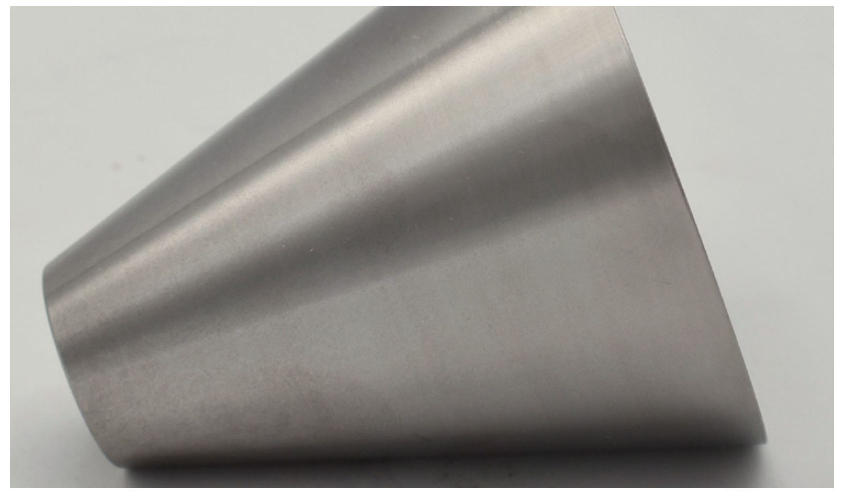
Selecting the Right Process

A five-axis CNC machine was selected to manufacture the candlestick holder after earlier lathe prototypes highlighted significant challenges in securely holding and accurately machining the workpiece.



Understanding Manufacturing Capability

To better understand the realities of manufacturing, I organised a site visit to inspect the production process and assess the tolerances and quality standards achievable through the chosen manufacturing method.



Delivered Product

A batch of 10 holders was delivered in an unfinished machined state, each weighing approximately 1.205 kg with a dimensional tolerance of ±0.25 mm. The machined surfaces were then prepared for the final finishing process.

Finish Experimentation

Using a transparent IKEA enclosure and 14 CFM compressor, I experimented with glass bead blasting and peening to develop the final finish. Testing identified 80 PSI with 75–150 μm glass beads as optimal, producing the uniform matte finish applied to the base. The conical edge was instead given a subtle medium polish to celebrate the precision machining.

1 - Precision Machined

Machined from 304 stainless steel for environmental resistance on a Doosan 5 axis CNC.

2 - Universal proportions

Proportioned based on the mean taper candlestick size ensures a snug interference fit for taper candles

3 - Proportioned Fillet

The top and base fillets are proportioned with equal chord lengths.

4 - Silicone Stability

Three silicone pads provide stability and protect the mounting surface.

5 - Peened Base

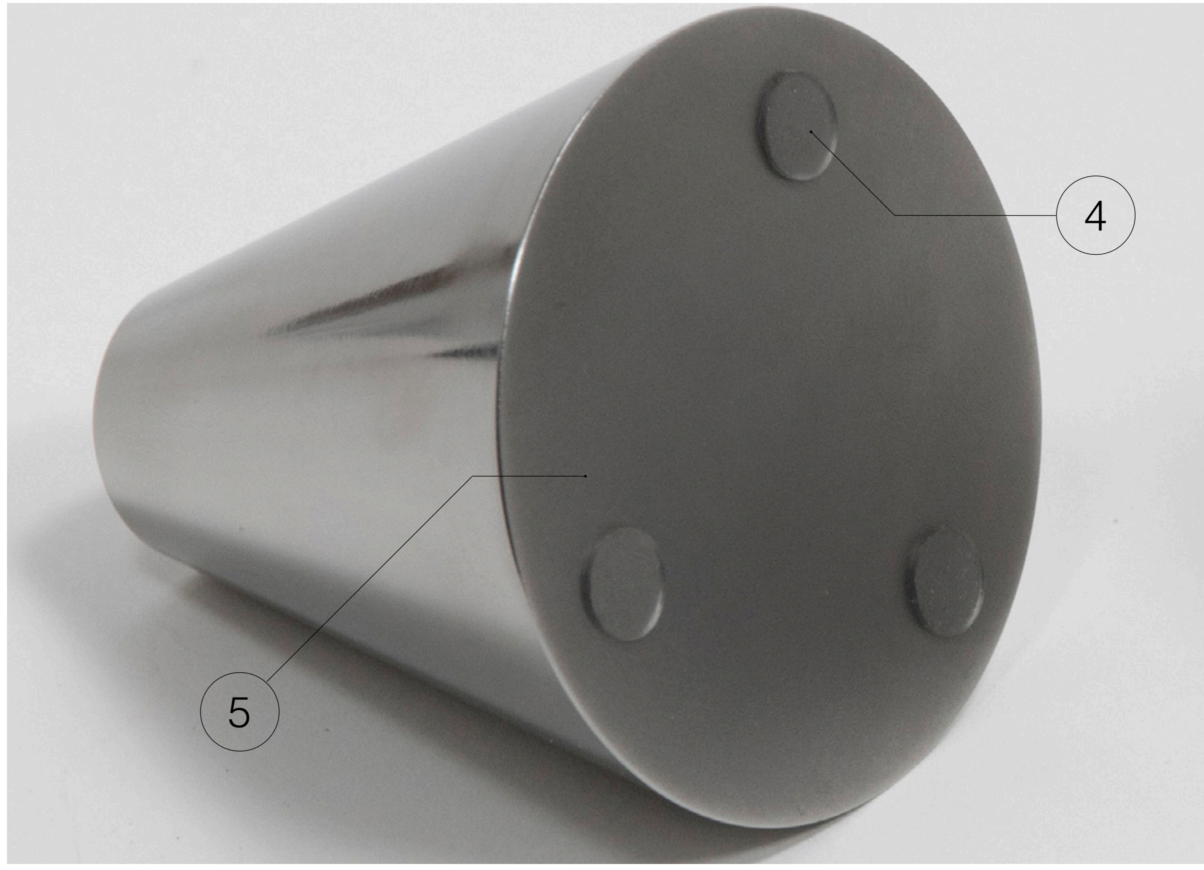
Peened using S110 shots followed by glass beads to provide environmental resistance.

6 - Polished Edge

A medium Jewelers Polish provides a subtle emphasis to the truncated edge.

7 - Micro Fillet

A micro-fillet on the top edge helps channel the candle into the hole.



Engineering longevity.

Designed to be used in dining settings and compatible with taper candles. Conic is CNC-machined from 304 solid stainless steel, with a shot peened and glass bead-blasted base. A medium polish on the conical edge adds a subtle emphasis to its form.

Louis Deane

2026 Portfolio

Mob	(+44) 7860 610072
Email	Louisdeanedesign@outlook.com
Linkedin	www.linkedin.com/in/louisdeane123