JUNE 2021 AALBORG UNIVERSITY MSC4-ID6 ANDREAS FENGER BENDIXSEN EMMA GUNDERSEN

COOL HUNT

Title page.

Title	Cool Hunt
Report type	Product Report
Theme	Master Thesis
Start of project	February 1st 2021
Submission	June 3rd 2021
Project team	Msc4-ID6
Main supervisor	Nis Ovesen
Co-supervisor	Jørgen Asbøll Kepler
Pages	24

Andreas Fenger Bendixsen

Emma Gundersen

Illustration list.

Bookyourhunt, n.d. Roe Buck Hunting per Trophy. List. [image] Available at: <https://www.bookyourhunt.com/en/Tour/11288?fbclid=IwAR2wUB8OdPN03HEetKcB-Z8Q1_1fEnnso8affFG8ngNIYf2zfh1irx4m-7WM> [Accessed 29 May 2021]

Colourbox, 2021. A beautiful view of a lake in a forest on sunny day, Stock image. [image].

Colourbox, 2021. Troop of roe deer. [image].

Abstract.

Dette afgangsprojekt er udviklet og skrevet af Cool Hunt, bestående af to industriel design studerende fra Aalborg Universitet.

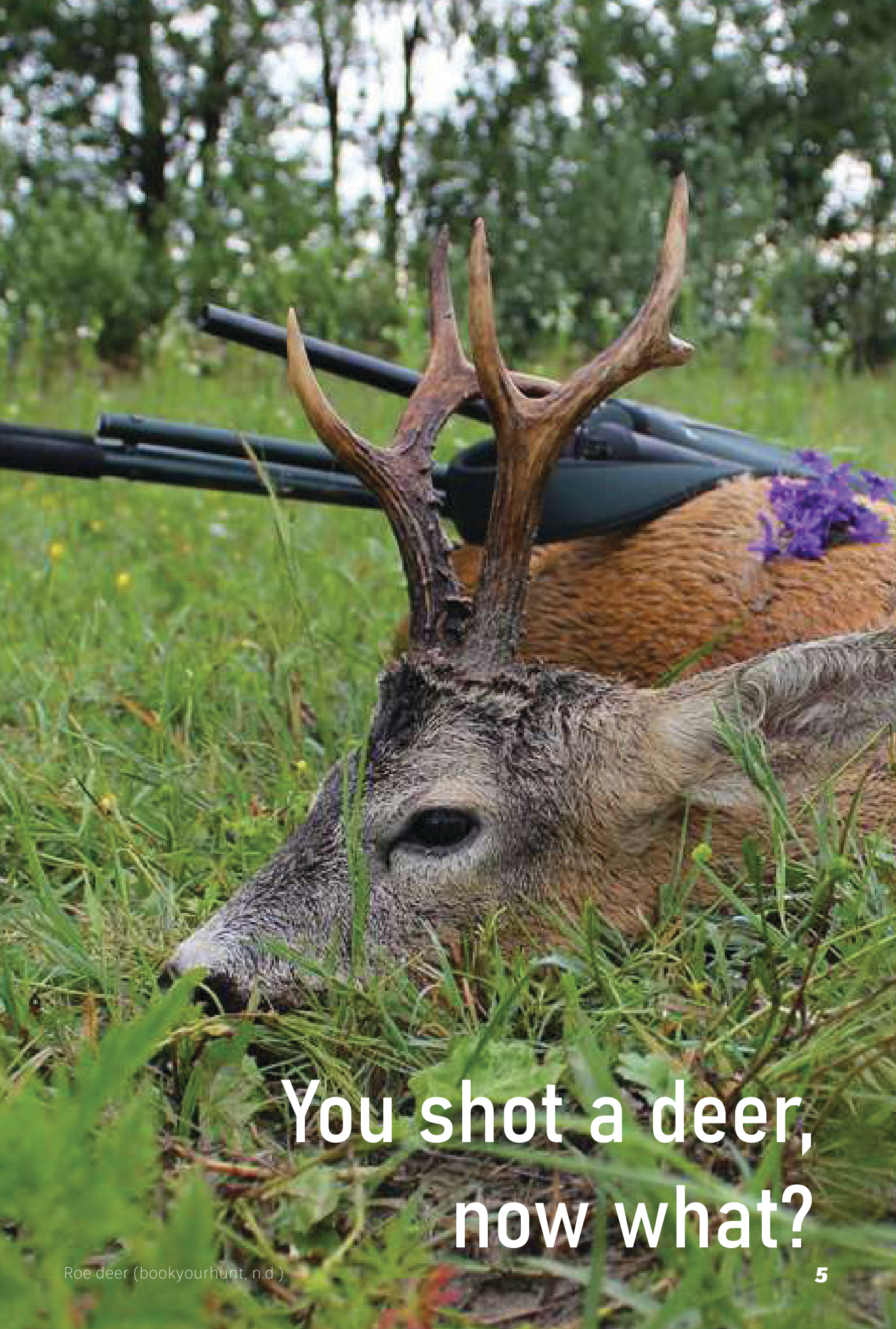
Projektet dykker ned i processen af udviklingen og udformningen af et køleaggregat til nedkøling af nedlagt vildt, primært rådyr. Det er fundet, at kødets kvalitet kraftigt afhænger af jægerens behandling af kødet, og med udgangspunkt heri, så er et hul i markedet identificeret, som peger på en løsning med fokus på optimal hygiejne, modning af kødet og i særdeleshed bekvæmmelighed for jægeren.

I dag er der generelt mange forskellige meninger blandt jægere, om hvorvidt og hvordan vildt skal efterbehandles, og der er kun begrænsede muligheder for nedkøling af vildt, hvorfor gruppen valgte at udvikle et specialiseret produkt til at afhjælpe og konkretisere denne problemstilling.

Resultatet af projektet er et kompakt og effektivt køleaggregat, der med udgangspunkt i jægernes behov skaber muligheden for at sikre høj kødkvalitet samtidig med at give jægeren en større frihed og evne til at slagte dyret, når det findes mest belejligt.

Forest (Colourbox, 2021)

Content.



You shot a deer, now what?

Roe deer (bookyourhunt, n.d.)

Why should I cool my game?

Hygiene.

Temperature control is crucial for proper hygienic conditions. Wildlife game should be kept under 7 °C, which is also recommended according to the Danish Veterinary and Food Administration.

Maturation.

Rigor mortis is the natural effect of death that stiffens the limbs. It usually dissapears again after 24 hours, leaving the meat much more tender.

Convenience.

Hunting can be exhausting when coming home late after the sun has set. Especially on a summer night, the last thing you want to do is skin and butcher your game. However, leaving it outside in uncontrolled and too warm weather can ruin the meat.


ELSK


Cooling unit.
Top.
Insulating cover.
Inner layer
of cover.
Power cord.
Top cover
attachment.
Height
adjustment rope.

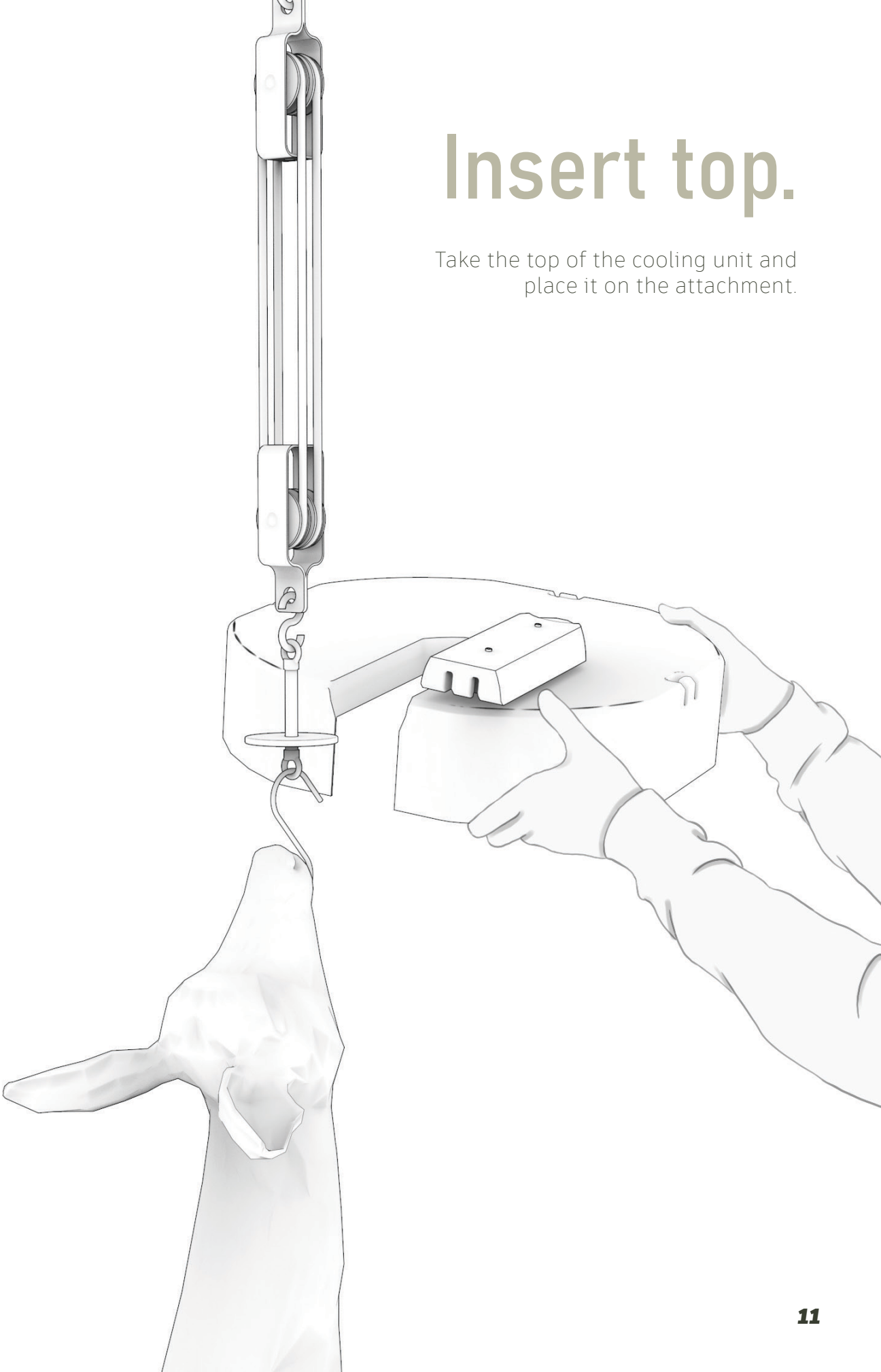
Hang the deer in its usual spot.

Connect the top cover attachment to your current hanging solution and leave it there for the future.

Find Cool Hunt when arriving home after hunting.

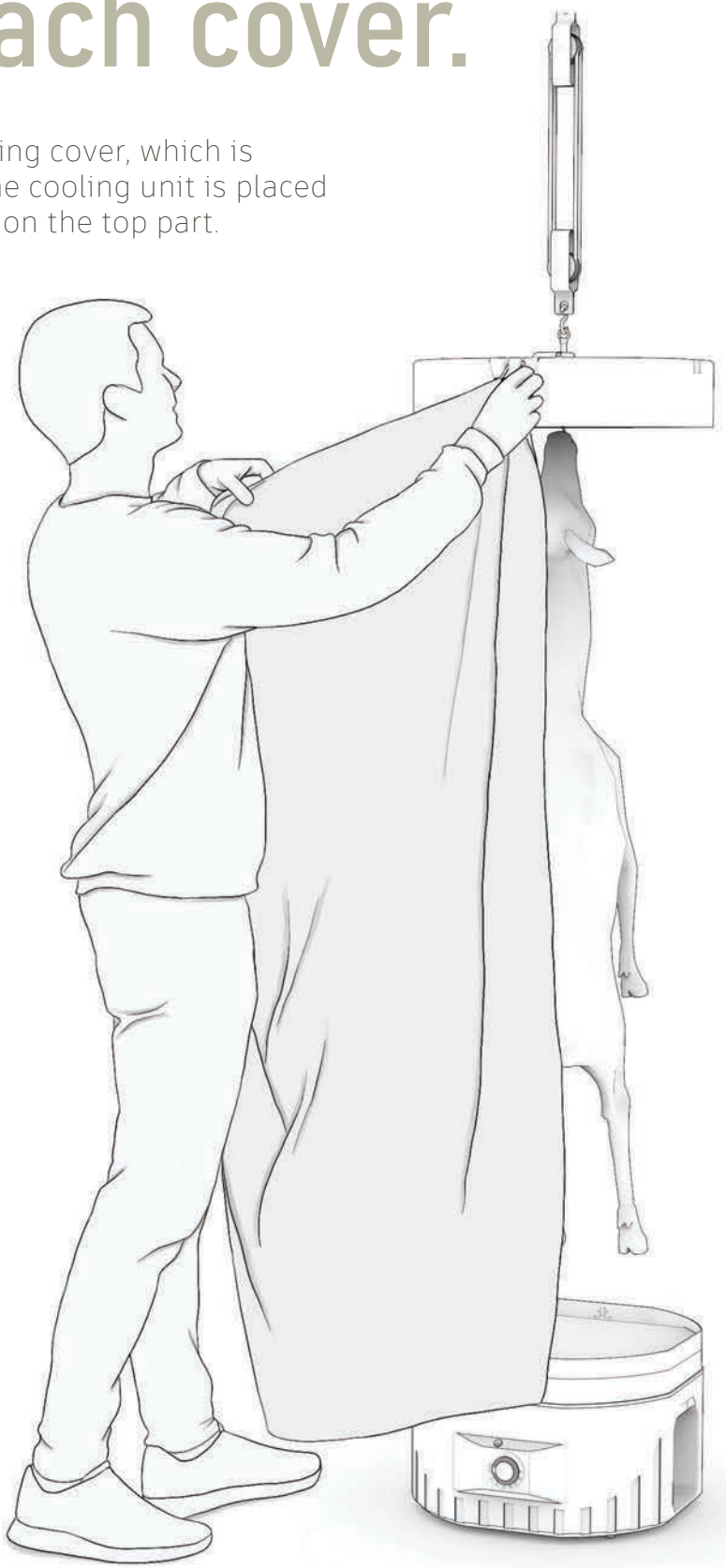
Insert top.

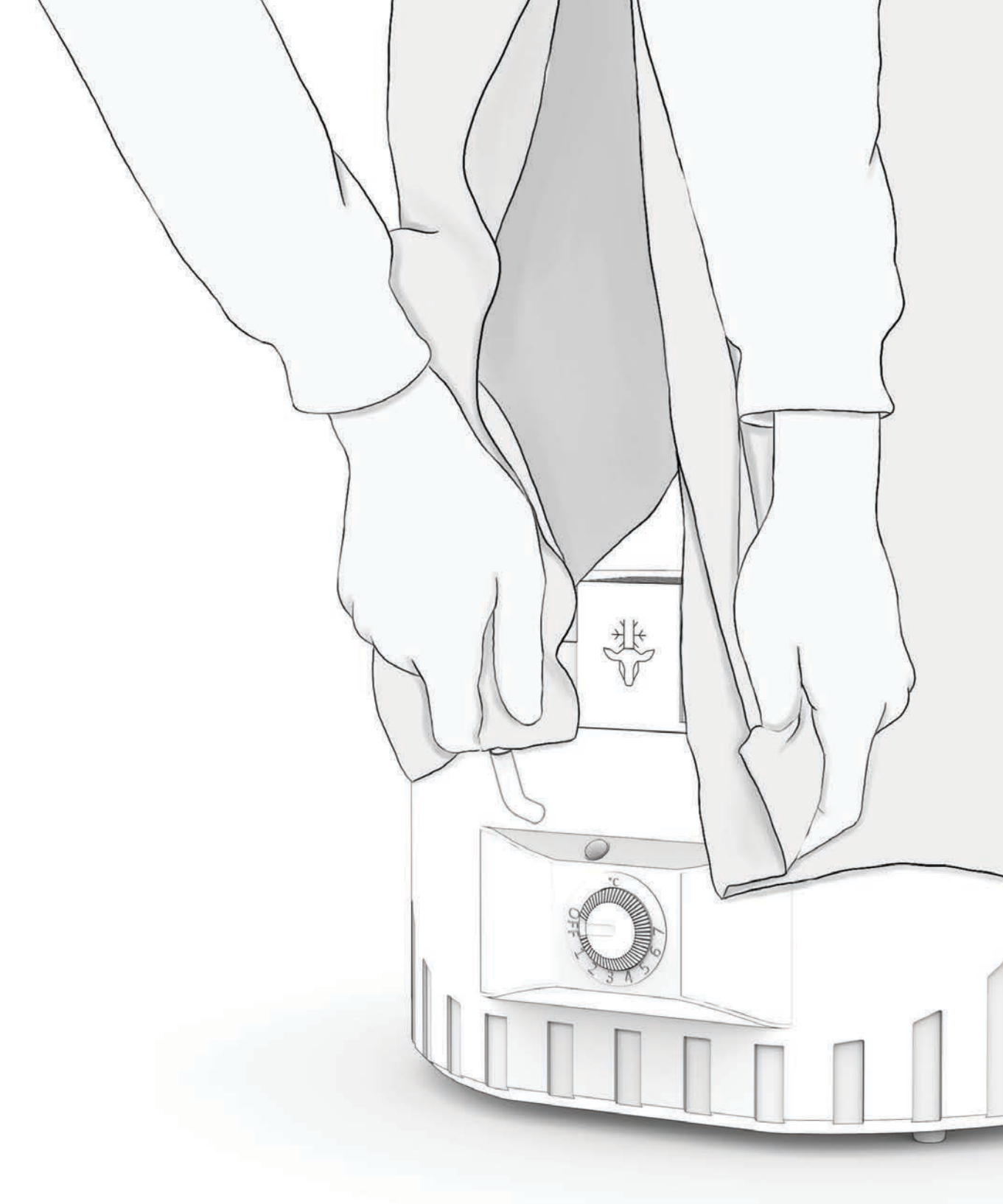
Take the top of the cooling unit and place it on the attachment.



Attach cover.

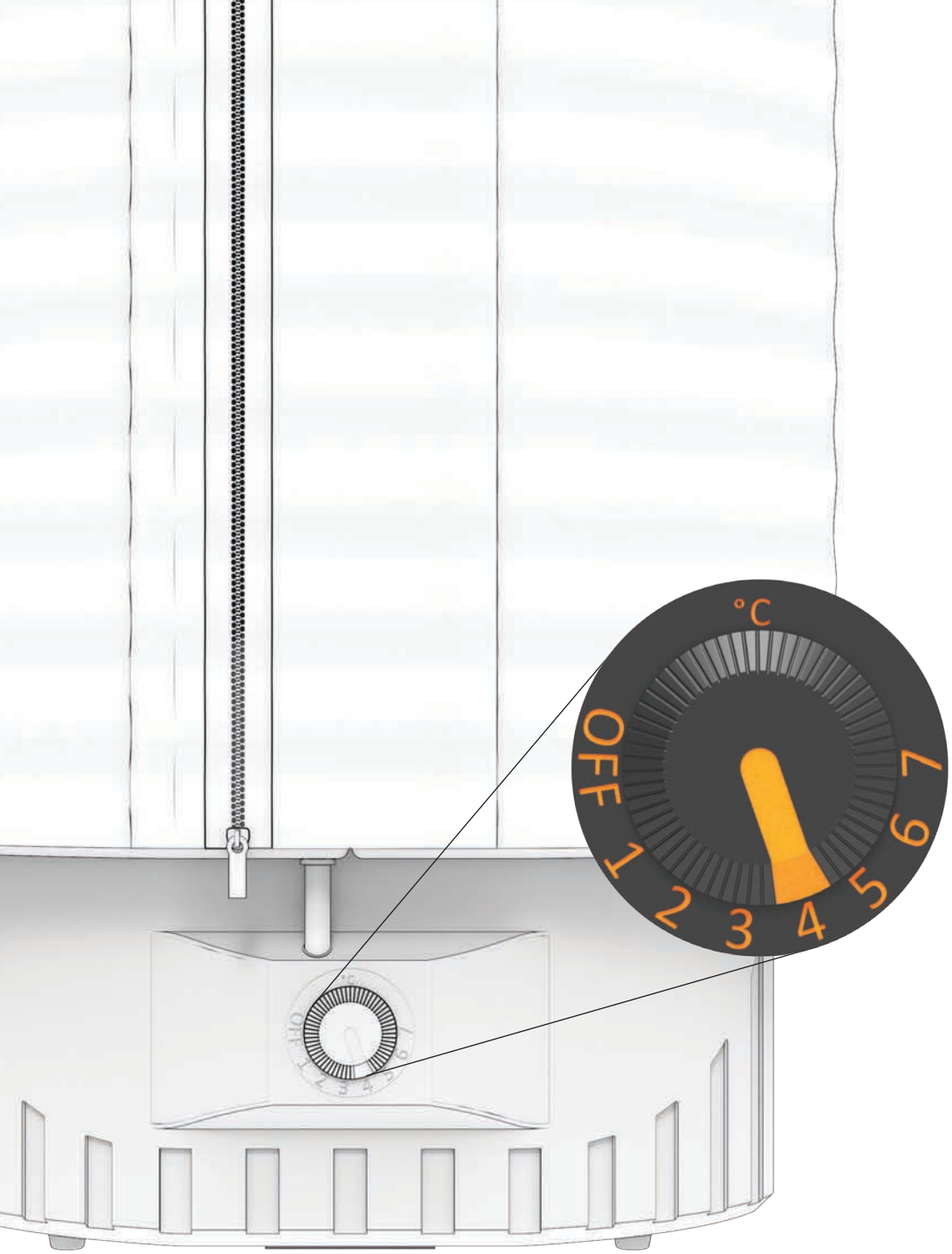
The insulating cover, which is stored in the cooling unit is placed with hooks on the top part.





Attach air valve.

A rubber hose ensures an air tight fit.



You're good to go.

Turn on the cooling unit by setting the desired temperature.

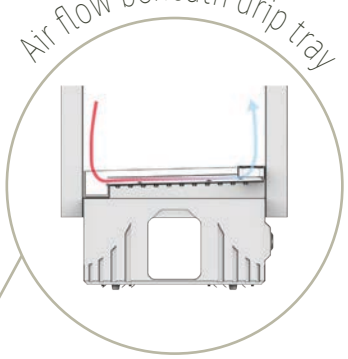
The cover will automatically inflate in order to ensure sufficient insulation.

Cool game.

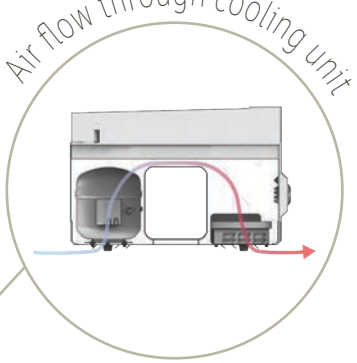
Let your game cool for
as long as wanted.

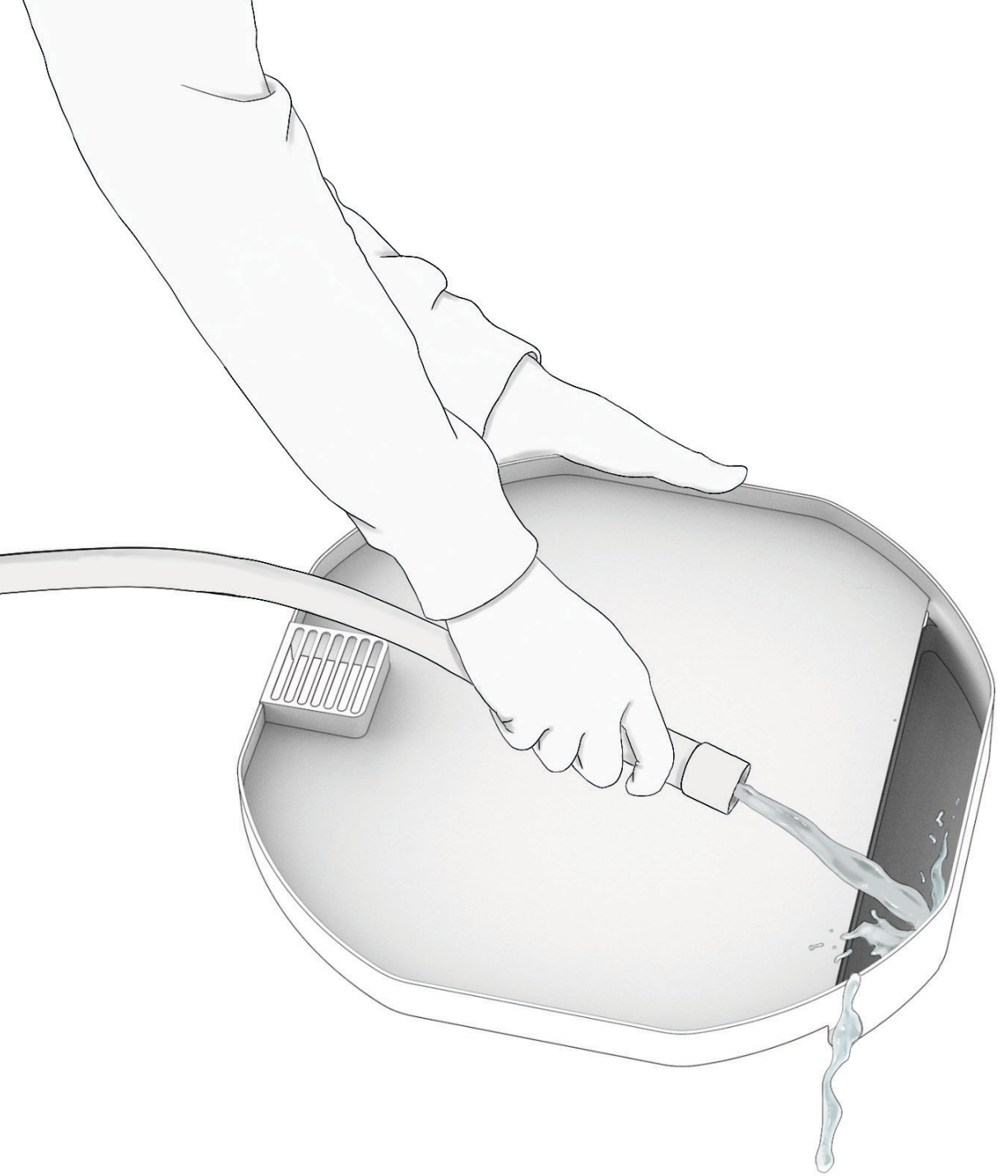
Pockets of air as insulator

Air flow beneath drip tray



Air flow through cooling unit





Clean drip tray.

The drip tray will collect blood, ticks, and condensed water from cooling unit.

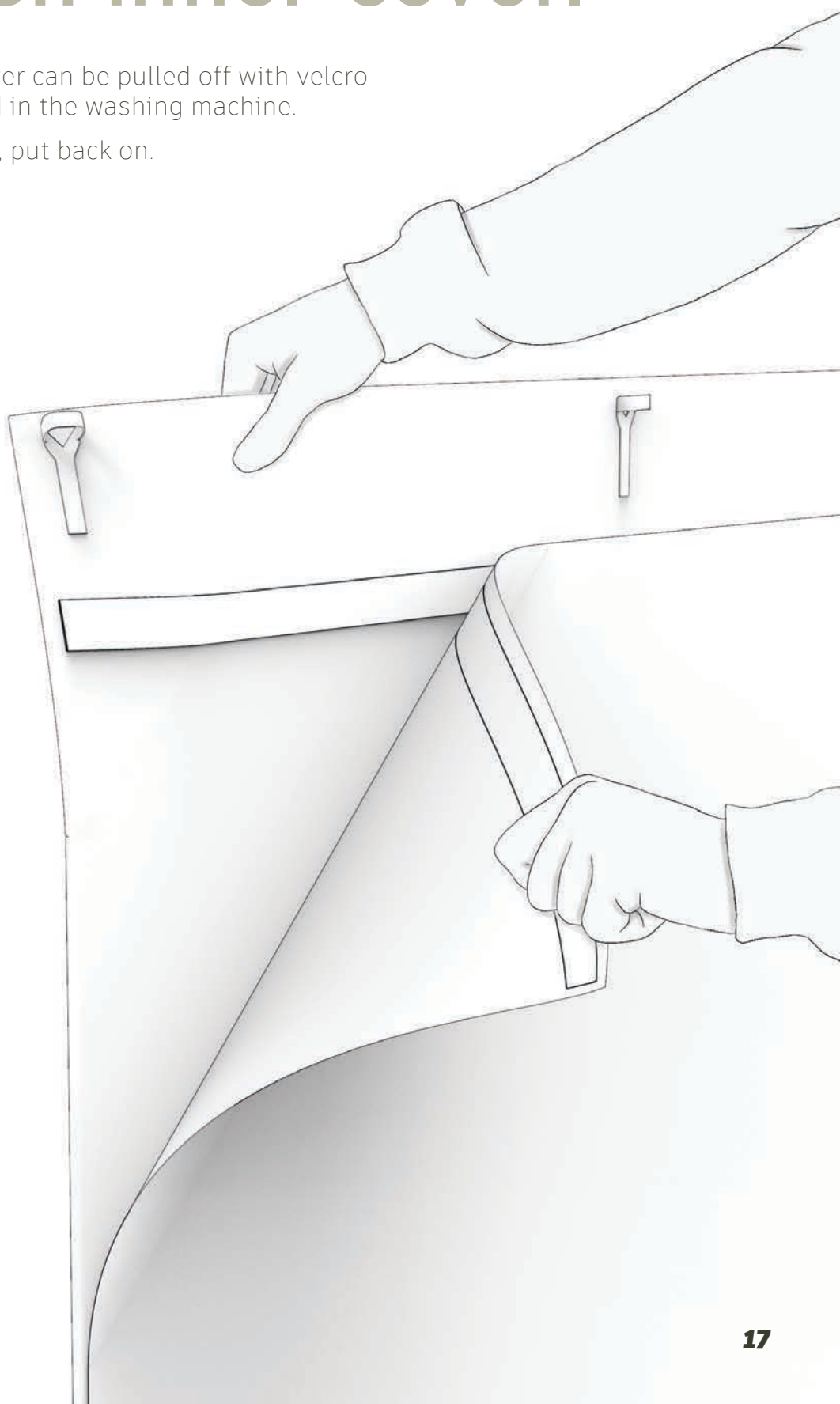
Take off and clean.

Put it back.

Wash inner cover.

An inner layer can be pulled off with velcro and washed in the washing machine.

When clean, put back on.



Pack down.

Pack everything down.

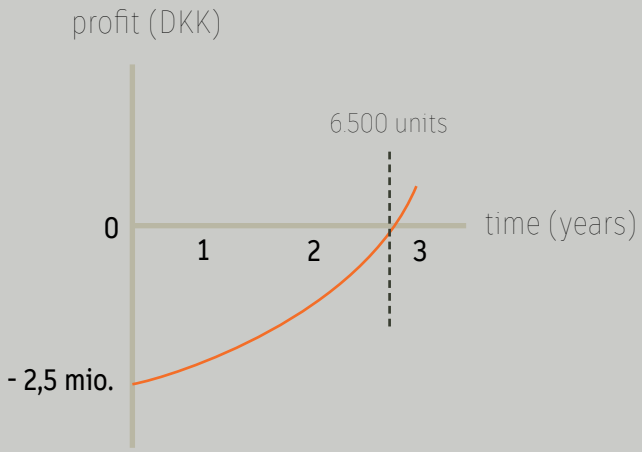
Roll up both cover parts together and store inside the cooling unit.

Convenient to store.

Breakeven.

The Cool Hunt product is available for 3.500 DKK. With an initial investment of 2.500.000 DKK it's able to return profit after 2,7 years on the market with around 6.500 sold units in Denmark and Germany.

Further development of the product will include an XL cooling unit, capable of cooling game bigger than a roe deer. This is suitable for other countries, where hunters are more likely to hunt bigger game as the U.S., U.K., France, Spain and Italy.



Plan for launching.

Development

Seeking further validation from the users, prototyping, testing, and design optimization.

10.000 DKK

// 4-5 months

Legal aspects

Seeking patent guidiance, and sending application. Risk evaluation, instruction for use, and CE marking tests.

50.000-400.000 DKK

// 2-3 months

Production preparation

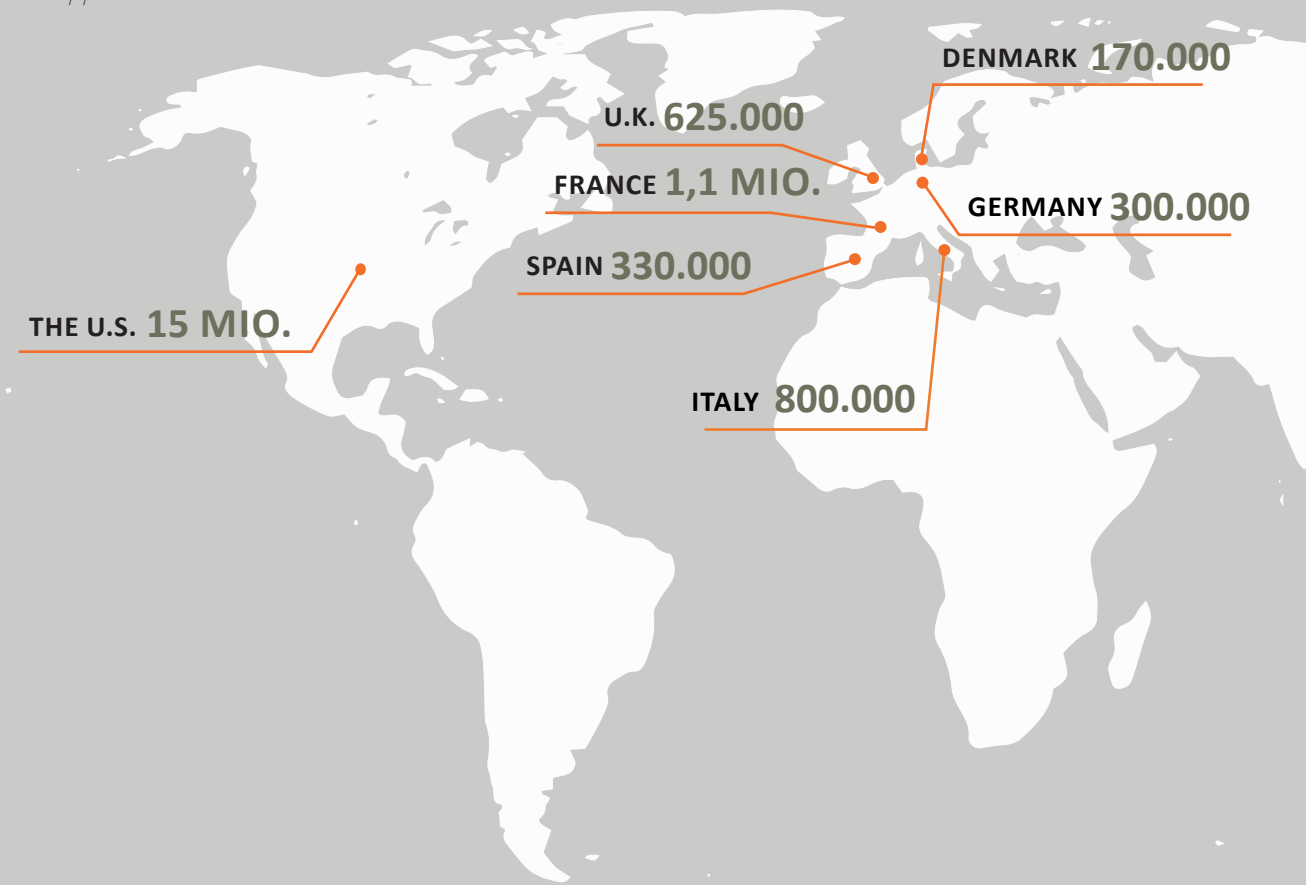
Getting consultancy of injection molding, design for manufacturing, and prototypes making.

200.000 DKK

// 2-3 months

Market.

// no. of hunters



Tool making

Tool making of injection molds, foam molds. Marketing including meeting clients, fairs, retail stores etc.

Production and marketing

First order of 200 units. Marketing to create awareness and push the product on the market.

Total

A total of the time and investment cost.

1.350.000 DKK

// 4 months

400.000 DKK

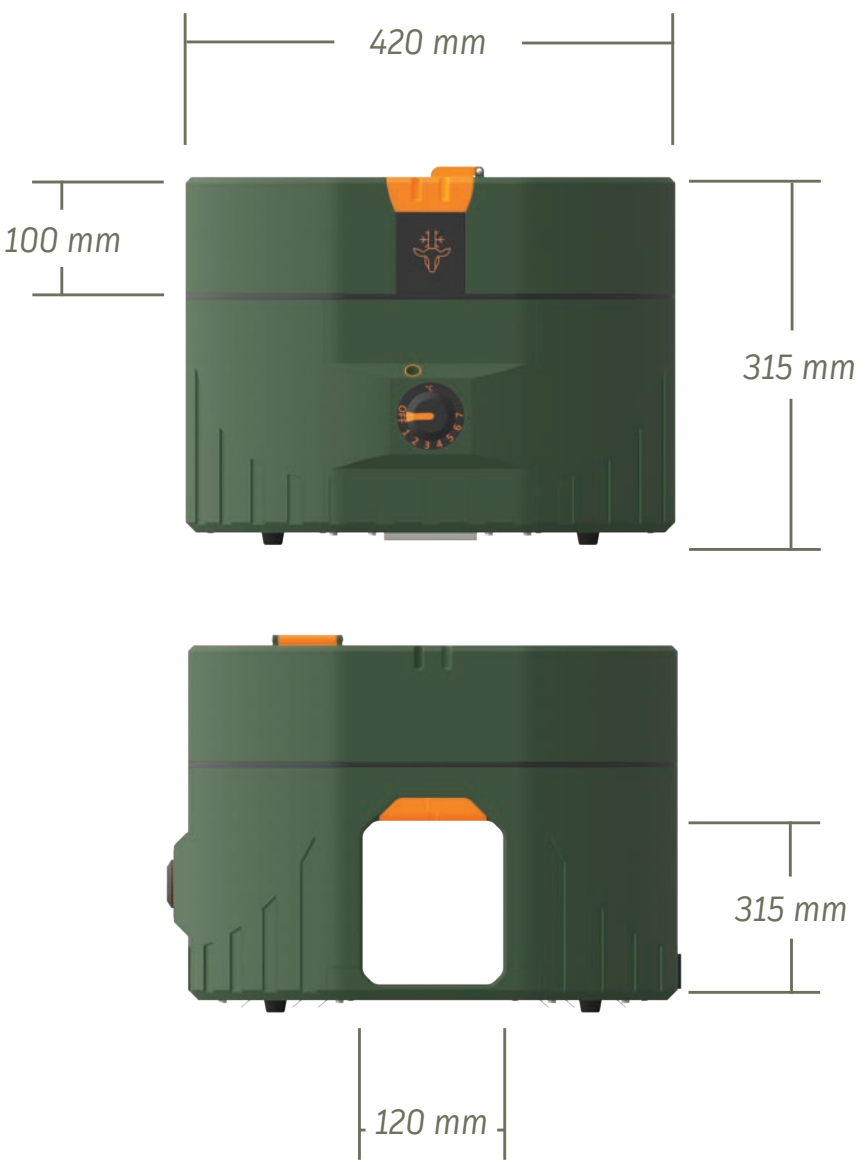
// 2-3 months

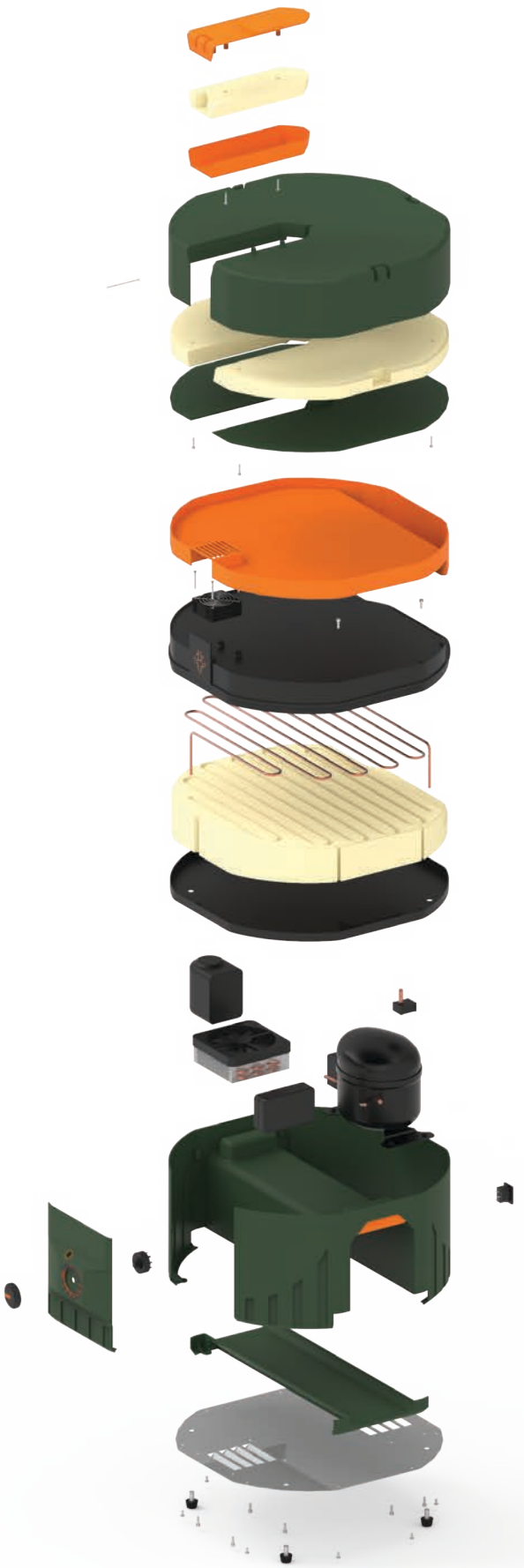
2.500.000 DKK

// 1 - 1 ½ year

Specifications.

Weight	10 kg.
Power consumption	147 kWh/annum
Dimensions	315 x 420 x 420 mm





Insulated latch.

Insulated top.

Drip tray.

Evaporator.

Compressor, condenser, and electronics.

Cooling unit compartment.

Base plate and feet.

AALBORG
UNIVERSITY

Roe deers (Colourbox, 2021)

COOL HUNT

PROCESS REPORT

JUNE 2021 AALBORG UNIVERSITY MSC4-ID6 ANDREAS FENGER BENDIXSEN EMMA GUNDERSEN

TITLE PAGE

Title	Cool Hunt
Report type	Process Report
Theme	Master Thesis
Start of project	Febuary 1st 2021
Submission	June 3rd 2021
Project team	Msc4-ID6
Main supervisor	Nis Ovesen
Co-supervisor	Jørgen Asbøll Kepler
Pages	100 excl. front and back

THE TEAM

Ill. 1. Andreas and Emma shooting with riffles at a shooting range for the first time

The team consist of Andreas Fenger Bendixsen, on the left, and Emma Gundersen, on the right, ill. 1. The two members complement each other well with different competences. Andreas has competences within 3D modelling and rendering whilst Emma works great with graphic design. Both team members have an interest in the early stages of understanding the users and their needs as well as implementing an easy construction that support a great product-user interaction.

ABSTRACT

Dette afgangsprojekt er udviklet og skrevet af Cool Hunt, bestående af to industriel design studerende fra Aalborg Universitet.

Projektet dykker ned i processen af udviklingen og udformningen af et køleaggregat til nedkøling af nedlagt vildt, primært rådyr. Det er fundet, at kødets kvalitet kraftigt afhænger af jægerens behandling af kødet, og med udgangspunkt heri, så er et hul i markedet identificeret, som peger på en løsning med fokus på optimal hygiejne, modning af kødet og i særdeleshed bekvæmmelighed for jægeren.

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READING GUIDE

This process report clarifies the process of the project Cool Hunt. The report will give an overview of the process and will give an understanding of the decisions that led to the final Cool Hunt product. It's recommended to read the product report first which explains exactly what the product consist of and secondly, read this process report. Only the most relevant information is showed in this process report, and the work behind the information can be found in Appendix referred to in-text as app. XX. The Appendix are based upon worksheet that are structured the same way divided into relevant headings. This gives the reader a structured understanding of the work tasks. The Appendix can be found on the USB-stick. Technical drawings will show and give an understanding of the constructional composition of the product.

Throughout the process requirements and wishes for the product will be collected from insights and research and shown in the report, together with an update on the direction and the main focus.

REQUIREMENT & WISHES

CONTENT

UNDERSTANDING

IDEATION

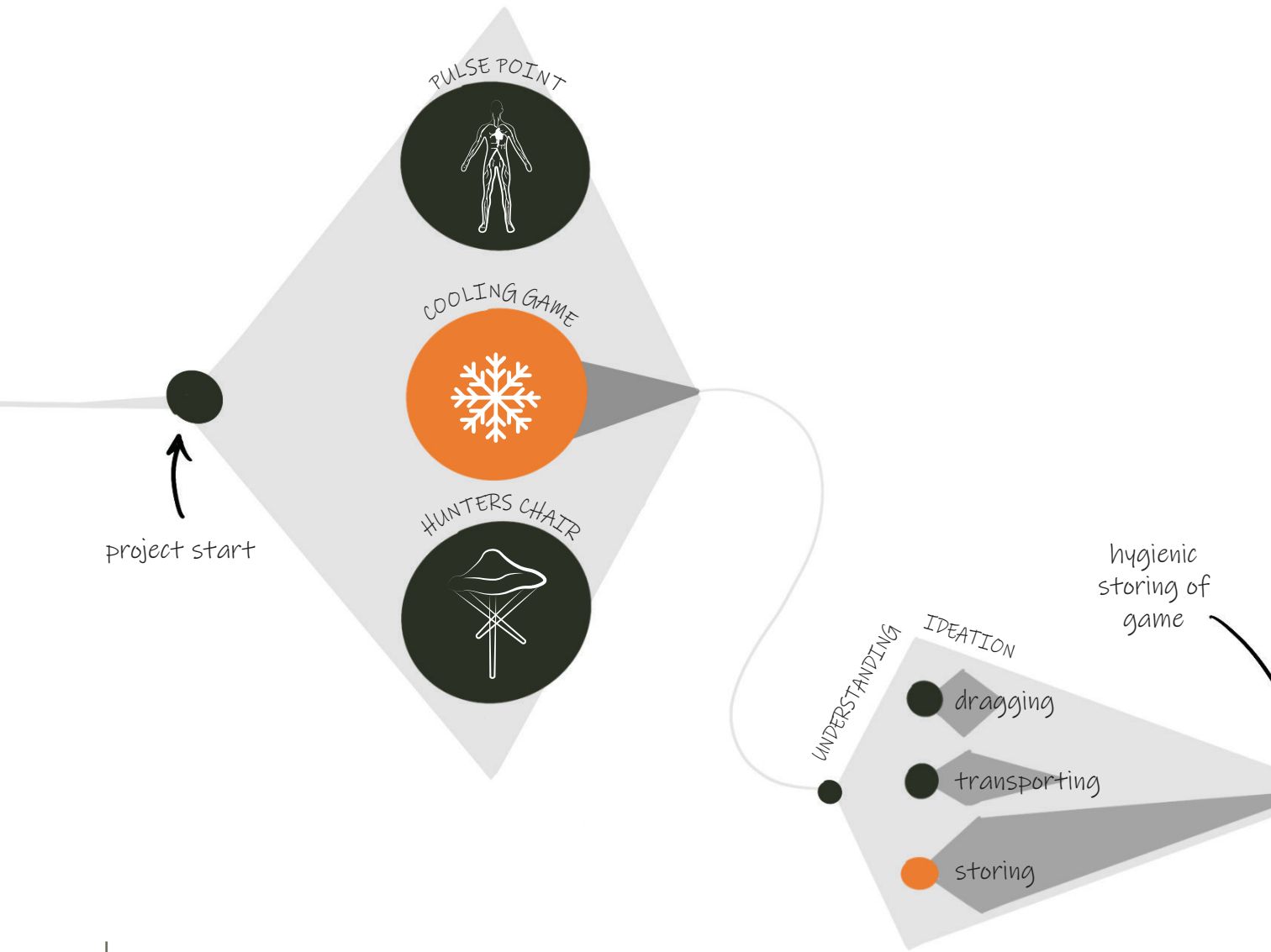
CONCEPTUALIZATION

DETAILING

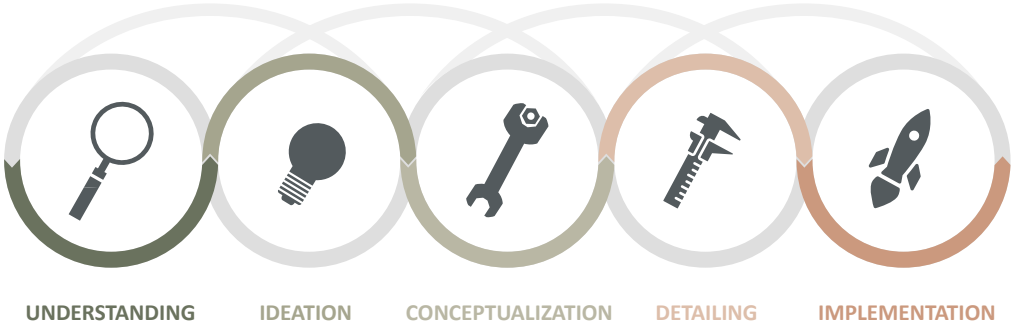
IMPLEMENTATION

OVERVIEW OF THE PROCESS

The initial scope of the project was a more optimal chair for the hunters. The scope was diverged early on to seek interesting dilemmas and opportunities. During an early interview with a hunter, we saw an opportunity and a problem of cooling game. The project was steered in this direction as we noticed a missed opportunity. App. 1-5 clarifies the process of the problem, market potential, opportunity, and reason for not choosing the direction of “hunters chair”. Furthermore, app. 6-8, clarifies the same aspects of “pulse points“. The chosen direction of “cooling game” was opened up with a main focus of hygiene in which three steps of the user journey that included hygienic dilemmas was chosen of “dragging“, “transporting”, and “storing”. The latter step of storing at home clearly had the biggest interest form our users and was chosen as the direction with the best opportunity. This process report leaves out the first two directions of “pulse points“ and “hunters chair“. The report focusses on the direction of “cooling game“ and we’re telling the story about how the product concept Cool Hunt was formed with the big main focus of hygienic handling of killed game, see ill. 2.



PROCESS APPROACH



Ill. 3. The five phases

The overall design process is divided into five phases, which is also used as chapters for this project, see ill. 3. Each phase is described into detail at the start of the given chapter.

DESIGN THINKING

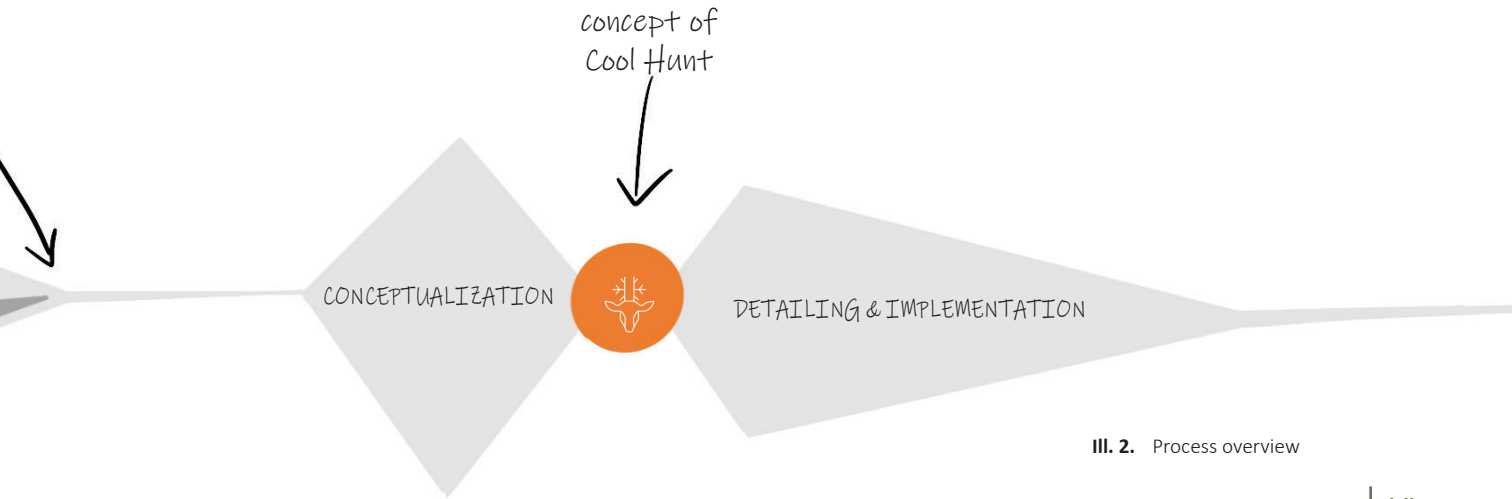
During the development of this project, the team has followed the Design thinking approach with hunters in focus and involving them every step of the way. It has helped to develop a concept, which is based on the user's actual needs to ensure both desirability, viability, and feasibility for a potential product on the market (Tollestrup and Laursen, 2017).

ITERATIVE PROCESS

Throughout the entire project, the team and the initial idea has gone through constant minor iterations, each shaping the process and refining the idea into an actual concept.

CONVERGING AND DIVERGING

During the project, the team has focused on having a converging/diverging process, as seen on ill. 2. Allowing the team to understand and developing a defined problem space and in the end focus on a concentrated solution space, to ensure the concept consisted of the best possible solutions.



Ill. 2. Process overview

UNDERSTANDING

In this understanding chapter the team is going to get into the mindset of the users, this is done by searching online, contacting hunters, interviewing them, and observing them while discussing the topic at hand. The team will define who the product is for and what their explicit needs, wishes, challenges and problems are. The gained insight will help to define both the direction and focus of the project.

WHAT IS HUNTING?

The human has been hunting for over a thousand of years to sustain themselves. In our modern society however, the reason for hunting has changed and we don't need to hunt for food anymore. Hunting today is for most people a way of getting closer to nature and being a part of a larger community (Les chasseurs aujourd'hui qui sont-ils, 2021). Although there's no real 'need' for hunting for food anymore, hunters still show great respect towards the animal and the meat, hide and antlers. One of the ethical rules state that any edible game is supposed to be enjoyed to its fullest (Jagtetiske regler, 2011).

In Denmark hunting is definitely an amateur sport as only 4% categorize themselves as professionals (Evaluering af formidling og efteruddannelse inden for jagt og vildtforvaltning, 2019). There's a huge set of both written and unwritten rules and regulations when hunting, which is also why it requires a license to go hunting (Jagttegn, n.d.), (Jagtetiske regler, 2011).

HUNTERS SEES HUNTING AS...

99%	Getting out in the open and appreciating nature
82%	The social aspect of sharing interests with others
78%	A way of getting outdoor exercise
46%	Liking the competition and seeing hunting as a sport

Ill. 5. (Les chasseurs aujourd'hui qui sont-ils, 2021)

Ill. 4. Hunter at sunset (Balts, 2020)

MARKET

HUNTING IN DENMARK

Hunting is a very popular sport in Denmark, as we have around 170.000 active hunters, who's license has to be renewed yearly, see ill. 6 (Antal jagttegnsberettiget og indløste jagttegn i Danmark, 2021). This is approximately 3 % of the total Danish population. Statistic shows that the number of hunters in Denmark have been relatively unchanged the last decade, however with a bit of an increase (Antal jagttegnsberettiget og indløste jagttegn i Danmark, 2021). This shows that the interest of hunting remains stable.

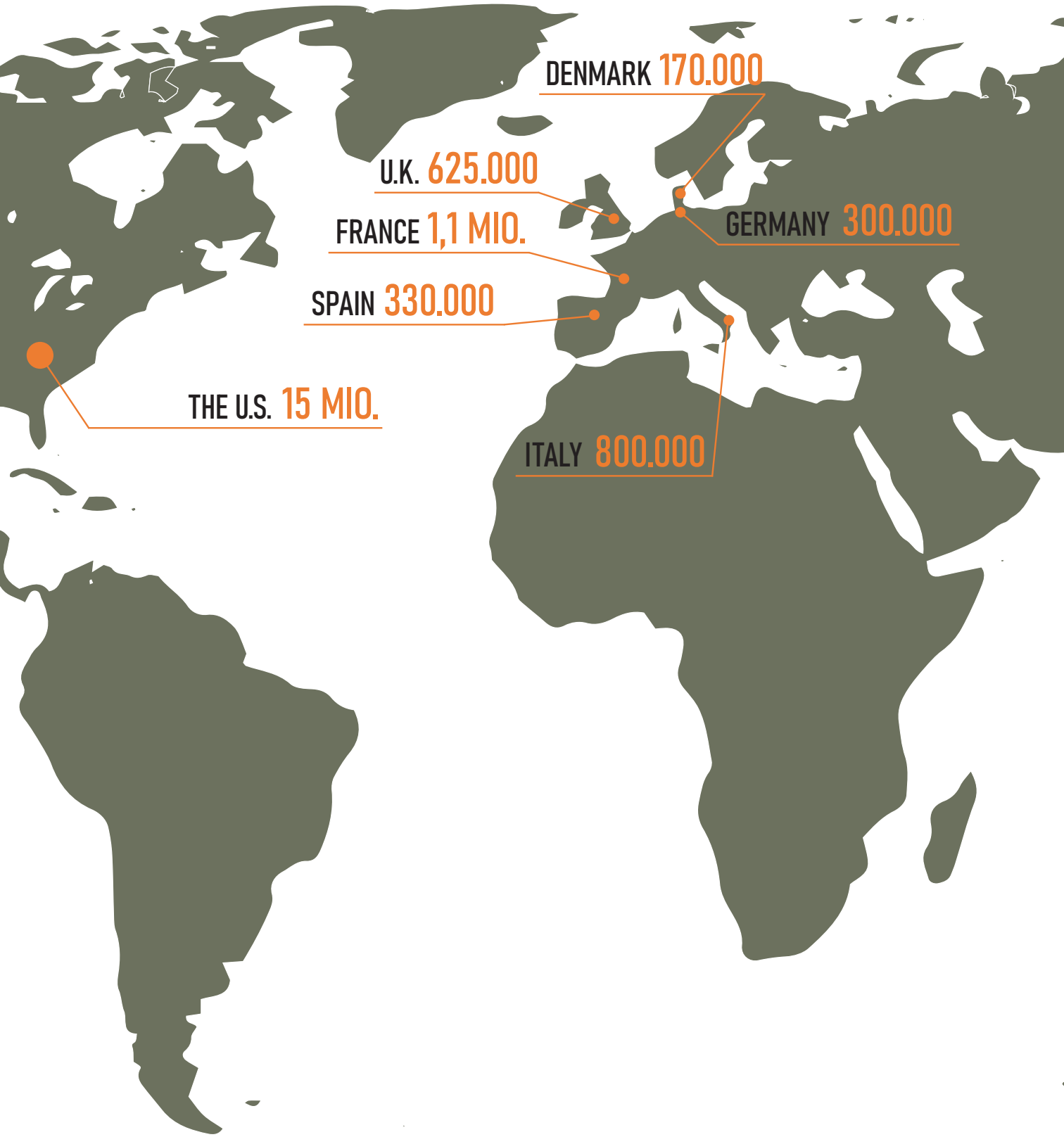
HUNTING IN EUROPE AND THE U.S.

Hunting is likewise a popular sport outside the Danish boarders. France is the country with most hunters followed by the U.K., Spain, Italy, and Germany, see ill. 6 (Hunters in Europe, 2010). These countries being placed further south with higher temperatures has great market opportunity for a product of cooling game. The U.S. is a huge market to target with more than 15 mio. hunters, which is 5% of the total population (Lange, 2020). For a market overview, see app. 9.

MARKET OPPORTUNITY

The biggest hunting store in Europe is located in Denmark and covers 5000 m^2. Looking at the equipment they offer, only a very small part of their inventory is aimed at the post-kill processes and actually none of it have focus on cooling the animal for proper storage (Østjysk Våbenhandel A/S, n.d.).

This indicates an unexplored opportunity in a gear heavy market. A potential Blue Ocean market where new needs can be created and fulfilled. When working on the blue market, competition of selling products becomes irrelevant as an uncontested market space is being taken advantage of (Kim and Mauborgne, n.d.). However, the hunters will have existing coping strategies for storing their killed game, which can be seen a competition, and this will be exploited later in the process.



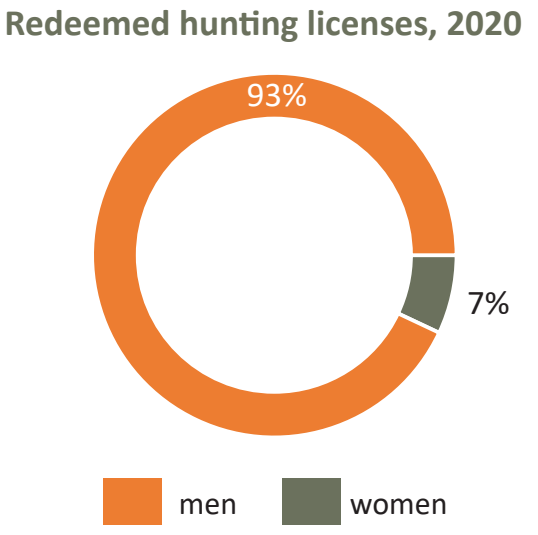
Ill. 6. Number of most hunters in Europe, Denmark, and the U.S.

HUNTERS

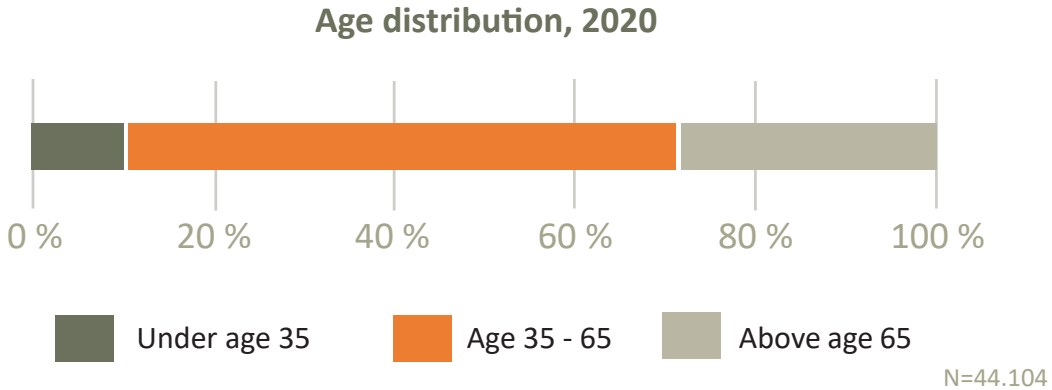
THE TYPICAL DANISH HUNTER

It's fair to say that the hunting world is very male dominated. The latest statistic from year 2020 in Denmark shows that 93 % of hunters are males and 7 % are women, see ill. 7, which is an almost unchanged percentage distribution throughout the last decade (Antal jagttegnsberettiget og indløste jagttegn i Danmark, 2021).

The age difference amongst danish hunters is wide starting at the age of 16 as you in Denmark are legally allowed to get a hunting license at age 16 (Jagttegn, n.d.). The majority of the danish hunters are above 35 years old, and 61 % is in the age range of 35-64, see ill. 8 (Evaluering af formidling og efteruddannelse inden for jagt og vildtforvaltning, 2019). This would mean that the typical hunter has a stable economy.



Ill. 7. Gender distribution statistic from Miljøstyrelsen of redeemed hunting licenses in year 2020 shown in percentage (Antal jagttegnsberettiget og indløste jagttegn i Danmark, 2021).



Ill. 8. Age distribution statistic from Miljøstyrelsen shown in percentage from year 2020 (Evaluering af formidling og efteruddannelse inden for jagt og vildtforvaltning, 2019)

The hunting industry is a very gear heavy market. In Europe, hunters collectively spend 120 billion DKK on hunting each year. With roughly 6.6 million hunters, this equals to around 18.000 DKK yearly per person, see ill. 10. In Denmark, we have around 170.000 active hunters, who spends 12.000 DKK on hunting annually, see ill. 11 (Sand, 2008). The only data available for what hunters spend their money on comes from an American study where they found that around half the expenses goes to equipment while the other half goes towards travels, fees and rent of hunting grounds (National Survey of Fishing, Hunting, and Wildlife, 2018).

72 % of the danish hunters lives in a municipality that is dominated by agriculture and 28 % lives in a municipality that is dominated by a bigger city in Denmark, see ill. 9 (Evaluering af formidling og efteruddannelse inden for jagt og vildtforvaltning, 2019). This means that the majority of danish hunters can be found outside the bigger cities in which the accessibility to hunting areas and nature is easier. Living in municipality dominated by agriculture, it's common to have plenty of space, and having a garage, carport etc.

Ill. 10. Europe

Ill. 11. Denmark

28 %
live in city municipality

72 %
live in agriculture municipality

Ill. 9. Distribution of hunters that live in which municipality from year 2019 (Evaluering af formidling og efteruddannelse inden for jagt og vildtforvaltning, 2019)

USER PANEL OF HUNTERS

Semi-structured interviews have been conducted with five different hunters (Poulsen, 2016). The interviews were able to give a general and realistic understanding of what hunting is, what gear is used and which scenarios the hunters go through. The hunters have different ages, backgrounds and level of experience which will ensure a broad view on hunting. The users have been a useful source throughout the design process to bring us depth on specific hunting scenarios, general insights, and feedback on concepts.

Ill. 12. Flemming Madsen (Aalborg og Omegns Jagtforening, n.d.)

Flemming Madsen
55 years old
Mechanical Engineer
17 years hunting experience

Active in the hunting community e.g. being secretary at "Aalborg og Omegns Jagtforening". Has a lot of equipment, but is price-conscious.

Ill. 13. Kasper Rodil

Kasper Rodil
39 years old
Associate Professor at AAU
4 years hunting experience

A new hunter that enjoys being in the nature. Goes hunting alone on a piece of land that he inherited.

Ill. 14. Anonymous person

Rene Andersen
54 years old
Janitor
37 years hunting experience

Very passionate hunter that goes hunting as much as possible. His wife is just as passionate about hunting as himself. He's an equipment lover.

Ill. 15. Jens Nielsen

Jens Nielsen
61 years old
Farmer
45 years hunting experience

Hunts on own land that surrounds his farm. With easy access he goes hunting alone when the day feels right.

Ill. 16. Mikkel Jørgensen

Mikkel Jørgesen
26 years old
Student
10 years hunting experience

Goes hunting on a smaller piece of land that his father rents from a farmer. He appriciates the quite mornings.

EXPERTS ON HYGIENIC HANDLING

The main focus of the project is hygienic handling of wildlife meat and therefore, it's been important to get input from experts on how to handle meat correctly in a hygienic manner. Below is a collection of the experts that has contributed with relevant knowledge and inputs. The interviews have consisted of short semi-structured phone interviews (Poulsen, 2016).

Ill. 19. (Nordvildt, 2018)

Nordvildt

Nordvildt is a small slaughter-house with two owners that only handles wildlife game. They think that it's a shame that a lot of private hunters don't know how to handle the meat.

Ill. 17. (Chriél, n.d.)

Mariann Chriel
Veterinarian and head consultant at DTU Vet, National Veterinary Institute

Mariann hosts courses to educate hunters in prober hygienic handling of wild life game. She has even won the hunterspirce 2018 for her educational skills (Dyrlæge Mariann Chriél modtager Jægerprisen, 2018).

Ill. 18. (Nørre Vosborg, n.d.)

Klosterhedens Vildt

Klosterhedens Vildt is a medium-sized slaughter-house that solely handles wildlife game. A lot of the game comes from private hunters in which the slaughter-house have seen a lot of meat being poorly handled in a hygienic perspective.

Ill. 20. (ZBC, n.d.)

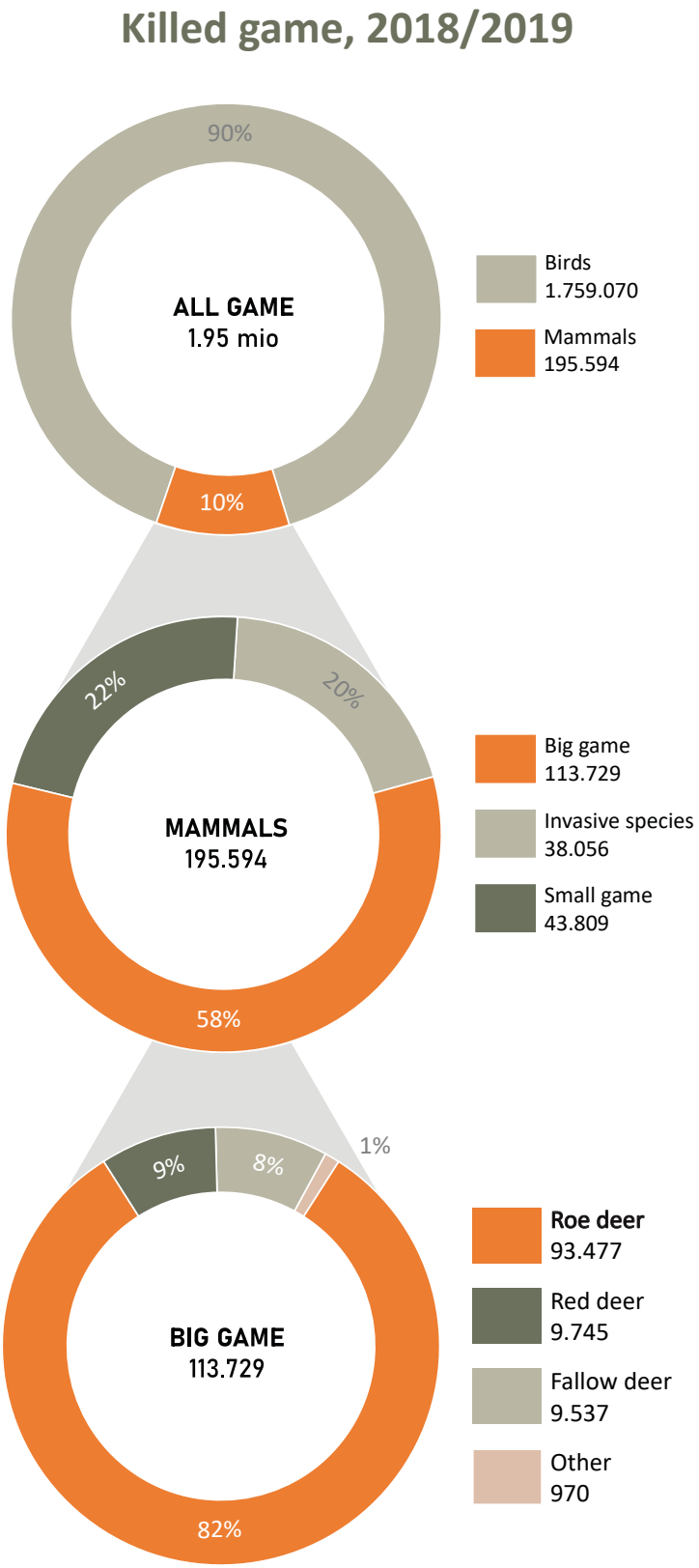
ZBC, Butcher Education, Roskilde

ZBC is a vocational education that is the only Butcher education in Denmark. The education ensures an education on responsible hygienic handling of meat. We've been in contact with one of the butcher teaching in hygienic handling.

THE GAME

In Denmark, hunters collectively kill around 1.95 million animals annually, see ill. 21 (Kjær Christensen, S. Balsby, Mikkelsen and Mellerup, 2020), and this might seem like a lot, but this amount is highly regulated by the government. The reason behind this is to keep the fauna at a balanced level, to ensure that all the animals in the different parts of Denmark have good living conditions and enough food. Too many of one species, can lead to diseases and starvation for both the specific species and other animals living in the wild, as the forests, where they get their food is also limited. Therefore, hunting is actually a combination of regulating wildlife and a sport (Regulering, n.d.).

There's a big number of birds in Denmark that hunters kill together with a lot of small game, see ill. 21. Looking at the big game the most hunted big game animal is the roe deer, see ill. 21.

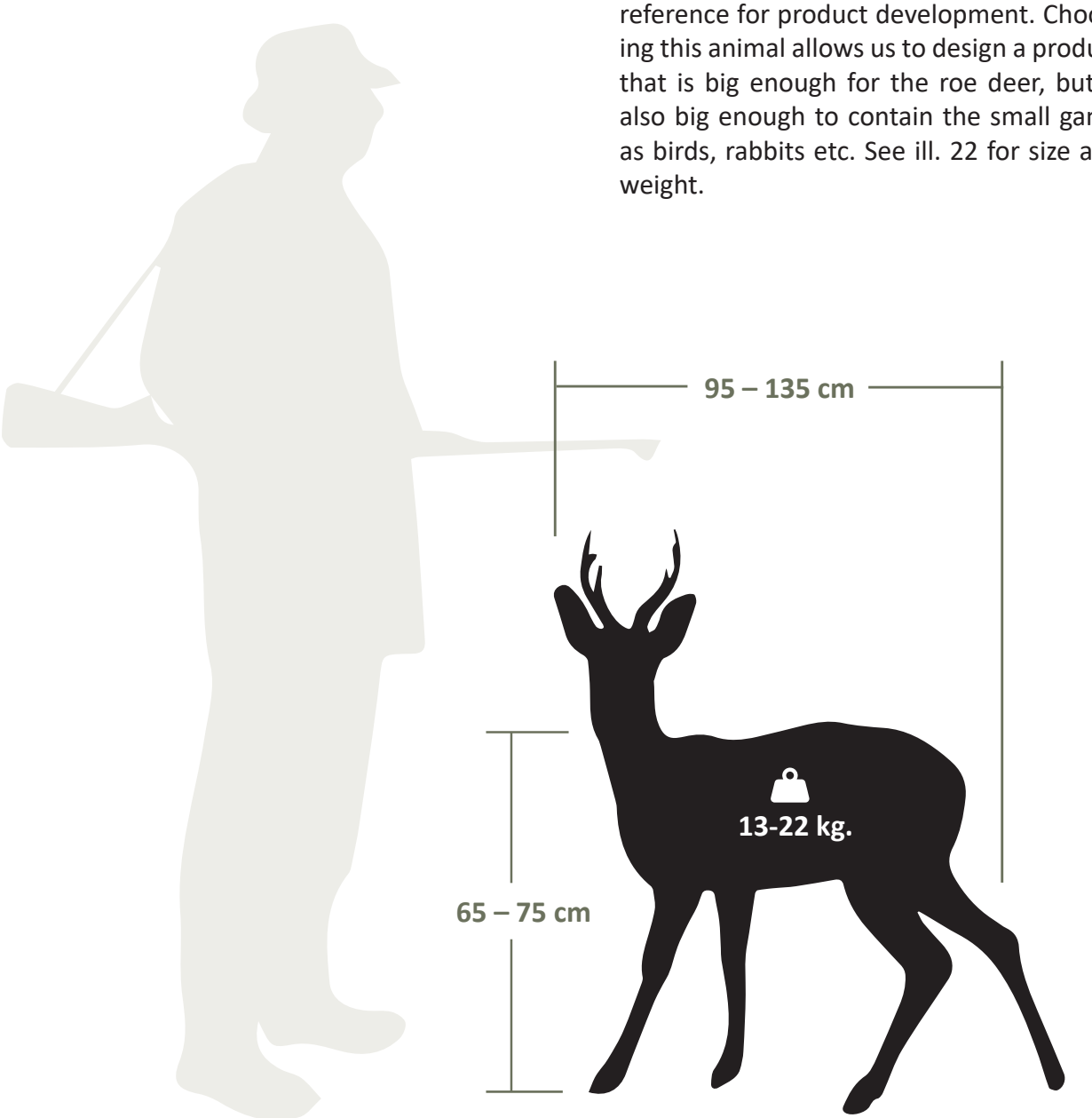


Ill. 21. Statistics of killed game in year 2018/2019 (Kjær Christensen, S. Balsby, Mikkelsen and Mellerup, 2020)

THE ROE DEER

During this research, the team became aware of a term that hunters refer to as 'the summer hunt'. This hunting season is especially important in Denmark, as you only are allowed to shoot one kind of animal, the roe deer. Most hunters that the team have met show a great excitement about this roe deer hunt that start the 16th of May, one hunter even refer to it as "a national holiday", app. 10. The roe deer is the most hunted big game in Denmark and there's two seasons for hunting roe deer - the winter and summer hunt. However, for the summer hunt the male roe deer has grown antlers (Opsatsen, n.d.). For this reason, a lot of the roe deers are saved and mostly hunted during the summer hunt (Mellerup, 2021).

The roe deer being the most hunted big game during the famous summer hunt had the team choose this game as the primary reference for product development. Choosing this animal allows us to design a product that is big enough for the roe deer, but is also big enough to contain the small game as birds, rabbits etc. See ill. 22 for size and weight.



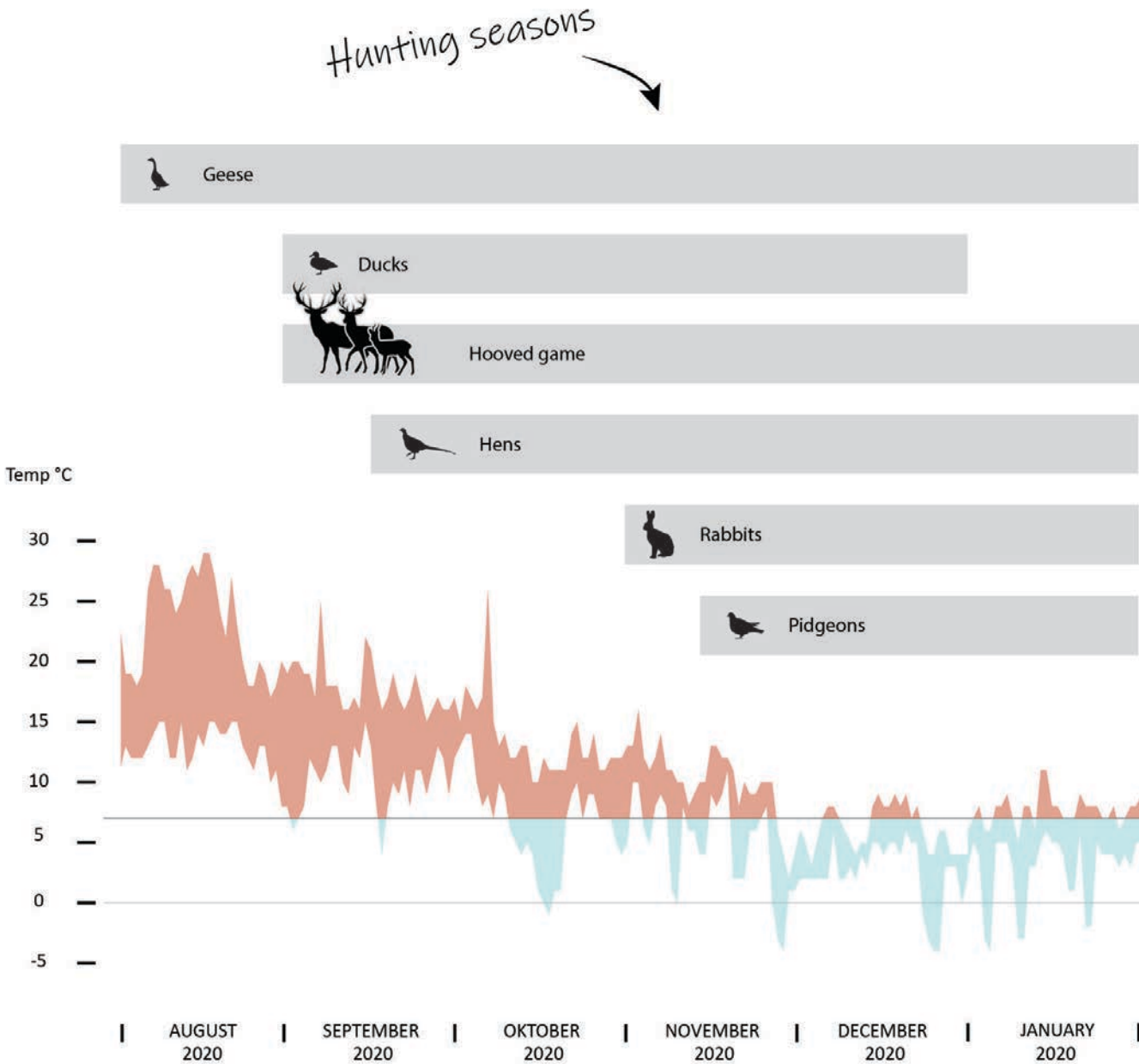
Ill. 22. Roe deer in relation to the size of a hunter. Weight (Vægten på handyr, hundyr og lam, n.d.), and dimensions (Rådyr, n.d.).

HUNTING SEASONS AND WEATHER

All animals that you are allowed to hunt, have their own season, in which you can hunt the specific species, see ill. 23.

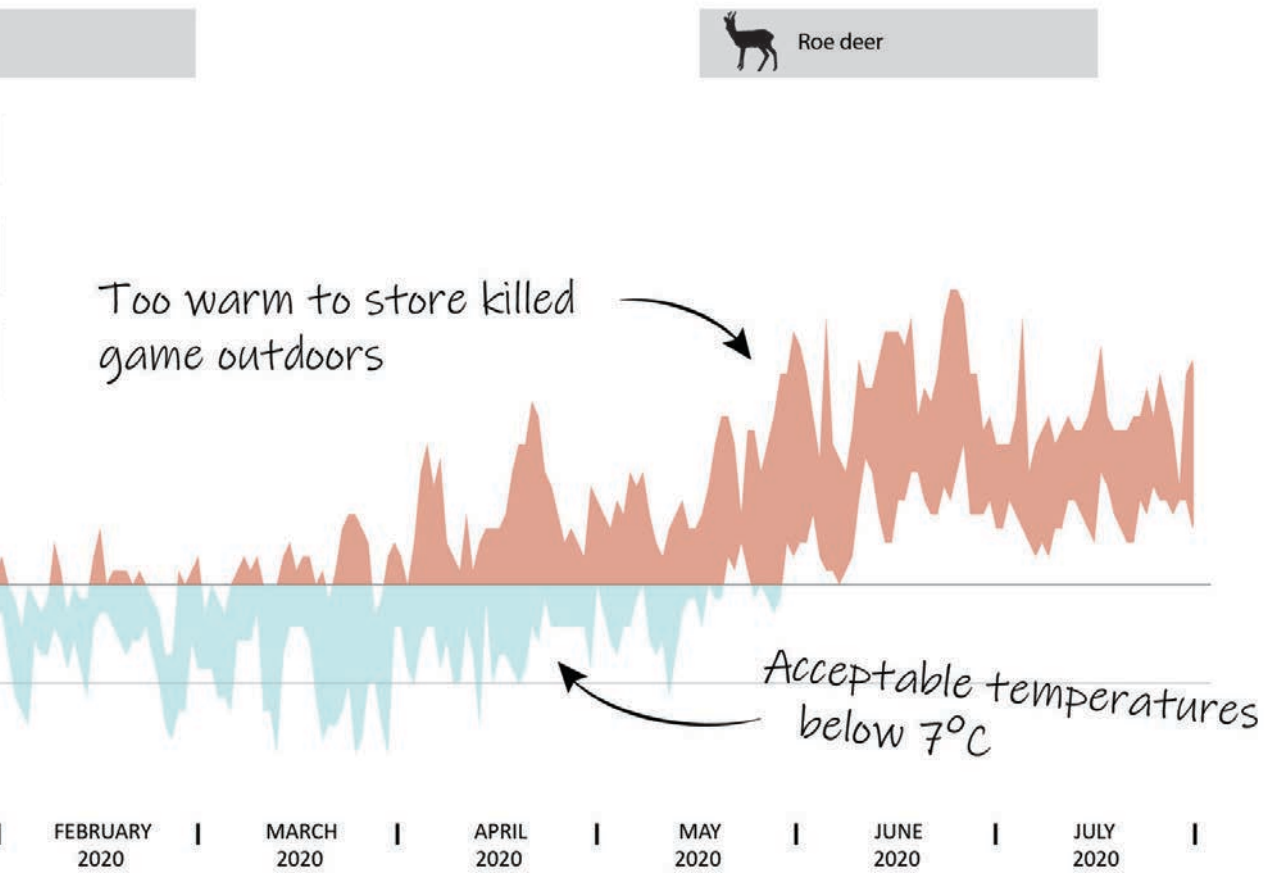
While discussing the important roe deer 'summer hunt' with Rene from the user panel, the team noticed a fridge that he keeps, just for storing and cooling roe deer, which he enjoys hunting. He pointed out that it's important to properly cool the animal during the summer as blood turns bad faster than the meat can cure. This is an expression that says that the meat benefits from curing for a couple of days, but if you don't watch the temperature, the meat will turn bad.

Looking at regulations for storing meat it was found that the acceptable temperature to keep big game at is below 7 °C, app. 11.



Looking at the hunting seasons for the most killed game, it was found that the temperatures in Denmark most of the time are too high for storing game. Ill. 23 shows the temperature high and low for year 2020, app. 12.

Talking with hunters, it became clear that a lot of them have trouble with handling the meat of roe deer in a convenient and satisfying way app. 13, and app. 14. As shown, it's not only the summer hunt that is an issue, since the roe deer is also hunted from September through February, in which the first three months of the season is likewise too warm to just store the game outside in the shadows. In addition, the small game like geese, ducks, hens, rabbits are also hunted during periods with too high temperatures.



Ill. 23. Hunting seasons and temperatures in Denmark, 2020 (App. 12)

USER JOURNEY

WHAT HAPPENS WHEN THE GAME IS SHOT?

As stated earlier there's a market opportunity with a lack of products for handling the game post hunting. This user journey, see ill. 24-29, will dive into the steps of what happens after the game have been shot with a focus on unsolved problems and opportunities. The user journey is based on in-depth interviews with Jens and Flemming from the user panel, app. 15 and app. 16.

Ill. 26. Deer in the trunk (Namigadde, 2017)

Ill. 24. Field-dressing a deer (Adams, 2013)

Ill. 25. Dragging game through forest (Biebel, 2018)

FIELD-DRESSING

After the deer is shot it's field-dressed which means that the animal is cut open from the stomach and the intestines are taken out. The deer is emptied for blood. Doing this job incorrectly or not being careful enough will cause bacterias to enter the meat.

DRAGGING

The animal is dragged through the forest in which the deer now is cut open and therefore, receptive of soil bacteria.

TRANSPORTING

The game is put in the trunk of the car and transported home. The deer is still bleeding a bit which can end up in the car, that some hunters use for e.g. driving their kids to school the next day.

Ill. 28. Skinning a deer (Hess and Hamilton, 2011)

Ill. 27. Deer hanging with flynet (Sie Hunting, 2021)

Ill. 29. Butchering a deer (Jacobsen, 2013)

HANGING

When the hunter arrives at home it's usually late and the hunter is tired. The deer is hanged with a flynet which prevents blow flies getting into the meat and the deer hangs usually for 1-3 days.

SKINNING

When the hunter have the time, usually a couple of days after the deer is shot, the deer is ready for skinning and butchering. Skinning the deer is done with a sharp knife and a steady hand, and it can be tricky.

BUTCHERING

The deer is butchered into big parts. Then the big parts are taken inside the kitchen for the meat to be butchering into smaller parts, put into plastic bags and finally put into the freezer. This task can take an hour or even longer.

USER JOURNEY

NARROWING THE SCOPE

During an early interview with one of the hunters, Rene, the idea of a cooling bag arose, app. 17. Rene is a passionate hunter that has a lot of gear, it seems that he has two of everything. He kept all of his hunting gear in his garage, where he also had an old fridge which he used for cooling game. This fridge started the idea of a cooling product which set a direction of exploring the post-kill scenario with the main focus of proper hygienic handling of game. The first step of field-dressing and the last two steps of skinning and butchering were phases that was difficult to enter with products to help the hunter improve the issues – it seems that these issues comes down to proper techniques and it's all about learning how to do it correctly. The last three steps of dragging, transporting, and hanging were chosen as they presented a viable way of helping the hunters.

COPING STRATEGIES

Further exploration and a wide understanding of the three chosen steps led to a big questionnaire in which 186 respondents contributed their input, knowledge and experiences. The most relevant and insightful answers are shown here. For the full questionnaire, app. 13. Insights from interviews and market analysis of current products will also be referred to for an elaboration of the coping strategies, problems and opportunities.

DRAGGING

HUNTERS COPING STRATEGIES

Most hunters, after field dressing the animal, either drag it by the front legs with head lodges in between the legs, to protect the antlers, others tie a rope to the antlers and drag it this way. App. 13.

OPPORTUNITIES BASED ON THE PROBLEMS

It's unwanted to get dirt into the open carcass as the dangerous bacteria, botulism, app. 18, is found in the soil.

TRANSPORTING

HUNTERS COPING STRATEGIES

Most hunters store the animals in large bricklayers' tubs or game bags while transporting it in the car, app. 19 and app. 20.

OPPORTUNITIES BASED ON THE PROBLEMS

The team found that it would be beneficial to cool the animal as soon as possible, app. 18.

HANGING

HUNTERS COPING STRATEGIES

It's normal to leave the deer hanging outside, in the shade, under a bug net, for a day or two, while the weather allows it. However, if the hunter deems the weather too warm, they will have to push through and butcher on the same day of the hunt, which in many cases isn't appreciated since hunting can be exhausting. In addition, most times the hunter arrives very late at home, especially during the summer as the hunting regulations allows hunting until just before sunset (Ellemann-Jensen, 2018). When hunters get home, they also have to clean their weapon and clothes etc., app. 13, app. 18, and app. 19. Some hunters keep an old fridge in the garage, app. 18, app. 19.

OPPORTUNITIES BASED ON THE PROBLEMS

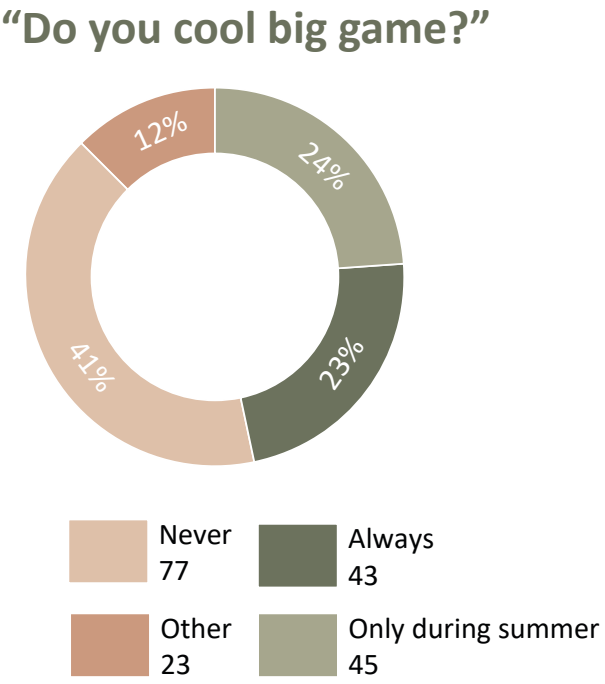
The team found that this solution isn't regarded as a viable solution for many, as the fridge has to be modified to fit the deers, app. 19, and takes up an unwanted amount of space, app. 18.

HYGIENIC MEAT HANDLING

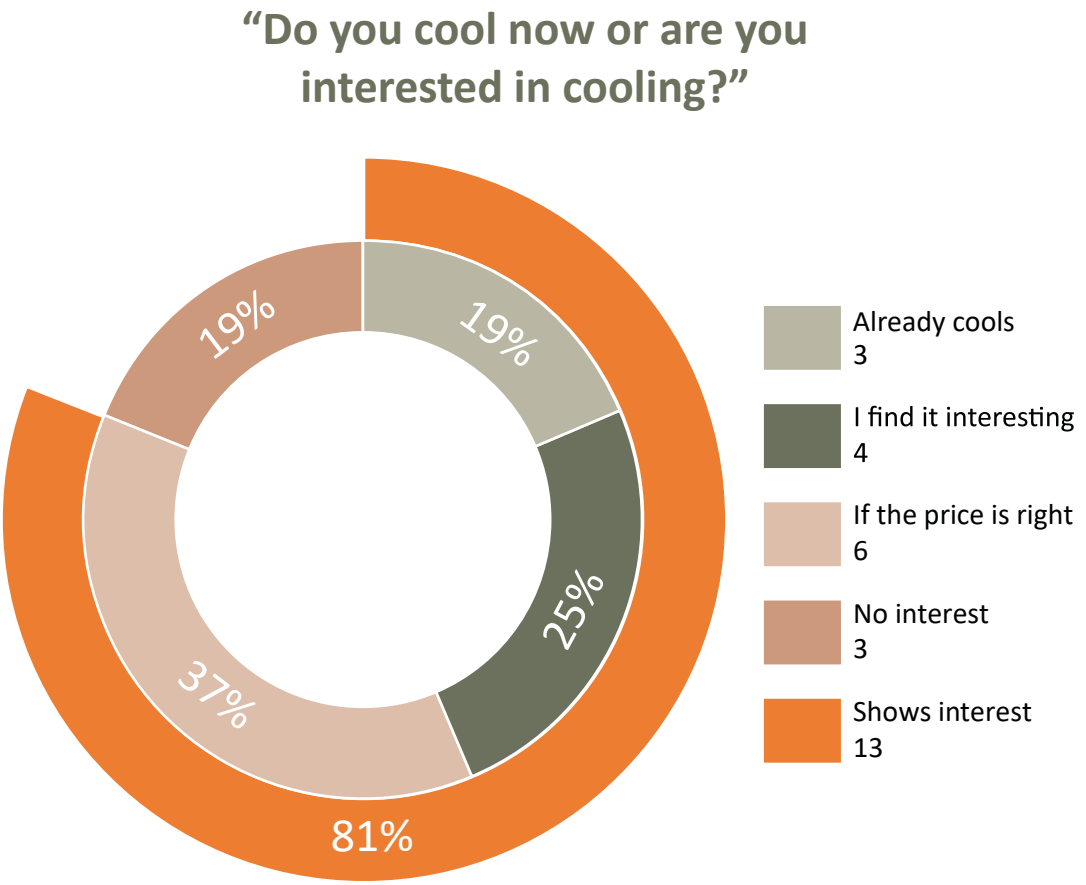
As the team has discovered, the way you handle the animal, has a big impact on how the quality of the meat turns out.

THE HUNTER'S VIEW

The team found through a questionnaire (n=12) that 50% have great interest in keeping a good meat hygiene, app. 14. The meat is a reward for their hunt after all. This is both visible in how they invest time in learning how to field dress properly and also from a questionnaire (n=186), that shows that 23% always cools big game, and 24% only does it in the summer, see ill. 30, app. 13. Digging deeper the team found that from another questionnaire (n=18) 81% of the respondents showed some form of interest in cooling, see Ill. 31, app. 14.



Ill. 30. Do you cool big game? (App. 13)



Ill. 31. Do you cool now or are you interested in cooling? (App. 14)

VETERINARIAN'S VIEW

The team contacted, Mariann, a veterinarian who does hygienic courses for hunters. She noted it's a common mistake to leave the deer hanging in 15 °C, which is why she also recommends people using a fridge for optimal hygiene. Storing it outside is okay when the weather allows it, but she pointed out that all hooved animals should be stored at 7 °C or below, app. 18. The same is stated by the Ministry of Food, app. 11.

Mariann also noted that big game benefits from curing at least for 24 hours, as this lets the rigor mortis dissipate, which affects the tenderness of the meat. When curing the deer, the hunter should keep the hide on the animal as this minimizes loss from the meat drying out, which has to be cut away before cooking. App. 18.

Lastly, Mariann stated that air circulation and humidity control was important. She advices people to get an old Coca Cola fridge and cool the animal with the door on squeeze for the first 24 hours of curing as to let all the moisture evaporate out. App. 18.

WILD GAME BUTCHER'S VIEW

At Klosterhedens Vildt, they take in and process game from hunters. When doing so, they demand that they get the carcass the day it was shot, or the day after if it has been stored at 5 °C. They themselves stores it at 0-1 °C as it prolongs shelf life, noting that keeping it at 10 °C will make the meat turn bad faster.

They would never butcher the carcass while it is still warm, as the warmer temperature in the meat accelerates bacteria growth, app. 21. Keeping the meat at such low temperatures allows them to store it with hide for up to 7 days. Without the hide on this would be reduced to 1 day. App. 22.

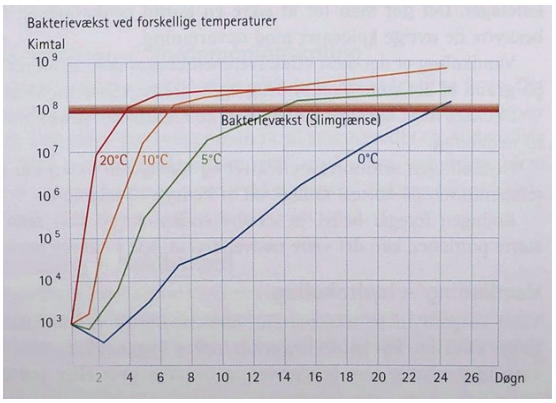
Contrary Mariann, the wild life butchers pointed out that they have no regulations from the Ministry of Food to keep the humidity at any specific values. What is important is to keep the air in circulation and preventing stale air, app. 22.

Some hunters refer to storing the meat at 40 degree/days (graddage) meaning that you can store the animal for two days at 20 °C, for the meat to properly cure. This, however, isn't advised by either the veterinarian or the wild game butchers, app. 21 and app. 18.

BUTCHERING HANDBOOK

When looking at what butcher students are taught, app. 23, it suggest air flow inside a fridge. It also shows how much of an effect the temperature has on bacteria growth. Ill. 32 shows the bacteria growth at different temperatures and it can be seen that the higher temperatures, the faster the bacterias grow (Borg Et Al., 2014).

Bacteria growth at different temperatures



Ill. 32. Bacteria growth at different temperatures (Borg Et Al., 2014)

PROCESSING THE MEAT

When it comes to processing the meat post-hunt, hunters have different ways on handling the meat, depending on their interest, equipment, and skills. Below there's an overview of the different coping strategies and processes that the hunters are interested in, is gathered through interviews and questionnaries.

MATURATION

BUTCHERING THE SAME DAY

A questionnaire (n=186) showed that only 19% of the hunters actually butcher on the same day. They do this because they either have the time, the weather is too warm, or they won't have time to get back to their home for the next couple of days. App. 13.

HANGING OUTSIDE WITH BUG-NET

The same questionnaire (n=186) showed that 46% of the hunters wait until the day after, because they trust that the weather is cool enough, they're exhausted from the hunt, and some people say that it's easier to skin and butcher when the animal is cold rather than warm. App. 13.

CONSERVATION

HANGING IN COOLING CABINET

A few hunters keep their own fridge for cooling the animals, while others have dedicated cold rooms as a part of their consortium, this both helps the hunter and the meat quality in regard to both tenderness and bacteria growth. App. 20

DRY-AGING, SMOKING, BRINING

Another questionnaire (n=14) showed that 57% of hunters seemed to be interested in further conservation of the meat such as dry-aging, smoking or other solutions, which is why the team will look into if any of these processes can be included in the final solution. App. 14.

INITIAL DESIGN BRIEF

DIRECTION

Throughout the phase of understanding the team became aware of gap in the gear-heavy market of hunting. There's a lack of products aimed towards post hunting, moreover, for the killed game and the team saw a missed opportunity. The idea of aiming a product for the killed game arose during an interview with the hunter, Rene, that led to a dive into the user scenarios of what happens when the game is shot. Three possible directions of "dragging, transporting, and storing" seemed relevant to target with unsolved issues.

MAIN FOCUS

"Optimal hygienic handling and maturation of killed fram from forest to table"

REQUIREMENTS & WISHES

Collected insights and research are put into requirements and wishes for the product to fulfill. These are further divided into the three chosen directions. Requirements are "need to have" and wishes are "nice to have".

DRAGGING

Requirements

Should assist in moving the game from forest to car

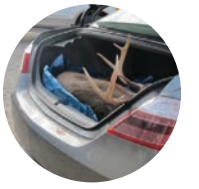
Should carry min. 22 kg.

Should be able to contain the size of a roe deer

Should protect the game from soil bacteria

Wishes

Shouldn't take up too much space



TRANSPORTING

Requirements

Should prevent the car from getting dirty

Should be able to cool the animal as soon as possible

Should be able to contain the size of a roe deer

HANGING

Requirements

Should keep blow flies from the meat

Should be able to cool below 7 °C

Should ensure air circulation

Should be able to contain the size of a roe deer

Wishes

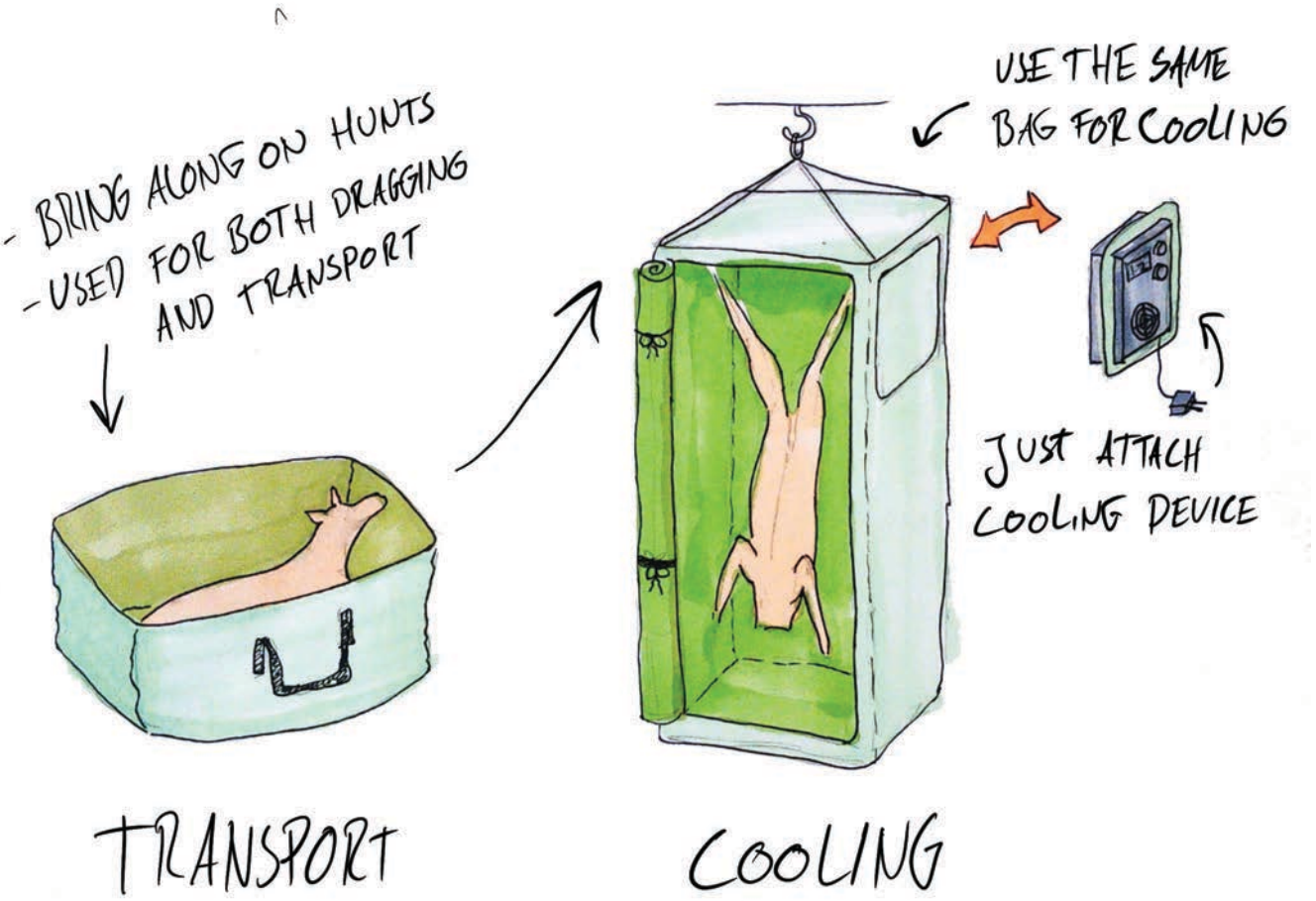
Should cool for at least 24 hours

Should allow moisture to escape/humidity control

INITIAL IDEATION

For the initial ideas, the team wanted to include all three problem spaces in the same solution. Ill. 33 shows a carrying bag that the hunter should bring along on all hunts. The bag works for both dragging the game through the forest and also, transporting it in the car as it's waterproof and can be zipped to prevent blow flies entering. When the hunter gets home, he/she can hang the bag, with the deer from the ceiling and attach a cooling unit. This idea brings together all three stages of the problem space so far.

At this point, the team has found a great interest for cooling down the animal, however, it's not yet verified how much of the after-processing they want, like smoking or dry-aging. This will be further investigated in the next chapter.



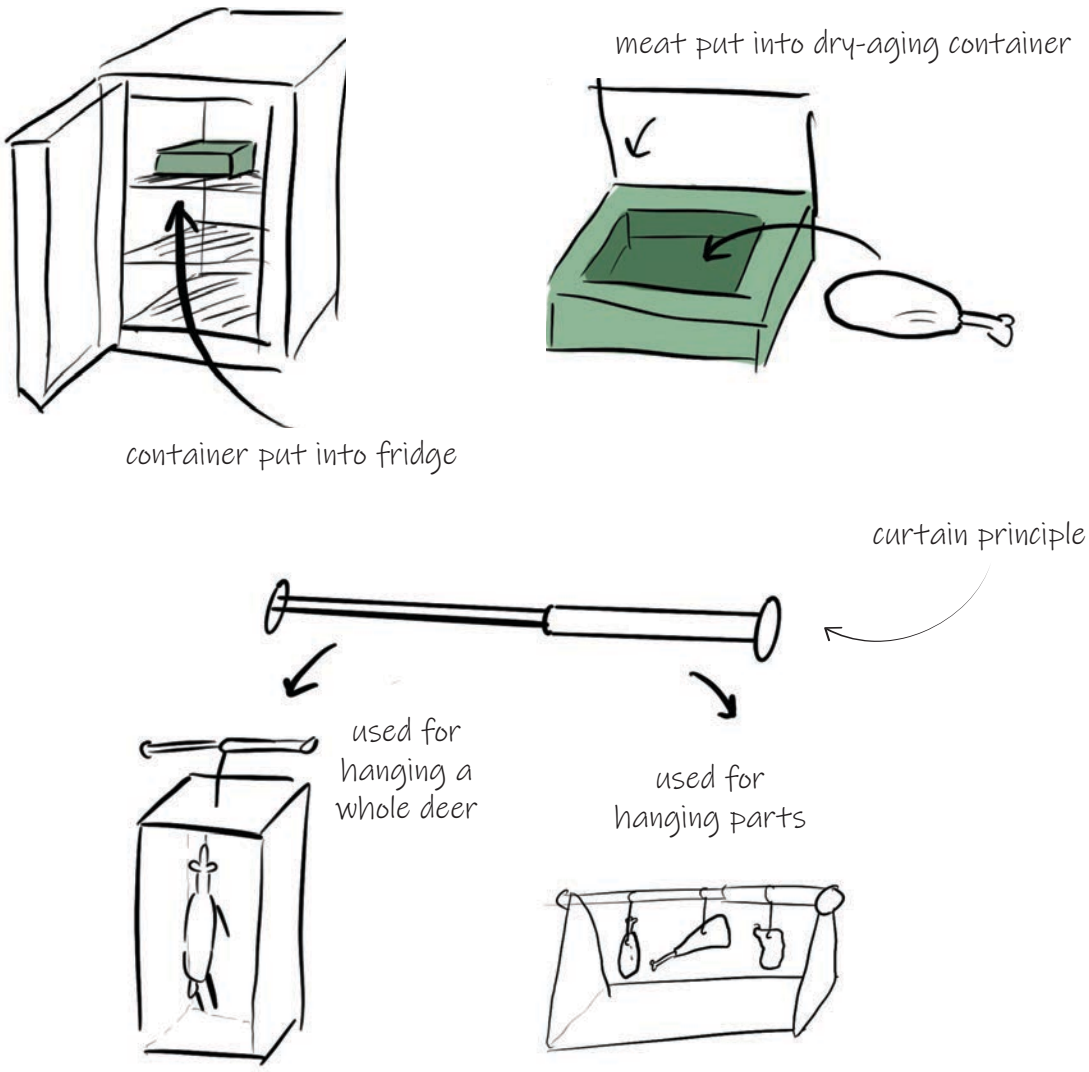
Ill. 33. Initial idea of a dragging, transportation and cooling bag for a killed roe deer

IDEATION

In this ideation chapter the team will start developing ideas, that matches the defined problem area, by breaking down the insights from the earlier chapter. Ideas and potential solutions will be investigated and tested coherently with the user's perspective, with a focus on the context and how hunters are handling the deer in all the three directional stages.

SKETCHING
// MATURATION AND CURING

At this point the team were trying to gather as much as possible into the product, looking at three different stages of the hunt and potential after processes like dry aging and smoking. But as the team started to look into products for dry aging, the team realized that even though people showed interest in it, it was difficult to find people who actually did it, and most hunters state that they can't even taste the difference of matured meat, app. 14. A lot of people wanted to be smoking, but after looking into the process, the team decided that it was too far from the objective of handling the meat in the three stages of dragging, transporting, and hanging. The after-processing of the meat like smoking and dry-aging etc. was discarded. The team did some sketching on the matter though, which can be found in app. 24, and some illustrations are shown here, see ill. 34.



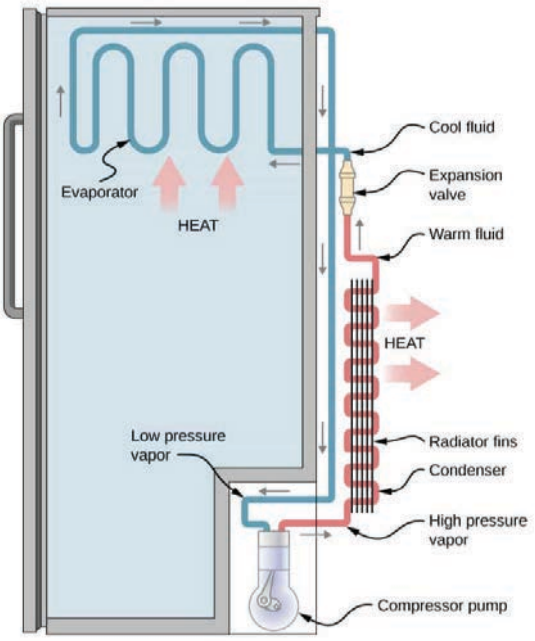
Ill. 34. Ideas for maturing and curing meat

COOLING TECHNOLOGIES

As the team has already found indications of cooling being relevant, different cooling technologies were examined to get a better general understanding.

COMPRESSOR

A normal refrigerator works by pushing a refrigerant around in a set of coils, with the power of a compressor. As seen on ill. 35 below, the compressor condenses a refrigerant, and pushes it out into the condenser, on the backside of the fridge, here some of the heat dissipates. It then goes through an expansion valve that lowers the pressure drastically, this induces a physical reaction, that cools down the gas significantly - just like the nozzle gets cold on a deodorant, if you keep pushing it. From here it goes into the evaporator, which is on the inside of the fridge, where it absorbs heat from whatever is contained in the fridge. It then repeats the cycle. (How does a refrigerator work?, n.d.)



Ill. 35. How a fridge works with a compressor (Butterfly EduFields, n.d.)

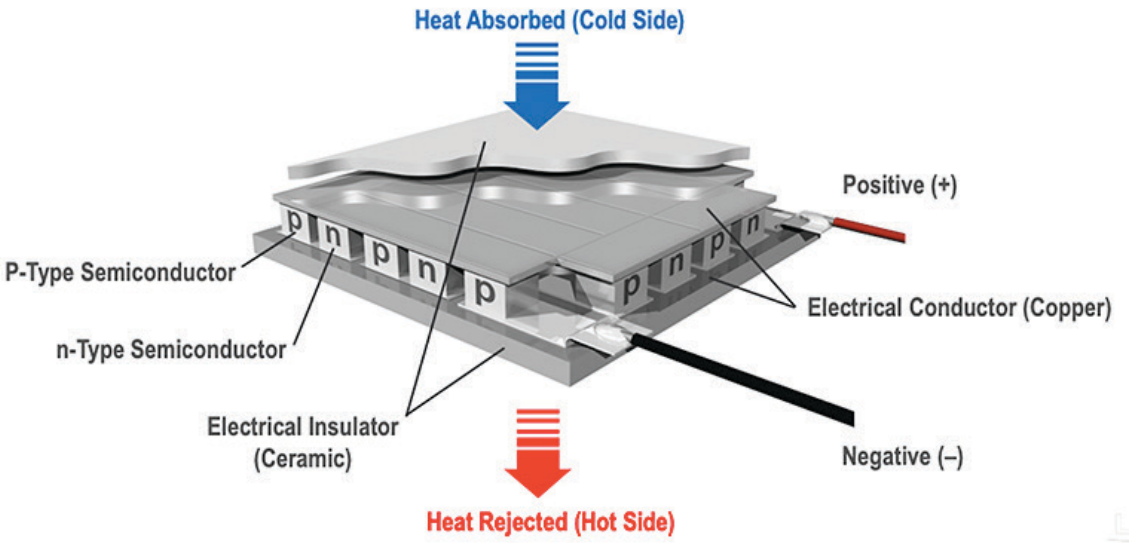
ABSORPTION COOLING

The heat is moved around almost like with the compressor, although the compressor is switched out with a boiler containing ammonia and water. This mixture of liquids are heated up with a gas burner and as it evaporates the substances, pushes themselves around through the condenser, expansion valve and evaporator. These are most often used in remote areas, since it doesn't require much electricity, but gas instead to move the inner liquids around (An Introduction to Absorption Refrigerators, n.d.)

PELTIER

Peltier moves heat, relying on the peltier effect. It's a small heat pump, often around 5x5x0.5 cm, made of two opposing ceramic plates, sandwiched around small joined conductors. When voltage is applied through the conductors, they move the energy through the circuit in such a way that one ceramic plate gets warm, taking energy from the other side, that turns cold, see ill. 36. It's cheap to produce and has no moving parts, which makes it low maintenance. However, it's also highly inefficient and has to be sandwiched between heatsinks and fans, to ensure that the cold side isn't heated up by the warm side. (How do thermoelectric coolers (TEC) work, n.d.)

This technology is most commonly found in cooling boxes, because of their relatively cheap cost and low power consumption. These characteristics has its drawbacks as the inefficiency makes better at keeping cool stuff cold rather actually cooling them. (Pros, Cons, and Applications of the Peltier Effect Explained, n.d.)



Ill. 36. The construction of a peltier (Laird Thermal Systems, n.d.)

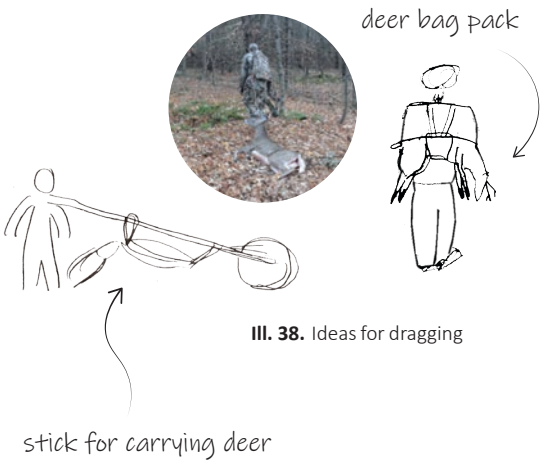
CONCLUSION

The team can't specify yet, which requirements the cooling unit needs to comply with which is why both peltier and compressor cooling will be researched further in the development. However, the team has deemed absorption cooling impractical since it requires the use of gas to run.

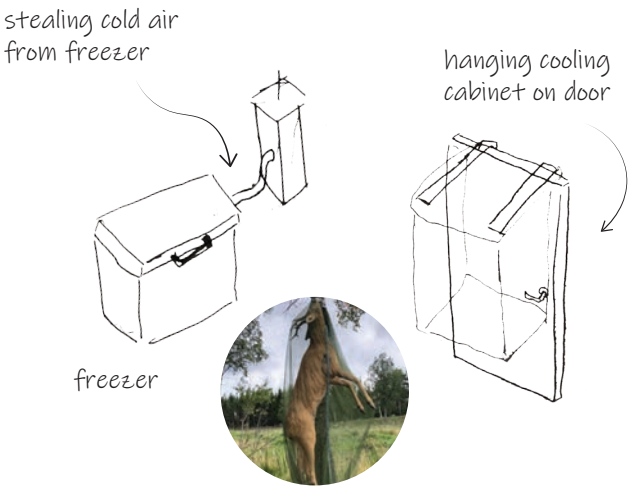
SKETCHING
// THE THREE PHASES

Having decided to narrow the scope of not focusing on conservation methods such as dry-aging due to a lack of interest from the users, the focus of hygienic handling of the animal was very much in focus. The team found that combining all three stages in one product was untangleable. Therefore, individual ideas were sketched, trying to solve the issues related to each of the phases. A lot of sketches and ideas were made with a creative and innovative mindset for a broad view for diverging the process as much as possible. See ill. 38-40 that shows part of the diverging process. Finally, three ideas were chosen, and they're shown on the next three pages. For all the sketches, thoughts, and arguments for choosing these three ideas, app. 25. The ideas were shown to the users in which videos would be an ideal way to communicate these. The videos were built as a storyline of usage in which the user should be able to relate and understand the ideas. See the QR code, ill. 37, that links to the three video presentations of each idea.

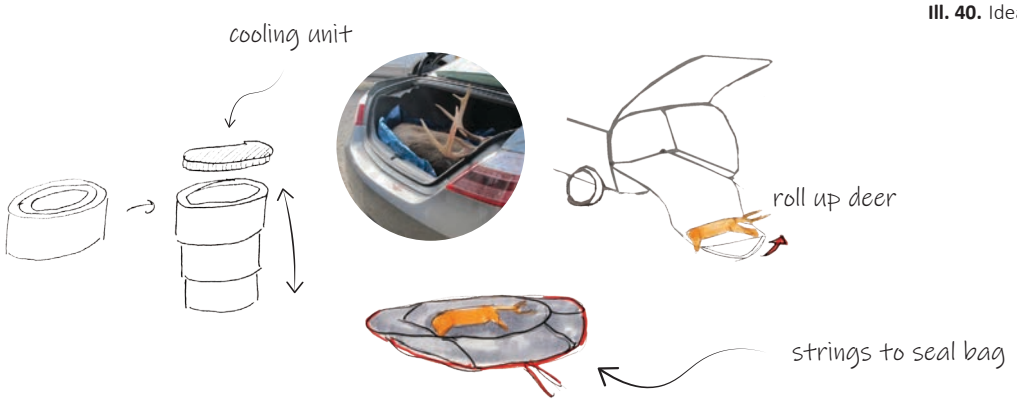
III. 37. QR code for the videos of the three final ideas



III. 38. Ideas for dragging



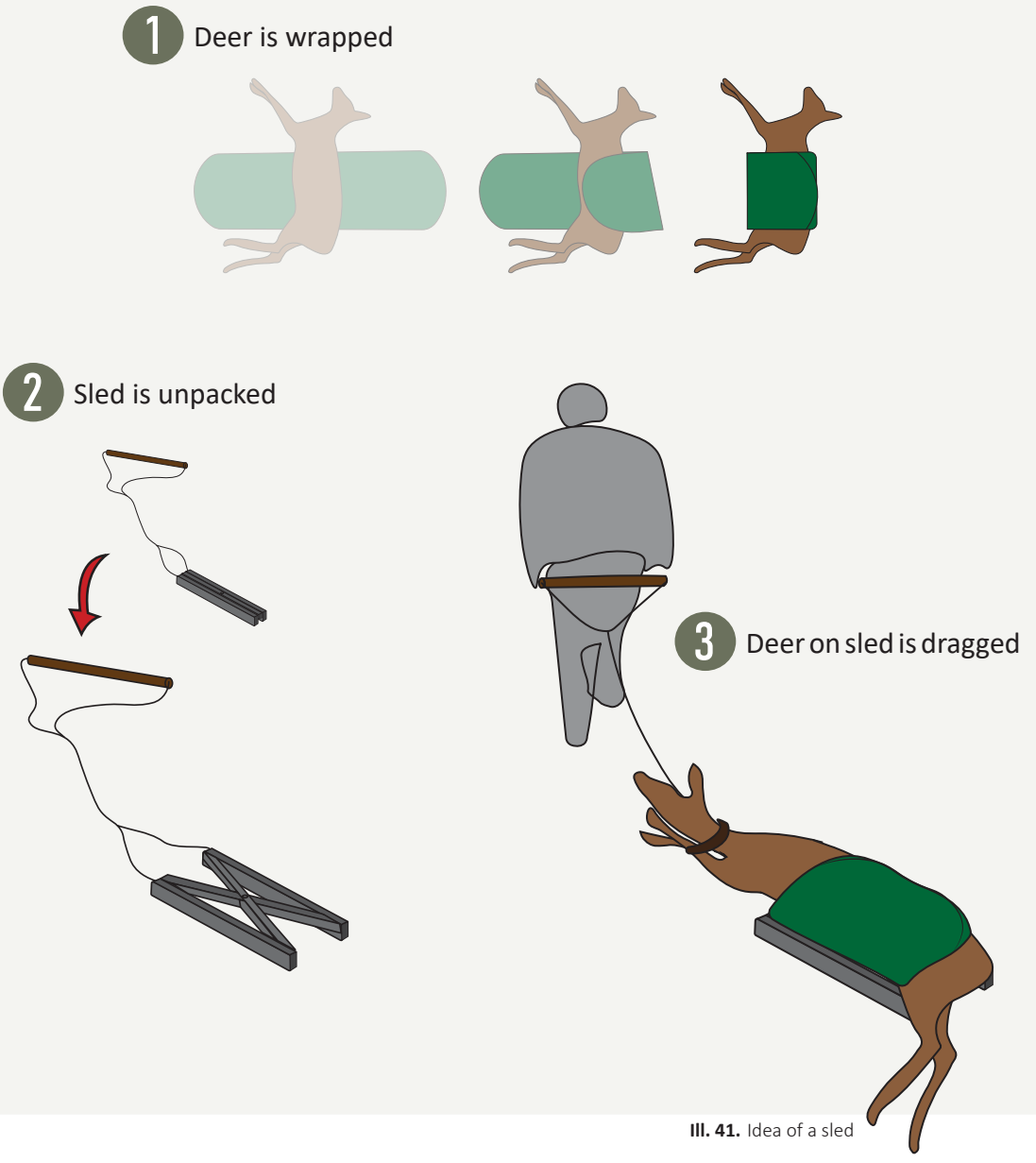
III. 40. Ideas for hanging



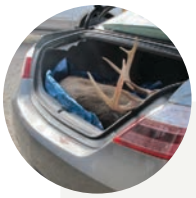
III. 39. Ideas for transporting

DRAGGING // IDEA OF A SLED

The idea consists of a cover that the user wraps around the deer and a sled to drag the animal to the car, ill. 41. A pro of the idea is that the sled will glide through the terrain easily. The solution is compact to carry in the backpack or the pockets, and the handle is shaped ergonomic with a leather detail. A strap for tying the front legs and head will protect the antlers, as this is the 'trophy'. The foldable cover will protect the stomach that is cut open and is receptive to bacteria. The concern is if the hunter would actually bring the device as the roe deer only weighs up to 22 kg. which is manageable to carry and most of them don't bring any device right now – unless it's a very heavy animal like red deer or wild boar etc. App. 25.

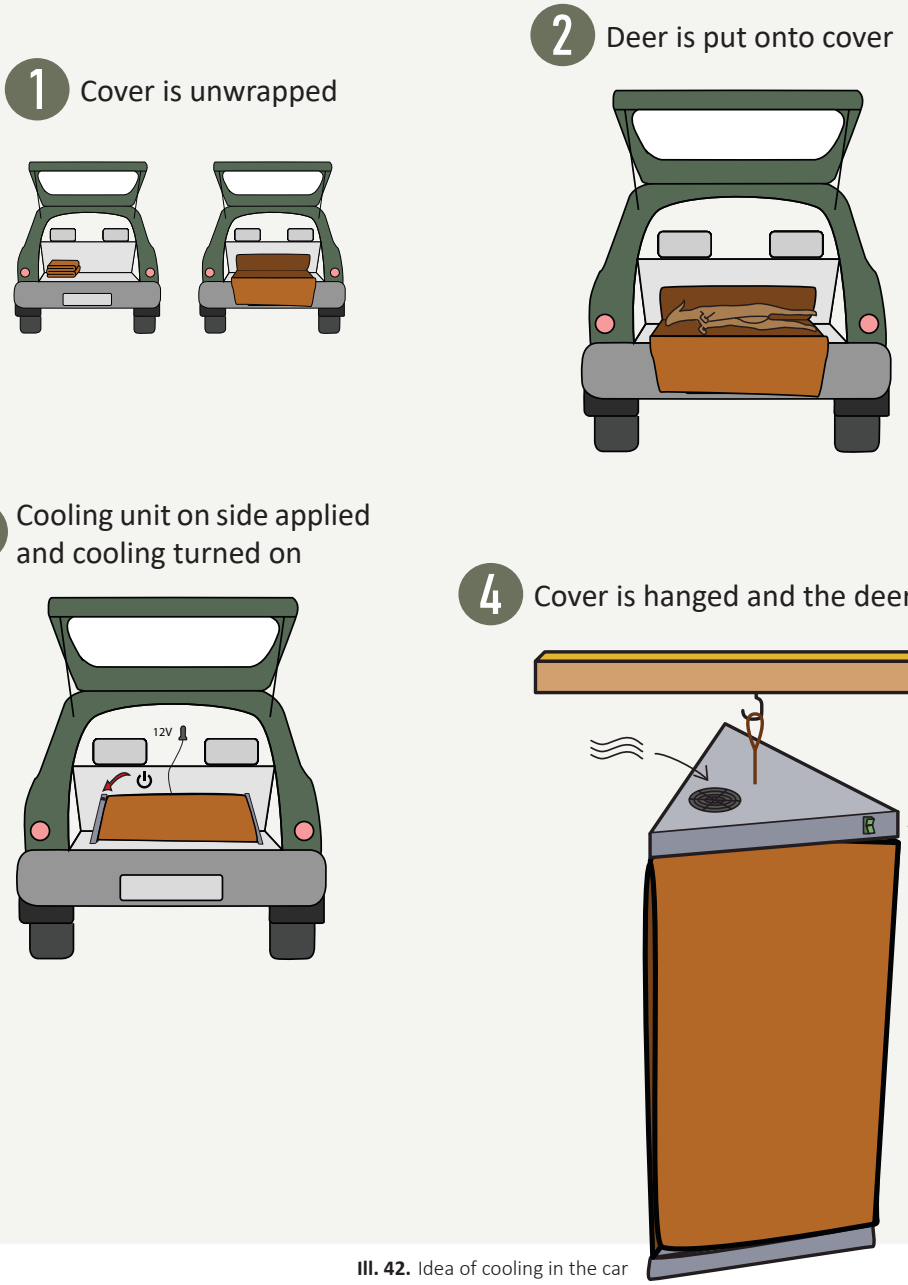


Ill. 41. Idea of a sled



TRANSPORTING // IDEA OF COOLING IN THE CAR

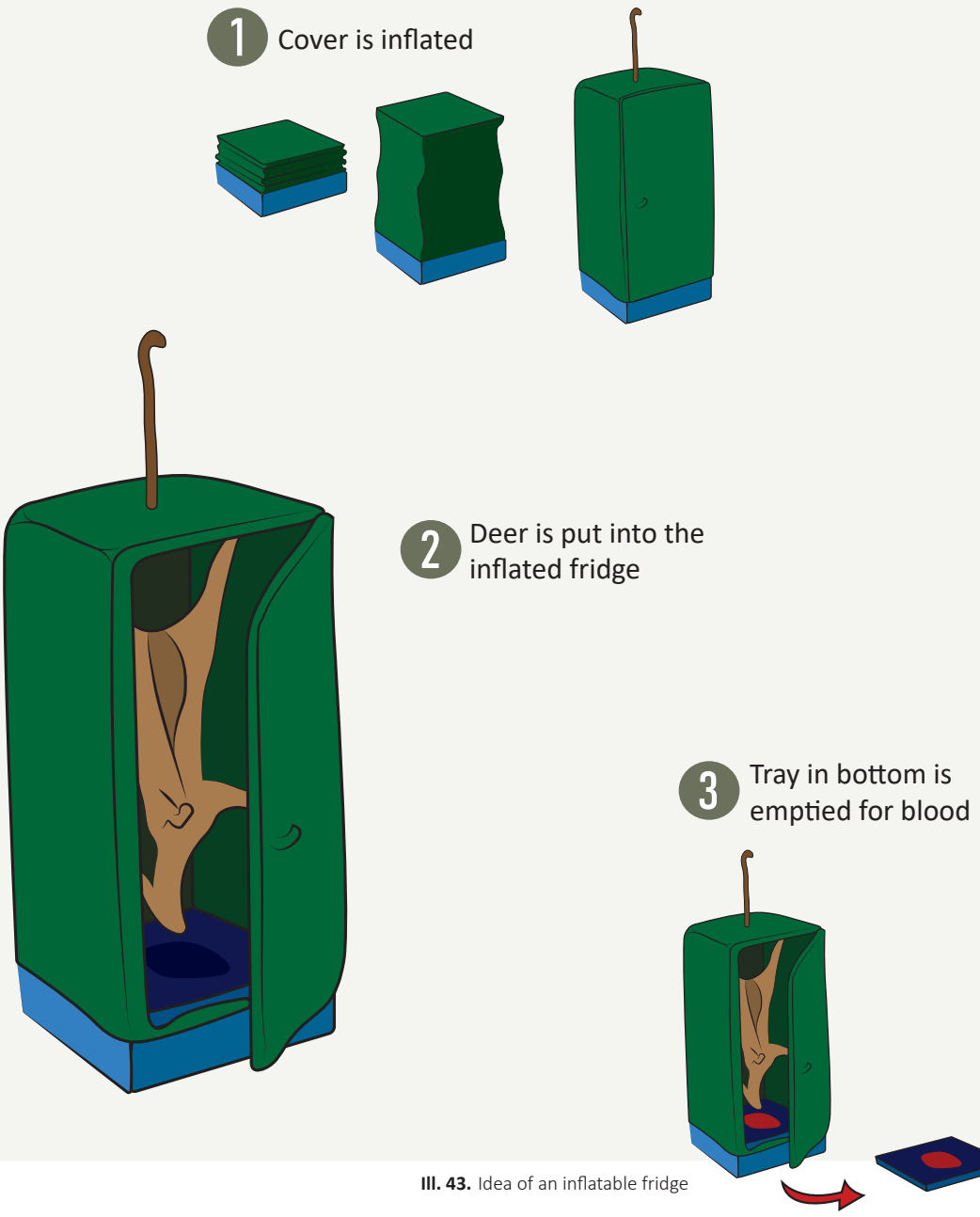
The idea consists of a foldable cover and a cooling unit that the hunter brings in the car, ill. 42. The cover is unfolded in which the deer can be placed and a cooling unit on the side will ensure cooling in the car. Furthermore, the solution works for hanging and cooling the deer at home. The pros are that the cooling is hooked up in the car, and the cooling is the same solution when you get home. The unfolding of the piece of insulating cover protects the car from blood and dirt. The concerns are how well will the cooling of the animal in the car work - will it drain the car battery? Another concern is if the hunter will bring the device as some of them might not have a long drive before arriving at home. App. 25.



Ill. 42. Idea of cooling in the car

HANGING // IDEA OF AN INFLATABLE FRIDGE

The idea consists of a cooling unit and a cover that the hunter stores at home, ill. 43. When the hunter arrives at home the product is placed on the floor and the cover is inflated. The deer is put into the inflated fridge and the cooling unit is turned on. There's a tray in the bottom for blood and ticks and such. The pro of the idea is that the solution is similar to a normal fridge in which it's recognizable to hunters. The inflatable cover will be insulated with the air and the tray will make sure that the worst dirt, blood, ticks etc. are collected in one place. The concerns are if the inflatable solution will look cheap and that the solution doesn't allow cooling in the car. App. 25.



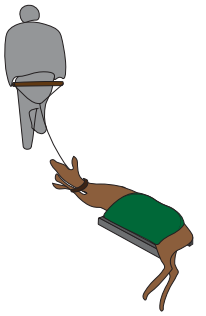
Ill. 43. Idea of an inflatable fridge

COMMENTS FROM THE USERS

// THE THREE PHASES

The videos of the three ideas were first showed to our users Jens, Rene, Flemming and Kasper. Afterwards, the videos were sent to hunters that said we could contact them again in the questionnaire from app. 13, to get a broader perspective.

For all the answers and comments on the three videos, app. 26. A sum-up and collection of the answers showed the following.



SLED

Not gonna use (9 of 15)

Better use for big game (7 of 15)

I can drag the animal fine (5 of 15)

Fasten back legs (2 of 15)

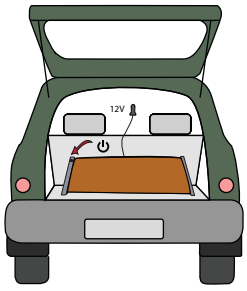
The rectum needs protection too

Make in V-form so dirt won't stick

Velcro straps for easy usage

Too many steps of use

It's too big and unhandy to bring (brings only nessecarities)



COOLING IN CAR

Not gonna use (8 of 15)

Only relevant for long drives e.g. Sweden or Germany (5 of 15)

Great because of seal so you can't smell the dead animal (3 of 15)

Use for small game also (2 of 15)

Great because of blood and dirt is kept away (2 of 15)

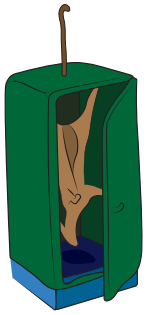
Should fit to a stuffed car (2 of 15)

Fast cooling is great

Great that it keeps blow flies away

Flexible solution would be good

Should be easy to clean because blood is hard to get off!



INFLATABLE FRIDGE

Not gonna use (4 of 15)

Great for minimal space (4 of 15)

Great with a dripping-tray (2 of 15)

Use for bigger game e.g.
sika, fallow deers

Should contain several sizes
(small game, roe deer, big deer game)

Need to control air humidity

Roe deer is 1.5-1.7 m. hanging from
the jaw and longer hanging
from the back legs

Needs to compete price-wise with a
cheap secondhand fridge

The deer would hang with
the laundry at home

Afraid of handling sharp knives
around the product

CONCLUSION

After getting feedback from 15 users, we found that 9 of them stated that the 'sled' is not something they would use. They especially didn't need the product for a roe deer – because the way that they drag a roe deer today is sufficient due to the 'light' weight of the deer and the convenience of not bringing a big product other than a rope (if they remember it). 7 of 15 mention that this solution for bigger game might be great for e.g. a red deer. However, existing solutions like a big plastic sled is already on the market, app. 27. Furthermore, the users don't have a hygienic concern of bacteria getting into the deer as only one user mentions this as an issue.

The need of 'cooling in car' isn't a big concern for the users, in which 8 of 15 says that they don't need cooling in the car. Mostly, people say that they might need cooling for long drives to Sweden, or Germany. Jens mentions that a bag without cooling in the car to prevent blow flies getting into the meat and preventing the car from getting dirty, is a concern that the idea solves. In addition, we haven't found any actual product for this on the market, as most users uses a bricklayer's tub or a plastic bag for transporting animals, app. 13.

The 'inflatable fridge' brought more attention, in which only 4 of 15 users say that they wouldn't use it. Rene could relate to the concept as he has an old fridge in this garage.

The concept of a sled is discarded due to a lack of interest from the users. The users showed the most interest in cooling at home, and therefore, this idea was prioritized as the most relevant solution. The team didn't want to discard the idea for the car just yet without testing if the user would find it interesting without cooling.

UPDATED DESIGN BRIEF

DIRECTION

The scope is narrowed down to the two directions “transporting” and “hanging”. For clarity, these are renamed “storing in car” and “home cooling”. The direction of “dragging” was discarded due to a lack of interest from the users. The users showed a great interest in the idea of home cooling, and this direction is prioritized as the most relevant. The idea of a protective bag for the car is still deemed relevant as the team want to test if the user finds this solution interesting if combined with the home cooling. This direction is noted as second priority.

MAIN FOCUS

Optimal hygienic handling of game from the car until ready for skinning and butchering

REQUIREMENTS & WISHES

STORING IN CAR
// 2ND PRIORITY

Requirements

Should prevent blood and dirt to get in the car

Should be able to contain the size of a roe deer

Should be able to let moisture escape

Should be able to carry 22 kg.

Should be easy to clean

Should fit into a stuffed car

Wishes

Should keep blow flies away from meat

Should be able to contain small game

Should be a flexible/compact solution

Should be able to prevent the smell of dead animal

HOME COOLING
// 1ST PRIORITY

Requirements

Should keep blow flies from the meat

Should be able to cool below 7 °C

Should ensure air circulation

Should be easy to clean

Should be able to carry 22 kg.

Should be able to contain the size of a roe deer

Should be stored away when not in use

Wishes

Should cool for at least 24 hours

Should be able to collect blood and ticks, and discard that easily

Should be able to contain small game

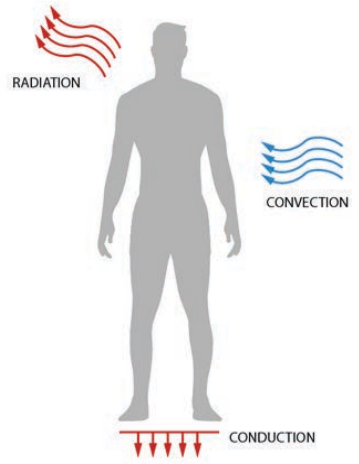
Should allow moisture to escape/humidity control

INSULATING MATERIALS

HOW DOES HEAT TRANSFER?

When it comes to how the body gets rid of heat, it comes down to radiation, evaporation, respiration, convection, and conduction. However, evaporation and respiration are set aside, as the animal, in this case, is dead.

As shown on ill. 44, radiation comes off all warm things, and mammals lose around 65% of their body heat through radiation, which is substantial. Less is lost through the moving air resulting in convection, and even less is lost through contact with other solid objects through conduction. (Cold Exposure: Ways the Body Loses Heat, 2020)



Ill. 44. Heat transfer of radiation, convection and conduction

The team looked into different products to insulate the body and noticed that conventional air mattresses use a refelective plastic foil on the inside, which reflects the radiation back to the body. Cool Hunt, won't take advantage of this as the purpose is to cool the carcass as fast as possible.

Convection will be used through blowing cold air around the carcass while a material with low thermal conductivity will be used as an insulator to keep warmth out.

INSULATING MATERIALS

When trying to determine which material to use for insulating the product, the obvious choice would be PUR-foam, which is currently used in modern refrigeration systems. (Fridges and freezers - Polyurethanes, n.d.) However, since the product isn't going to be a conventional refrigerator, the team explored other materials with different properties.

A material's insulating property is noted with a lambda-value (λ), which is expressed as W/mK, and the lower the better.

The team found some interesting materials online:

Air	0.026 W/mK
PUR (rigid) foam	0.03 W/mK
PUR (flexible) foam	0.03 W/mK

Ill. 45. (Thermal Conductivity of some selected Materials and Gases, 2003)

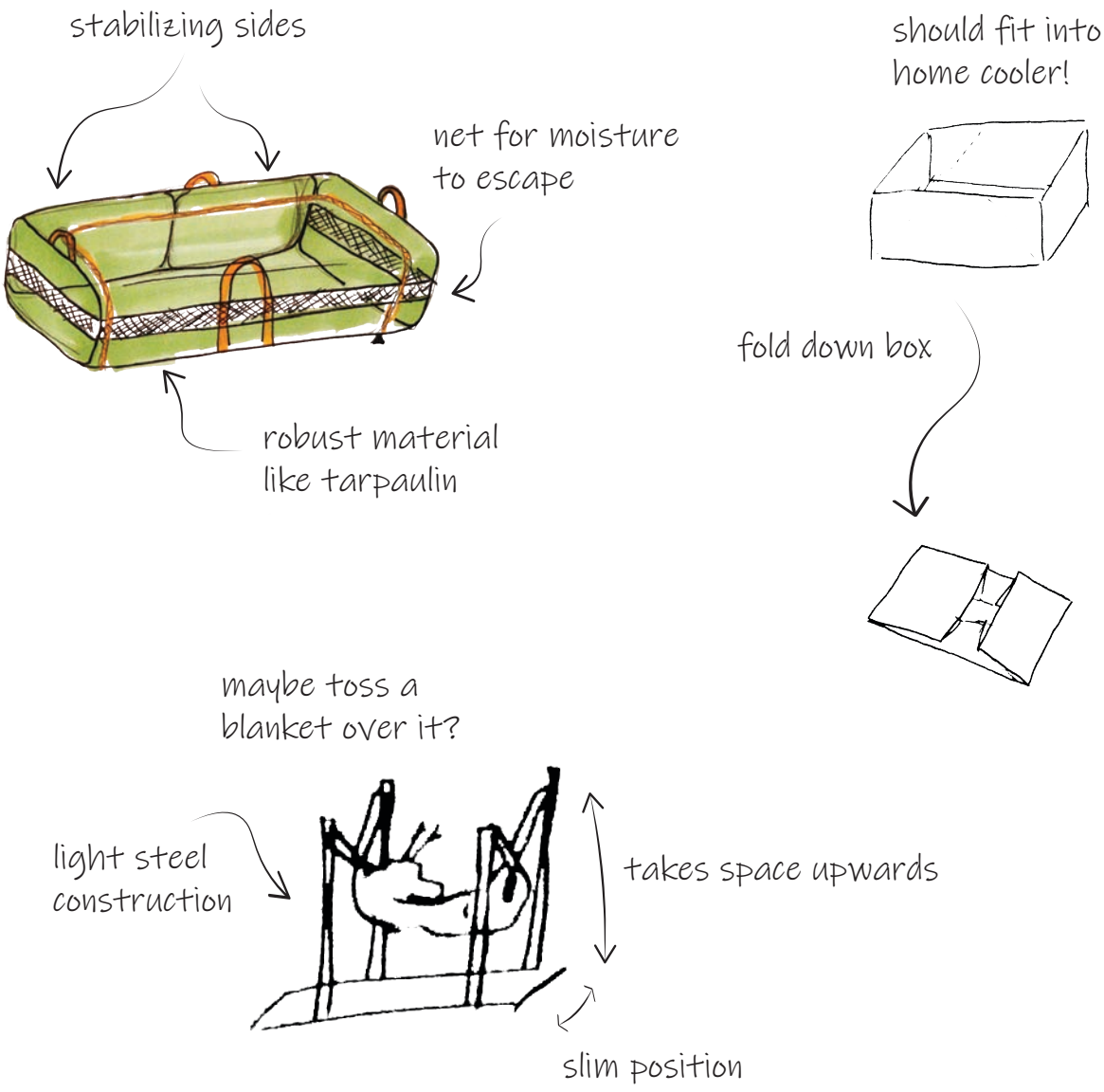
The team had interest in the rigid PUR, but also wanted to experiment with its flexible counterpart, which has the same insulating properties – while doing so, the team also noted that air, also has a noteworthy thermal conductivity. For air to be used effectively as an insulator, it has to be encapsulated in order to prevent convection as stillstanding air has the best insulating properties. (Lohner, 2017)

While getting feedback on the inflatable fridge, a hunter noted that he would be afraid to puncture the fridge while handling sharp knives, app. 26. Therefore, the team continued to work with flexible and rigid PUR to figure out a way to take advantage of its properties to make the product smaller and easier to work with.

SKETCHING
// INSULATING MATERIALS

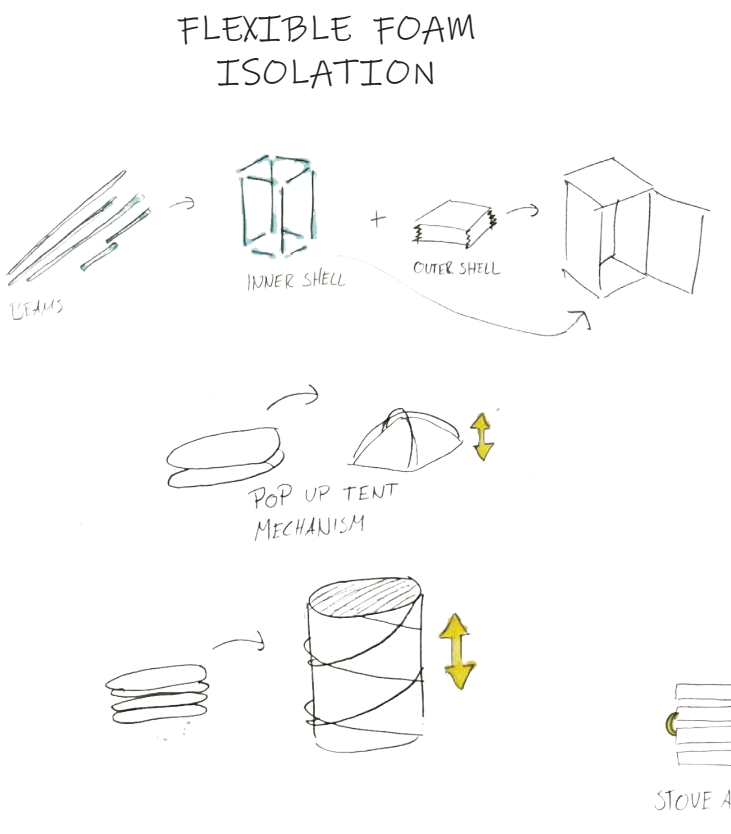
With all the insights gathered with feedback of the videoes, app. 26, together with an updataed design brief, the team were ready to start a new sketching round. Important to note is that the users in gerenal, didn't show that much interest in cooling in the car, but rather a convienient transport solution. The research in insulating materials also gave the team a new understanding of which material properties to work with. A selection of the sketches is shown and explained on ill. 46-48, see app. 28 for all the sketches.

STORING IN CAR // 2ST PRIORITY

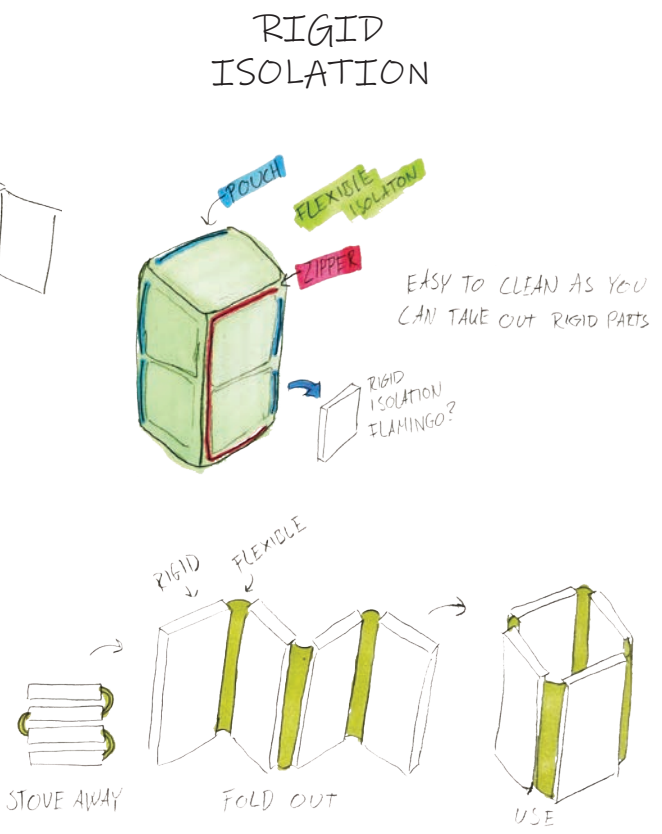


Ill. 46. Sketch of different solutions for a transportation bag

HOME COOLING // 1ST PRIORITY



III. 47. Sketch of different ideas for flexible foam solutions



III. 48. Sketch of different ideas for rigid isolation solutions

CONCLUSION

The ideas were great with a broad and innovative way of incorporating the different insulating materials as well as the comments from the users. However, the team had a hard time of selecting and choosing which were better and for what reasons and arguments. The team discussed that with the flexible material the interaction of unfolding the fridge can be made a lot smoother and faster. The team took inspiration from an old yoga mat and started looking into PUR and EVA foam. PUR seemed like a good candidate with low thermal conductivity. With the rigid solutions it was found to be either very bulky, but easy to unfold or very compact, but with a high complexity when assembling. The flexible material for isolation was chosen.

SIMPLIFIED DESIGN BRIEF

DIRECTION

The two directions of “storing in car” and “home cooling” are still intact.

MAIN FOCUS

Optimal hygienic handling of game from the car until ready for skinning and butchering

REQUIREMENTS & WISHES

As mentioned earlier while sketching for insulating materials, the team were struggling to make decisions and moving forward and advancing in the project. There were a lot of requirements and wishes, which was a lot to grasp when sketching. Therefore, the team decided to cut down on the requirements and wishes. This was not to remove them, but it was done to neglect those that didn’t have an impact on the sketches at our current state like ‘should cool below 7 °C’.

STORING IN CAR
// 2ND PRIORITY

Requirements

Should prevent blood and dirt to get in the car

Should be able to let moisture escape

Should fit into a stuffed car

HOME COOLING
// 1ST PRIORITY

Requirements

Should be easy to unfold

Should keep blow flies from the meat

Should be easy to clean

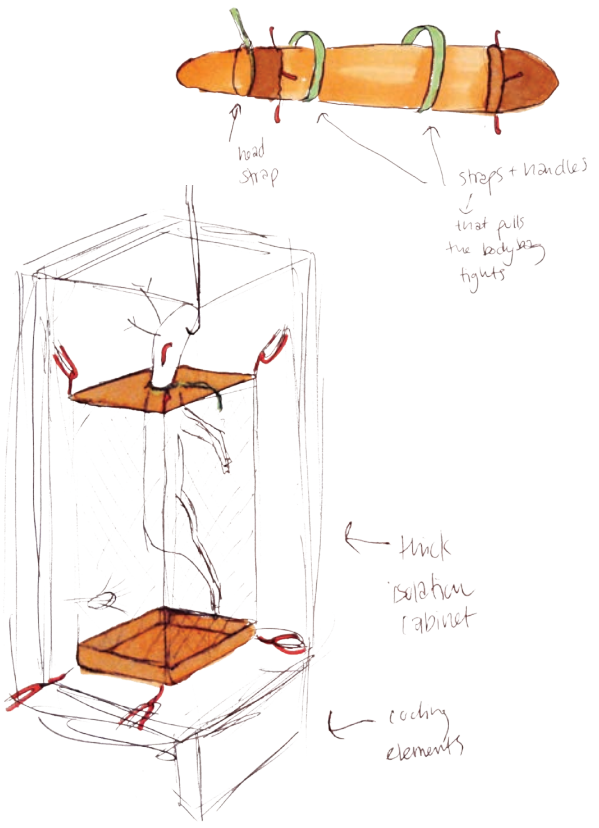
Wishes

Should be able to collect blood and ticks, and discard that easily

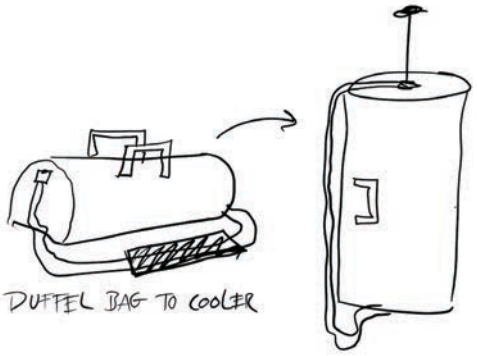
SKETCHING

// MERGING THE SOLUTIONS OF STORING IN CAR AND HOME COOLING

With the simplified design brief the team was able to sketch new ideas with a focused set of requirements. Prior it was stated that the 'storing in car' should be integrated into the solution of the home cooling which was the focus of this sketch session. A few examples are shown on ill. 49-50, see app. 29 for all the sketches.



Ill. 49. Sketch of a transportation bag that can be inserted into a home cooling solution



Ill. 50. Sketch of a transportation bagpack that can be inserted into a home cooling solution

CONCLUSION

Trying to merge the two solutions together seemed to block the creativity and ideation rather than bringing the project forward. The team decided to remove the transportation part of the product from the main focus. For all the arguments, see app. 29. The main arguments are that the team simply forgot to listen to what the users wanted from the comments of the three ideas, app. 26. At that time, it seemed like the transportation bag for the car would fit into a combined solution with the home cooling. However, none of the drawn ideations fit really well with the first prioritized solution of a home cooling device. In addition, it was difficult to argue the great advantages over the bricklayer tub or plastic bag that most hunters use today.

HOME COOLING DESIGN BRIEF

DIRECTION

The scope of the project is narrowed to home cooling. The solution for ‘storing in car’ to transport game is discarded due to first of all, a lack of interest from the users. In addition, the solution was missing unique selling points to compete with the existing solutions of a bricklayer tub or plastic bag that the hunters use today. The solution had moved further away from the main focus of an optimized hygienic handling of game, but more towards a convenience of keeping the car clean from blood and dirt. With a narrow direction the team is now able to put all energy and focus on the next phase of conceptualization.

MAIN FOCUS

Optimal hygienic handling of game at home

REQUIREMENTS & WISHES

HOME COOLING

Requirements

Should be easy to unfold

Should keep blow flies from the meat

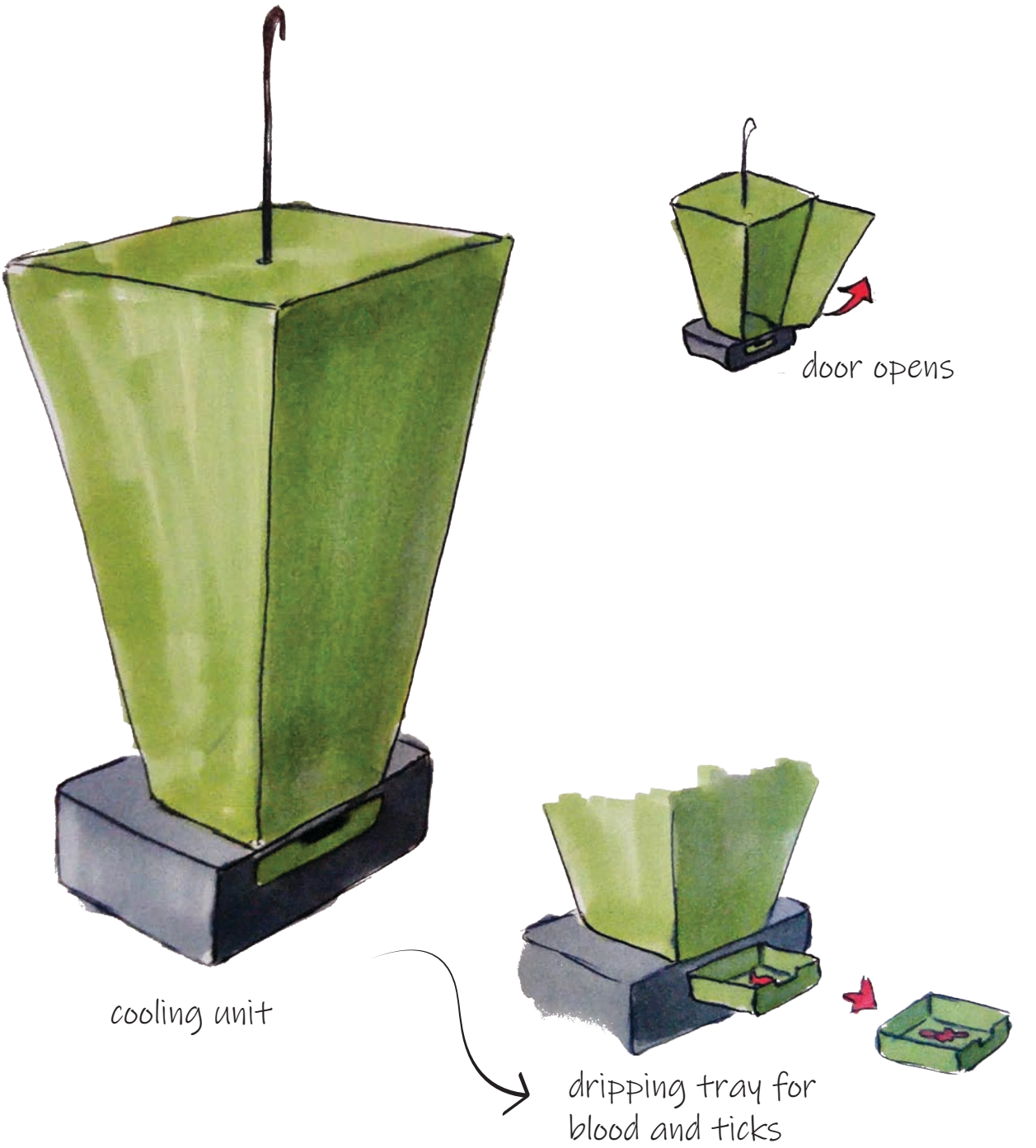
Should be easy to clean

Wishes

Should be able to collect blood and ticks, and discard that easily

HOME COOLING AS FINAL IDEA

With a narrow scope of home cooling one idea was formed, see ill. 51, it combines a lot of the ideas trying to solve the set requirements. This illustration is a temporary flash that points in a direction of home cooling which will be explored during the next phase of conceptualization in which the goal is to shape a concrete concept.



Ill. 51. Idea of a home cooling solution

CONCEPTUALIZATION

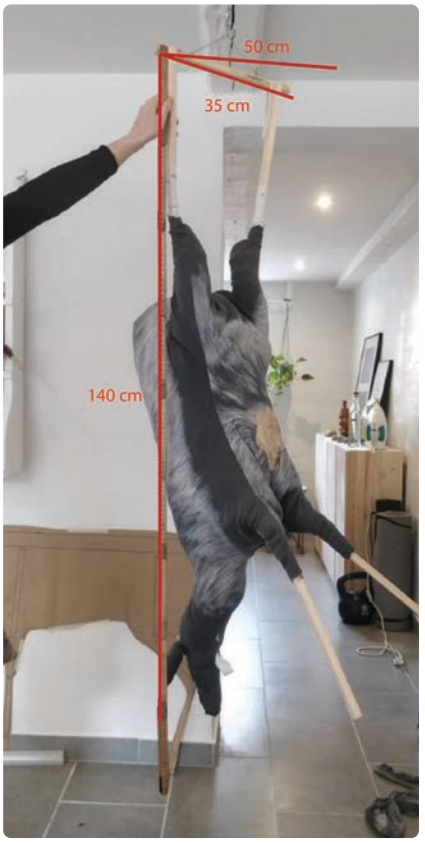
In this conceptualization chapter the team will be starting to break down the element of cooling meat and analyzing, in a more technical fashion, what current technologies are capable of and how different materials can be exploited to make a product that meets the expectations of the users. This will be done through a series of sketches and prototypes, to understand each scenario better to create an outline for the functionalities of the product. A final concept with a determined product architecture will be defined and chosen.

REAL SIZE ROE DEER DUMMY

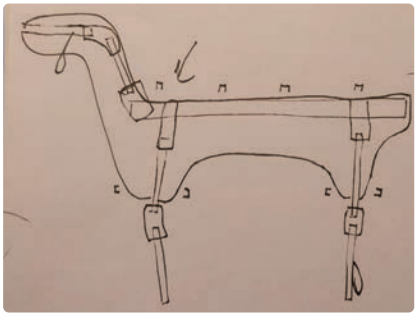
A roe deer dummy in the size 1:1, measured from pictures, was made with the purpose of being useful for interaction, size testing, user scenarios act-out, and prototype testing. Ill. 55 shows how the roe deer was made with a wood skeleton to have a realistic structure, when hanging either from the jaw or the back legs, as we know are the two ways that hunters hang a deer, app. 14. The intention was to apply the weight of 18-20 kg. as seen on ill. 52, however, the fabric couldn't withstand the weight and the sandbags were removed. Ill. 53 shows the final result of the dummy. Firstly, the deer was used for a simple volume test, and the conclusion was that a cylindric shape had the smallest volume of 176 L to fit the roe deer, if the legs of the roe deer could touch the fabric, see general dimensions on ill. 54. For more information about how it was made, volume calculations, see app. 30.

Ill. 52. Wood skeleton with 18-20 kg. sandbags

Ill. 53. Emma and Andreas proudly showing the dummy



Ill. 54. Dimensions of the dummy hanging

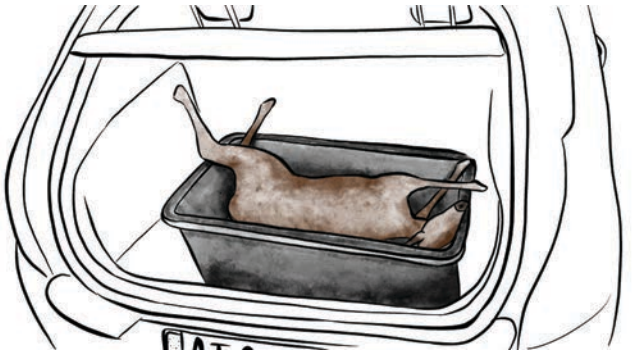


Ill. 55. rawing of the intention of the wood skeleton

USER JOURNEY

// IN DEPTH WITH HANDLING ROE DEER FROM CAR TO BUTCHERING

Having a clear design brief with the direction of home cooling, it was relevant to understand the user scenario in detail of taking a roe deer from the car and hanging it. Two interviews were conducted to map these steps with the hunters Rene and Flemming, see app. 19 and app. 20 for the full interviews. By using the dummy roe deer, the users were able to show us in detail what happens. The user journey is based upon the two interviews, combined with knowledge from app. 13 (N=186) to ensure that the story was as common as possible, both have a broad spectrum and a deep understanding. See ill. 56 for the user journey and app. 31 for what each step is based upon.



1 Deer in bricklayer tub in the back of the car

2 The bricklayer tub with roe deer is dragged to the garage

3 The bricklayer tub is placed where the roe deer should be hanged in the garage

4 A hook is placed in the jaw of the deer

6 The deer is hanged with a bugnet and hangs for about 24 hours at 20 °C

7 The skin is peeled off and this takes about 40 min.

5 The deer is pulled up whilst being hooked

8 The deer is butchered in big parts and takes about 20 min.

III. 56. Sketch of the 8 steps of the user journey in depth

CONTEXT AND USED PRODUCTS

Ill. 57. Dummy deer hanging from hoisting system from hind legs

Ill. 58. Simple mount in garage

Ill. 59. Deer hooked in jaw

JAW OR HIND LEGS

Having a better understanding of the core process of the user journey for the hunter, the team looked at the context, where a majority kept the deer in either their carport or their garage. This study also showed that it's mixed whether or not the hunters hang the deer in the jaw, see ill. 59, or from the hind legs, see ill. 57, which is why both of these requirements should be catered. App. 14, app. 19 and app. 20.

CEILING

The study showed no similarities in ceilings, meaning that some were tilted, none were the same height and others had beams going across it. This means that the product should be adjustable to most ceilings and preferable, the product should be standing on the floor to avoid this issue of fitting onto a ceiling. App. 32.

HANGER

Some users used an assisted hoist, see ill. 57, while others didn't mind lifting the deer up to a simple ceiling mount after it's been hook, see ill. 58. The team liked the idea of letting the hunters keep the same equipment that they already own and will therefore, try to incorporate their system into the final product, so that the users shouldn't substitute the system they already use. For more detail on this study, app. 32.

USER JOURNEY DESIGN BRIEF

DIRECTION

With home cooling as the direction, the deep understanding of the user journey has contributed to new requirements and wishes in which the product should support the hunter's way of hanging the deer today.

MAIN FOCUS

Optimal hygienic handling of game at home

REQUIREMENTS & WISHES

The requirements and wishes were added again, and furthermore, divided into the two categories of "interaction" and "technical".

INTERACTION

Requirements

Should be packed down and stored away when not in use

Should be easy unfold and set up

Should support that the deer hangs from either the jaw or the hind legs

Should support and allow the user to hook the deer from the floor

Should fit into the hoisting system that the user use today

Should be removed/not be in the way when the user needs to skin and butcher

Should collect blood an ticks and discard it easily

Areas prone to dirt, should be easy to clean

Wishes

Should be able to contain small game

Should hang from the ceiling

TECHNICAL

Requirements

Should keep blow flies from the meat

Should be able to cool below 7 °C

Should ensure air circulation

Should be able to fit a roe deer

Should be able to cool 200L

Should cool for at least 5 days

Wishes

Should be able to contain small game

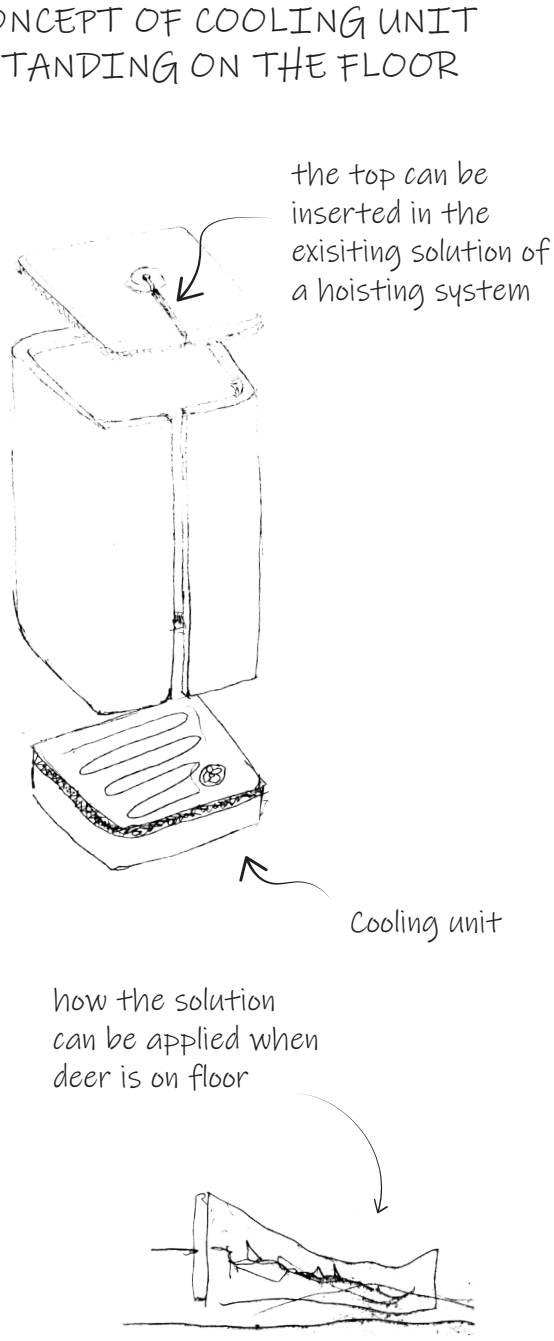
Should allow moisture to escape/humidity control

SKETCHING

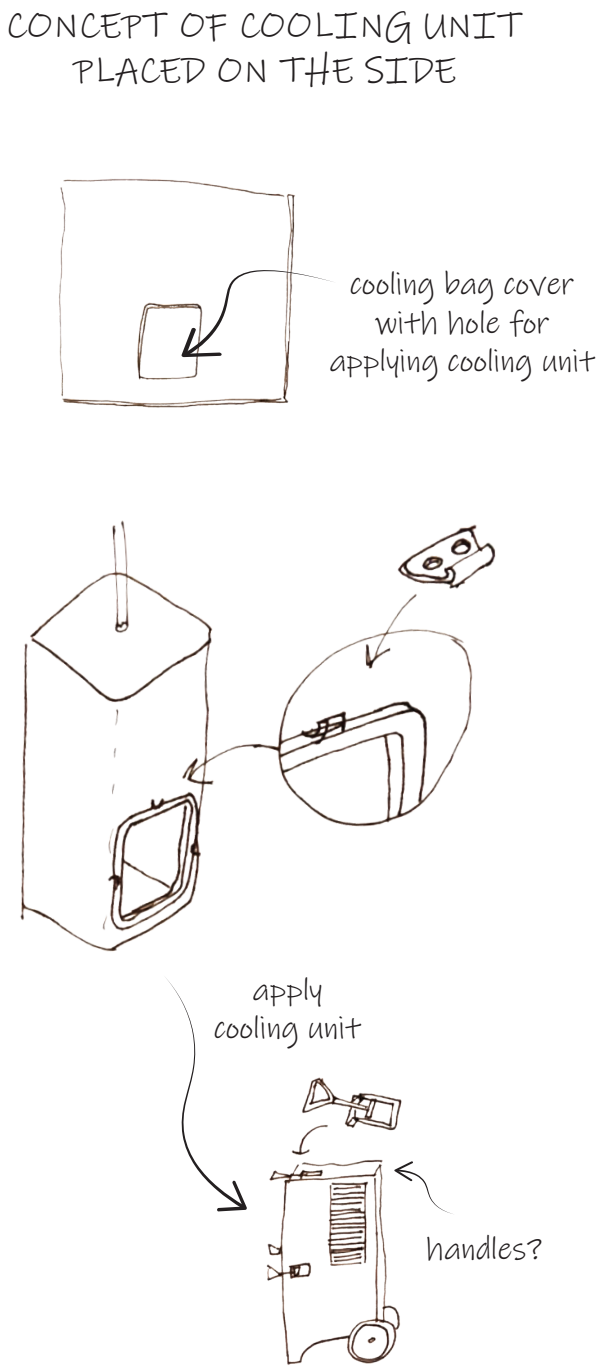
// AFTER UNDERSTANDING THE USER JOURNEY IN DEPTH

After mapping the steps of the user journey of getting the deer from the car and hanging it, the team had gained new relevant insights formed into requirements. This had formed fresh ideas in our heads that needed to be put down on a piece of paper with no boundaries or intention, see ill.60-63. See app. 33 and app. 34 for all the sketches.

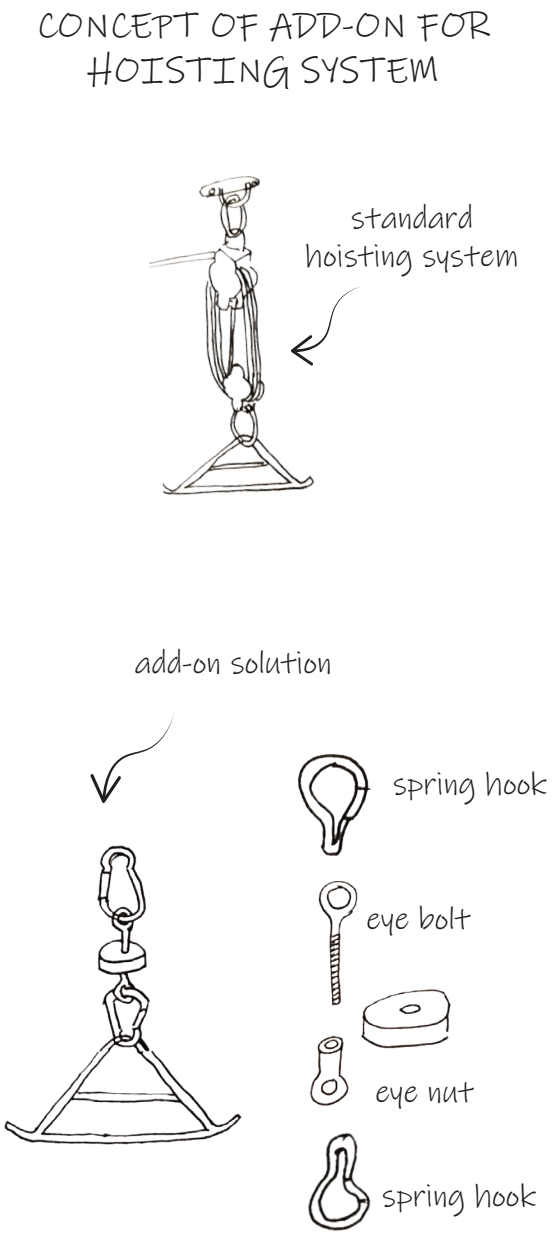
Ill. 60. Sketch of concept of cooling unit hanging from the ceiling



Ill. 61. Sketch of concept of cooling unit standing on floor



Ill. 62. Sketch of concept of cooling unit places on the side



Ill. 63. Sketch of concept of add-on for hositing system

CONCLUSION

The sketches circles around the product architecture. Questions like where to place the cooling unit? How should the top look? And how should the top be inserted into the current solution of a hoisting system? The sketching made the team realize that a systematic approach was necessary to evaluate the concepts based upon research and testing.

BACK IN CONTROL

// AFTER UNDERSTANDING AND SKETCHING FOR THE USER JOURNEY

During the last couple of weeks which includes the ending of the ideation phase and the start of the conceptualization phase, the team had a hard time advancing the project and in general, had a feeling of being stuck. There has been a lot of great ideas based on input from users, observations, and a broad understanding of the problems, however there were no criteria or tests to understand if these ideas and concepts would be better than another one. Therefore, the team needed to make a plan with very specific tasks breaking the structure of the concept down into sub-problems to challenge the product architecture, especially concerning technical and interaction aspects. Technically, the team needed to get in depth with the technologies used, the sub-elements, and set technical requirements for testing different variants of the product architecture. Furthermore, the tasks concerning interaction included mockup tests to determine the ease of use, measurements of dimension on context etc. Below, the plan is shown, which is divided into a prioritized list starting with the most relevant tasks. The relevance was chosen based upon what would influence the concept. For the sub-tasks of each task, see app. 35.

VERY IMPORTANT

Technical: Humidity and air flow
Technical: Heat and flow simulations

IMPORTANT

Interaction: Unfolding the cover

MEDIUM IMPORTANT

Interaction: How to attach the cover
Interaction: How to make top fit into exsisting solutions

LOW IMPORTANCE

Conceptualization: Use knowledge from ‘heat and flow simulations’ and ‘humidity and air flow’ for shaping cooling unit

HUMIDITY AND AIR FLOW

During the process, the team was informed by Mariann, the veterinarian, that humidity control is important. She advised people who uses a fridge to cool the deer, to leave the door ajar for the first 24 hours, app. 18, but besides that the team couldn't find any information on this.

In an interview with the wildlife slaughter-house, Nordvildt, the team found that they consider humidity very important, but that was in regard to dry-aging for much longer durations, in which it's known that humidity control is very important (Motz, 2020). App. 36.

As parts of the interviews with Klosterhedens Vildt, a cooling technician and ZBC (butcher training), the team found that they don't monitor the humidity in their cooling rooms, and that there aren't any requirements by the government to do so. It is however very important to ensure that there is sufficient air circulation as the faster moving air helps to cool down the product more rapidly. App. 37, app. 22, and app. 38. The cooling technician also noted that humidity is partly regulated by the evaporator as moisture will condensate on its cool surface. App. 38.

ZBC, a butcher school in Roskilde, informed the team that it's not necessary to bring in 'fresh air' into the cooling department. App. 37.

Therefore, the team will not include any functionalities for humidity control in the product, but will look into ensuring proper air circulation.

NORDVILDT
EST. 2018

Ill. 66. (Nordvildt, 2018)

Nordvildt is a small slaughter-house with two owners that only handles wildlife game.

KLOSTERHEDENS VILDT

Ill. 65. (Nørre Vosborg, n.d.)

Klosterhedens Vildt is a medium-sized slaughter-house that solely handles wildlife game.

Ill. 64. (Chriél, n.d.)

Mariann Chriel

Veterinarian and head consultant at DTU Vet, National Veterinary Institute

Mariann hosts courses to educate hunters in hygienic handling of wild life game.

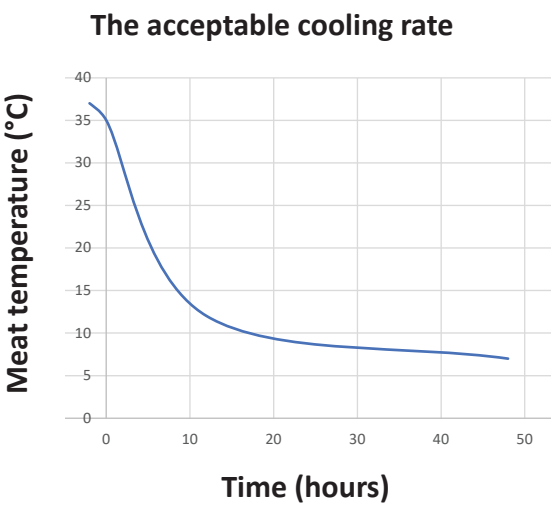
ZBC

Ill. 67. (ZBC, n.d.)

ZBC is a vocational education that's the only Butcher education in Denmark.

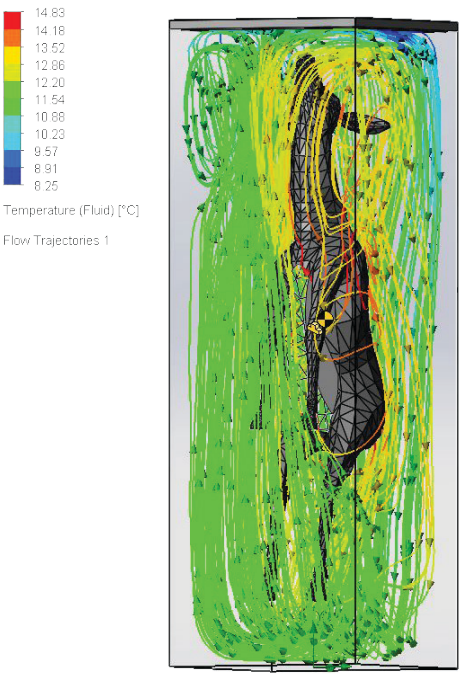
HEAT AND FLOW SIMULATIONS

The compressor technology had been chosen as the cooling technology, because the peltier had proved to be too ineffecient for the size of the product, app. 39. The team have been making various sketches upon where to place the cooling unit. Optimally, the cooling unit would be placed on the floor due to the compressor weighing 9 kg. (Køleanlæg Isotherm 2006 Classic Compact, n.d.), and uneven ceilings. However, this decision seemed a bit illogical as physics says that hot air rises and cool air falls. To challenge the product architecture, heat and air flow simulations were made upon three variants which are 1. Cooling from the top, 2. Cooling from the bottom, and 3. Cooling from the bottom with a fan blowing cool air upwards, see ill. 69-74. The expected outcome was the 3rd variant would cool just as much as the 1st variant. An acceptable cooling rate was made, see ill. 68, as the cooling requirement for the product, and the rate was based upon comments from butchers and the butcher book, app. 23. See app. 40 for the full information about the temperature and air flow simulations.

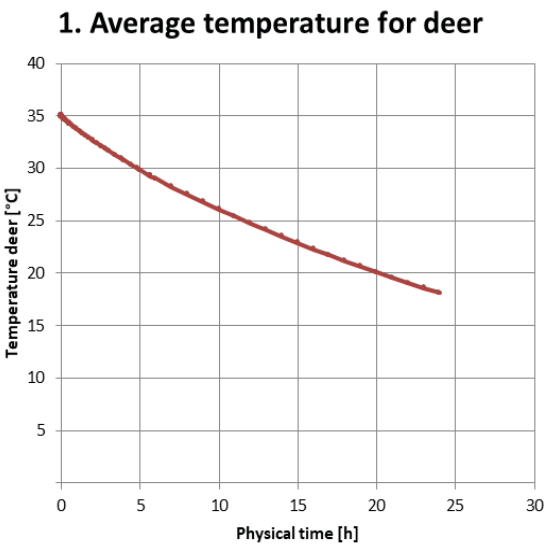


Ill. 68. The acceptable cooling rate

1. COOLING FROM THE TOP

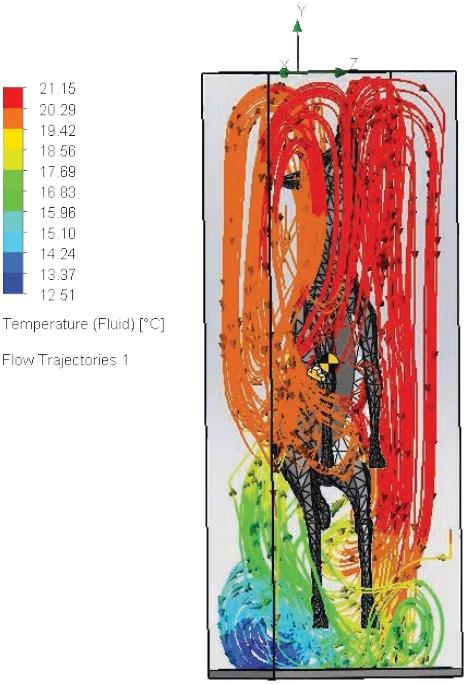


Ill. 69. Temperature and air flow simulation 1

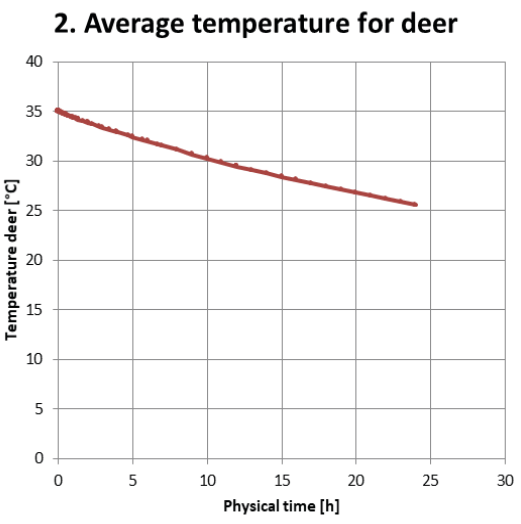


Ill. 70. Graph of solution 1 of the average temperature of a roe deer over the time of 24 hours

2. COOLING FROM THE BOTTOM



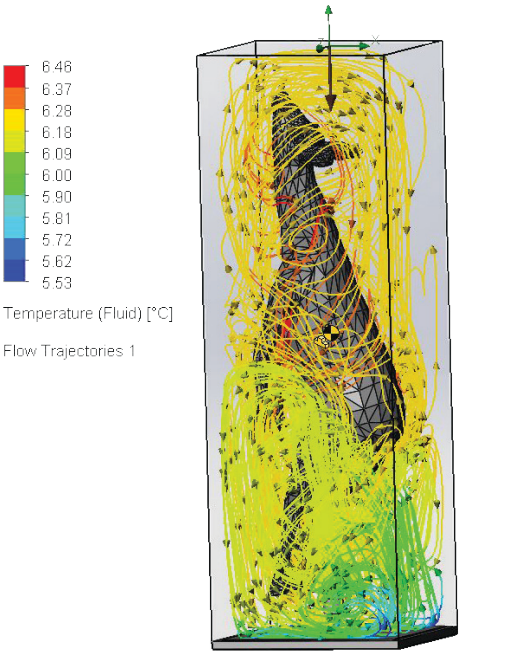
Ill. 71. Temperature and air flow simulation 2



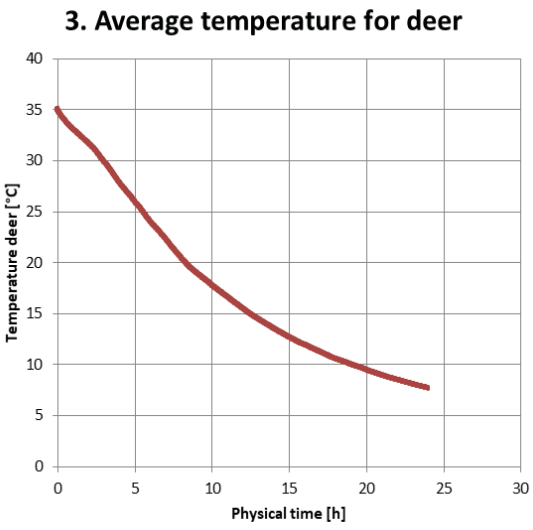
Ill. 72. Graph of solution 2 of the average temperature of a roe deer over the time of 24 hours

3. COOLING FROM THE BOTTOM

// WITH A FAN BLOWING COOL AIR UPWARDS



Ill. 73. Temperature and air flow simulation 3



Ill. 74. Graph of solution 3 of the average temperature of a roe deer over the time of 24 hours

CONCLUSION

Variants 1 and 2 does not meet the acceptable cooling rate. At 1. variant the deer is about 25 °C after 12 hours, and 2. variant the deer is about 30 °C. Variant 3 doesn't quite meet the acceptable cooling rate as the deer is about 15 °C, however, it's close to the acceptable rate. The expected outcome was not met as only variant 3 comes close to the acceptable rate and is more efficient than first expected. The conclusion is that placing the cooling unit at the bottom with a fan that circulates the air upwards is an acceptable product architecture that with small adjustments can meet the requirement of cooling a roe deer.

FOLDING TECHNIQUES OF COVER

// 1:5 MOCKUP TESTING WITH FOAM ISOLATION

A test of different folding techniques for the cooling cabinet was made in the scale of 1:5 with flexible foam. The variants were valued on a point system with the current requirements, shown here. For the full description of each variant, see app. 41. The evaluation was made by the team and therefore, highly objective. However, it helped the team to evaluate the different solutions and move forward. A conclusion can be found on next page.

1 // TWISTING SQUARE

Ill. 75. Paper version

Ill. 76. Unfolded

Ill. 77. Folded

2 // FOLDABLE PIECES

Ill. 78. Unfolded

Ill. 79. Folded

3 // SIMPLE ONE PIECE

Ill. 80. Unfolded

Ill. 81. Folded

1 is worst while 5 is the best score

Should allow easy setup	2	3	5
Should not intefere with the deers position	4	4	4
Should be easy to clean	3	2	5
Should be removeable without moving deer	2	1	3
Should be easy to pack down	4	1	3
Should be convienient to store	3	4	3
TOTAL SCORE	**18**	**15**	**23**

4 //TWISTING CYLINDER

Ill. 82. Unfolded

Ill. 83. Folded

5 //FOLDABLE SIDES

Ill. 84. Unfolded

Ill. 85. Folded

6 //STACKING SQUARES

Ill. 86. Unfolded

Ill. 87. Folded

7 //FOLDABLE ONE PIECE

Ill. 88. Unfolded

Ill. 89. From the side

Ill. 90. Folded

5	4	4	1
3	4	2	4
3	4	3	3
3	2	2	2
2	3	3	3
3	3	3	4
19	**20**	**17**	**17**

FOLDING TECHNIQUES OF COVER

// CONCLUSION

The solution of a simple one piece was chosen as the most relevant solution, see ill. 91-92. The reasons for choosing this were that it was evaluated to be easier to clean due to minimal “creases”. In addition, the solution was evaluated as easy to unfold and set up, which was one of the primary requirements, as hunters are tired when arriving home late after hunting. However, the downsides of the solution were that the action of packing it down is funky and not intuitional. The team is afraid that the wrapping of the material, ill. 92, will deform the solution over time making it look ugly, and maybe even damage the insulating properties. Having tested various variants of a flexible foam solution the team discussed the possibility of other materials, in which the initial inflatable solution was brought back up. This solution had earlier been discarded due to handling of sharp knives around the product. However, the deep understanding of the user journey had changed the usage of the product a bit - the insulating cover should be removed completely before the deer is skinned and butchered.

In order for the team to decide whether foam or air was the most appropriate, a list of pros and cons of each solution was made, see the full list in app. 42.

The most important arguments for choosing the inflatable solution are a compact solution, and air, in theory, has a little better insulation capabilities than foam. In addition, the solution will not deform over time as the foam might. The disadvantages are an extra step of interaction because the cover needs to be connected to an air pump, the possibility of punctuation, and an extra sub-element of an air pump, see ill. 93.

Ill. 91. Unfolded solution with flexible foam

Ill. 92. Folded solution with flexible foam

Ill. 93. Inflatable solution with air as insulation

CONCLUSION

The inflatable solution is chosen as the advantages are deemed more important.

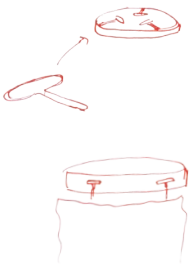
HOW TO ATTACH THE COVER

// 1:1 MOCKUP TESTING

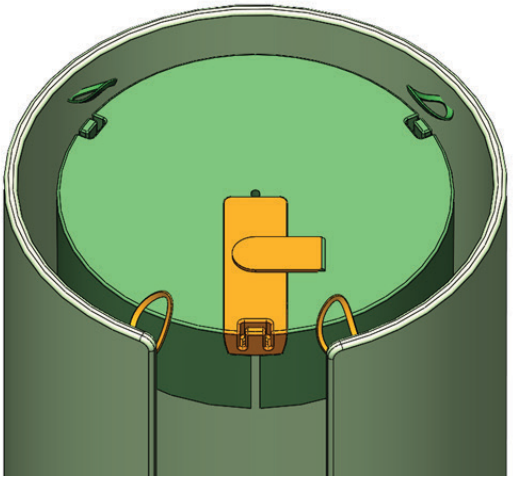
After the team realized that using an inflatable cover, would be beneficial, a solution of attaching it to the product's top plate had to be found. The first try was to attach the cover using velcro, see ill. 94, and found that if the top cover could rotate, the user would be able to stand in one spot while attaching the cover. However, using velcro wasn't ideal as it wasn't easy to align it probably the whole way around.

Through testing with velcro, the team found that only 3-4 attachment points were needed to secure the insulated cover properly. The initial idea is illustrated with t-hooks in ill. 95, while the final solution is strops of fabric, see ill. 96.

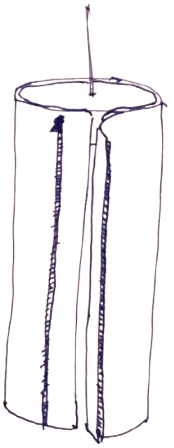
Ill. 94. Velcro test



Ill. 95. T-slots and T-hooks



Ill. 96. Final attachment solution with elastic bands



Ill. 97. Final closure solution with zipper

CONCLUSION

Contemplating with this, the team found that with four straps on the insulating cover and three slots on the top cover, the user could easily attach the two parts together. This would also ensure that the long sides of the insulated cover met at the same point, see ill. 96, where the orange straps are. For the whole process, see app. 43 and app. 44.

For closing the long side of the insulated cover, the team tried different solutions in an acting out scenario and found that using a zipper, had the most benefits, compared to velcro. For the chosen solution, see ill. 97, an offset zipper would be used which will allow for easy interaction while the product is deflated, but a tight fit once it's inflated. For more details on this study see app. 44.

PRODUCT ARCHITECTURE

// COOLING UNIT

To shape the cooling unit, requirements needed to be set. The requirements that have an impact on the cooling unit are how the product will be moved and transported. Hunters have mentioned that they like a compact solution that doesn't take up space, app. W26, in which the product "should be able to be moved and stored away". From the user journey, app. 31, it was discovered that the product should be moved out of the way, when the hunter need to skin and butcher. Lastly, the users have expressed that they want to be able to bring it to Sweden or Germany for weekend trips, app. 26 and a wish is set of "the dimensions should be able to fit into the trunk of a car".

Requirements

Should be able to be moved and stored away when not in use

Should be able to be moved away to skin and butcher the deer the same place

Wishes

The dimensions should be able to fit into the trunk of a car

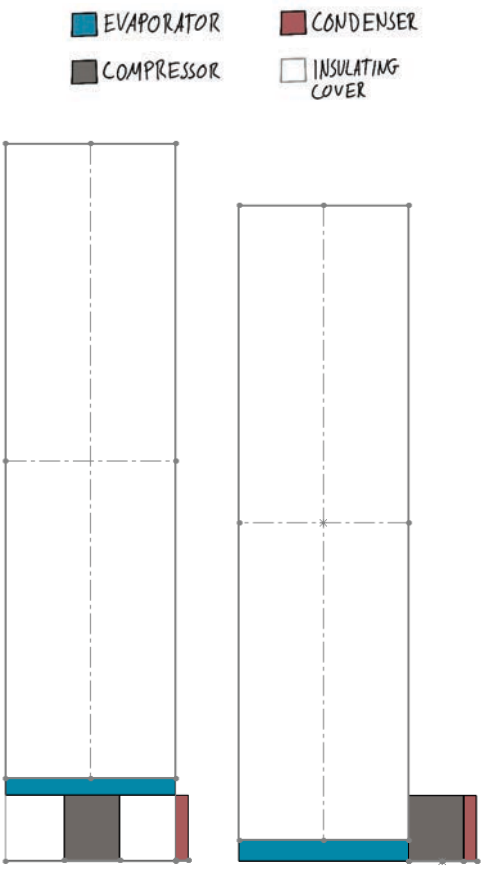
WEIGHT AND DIMENSIONS

The weight and dimensions of the elements that are going to be inside the cooling unit will have an impact of how it will be handled. The inside elements consist of the compressor, evaporator, condenser, air pump, a fan for blowing cool air up, and a dripping tray for collecting blood and ticks. The compressor will be the heaviest element, as previously mentioned a compact solutions can weigh 9 kg. The total weight is therefore estimated to be 13 kg.

CONCEPTUAL VARIANTS OF ELEMENT PLACEMENT

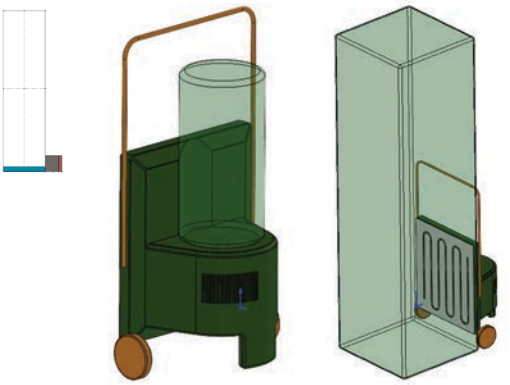
Variants of placing the entire cooling unit on the ground and on the floor, has been made and evaluated in relation to the heat and air flow simulations, the contextual setting, and the use of the product, for the evaluation see app. 45. The final choice was to place the cooling unit on the ground.

The team studied two different placements of the cooling unit on the ground including the sub-elements of the cooling unit as compressor and condenser in relation to the evaporator and insulating cover (Tjalve, 2003), see ill. 98.



Ill. 98. Conceptual variants of sub-elements placement

COOLING UNIT ON SIDE



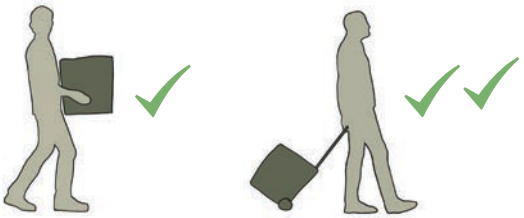
Ill. 99. Concept placing compressor and condenser on the side

This concept, see ill. 99, show that both the compressor and the condenser is moved out from underneath the evaporator, this would be more efficient since it allows for the warm air to be expelled even further away from the cool parts. It makes the footprint bigger. For easy moving the product around inside a shed or garage, a handle for pulling it and wheels is incorporated. This means e.g., that it can't be dragged across the floor like a trolley with small wheels, since it can encounter uneven flooring, loose gravel, door thresholds and miscellaneous items that are also stowed away.

This concept looks very functional and not integrated, coherent and unified.

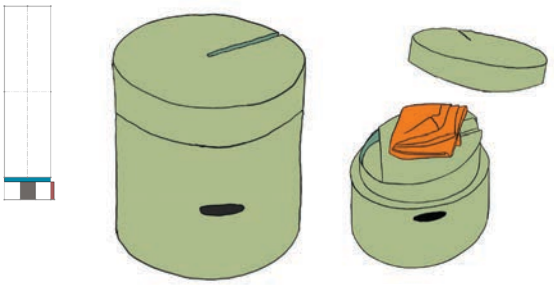
REQUIREMENT SPECIFICATION OF MOVABILITY

For the requirement of "should be able to be moved and stored away when not in use" this needed to be specified even more. As the whole system is expected to weigh around 13 kg., which is a little above the carrying limit of 12 kg. for 2 m. distances according to the Danish Working Environment Authority (Løft, træk og skub - Arbejdstilsynet, 2005). However, considering that the product should not be moved far, and the hunter is capable of carrying the 20 kg. heavy animal, it's okay for the hunter to carry the Cool Hunt product, even though it's not ideal, see ill. 100.



Ill. 100. Requirement specification of moving the product

COOLING UNIT ON BOTTOM



Ill. 101. Concept placing compressor and condenser on bottom

For this concept, see ill. 101, the compressor and condenser are placed beneath the evaporator and insulating cover. This has the benefits of having a smaller footprint. The condenser, which gets warm, is placed away from the evaporator, which should be kept cool. A downside is that a big empty volume is wasted inside the cooling unit, however, other sub-elements as an air pump can be placed here.

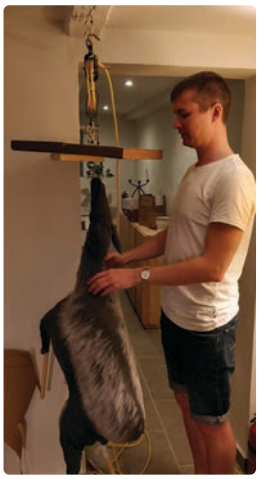
This concept is more unified, which is an advantage as the product will be placed on a shelf or on the floor for storage most of the time, when not in use. As mentioned, the weight of the product is considered okay to carry. A dripping tray for collecting blood, and ticks is incorporated into the concept, however, the ideas, thoughts and variants of this will be explained in the detailing phase.

CONCLUSION

The latter concept of the cooling unit at the bottom was chosen due to a more coherent and unified appearance, which is valued highly as the product will be stored for most of the time on a shelf or on the floor in a garage, shed or such.

PRODUCT ARCHITECTURE
// TOPPLATE

As the team has already found, it would be practical for the hunter, if they could just attach the product to their existing solution of either a hoisting system or a simple hook. For that to happen, the team studied how this could be done easiest, through a series of sketches and prototyping. The first thought was that a top plate could be attached at all times, but a test, see ill. 102 and 103, showed that this would get in the way. For the entire test see app. 46.



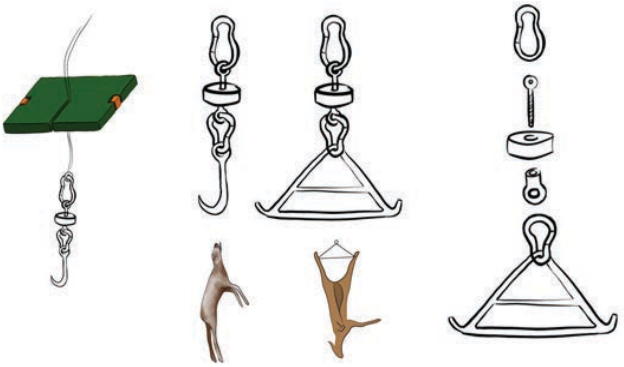
Ill. 102. Top plate blocks vision and accesability

Ill. 103. Top plate is cumbersome when attaching the deer

From the test, the team realized that the top has to be removable from the hoisting system, as to not interfere with how hunters use their current equipment. The solution should therefore be almost entirely detachable from the hoisting system, without moving the deer.

The team came up with a solution with a small attachment, which should be left on the hoisting system after the first use, see ill. 104. This allows the user to easily remove the top cover.

The team will later figure out how to insulate the gap that is created in the top cover as a result.



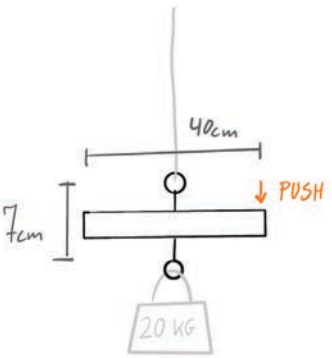
Ill. 104. Final concept of the topplate attachment

As shown the attachment can be made of simple components, but the team will later have to figure out how this affects the height adjustment in regards to the top cover, inflatable cover and the cooling unit being aligned properly.

STABILITY

The team was worried that the top would feel unstable at this point, so a test-rig was made, see ill. 105 and 106.

Ill. 105. Stability test



Ill. 106. Simplesketchofstabilitytest

Without measuring how much force it took to tilt the piece of wood, it was concluded that it felt very sturdy and that this wouldn't compromise the user's experience of the product. It's important to note, that the sturdiness is affected by the weight of the game.

FINAL DESIGN BRIEF

DIRECTION

With home cooling as the direction, a long list of requirements and wishes has been collected throughout process. The phase of conceptualization have had an impact on these, and below a final list of requirement and wishes is shown.

MAIN FOCUS

Optimal hygienic handling of game at home

REQUIREMENTS & WISHES

COVER

Requirements

Should be packed down and stored away when not in use

Should be easy unfold and set up

Should be removed/not be in the way when the user needs to skin and butcher

Areas prone to dirt, should be easy to clean

TECHNICAL

Requirements

Should be able to fit a roe deer

Should be able to cool 200L

Should be able to cool 12 °C after 12 hours, and 7 °C after 48 hours

Should ensure air circulation

Should be able to cool an animal for at least 5 days

Should keep blow flies away from meat

Wishes

Should be able to contain small game

The user should be able to adjust the temperature

TOP PLATE

Requirements

Should support that the deer hangs from either the jaw or the hind legs

Should support and allow the user to hook the deer from the floor

Should fit into the hoisting system that the user use today

Should be removed/not be in the way when the user needs to skin and butcher

Should hang from the ceiling

COOLING UNIT

Requirements

Should be able to be moved and stored away when not in use

Should be able to be moved away to skin and butcher the deer the same place

Should collect blood an ticks and discard it easily

Wishes

The dimensions should be able to fit into the trunk of a car

Should stand on the floor

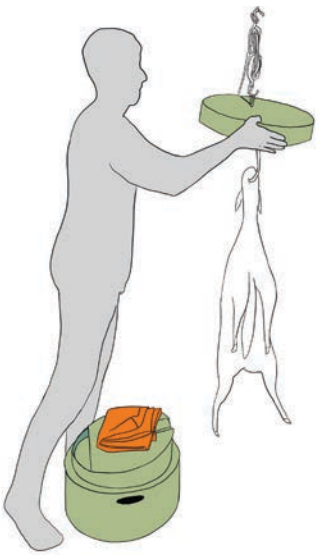
VERIFYING THE CONCEPT

// SHOW THE CONCEPT TO THE USERS

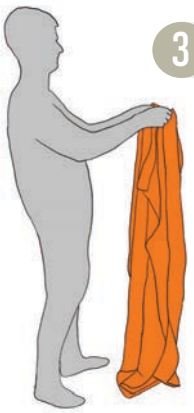
Ill. 107. QRcodeforconcept

With all the knowledge gained in this chapter, the team made a new concept, see ill. 108, and in order to verify it, the team uploaded a video to Facebook again, which had previously shown to be a great way to interact with hunters. The team wanted to know if the hunters could see themselves using the product and whether they had any good or bad inputs. Scan the QR code, ill. 107, to see the video and see app. 47 for the full list of feedback.

1 Take lid off

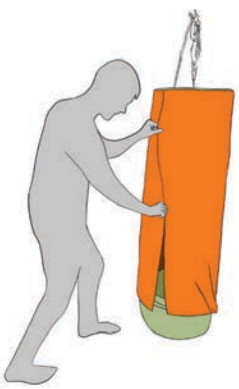


2 Insert top into hoisting system



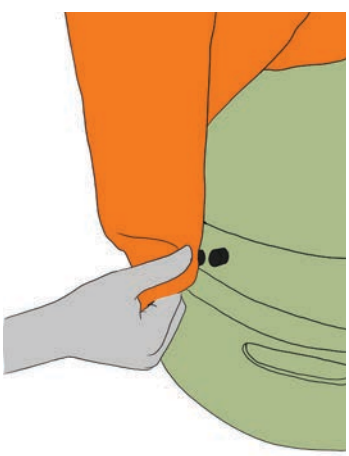
3 Unfold cover

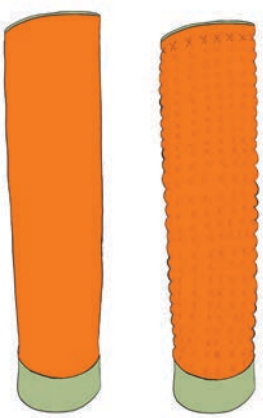
4 Put cover onto top



5 Close cover

6 Put valve into air pump





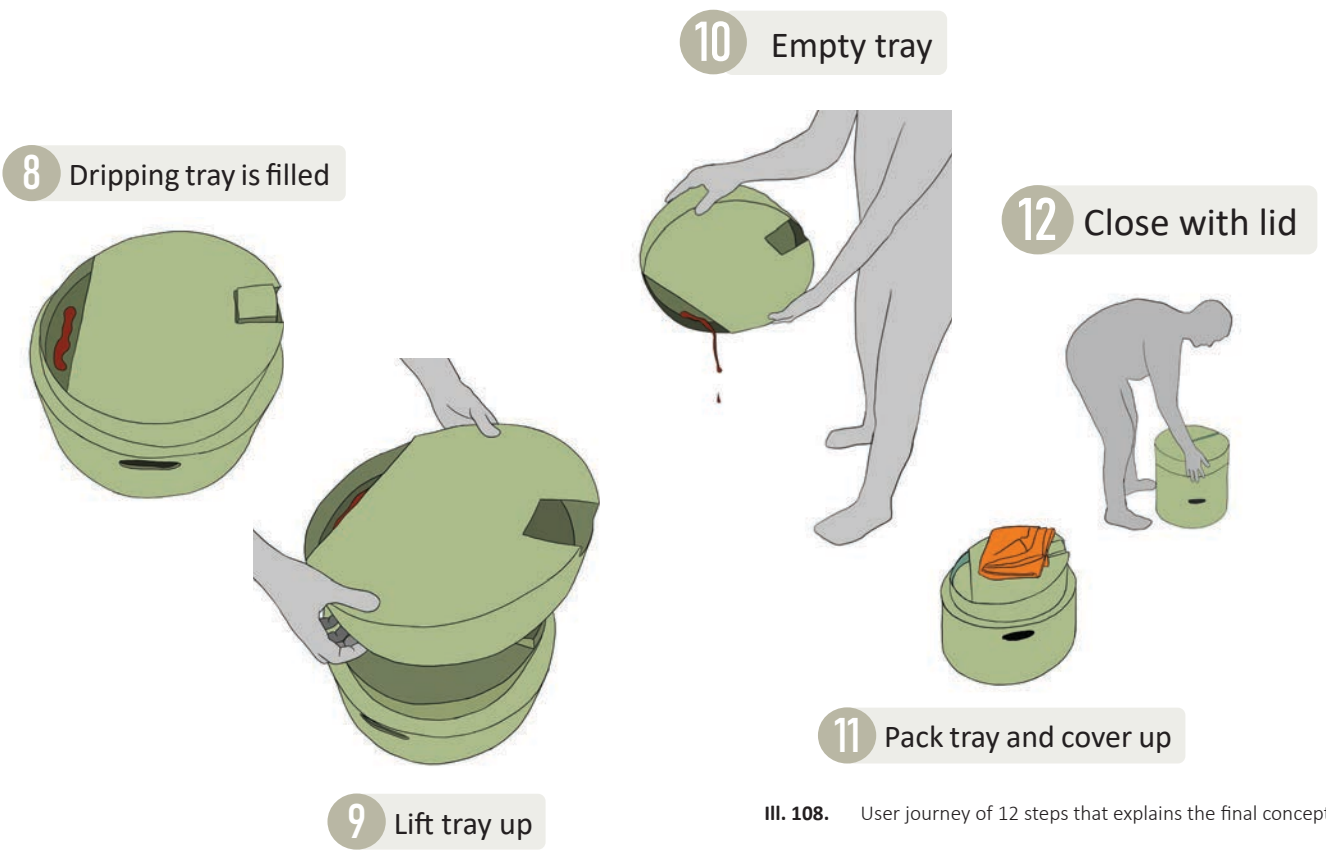
7 Inflate cover

COMMENTS FROM HUNTERS

The team received a lot of responses on Facebook, definitely more than expected with a total of 75 answers. A sum-up of all the answers is collected underneath. The comments will be used for detailing and making a relevant business strategy for the Cool Hunt product in the next two phases.

NO.	COMMENTS
27	Likes/wants to use
9	Use for bigger animals such as wild boars, red deer, and fallow deer
6	Good cooling/concerned about good enough cooling
5	Wants to use 12V (car battery) instead of 240V
3	Concerned about/want good ventilation
3	Air around animal/concerned about space
3	Asking/concerned about price
3	Concerned about/make sure it's easy to clean
2	Want to have an inner part to wash
2	Doesn't like/don't want to use

In gerenal a lot of the feedback was very positive and the hunters seemed like they really wanted to know more about the product. It was interesting to see how many were asking for a bigger model, capable of containing red deer or wild boars.



Ill. 108. User journey of 12 steps that explains the final concept

DETAILING

In this detailing chapter the team have a big focus on interactions and how the user might make use of the product. It will contain several zooms on the product with details of how it's intended to be understood and used, with a focus on optimal alignment with all the insights gathered from the users throughout the process. The product will take shape and be more tangible.

STYLEBOARDS

Starting the detailing phase, it's important to ensure that the style and aesthetics of hunting is brought into the product. The team has identified two different styles when looking at hunter's equipment. It's mainly separated in the traditional hunter, see ill. 109, and the practical hunter, see ill. 110. The traditional hunting gear is true to time-proven materials, equipment, and aesthetics while the practical equipment isn't shy of using newer, lighter, and more quiet materials, which can be more beneficial while hunting.

Even though the two different types of equipment are very diverse in both style and make, the hunters who use the equipment isn't as divided since most hunters uses gear from both categories as part of their inventory. The team hasn't encountered hunters yet, who only stick to one category.

The different styles of equipment aren't separated by price either since almost all gear can be obtained at different price points, depending on quality of materials and craftmanship.

Ill. 109. Traditional styleboard (Jagtkniv, n.d.), (Sauer S 404, n.d.), (Normak Jagtstol læder, n.d.), (Skydestok i træ, n.d.), (Leica 10x42, n.d.), and (Härkila Riffelfoderal med lommer, n.d.)

Ill. 110. Practical styleboard (Robust jagtkniv med bugåbner, n.d.), (Blaser, n.d.), (Black Moose Rygsækstol Moleskin soft, n.d.), (Viper Flex Elite, n.d.), (Vortex Fury HD5000 10x42, n.d.), and (Buffalo River Riffelkuffert, n.d.)

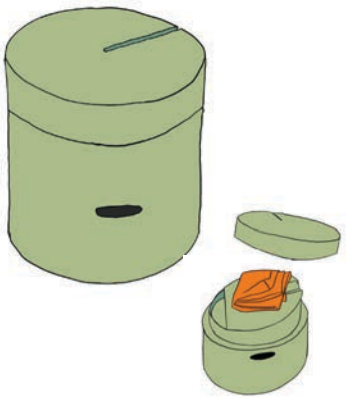
CONCLUSION

Cool Hunt will lean towards the practical equipment style as it's introducing new technologies to the market and satisfies needs that haven't been delt with properly before. The product should deliver a sturdy feel with both good materials and a solid build. The team also identified the colors orange, green and brown to be recurring in a lot of gear.

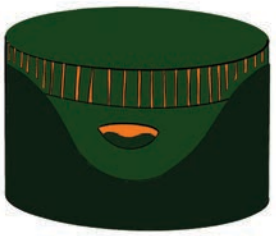
COOLING UNIT

AESTHETICS

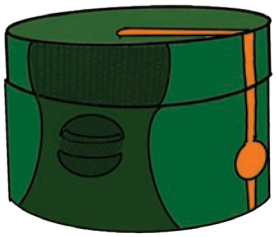
The concept left off from the cylinder shape, see ill. 111, that needed to be shaped and detailed fitting into the hunter's aesthetics. Various suggestions were made from inspirational styleboards. The typical hunter color, green was incorporated as the main color while orange highlights interaction points. The team tried including the organic lines from the traditional styleboard on ill. 112 and 113, while a more geometric shape from the practical styleboard was made in ill. 114. The final aesthetics, see ill. 116, leans very much towards the practical hunter, especially with inspiration from a pair of binoculars, see ill. 115, with curved lines, and rough textured surfaces for interaction (this is incorporated into the handles of the product Cool Hunt). Shaping a more practical appearance emphasizes how this is a new product on the market and doesn't rely on the aesthetics of the old fashion equipment which has been shaped through centuries of hunting. For more sketches, details, and thoughts about the aesthetics, see app. 48.



Ill. 111. Final concept of Cool Hunt

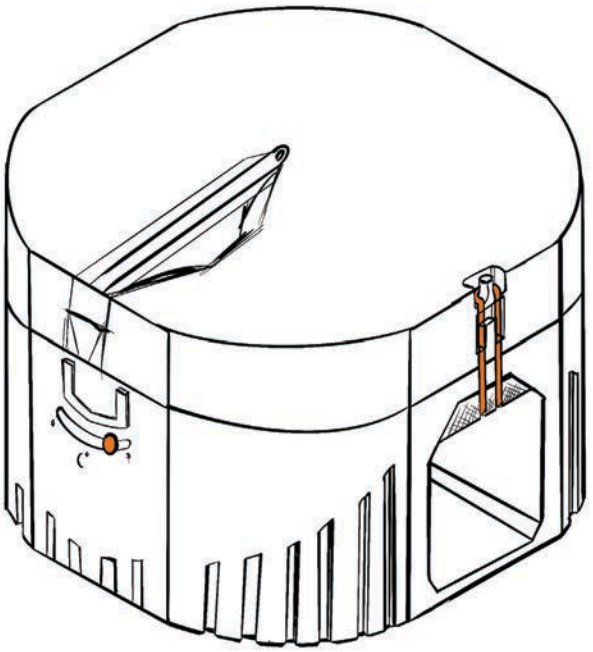


Ill. 112. Organic shaping



Ill. 113. Organic shaping

Ill. 114. Edgy shaping

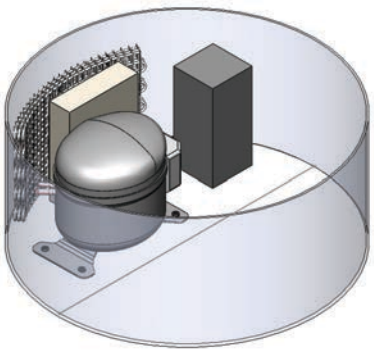


Ill. 115. Binoculars (Vortex Fury HD5000 10x42, n.d.)

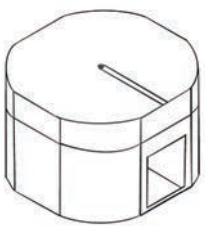
Ill. 116. Final aesthetics of Cool Hunt

PLACEMENT OF COVER

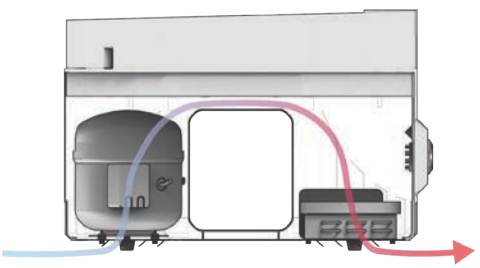
After going away from using foam as the insulating cover and turning to the inflatable cover, it occurred to the team that the insulated cover doesn't take up as much storage – most of the foam concepts had a square footprint when folded down, but the insulated cover could be rolled up and stored within the cooling unit as there were excess volume besides the condenser and compressor, see ill. 117. The team drew different variants, with the components in different configurations, see app. 48. The final solutions was to move the components to either side while allowing for the middle to be hollow, see ill. 118. The team found that the hole could double as handles. Ill. 119, shows how air flows through the product.



Ill. 117. Excess volume inside with compressor and condenser



Ill. 118. Shaping a hole for the cover in the middle

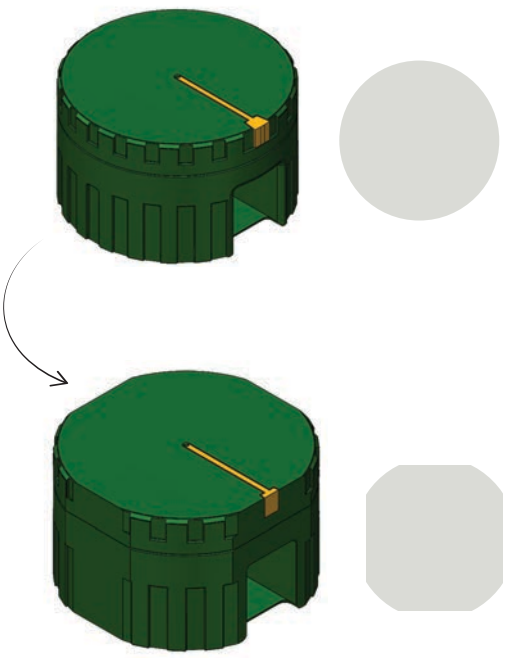


Ill. 119. Shaping the overall shape of Cool Hunt

OVERALL SHAPE

The conceptual product was initally shaped round, see ill. 111. The reasons for shaping the cooling unit round can be found in app. 49, however, the main reasons were that the round shape looked a bit more innovative and appealing as supposed to a squared shape that is similar to a normal fridge. The unit was shaped further later on in the process of detailing the cooling unit, see ill. 120.

The edges of the product were cut off to make a more coherent product with a visual orientation with a flat surface as front, and also with the hole in the middle that could help the user to identify more easily where and how to grab the product. The team will try to make the front of the unit even more directonal when forming the interface later in this phase.



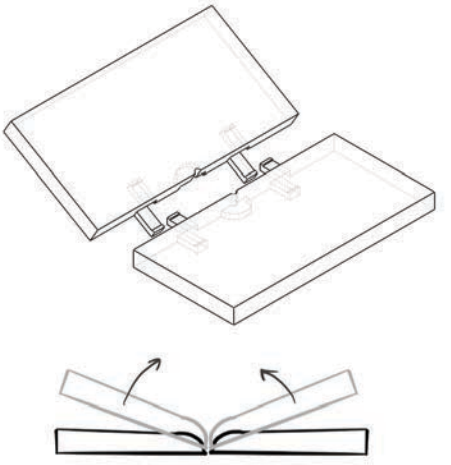
Ill. 120. Shaping the overall shape of Cool Hunt

TOP PLATE

As mentioned in the previous conceptualization phase, the top plate has to be removable and inserted into the existing solution of a hoisting system with an add-on, see ill. 121. The top cover is meant to be insulated with foam, however, the insertion of the top cover left a gap in the top cover that would have a negative effect on the insulating properties. The team tried through 3D sketches to patch this hole in a convenient way, while also taking account of rigidity, ease of use, and complexity.

Ill. 121. Final conceptual solution for add-on

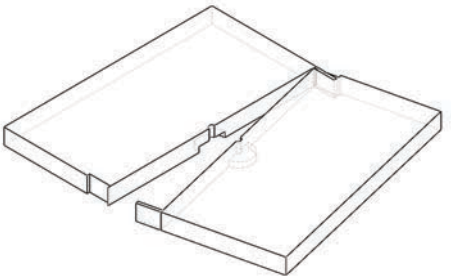
1 //MERGE SOLUTION



Ill. 122. Merge solution for top cover

This solution, on ill. 122, is drawn with two identical parts that can lock into each other. It could be made to make a satisfying click, when locked in place to convince the user that its proper fastened. However, the insulating properties of this concept is reduced as a substantial amount of material has to be removed from the middle where the two plates meet and fold over each other, see the bottom on ill. 122.

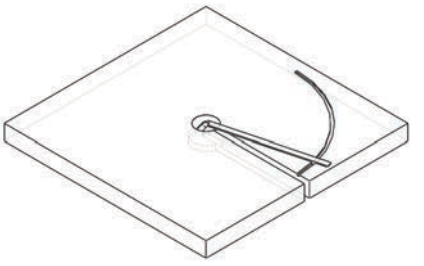
2 //HINGE FROM SIDE SOLUTION



Ill. 123. Hinge from side solution for top cover

This solution, on ill. 123, was supposed to tackle the before mentioned relationship between the two halves. As it has a hinge in one side and a snapping lock in the other. Unfortunately, the team found that this puts the whole load of carrying the insulating cover on top of the hinge and the lock, which is why the team concluded that this part would be too complex to continue with.

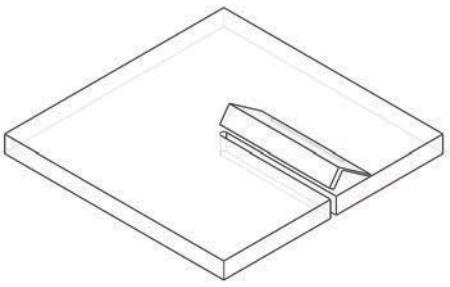
3
// ROTATION SOLUTION



Ill. 124. Rotation solution for top cover

For this solution, on ill. 124, the top cover is supposed to be slided on instead of clipped on. It creates a new problem however as there now is a cut in the cover without insulating material. The team speculated whether this would have a noticeable impact on the insulating properties or not. The conclusion however was that even if it didn't have an impact, it would leave the design seemingly flawed.

4
// HINGE FROM ABOVE SOLUTION

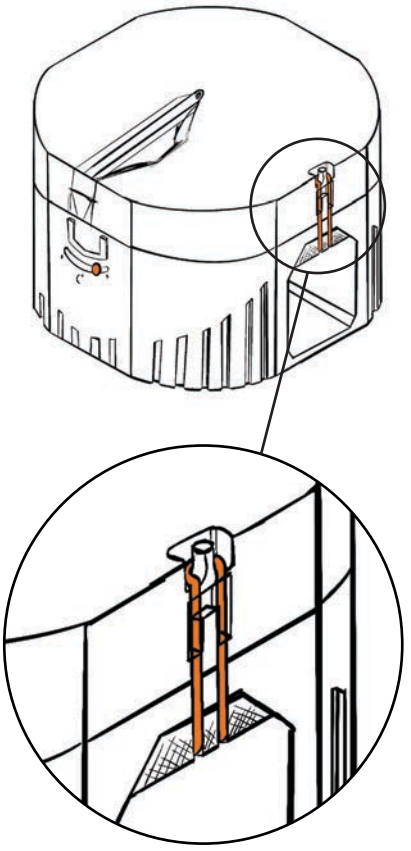


Ill. 125. Hinge from above solution for top cover

For the chosen concept, on ill. 125, a simple flip mechanism was put in place to be able to fill out the gap in the cutout. This solution requires more parts than some of the others, but it will leave the product without any complex flimsy parts that might break if misused. When the flip mechanism is opened, the cover is free to slide on and off the attachment. When it's flipped closed it doubles as the locking mechanism that secures that the cover doesn't slide out of place.

WHICH CLOSING MECHANISM TO USE WHEN THE TOP COVER ACTS AS A LID?

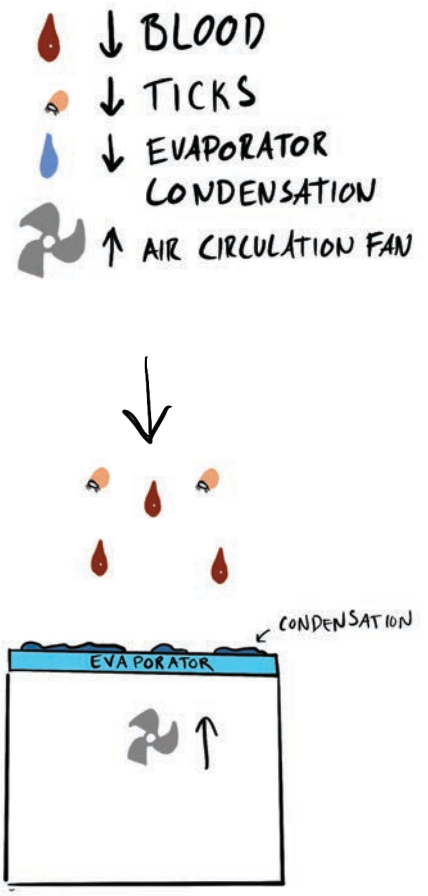
The top cover is also supposed to have the function of a lid for the cooling unit when stored, and the team did some researching on which mechanisms would be appropriate, see app. 50 for the reference products, thoughts, and decisions. The final choice was made during the aesthetic sketching of the cooling unit, as one solution seemed simple and integrated, see ill. 126. This solution take advantage of the "hooks" already designed for keeping the inflatable cover up. These could also be used for holding the lid down with fabric-covered elastics, as seen on the close-up on ill. 126.



Ill. 126. Zoom on closing mechanism for top cover acting as a lid

DRIP TRAY

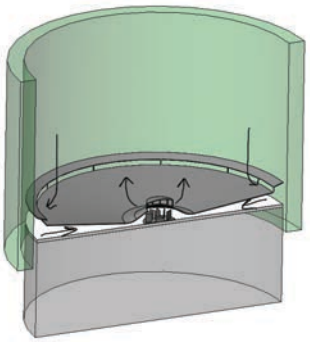
The team got several responses on an earlier questionnaire, saying that the hunters were interested and liked the idea of a drip tray, which got presented in app. 26. Therefore, the team wanted to incorporate this into the final solution. There was one problem though, the animal is dripping ticks and blood, and the evaporator, which is placed in the bottom of the cooling enclosure, will emit condensation as it goes through its cooling cycles, see ill. 127. Lastly, the fan has to be placed above the evaporator in order to move the cold air upwards within the enclosure. Different solutions were modelled to fix these issues.



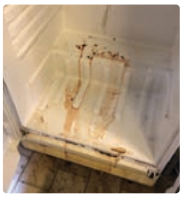
Ill. 127. Simple illustration explaining the direction of blood, ticks, condensation and air flow

DESIGN SUGGESTIONS

This design of drip tray, see ill. 128, is designed to catch ticks and blood coming from the animal while allowing the fan to move the air around (indicated with arrows in illustration). This solution does not consider how to collect condensation from the evaporator.

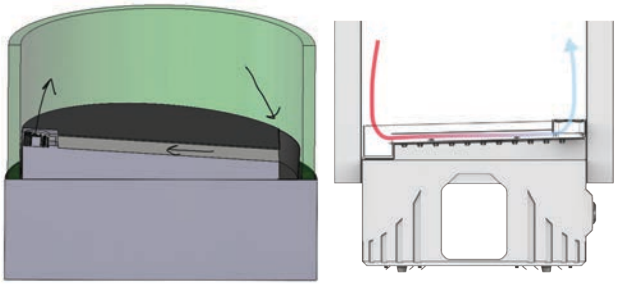


Ill. 128. Drip tray without consideration of condensation



Ill. 129. Blood centralized in fridge

The team realized at this point, by looking at a picture from one of the hunters' fridge for keeping roe deer, see ill. 129, that ticks and blood was centralized just beneath the deer. This meant that a fan could be placed in a corner of the cooling unit and not be covered completely, and this would contribute to increase the airflow. Furthermore, it collects both condensation, ticks, and blood by having two parallel 2.5% slanted surfaces, that collects the waste in the small container on the right. See ill. 130. (Sode, 2018).



Ill. 130. Drip tray with consideration of condensation and air flow

ELECTRONIC COMPONENTS

It's crucial for the product to contain the correct electronic components, as they will be the core of the product's functionalities.

COMPRESSOR

It's difficult to find consistent component specifications on cooling units from Chinese wholesalers. The team found a compressor unit with build in fan and condenser from the Swedish company, Dometic (Dometic ColdMachine CU 85, n.d.) which is used for the cooling calculations. To get a better understanding of what price point could be achieved, purchasing directly from the manufacturer the team found a similar system on Alibaba, which costs 1.100 DKK (Micro Cooling Condesing Unit, n.d.). This price will be used for the project, while the specifications used will be from Dometic.

1.100 DKK
6 kg.
12/24V
45W
220x160x220 mm.

Ill. 131. ColdMachine compressor cooling unit (Dometic, n.d.)

EVAPORATOR

Evaporators are cheap to manufacturer and often customized to fit new solutions, in Cool Hunt's case, it will be assisted by a small fan to optimize efficiency.

6 DKK
Estimated 0,2 kg.
420x420mm

Ill. 132. Evaporator (Roll Bond Evaporator Plate, n.d.)

COOLING FAN

The fan, for the cooling compartment, is small, robust, and waterproof, which allows it to be partially uncovered while securing air circulation.

6 DKK
12V
3.6W
60x60x25 mm.

Ill. 133. Fan (Waterproof Air Cooling Fan, n.d.)

THERMOSTAT

The thermostat is the component making sure to turn on and off the compressor to regulate the correct temperature inside the cooling cabinet. This is placed closed to the evaporator like in modern day fridges.

5 DKK
220V/110V

Ill. 134. Thermostat (Thermostat, n.d.)

AIR PUMP

The air pump is used for both inflating and deflating the insulating cover.

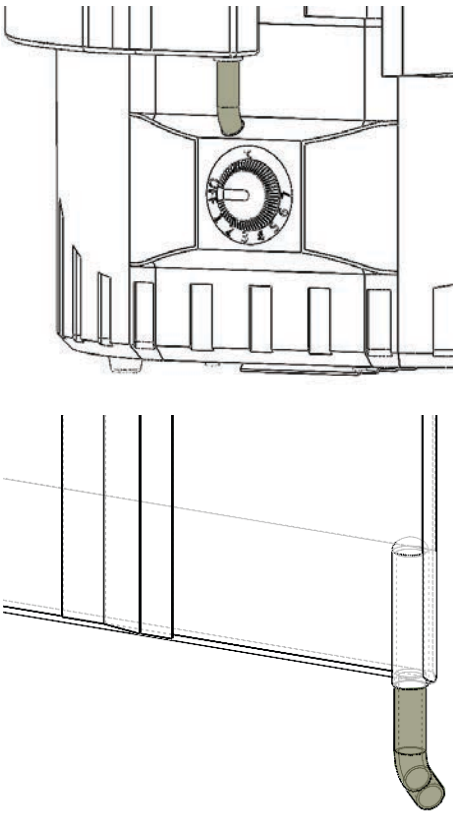
21 DKK
0.6 kg.
220V/110V 12V/24V
130x130x115mm.

Ill. 135. Air pump (Electric Air Pump, n.d.)

INFLATING THE COVER

As the insulating cover will be inflatable, the above-mentioned air pump, will be installed in the cooling unit. The user will have to manually set the height of the product during the first use, the details of this is explained later. After this, the user will simply have to attach the insulating cover to the top plate and attach the insulating cover's air hose to the cooling unit, and zip the insulated cover closed. See app. 51 for more details on the tests.

As the team noticed during a 1:1 mockup test, see ill. 136, app. 51, there's a chance of the user, readjusting the height after attaching the insulated cover to the cooling unit by accident. To ensure that nothing breaks, the connection between these two will be a flexible rubber hose, which is pushed into a hole of the cooling unit at a 45° angle. See ill. 137.



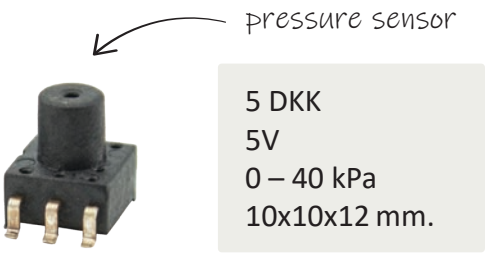
Ill. 137. Connection of air hose in air pump

Ill. 136. 1:1 mockup testing of aligning air valve on cover with air pump on box

AIR PUMP

Inside the cooling unit, the air pump is placed, along with a pressure sensor, see ill. 138. The pressure sensor will monitor the pressure inside the insulated cover and ensure that the cover is inflated/deflated. The team discovered in app. 53, that a standard air pump from electronic air mattresses, can inflate the cover in just around 20 seconds, which was considered fast enough.

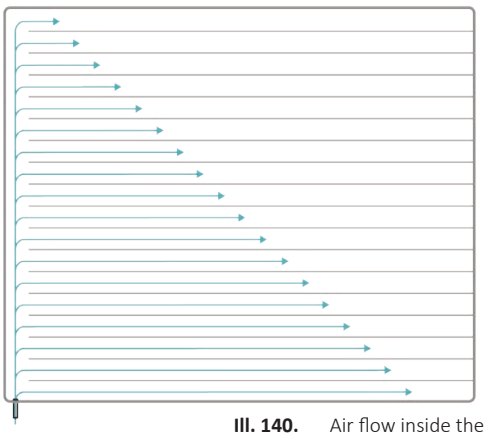
As the air inside the inflatable cover gets cold, it will shrink, so the pressure sensor will also monitor that the air pressure inside the cover after inflation in order to readjust for any shrinkage or small leaks. See app. 53 for the study and how the air pump switches between inflate and deflate.



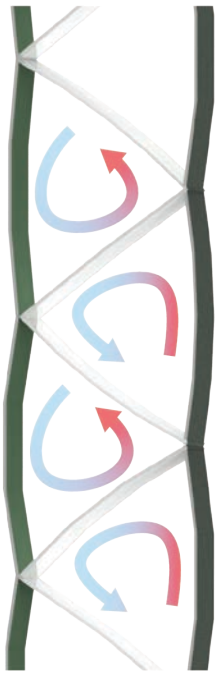
Ill. 138. Pressure sensor (Pressure Sensor 0-40kpa, n.d.)

STRUCTURE OF THE INFLATABLE COVER

To ensure that minimal convection happens inside the insulated cover, the inner layers will be constructed in a set of horizontal tubes as the cross section view in ill. 139. The other cross section view, ill. 140 shows how the air will enter the insulated cover to ensure that a minimal amount of vertical shafts which are prone to high convection flows.



Ill. 140. Air flow inside the cover



Ill. 139. Air moving around the cover

HEIGHT ADJUSTMENT

The team found that it's important to set the correct height of the hoisting system as this directly affects how well the inflatable cover fits to the cooling unit. The team previously made a requirement saying, "should be easy to unfold and set up", but this isn't found as crucial for the first use of the product as a more extensive initial setup could mean that all following uses could be a lot easier.

The team made a solution with two rope clamps and a rope which can be adjusted to the correct height before the first use. This would be put in place on the ceiling hook and the top plate attachment, meaning that when the hoisting system is lowered enough, the height adjuster would carry the load of the deer, see ill. 141 and 142. This solution also allows the user readjust the height if they were to bring the cooling unit to sweden etc. See app. 52 for the study.

Ill. 141. 1:1 mockup testing of adjustable rope that stops the hoisting system

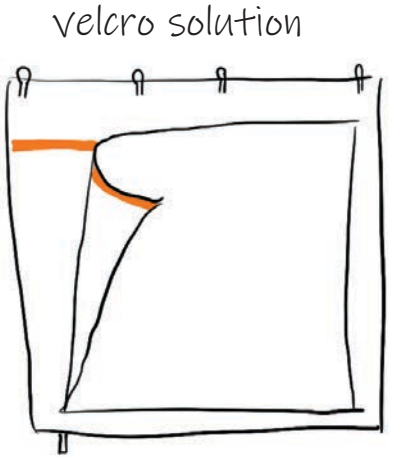
Ill. 142. Final solution of adjustable rope

CLEANING THE COVER

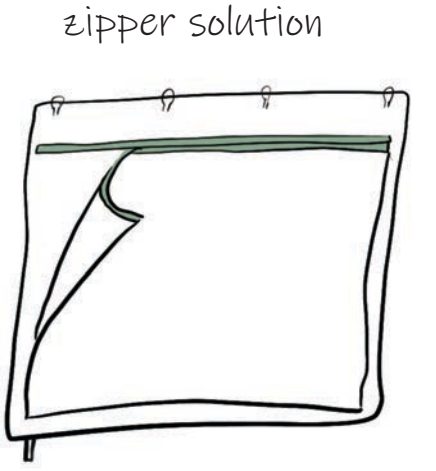
As the main focus of the product is hygienic handling, the team also needed to determine a suitable way for the user to clean the inflatable cover, which would also come in contact with the deer. The team wagered if the inside of should just be water repelling and therefore easy to hose down or if it should be detachable and able to go in the washing machine.

Both Rene and Flemming from the user panel as well as commenters on the video of the Cool Hunt concept from Facebook was asked, app. 47. Five out of seven leaned towards the detachable solution.

Again, the team wasn't sure whether to use velcro or a zipper, see ill. 143 and 144, but ended up finding the solution with velcro the most appropriate as it wouldn't create any small creases in the fabric where dirt could collect. Velcro will be adhered to the inflatable cover with high frequency welding, which we will later find is the production method for the whole inflatable cover, while it will be sewn into the inner cover, to make it washable. See app. 55 for the whole study.



Ill. 143. Solution of velcro for attaching the inner layer



Ill. 144. Solution of a zipper for attaching the inner layer

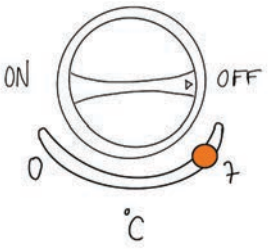
CONCLUSION

The hunters wanted the product to be easy to clean, which is why an inner cover will be attached with velcro. It's designed to be thrown into the washing machine, making the job easier for the hunter.

INTERFACE

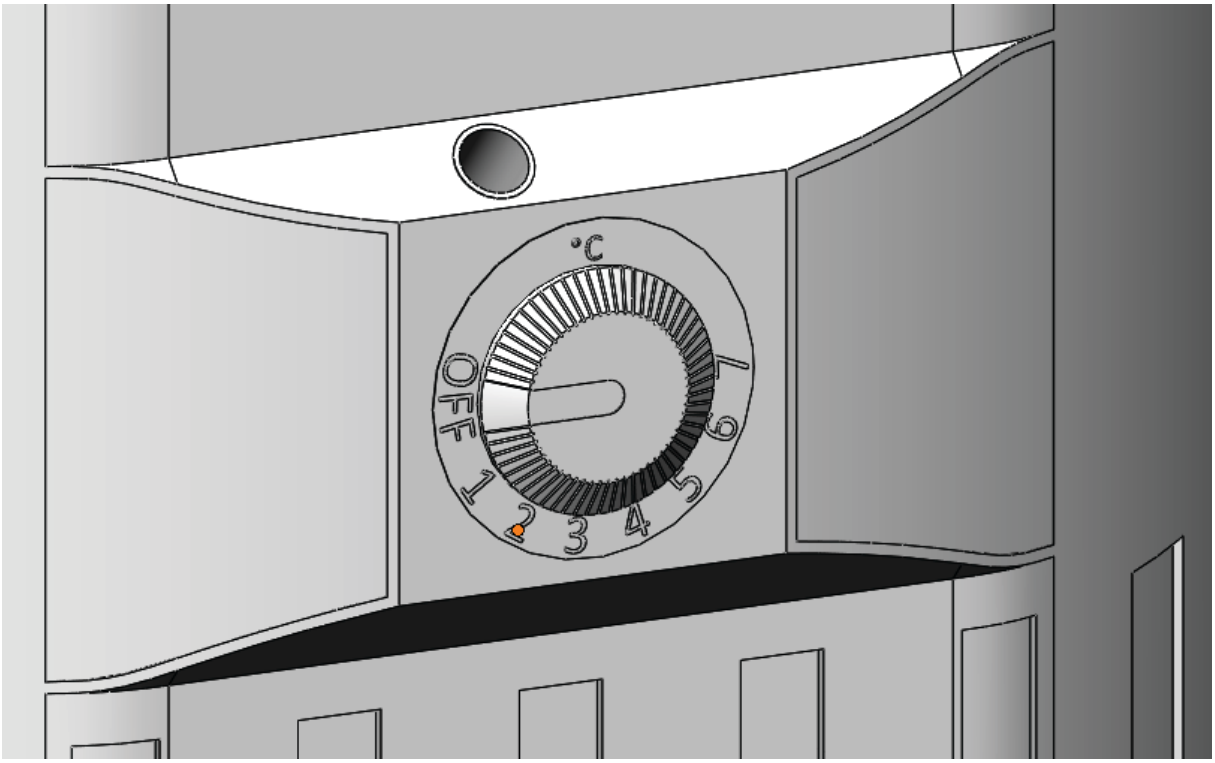
A solution of how to connect the air valve with the air pump as well as which features the user should be able to adjust should be combined into an interface. Different interface options were made and tested, see app. 54. The results shows that a simplified version with an on and off switch would work the best, see ill. 145. The “on” will inflate the cover and turn on the cooling unit and the “off” will turn off the cooling unit, and deflate the cover. From comments on the final concept, app. 47, some hunters wanted to adjust the exact temperature, especially, as many hunters lives by the old rule of “days of degrees”, see app. 47 and app. 13, and this was included, see ill. 145.

Requirements and wishes for shaping the interface were set, see app. 54. The most important requirements were that the interface should be integrated into the design of the box, and the air valve on the cover has to be inserted from the top - if the user accidentally pulls the hoisting system in which the air valve might be damaged. A various set of designs were formed and evaluated, see app. 54. The most difficult task was to integrate the interface into the design to create a coherent aesthetic and also, ensure that the interface wouldn’t stick out and be exposed to impacts etc.



Ill. 145. Features to adjust for the user

The final design of the interface, see ill. 146. The turntable knob allows the user to set the unit to “off” and when turning the knob to 1-7 °C, then the unit is turned “on”.



Ill. 146. The final interface

COOLING CALCULATIONS

DEFINITION OF USED MEASUREMENTS

Thermal conductivity (k) W/mK

Is a measure of how much energy (watts) that flows through a given thickness (meter) of a material with a temperature difference of 1°K (kelvin). The lower the value, the better insulating properties.

Resistivity to heat (R) $\frac{t}{k} = \frac{m^2K}{W}$

Is the measure of how well a material resists to conduct heat. It takes into account both the thickness of the material and the area. A higher R-value indicates a better insulating property.

Thermal transmittance (U) $\frac{1}{R} = \frac{k}{t} = \frac{W}{m^2K}$

Indicates the heat flow (watts) through 1m^2 of the material with a difference of 1°K. The lower the U-value, the better insulating properties.

(Evans, 2017)

AIR AS AN INSULATING MATERIAL

As stated earlier, air has a thermal conductivity of 0.026 W/mK, but this is for ideal conditions where no convection occurs. As the insulating cover will be constructed of a series of tubes, like a sleeping pad, see ill. 147, some convection will happen internally and affect the thermal conductivity. The team found a sleeping pad, see ill. 147, with a measured R-value with a certain thickness, which will be converted to the value of the air's thermal conductivity and used for the product.

Thickness	8.9 cm
R-value	3

Ill. 147. Sleeping pad with tubes (Traverse Core Mummy liggeunderlag, n.d.)

Calculations of the thermal conductivity from the sleeping pad's values:

$$\frac{0.089\ m}{3\frac{m^2K}{W}} = 0.03\frac{W}{mK}$$

So, in this case we will say that the material constant of the thermal conductivity of the insulated cover will be 0.03 W/mK

HEAT LOADS

When trying to cool something e.g., an apple in a fridge, one would have to take into account the surface area of the cooling cabinet (transmission load), the specific heat and size of the product being cooled (product load) and what heat may be generated by the equipment used (equipment load).

TRANSMISSION LOAD

The surface area was read from Solidworks.

Insulating cover

Surface area of insulated cover: 1.96m^2

k_{AIR} = 0.03 w/mK

Thickness of insulating cover: 0.05m

U_{AIR} = 0.05 m/k_{AIR} = 1.2 W/m^2 · K

Top cover and bottom insulation

Surface area of top and bottom: 0.31m^2

k_{PUR} = 0.03 W/mK

Thickness of top and bottom 0.05m

U_{PUR} = 0,05 m/k_{PUR} = 1.2 W/m^2 · K

Conditions

Since the insulating properties are the same for PUR and Air in this case, the collective surface area will be used.

$Temp_{inside}$ = 5°C

$Temp_{outside}$ = 20°C

$$Q_{transmission} = 1.2\frac{W}{m^2K} * 2.26m^2 * (5°C - 20°C) * \frac{24}{1000} = 0{,}488\frac{kWh}{day}$$

PRODUCT LOAD

Deer conditions

m_{deer} = 20 kg

$Temp_{start}$ = 35°C

$Temp_{end}$ = 5°C

Specific heat capacitity

Cp_{deer} = 2.85 kJ/kg · C

(Specific Heat of Food and Foodstuff, 2003)

$$Q_{product} = 20\ kg * 2.85\frac{kJ}{kgC} * \frac{(35°C - 5°C)}{3600} = 0.475\frac{kWh}{day}$$

EQUIPMENT LOAD

Electronic fan inside cooling cabinet power consumption: 3.6 W (Waterproof fan, n.d.)

$$Q_{equipment} = 24 * \frac{3.6}{1000} = 0.086\frac{kWh}{day}$$

TOTAL HEAT LOAD

$$Q_{total} = 0.488\frac{kWh}{day} + 0.475\frac{kWh}{day} + 0.086\frac{kWh}{day} = 1.049\frac{kWh}{day}$$

A FOS of 1.2 will be added to make of the system not being in ideal conditions.

$$Q_{total} * 1.2 = 1.258\frac{kWh}{day}$$

This can be converted to see how many watts of energy the cooling unit needs to counteract in order to keep the product at the required temperature.

$$W_{total} = 1.258\frac{KWh}{day} * \frac{1000}{24} = 52W$$

After the first day, the animal is cooled down, which means the compressor doesn't have to work as hard.

$$Q_{total\_2} = 0.488\frac{kWh}{day} + 0.086\frac{kWh}{day} = 0.574\frac{kWh}{day}$$

$$Q_{total_2} * 1.2 = 0{,}688\frac{KWh}{day}$$

$$W_{total\_2} = 0.688\frac{kWh}{day} * \frac{1000}{24} = 29W$$

$$\frac{W_{total_2}}{W_{total}} * 100 = 56\%$$

So, after the first initial day, it can be found that the power consumption will drop to 56% of that of the first day.

COOLING REQUIREMENTS

Through the interview with the cooling technician, the team learned that modern cooling units has a coefficient of performance (COP) of 2.5, which means that by using 100W it's able to move 250W of energy, app. 38.

Meaning that the cooling unit in the Cool Hunt has to use a minimum of $\frac{52W}{2.5} = 21W$ to cool the product sufficiently on the first day, and $\frac{29W}{2.5} = 11.6\,W$ starting on the second day.

However, modern fridges go through regular cooling cycles as the devices isn't able to adapt the temperature of the evaporator, it's either cooling (to around -30°C) or not (Refrigerator, n.d.). These cycles are often around 30 minutes each, to keep the fridge temperature at 5°C (Mcfadden, n.d.). This means that the cooling unit is actually only turned on for half the time.

Specifications on cooling units are hard to come by online, but the team found a unit, see ill. 148, made for customized fridges in boats. It's stated that the unit can cool up to 250L in cooling cabinet volume and uses 45W, which is close to what the team needs for the product (Dometic ColdMachine CU 85, n.d.).

Ill. 148. ColdMachine compressor cooling unit (Dometic, n.d.)

To compensate for the heat load calculated above, the compressor is only able to run for 30 min. at a time, which means that it's able to transfer heat at 'half capacity' as the duty cycle is 50%.

45W*0.5 = 22.5W

This agrees with the 21W required to cool sufficiently.

So, as found, after the first initial day, the demand for heat transferring drops significantly and the compressor can lessen its duty cycle to roughly 30%.

45W*0.33 = 14.85W

And this agrees with the 11.6W required to cool the initial days.

Calculating the annually power consumption is done through a standardized test, that lasts several days. The standard couldn't be obtained, however. (COMMISSION REGULATION (EU) 2019/2019, 2021)

The standard use of the product could be that the hunter is cooling the deer for 4 days.

The first day would require

22.5W*24/1000 = 0.54 kWh/day

The following days would be

14.85W*24/1000 = 0.356 kWh/day

This gives an average of

$$\frac{0.54\frac{kWh}{day} + (3 * 0.356\frac{kWh}{day})}{4} = 0.402\frac{KWh}{day}$$

Therefore, the annual consumption is

$$0.402\frac{kWh}{day} * 365 = 147\frac{kWh}{annum}$$

CONCLUSION

A cooling unit like the Cold Machine CU85 is sufficient when using an inflated insulating cover with a thickness of 5cm.

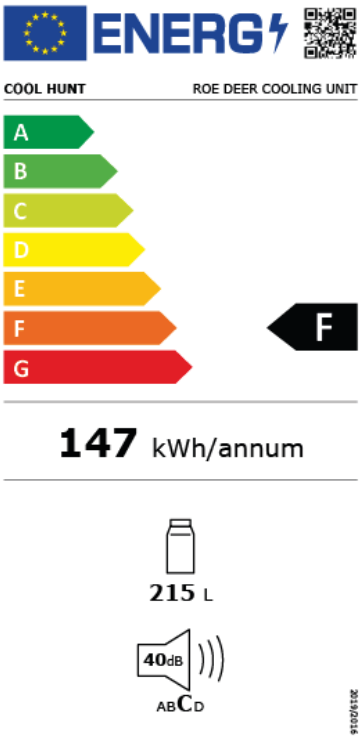
ENERGY LABEL

It's not possible for the team to calculate the exact energy classification of the cooling unit, as it requires explicit details of the product, which is estimated before the product is manufactured, and measured more precisely after the refrigerator is produced. (About the energy label and ecodesign, 2021)

Looking at the specification of the before-mentioned compressor, see ill. 148 (Dometic ColdMachine CU 85, n.d.), it's classified for up to 250L in volume, and an evaporator (VD-15), see ill. 149, by the same company with the dimensions of 220x275mm, which is also rated for 250L with 50mm of insulation (REFRIGERATIONCOOLING UNIT, 2021). Therefore, it's possible for Cool Hunt to function under current requirements as the volume of Cool Hunt is 215L with an evaporator measuring 420x420mm.

Ill. 149. Evaporator (Dometic, n.d.)

A hypothetical energy label was made with annually power consumption (assuming it's used throughout the whole year), how it fares compared to other cooling appliances, the volume and how loud the product is while running, see ill. 150. It's by law for cooling appliances sold within EU, to carry these, which just got updated by the 1st of March with a simpler layout. (About the energy label and ecodesign, 2021)



Ill. 150. Hypothetical energy label (About the energy label and ecodesign, 2021)

USING A CAR BATTERY

With the received feedback of the final concept from the hunters on the uploaded video on Facebook, app. 47, some users replied that the product would benefit from a 12v solution. The reason for this was that they would like to bring Cool Hunt to rural areas of Sweden, where they wouldn't be connected to the power grid. Looking into this, the team found that even though a car battery, contains a lot of energy, it wouldn't be too convenient to rely on.

Estimates suggest that a normal car battery could power the cooling unit for roughly 19 hours, before cutting off, which isn't desirable since it's not even able to make it run for a full day. See app. 56 for calculations. A solution could be that solar panels are connected to a standalone battery. In this way the battery will charge and run the cooling unit by day, and by night the cooling unit will rely on the battery's stored energy. The main focus for most hunters isn't to use it off grid however, which is why this version of the product won't have solar panels or integrated batteries.

HEAT AND FLOW SIMULATIONS

// FINAL PRODUCT CONCEPT SIMULATIONS

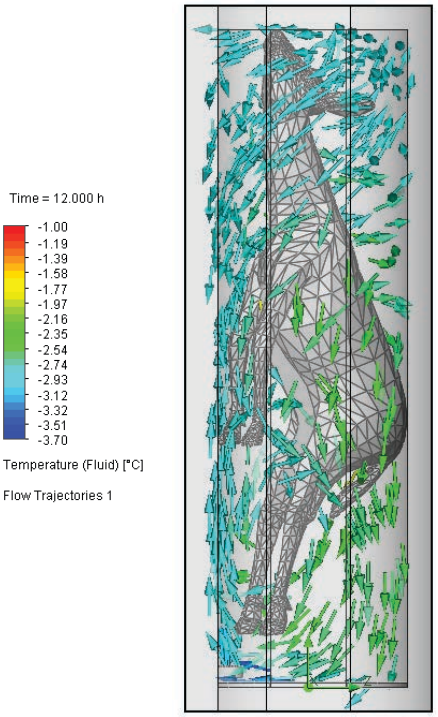
Since the team now has more specific details about the volume, shape, insulation and cooling technology, another cooling simulation was done to make more precise and realistic results. See app. 57 for the test specifications.

Ill. 151 shows how the air has cooled down significantly at the 12th hour, in which the air is actually below the recommended, which indicates that the cooling rate of the cooling unit is efficient enough to meet the requirements set in app. 40.

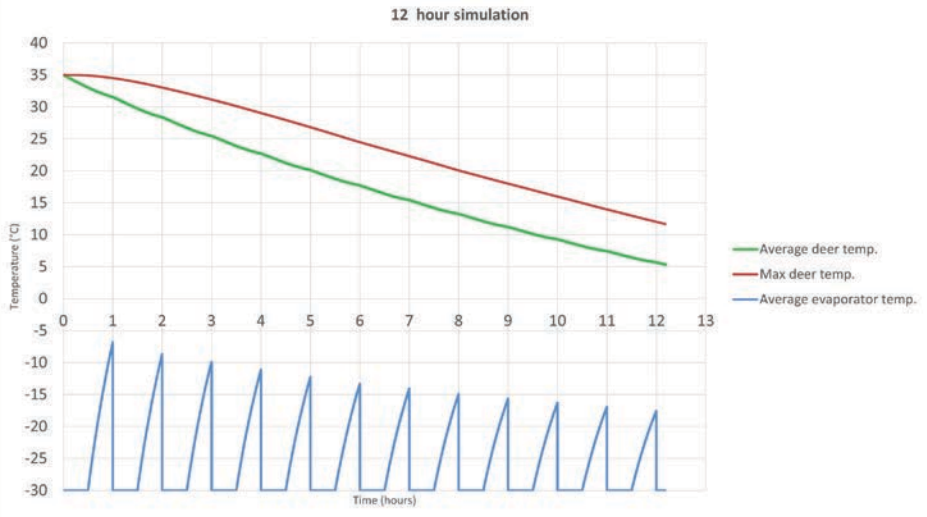
Ill. 152, shows a graph, in which it can be seen how, even though the evaporator is going through multiple cycles, the temperature of the deer is dropping steadily.

At the 12-hour mark, the average temperature of the deer is 5°C, while the maximum is 12°C. This is within, and actually cooling faster than the requirements found in app. 40.

In reality the compressor would have adjusted the cooling cycle during the cooling process, so that the deer wouldn't cool down too much and too fast. This proves that the concept and technology that Cool Hunt builds upon is working in theory. As part of the launch plan, the technology used has to be verified in a practical test.



Ill. 151. Heat and air flow simulation for final concept



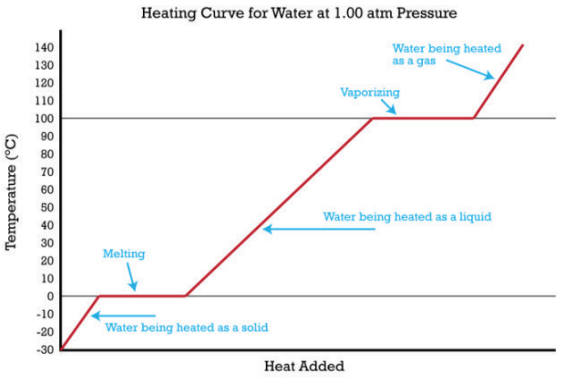
Ill. 152. Graph of 12 hour temperature changes of the deer

ICE CUBE CALCULATIONS

// WOULD IT BE SMARTER TO USE ICE INSTEAD OF A COMPRESSOR?

The teamed looked into if an ice cube could be used instead of the more expensive cooling unit of a compressor technology. After all, ice is an easy attainable product that is able to absorb a lot of energy.

Looking at a phase change diagram for water, see ill. 153, it's clear that the change from ice to liquid, is a very energy heavy process, which needs quite a lot of heat added to melt the ice. The team was wondering if this could be taken advantage of in the product for a cheaper solution than the compressor. (Belford and Kattoum, 2019)



Ill. 153. Heat curve for water (Chemistry LibreTexts, 2019)

Characteristics of ice

Cp_{ice}=2.06 kJ/kgC

Phase change = 334 kJ/kg

m_{ice} = 5 kg

$Temp_{start}$ = -18°C

$Temp_{end}$ = 0°C

(Belford and Kattoum, 2019)

The team envisioned that a 5kg block of ice would be the maximum of what a hunter would agree on having stored in their fridge before going hunting.

$$Energy_{ice} = 2.06\frac{kJ}{kgC} * 5kg * 18°C + 5kg * 334\frac{kJ}{kg} = 1855\ kJ$$

The ice is able to absorb 1855 kJ of energy before melting.

Converting this to kWh

1855kJ*0.00027=0.515 kWh

The ice is able absorb 0.515 kWh before being melted completely.

Looking at the prior calculations for the cooling it was found that

Q_{total}*1.2 = 1.258 kWh/day

$$\frac{1.528kWh}{0.515\ kWh} = 2.4$$

This means that it requires 2.4 ice cubes of 5 kg for cooling the first day, or 12 kg in total.

Q_{total_2}*1.2 = 0,688 KWh/day

$$\frac{0.688kWh}{0.515kWh} = 1.3$$

And for the following days, the hunter has to change the ice cube 1.3 times a day or use 6.5 kg of ice each day.

12kg+3*6.5kg = 31.5 kg

The user would need over 30 kg of ice for cooling the animal properly for 4 days. Which isn't a viable solution. Granted the user could make new ice while cooling with a new block, the product would still demand constant attention and is far from as convenient as using the cooling unit.

IMPLEMENTATION

In this implementation chapter the team will outline how the product should enter the market, what the launch strategies are and how this is implemented in the product. This chapter will contain technical details about manufacturing processes and what materials are most fitted for the product.

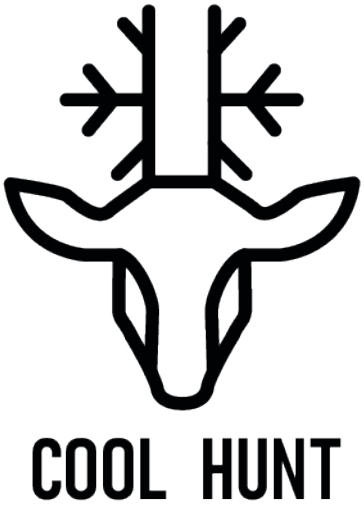
STARTUP

The Cool Hunt team is looking into making a startup company and launching the product on their own. It's a whole new market, with the first inflatable fridge which satisfies unprecedented needs. The market is big, worldwide and with customers having a relatively big purchasing power for specialized consumers products, it's a great opportunity.

It's going to be crucial to find the correct investors, who might have insights into the world of hunting products, as the initial phases are going to be tough. Starting out with a product like this is going to take effort, to get traction as the customers has to be convinced that there actually is a solution for needs, they might not have noticed themselves yet.

The appropriate investors will allow the Cool Hunt team to develop functional prototypes, collect enough funds to start a production line and add in with insights about both productions, the market, and the users in terms of both sales and marketing.

The launch plan is divided into 5 phases, going from finding the investors to launching the actual product. A shortened plan for launch can be seen on ill. 155 on the next page, and for the full launch plan, see app. 58.



Ill. 154. Cool Hunt logo

LAUNCH PLAN

PHASE 1: PROTOTYPES, TESTING, DESIGN OPTIMIZATION // 4-5 MONTHS

Validation from the user and design optimization		Own
First simple prototype for testing with user	8.000	Funds/own
Design optimization based on feedback from user		Own
TOTAL	**8.000**	**Funds/own**

PHASE 2: LEGAL ASPECTS // 2-3 MONTHS

Patent application (starting with Denmark)	50.000-450.000	Funds/investor
Guidiance, preparations for risk evaluation, CE-mark, and refrigerator approvals/tests	2.000-10.000	Funds/investors
Instruction for use, and risk evaluation		Own
TOTAL	**52.000-460.000**	**Funds/investors**

PHASE 3: PREPARATION FOR PRODUCTION // 2-3 MONTHS

Consultancy for injection molding agency	100.000	Funds/investors
Design for manufacturing		Own
Prototype in 3D print with real material	40.000	Funds/investors
Tests for CE-marks, refrigeration approvals etc.	50.000-100.000	Funds/investors
TOTAL	**190.000-240.000**	**Funds/investors**

PHASE 4: TOOL MAKING // 4 MONTHS

Tool making of injection molds, foam mold, and cover (+5% buffer)	1.277.000	Funds/investors
Marketing (meeting clients, fairs, retail stores etc.)	50.000-100.000	Funds/investors
TOTAL	**1.377.000**	**Funds/investors**

PHASE 5: PRODUCTION AND MARKETING // 2-3 MONTHS

First order of 200 units	300.000	Funds/investors
Marketing (meeting clients, fairs, retail stores etc.)	50.000-100.000	Funds/investors
TOTAL	**400.000**	**Funds/investors**

TOTAL // 14-18 MONTHS (1-1 1/2 YEAAR)

TOTAL ESTIMATED EXPENSES	**About 2.500.0000**	**Funds/investors**

Ill. 155. Launch plan

BUSINESS STRATEGY

Initially the startup will start in Denmark, as it's base for all the research, but will gradually be expanded to other countries. Throughout the process, the team has noticed a great interest and high interaction from danish hunters, especially through Facebook-pages, which seems to be great talkative communities, that shows immense curiosity in everything new. Throughout the project, the team has managed to generate awareness about the concept, especially with a video reaching more than 1.000 hunters (Bendixsen and Gundersen, 2021). In the future, the team will attend conferences and fairs to create further awareness. At first the product will be sold directly to the customers through online sales, but as a steady production is established, the production costs can be lowered, in which case the product should become available in hunting retail stores.

As the team has found during the research – wildlife and hunting is not equal in all countries, meaning that roe deer is a relatively small animal, compared to what is most hunted in other countries, app. 9. This opens the opportunity for widening the product portfolio with complementary bigger versions that is suited for both bigger deer and boars, to suit customers in both Denmark and more crucial, abroad.

Ill. 156 is a chart showing number of hunters and killed roe deer for a selection of other countries, this shows that even though there's a great interest for the product in Denmark, there might be an even bigger market in other countries, especially Germany, Poland, and USA.

	Population	Hunters	Market share (1%)	Roe deer	Roe deer shot pr. hunter
Danmark	5.806.000	175.000	1750	100.000	0,6
Germany	83.020.000	300.000	3000	1.200.000	4
Poland	37.970.000	125.000	1250	225.000	1,8
Sweden	10.230.000	300.000	3000	105.000	0,4
France	67.060.000	1.100.000	11000	590.000	0,5
Spain	46.940.000	330.000	3300	66.000	0,2
UK	66.650.000	625.000	6250	X	X
USA	328.300.000	15.090.000	150900	X	X
Total		**18.045.000**	**180450**		

Ill. 156. Chart of potential market countries

PRODUCTION METHOD & MATERIAL

// INFLATABLE INSULATING COVER

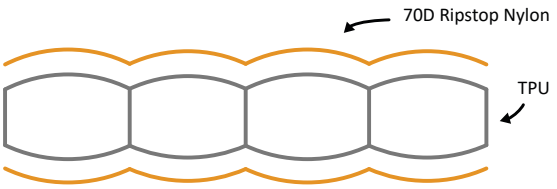
The insulated cover will be constructed much like traditional sleeping pads in a multilayer construction, see ill. 157 (ChrisGoesOutside, 2018).

It consists of an outer nylon with rip stop properties and a thickness described in the Denier scale, see ill. 158. The higher the D-value, the higher density of the woven nylon and better tear-resistance. (Sprague, 2016). The inside layer is made from TPU (Thermoplastic polyurethane), which makes it airtight. (NeoAir Xlite liggeunderlag, n.d.). Cool Hunt will use 70D ripstop Nylon as it's relatively sturdy and lightweight. Nylon is also found to be food safe (Food Safety Of Engineering Plastics, 2016).

As the materials are thermo plastic, the insulated cover will be manufactured with the process of high frequency welding, where heat and pressures are applied, to melt the materials together, which forms a strong bond. (What is High Frequency Welding, n.d.)

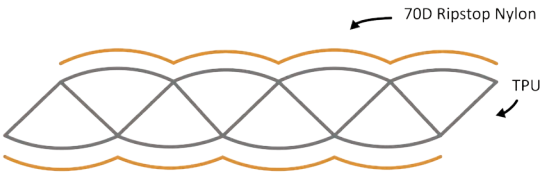
The five fasteners, the velcro on the inside as well as the zipper will also be fastened with the use HF welding.

A conventional sleeping pad construction



Ill. 157. Conventional sleeping pad construction

Cool Hunt cover construction



Ill. 158. Cool Hunt cover construction

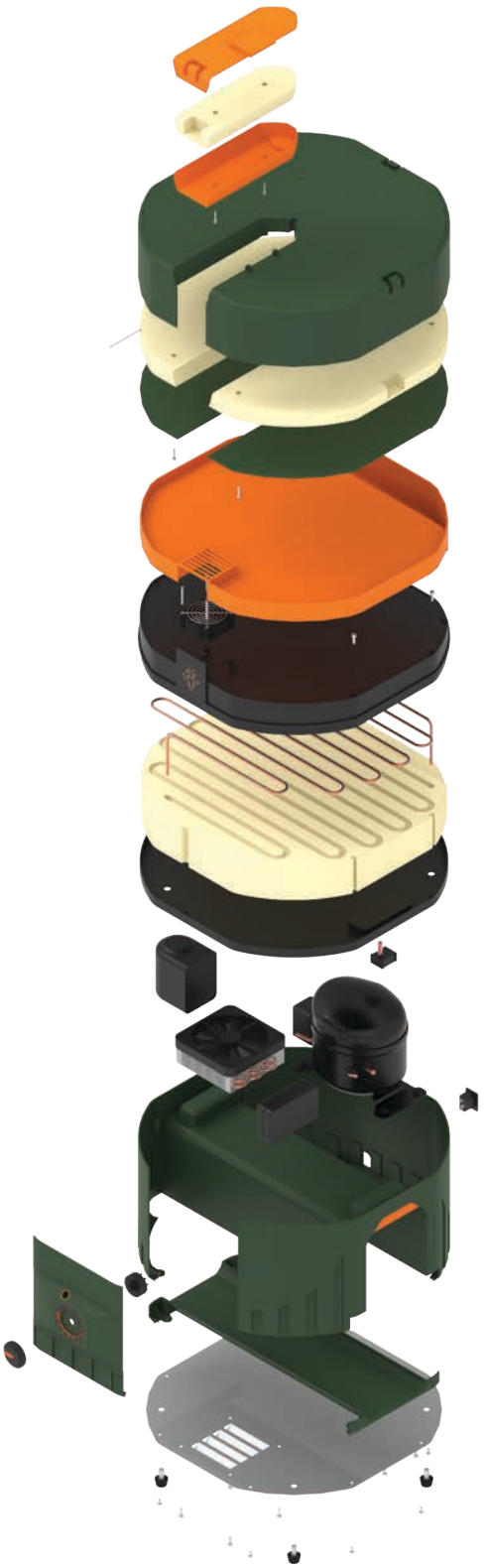
// INJECTION MOLDING OF INSULATING PLASTIC

Both the top cover and the cooling unit will be insulated to make sure to keep the heat outside of the cooling cabinet, see ill. 159 and the off-white colored parts. PUR will be used in a reaction injection molding, as it's scalable, with a low price and high insulating properties. (Thompson, 2007)

// PUNCHING AND BENDING OF SHEET METAL

The bottom plate in the cooling unit, see ill. 159 and the grey colored part, which will hold most of the electronic components, will be punched in 1mm sheet metal. This will be a cheap firm constructio. The sheet will be punched to take the shape of the cooling unit, adding holes for nuts, and forming the air vents. The hole for the adjustable feet has to be threaded as a second step in production. (Thompson, 2007)

// INJECTION MOLDING OF STRUCTURAL PLASTIC PARTS



Ill. 159. Exploded view of all the components

For the structural plastic parts, see ill. 159 and the parts colored green, orange and black, they will be injection molded. The material for the parts needs to be rigid and reliable, as well as having great strength properties, so the product won't break during use. Three different plastics were considered for productions of the structural parts: PP, PE, ABS.

Polypropylene
Polypropylene is a thermoplastic widely used for its tough properties, good chemical resistance, and low density, making it a lighter plastic. It's the second most used plastic in the world. (Everything-You-Need-To-Know-About-PP-Plastic, 2016)

Polyethylene
Polyethylene is the most used plastic and is used for its high ductility and impact-resistance, it has however, a low strength. (Rogers, 2015)

Acrylonitrile butadiene styrene
ABS is also a common thermoplastic, which is known for its great strength and chemical resistance, but has a higher density that PP. (Rogers, 2015)

All above plastics are food safe, but PP is chosen for its resilience to impacts, density and rigidity. It's ensures that the Cool Hunt product can be kept at a lower weight while still having the structural integrity that it will take to make the product last for years, without break.

The handles on the cooling unit will consist of thermoplastic styrene elastomers (TPS), which will give a good grip and with a contrasting color, will allow the user to easily identify the handles. This can be done in the same mold with multi-shot injection molding. (Thompson, 2007)

UNIT COST ESTIMATION

A unit cost estimate has been calculated based on standard components and special-made parts consisting of injection molded plastic and foam parts, an inflatable cover, and processed sheet metal, see app. 59 for all details. A sum-up of the cost price can be seen in ill. 160, and the total cost unit is estimated to 1.250 DKK pr. unit. The highest expense of the product is the compressor incl. condenser, see ill. 161. Actually, it's 88 % of the total unit cost estimate. Finding a better cost price for the compressor will lower the unit price significantly. This will be done by establishing a relation with producing companies. As seen from the market research on refrigerators, app. 60, cheap fridges can be found for around 1.500-2.000 DKK, and it's assumed that a cheaper compressor can be purchased when digging into the compressor market. The initial cost price will eventually be lowered as the production will increase.

Components	Total price (DKK)	Price of investment (DKK)
BIG STANDARD COMPONENTS	1.138	
INJECTION MOLDING PARTS	4	1.172.000
OTHER BOX COMPONENTS	41	
ADD-ON HOOK EXTENSION	12,2	
INFLATABLE COVER	55	
TOAL	**1.250**	

Ill. 160. Sumup of the total cost unit estimation

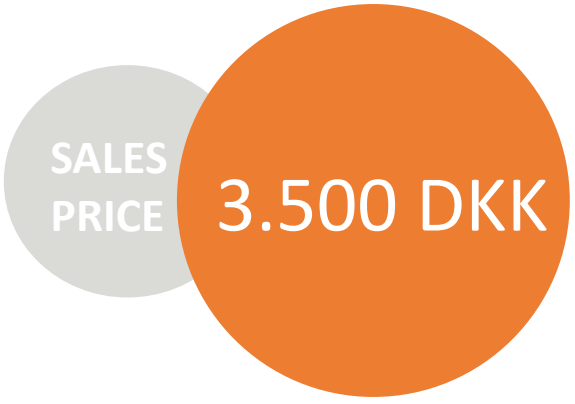
Components	Quantity	Material cost (DKK/kg.)	Material weight (kg.)	Production method	Unit price (DKK)	Total price (DKK)	Price of investment (DKK)
BIG STANDARD COMPONENTS							
Compressor incl. condenser	1		6	Std. component	1.100	1.100	
Evaporator	1		0,2	Std. component	6	6	
Cooling fan	1			Std. component	6	6	
Thermostat	1			Std. component	5	5	
Air pump	1		0,6	Std. component	21	21	
Total						**1.138**	

Ill. 161. Big standard components

PRICE SETTING

With a relatively high unit cost price of 1.250 DKK, the sales price will be set relatively high in order for the startup to receive and profitable income. Above-mentioned cost unit estimation excludes labor such as production method of e.g., bending, and punching sheet metal, assembling which is added with a 15 % variable overhead and a total cost unit estimate is about 1.400 DKK. The sales price is set to 3.500 DKK, more than half of the unit cost estimation generating a profit from direct sales, and an acceptable profit sold through sales channels in retails stores and expanding outside the borders of Denmark. Also, as mentioned prior, the cost unit price will presumably be lowered due to a cheaper compressor, allowing an even bigger profit.

As mentioned earlier hunting is a sport for passionate enthusiast, that yearly in Denmark spend 12.000 DKK on hunting (Sand, 2008). Therefore, a price setting at 3.500 DKK doesn't seem unrealistic in the hunting industry, specially being an innovative product on the market in a blue ocean.



REACHING BREAK EVEN

Break even is reached at around 6.500 units sold, during the second half of the second year, see ill. 163 and ill. 164. The team estimates that it's possible to reach a market share of 0.68% in Denmark, and 1% in Germany by this time with 175.000 and 300.000 hunters respectively, see Ill. 164. These sold units will cover the estimated start investment at 2.500.000 DKK that the team set for the launch plan. The calculation of the break even is based upon the unit cost estimation with other factors considered such as packaging cost, employee salary, and an overhead of 50 % of all expenses to cover rent, marketing, shipping etc.

By the end of the third year on the market, see ill. 164, the team estimates a modest profit of 347.000 DKK.

Year	Market share (%)	Country	
2022	0,45%	Denmark	
Income			
	Direct sale	**Sales channels**	
Sales price (DKK)	3.500		
Contribution margin (DKK)	560	0	
Contribution margin (%)	16		
Sold units	800		
Total income (DKK)	2800000		2800000
Variabel costs			
Cost price pr. unit incl. 15% overhead (DKK)	1400		
Total cost price (DKK)	1120000		1120000
Packaging			
Unit price (DKK)	20		
Total (DKK)	16000		16000
Employee salary			
Monthly salary	18000		
Yearly salary	216000		
Total yearly salary	432000		432000
Salary pr. unit	540		
Overhead (50% of all expenses)*			
Pr. Unit	980		
Total	784000		784000
Total income - costs (DKK)			**448000**
Total result (incl. fixed expenses)			**-2.052.000**

Ill. 162. Breakeven calculations

Year	Market share (%)	Country	
2023	0,57% (DK), 0,57 % (Germany)	Denmark, Germany	
Income			
	Direct sale	**Sales channels**	
Sales price (DKK)	3.500	2.500	
Contribution margin (DKK)	722	145	
Contribution margin (%)	21	6	
Sold units	1000	1700	
Overhead (50% of all expenses)			
Pr. Unit	926	785	
Total	926000	1334500	2260500
Total income - costs (DKK)			**968500**
Total result (incl. fixed expenses)			**-1.083.500,00 kr.**

Ill. 163. Estimated end result, year 2023

Year	Market share (%)	Country	
2024	0,68 % (DK), 1 % (Germany)	Denmark,Germany	
Income			
	Direct sale	**Sales channels**	
Sales price (DKK)	3.500	2.500	
Contribution margin (DKK)	830	145	
Contribution margin (%)	24	6	
Sold units	1200	3000	
Overhead (50% of all expenses)			
Pr. Unit	890	785	
Total	1068000	2355000	3423000
Total income - costs (DKK)			**1431000**
Total result (incl. fixed expenses)			**347.500,00 kr.**

Ill. 164. Estimated end result, year 2024

CONCLUSION

This master thesis has its foundation in continuous cooperation with hobbyist hunters, hygienic and technical experts, throughout research on the topics concerning how the hunters operate, in which context they work and what explicit needs were identified during the process. This made the team realize that it's common to have great interest in hygienic handling of game, even though the knowledge hunters have is widely different and often contradicting of one another. The team realized that the hunters was only partly interested in the project because of hygiene, but mostly because of the convenience the product creates for them, as it gives them the possibility of being flexible in when to skin and butcher the animal. Furthermore, Cool Hunt has been designed to be an addition to their current workflow and setup, allowing them to implement it without having to readjust their own equipment or acquire additional gear.

The final product is shaped around an inflatable cover, which makes use of how good of a thermal insulator still standing air is. The concept hasn't been proven in context yet and is therefore only a theoretical solution so far. Because of the inflatable cover, the product is able to be folded to a very compact form factor, which makes it possible to stow away and bring it on hunting trips.

REFLECTION

PRODUCT

Interface

For the interface of the product - mainly the on/off function together with setting the temperature, the team hasn't truly tested the current setup on the users, even though it's designed with the demands the team gathered from the hunters. The general design of the settings and the dial is only tested through storytelling on other students, to pick the most straight-forward solution. The team would like to test it by showing different solutions to the hunters and through that find the most optimal solution.

Height adjustment

The height adjuster hasn't been discussed with the users and is solely designed by the team looking for a cheap, but functional solution. With more time the team sees it as an interesting design challenge to figure out a fast, cheap, and easy solution for changing the height of the product.

Stability of top cover

Since most prototypes were build in cardboard, the team hasn't tested the true stability of the top cover, when attached to a hoisting system. The hope is that the tolerances between the top cover and the top cover attachment, together with the height of the top cover attachment piece is enough to ensure that the product is comfortable to work with. Therefore, the team would like to do more proper tests on this.

Air valve

The team has been looking for standard solutions for the air hose but hasn't been able to. The team speculates that there should be real components for a loosely connected, but airtight solution and therefore wants to research this part and its interactions further. The solution could make the functionality of the piece easier to read and the handling of the part simpler with a clearer feedforward language.

Potential markets

As the product targets a niche market, the team would like to explore if the concept of the product could be fitted to be used in other contexts. This could be in the restaurant industry when delivering and preparing food on off-site locations, since it can cool a big volume, but has a compact design. Another context of the design could include the possibility of cooling whole crates of beer and soda as the team has found that some hunters use their modified second-hand fridge, for cooling beverages if they were to host a summer party etc.

THE PROCESS

Looking back at the entire process for the project, the team started out being confident about the fuzzy front end and had a good overview, dealing with multiple problem spaces at once. Quite early the team got in contact with the two hunters; Rene and Flemming and established physical meetings with them for discussing what gear they used and got great insights of their hunting processes. Keeping an open mind in the start allowed the team to visit the hunters with a hunting chair in mind and realizing a better business opportunity could be to develop a product as a response to second hand modified refrigerators.
The team had difficulties moving on in the conceptualization phase however, as all the technical aspects were hard to define without prober knowledge about cooling technologies and their properties. Only when the team realized that nothing proper had been produced for a while, it became clear for the team that the exploration part of the project had to be shifted to creative problem-solving process, and this brought the process forward. The tool for this was the extensive heat and flow simulations, which helped the team define the product architecture, which set off further development. Because of this, the team ended up starting the detailing phase later than anticipated, and this affected how in depth some of the studies could've been, because of the hand-in deadline.

PROJECT MANAGEMENT AND TEAMWORK

The team felt comfortable during early stages of the project, knowing that an unexplored problem had to be found in the hunting industry. However, as the project advanced the team realized that the role of a project manager was only partly fulfilled by both team members and lacked a systematic approach for difficult stages of the project. For the other processes of the project though, the members complimented each other's skills in a satisfactory fashion.

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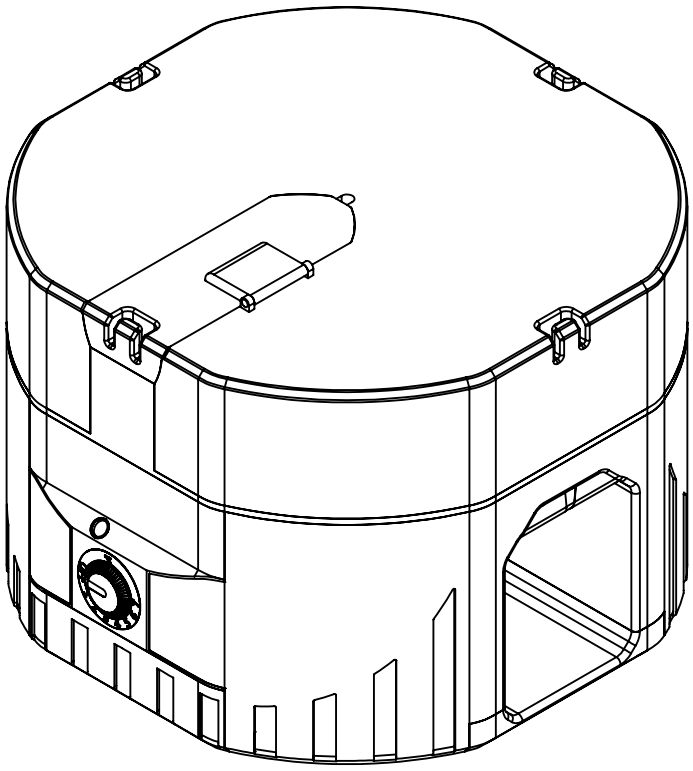
COOL HUNT - TECHNICAL DRAWINSGS



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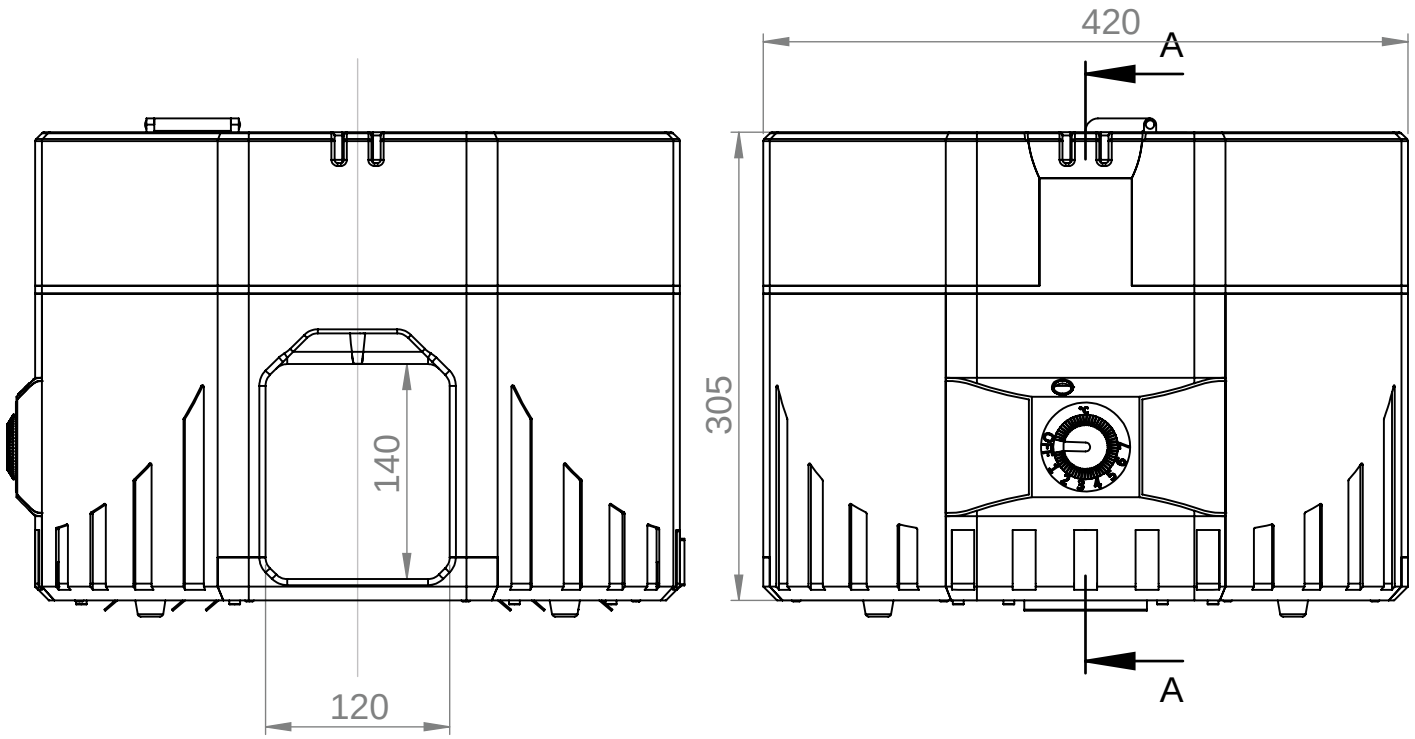
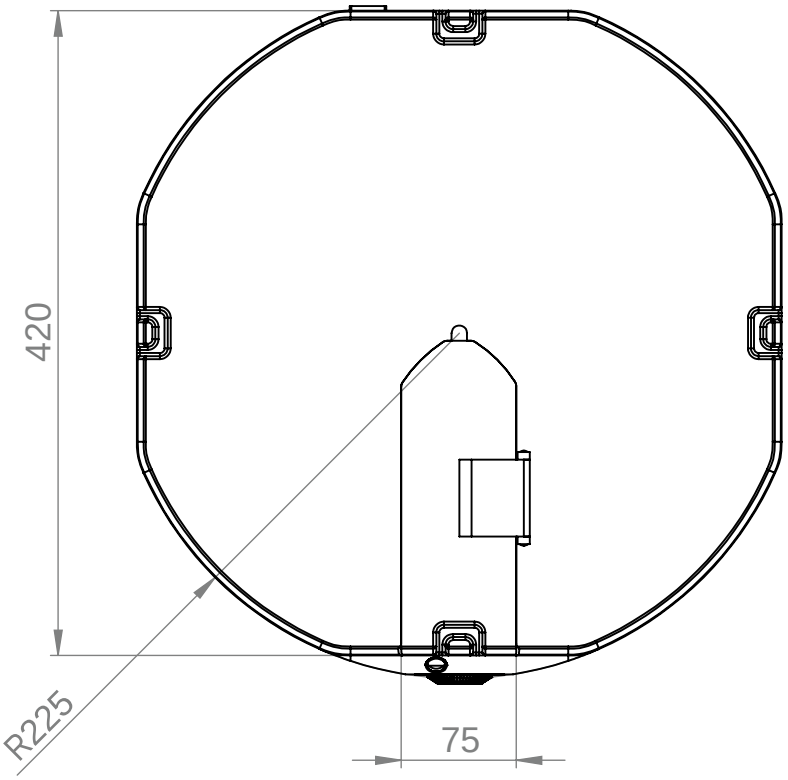
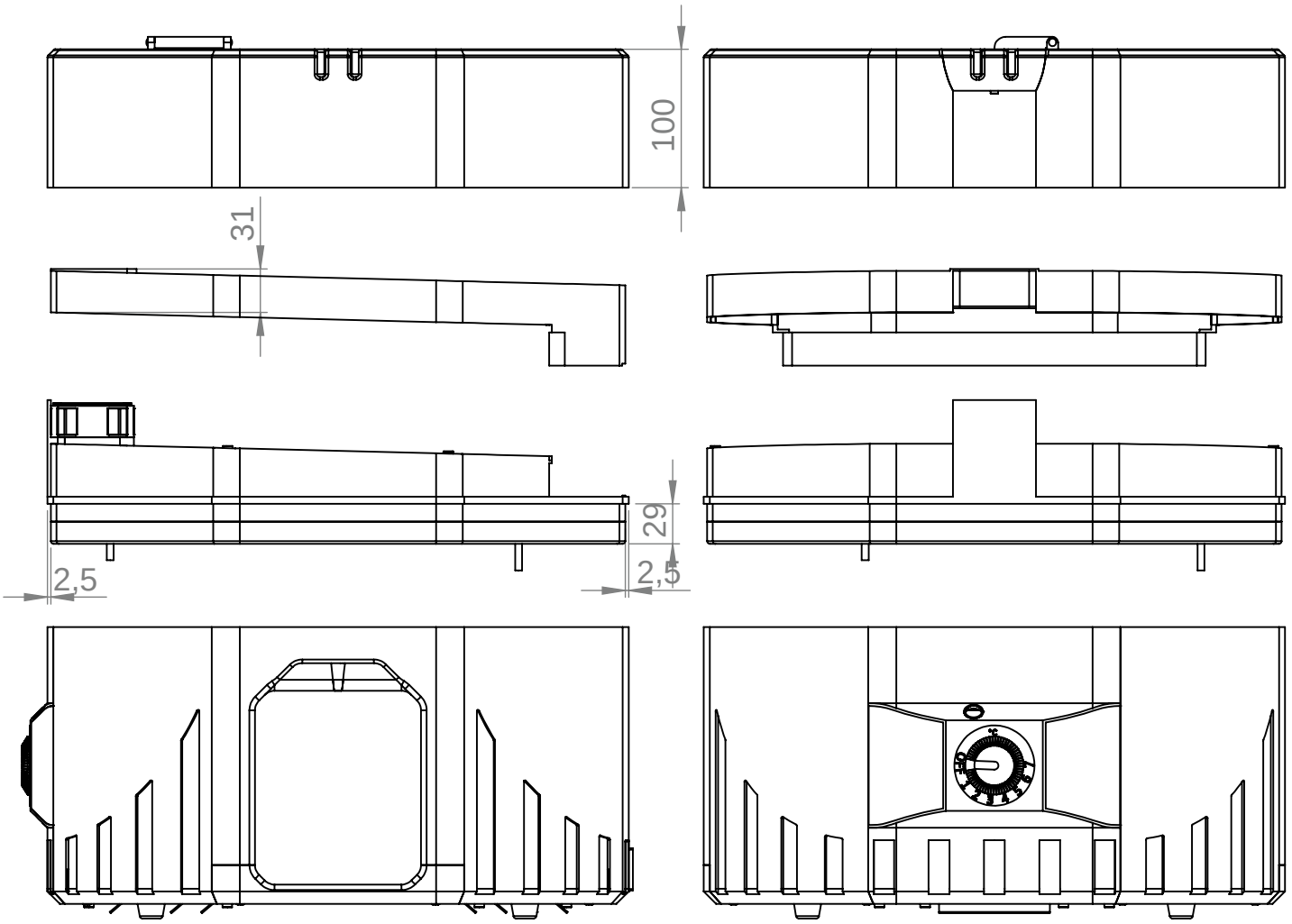
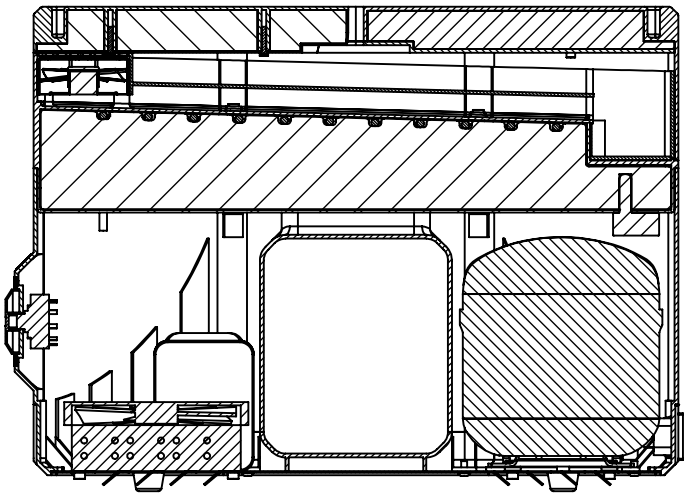
CONTENT





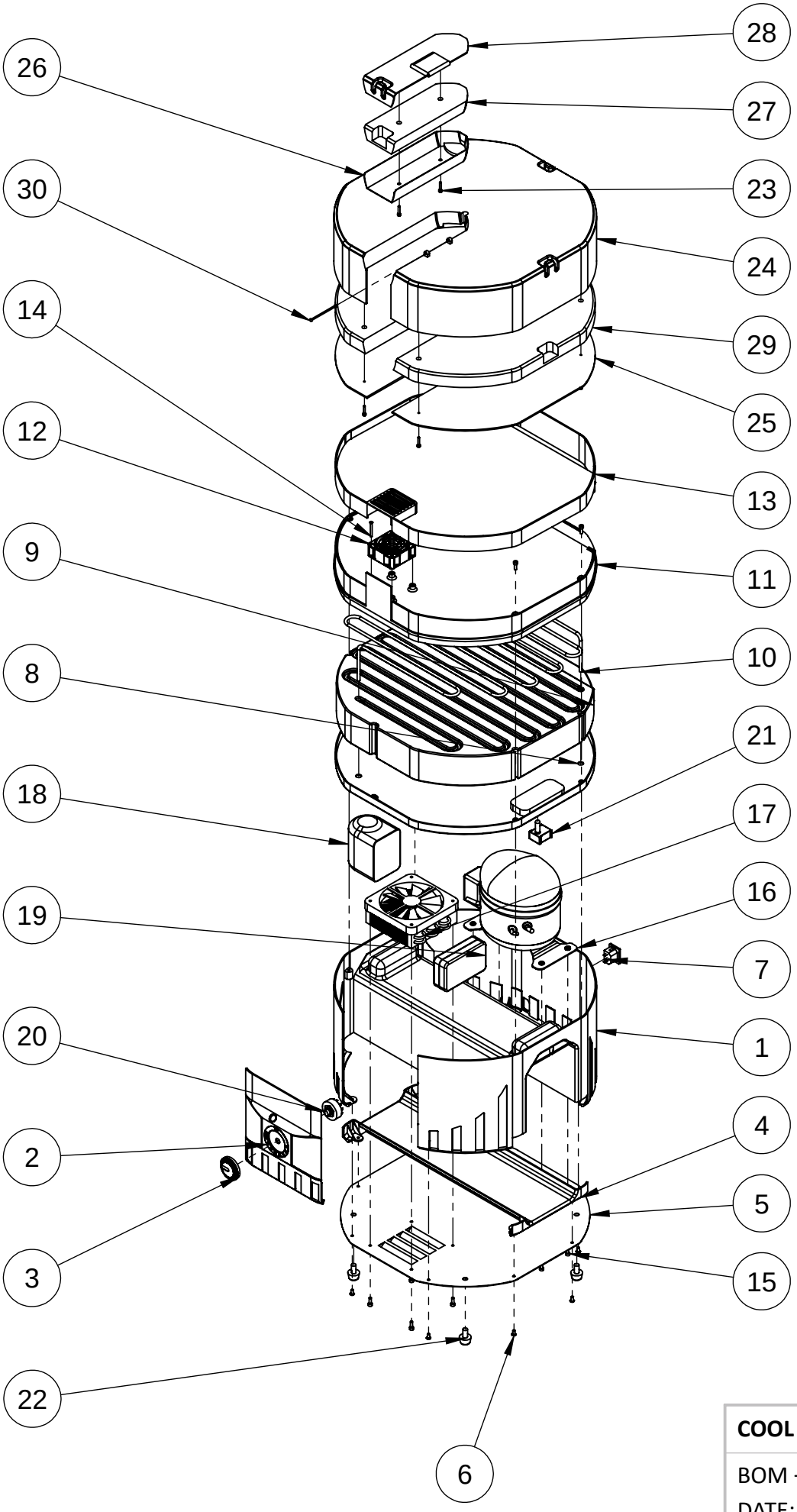




SECTION A-A

COOL HUNT
ASSEMBLY DRAWING
DATE: 03/06/2021
SCALE: 1:5
UNIT: mm
SHEET 1 OF 1

ITEM NO.	PART NAME	MATERIAL	QTY.
1	Base cover	Polypropylene	1
2	Base interface	Polypropylene	1
3	Dial	Polypropylene	1
4	Base bottom	Polypropylene	1
5	Base plate	Stainless steel	1
6	ISO 7380 - M4 x 8		8
7	C14 plug		1
8	Cooling plate bottom	Polypropylene	1
9	Cooling plate insulater	Polyurethan	1
10	Evaporator		1
11	Cooling plate top	Polypropylene	1
12	Cooling plate fan		1
13	Drip tray	Polypropylene	1
14	ISO 14581 M3x30		4
15	ISO 4762 M4 x 12		12
16	Compressor		1
17	Condensor fan		1
18	Air pump		1
19	PCB box		1
20	Rotary switch		1
21	Thermostat		1
22	Feet		4
23	ISO 4762 M3 x 16		6
24	Top cover top	Polypropylene	1
25	Top cover bottom	Polypropylene	1
26	Latch bottom	Polypropylene	1
27	Latch insulator	Polyurethan	1
28	Latch top	Polypropylene	1
29	Top cover insulator	Polyurethan	1
30	Split		1



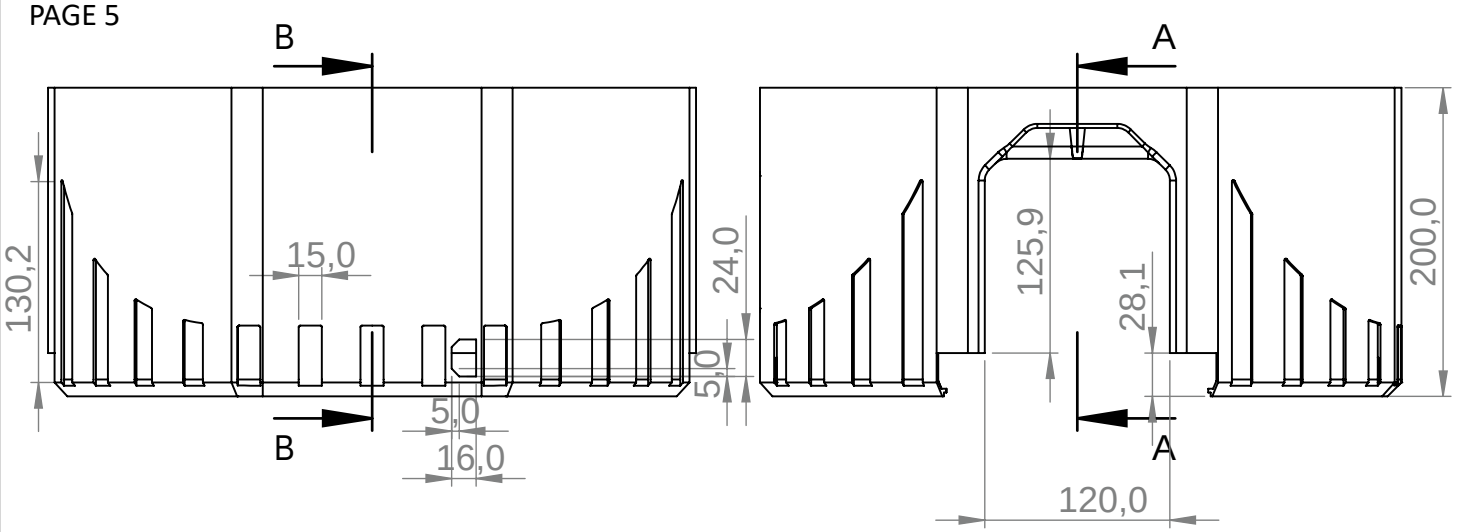
COOL HUNT

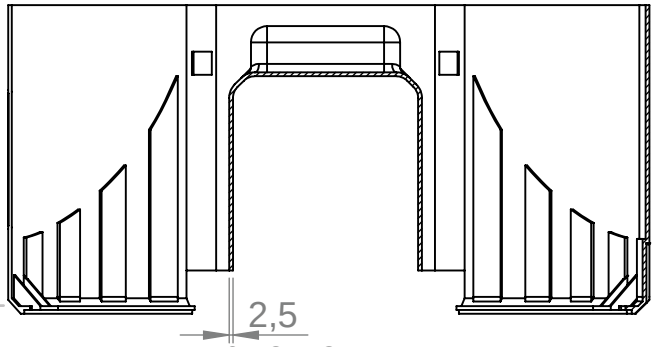
BOM + EXPLODED VIEW

DATE: 03/06/2021

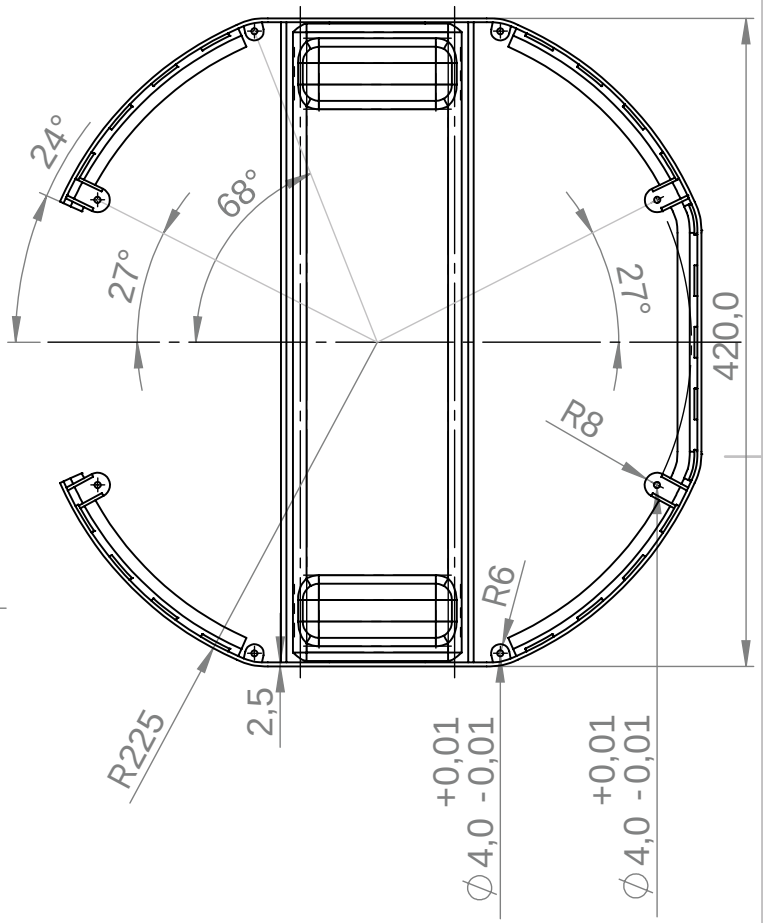
SHEET 1 OF 1

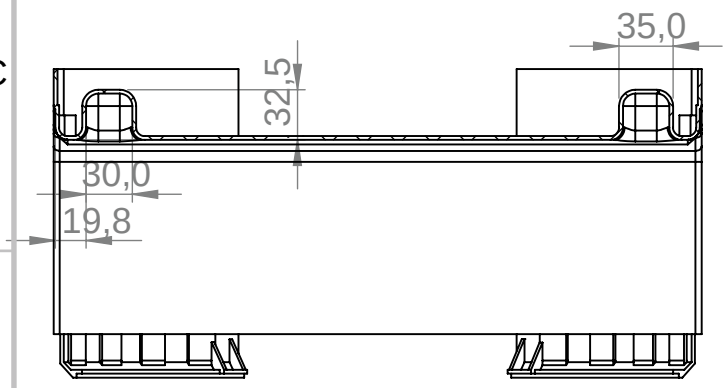
PAGE 5





SECTION B-B

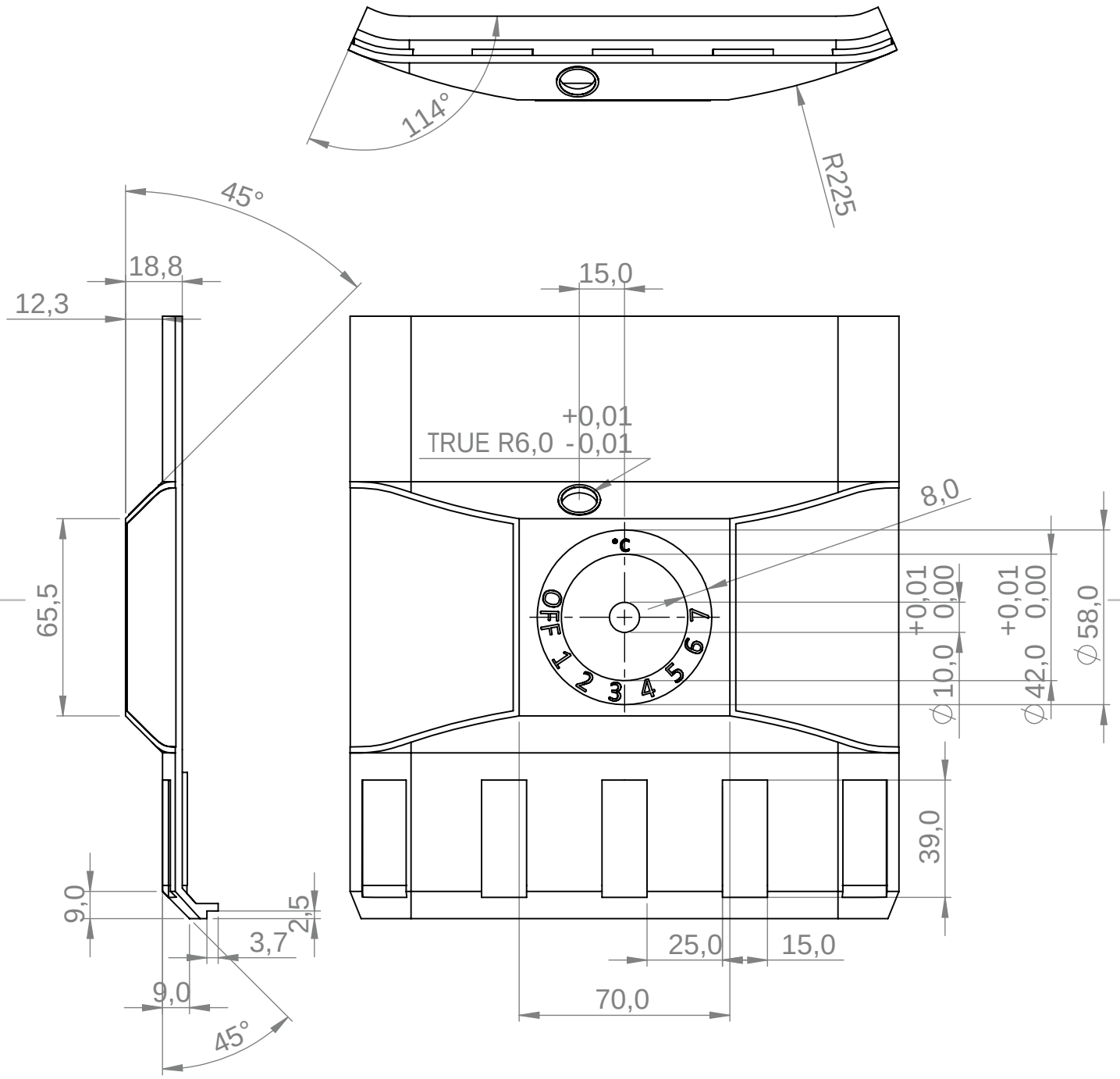




SECTION A-A

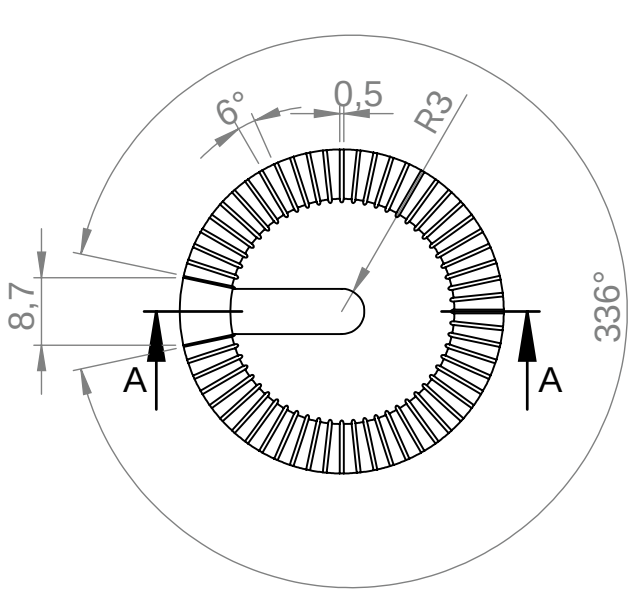
COOL HUNT	
TITILE: BASE	DATE: 03/06/2021
PART NO: 1	UNIT: mm
SCALE: 1:5	SHEET 1 OF 1

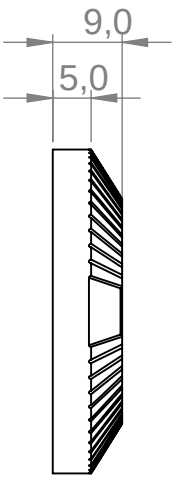
UNLESS OTHERWISE SPECIFIED:
ALL DIM TOLERANCES: ±0,05
ANGLE TOLERANCES: ±0,5°

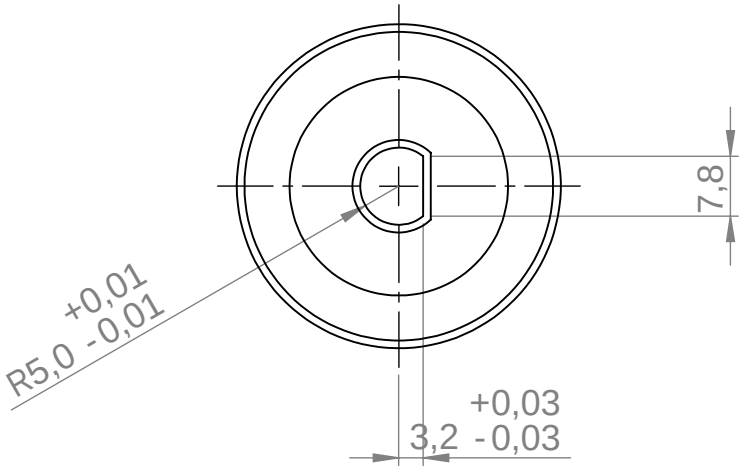


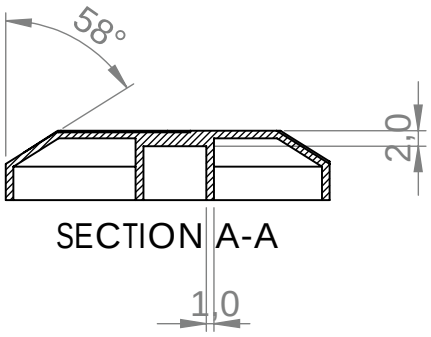
COOL HUNT	
TITILE: INTERFACE	DATE: 03/06/2021
PART NO: 2	UNIT: mm
SCALE: 1:2	SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED:
ALL DIM TOLERANCES: ±0,05
ANGLE TOLERANCES: ±0,5°



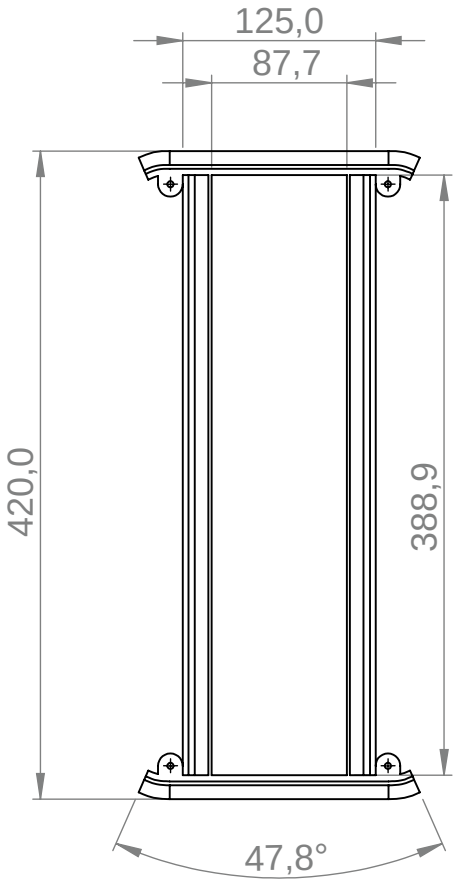


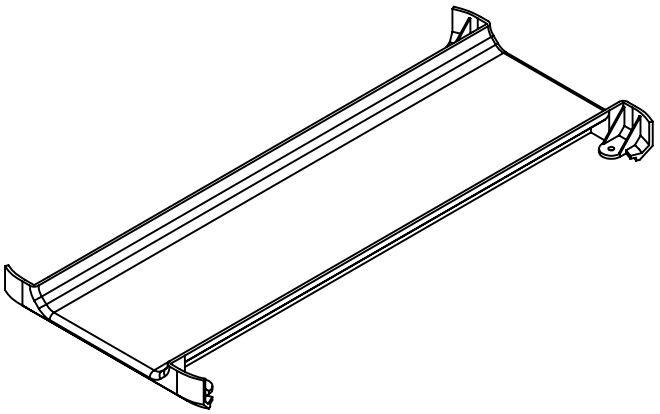


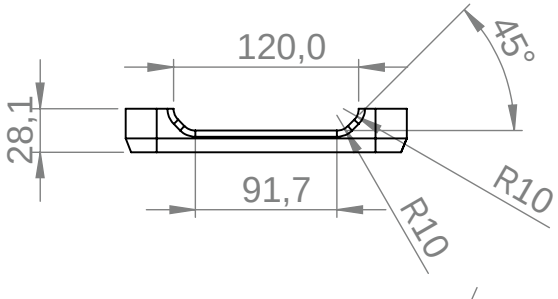


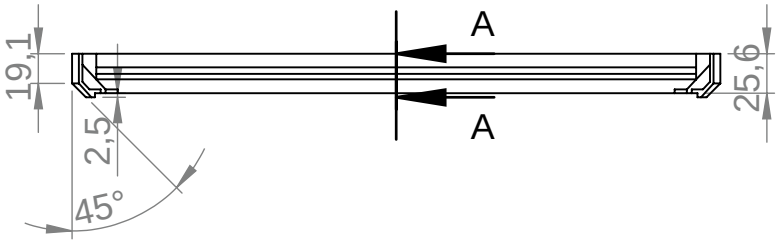
UNLESS OTHERWISE SPECIFIED:
ALL DIM TOLERANCES: ±0,05
ANGLE TOLERANCES: ±0,5°

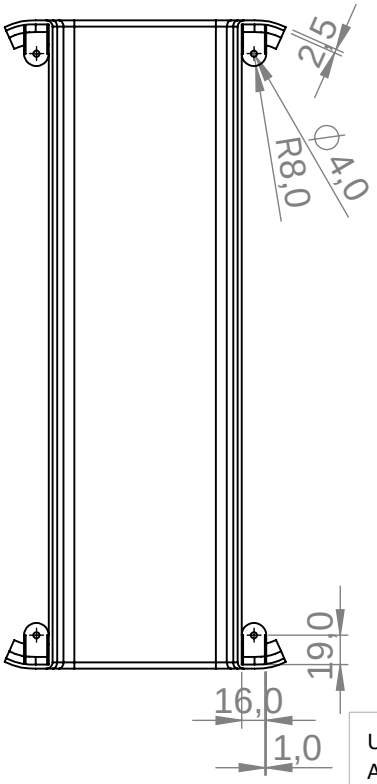
COOL HUNT	
TITILE: DIAL	DATE: 03/06/2021
PART NO: 3	UNIT: mm
SCALE: 1:1	SHEET 1 OF 1

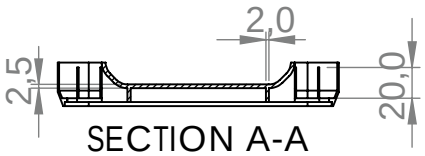












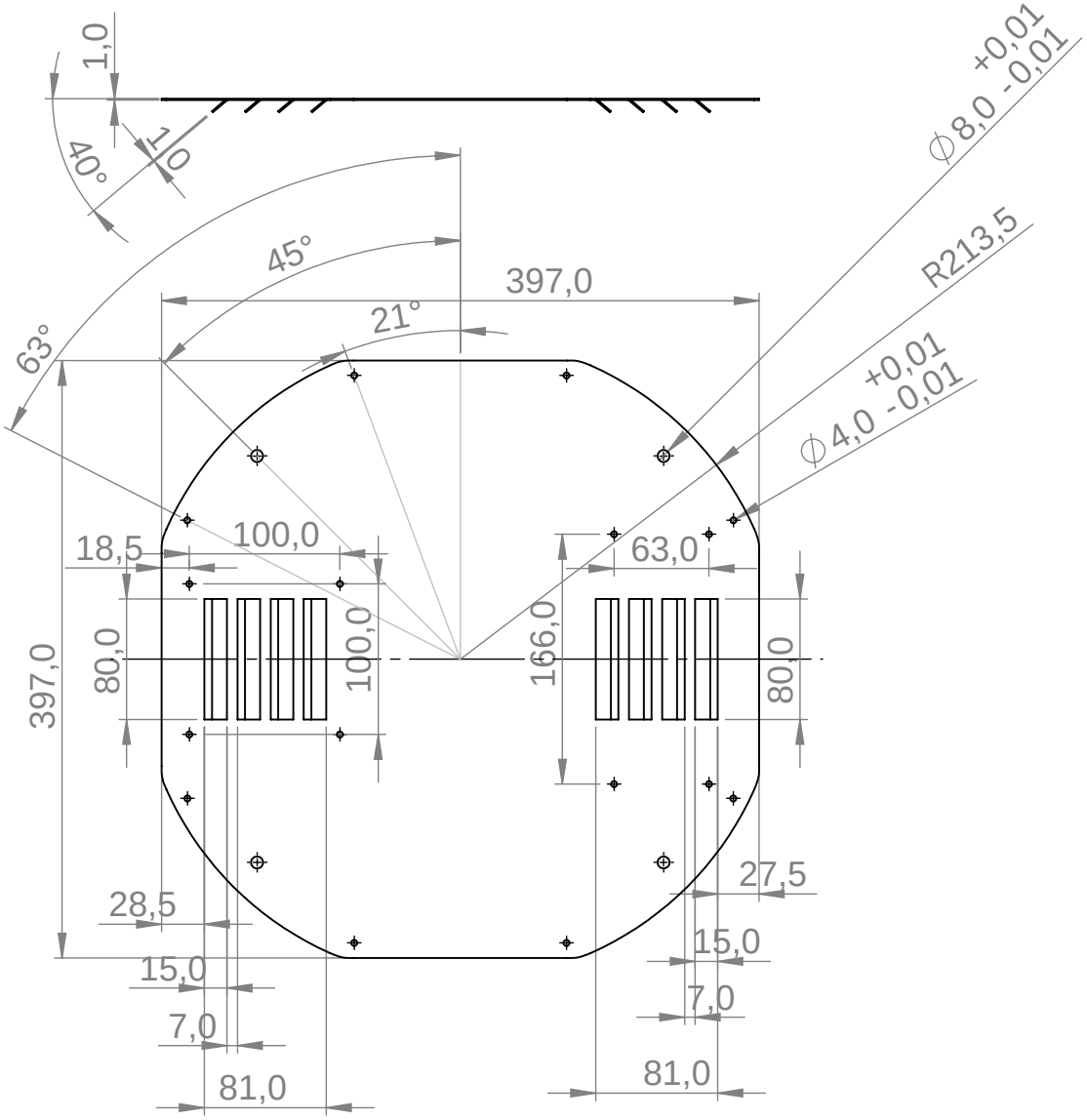
SECTION A-A

UNLESS OTHERWISE SPECIFIED:
ALL DIM TOLERANCES: ±0,05
ANGLE TOLERANCES: ±0,5°

COOL HUNT

TITILE: BASE BOTTOM
PART NO: 4
SCALE: 1:5

DATE: 03/06/2021
UNIT: mm
SHEET 1 OF 1



COOL HUNT	
TITILE: BASE PLATE	DATE: 03/06/2021
PART NO: 5	UNIT: mm
SCALE: 1:5	SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED:
ALL DIM TOLERANCES: ±0,05
ANGLE TOLERANCES: ±0,5°