

Design of Multifunctional and Sustainable Backpacks

Combining Skiing, Snowboarding, and Urban Usage



Marcus Jonsson

**Industrial Design Engineering, master's level
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Luleå University of Technology
Department of Business Administration, Technology and Social Sciences

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Marcus Jonsson

2018

Supervisor: Åsa Wikberg-Nilsson

Examiner: Åsa Wikberg-Nilsson

Reviewer: Peter Törlind

Master of Science Thesis

Design of multifunctional and sustainable backpacks
- Combining skiing, snowboarding, and urban usage

Master of Science Thesis in Industrial Design Engineering – Product Design and Development

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Marcus Jonsson
Luleå, June 2018

ABSTRACT

Today, backpacks and duffel bags are often designed with a focus on a specific area of use, which makes it difficult to use them on other occasions. A clear example where the differences are noticeable is between functional mountaineer bags and urban bags. It is not uncommon for people staying in these environments to have far beyond two bags in their possession. Overconsumption is harmful to the environment, especially when it is from an industry that is pursued with poor working conditions and dangerous emissions in nature. Therefore, multifunctionality and sustainable design have been of high priority when the products in this project were developed.

In this thesis, two models of bags have been developed through a human-centered design process. A large number of user interviews and expert interviews, as well as a focus group, laid the foundation for the requirements and needs of the bags. Spektrum's company values, as well as the identity of their current products, were interpreted to create brand recognition in the new products. Idea generation was performed through various creative sessions, prototyping, and through a workshop. Evaluation and concept selection was performed by representatives from the target group in the form of personas, as well as by Spektrum. Finally, detailed technical drawings of the concepts were created in Adobe Illustrator.

The first model is a backpack designed to work just as well on the mountain as in the city. The other model is a duffel bag that can be carried both on the back and in the hand. It is also designed to perform well in both mountain and urban environments. Both bags are made of polyester from recycled PET bottles and the material is controlled and approved by the highly rated environmental certification bluesign®. The metal parts of the bags are made of recycled aluminum. Both models are adjustable to fit all users within the 5th to 95th percentile.

The thesis resulted in the ordering of two alpha prototypes of each model, factory-made by my technical drawings. According to Spektrum, the designs have created great interest among retailers and company shareholders. Both models will, therefore, be put into production and released to the market within two years.

Keywords: Backpack, Duffel Bag, Multifunctional, Brand Transformation, Sustainable Design, Textile Design, Industrial Design Engineering

SAMMANFATTNING

Dagens ryggsäckar och duffelväskor är ofta designade med fokus på ett specifikt användningsområde vilket försvårar användandet vid andra tillfällen. Ett tydlig exempel där skillnaderna är stora är mellan funktionella skidåkarväskor och urbana vardagsväskor. Därför är det inte ovanligt att personer som vistas i dessa miljöer äger långt över två väskor. Detta bidrar till överkonsumtion vilket är skadligt för miljön, inte minst från en bransch som kantas av dåliga arbetsförhållanden och farliga utsläpp i naturen. Därför har multifunktion och hållbar design haft en hög prioritet under produktutvecklingen.

I det här examensarbetet har två modeller av väskor tagits fram via en människocentrerad designprocess. Ett stort antal användarintervjuer och expertintervjuer, samt en fokusgrupp, la grunden till de krav och behov som ställdes på väskorna. Spektrums värden och formspråk på nuvarande produkter har tolkats för att kunna skapa en företagsrelaterad igenkänning i de nya produkterna. Idégenereringen utfördes genom olika kreativa sessioner, prototypande, samt via en workshop. Utvärdering och konceptval utfördes av representanter från målgruppen i form av personas, samt av Spektrum. Slutligen skapades detaljerade ritningar av koncepten i Adobe Illustrator.

Den ena väskan är en ryggsäck designad för att fungera lika bra vid utförsåkning på fjället som vid urbant användande. Den andra modellen är en så kallad duffelväska som går att bära såväl på ryggen som i handen. Även den är utvecklad för att användas i både fjäll- och stadsmiljö. Båda väskorna är tillverkade i polyester från återvunna PET-flaskor och materialet är kontrollerat och godkänt av den högt klassade miljöcertifieringen bluesign®. Väskornas metalldelar är tillverkade i återvunnen aluminium. Båda modellerna är justerbara för att passa alla användare inom 5:e till 95:e percentilen.

Examensarbetet resulterade i en beställning av två alfa prototyper av vardera modell, fabrikssydda efter mina ritningar. Prototyperna har enligt Spektrum skapat stort intresse bland återförsäljare och företagets aktieägare. Bägge modellerna kommer därför gå i produktion och släppas på marknaden inom två år.

Nyckelord: Ryggsäck, Duffelväska, Multifunktion, Varumärkesöverföring, Hållbar Design, Textil Design, Teknisk Design

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1. INTRODUCTION



Today, it is hard to find multifunctional backpacks that are suitable for a variety of occasions, meaning that the user purchases multiple ones to meet all their needs. This in turn contributes to over consuming, where exceeding the earth's assets can be harmful for the planet. Further, if the sustainable choice of materials, manufacturing, and recycling is neglected, the products will contribute to an even larger environmental footprint. It is undeniably important to argue for the use of sustainable design when developing a new product. One solution is to develop products that can replace multiple others. Another is where the design and life cycle of the product is considered to reduce the environmental impact.

These were some of the aspects taken into consideration during this master thesis that was a part of the final graduation in Industrial Design Engineering at Luleå University of Technology (LTU). The course named D7014A consist of 30 ECTS, that is equivalent to 20 weeks of full-time work. This project was conducted in collaboration with the outdoor brand Spektrum in Åre during the spring of 2018.

1.1 BACKGROUND

With an increasing interest in outdoor activities in recent years, the practitioners gear constantly advancing. In activities like skiing and snowboarding, this can be shown in more advance and durable clothing, together with high-performance equipment. Another trend is to venture further out into nature in a search for the unexploited terrain. Ski lifts are no longer a requirement and the riders rather hike to their desired location or feature. When exploring areas outside the resort, the gear the riders carry with them is essential and can in some situations be a matter of life and death. The most common way to carry all the necessary equipment on the mountain is within a backpack.

These outdoor activities involve a great amount of gear that needs to be carried or transported in an efficient way. Tough terrain or conditions in connection with the activities prevent the usability of a normal suitcase. Instead, luggage is often carried in larger bags called duffel bags. In today's market, many of the backpacks and duffel bags only considering either function or style, which prevents usage elsewhere than the intended area.

Since nature is the practitioner's habitat, many of them are environmentally conscious and careful not to do any harmful impact on their surroundings. Sustainable design is of high importance and can even be crucial for some users within the target group. The sustainable aspects of the products involve materials, manufacturing, and recycling but also the usage, applications, and durability.

1.2 STAKEHOLDERS

The stakeholders can be divided into two main categories; *Spektrum* as a company and the *users* of their products. Spektrum is a Swedish manufacturer of goggles for skiers and snowboarders (figure 1). In the past years, the company has expanded rapidly and their products are to be found in stores all over Europe. Their design office is based in Åre, Sweden, and is led by the brand's co-founder Henrik Köhler. Recently, Spektrum has started to produce sunglasses as a step to reach urban users outside the slopes. Since the brand is expanding, they are currently looking to add new products to their lineup. One of these segments will be backpacks and duffel bags.

Spektrums target group are people with an active lifestyle that travels and perform outdoor activities where they want to bring their gear or equipment in an efficient and elegant way. The users are a mix of genders, where the main activities are skiing and snowboarding. There is also a high demand for urban usage. The target group is environmentally conscious and desire functional products that are sustainable and durable.

When offering sustainable products, Spektrum can take important market shares from their competitors. This is in line with their reorganization of the company to only offer sustainable products with low ecological impact. The environmental consciousness throughout the entire production line entails indirect stakeholders in form of the producers and their employees, as well as nature itself. By decreasing the environmental footprint, Spektrum can also show the industry that a relatively small brand can take a leading position in the question of sustainable design against considerably larger competitors.

1.3 OBJECTIVE & AIMS

The objective is to design a backpack and a duffel bag for Spektrum that address their target group of urban users, but also perform and is functional on the mountain. An important detail on the backpack is to be able to mount skis or snowboard for hiking. The bags have to be durable and the materials and manufacturing process needs to be sustainable with the environment in mind. A well-motivated design rationale in form of the thesis, as well as high-fidelity technical drawings and prototypes, should be delivered to Spektrum. The design rationale will be achieved by in-depth analysis, development, and testing.

The aim is to see the bags be produced and labeled with a recognized sustainable certification. Eventually, the aim is to see the designs reach stores and have an impact on the market.

To ensure that the purpose of the project was clear, three research questions were established. The questions are presented on the next page and will later be answered in the conclusion chapter.

1.4 RESEARCH QUESTIONS

- How to transfer Spektrums design identity from one product category to a completely new?
- How to include multifunctionality without interfering with style?
- How to design for ecological, social, and economic sustainability?

1.5 PROJECT SCOPE

The core focus of this project is the users and their needs based on a Human Centered Design approach. Therefore, interaction with them is of high importance and a natural part of the design process. The final products should be focusing on three factors; *functionality*, *style*, and *sustainability*. The process will contain both low and high fidelity prototyping for evaluating and testing.

Spektrum is targeting the low to mid price segment of the market, hence one of the requirements is that the products must be cost-efficient. Therefore, a limitation is that costs of materials and manufacturing need to be considered. Still, the sustainability and functionality of the products are of high importance. The outcome of this project will be evaluated by the stakeholders with the possibility of going into full-scale production. The final products can in a best-case scenario reach the market in late 2019.

1.6 THESIS OUTLINE

This thesis consists of eight main chapters, where the first, *Introduction*, introduces the background and purpose of the project. The *Context* chapter will set the theme of the thesis and give an impression of the current industry and solutions. Next, the *Theory* chapter presents the fundamental theory that is the scientific foundation of the final results, along with how it connects to industrial design engineering. The *Method* chapter presents all methods used to perform the project, including gather knowledge, perform ideation, and implementing the solutions. The methods execution, validity, and reliability are also discussed. All the results will be presented in the chapter *Result*, where the final designs also will be found. The *Discussion* chapter will argue of the final result, based on the implemented theory and methods of the project. Chapter seven, *Conclusion*, will answer the research questions. Last, there is a *References* chapter where all of the used sources are presented according to the APA reference system.



Figure 1. Spektrum Helags goggle.

2. CONTEXT



This chapter contains basic insight necessary to understand some of the main factors that are the foundation of the project. The chapter includes current solutions, benchmarking, and a mood board. The information is based on the author's interpretations if nothing else is stated.

2.1 CURRENT STATE

Today, most brands compete by niching their bags in one way or another. One model can be designed for carrying fragile and heavy camera equipment, whilst another need to be small and lightweight to address another field of use. Some compete with aesthetics or brand, other with low price or functions. With hundreds of different models, at a first glance, it may seem overwhelming and hard to find a white spot on the market.

When looking at backpacks designed to be used for mountain activities, a mutual feature is to be able to attach skis or snowboard to the backpack. The ways that this can be done varies from model to model. The two most common methods is either the usage of straps that can be buckled and tighten, or fixed loops where the equipment can be thread through. The result is often that these backpacks are consisting of a dozen of loose hanging straps, that completely lose their usability outside the mountain.

In the clothing fashion industry today, we can see brands blending outdoor and urban fashion together, bringing functional fabrics into the city, and urban design elements to the outdoor collections. An example of this mix is the well known outdoor brand The North Face and their collaboration with the extremely hyped street brand Supreme, as shown in figure 2.

Another trend is that outdoor brands are adapting to the consumers higher demand for environmentally friendly products, where backpacks are no exception. Today, you can find backpacks made of recycled or eco-certificated fabrics. Some are produced with new manufacturing techniques that require less energy, chemicals, or water consumption. These products or materials are often labeled with some sort of sustainable certification for the consumers to see.



Figure 2. The North Face x Supreme jacket.

2.2 ATTACHMENT

With an increasing popularity for outdoor activities, some people want to venture further out into nature. When it comes to skiing and snowboarding, this could mean that you have to take off your equipment and hike parts of the mountain to reach a certain feature or untouched terrain (figure 5). By attaching the equipment on the backpack, the carriers hands are free, which drastically relieves the ascent. This can be useful whether the hike is up a steep mountaintop, or from the parking lot with hands full of other gear.

There are several ways to attach skis or snowboard to a backpack. When attached, it is important that the equipment allows clear movement of arms, head and heels. There are some standard ways to do this which are presented on the next two pages.

2.2.1 SKIS

The two common attachment methods for skis are A-mount and diagonal mount. They both have their pros and cons, that will be described further on this page.

A-mount; Skis are attached on each side of the backpack. The tips of the skis are fixed with a separate strap and the constellation form the shape of the capital letter A (figure 3).

- **Pros;** The weight is close to the body and evenly distributed on each side, making this a more stable attachment. Heels and head are free when walking.
- **Cons;** The attachment makes the backpack wider, with a risk of constraining the movability of the arms. The attachment needs at least four attachment points, increasing the number of operations to secure the skis.

Diagonal; Skis are attached together with the bindings built-in skistoppers. The pair is then attached diagonally with the bindings in the center of the backpack to prevent an unstable weight distribution (figure 4).

- **Pros:** Heels, head, and arms are free when walking. It is a fast way to attach skis without the need of multiple operations.
- **Cons:** It is less stable with a loose or empty backpack. Weight is further from the body making it harder to carry, including that the diagonal shape can make it feel unstable.

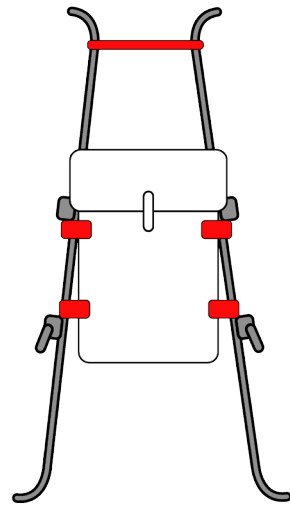


Figure 3. Skis A-mount.

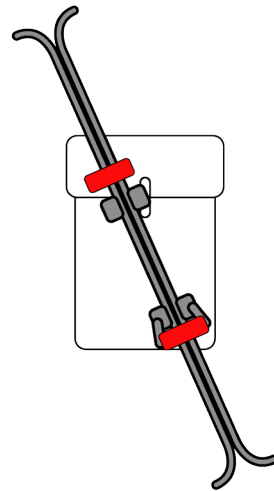


Figure 4. Skis diagonal.



(Sundberg, M., 2017)

Figure 5. Hiking with skis attached by diagonal (front) and A-mount (back).

2.2.2 SNOWBOARD

The two attachment methods that are common for snowboard are vertical and horizontal mount.

Vertical; Attaching the snowboard vertical on the outside of the backpack (figure 6).

- **Pros;** Heels and arms are free to move. Only the height of the packing is to be considered.
- **Con;** Head can be constrained due to the snowboard sticking up high.

Horizontal; Attaching the snowboard horizontal, either on the outside of the backpack or close to the body (figure 7).

- **Pros;** Head and heels are free to move.
- **Con;** The packing will be wide and restrict movement of arms. It will also be an obstacle in tight terrain. The close contact to the steel edge of the snowboard can cause tears in clothing.

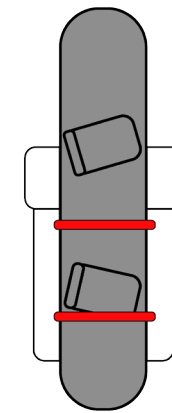


Figure 6. Snowboard vertical.

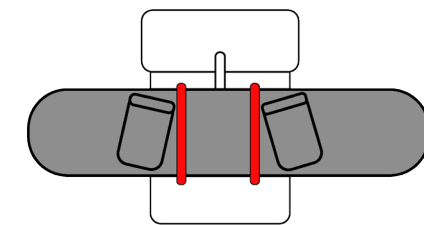


Figure 7. Snowboard horizontal.

2.3 BENCHMARKING

There are hundreds of different brands producing backpacks today, each with a variety of different models, making it impossible to compare them all within the given timeframe. Since all bags have one mutual purpose, to carry stuff, the brands need to niche their products to reach different consumers. They can do so by competing with such things as price, style, functions, fit, and materials. In recent time, a new factor is also present, that is sustainability.

Large outdoor brands such as Fjällräven, Haglöfs, Patagonia, and Helly Hansen are competing with products that are labeled as environmentally-friendly. When visiting their websites, you can find whole sections about sustainability, eco-friendly materials, and how the brand cares about their environmental footprint. As a consumer, it is not unusual that you can filter your search for sustainable products labeled with a certain certification.

Many of these outdoor brands offer backpack models for skiing and snowboarding. For the majority though, the bags are just a small segment of

the brand's entire product assortment. Other outdoor brands, such as Osprey and Douchebags, are strictly producing bags.

Backpacks that are aimed to be used in the mountains can be divided into two main categories, with or without Avalanche Balloon Secure-system (ABS). A backpack with an ABS system can be useful when riding in avalanche terrain, adding an extra security to the wearer. Because of the system, these backpacks are often heavier and has a smaller packing compartment, making it less suitable for usage anywhere else.

The majority of the mountain niched backpacks on the market today offer either ski or snowboard attachment, making it less common to see a combined solution. Since backpacks with both ski and snowboard attachment are using different solutions for each kind of equipment, the amount of straps, buckles, and loops on the bag increases drastically. The majority of the systems are constructed of straps to secure the equipment, or loops were skis or snowboards are meant to be thread through.

2.4 MOOD BOARD

Many of the creative industries, especially fashion and design industries, are frequently working with visuals in the form of mood boards to in a quick way introduce the viewer to a certain mood or theme. The mood board is able to trigger senses that support innovative solutions in a product design process. It should set the theme, but also provide creative freedom and leave room for interpretation (Endrissat, Islam, & Noppeney, 2015). A mood board based on Spektrums values and brand message is displayed on the next page (figure 9). The brand values are; *Style, Function, and Sustainability*. Spektrum want to express a clean and modern look, as well as encourage to explore and adventure in nature. The purpose of presenting this in an early stage is to set a theme for the reader throughout the rest of the thesis.

2.5 THE TEXTILE INDUSTRY

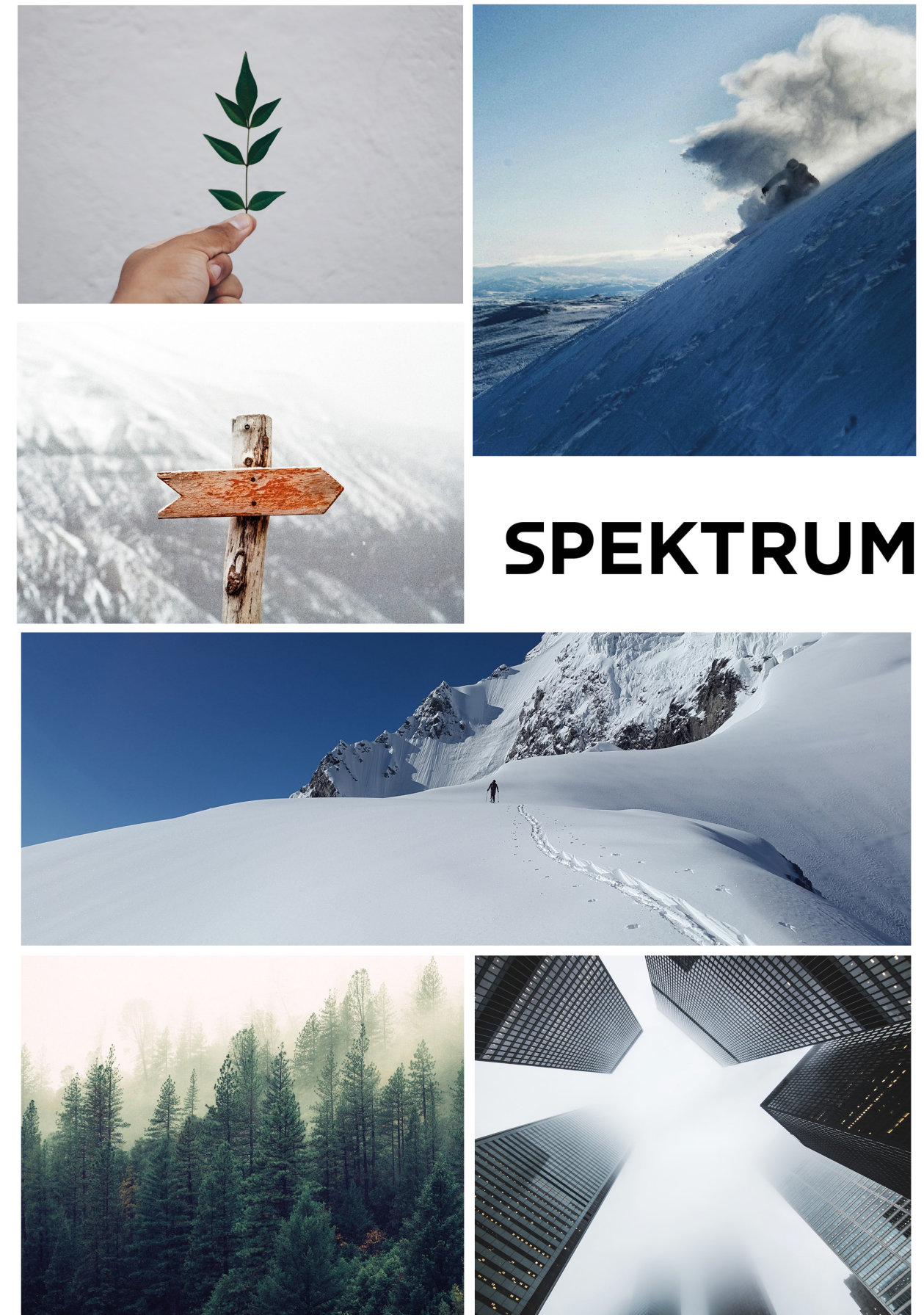
According to bluesign®, up to 60 million tons of natural or synthetically produced fabrics are processed to textiles every year (bluesign®, 2017). To produce 1 kg worth of textile, it requires up to 600 Liters of clean water and about 1 kg of chemicals. Chemicals that, when used irresponsibly, can be harmful to the factory workers, the consumers, and the environment (bluesign®, 2017; Energy [R] evolution report, 2012). The International Labour Organization (ILO), has established guidelines to ensure fair textile production. This, however, is something that not all countries follow (ILO, 2015).

According to IPCC (2015), Asia accounts for about 60% of the world's textile and clothes production. In Europe alone, roughly 70% of these types of goods are imported from Asia and is often bought by global companies, like H&M and Zara, that are looking for low costs and high production efficiency. Since fashion continuously changes, the factories have to adapt and follow the companies varying demands on volumes, production methods, and timeframes. Rapid changes like these can be stressful for the factories, affecting the workers and their working conditions.

Textile products can be labeled with different certifications to inform the customer if the products are fairly made. These labels can, for example, inform that organic materials are used, that specific requirements are met, or that the producers are working under controlled circumstances. Some of these recognized labels are; *Fairtrade, Global Organic Textile Standard, Svanen, and bluesign®*. All displayed in chronological order in figure 8.



Figure 8. Examples of certification labels. (All logos are creative commons, available at respective homepage.)



SPEKTRUM

Figure 9. Mood board.

3. THEORY



This chapter presents all the relevant theory regarding topics that are the framework of the project, including industrial design engineering, different materials, sustainable design, and brand transformation. The content is a result of a literature review, mainly based on peer-reviewed articles and reports.

3.1 HUMAN CENTERED DESIGN

According to IDEO (2015), Human Centered Design (HCD) is a creative approach to problem-solving and a framework to create innovative solutions to meet human needs. When understanding and designing for people, unexpected answers, and valuable insights may occur along the way that shapes the solution to something they embrace. HCD is based on both physical and physiological needs of the user (IDEO, 2015). The term HCD became widely used after a publication of Donald Norman in the 1980's (Norman & Draper, 1986). Twenty years later, Norman still arguing for the benefits, but also enlighten concerns of HCD. Norman (2005) states that when focus on targeting individuals or groups, a tailored solution might improve things for some, at the cost of making it worse for others.

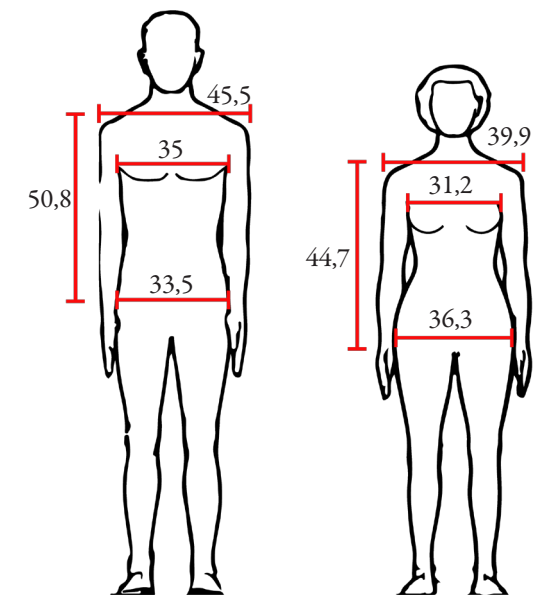


Figure 10. Relevant measurements of the torso based on the 50th percentile of a sample populations ranging from 2000-4000 individuals. (Adapted illustration from H. Dreyfuss, 1967)

3.1.1 ANTHROPOMETRY

Spektrum's target group is consisting of both men and women with varying anthropometrics. To ensure good ergonomics for the 5th-95th percentile, adjustable parameters are considered for the final designs. Anthropometry is involving the measurements of the human being, including sizes, weights, form, reach etc. This field is used in a design process when developing products to be functional for different humans and their interactions. Instead of doing own research on people, prepared charts can be used. Usually, the aim is to design products that fit the 5th to 95th percentile, which means that the final product will address 90 percent of the target group in terms of usability, excluding the top and bottom five percent. The risk of constraining the design for "all" humans is that the product can become too general and lose functionality. Instead, the product can be designed with adjustable parameters, to ensure good ergonomics for a larger group of people (Wikberg-Nilsson, Ericson & Törlind, 2015; Dreyfuss, 1967).

Since the products also will be used in combination with other gear, such as large down jackets and gloves, the margin of adjustability is of extra importance. Some of the relevant human areas looked at are presented in figure 10. The most divergent measurements between the 5th and 95th percentile, as well as between man and female, is the length of the back and the perimeter around hips and chest (Dreyfuss, 1967).

3.2 INDUSTRIAL DESIGN ENGINEERING

An industrial design engineer is taught through a problem-based learning and has great knowledge in all areas of the whole product development process. They care about aesthetics as well as qualities of materials and constructions in the design process (Ashby & Johnson, 2005). When designing products for humans, the abilities, limits, and behavior of a human being need to be considered (Norman, 2013).

Industrial design engineering is best described as a combination of the two more traditional fields of mechanical engineering and industrial design (Eekels, 1987). Mechanical engineering is, as it sounds, mechanically oriented with core areas including mechanics, dynamics, and thermodynamics, where industrial design is more aimed at the aesthetic and creative part of the product development process (Tovey, 1997). When combining these two fields, Cross (2008) state that common misunderstandings and conflicts between designers and engineers no longer are an issue.

Climate change and its long-term effects on the planet is a hot topic in today's society. Some arguing that industrial design is contributing to the environmental burden by pushing out many unnecessary products on the market and inviting to overconsumption (Fletcher & Dewberry, 2002). Due to this, in *Design for the Real World*, Victor Papanek (1971) states that industrial design has become one of the most harmful professions. Others saying that industrial design can be the solution to a lot of environmental problems, bringing sustainable design into consumer products (Yang & Giard, 2001).

3.3 SUSTAINABLE DESIGN

One of the requirements of the project is that the products should be sustainably designed. To design a product with sustainability in mind is not only important to reduce the environmental impact, Thorpe (2008) state that;

"Sustainable design can give the company a competitive advantage on the market." (p. 111)

The term sustainable design is so widely used that it can be hard to define. These underlying headings will present and explain relevant research about sustainable design that can affect the project outcome.

3.3.1 ENVIRONMENTAL IMPACT

So what is sustainable design? According to Shu-Yang, Freedman, and Cote (2004), it has become more common, especially in western Europe, to apply sustainable design to the development and manufacturing of products. In a product development cycle, there are a lot of environmental burdens to be found. For example in the extraction

and harvesting of materials, the manufacturing process, the consumer uses of the products, and last but not least, the recycling and disposal. Shu-Yang et al. (2004) list how a designer can make a product more environmentally friendly (p. 107).

- Selecting low-impact materials
- Reducing material use
- Optimizing production techniques
- Optimizing distribution systems
- Reducing impact during use
- Enhancing durability
- Optimizing recovery, reuse, and recyclability

3.3.2 RECYCLING

Recycling is highly relevant for this project, since the final designs may contain recycled materials and parts. It is also important to consider the disposal and recycling of the product when it reaches its end-life. There exist a lot of benefits with recycling, but of course, there are issues too. One thing the recycling industry struggles with is to preserve the structure and concentration of recycled materials. When quality continuously drops in each cycle, a material can only be recycled a number of times before it has lost its characteristics. The main reason for the loss of quality is due to impurities, added in the recycling process, or by insufficient separations. Even if a textile product is made of 100% cotton, the buttons, zippers, and thread can consist of other materials, making it hard to separate before recycling (Thorpe 2008). Impurities can also occur when products that are designed for one purpose is recycled to completely different products. Plastic PET-bottles can, for example, be recycled and reused in clothing. But the material composition and chemicals from the bottles may not always be suitable for long-term contact with human skin (Shu-Yang et al. 2004; Thorpe 2008).



Figure 11. Non-recycled plastic bottles that have ended up in landfill.

According to Thorpe (2008), a recycled material with lower quality or functionality than the original material is called downcycling. The opposite term is called upcycling, where the recycling process creates new materials and products with better qualities or with better environmental values than the original ones. Further, A material can be sorted into two categories. Organic materials that are created by nature, and synthetic materials that are technically produced. Even though the first category sounds more ecological, in the current industrial situation, the whole process of making an organic product is not necessarily more environmentally friendly (Thorpe 2008).

3.3.3 BLUESIGN®

The bluesign® system is a standard for environmental certification of textile production, managed by Bluesign Technologies. The certification is of high status in the textile industry and bluesign® is partnering with a dozen of the largest outdoor brands, such as; Patagonia, The North Face, Helly Hansen, and Haglöfs, for naming a few (bluesign®, 2017). Since bluesign® has such high status within the industry and among Spektrum's competitors, the focus is to involve this certification over others in the final design. According to bluesign® (2017), their system ensures a reduced environmental impact by eliminating harmful substances at the beginning of the manufacturing process and setting standards for a safe production. The certification involves approved bluesign® materials, but are also including manufacturers and brands that affiliates to bluesign® as partners. There are five principles of bluesign®, all listed below (bluesign®, 2017).

- **Resource productivity;** Adding value to the manufacturer and the product by minimizing consumption of resources used to produce the fabrics. Resulting in cost and energy efficiency as well as a decreased ecological footprint.
- **Consumer Safety;** Promise that the customer gets high-quality textile products as well as a clear conscience. The complete production process chain has to be controlled to ensure the lowest possible impact on nature and human health.
- **Water Emission;** Optimizing the production to reduce the amount of wastewater and control that only purified water return in the water cycle.

- **Air Emission;** Factory emissions, harvesting of raw materials and chemical and energy productions are all large parts of the textile industries air emissions. The bluesign® system targeting the selection of raw materials and chemical product to reduce CO² emissions.

- **Occupational Health & Safety;** A careful and safe handling of chemical substances during the textile production process is crucial, both for nature and the human in contact. Training programs with the employees on how to handle and store harmful substances are a bluesign® obligatory.

3.4 MATERIALS & PROCESSING

The products will contain both soft and hard components. Therefore, the relevant and suitable materials within the limitations of the project are researched. For the fabrics of the product, cotton and polyester are examined. For the buckles and hooks, the candidates are aluminum and plastic. The main aspects considered during the research are the sustainable and durable properties of the materials, as well as the processing.

3.4.1 COTTON

Each year, around 20 million tonnes of cotton fibers are recovered from the seed hairs of cotton plants (figure 12), providing 30-40 percent of the global fiber requirements (Cherrett, Barrett, Clemett, Chadwick & Chadwick, 2005). In 2001, only 6000 tonnes, or 0,03 percent, of the world's cotton production was organic according to an international market survey of organic cotton and eco-textiles (PAN UK, 2002). The survey indicates that Europe is the largest market for organic cotton since more than half of the world's production of the organic fibers (3500 tonnes) end up there. The production of cotton must follow certain standards to be labeled as organic, prohibiting any use of synthetic fertilizers and toxic pesticide (Cherrett et al., 2005). According to Boon et al. (1999), studies in the USA shows that the yields of organic cotton are 20 to 50 percent lower than conventional cotton, meaning that greater growing areas are necessary to fully replace the standard production. Further, due to increased costs in production and processing, the average price for organic cotton (in 2017) is around 50 percent higher than conventional cotton (Boon et al., 1999; Statista, 2018).



Figure 12. Cotton plant.

The major advantage of cotton is that the fibers are biodegradable and will break down over time if they end up in nature. The ecological downsides with cotton are that it requires a large amount of water and land area to grow. Myers and Stolton (1999) have calculated the amount of required water to about 9 million liters per hectare and growing season. Further, one hectare can provide about 400-800 kilogram worth of cotton per yield (Soth, 1999). The high demand for fresh water and land area, that often are limited resources, can be a cultural, social and ethical burden for the local population (Cherrett et al., 2005).

The properties of a cotton fabric are that it is breathable and moisture absorbing, making it comfortable to wear as clothing close to the body. Depending on the weave and finish, the fabric can be shaped to be both soft and strong. The durable downsides are that the material can shrink and the colors can fade when washed (Smith & Cotheren, 1999).

3.4.2 POLYESTER

Polyester is produced from crude oil which is a non-renewable resource that requires a large amount of energy to harvest. In addition, the polyester manufacturing process itself involves high energy inputs. Unless the energy is collected from renewable resources and the chemical usage are under high control, the production chain generates large amounts of both atmospheric and water-borne emissions that are harmful to the environment. (Laursen & Hansen, 1999; Franklin Associates, 1993).

In 2001, polyester represented roughly 30 percent, equivalent to 17 million tonnes, of the global fiber requirements (Stepanski & Rutti, 2003). However, this number has increased dramatically in recent

years. According to the analytic institute *PCI's Fibres Global Supply & Demand Report* (2017), the polyester demand of 2014 was 46 million tonnes. The report forecast that the demand for polyester will reach 70 million tonnes in the year 2030, compared to cotton that will stay around 30 million tonnes (PCI, 2017). Cherrett et al. (2005) thinks that the popularity of polyester depends on falling prices in combination with the textiles properties that make it stretch resistant, thermally stable and moisture repellent. A cotton and polyester price comparison from September 2017, received from the *Textile and Clothing Trade Information* (2017), shows that 1 kg of polyester was roughly half the price of 1 kg cotton. Recycled polyester uses PET as raw material, meaning it can be manufactured from plastic bottles that otherwise often end up in nature. Research published in *The Guardian* (2017) indicates that;

"Fewer than half of the bottles bought (globally) in 2016 were collected for recycling [...] most plastic bottles produced end up in landfill or in the ocean."

According to Cherrett et al. (2005), it requires up to 50 percent less energy to create polyester from bottles than creating it from scratch. Old polyester fabrics can also be recycled into new, reducing the dependence of oil that virgin polyester production requires. In compare to cotton that needs a large amount of water to grow, there is no such input in the production of polyester (Cherrett et al., 2005).

There are however issues with these type of materials too. Research has shown that polyester and other plastic based fabrics can release microscopic fibers, so-called microplastics, into the wastewater when washed. Some of the fibers are too small to be stopped by filters, which enable them to eventually reach nature. The amount of releases depends on the fabric structure, where fleece is one of the worst (Napper & Thompson, 2016; Roos, Levens-tam Arturin & Hanning, 2017). In the report *Microplastics Shedding from Polyester Fabrics* (Roos et al., 2017), the authors conclude that;

"When the microplastics enter animals and plants in the aquatic environment, they bring contaminants with hazardous properties with them." (p. 1)

The report suggests that microplastics can be reduced by ultrasound cutting in the sewing process together with a reduced brushing of the fabrics. Further, results in the report show that the tested sample of recycled polyester sheed about half the amount (843 fibers) compared to the virgin sample (1890 fibers).

The properties of polyester are that it is long lasting and can withstand a great amount of wear and tear. Polyester holds its shape well and will rarely shrink or fade. Since the fabric do not absorb water like cotton, it dries quicker. This does, however, cause the fabric to be less breathable (Thorpe, 2008).

3.4.3 CONVENTIONAL TEXTILE DYEING

The conventional way of adding colors to textiles and yarns are made from chemical dyeing. *The World Bank Group* (1998) estimates that the textile dyeing sector contributes to up to 20 percent of the planets total water pollution. According to Rita Kant (2012), the dyeing and finishing process of textiles is one of the most chemically intensive industries of today, using more than 8000 various chemicals. This is a reason why the industry is also one of the most common polluters of clean water. Many of the chemicals are a hazard for nature and human health. For an averagely sized textile fabric, it requires 30 to 50 Liters of water to dye 1 Kilogram of fabrics, and about 60 Liters per Kilogram of yarn (Kant, 2012).

3.4.4 NEW DYEING METHODS

The British newspaper *The Guardian* (2015) writes in an article that major brands, such as Nike and Adidas, are integrating new methods of dyeing fabrics to reduce the usage of water, chemicals, and energy. However, due to high costs and limitations, the new methods are still rarely present in an industry where consumers constantly searching for cheaper textile products.

The new dyeing technologies are depending on if the fibers of the fabric are organic or synthetic. This can be a limitation for brands that involves a large span of materials in their products. The company ColorZen focusing on cotton, where pre-treatment making the fibers more receptive for dye, which in turn significantly reduces the water, chemical, and energy consumption in the dyeing process (The Guardian, 2015; ColorZen, 2018). Other companies, such as Air Dyeing Technol-

ogy and DyeCoo, focusing on a waterless dyeing process of polyester, also significantly reducing the environmental impact (The Guardian, 2015). According to Kant (2012), Air Dyeing require 95 percent less water, 87 percent less energy, and emits 84 percent less greenhouse gas than conventional dyeing methods.

The main limitations of the new technologies are that it is more expensive, offers a narrower range of colors, and that different fibers require different techniques. As long as consumers demand low price textiles, companies will have a hard time to adapt to these unexplored and costly methods, making the development and improvements of the techniques slower (The Guardian, 2015).

3.4.5 ALUMINUM

Virgin aluminum is produced by refining the minerals bauxite and cryolite in a melting process, combining electric currents and temperatures of 950 degrees Celsius. It is a process that consumes high amounts of energy (The Aluminum Association, 2018). Recycling aluminum, on the other hand, requires just 5 percent of that same energy. Aluminum can be recycled indefinitely number of times and nearly 75 percent of all aluminum ever produced is still in use (The Economist, 2007; The Aluminum Association, 2018). However, according to the Aluminum Association Report (2011), recycled aluminum has its disadvantages too. For every tonne of melted aluminum, 200 to 500 kilograms of waste products are produced. This waste can be toxic to nature if it not being disposed correctly.

3.4.6 PLASTIC

Recycled plastic requires on average 30 percent of the energy it takes to create it from scratch (The Economist, 2007). Thorpe (2008) states that plastic only can be recycled a few times before it loose structure and quality. Overall, plastic has less strength compared to aluminum. Many of the plastics compositions can also get brittle when cold. An advantage of plastic compared to aluminum, however, is that plastic in general has a lower density, making it lighter and contributing to less greenhouse gas emissions when transported by methods using fossil fuels (Vert et al., 2012).

3.5 BRAND IDENTITY

Up until now, Spektrum's product categories has only consisted of eyewear. When starting a completely new line of products, it is necessary that the brand identity follows to maintain recognition and a strong product identity. Karjalainen and Warell (2005) states that this is of extra importance on saturated markets that involves many competitors. Further, studies are showing that product design can carry a strategic message and create recognition of the brand (Karjalainen, 2004; Warell, 2001; Muller, 2001). To describe product identity, Karjalainen and Warell (2005) states that;

"Product identity is largely constructed through visual recognition and brand-specific associations." (p. 1)

Product identity is created through either semantic transformation or formal syntactics. The first refer to the transference of the company's brand strategy and the messages carried by the products design cues. Design cues that later evolves into visual elements in the new products. The second, formal syntactics, is based on sharing these design cues in a consistent way to create recognition of the brand (Karjalainen, 2004; Warell, 2001; Muller, 2001).

3.5.1 IDENTITY TRANSFORMATION

Brand identity transformation can be divided into two types, *category-specific*, and *category-independent* (figure 13 & 14). When the visual design cues are transferred between products of the same type, e.g. computers made of Apple, it is category-specific identity transformation. It is easier to recognize design cues of products that are from the same category since they are interpreted in the same context.

Category-independent, on the other hand, is when the identity is transferred from one product type to another, e.g. an Apple computer to an Apple pen. With no similarities between the product type, the brand recognition must be based on explicit visual elements and brand signifiers. The obvious one is the brand's logotype, but it could also be form and integrated elements of the product (Karjalainen & Warell, 2005).



Figure 13. Illustration of Category-specific identity transformation (same product type).



Figure 14. Illustration of Category-independent identity transformation (different product types).

The brand identity of a product can be seen in two ways, a *syntactic* and a *semantic level*. The syntactic level is mainly sensory visual perception. It is described as the recognition of something that previously has been perceived without necessarily have any prior knowledge about the brand. According to Karjalainen and Warell (2005), research suggests that it is the first exposure of the products characterized main futures that can differentiate one product from another of the same type. By repetition of these characteristics in the products, recognition of the brand is continuously strengthened. An example of repetitive design elements is used by the brand Thule and their aluminum extrudes that can be found in a majority of their products.

The semantic level is on the other hand categorized by a cognitive mode, relying on the interpretation of meaning that is associated with the brand messages and values. In the example of Thules aluminum extrudes, it can be interpreted as a durable construction and associated with feelings as "strength" and "safety", that also are some of the brand values. The interpretation is dependent on the viewer's previous knowledge, experience, and cultural factors, making the communication more efficient within specific groups and contexts (Karjalainen, 2004).

3.5.2 DESIGN CUES

According to Karjalainen and Warell (2005), there are three different types of design cues of the visual product form. The first two are mainly related to the syntactic level, where the last is related to the semantic level. The three different types are described below.

- **Specific/explicit design cues;** Specific, refers to the design elements that are precisely definable and explicit to elements that are expressed without vagueness. Examples of this elements are consistent use of specific forms, materials, and colors in the whole product portfolio.
- **Non-specific/implicit design cues;** Refers to a general style and form identity and implicit to design elements that are not fully distinguishable. This can be created by brand-specific association rather than appearance.
- **Qualitative characteristics;** Connection and consistency of product messages through the product portfolio that support the brand core values and identity. These design cues are often passed through product generations to establish and communicate a strong brand message. The elements are communicated through visual design cues and involves sign interpretation of the observer. For example, Thules characteristic aluminum extrudes can be found on their strollers (figure 15), not necessarily for function, but rather as a design element to express "safety".

3.6 PROTOTYPING

According to Buchenau and Suri (2000), a prototype is the representation of a design before the existence of the final item. IDEO (2015) states that prototyping is a fast method to explore ideas and make them tangible. It is also a quick way to learn through making and get key feedback from the users that the product is designed for (IDEO, 2015). Kelley (2001) agrees and continues that a consumer product often requires a physical prototype when developed. Ulrich and Eppinger (2001) state there is a wide range of prototypes and they are often displayed as a physical or digital object. The prototypes can differ in levels of fidelity and properties, where different variants are more suitable for different stages of the design process (Ulrich & Eppinger, 2012). Mock-up prototypes are typical of low or mid fidelity, built in an early stage. They often consist of basic materials such as foam or paper to examine form or other properties such as ergonomics (Ulrich & Eppinger, 2012). Ulrich and Eppinger (2012) describe that function prototypes can range between low to high fidelity and that they often are built to verify functions or technical solutions. This can be important in a design process to prove the feasibility of the concept for stakeholders. They further state that a prototype that is built with parts and materials similar to the intended end product is of high-fidelity and called an Alpha prototype. These types of prototypes are often built in a later phase of the process (Ulrich & Eppinger, 2012).



Figure 15. A stroller from Thule with the brand's characteristic aluminum extrudes.

4. METHOD



Supported by theory, this chapter describes the methods of the project as well as how they were executed. Starting with the project process and planning, it continues with an in-depth review of the three main phases; *Inspiration*, *Ideation*, and *Implementation*.

4.1 PROJECT PROCESS

The project process was based on the three activities mentioned in the field guide of Human Centred Design (HCD) developed by the design organization IDEO (2015). The activities are; *Inspiration*, *Ideation*, and *Implementation*, which all will be described further down in this section. Rather than following the process linearly, IDEO encourages the designer to iterate between phases. The method suggests a great mix of interaction with users, highly abstract design thinking, prototyping, and testing as natural parts of the phases.

The aim of the HCD process is to arrive at solutions that are desirable, feasible, and viable. Starting by examining the human needs, the results often reveal what solutions that are most desirable. With a range of solutions, the focus should shift to the ones that are technically feasible and financially viable to implement. IDEO (2015) describes it as an important objective that requires a lot of room for consideration.

"It's a balancing act, but one that's absolutely crucial to designing solutions that are successful and sustainable." (IDEO, 2015, p. 14)

When cycling the activities in the HCD process, the ideas and solutions are continuously diverging and converging, bringing the designer closer to a market-ready solution. This model is described by The British Design Council as the double-diamond model and is divided into the four stages; *Discover*, *Define*, *Develop* and *Deliver* (BDC, 2007). The process in this project is a combination of HCD and the double-diamond model, where HCD gives an overview of the entire project and the model describes the work process from a general problem A to a specific solution B (Figure 16).

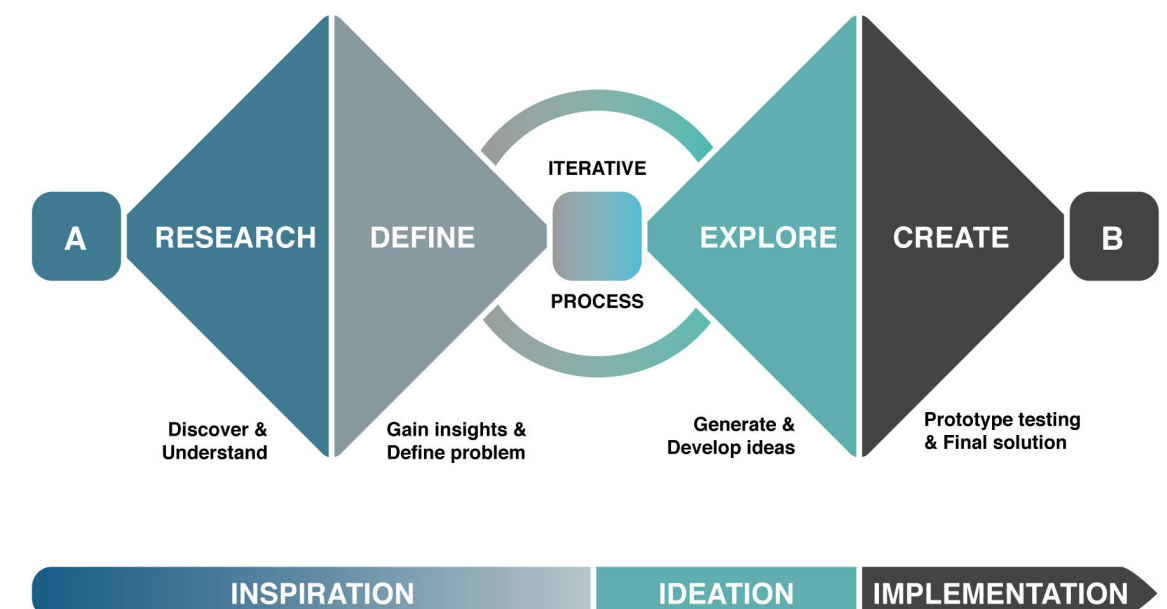


Figure 16. Illustration of the project process showing the Converging and Diverging phases from a general problem A to a specific solution B.

The first phase, *Inspiration*, consist of two main activities; *Research* and *Define*. This phase is to understand the users and their needs. It is done by collecting data and information from users together with researching the market and examine current solutions. The data is then defined to be graspable. The second phase, *Ideation*, use the main activity *Explore* to examine possible solutions and generate a large space of ideas from all that is learned in the previous phase. It is also where to develop the opportunities for design and test different solutions. The third and final phase, *Implementation*, have *Create* as the main activity. This is where the final prototypes and testing takes place. This is also where the solution will come alive along with a plan on how to bring it to the market and maximize the impact.

4.2 PROJECT PLANNING

In a project like this, it is important to have a well thought out plan that covers the main activities and stages of the project from start to finish. A standard method is to set up a timeline where important activities and deadlines are marked. The main purpose of the planning, besides getting started with the project, is to discuss and clarify what the project is all about. The plan will make it easier to follow up and evaluate the different stages. One should be aware of that situations and conditions can change over time, making it hard to follow the plan to the letter. It is therefore important to always check the plan and be prepared to rethink it. The project plan is not only a helping guide for the designer but also an agreement with the employer or supervisor (Wikberg-Nilsson et al., 2015).

The project plan was the first thing that was conducted in the project. It included the design brief as well as aims, goals, and limitations of the project. The timeline, fully displayed in appendix A, was divided into months and weeks, where every set of activities were dated with deadlines. The plan was printed out in physical form to continuously check off the activities along the way.

4.3 INSPIRATION

This section presents the methods used in the initial steps of the project. It includes descriptions of research methods and how data was collected and interpreted.

4.3.1 BENCHMARKING

The main sources for the benchmarking were sport, urban, and outdoor stores on the Internet along with online reviews of different models. A majority of the online-stores had detailed specifications of the materials and functions of the bags, showcased with high-resolution pictures. Physical stores in Luleå, Östersund, and Åre were also visited to interact with functions, take measurements, and get a feel for different materials. The range of bags offered by different type of stores was compared to each other. How did the bags in a mountaineer oriented store, like Åre Skidsport, differ from an outdoor store as Naturkompaniet or a street fashion store as Volt?



Figure 17. A skiing backpack found at Åre Skidsport (to the left) compared with an urban backpack found at Volt (to the right).

Camera bags and travel suitcases were also part of the benchmarking. Other product segments, such as clothing and storage solutions, were as well explored in the search for different materials, styles, and functions. To look even further, completely different branches were examined to collect inspiration on different ways to attach and store equipment in a convenient way. An example of brands looked at was Thule that, among other things, develop roof racks and boxes for skis and snowboards.

4.3.2 LITERATURE REVIEW

A literature review was made to gain knowledge about the involved subjects and to collect relevant theory that could support the final result. The method is described by Milton and Rodgers (2013) in five stages. The first stage is to formulate questions that will be the main purpose to resolve. Next stage is that the data collection should be defined and the sources should be preferably reviewed articles. The third stage is that the data should be evaluated to examine if it holds high quality and validity. The following stage is that all the major findings based on qualitative or quantitative data should be interpreted and analyzed. Last, the results should be presented as comprehensively as possible to ensure the audience understanding.

All of these five steps were followed when doing the literature review. A majority of the research in this project was obtained in an early stage, to later be complemented along the way. The main areas, and the keywords used when researching were; *Industrial Design Engineering, Human Centered Design, Sustainable Design, Anthropometry, Recycling, Brand transformation, Needfinding*, as well as the names of relevant materials. The majority of the sources are peer-reviewed articles provided by the library search engine at Luleå University of Technology. Books and online articles were also sources of information, although with a higher skepticism against reliability.

4.3.3 MOOD BOARD

The mood board displayed in the context chapter (Figure 8) was created in an early phase of the project to develop a feeling for the brand, their values, and expression. By pictures, it showcases interpretations of the brand Spektrum based on my own experiences with their values and products. The purpose of the mood board was to help the audience, including myself, to trigger senses and feelings of the brand. It was also used as a tool to check if the developed designs followed and expressed the same theme and brand message as the current products. The pictures are creative commons and were found on the online gallery engine Pexels. The keywords used when searching were; *Snow, Skiing, Adventure, Nature, Exploring, Urban*, and *Sustainability*. These are apparently words that Spektrum want to associate their brand with, since they are found as hashtags in many of their Instagram pictures on social media. Calm pictures without too much noise were selected to

leave better room for interpretation to the observer. The colors in the mood board were also an inspiration for a palette that alludes to earth tones, sustainability, and nature.

4.3.4 INTERVIEWS

Interviews are not only an effective method to get knowledge about people's feelings and thoughts, it is also a great way to understand stakeholders and how they relate to a subject. (Wikberg-Nilsson et al., 2015; IDEO, 2015) The design organization IDEO (2015) states that;

"There's no better way to understand the hopes, desires, and aspirations of those you're designing for than by talking with them directly." (p. 39)

In compare to questionnaires, interviews make it easier to avoid misunderstandings and misinterpretation, since the investigator can ask for refined answers when in doubt. A semi-structured interview can further the understanding of the responses with follow-up questions on issues of importance. This interview form can open up to a discussion, resulting in entire new insights that were not taught about before the interview started. The limitations of interviews are that they are time-consuming and that the quality depend highly on the investigator and the participant's abilities to ask and answer to questions. When the investigator is present, the participant's anonymity is breached and they may hold back strong opinions or distort the answer to better suit the listener (Jordan, 2000).

Expert interviews

The design kit of IDEO recommend the designer to interview experts to gain valuable perspective on topics of their knowledge. IDEO (2015) state that;

"Experts can get you up to speed quickly on a topic, giving you key insights into relevant history, context, and innovations." (p. 43)

In the beginning of the project, a semi-structured telephone interview was held with Hampus Östberg, a senior industrial designer that has designed a variety of backpacks for large outdoor brands including Peak Performance and Haglöfs. The purpose of the interview was to gain knowledge about

the process, from sketch to final product, and also to get tips on how to succeed in the design and avoid common mistakes. A few questions were prepared to get the interview started, but with all of Hampus experience, the conversation was quickly flowing naturally, lasting for almost two hours. The interview was recorded to ensure that nothing important was forgotten when it later was transferred to text. The interview questions are to be found in Appendix B.

A half hour semi-structured interview was held with Henrik Köhler, that beside being co-founder and design chief of Spektrum, also is a senior designer of sport outerwear for the brand Cross. The main purpose of the interview was to get an insight in the latest and upcoming trends regarding clothing within the sport and outdoor industry. Topics about fashion, trends, materials, colors, and sustainability were discussed.

Another semi-structured Interview was held with Robert Olsson that is a senior designer at the outdoor brand Haglöfs. The interview lasted for about 30 minutes in connection with another meeting. The main topic were about technical solutions, such as zippers, water sealings, and overall durability. Since Haglöfs is one of the leading outdoor brands in sustainability, frequently using bluesign® approved materials in their products, I took the opportunity to ask questions about that too. The questions are fully displayed in Appendix B.

User interviews

The method of Semi-structured interviews continued with typical users from Spektrum's main target group. The selection was based on metrics provided by Spektrum. To get a great variety, the participants were selected by different genders and ages, along with different styles and experiences. The interviews were held face to face or over the telephone, where the person was asked to either show or describe their current solutions along with its advantages and disadvantages. There was ten user interviews in total, where the participants extended all the way from Spektrum team athletes, to users that rather spend their time in the cities than on the mountain. Open questions, presented in Appendix B, were prepared in advance and follow-up questions were asked continuously whenever an interesting topic or new insight was brought up. Each interview took about 30 minutes to complete.

4.3.5 FOCUS GROUP

In *Design: Process och Metod*, Wikberg-Nilsson et al. (2015) describes a focus group as a selected group of people, preferably 3-7 persons, discussing a defined subject. The participants are often selected from the specific target group and the answers are expected to be on a more general level than in an interview. It is a good idea to prepare a few topics or questions, but the purpose of the method is to let the participants build on each other's questions or opinions. A focus group can be conducted at the beginning of a design process to get a better understanding of the users current solutions and needs. A focus group that represents the target group can be a helping factor to evaluate concepts in a later part of the process. To get the best out of the session, it is important that the facilitator is well prepared and gives everyone the change to speak (Wikberg-Nilsson et al., 2015).

In this project, a focus group was conducted in an early stage with the purpose to better understand the user's needs and current solutions. An invitation was sent out among selected Facebook friends, who was known to have expert knowledge in backcountry skiing and snowboarding, resulting in six persons attending. The participants were a mix of male and females, snowboarder, and skiers that were aged between 20 and 30 years old. They were requested to bring their current backpacks and duffel bags to be examined and serve as inspiration during the session (figure 18-20).

An introduction to the design brief and a few open questions (Appendix C) was prepared to get the group started. The discussion was kept on going for about two hours. When a subject had been discussed for a while and was about to die out, a new question or point of view were thrown in the conversation making the debate constantly flowing. Markers and papers together with skis, snowboard, and associated equipment were within close reach in the local if thoughts had to be illustrated or tested out. The last half hour was strictly dedicated to idea generation of solutions to current problems. The ideas were both sketched and described in words on paper.



Figure 18. The participants of the focus group share their expertise. (Berglund, S. 2018)

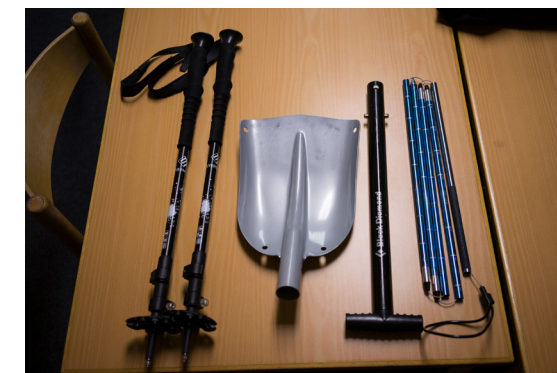


Figure 19. Equipment used on the mountain was in close reach if anything had to be tested out.

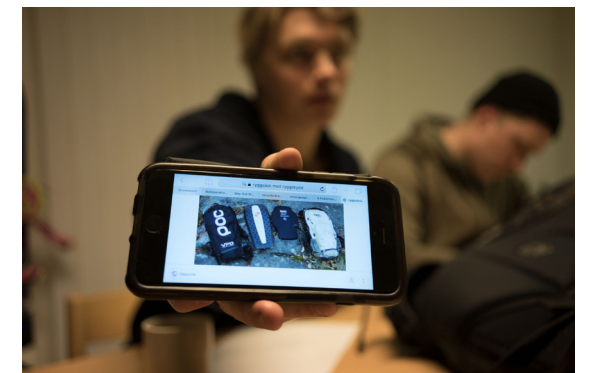


Figure 20. The participants had great experience of different solutions offered at the market today.

4.3.6 PERSONAS

One of the main principles of Human Centered Design is that the process focus upon user needs and requirements. Though, it is not always appropriate or possible to involve real users in a design process (Grudin & Pruitt, 2002). Approximations of the end users can be done to better understand the requirements of the design. Grudin and Pruitt (2002) suggest that a useful method to understand a design problem is to present it as a scenario, but continues that the weakness of a stand alone scenario is that it is not engaging.

A persona is a fictional person, described as a real person, with attributes as name, gender, age, interests, goals and tasks. The information about the persona is based on collected data from other

research methods. The purpose of the persona is to identify user requirements. Scenarios could be constructed around the persona to enhance the experience. Important is that the persona should be treated as a real person, rather than as an actor in a script (Grudin & Pruitt, 2002; Marshall et al., 2013).

Typical, 1 to 7 personas with different goals and behaviors are recommended to support a project according to Saffer (2007). He further state that personas have a psychological focus, and will define what the users actually want from using a product. A persona can also be used as a communicate tool to ensure that all stakeholders have the same understanding of the customers and their requirements (Saffer, 2007).

With years of collected data from online sells, social media and customer contacts, Spektrum has been able to precise their target group. From this data combined with all of my collected data, three descriptions of archetypical users could be extracted and developed to personas. To make the personas more engaging, they were illustrated with portraits and associated with a scenario. The personas were then used throughout the rest of the project and performed tasks such as concept decisions and evaluations.

4.3.7 LIST OF REQUIREMENTS

With all the collected data, certain needs could be determined and listed. The majority of the needs sat requirements on functions, others on style. To get an easy overview, all needs and requirements were categorized into topics and compiled into two lists, one for the duffel bag and one for the backpack. The topics are listed below followed by a short description. The complete lists of requirements can be found in Appendix D.

- **Manufacturing;** Including max costs and demands on the materials.
- **Outside attachment;** Listing the needs of the attachment system for skis, snowboard, and other equipment. The usability of the attachment was also included.
- **Carrying system;** Involves both the usage of carrying the bags on the back and in the hand, as well as requirements for support straps.
- **Inside storage;** Everything that concerns access and organization. Some of these needs were of extra importance due to the matter of avalanche safety.
- **Style;** The mutual requirement for the duffel and backpack was to reduce the amount of loose hanging straps.

4.4 IDEATION

In this phase, the collected data from the inspiration phase was processed and transformed into ideas and concepts. The stage initiated with creative methods and sessions to create a large space of ideas and solutions. Mock-up prototyping was an ongoing process throughout the phase to quickly evaluate solutions.

4.4.1 WORD ASSOCIATION

One of the first creative methods used was Word Association. The purpose is to create a list of words that relate to the project in one way or another. The list can work as support for other creative methods, or be an inspiration when the designer get stuck in the design process (Lykke-Nielsen & Ingwersen, 1999). The list was created by writing the first word *Spektrum* down on a piece of paper. Next, a word associating with the first was written down. This was repeated several times to conduct a long list of words, each associated with the previous. A goal of at least 50 words was set and it took about 10 minutes to reach the desired amount, all displayed in Appendix E.

One of the problems, and sometimes strengths, with the method is that associations rapidly can stretch far away from the main topic. When the words no longer make sense to the subject, a new relevant word can be selected to continue on. However, non-related words can still inspire the creative process and contribute to a larger space of ideas (Lykke-Nielsen & Ingwersen, 1999).

4.4.2 WORKSHOP

A workshop is a method to gather a group of people, that can be experts, stakeholders or persons that are completely unrelated to the project, and in a creative way examine a specific subject. The main purpose of a workshop is to use the collected creativeness, ideas, and solutions generated by a whole group of people. (Westerlund, 2009; Wikberg-Nilsson et al., 2015).

Planning the workshop

A room with large windows, high ceiling, white-board walls, and movable furnitures was booked to inspire creativity. Wikberg-Nilsson et al. (2015) suggest that up to 25 persons are a good amount of participants in a workshop. I tried to reach out

to as many as possible and had a great support of Spektrum that contributed with a free pair of goggles that could be raffled amongst the participants in the end of the session.

To get an idea of how many participants that would appear, a Facebook event was created and shared through the university social media channel. The duration was set to one and a half hour, based on a planed schedule. Since the experience of the participants was unknown, the plan was to bring different types of equipment and gear in inspirational purpose. A packing list was created and checked to ensure that everything was included on the day of the workshop.

Execution of the workshop

The workshop was held at Multistudion at Luleå University of Technology with the aim to collect a wide range of ideas. The workshop started with a presentation of the agenda and the project brief, followed by a short introduction about the brand Spektrum, their current products and reorganization towards more sustainable products. I asked permission to take photos during the session to ensure that all the participants accepted any type of appearance in a future publication of the thesis. There were 11 participants in a mix of genders and ages, where the majority were design students. There was also a great mix of experience regarding outdoor activities, resulting in a whole bunch of new approaches to problems. The workshop was led by me as a facilitator, focusing on instructing and encourage the group, keep times and document the whole session. The workshop consisted of three main tasks, presented in the following pages.

Task 1; The first task was of a playful character to make the group get in a good mood and practice creativity. The purpose was to exercise lateral thinking, described by Edward De Bono (1993) as a way to boost creativity and get away from standard logical thinking. Therefore the instructions were to not hold back on ideas, even how unrealistic they may be. The aim was that the group should continue in this mindset for the rest of the workshop.

The big group was divided into smaller groups by three. Each group had three minutes to write down as many advantages as they could think of on the topic; *flying an aircraft upside-down*. The partic-

ipants discussed and elaborated on each other's ideas within the group. In the end, the groups were asked to describe their craziest ideas. For example, one advantage could be that;

"All your blood is rushing to your head, eventually making you hallucinate, which holds you stimulated through long-distance flights."

These kinds of presentations was followed by a good laugh, making people comfortable with each other and not afraid to present unlogical ideas later on.

Task 2; The second task was a Braindrawing session based on pre-defined subjects. Braindrawing is a creative method to receive a quantity of sketched ideas in a short matter of time (Wikberg-Nilsson et. al 2015). The participants had two minutes each to individual sketch their ideas on a paper before it was sent to the next person in the circle to either continue on, or draw something completely new to. The direction of the passes was changed to mix styles. The purpose was to inspire each other and generate a large variety of ideas and styles. The topics are listed below.

- Draw a backpack.
- Draw how to attach your equipment (skis/snowboard/other) on the backpack.
- Draw an environmental friendly backpack.
- Draw how the backpack would save you in an avalanche.
- Draw a luxury backpack.
- Draw another area of use for the bag.

All the sketches were then collected to be interpreted at a later stage. This followed by a short coffee break to raise energy levels before the final task.



Figure 21. Braindrawing session during the design workshop.



Figure 22. Overview of the workshops different stations.

Task 3; The final task was an in-depth idea generation around different problems. This exercise was performed at four different stations with props that were placed out in the room. Again, the group was divided into smaller groups of three. The groups were spending 10 minutes on each station before they rotated to the next one. On each station, there were different props that could inspire or help the group with a better understanding of the problem. I was walking around the stations to answer questions, take photos, and make sure that none of the groups got stuck. After all four rounds were done, the whole group gathered on one station at the time to discuss their solutions. The stations and the problem questions are listed in the following section.

- **Attachment;** How to attach skis or snowboard in an easy and efficient way? How to attach other equipment such as helmets or poles?
- **Functions;** Where to put the chest and waist-strap when not in use? How to reach shovel and probe in a fast and easy way?



Figure 23. Testing and interaction was a natural part of the workshop.

- **Sustainable design;** How should the bag communicate sustainable design? Which other sustainable values can the bag contribute to?
- **Organization duffel bag;** How to hide or use the shoulder straps in a creative way? How to organize the inside of the bag?

Before the ending raffle, the whole group was thanked for their participation and engagement. A question about the experience of the workshop resulted in solely positive feedback on the arrangement and execution.

4.4.3 BRAINSTORMING

Brainstorming is a well known creative method and today there are a lot of variants that builds upon it. The original method was first published by Alex Osborn in the book *Your Creative Power* (1948), with a few rules to follow. These rules can be applied to all other versions to prevent limitations on the creative thinking. The basic rules are that; *no ideas should be criticized*, *spontaneity should be encouraged*, and *the aim is quantity before quality* (Osborn, 1948).

A brainstorming session could be done individually or in a group, both of them with their different advantages. Diehl and Stroebe (1987) state that people are more creative when brainstorming on their own due to certain aspects. First, they can work at their own pace, when and wherever they want, driving their own idea generation when they feel creative. A silent and retrieved participant can get blocked in group sessions, a restraint that not occur if they are alone. Last, the fear of sharing crazy ideas may prevent people to express them in groups, perhaps missing out on the really creative solutions. In another hand, individual brainstorming lacks the shared experience and expertise that a group session can provide. The advantage of adapting or get inspired by others ideas are also missing (Deihl et al., 1987).

Since the project was done by only one designer, instead of a whole team, the brainstorming sessions were done single handed. Instead of shouting out the ideas in mid-air, they were rather written or sketched down on papers. According to IDEO (2015), there are many benefits from get-

ting visual in a brainstorming session. The ideas get more tangible and will help to clarify the designer's thoughts. IDEO (2015) continues that it is often easier to express and explain even low-resolution drawings to stakeholders. Further, the visualizations do not need to be limited to drawings, other suggested methods are clay or collagen.

Even though the task was done individually, the rules mentioned by Osborn (1948) was followed and all kind of ideas, crazy or realistic, were noted. This was an effective method to remember early ideas throughout the entire project. To keep focus during the sessions, a timer was set for 15 minutes intervals to brainstorm on a subject or a randomly picked word from the previously created word association list. When the alarm rang, there was time for a 5-minute break before a new 15-minute session on a new topic started.

4.4.4 CREATING CONCEPTS

According to the field guide of IDEO (2015), there are some basic criterias for a concept. A concept can be a combination of many ideas, still, it has to be more complete than an idea. The concept is what the designer should push forward and continuously refine. Further, the look of the concept should be of higher quality so it single-handedly can answer for the design challenge. IDEO (2015) recommend the designer to keep referring to the design challenge to ensure no elements are missing in the solution.

To get an easy overview, all the ideas gathered from the ideation phase were taped up on a wall in the categories; *Attachment system*, *Carrying system*, *Straps*, *Style*, *Organization*, *Sustainability* and *Darkhorse*, where Darkhorse was unrealistic or far-fetched ideas. Since the same ideas could be implemented on both the duffel and the backpack, the models were not divided. Ideas and solutions from each of the categories were then combined with the aim to create robust and realistic concepts of both the backpack and the duffel bag. Some of the concepts had to be tested out with quick prototypes to ensure function.

4.4.5 MOCK-UP PROTOTYPING

Mock-ups are often full-size models to evaluate form, function, ergonomics, or movement. These kinds of models are preferably used in an early stage of the project to try solutions or do user testing (Ulrich & Eppinger, 2012). Mock-ups involves sketching and building prototypes, that gets refined until the solution fits the context (Wikberg-Nilsson et al., 2015). The objective with these kinds of early mock-up prototypes is to quickly validate and improve theoretical solutions. The method is often used to test function rather than aesthetics, preventing the designer from wasting too much time on each prototype.

The early full-size prototypes were built on existing bags with the purpose to test usability and function on certain details of the concepts. The advantage of a full-size prototype is that it could be tested and evaluated with real equipment such as skis and snowboard. The mock-up of the backpack was created with external straps and carbine hooks to test the attachment system. The carrying system of the duffel bag was built by cardboard, tape, and straps to test and examine how it would carry by hand and on the back by different users.

Even though the mock-up method is a fast way of testing solutions, only certain details could be validated and not the product in its whole since the

prototypes weren't created from scratch. Therefore, a mock-up should be followed up by a higher fidelity alpha prototype (Ulrich & Eppinger, 2012). With validated solutions, the next step in the process was to create concepts and technical drawings that could be produced into alpha prototypes.



Figure 24. A mock-up prototype of the duffel bags carrying system.



Figure 25. A mock-up prototype of the backpacks attachment system.

4.5 IMPLEMENTATION

This section presents the last step of the process where the evaluation and design of the final concepts were made. The evaluations were conducted by the list of requirements, the personas, and the team of Spektrum. Further, the technical drawings and all other relevant methods used to develop the alpha prototypes are described.

4.5.1 FINAL CONCEPT EVALUATION

A concept evaluation process plays a critical role to converge the remaining concepts to a graspable amount. (van Boeijen et al., 2014; Zhai et al., 2008). Zhai et al. (2008) describe that it can have a large effect on the final product;

"It (the concept evaluation) has significant impact on the downstream development processes as well as on the success of the product developed." (p. 1)

According to van Boeijen et al. (2014), the product concept evaluation often includes experts and stakeholders. Further, it is more common to use representatives or data from the target group rather than users themselves. Three evaluation methods, presented in the following section, were used to reach two final concepts.

List of requirements

The list of requirements was the first evaluating method used to converge the large space of concepts. It was conducted by simply comparing them to the list, checking them off one by one, and putting aside the ones that did not reach all the requirements and needs. Next, the concepts that passed were evaluated by voting, first performed by the personas and then the Spektrum team.

Personas

The personas, representing the users within the target group, were used in the evaluating process. It was performed by me through the eyes of the personas, strictly based on their needs and requirements retrieved from their profiles and scenarios. By doing so, the risk of affecting the voting by my personal opinions was significantly decreased. The concepts were evaluated one by one and scored from 1 to 5 (where 5 was the best) on how well the concept fulfilled their needs. The three best con-

cepts of each model that scored highest by the personas were then passed on to the final evaluation.

Spektrum team

The remaining concepts were displayed to the designer and board members of Spektrum, during a meeting in the office. The session involved feedback on each design followed by an open voting to decide the final concepts. According to Spektrum, the decisions were mainly based on style, function, manufacturing costs, and the expression of the brand message. Finally, there was room for discussion to transfer specific functions or design elements from the concepts that did not make it.

4.5.2 TECHNICAL DRAWINGS

The final concepts of the backpack and the duffel bag were transferred into digital technical drawings of high fidelity. This was also where the brand transformation was made. The brand's design cues and identity, such as the use and placement of logos and colors as well as certain form and materials, were retrieved from Spektrums 2018/2019 collection of goggles. The collection consist of three standard models, as well as a black line version, which all were compared to find visual design cues that could be listed in a table to get a better overview of common or conflicting design elements (Appendix F). Different shapes, features, and forms were tested out in the technical drawings under the supervision of Spektrum's designer. Examples of this can be seen in figure 26, where form elements are transferred from a Spektrum G007 goggle to the hooks of the bags. The different designs were also shown to the rest of the Spektrum team, as well as to independent observers, to see which design that best conveyed brand recognition.

All the technical drawings were made in the illustration software Adobe Illustrator. According to the experts interviewed, Adobe Illustrator is the branch praxis to use when doing technical drawings for the textile industry. The products had to be presented in different angles along with measurements of every part and detail. A great advantage with Adobe Illustrator is that you continuously can duplicate and add to sketches, making it a really fast way to go back in history and do changes. It is also an effective and fast method to multiply a bunch of bags and highlight different features and details on them individually. The technical drawings consisted of all the six views to display

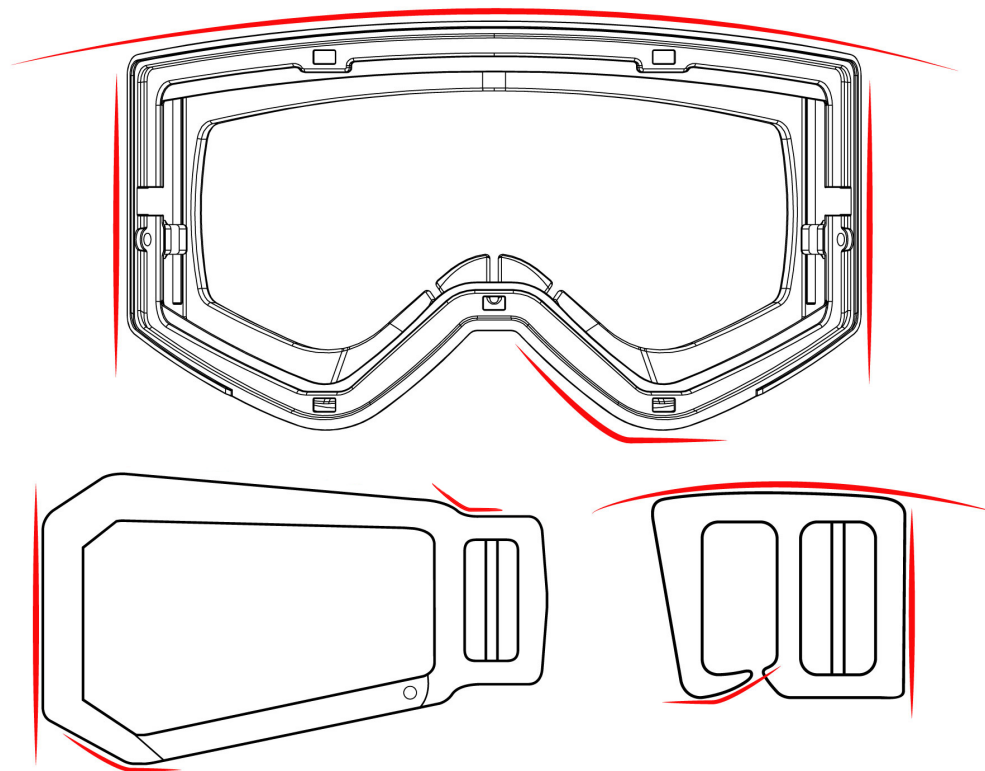


Figure 26. Identifying and transferring form elements between the different product categories.

a 3D-object. A perspective- and inside view was also added to cover the full geometry. The fill colors used in the drawings were white and grey. A contrasting red was used to highlight details and measurements. Minor details in the designs were added along the way as long as it improved the design without affect any of the personas negative. For example, if a zipper puller made it easier for all the personas to access a pocket with or without gloves, it brought a value to the design and was added. In addition to the bags, the hooks, buckles, and zippers were also designed in Illustrator.

4.5.3 MEASUREMENTS

The maximum and minimum measurements of the backpack were determined by the ability to use it while riding. If the backpack turns out to be oversized, it risks being too heavy and bulky for a day on the mountain. A too small backpack, on the other hand, will limit the ability to hold packing and necessary avalanche gear. By the benchmarking and collected data from the interviews and focus group, a great over-all size was determined to be around 20 Liters.

Henry Dreyfus anthropometric charts (1967), displaying the 5th to 95th percentile of men and

women, were used to determine suitable measurements of the backpack to make it ergonomic for the majority of the target group. With the volume of the backpack already established, the allowed maximum and minimum measurements could be determined by the charts. To cover the broad field of users, the parts of the backpack that was in connection with the largest differentials of the human body needed to be adjustable. The adjustments were placed in the shoulder straps, as well as the waist and chest strap. Since the duffel bag also would work as a backpack, these specific measurements were possible to transfer to that design.

One of the important demands of the duffel bag was that it had to take as much packing as possible, but still be sized for the standard requirements of airplane hand luggage. Different airline requirements were compared and the maximum measurements were set with a final size that equals about 40 Liters. Besides the measurements already developed for the backpack, the handheld parts of the duffel bag were also considered with the anthropometry charts (Dreyfus, 1967). The reason was to ensure that a majority of the users can carry the bag with a straight arm by any of the bags different handles, without it touching the ground.



Figure 27. All measurements in the technical drawings were replicated with tape in scale 1:1.

The mock-up prototypes, as well as benchmarking of existing backpacks and duffel bags, were also used to determine certain measurements, form of padding, and technical details. To ensure all measurements in the technical drawings were correct, the parts were replicated with tape in scale 1:1 on a table (figure 27). Skis and snowboard were later placed on top of these shadow images to do a final sizing of straps, details, and placements.

4.5.4 EXTERNAL REVIEW

Robert Olsson, an Åre based designer for the outdoor brand Haglöfs, was invited to Spektrum's office to take a look at the technical drawings. With long experience of textile outdoor products, he observed certain details that needed to be redesigned to ensure the best possible outcome of the bags. The most significant change was the back access to the main compartment of the backpack, where the zippers would expose a high amount of stress when heavy equipment is attached. The back opening is something often seen on camera bags to easier load large and fragile camera gear into the main compartment. The extra lever of outside attached skis or snowboard was not thought through when doing this first design. Robert said that it would be possible to reinforce the feature, but with the consequence of drastically exceeded manufacturing costs. To prevent this, the placement and construction of the zippers were re-designed to ensure better strength properties, without conflicting with the list of requirements.

4.5.5 MATERIAL SELECTION

When working with textiles, you soon experience how much slight changes in the material properties drastically can alter the feeling, behavior, and finish of a fabric. Rather than screening pictures and lists of material compositions, the fastest way to get an understanding of the material is to physically interact with it. Several binders of textile samples were ordered from the backpack manufacturing agent Baruma, located in Gothenburg. The samples consisted of both cotton and polyester-based fabrics, as well as recycled and virgin materials. The thickness, structure, and flexibility varied a lot among the samples, where some even were covered with a water repellent or reinforced coating. Some of the samples are pictured in figure 28.

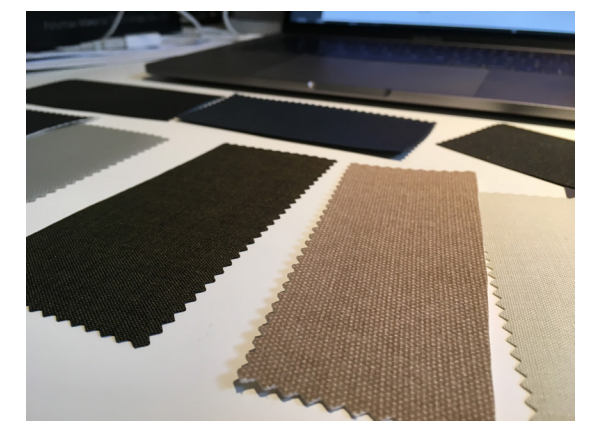


Figure 28. Organic and synthetic textile samples with different properties.

Samples with relevant properties were selected and smaller specimens were cut out from the binders. The concerning factors during the selection were; *sustainability, recyclability, durability, stiffness, texture, and water resistance*. The specimens were then compared or combined with each other to form drafts of different compositions. The first evaluation was made in form of scratch and water repellent tests. These were simply executed by ripsing the sample with a scissor, seen in figure 29, and by rinse it under water. The samples that passed the test were then evaluated in consultation with Spektrum to select the final materials by looks and feel.



Figure 29. Scratch test executed by ripsing the sample with a scissor. The left sample is unharmed, whilst the right one leaves marks.

To enhance brand recognition, four colors were selected from the 2018/2019 season of Spektrum goggles, where the color palette uppermost was consisting of dull earth tones. The selection was a mutual decision made by me and Spektrum's designer, basically performed by examining colored versions of the technical drawings (figure 30). A contributing factor, however, was metrics of which colors of the goggles that sold the best. The selected colors were white, black, blue, and yellow.

4.5.6 DRAWINGS SUBMISSION

The technical drawings and material references were sent to Urban Wallbert at Baruma in Gothenburg, Sweden. Baruma is an agency with close contact to textile factories and prototype developers in Asia. Urban was very impressed by the execution and approved the drawings the same day. From this point, Baruma was handling all the contact with the factory. The manufacturing of the alpha prototypes was estimated to 3-4 weeks. A few extra weeks for transport and eventual delays were added to the time plan.



Figure 30. Spektrums next season color palette was tested on the technical drawings. The bottom four colors were finally selected.

4.6 METHOD DISCUSSION

In this section, the reliability of the used methods is discussed. Own thoughts and evaluations of the methods, along with their advantages and disadvantages, are also presented. Some of the discussion is about how to improve the methods for anyone who wants to replicate them.

4.6.1 PROCESS & PLANNING

By combining the framework of HCD with a model that specify the diverging and converging phases, a more detailed and foreseeable design process could be established. Since the products in this project are developed for humans, it felt natural to use a human-centered process. HCD was chosen over other user-focused processes due to its reputation of being a modern, proven and well-recognized design framework (Norman, 2013; IDEO, 2015). Stakeholders, in the form of users or Spektrum representatives, were continuously involved whenever it was possible to get the best out of the process.

The project planning was based on the design process and its different phases. Since the tasks and scope of the project were not completely settled at the time, the timeline was roughly made with some deadlines that only could be guessed. With a physical copy of the timeline, notations and arrangements could be done along the way to keep it up to date.

4.6.2 INSPIRATION

The research was an ongoing task along the whole project, focusing on theory and market analysis. Since I have personal experience in subjects like freeride skiing, part of the research was made to support my own knowledge. This was due to the risk of relying on own assumptions, that could be proven wrong. My aim has been to use multiple sources for the statements. This, however, has been hard to do consistent, either depending on the lack of existing research within a specific subject or by the limitation of time.

The mood board is not scientifically reliable since it was created by my own interpretations. The content was based on creative common pictures, that drastically decreased the search field. Further, cultural differences or previous experiences can

make the interpretation of the mood board vary by different observers. The mood board should be observed as an inspiration rather than a statement.

4.6.3 DATA COLLECTION & EVALUATION

The interviews generated a lot of answers from both experts and users. By doing them individually and on a pre-scheduled time, no other distractions had to be considered. All questions asked were answered and due to the semi-structured form, additional information was also contributed. The downside of the method is that it can be hard to know what questions to ask to get the most out of the interview. To ensure that no future doubts should appear, the participant's contact information were saved to eventually be used in a later stage if something had to be complimented.

The participants of the expert interviews were mainly selected by recommendations. The first expert interview with Hampus Östberg was of natural choice, since he had performed my journey once before and possessed a lot of valuable information. During the first interview, names of other experts within the industry were dropped, that presumably had better knowledge regarding certain topics.

The user interview selection was based on Spektrums own metrics of users within their target group. To differentiate and not only targeting the core, representatives from all edges of the target group were selected. A possible downside was that the majority of these persons were picked within the own acquaintance, resulting in participants that had a personal connection to me as an interviewer. An advantage though, was that the interview situation felt more comfortable and relaxed, making it easier to ask follow-up questions and request explanations. Some of the user interviews were due to the circumstances made without a recording device. These were significantly harder to perform since the answers had to be noted directly, losing focus on the interview itself. The interviews made over the telephone was also harder to conduct, missing out on facial expressions or body language.

The selection of the focus groups participants was based on their correspondence to Spektrums core target group of high-experienced skiers and snowboarders. Since I am included in this group, I was

part a facilitator and part a participant (and part a photographer and secretary too, since the session had to be documented). This was a bit stressful and it could be hard to maintain focus from time to time. To create some relief, the audio was recorded. Again, since the invitation was shared among Facebook friends, the participants had a personal connection to me as the facilitator.

The challenge when conducting the personas was to make them represent the whole target group without being too general or spread. Instead of doing a persona for every outskirts of the target group, the attributes of the extremes were rather combined and attached to the three different core users which constituted the base. The personas were then reviewed by Spektrum to confirm their accuracy.

4.6.4 IDEATION

To prevent the risk of tunnel vision and making early design decisions, I felt it was important to involve other persons in the ideation process rather than doing it all individually. The workshop was a great way to involve designers and persons with no previous experience of mountain activities in a creative session that could contribute to ideas outside the box. The outcome was over expectations, and part of the success was that the workshop was well planned, that every task had a well-motivated purpose, time was held and that the participants needed to interact with each other and the props. If something were to change, the invitations should have been sent out in more channels than Facebook to reach a broader audience.

The mock-up prototypes made in the project was of high importance to ensure functionality of solutions. Even though the mock-ups was a fast way to examine form and function, the simple looks of the prototypes can be perceived as careless from a stakeholders point of view. Since the functions were built on existing bags and had to be partly adjusted to the existing proportions, the prototypes cannot be fully reliable. Another source of error was the material behavior, where, for example, the cardboard lack in flexibility compared to a textile.

4.6.5 IMPLEMENTATION

The evaluation process of the concepts was made in several steps to successively decrease the numbers to graspable amounts. The list of requirements and the personas were representing the voice of the users during the evaluation procedure, where Spektrum was assigned to do the final decision on the remaining concepts. It felt important to involve all stakeholders in the process and the methods used decreased the solutions in a steady tempo.

As an Industrial Design Engineer, I am used to create 3D-objects in a CAD software. It was, therefore, a challenge to suddenly use a different method constrained to only two dimensions, accompanied by both advantages and disadvantages. Illustrator drawings can be a bit time consuming when all the angles of the products need to be created one by one. A 3D-model in the other hand, is possible to render in all kind of angles when completed. The superior of Illustrator drawings, however, is that they are easy to multiply, modify, and add features on, with a fast workflow as follows. The quick way of modifying and adding to a design was incredibly useful when doing brand transformation of form elements from current products. For example, the design of a hook could be copied multiple times, where each version was tweaked a little, to finally compare them all and evaluate which best represented Spektrum.

When doing all of the drawings in the computer, it can be hard to get an estimate of actual size and form. The final check was therefore important to ensure that correct measurement were sent to the factory. The procedure was time-consuming but had a high payoff, since a returned prototype with wrong dimensions is taking unnecessary time and budget from the project. The material selection was made as the last stage of the implementation phase. The purpose was to not constrain the design by a material behavior at an early stage. The disadvantage with these kinds of late decisions is that a concept, without any material properties in mind during the designing process, drastically can reduce the field of usable materials in the end.

5. RESULT



This chapter presents the results from the previous stages of the project. The results are categorized under the three main phases; *Inspiration*, *Ideation*, and *Implementation*. The chapter ends with an overview of the final design.

5.1 INSPIRATION

In this section, the results from the Inspiration stage are displayed. This includes results from the market analysis, interviews, and focus group, as well as a full presentation of the personas.

5.1.1 BENCHMARKING

The benchmarking resulted in a better understanding of the current market situation. It also displayed the gaps between sport, outdoor, and urban backpacks and duffel bags regarding fashion and function. The benchmarking contributed with inspiration on certain design cues that distinguish an urban backpack from one that is used in the mountains. The functions on a sports bag are often displayed, such as the equipment attachment system consisting of straps and loops. An urban bag can also contain a lot of functions, but these are often hidden until needed to keep a clean outer

look. These categories are visualized in a chart (figure 31) to mark the white spot where the products of this project could be established.

5.1.2 INTERVIEWS

By meeting and interviewing different users and experts, great knowledge and new insights were gained. When it was possible, the interviews were held in person making the conversations more naturally going and gave the participants an option to display their thoughts in other ways than words.

Expert interviews

The expert interview with Hampus Östberg was an important and fast way to get key insights into the design process of a backpack. The support and engagement from Hampus did also bring energy and inspiration to the project. The most important tips were regarding the prototypes and how to ensure the receivers understanding. Since the prototypes often are manufactured in Asia, there may be com-



Figure 31. A chart that indicates the white spot on the market.

munication shortcomings, meaning that the technical drawings need to focus on illustrations rather than texts. To ensure a good first alpha prototype, the drawings and measurements should leave no room for misunderstandings. Still, the prototype manufacturers are experts in their field and will contribute where they find it necessary to ensure the delivery of a working product. Hampus also contributed with expert knowledge about technical aspects such as zippers, water resistance and how different fabrics behave.

Regarding water resistance and the overall quality of a bag, the weak link is often the zipper. The recommendation and general branch standard were to use zippers from the manufacturer YKK. The roughness and flexibility of the fabrics are defined by the thread thickness and has the unit Denier. A material with high Denier is thicker and more durable against wear, but also heavier and less flexible. A common solution in the industry to make a bag lightweight and durable is to combine different fabrics, using a thicker fabric on surfaces exposed to wear. To make the fabric waterproof, some sort of coating and welded seams are necessary. The manufacturing cost can increase drastically due to the choice of materials. Another factor is if the design contains a lot of features since more advanced seamwork will result in a product that is more expensive to manufacture.

The interview with Henrik Köhler was resulting in a deeper knowledge of fashion, trends, and the overall textile industry. Henrik described that on Cross, and many other outdoor brands, the gap between functional sportswear and street fashion is decreasing more and more. This can be shown in more shaded colors, hidden functions, and overall cleaner looks. As a designer for both Spektrum and Cross, Henrik predicts that;

“In a near future, sustainable design will be crucial for a brands survival.”

He continues that this will be a result of higher customer demands, tighter regulations, more competitors, and higher environmental awareness.

Robert Olsson, from Haglöfs, talked about the brand’s ambition to enlarge their collection of sustainable products and what requirements a product need to reach to achieve bluesign® status. He described that materials used in a product can

be bluesign® approved, but that every part of the product, including zippers and buckles, need to follow all the requirements to be labeled as a bluesign® product. The major factor of why not all of Haglöfs products are bluesign® approved is due to existing manufacturing techniques, material properties, and excess costs.

User interviews

The result of all the user interviews was qualitative data that could be interpreted. The data highlighted the users most desired needs, most common problems with current solutions, and conflicting needs between different user groups. Examples of this conflicts could be that an urban user desired a clean look without unnecessary functions, whilst a freeride skier needed many (for them necessary) functions, such as fast and secure attachment systems or special storage for avalanche gear. Common needs were on another hand the possibility of ergonomic adjustments and a dedicated laptop storage. The users major problems of each model are presented in the following lists.

Major problems - backpacks

- Only one opening to the main compartment
- Chest and waist strap is in the way when not used
- Not possible to overload
- Design for the aimed purpose only
- Loose hanging straps
- Easily broken zippers and buckles
- Equipment needs to be threaded through loops
- No dedicated pockets for avalanche gear
- Not water repellent



Figure 32. A user describes problems with his current solution during an interview.

Major problems - duffel bags

- Too small opening to the main compartment
- Hard to keep organized inside
- Lack of smaller pockets
- No expandable compartment
- Not possible to tighten when loose packed
- Not possible to use as a backpack
- Slow process to shift from handle to shoulder straps
- No laptop pocket
- Not water repellent

5.1.3 FOCUS GROUP

A common solution to attach skis to a backpack is to thread them through fixed loops of the backpacks outside. This is a real hazard on a steep mountain where the loss of the backpack or equipment can be devastating. In these environments, you want to keep one hand on the equipment and one on the backpack without the need of doing any big movements. Threading two 15 cm wide and 188 cm long freeride skis through a narrow loop was during testing a real struggle, even in a controlled indoor environment without gloves.

When attaching skis, the diagonal shape was preferable over the A-shape due to the fewer operations needed to secure the equipment. The diagonal

shape is allowing more mobility but has a risk of being unstable if the backpack is loosely fit or unpacked. Too stiff backpacks are, however, harder to pack and will limit the possibility to overload. All of the participants agreed that the chest and waist strap is of high importance, although arguing for it to be removable. Another suggestion was to skip any pockets on the waist strap, that apparently is common on freeride backpacks. According to the participants, these kinds of features only makes the strap thick which restricts mobility. Further, ergonomic adjustments should be possible to do to extend or shorten necessary straps, including the shoulder straps. The straps should be possible to hide when not in use since they can be a danger while riding in forests or in the ski lifts, with the risk of getting stuck.

Some of the participants had a bad experience with backpacks that did not handle the equipment’s steel edges, leaving ugly marks and scratches after a short time of wear. Another hot topic was the incomprehensible use of plastic buckles, that easily breaks in cold conditions. Suggestions were to reinforce front and bottom of the backpack, as well as using metal buckles and hooks. Another desire was compartments that you can reach without completely taking off the backpack, as well as quick access to the main compartment even with



Figure 33. The participants shared a lot of problems with current solutions.

equipment attached. The zippers, buckles and handles should be possible to operate even with thicker gloves. It should also be possible to overload the backpack, since the packing often is larger (in form of outerwear, helmet, food etc.) on the way up the mountain, than on the way down.

When discussing the avalanche equipment, special pockets for probe and shovel turned out to be essential. One of the participants stated;

“Get at much of the avalanche gear as possible inside the backpack. It can be a direct or indirect danger to have it attached to the outside. You don’t want to land on a pointing shovel shaft when falling off a cliff, neither do you want to discover that you have lost part of your outside attached equipment during an avalanche situation.”

A shovel is an essential part of the avalanche gear and the whole focus group agreed that the blade has to be placed as far away from the back as possible, protecting the spine in a fall. An integrated back protection was nothing that was desired since it makes the backpack heavier and stiffer. All of the participants used their own back protections specially selected for their type of body shape.

When purchasing a backpack, the style (including colors, design elements, and form) was of equal importance as the functions, closely followed by comfort. The participants agreed that a sustainable backpack always is to prefer and that it should be represented by material or color rather than too obvious and bragging design elements.

5.1.4 DATA EVALUATION & PERSONAS

The data collection and evaluation resulted in three personas that represent the main target group. The personas are each described with portraits, a short presentation, and a scenario in the next section. The personas were an important part when determining the lists of requirements since they represented the user needs and demands that were exposed during the data collection. The majority of the lists was, therefore, user-oriented expect certain factors, such as manufacturing costs, that were set by Spektrum. The lists of requirements can be found in Appendix D.



MAJA, 26

SNOWBOARDER

In Backpack; Shovel, Probe, Extra jacket,

In Duffel; Gear, Clothing, Laptop

Riding; Off-piste

Importance; Sustainability & Function

Profile; Maja is 26 years old and studying Environmental and Nature Resources at Luleå University of Technology in Luleå, Sweden. Her goal after graduation is to work with sustainable issues that can improve the society. The reason she moved to Luleå was for the snowy winters and closeness to nature. Though, a lot of the ski resorts are in the outer surroundings where Maja need to take some sort of transportation to visit. She spends over 40 days per season in the mountains and she prefers off-piste riding. She is an active member of Protect Our Winters (POW), that is an organization aiming to spread environmental consciousness among skiers and snowboarders. When it comes to clothing and products, Maja prefers the brand Fjällräven, with their clean looks and smart design. Fjällräven is also a brand that is trying to reduce their environmental footprint, something that Maja wants to support.

Scenario; The weekend is finally here and Maja spends the evening packing her gear so she can take the morning train to the ski resort Riksgränsen the next day. A seven-hour journey that will take her to one of Sweden's best off-piste areas. She packs her equipment in a snowboard bag, clothes and other gear in a rollable suitcase and finally personal belongings in a backpack. The 15L Salomon backpack is the same that she rides with in the slopes.

The backpack has high function, is lightweight and is colored in a high contrast orange. Since the backpack is small she can not fit much in it. Therefore, the food for the train ride and her laptop needs to be put in a separate textile bag. When arriving at the train station in Riksgränsen, she has to walk for 800 meters to get to the guest house. It has snowed during the night, making her rollable suitcase not so rollable anymore. Maja really has to struggle to make her way to the accommodation. Next day starts with a boot hike up for Vassitjåkka, a nearby mountain outside the resort. The backpack is packed with a shovel, a probe, a water bottle, protein bars and an extra jacket. On the outside is the snowboard horizontally attached close to the back. In her hands are hiking poles, but the snowboard preventing her arms to move freely. She is also afraid to do certain moves since the steel edge of the snowboard can rip her jacket open. The buckle to attach the helmet on the backpack is broken since it was made of plastic and got crushed one cold day. Luckily, there are a dozen of other straps to be used instead. Overall, she likes the multifunctionality that the variety of straps offer, besides when skiing in the forest, knowing it could be really dangerous if the straps sticks in a branch at high speed.



JENS, 21

SKIER

In Backpack; Camera, Lenses, Shovel

In Duffel; Gear, Clothing, Laptop

Riding; Park & Street

Importance; Style & Durability

Profile; Jens is 21 years old and works at a local supermarket in Östersund, Sweden. The short time goal is to save money for a car and some new lenses to his camera. The long-term is to get recognized in the ski community and be able to live as a professional skier. Jens has a season pass in the close by ski resort Åre, where he goes as soon he has some spare time. With the lack of an own car, he often goes there by bus or train. It is always a struggle to get on board with multiple bags and loose gear. When in Åre, Jens and his friends prefer to ski in the terrain park, filming their tricks and publish them in ski edits. Because of this, Jens always carry his camera, extra batteries, lenses, tripod and a shovel in his backpack. A trick can require several tries were he often need to hike back to the inrun. The backpack he uses today is of very simple design since bags aimed for freeride skiing looks to sporty and do not fit his image.

Scenario; Jens is standing on the bus station in Östersund waiting for the bus to Åre. He has a ski bag packed with the equipment, a large hiking backpack for his gear and a smaller backpack with his laptop and camera equipment. Since Jens do not have a car, he has to do a bit of walking to reach certain destinations. In snowy conditions, he is forced to be able to carry his stuff in hand or on the back. The hiking backpack is comfortable to carry, but it is a nightmare to keep the content organized. It is only possible to load packing from the top, making it a mess trying to reach something in the bottom. When in Åre, he does not even need to call his friends, he knows where to find them. The terrain park is open to 15.00 and he does not have to ski long by himself before he encounters someone he knows. Jens always brings his backpack, equipped with his camera gear and a shovel. The crew only need a few more minutes of footage for the new ski edit and they continue riding even after the lift is closed, hiking the jump section with skis in their hands or on shoulders to get the last shots. When riders are dropping in unannounced, Jens has to drop his skis, throw off his backpack and rapidly search and reach his camera to aim and press record. A procedure that often takes a long time, resulting in a shaky or missed shot. Since fashion is a big part of the skiing community, Jens like the urban style of his backpack. What he does not like is that it is almost impossible to ski with. With no adjustability or straps to secure it to the body, the bag is very unstable and uncomfortable. There is only one way into the main compartment,

making him have to take off the backpack every time he needs to grasp his camera. Since there are no attachment points on the outside, the tripod is placed in the main compartment where it, due to its length, sticks out through the upper zippers.



ALLAN, 42

TRAVELER

In Backpack; Groceries, Training gear
In Duffel; Suit, Shoes, Clothing, Laptop
Riding; Airplane
Importance; Style & Status

Profile; Allan is 42 years old and lives in Stockholm, Sweden, where he works at a design agency. His life goal is to explore the world, traveling to a new country at least once a year. He likes the pulse of a big city but spends some of his weekends in nature just to have some relaxation (and post some Instagram stories too). It is trendy to be active and close to nature, which fits Allan's image. He has a variety of bags for different occasions since they need to work in the city, on a hiking mission, and on travels. He have a hard time finding one bag that works for all. He prefers duffel bags, since they could be carried by hand in the city, on the back in nature, and fit all of his packings when traveling. The problem with the ones on the market today is that they are designed to either look good on the back or in the hand, not both. When traveling, his requirements is to have a bag that is easy to pack and sized to carry as hand luggage in airplanes.

Scenario; After a day of working, Allan is now on his way to the grand central in Stockholm. In a few

minutes, he will sit on a high-speed train towards the airport with the next destination Narvik, Norway. During the weekend in Norway, he will do some hiking close to the hotel, but also hang around in the city. Allan has a duffel bag as only packing and he like the look carrying it around in the city. It is easy to pack and overview, but lack compartments beside the main, making it a bit hard to keep the packing organized. The duffel bag is also possible to wear as a backpack, but that is something he rarely does due to the ugly, and possibly forgotten, design of the bags underneath. When Allan purchased the duffel bag, one of the important details, besides the style, was that the size made it possible to carry as hand luggage in airplanes. When doing so, the plane tickets are less expensive, making it more realistic for Allan to reach his goals of traveling. Even though Allan do a lot of flights a year, he cares about the environment and tries to consume sustainable products. He sees it as a plus if they are designed to look eco, as long as it is not too prominent. He does not want to brag about it, but he likes the subtle look that fit his image, both as an urban- and an outdoor explorer.

5.2 IDEATION

In this section, the results from the ideation stage are presented, including results from the workshop as well as the individual and group-oriented brainstorming sessions.

5.2.1 CREATIVE SESSIONS

All the creative sessions, based on lateral thinking, workshop, and different types of individual and group brainstorms resulted in a total of 146 unique ideas. These ideas were either explained as an illustration or a written sentence on a piece of paper. The workshop generated the most far-fetched and unrealistic ideas. One of the reasons could be that the participants had been practicing lateral thinking as part of the workshop and were encouraged to think outside the box. Another reason could be that a majority of the participants had little prior experience of mountain activities.

The brainstorming session performed with the experienced group of freeriders during the focus group generated a bunch of very realistic, but not so innovative ideas. Even though they too were encouraged to think outside the box, their prior

knowledge may have constrained them. The individual brainstorming sessions I did by myself was a mixture of both realistic and unrealistic solutions. They were brought together in concepts created by completely new ideas, spin-offs, and add-ons on the previous group generated ideas. Some of the illustrated ideas and concepts are presented in figure 34.

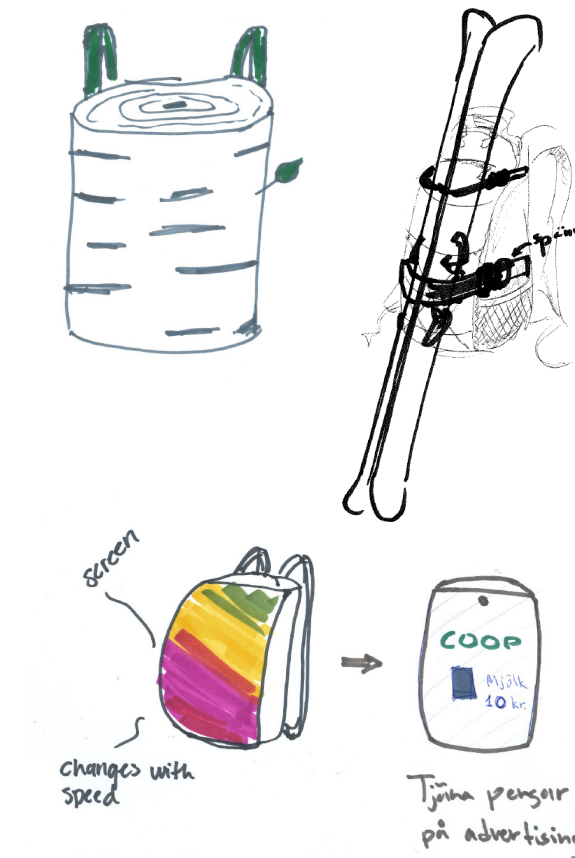


Figure 34. Some of the ideas conducted during creative sessions.

5.2.2 FORM & FUNCTIONS

The result of the mock-up prototypes, benchmarking and anthropometry studies, was that certain form and functions of the bags could be established. On both of the bags, each shoulder strap is 70 mm wide and separated by a 40 mm gap, fitting human shoulders for the entire 5th to 95th percentile. This includes the 5th percentile woman, where the shoulder to neck distance is 137 mm, to the 95th percentile male population, where same distance measuring 193 mm (Dreyfuss, 1967). The padded part of the shoulder strap is 460 mm in length, followed by a 450 mm long adjustable strap. The padding in contact with the wearers back is measuring 440 mm high and 270 mm wide. The back length of the shortest women in the 5th

percentile is 480 mm and the longest in the 95th male percentile is 627 mm (Dreyfuss, 1967). The chest strap is adjustable up to 300 mm in length, as well as 230 mm in height. The waist strap is adjustable up to 500 mm on each side. All of the handles offers a grip of at least 140 mm in length to enable good usability with gloves (figure 35 & 36).



Figure 35. Mock-up prototyping verified some of the form and functions.



Figure 36. The anthropometry charts sometimes had to be questioned. What if the user wears thick gloves or jackets?

5.3 IMPLEMENTATION

This section presents the result from the implementation stage where the different concepts were evaluated and selected. The technical drawings, material selection, and design changes are also presented.

5.3.1 EVALUATION

The first evaluation, made with the list of requirements, converged about 50 concepts down to 12. With the aim of eventually reaching three concepts of each model to present for Spektrum, this amount had to be reduced by half. It was achieved with another evaluation process, made by the personas in a voting procedure. The three concepts of each model that scored highest by the personas are presented in the following section (figure 37-42). Since the material selection was a later question, the concepts focused on form and function rather than sustainability. The voting and final scores are presented in table 1.

BACKPACK CONCEPT #B1

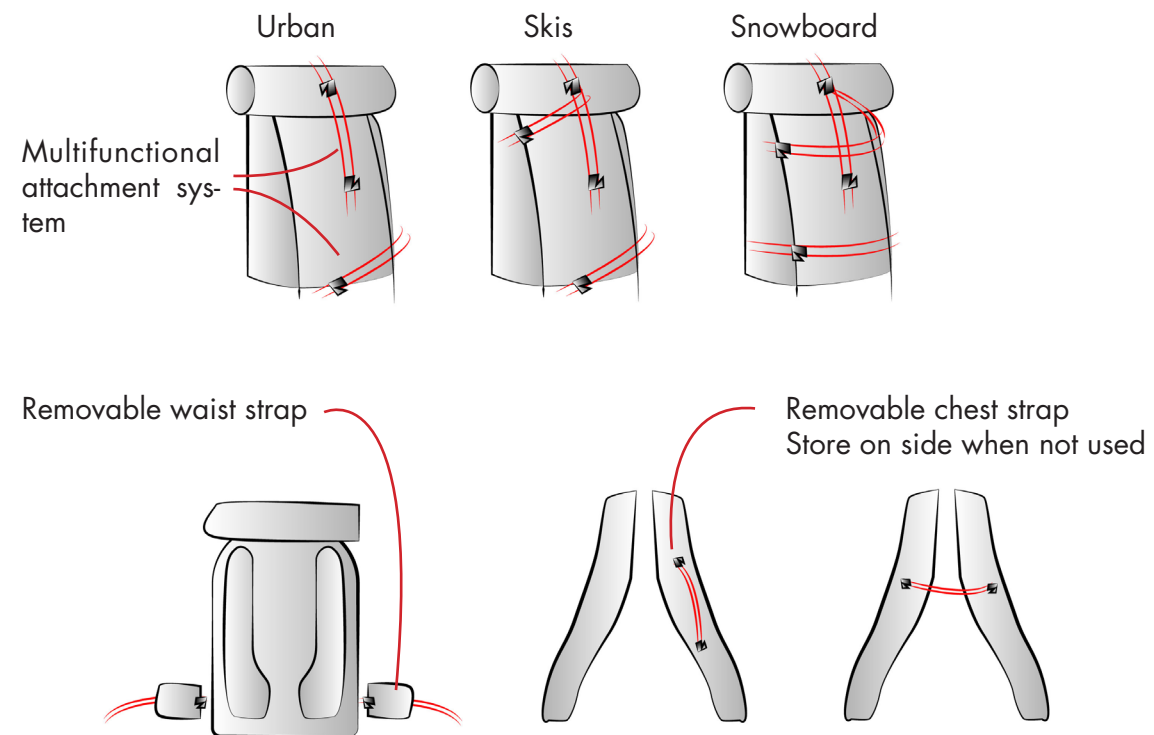


Figure 37. Backpack concept 1.

BACKPACK CONCEPT #B2

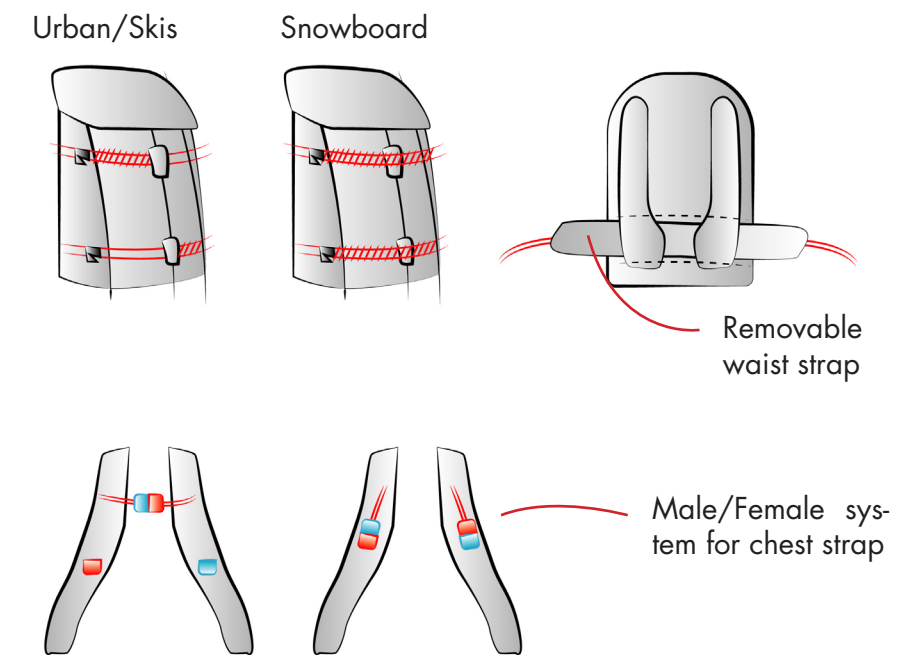


Figure 38. Backpack concept 2.

BACKPACK CONCEPT #B3

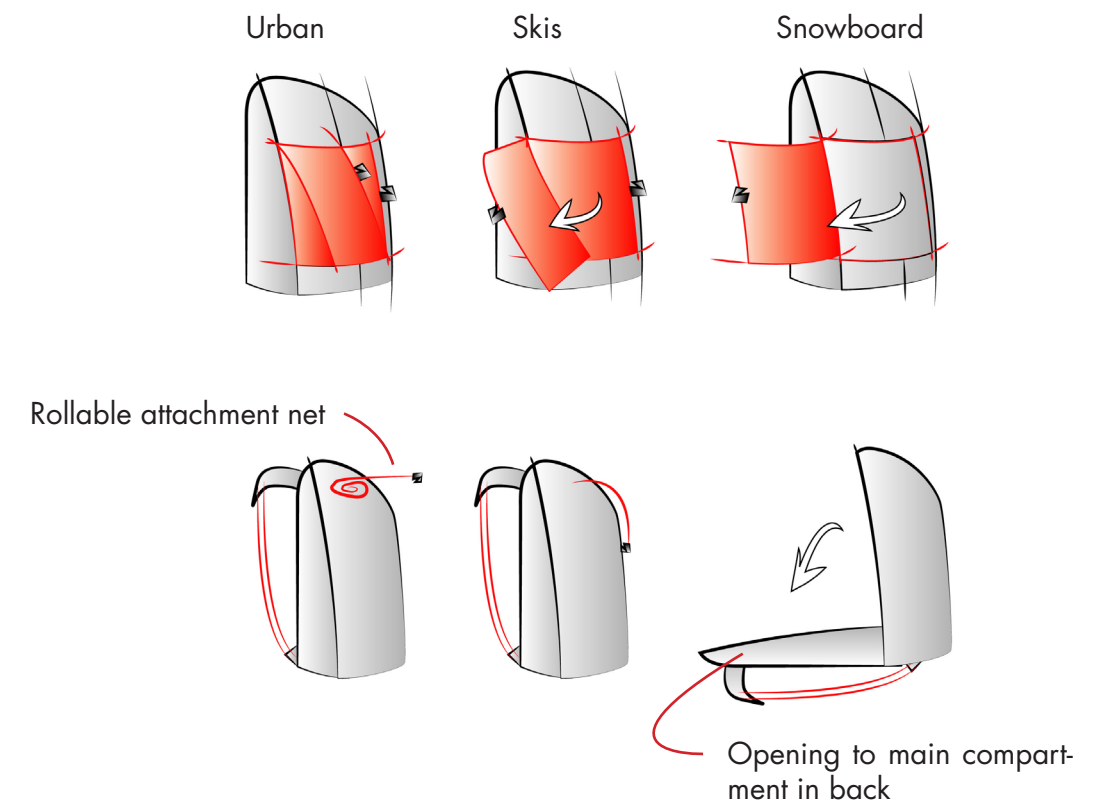


Figure 39. Backpack concept 3.

DUFFEL BAG CONCEPT #D1

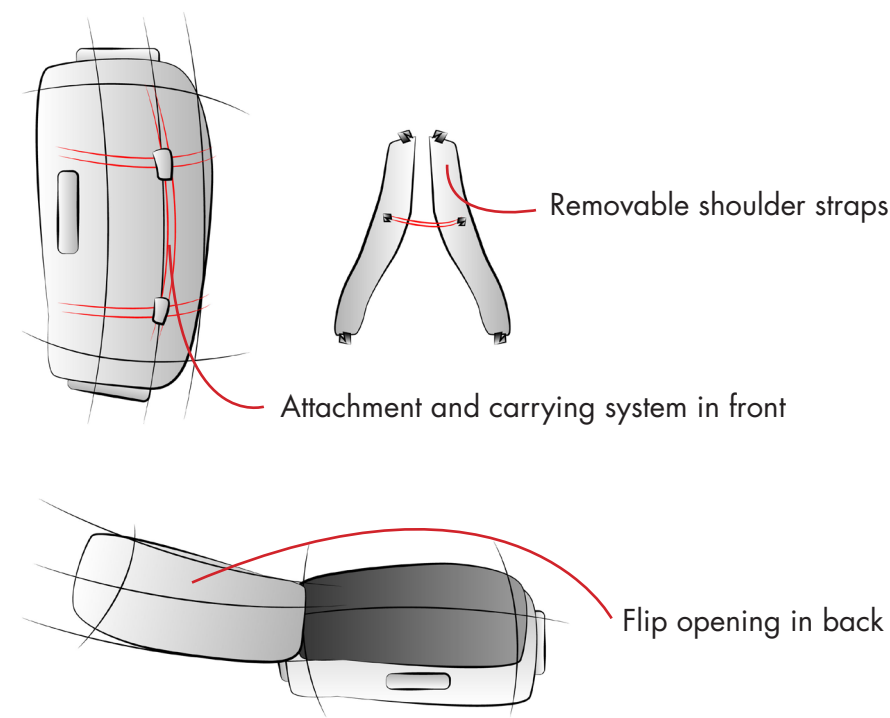


Figure 40. Duffel bag concept 1.

DUFFEL BAG CONCEPT #D2

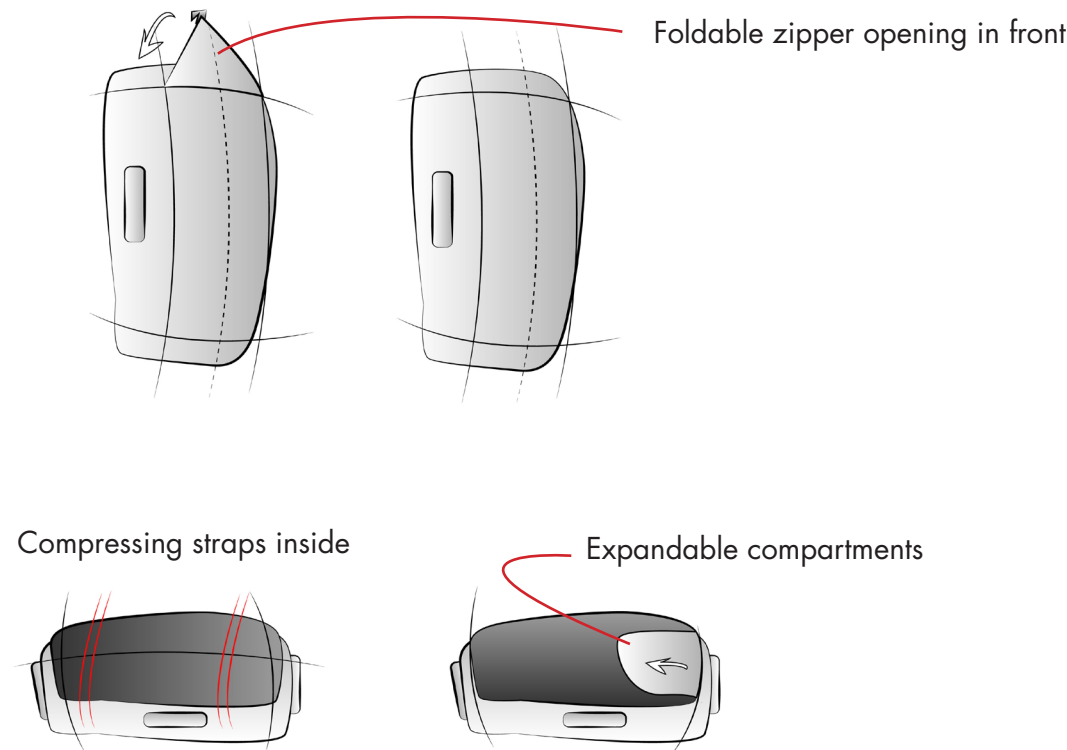


Figure 41. Duffel bag concept 2.

DUFFEL BAG CONCEPT #D3

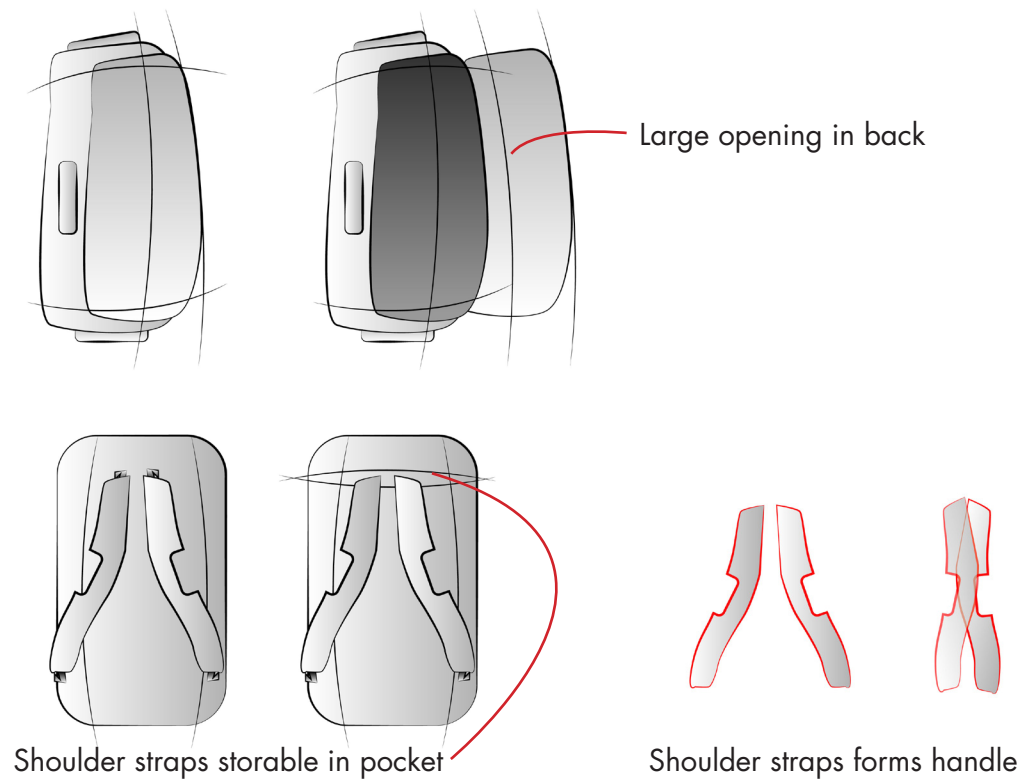


Figure 42. Duffel bag concept 3.

Table 1. Table 1. The three concepts of each model that scored highest by the personas. The backpack concept #B1 and the duffel bag concept #D3 scored highest among them all.

CONCEPT	#B1	#B2	#B3	#D1	#D2	#D3
MAJA	3	3	5	4	3	3
ALLAN	4	3	3	2	4	5
JENS	5	4	2	3	3	4
TOTAL	12	10	10	9	10	12

Among the backpacks, Jens and Allan like concept #B1 the best and it is also the concept that scores the highest among the three. It has a clean urban style and allows high function. Allan really like the ability to overload the backpack when shopping in the city. Jens like the discreet attachment system on the outside as well as the storable chest and waist strap. The urban rolltop style erases the conventional look of a mountain backpack. Maja like the concept too, but think the attachment system requires extra operations compared to other solutions when mounting a snowboard. Maja like concept #B3 best since it has a fast and easy attachment method for snowboard, it is easy to access the main compartment from the back, and it has hidden features to attach other gear such as a helmet. Allan and Jens scored it lower since it interferes with the clean and urban look.

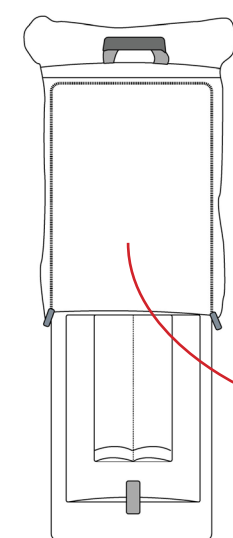
The concept that scored highest among the duffel bags was #D3. It had the most innovative carrying system of the three and the user can easily shift between handheld and backpack. Maja scored this concept lower since the lack of possibilities to attach gear on the outside. However, Allan and Jens think this clean look is to prefer. The smart inside organization of concept #D2 was what brought it to a second place. Spektrum also voted concept #B1 and #D3 the highest. Their motivation was that these were the most innovative and market competitive of them all. One request though, was

to examine if some of the features or functions that scored high by the personas on the other concepts could be implemented in the final ones.

5.3.2 TECHNICAL DRAWINGS

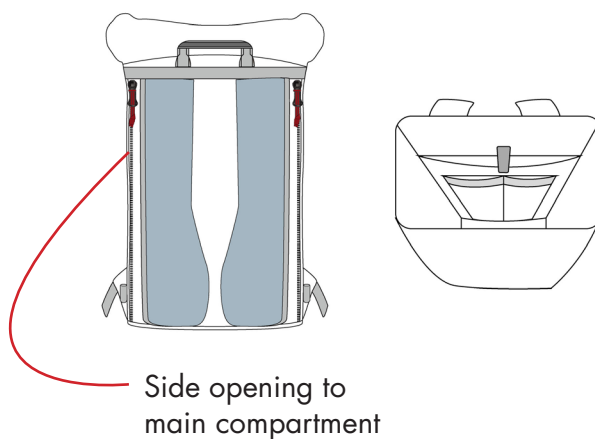
The final concepts were refined into detailed technical drawings. Some of the features from the top three concepts, that scored high by the personas, were transferred and tested out on these drawings. The features used from the duffel bag concepts #D1 and #D2 were expendable compartment, inside compression straps, and outside attachment straps. The back opening from the #B3 concept was transferred to the backpack design. After the consultation with Haglöfs designer Robert Olsson and Spektrum designer Henrik Köhler, there were a few design changes made. The most significant was the re-design of the access to the main compartment on the backpack pictured in figure 43. Due to cost and durability issues, the fully openable back zipper was replaced with two single side zippers. The new design fulfilled the same function of accessing the main compartment from more than one opening but was in theory much more durable to tare than the old solution. Other design changes were more of esthetic characters such as placement of logos, the look of the handles, and overall seam work. Extractions from the technical drawings are displayed in figures 45-57. The complete drawings can be found in Appendix G and H.

Version one



Fully openable back to main compartment

Version two



Side opening to main compartment

Figure 43. Version one (left) with a fully openable back. Version two (right) is instead accessible from the side, with the same storage possibilities on the inside.

5.3.3 MATERIAL SELECTION

The final fabric selected was a 600 Denier recycled polyester with a water-repellent TPU-coating on the back. Polyester was selected over cotton due to the material properties, lower costs, and the sustainable advantages. Unlike a garment, the superior moisture transportation and breathability of a cotton fabric is not needed in this kind of product that has no direct contact with human skin. The polyester is made of recycled PET-bottles and the fabric is bluesign® approved. The first idea was to use several types of fabrics in the bags to achieve varying textures and properties in different parts of the product. With the one-side coated fabric, this could now be achieved by letting the coated back, or textured front be facing out. To reduce material consumption even more, the initial plan of an inner lining was also discarded. The lining main function is to prevent moisture to reach the bags inside but has actually no function when the fabric is water repellent.

Based on the research made in the theory chapter, as well as the personas need of durability, the buckles and hooks will be produced in recycled

aluminum. The material has high strength, is lightweight, and sustainable in its recycled form. The brand YKK, that is one of the largest and most trusted zipper producers in the industry, will provide the zippers. Since zippers are the products weak link according to the experts, it made sense to spend some extra on this feature to ensure good and long-lasting quality.

The straps and handles are made of polyester and the foam in the padding is EVA-foam that is branch standard. The handles and patches of the backpack and duffel bag are reinforced with hypalon. The material is incredibly tough against tare and the fabric is already used in Spektrum's logo patches on their goggle straps (figure 44). Beside durability aspects, this is also part of transferring specific design-cues from Spektrum's current products and enhance brand recognition. The brands characteristic metal logo is also used on the bags as part of the transformation. Beside brand recognition, the use of same materials in several products can reduce cost, transport, and material storage. It will also increase the opportunity to use out cuts and waste parts from one production line to an-



Figure 44. Spektrums characteristic metal logo on a hypalon patch, seen on one of their Goo7 Helags goggles.

5.4 FINAL DESIGNS

Due to delays of the alpha prototypes, the final designs are presented through the technical drawings in the following section. The major problems of the user's current bags, discovered in the inspiration phase, are commented and compared to the final designs. Naturally, since the concepts passed the list of requirements evaluation, they fulfill all the other requirements.

BACKPACK

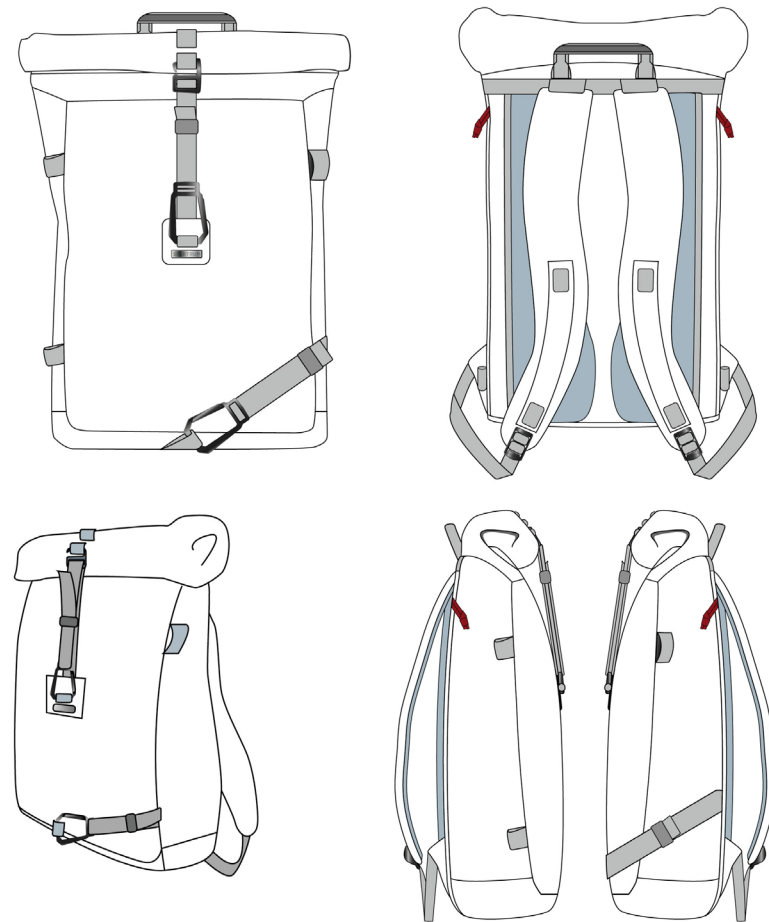


Figure 45. The backpack displayed in different angles.

Problem: Only one opening to the main compartment

Solution: The backpack has two openings to the main compartment. Through the rolltop opening and through the side pocket in the back (figure 46). Both openings are accessible even with equipment attached.

Problem: Not possible to overload

Solution: Due to the rolltop opening, the backpack is possible to overload with a few extra liters by not rolling it fully before the hook is secured.

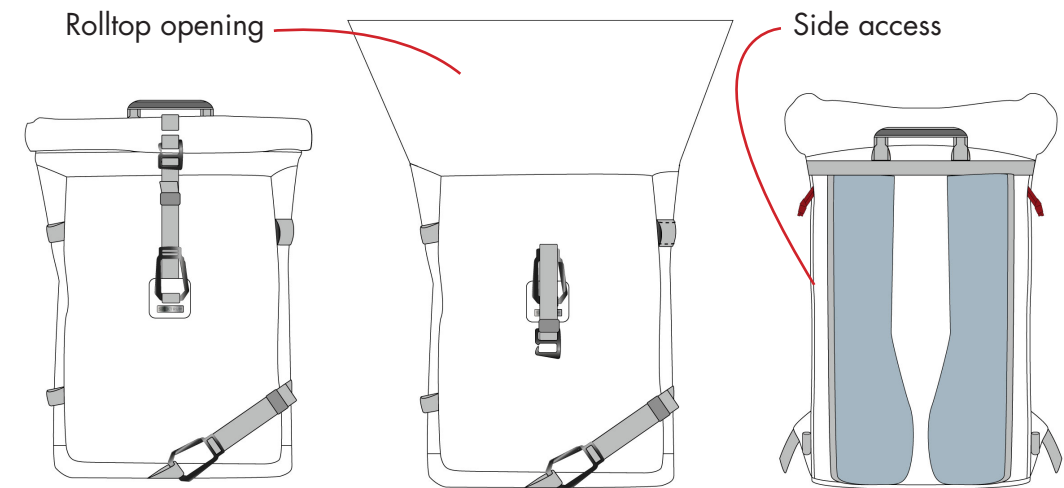


Figure 46. The different access points to the main compartment.

Problem: Chest and waist strap is in the way when not used

Solution: This is solved by the ability to detach the waist strap and store it in the bottom pocket (figure 47, top). The chest strap can be attached and tightened to one side of the shoulder straps when not in use (figure 47, bottom).

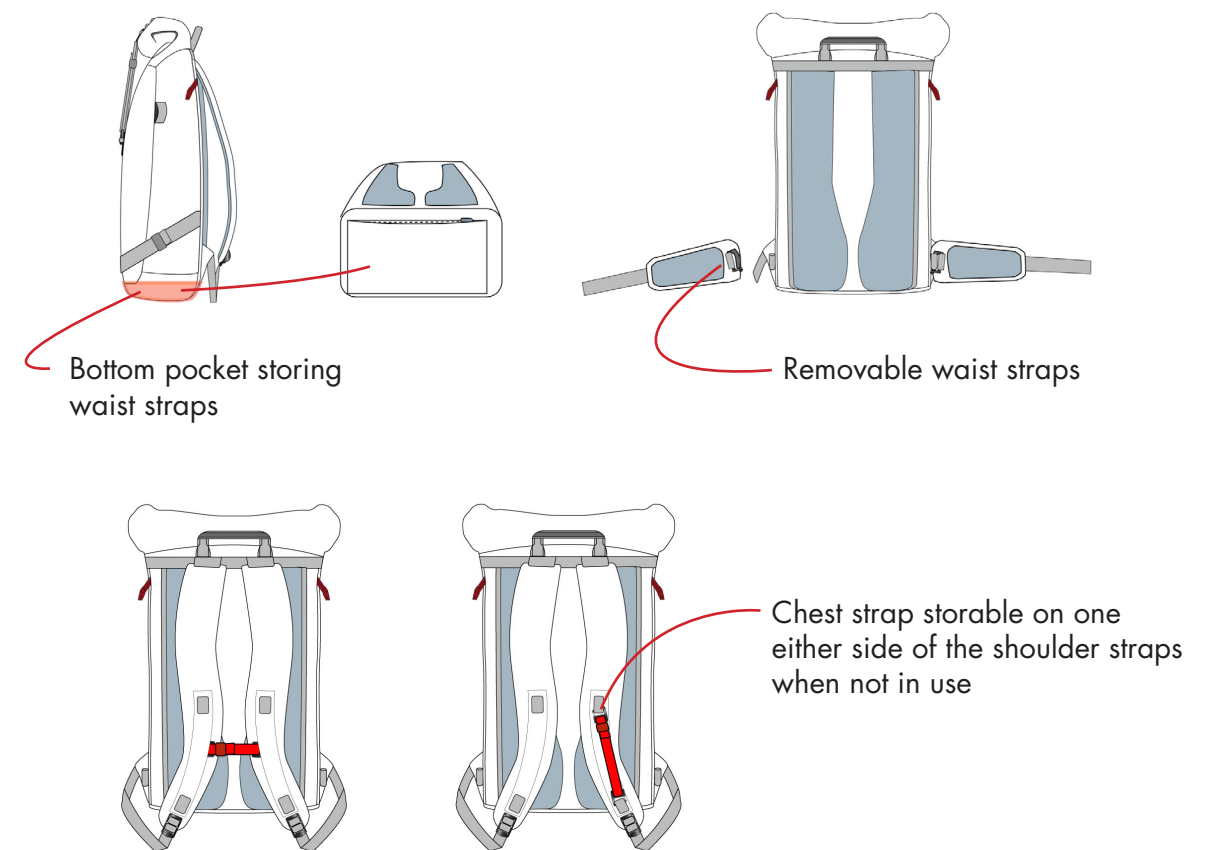


Figure 47. The storage of the removable waist and chest strap.

Problem: Design for the aimed purpose only

Solution: The design enables the user to change the appearance of the backpack depending on the occasion (figure 48). Chest and waist strap is removable, and the attachment system is a hidden future when not in use.

Problem: Loose hanging straps

Solution: By restricting the number of attachment straps to two (where one of them is integrated with the closing strap of the rolltop opening), there is no loose hanging straps or loops that can get stuck when riding. The attachment straps are always tight to the backpack and secured by carbine hooks (figure 48).

Problem: Equipment needs to be threaded through loops

Solution: The carbine hooks make it easy to simply place the equipment on the backpack and secure it on the spot without any need for treading.

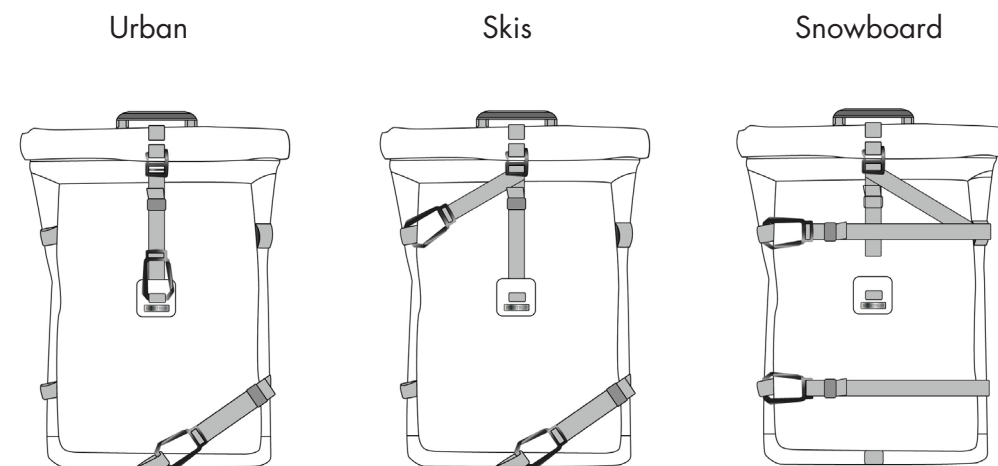


Figure 48. The three different attachment strap combinations.

Problem: Easily broken zippers and buckles

Solution: The aluminum buckles are durable to wear and tear. The zippers used in the final products are from YKK that is market leading according to experts interviewed.

Problem: Not water repellent.

Solution: The TPU coated polyester fabric makes the product water repellent. The zippers are covered and secured by magnets to make the content in the backpack even more protected from heavy rain or snow.

Problem: No dedicated pockets for avalanche gear

Solution: The laptop sleeve inside the backpack hosts two pockets dedicated to the probe and the shovel shaft (figure 49, top). The shovel blade has a dedicated pocket on the front inside of the bag (figure 49, bottom). The shovel blade is as far away as possible from the wearer's spine, since it can be sharp and dangerous to fall on.

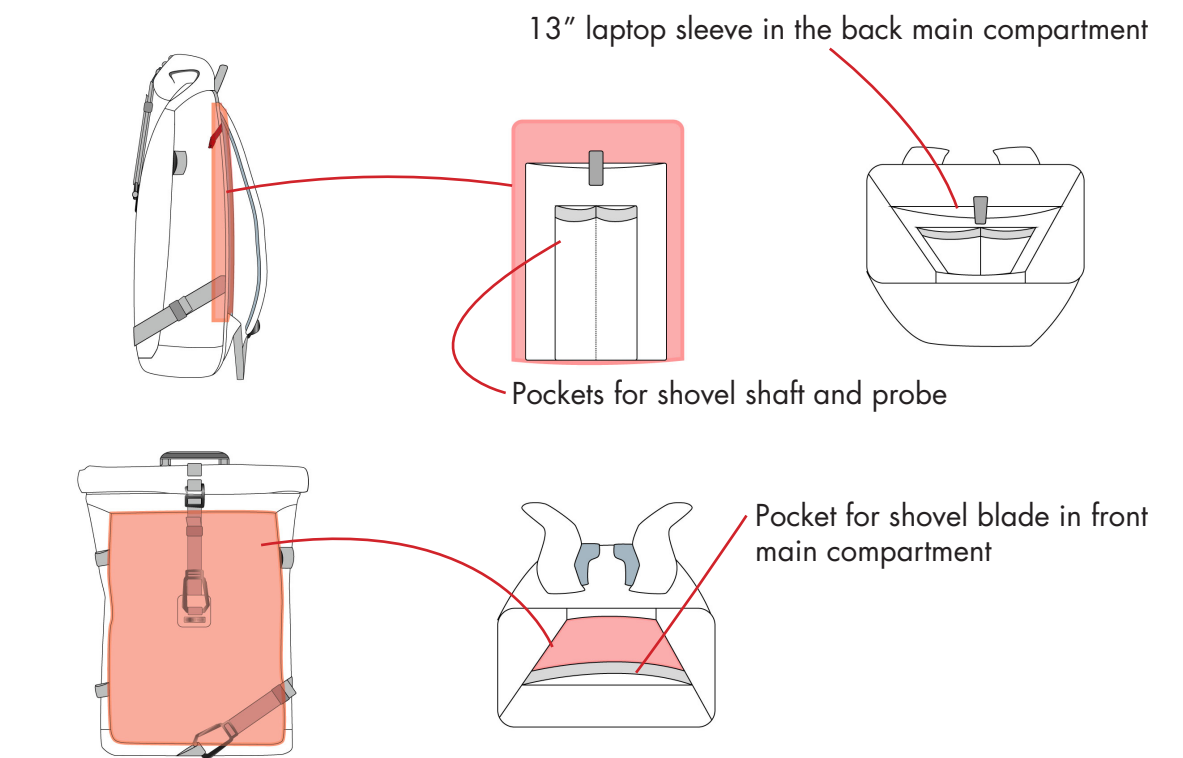


Figure 49. The inner pockets of the main compartment.



Figure 50. Illustration of the final backpack design.

DUFFEL BAG

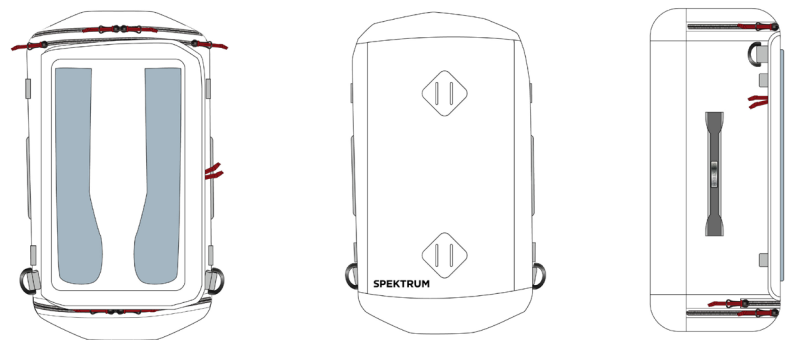


Figure 51. The duffel bag with shoulder and attachment straps hidden.

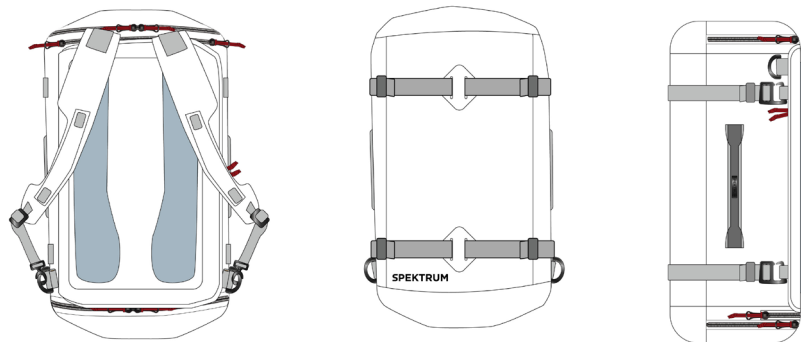


Figure 52. The duffel bag with shoulder and attachment straps displayed.

Problem: Too small opening to the main compartment

Solution: The duffel bag has a large top lid, which when opened reveals the entire main compartment (figure 53).

Problem: No laptop pocket

Solution: There is a laptop sleeve for up to 15-inch laptops in the top lid (figure 53).

Problem: Lack of smaller pockets

Solution: There are two smaller pockets on the top and bottom of the duffel bag (figure 54, left).

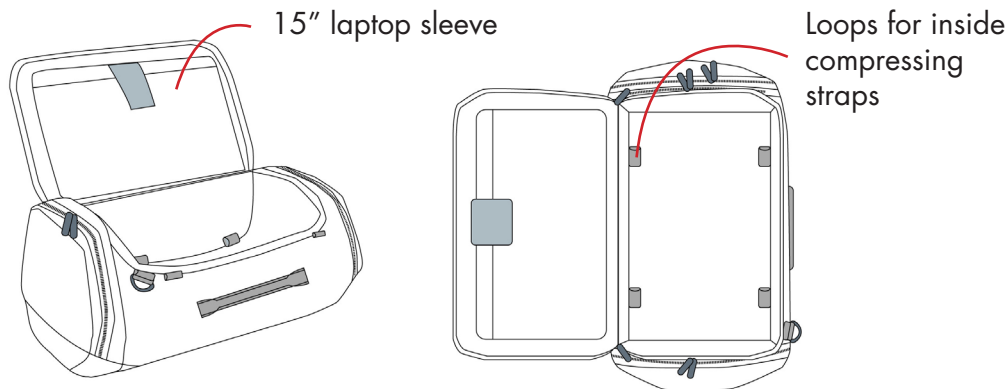


Figure 53. The main compartment of the duffel bag.

Problem: No expandable compartment

Solution: The bottom pocket is expandable, making it a great compartment for storing wet or dirty packing (figure 54, left).

Problem: Slow process to shift from handle to shoulder straps

Solution: The cut-out handles on the shoulder straps allows the user to carry it on the back and by the hand, without any need of rearrangement (figure 54, right).

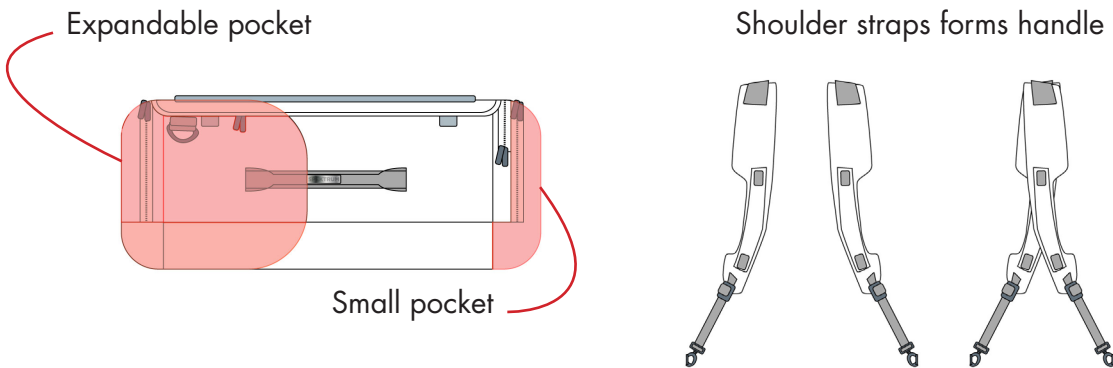


Figure 54. The top and bottom pockets (left) and the shoulder straps forming a handle (right).

Problem: Not possible to use as a backpack

Solution: The wide shoulder straps and padded top lid makes the duffel bag comfortable to wear as a backpack. The transformation from handheld to backpack is displayed in figure 55. The chest and waist strap supports is an extra support when carrying it on the back (figure 56).

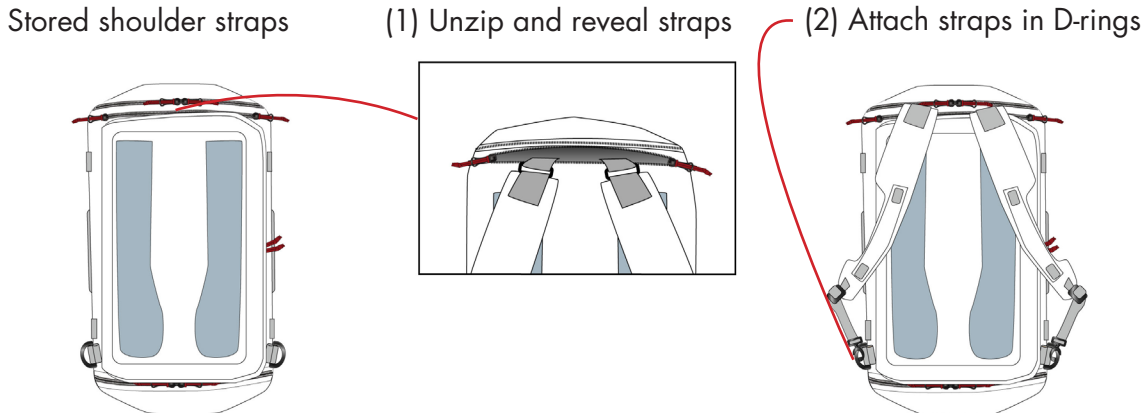


Figure 55. From side held duffel bag (left) to a backpack (right) in two steps. Unzip the shoulder strap pocket (1). Attach the hooks in the D-rings (2).

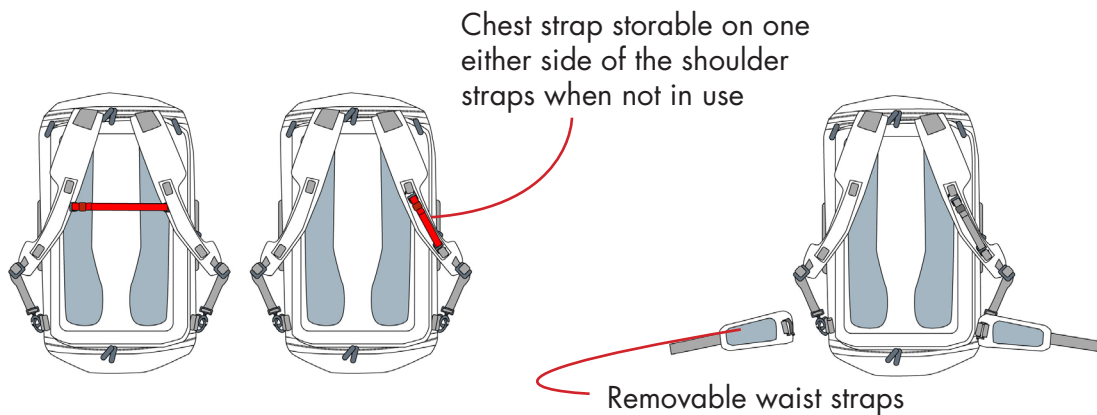


Figure 56. Removable waist and chest strap.



Figure 57. Illustration of the final duffel bag design.

5.4.1 ATTACHMENT SYSTEM

As seen in figure 58 and 59 on the next page, both of the models can carry snowboard and skis in their respective attachment systems. Since the attachment straps are possible to release and remove, there is no need for trading any equipment. This not only offers a better user experience but will also prevent the risk of losing the bag down a mountain face as discovered during the focus group. The attachment possibilities were specially requested for the backpack but were also implemented on the duffel bag since it did not affect the design in any negative way. Since the straps are adjustable in length, the size of skis and snowboards can vary a lot and still be attached in a secure way.

5.4.2 PRODUCTION

When the final technical drawings, accompanied by the mock-up prototypes as a proof of concept, were displayed for Spektrum and their sharehold-

ers, there was an agreed decision to proceed and prepare for production. After sale meetings with retailers, a goal of products in stores is set to the year 2020. However, a bulk production of 500 pieces of each model can be available as soon as within a year at Spektrum's own webshop. Due to this positive announcement, the alpha prototypes, that often are manufactured by materials available at the time in the factory, were instead ordered in the accurate recycled double-sided fabric. Since the right materials needed to be located, ordered, and shipped to the factory, the alpha prototypes were significantly delayed. The overall time to reach a market ready product is, however, decreased.

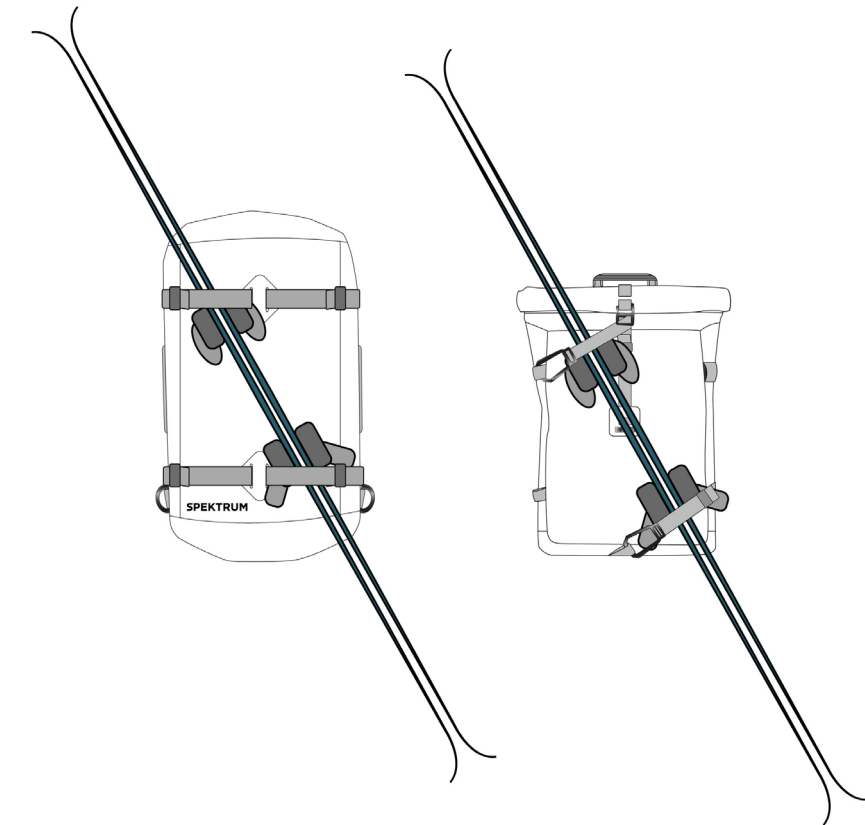


Figure 58. The attachment system of the duffel bag (left) and backpack (right) with mounted skis.

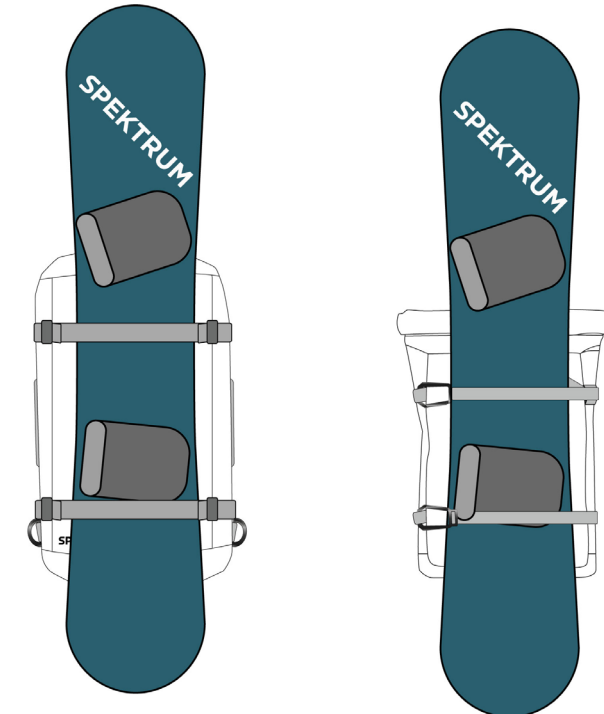


Figure 59. The attachment system of the duffel bag (left) and backpack (right) with mounted snowboard.

5.4.3 STAKEHOLDER FEEDBACK

Stakeholders, in form of Spektrum representatives and persons with a key insight in the project, were asked for feedback of the results. Also, the personas were brought back to evaluate how the final designs met their requirements and needs. Some of the stakeholder's quotes and the personas feedback are presented in the following section.

"The designs are representing Spektrum by expressing our style and values, not at least by being in line with our companies sustainable goals."

- Andreas Nilemo
CEO at Spektrum

"By combining multiple functions, their presence varies by the user's needs, occasion, and environment. I think it's very innovative and keeps the design clean. I believe some of the solutions are completely new to this segment."

- Henrik Köhler,
Head of Design at Spektrum

"The trend shows that sustainable design soon will be crucial within the industry, making these products state a first mover advantage among consumers and competitors."

- Robert Olsson,
Senior Designer at Haglöfs

"The possibility of using chest and waist straps on the duffel not only allows me to comfortably carry it on the back for longer distances, it also open up the potential to use it on the mountain. With the outside attachment straps to secure equipment, it is actually possible to use it with the same purpose as the backpack, but with room for even more packing."

- Jakob Wilhelmson,
Professional Snowboarder
and Spektrum Ambassador

MAJA



Maja's first encounter with the bags was of great experience. One of the problems she had with her current backpack was that it was a fixed size, making it hard to fit anything more than the essentials. The rolltop opening on the Spektrum backpack makes it possible to fit a few extra liters of packing when needed, still allowing the opening to be tightened and make it slick while riding. She adjusted the backpack to fit her body shape and it is staying really tight to the body when using the chest and waist straps. In comparison to her early backpacks, there are no loose straps in the risk zone of being stuck in branches while riding in the forest. The avalanche gear is easy to access and organize by their dedicated pockets. She really likes that there are storm-proof pockets, making the backpack even more water repellent.

Maja has completely replaced her previous suitcase for the Spektrum duffel bag. She often carries it by hand on short distances and puts it on the back when doing longer walks. Since the handle carrying and shoulder strap system is the same, she never has to consider to switch between them. For longer hiking missions in the mountains, where more equipment and gear is needed, she actually prefers the duffel bag before the backpack. It allows more packing and is firmly secured to the body with the chest and waist strap when riding. The combined attachment and compression straps on the outside of the bag allow her to attach her snowboard when needed. This is not only useful when hiking, but also when traveling between locations, making the previous board bag no longer a requirement.

The fact that both of the bags are sustainably produced, with bluesign® approved and recycled materials, makes her choice even easier over less eco-friendly competitors.

JENS



Jens instantly reached for the black versions of the bags when they were displayed. Even though this is supposed to be a standard color, it is a rarity on the freeride market that is flooded by sporty looking high contrast neon colors. Jens loves the clean and urban look on the bags, both with their hidden and multifunctional features. The backpack is used daily, whether it is in the city or in the slopes. However, the waist and chest straps are always removed when not in use to keep the clean look. In his opinion, one of the backpacks top features is the quick access to the main compartment from the back pocket. This is a fast and convenient way to reach his camera without the need of removing the backpack completely from the back. Another favorite is the multifunctional attachment system that, besides being great for attaching skis, also easily can secure other equipment such as his tripod. The padding in the shoulder straps and back makes it comfortable to wear, even with heavy camera equipment.

The duffel bag is as comfortable as his previous hiking bag but with the great advantage of a big opening to the main compartment, making the organization and accessibility superior the previous. He can fit all of his ski gear, including the ski boots, in the bag, still having the option to attach even more on the outside. The laptop sleeve in the top lid allows him to carry his 15-inch laptop in a secure way.

Jens really like that the two models have a similar style since they often are used in connection with each other. For him, style and durability is of highest importance when selecting bags, something that both of Spektrum's models indeed achieve.

ALLAN

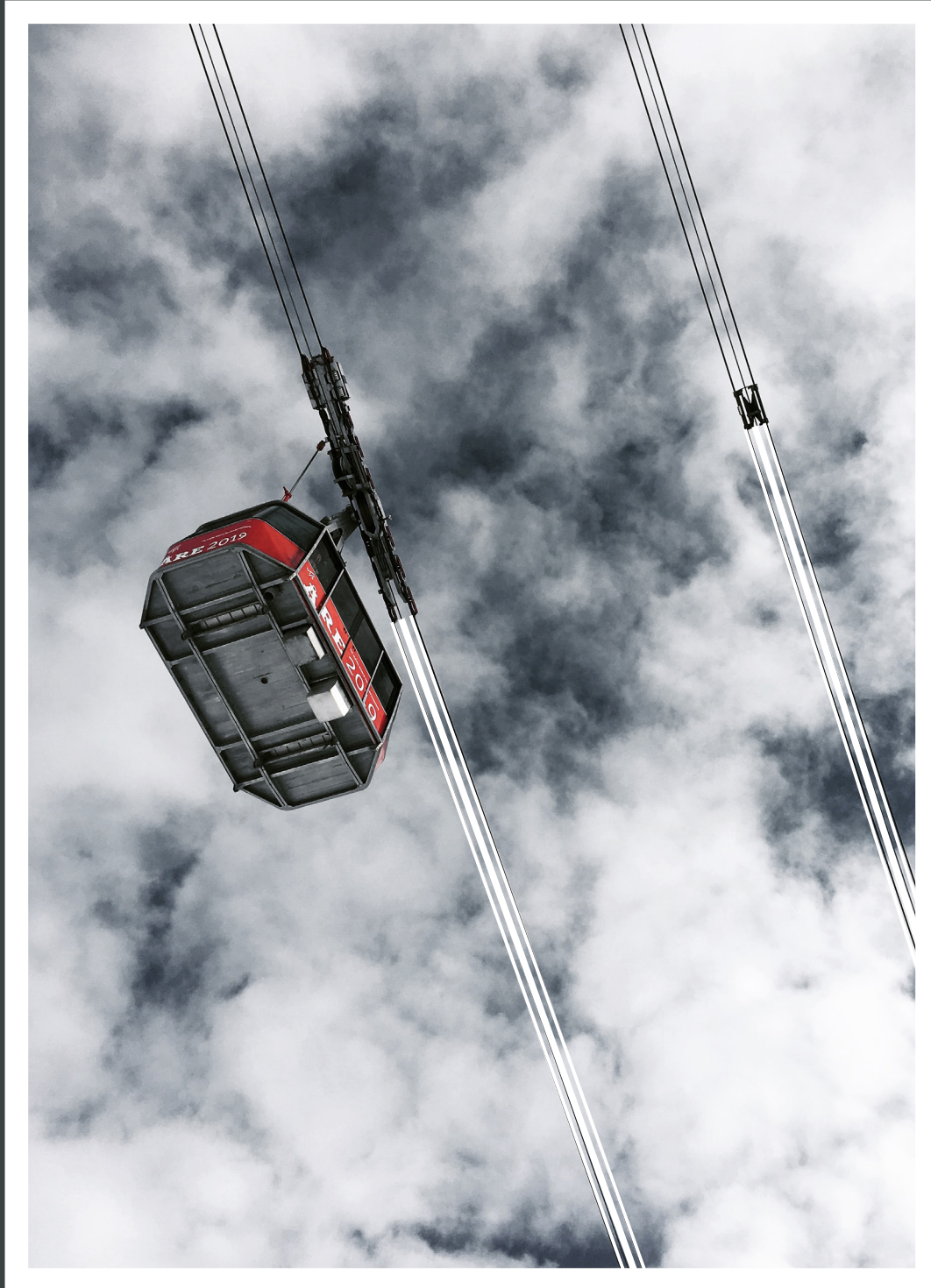


Allan picked the white backpack due to it trendy look that stands out among others on the market, yet with its discrete and urban design. The roll-top make it a great city bag, possible to overload when shopping. He has used the attachment system a few times to fasten random things like his bike lock, but other than that it is more a design element than an important feature for him. Still, since the attachment strap is integrated with the closing function, it does not matter that it is not used frequently.

The blue Spektrum duffel bag is, however, Allan's go-to bag for most occasions. He often stores the shoulder straps to carry it by one of the side handles in urban environments. The outside attachment straps are removed to be used as compression straps on the inside of the main compartment. This keeps all his packed gear in place at the same time as it makes the look of the outside even cleaner. The 40 Liter hold all of his desired packings and the sizing allows him to take it as hand luggage when traveling by air. The expandable compartment is used either as a place for laundry, separated from all the clean clothes when traveling or as a place to store his training shoes when attending the gym.

Allan values style and status, where environmental consciousness is of high status in today's society. Therefore, the sustainability of the bags is one of many aspects that make them superior over competitors.

6. DISCUSSION



In this chapter, the results of the project are discussed by relating it to the theory. Suggestions for further development and recommendations regarding the release of final products are also presented.

6.1 RESULT

The research, benchmarking, and data collection were all indicating a white spot on the market. This apparition was kind of unexpected for me since this segment at a first glance seemed flooded with such a large variety of models. What makes Spektrum's models stand out among others is the bridging between high multifunctionality bags and clean and fashionable urban designs. The designs are based on the theory of brand identity transformation described by Karjalainen and Warell (2005), as well as Dreyfuss (1967) antropometry charts. Some of the functions were determined first after they were tested with different types of prototyping. The final looks were, however, set by me as a designer, based on my own interpretations of the brand and the desires of the target group.

During the project, I have learned a lot about the textile industry and how to design with fabrics. Undeniably, textile design exists within the industrial design field but is still something that I have not encountered earlier in my education. The project was, therefore, a great experience and helped me broaden my knowledge as an industrial design engineer.

In a project like this, it is inevitable to face challenges and setbacks. Therefore, it is important to determine and maintain the limitations of the project to reach a result within the given timeframe. In terms of materials, only cotton and polyester, as well as plastic and aluminum, were researched. This was both due to time limitations, as well as the available experience and resources at the factory. Polyester and cotton mixes, as well as different types of plastic compositions, could have been researched further to get a more in-depth comparison. The material of the smaller details, such as logo patches, were not part of the research. Instead, those types of material selections were motivated through brand recognition described by Karjalainen and Warell (2005).

The brand transformation between two so different product categories was a tough challenge, especially when the current product portfolio not yet is broader than a few models of goggles. I was aware of the risk of overdoing the transformation, where too much similar elements could intrude on the overall design and function. The specific design cues, described by Karjalainen and Warell (2005), that were transferred was certain materials, forms, logos, and colors. The non-specific and qualitative characteristics, often related to the brand message and values, were sustainability, quality, and clean style. Since these characteristics are diffuse, and somehow determined by the observer, there was an ongoing dialog with Spektrum to ensure that my interpretations were in the right direction. For them, the non-specific characteristics were superior to any other, since the product categories were so different. In the end, the desire was not to make a backpack that looked like a goggle, but rather a backpack that could enhance the values and feeling of the brand. Instead, more important was that the backpack and the duffel bag looked like it belonged to the same family. This criterion was not specified at the beginning of the project but was rather emerging during the design process. The brand transformation was, therefore, just as important between the two product models, as between the two product categories.

The fact that the project involved two similar products, that shared the same target group but not necessarily the same functions or are of use, was another great challenge. It was hard to not favor one of the models and direct all focus on that design. Therefore, the time and engagement had to be distributed equally between the models to ensure that both the outcomes were well motivated and developed with the same amount of effort.

To know that high-fidelity prototypes were going to be manufactured after my designs were one of

the things that really enhanced the project. Even though their arrival did not occur within the thesis time frame, further work will be to actually test and interact with them. This is crucial in this kind of product development to ensure a high quality and functional product when finally produced. This is something that Ulrich and Eppinger (2012) also conclude when analyzing the values of prototyping in a design process.

The alpha prototypes were one of the promised deliveries to Spektrum, meaning that the project had to be somehow planned and structured around this event. Six months may seem like a long time for a project, but in a product development process like this, the time is fairly short. Since the production of the prototypes was estimated to four to six weeks, the initial phases of the project had to be compressed to increase the chances that the arrival of the prototypes was within the projects time frame. Due to the delays, the alpha prototypes are, however, estimated to arrive just a few days after this thesis are sent in for publication.

Another consideration was regarding the cost limitations during the final design. When it stood clear that the selected concepts most likely were going to be produced and released on the market, manufacturing costs had to be concerned on a higher level. Since function and sustainability were of high importance, where both contributes to increased production costs, other non-essential features, such as extra inner compartments, was overridden in the design. This became a subconscious constraint, even though Spektrum was clear about that the alpha prototype was allowed to be as expensive as needed.

Throughout the process, Spektrum has been really open-minded with the designs as long as all my decisions were backed up by theory or key insights. Some sort of ecological sustainability was requested at the beginning of the project, although without being defined how it should be achieved. Therefore, Spektrum expressed that my results were over expectations by also include social and economic sustainability. Suddenly, not only nature could benefit, but also the whole chain from producers to consumers as well as Spektrum as a company.

6.2 SUSTAINABILITY

As an industrial designer, I feel a great responsibility to develop sustainable products and will always question myself if the design has a value. I do not want to be a designer that Papanek (1971) refers to when he talks about unnecessary products, over-consumption, and large environmental footprints. Instead, I want to bring sustainable design into consumers products to solve parts of the environmental problems of today. This is something that Yang and Giard (2001) argues for since it can create a new meaning to the industrial design profession.

It may seem counterproductive to first argue about sustainability and the danger of over-consumption, to in a few moments later develop products for people to consume. However, products like this need to be considered for their direct and indirect positive effects on a long-term basis. The production of a backpack will always leave an environmental footprint, but if one backpack can replace three others, the total footprint in the long term will be significantly smaller. Further, if the complete production chain is considered and cared for in a sustainable way, factory workers, users, and nature can benefit. It is also a great way to make a statement and inspire others, both companies and consumers, to be more environmentally conscious.

The final designs were checked with the list made by Shu-Yang et al. (2004) that describes how a designer can make a product more environmentally friendly. The environmental impact has been reduced by; *Selecting low-impact materials, reducing material use, reducing impact during use, and enhancing durability*. What further need to be considered are; *Optimizing of production techniques, optimizing of distribution systems, and optimizing of recovery, reuse, and recyclability*. These are topics that all been touched but not fully implemented in the project due to time limitations.

The material selections of the final designs were based on the research presented in the theory chapter. The fabrics were considered to reduce the material usage and environmental impact, without lacking in durability. The fabrics used in the final products are controlled throughout the complete production chain and are bluesign® approved. However, to get a product completely bluesign® certified, all the components need to be controlled and approved (bluesign®, 2017). In products like

these that include other materials and components, it can take a long time to reach a full certification, which will be a later question for Spektrum.

6.3 RECOMMENDATIONS

A recommendation for the future is to implement any of the new and more sustainable methods of textile dyeing. Some examples are described by The Guardian (2015), but the field should be researched deeper and factories should be searched in close range of the producer. Otherwise, it is necessary to calculate if there is a sustainable benefit of transporting the textiles, sometimes in very long distances, in exchange for a better processing method. By using less chemicals, water, and energy, the environmental footprint can, however, decrease drastically (Kant, 2012). Other improvements during the manufacturing process are to use ultrasound cutting of the polyester fabrics. This can according to research reduce the sheeding of microplastic fibers in wastewater by half (Roos et al., 2017).

Another suggestion is forwarded to the board members, encouraging an implementation of some sort of recycle program in the business. Shu-Yang et al. (2004) list the recycling of an end-life product as one of the important topics on how to reduce environmental impact. Since the backpacks mainly contain polyester and aluminum, it is possible to recycle both of the materials (Cherrett et. al, 2005; The Aluminum Association, 2018). In order to do this though, the metal and textile parts need to be separated. This is something that, due to the seamwork, can be hard for the consumer to do by themselves (Thorpe, 2008). Some sort of replacement program or disposal opportunities at retailers is a recommendation.

Finally, my recommendation to a person that is about to design a backpack is to not underestimate the power of prototyping and physical interaction with a large amount of fabrics. Unlike hard surfaced products, a backpack will behave in many different ways depending on certain factors. Besides the material properties and structure, the look of the bag will also variate a lot by the amount of packing, and how the surfaces are connected. Therefore, it is necessary to create a high-fidelity alpha prototype to test, evaluate, and eventually re-design, before starting final production. These types of prototypes are something that the Hu-

man Centered Design process, along with research about product development, encourage (IDEO, 2015; Ulrich & Eppinger, 2012). When doing these prototypes, thoroughly executed technical drawings will reduce the risks of time-consuming design changes of details the manufacturer was interpreting wrong. This was one of the most important tips I received from experts at the very beginning of the project. It is also the final tip I want to pass along to ensure success with the design.

7. CONCLUSION



Below, the objectives and aims conducted in the projects very beginning are recapped and concluded. These goals were the foundation when establishing the projects three research questions, that also will be answered in this chapter.

7.1 RECAP

“The objective is to design a backpack and a duffel bag for Spektrum that address their target group of urban users, but also perform and is functional on the mountain. An important detail on the backpack is to be able to mount skis or snowboard for hiking. The bags have to be durable and the materials and manufacturing process needs to be sustainable with the environment in mind. A well-motivated design rationale in form of the thesis, as well as high-fidelity technical drawings and prototypes, should be delivered to Spektrum. The design rationale will be achieved by in-depth analysis, development, and testing.

The aim is to see the bags be produced and labeled with a recognized sustainable certification. Eventually, the aim is to see the designs reach stores and have an impact on the market.”

7.2 HOW TO TRANSFER SPEKTRUMS DESIGN IDENTITY FROM ONE PRODUCT CATEGORY TO A COMPLETELY NEW?

There are recognized ways to successfully transfer a design identity between products. The transformation can either be done within the same product line or between completely different categories. This project actually included both versions since the transformation involved both current products and the two different models of the bags.

The first objective when doing this type of transformation is to understand Spektrum's values and what messages they want to express. Methods to achieve this can be in form of mood boards, examinations of the brand's current products, as well as dialogues with the stakeholders. It is also important to understand what environments, audience, and purposes the products are aimed for. This will help the designer to transfer the specific and non-specific design cues from a product to another and keep the associations within the brand.

It is a good idea to check if the transformation is successful by presenting the new design for both stakeholders and independent observers. If the brand's values and design cues are represented in the products and noticed by observers, there is also a high chance for overall brand recognition. The transformation and implementation of these elements is a balancing act, where overdoing can affect the products look and function in a negative way.

Of course, it is important that specific design elements are distinct when transferred between different product categories. However, just by placing a logotype on a product does not make that product reflect the brand. Therefore, the non-specific and qualitative design cues are probably more important to succeed with, especially when the transfer is between two different product categories.



Figure 60. Spektrum backpack compared with their next season concept Go07 Helags goggle.

7.3 HOW TO INCLUDE MULTIFUNCTIONALITY WITHOUT INTERFERING WITH STYLE?

This can be a bit hard to define since the definition of *style* is set by the observer. The first objective is to understand and determine what the meaning of style is for the specific target group. For Spektrum's audience, the style has to be clean, yet functional. A clean look can be achieved by hiding features when they are not in use. Another way is to use the same feature for multiple functions. Since the style aspect varies from person to person, the products can allow minor customizations to make it more personal, without interfering with the brand identity. The bags removable and hideable functions also allow the user to transform the look and feel of the products depending on the occasion and area of use. Finally, the products are offered in dif-

ferent colors, addressing a broader audience by letting the user select their favorite.

It is a good idea to involve stakeholders throughout the design process to get valuable inputs about style contra function. Sometimes, a solution or aesthetics need to be compromised with the risk of intruding on either of the sides. To avoid this, the aim should be to bridge the two elements together when possible. Another way to ensure a successful esthetic and functional design is to involve representants from the target group to evaluate or test the products. This can be performed either in direct contact with the users or by the help of the personas.

7.4 HOW TO DESIGN FOR ECOLOGICAL, SOCIAL, AND ECONOMIC SUSTAINABILITY?

Ecological

The whole product cycle, from the harvesting of the materials to the disposal of the end-life product, need to be considered when designing for ecological sustainability. The selection of materials will have a high impact on the final product's ecological footprint. Organic materials do not necessarily have to be more environmentally friendly than synthetic ones. Recycled materials are however often to prefer before virgin. Reducing the material usage of the product is another way to improve ecological sustainability. However, there is a balancing act when selecting materials, since the choice can affect the product outcome and durability. A backpack produced to be environment-friendly but that is not durable on the field can actually be less sustainable in the long term, since it has to be replaced more often. By having a carefully thought out plan and find a balance between sustainability and durability in the design, the environmental impact can decrease significantly.

Social

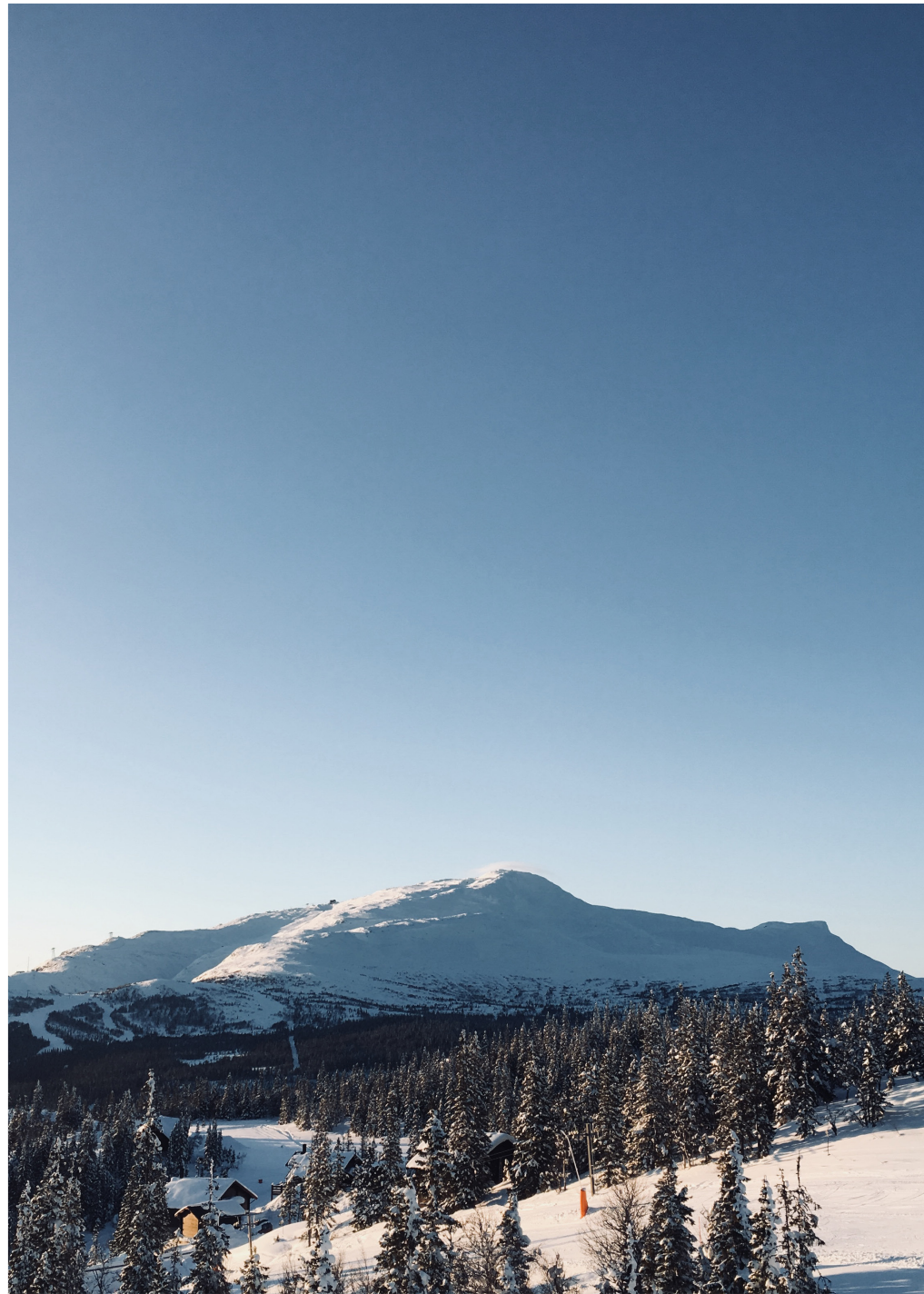
The social sustainability involves everyone from the factory worker in the production line to the final end-user. The social benefits are better and safer working conditions for everyone involved in the production, as well as a clearer conscience for the brand and the consumer. Today, there is a social

status to care for the environment and use sustainable products as a statement to the surroundings. From the brand, this social status can be shown through a sustainable certification on the price tag or in marketing. A consumer can then represent this statement by using the brand's sustainable products. By designing sustainable products that still have high function and good looks, it is easier to attract all types of consumers and fill the gap between the ones that are highly environmentally conscious and the ones that just following trends.

Economic

A great challenge within the textile industry today is the consumer demand for cheaper and cheaper products. Since a sustainable fabric with a high-status certification often is more expensive to produce, the consumers forcing many of the large companies to use cheaper and inferior methods. That in turn delay development of new and more sustainable solutions since the money is placed elsewhere. If consumers would be willing to pay extra for sustainable products, I am confident that the branch shortly would follow. It is important that brands like Spektrum are changing the customer behavior by only offer sustainable products. When the environmental concern eventually strikes more and more consumers, the companies early in the sustainable reorganization will most likely have a competitive lead.

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APPENDICES

A.	PROJECT PLAN	
B.	INTERVIEW QUESTIONS	(SWEDISH)
C.	FOCUS GROUP QUESTIONS	(SWEDISH)
D.	LIST OF REQUIREMENTS	
E.	WORD ASSOCIATION	
F.	DESIGN CUES	
G.	TECHNICAL DRAWINGS OF BACKPACK	(OUT EDITED MEASUREMENTS)
H.	TECHNICAL DRAWINGS OF DUFFEL BAG	(OUT EDITED MEASUREMENTS)

Appendix A displays the project plan where the key activities are listed in a timeline, divided into weeks and months.

JANUARY.

Week	To do	Deadline
2	Planing Initial research Brand analysis Thesis structure	7 January
3	Telephone meeting with Spektrum Meeting with coach at LTU Market analysis (benchmarking) Project plan submission (22 January)	19 January
4	Material analysis Sustainable analysis Cost analysis Manufacturing analysis Expertise interview	28 January

FEBRUARY.

Week	To do	Deadline
5	User interviews Focus groups	4 February
6	Personas Determine functions Concept development	11 February
7	Prototyping	18 February
8	Sketching Koncept development	25 February

MARS.

Week	To do	Deadline
9	Design reconciliation with Spektrum	Undated
10	Blueprints and specifications list Send to factory for prototype manufacturing (2-3 weeks)	11 Mars
11	50% thesis submission (12 mars) 50% presentation (17 mars)	17 Mars
12	Prototype testing, evaluating, developing,	Depend on recei- ving of prototype
13	Update blueprints and specifications list Send to factory for Final sample (2-3 weeks)	31 Mars

APRIL.

Week	To do	Deadline
14	Thesis illustrations	8 April
15	70% Thesis	15 April
16	Final sample testing, evaluating	Depend on recei- ving of sample
17	Photoshoot of sample Display functions	29 April

MAY.

Week	To do	Deadline
18	Buffer for delays Thesis writing	
19	Buffer for delays Thesis writing	
20	90% Thesis submission (21 May)	20 May
21	95% Thesis submission (28 May)	27 May

JUNE.

Week	To do	Deadline
22	Presentation 100% Thesis	Undated

OCTOBER.

To do	Deadline
Submission to Red Dot Design Award (Open 9 oct 2018)	9 February 2019

FALL 2019/2020.

Products on market

Appendix B displays the interview questions used when conducting the three expert inter-views (1/2), as well as the ten user interviews (2/2) of the project. The questions are pre-sented in Swedish.

EXPERTINTERVJUER

HAMPUS ÖSTBERG

Vilket förarbete gör du för att komma fram till designen av en väska?

Vad är det viktigaste att tänka på när man designar en väska?

Vilka hinder/fallgropar ska man akta sig för?

Vad ska man vara tydlig med när man skickar efter en prototyp?

Vilka är vanliga material och egenskaper att undersöka?

Vad är det som ofta drar iväg kostnaderna vid produktion?

HENRIK KÖHLER

Du som är insatt i modeindustrin, vilka trender ser man nu och framöver inom kläder- och accessoarer?

Hur väljer ni färger på Cross Sportswear kollektionerna?

Hur går materialvalet till?

Vilka hållbara åtgärder implementerar ni i designen?

ROBERT OLSSON

Vilka tekniska delar ska man vara extra noggrann med vid väskdesign?

Hur väderskyddar man bäst textila produkter?

Hur jobbar Haglöfs med bluesign®?

Är det några funktionsmässiga svårigheter att jobba med återvunna tyger?

Appendix B. Interview questions (2/2)

ANVÄNDARINTERVJUER

INTRO

Kan du ge en kort introduktion om dig själv?

Vad har du för väskor i dagsläget och vad använder du dom till?

(Vid flera väskor, gå igenom de som är relevanta med dessa frågor)

Vad är det för modell och hur många liter är väskan?

Vad var det som gjorde att du valde just den?

Vad är det bästa med väskan?

Vad är det sämsta?

Om en väska är miljövänligt producerad, hur ska det synas?

I SAMBAND MED SKID/SNOWBOARDÅKNING

När är det aktuellt att spänna fast utrustning?

Hur spänner du fast den samt för/nackdelar med metoden?

Vad har du med dig i väskan?

Vilka är de viktigaste funktionerna?

Använder du samma väska till något annat än åkning?

I SAMBAND MED STADSLIV/ÖVRIGA AKTIVITETER

Vad vill du få plats med i väskan?

Vilka är de viktigaste funktionerna?

Använder du avlastningsspännen, i så fall när?

Till vilka aktiviteter använder du väskan?

I SAMBAND MED RESA/STÖRRE PACKNING

Vad vill du få plats med i väskan?

Hur organiserar du i väskan?

Vilka är de viktigaste funktionerna?

Hur bär du oftast väskan (axelrem, handtag, som ryggsäck)?

Appendix C. Focus group questions (1/1)

Appendix C displays the questions used during the focus group. The questions are presented in Swedish.

FOKUSGRUPPEN

Vad har du för ryggsäck i dagsläget och varför valde du den? (Kolla på medtagna väskor för att hitta för och nackdelar)

Undersöktes väskans tekniska specifikationer?

Vid vilka tillfällen använder ni ryggsäck i åkningen? Vad har ni oftast med er då?

När är det aktuellt att spänna fast utrustning? Vilken typ av utrustning och vilken metod används då, samt för- och nackdelar?

Hur organiserar ni i väskan?

Hur ska lavinutrustning förvaras?

Vad är viktigt på ryggsäcken? (Midje/brösthälte, storlek, stil, funktioner osv.)

Använder ni samma väskor utanför berget? Till vadå?

Använder ni större väskor vid resa till åkningen? Fördelar/nackdelar/önskemål med den?

Om det är möjligt, är det viktigt för dig att produkterna du använder är miljövänliga? Hur ska det synas utåt?

Appendix D displays the list of requirements of the backpack (1/2) and the duffel bag (2/2).

BACKPACK	CONTENTS	NEEDS
Manufacturing	Price	Max cost (classified)
	Material	Water resistant UV-resistant Durable Environmental friendly
	Sustainable design	Low environmental impact Durable over time
Attachment (Outside)	Skis	Diagonal attachment Fiting different types and sizes
	Snowboard	Vertical attachment Fiting different types and sizes
	Usability	Not blocking compartments Multifunction No need for treading Light weight Strong
	Other gear	Adjustable to content
Carrying system	Shoulder straps	Adjustable in lenght
	Chest strap	Adjustable in lenght Adjustable in hight Removable/Hideable
	Waist strap	Adjustable in lenght Removable/Hideable
Storage (Inside)	Main compartment	Minimum of two entrances Expandable storage
	Shovel blade	Far from spine
	Organization	Shovel shaft Probe 13" laptop sleeve
Style	Clean	Reduced amount of straps
	Spektrum design	Colours Quality Mountain Urban

Appendix D displays the list of requirements of the backpack (1/2) and the duffel bag (2/2).

DUFFELBAG	CONTENTS	NEEDS
Manufacturing	Price	Max cost (classified)
	Material	Water resistant UV-resistant Durable Environmental friendly
	Sustainable design	Low environmental impact Durable over time
Carrying system	Handles	Short handle Long handle
	Shoulder straps	Adjustable in lenght Multifunction Removable/Hideable
Storage	Main compartment	Large entrance
	Small compartments	Separated from main
	Organization	15" laptop sleeve Inner pockets
	Size	Handluggage on aircrafts
Style	Clean	Reduced amount of straps
	Spektrum design	Colours Quality Traveling Urban

Appendix D displays the list of requirements of the backpack (1/2) and the duffel bag (2/2).

Appendix E. Word association (1/1)

Appendix E displays the word association cloud used during the creative sessions.



Appendix F. Design cues (1/1)

Appendix F displays the comparison of Spektrum season 18/19 goggles in search of design cues.



	G007 STANDARD LINE	G008 STANDARD LINE	G009 STANDARD LINE	G007 BLACK LINE
PRINTED LOGO ON GLAS	YES	YES	YES	YES
STRIPES ON BAND	YES	YES	YES	NO
DISPLAYED LENS FUNCTION	YES	NO	YES	YES
LOGO ON BAND	METAL	METAL	METAL	SILICONE

Appendix G. Technical drawings of backpack (1/19)

Appendix G displays the technical drawings of the backpack that were sent to Baruma for alpha prototype manufacturing. The measurements are out edited due to copyright reasons.

SPEKTRUM
ROLLTOP

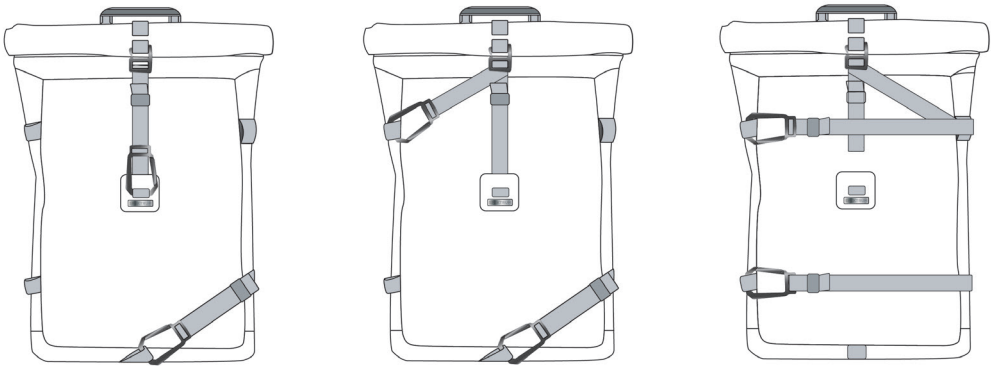


All measurements in [mm]

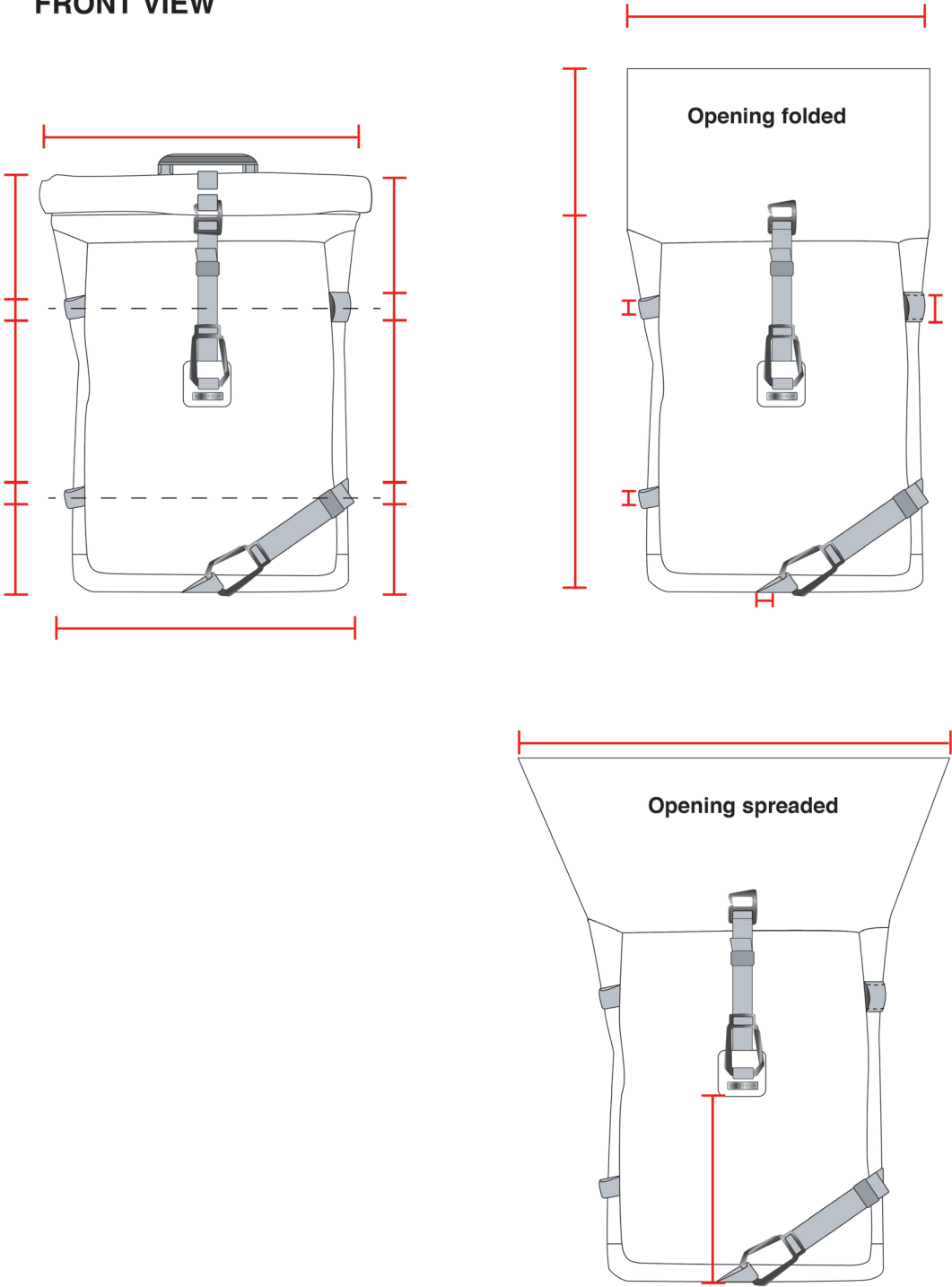
OVERVIEW

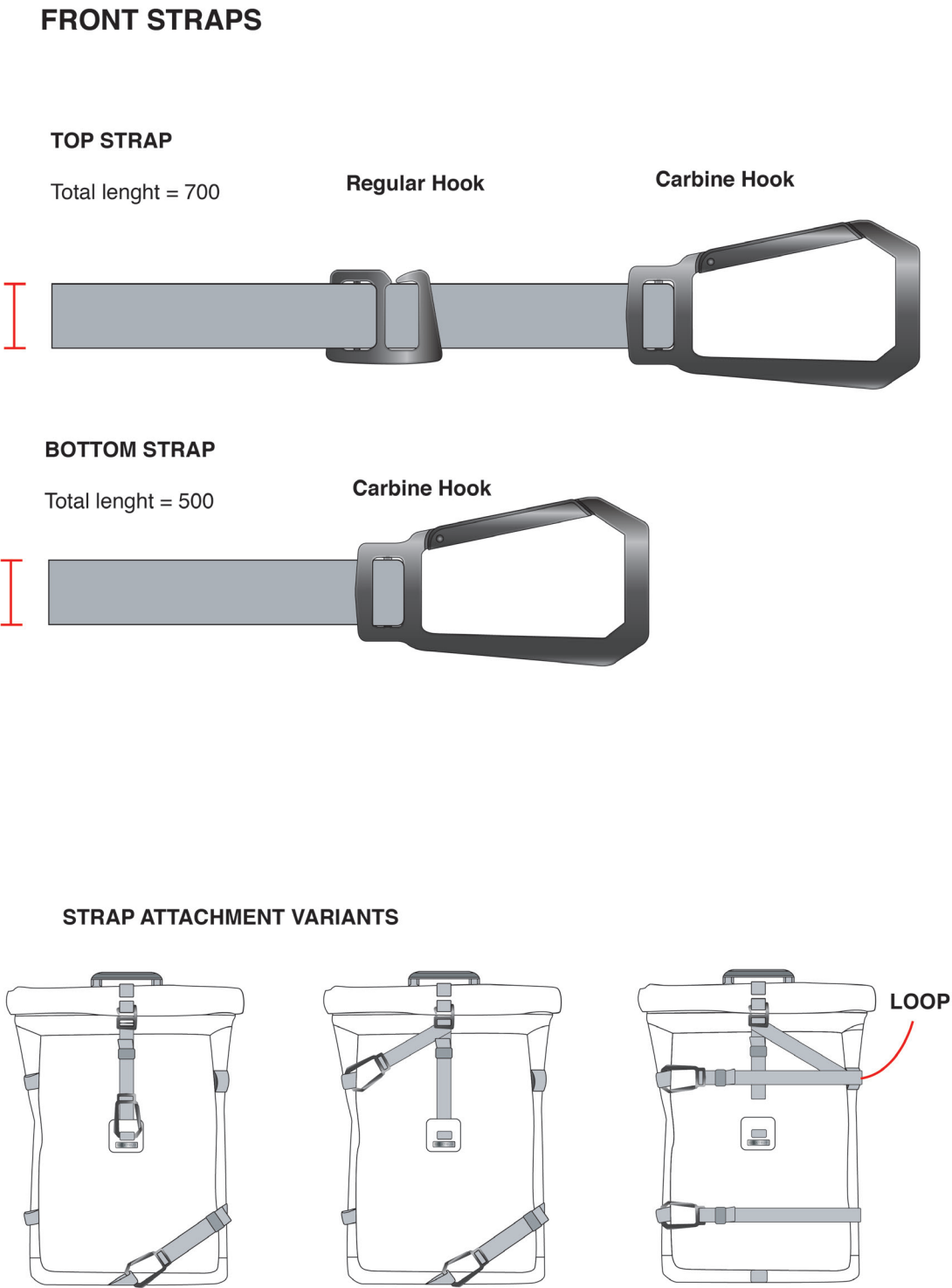
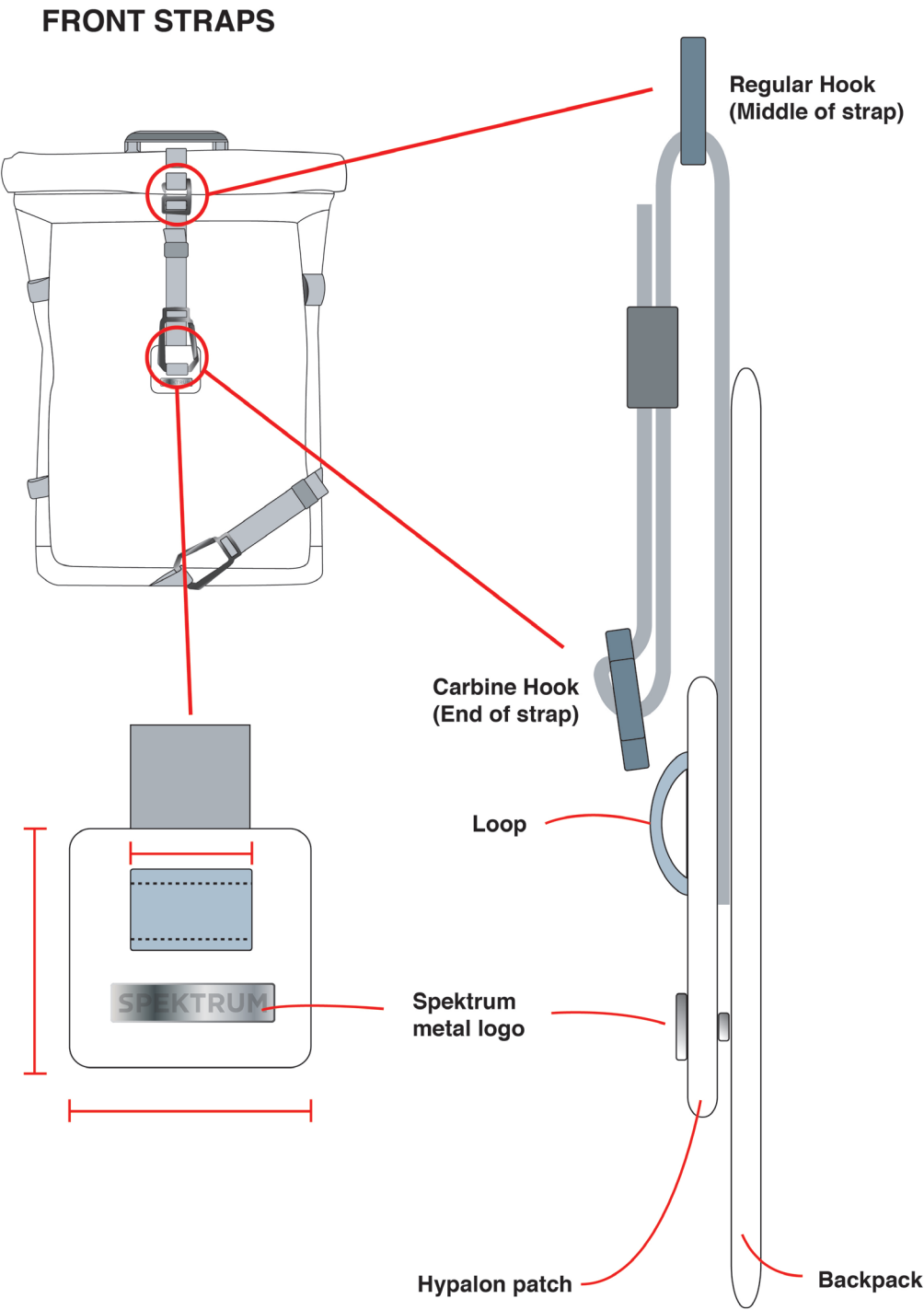


STRAP ATTACHMENT VARIANTS

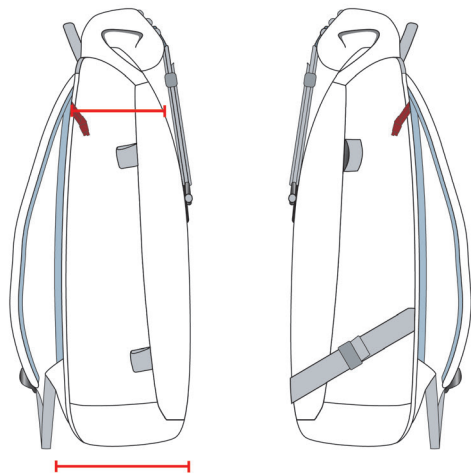


FRONT VIEW

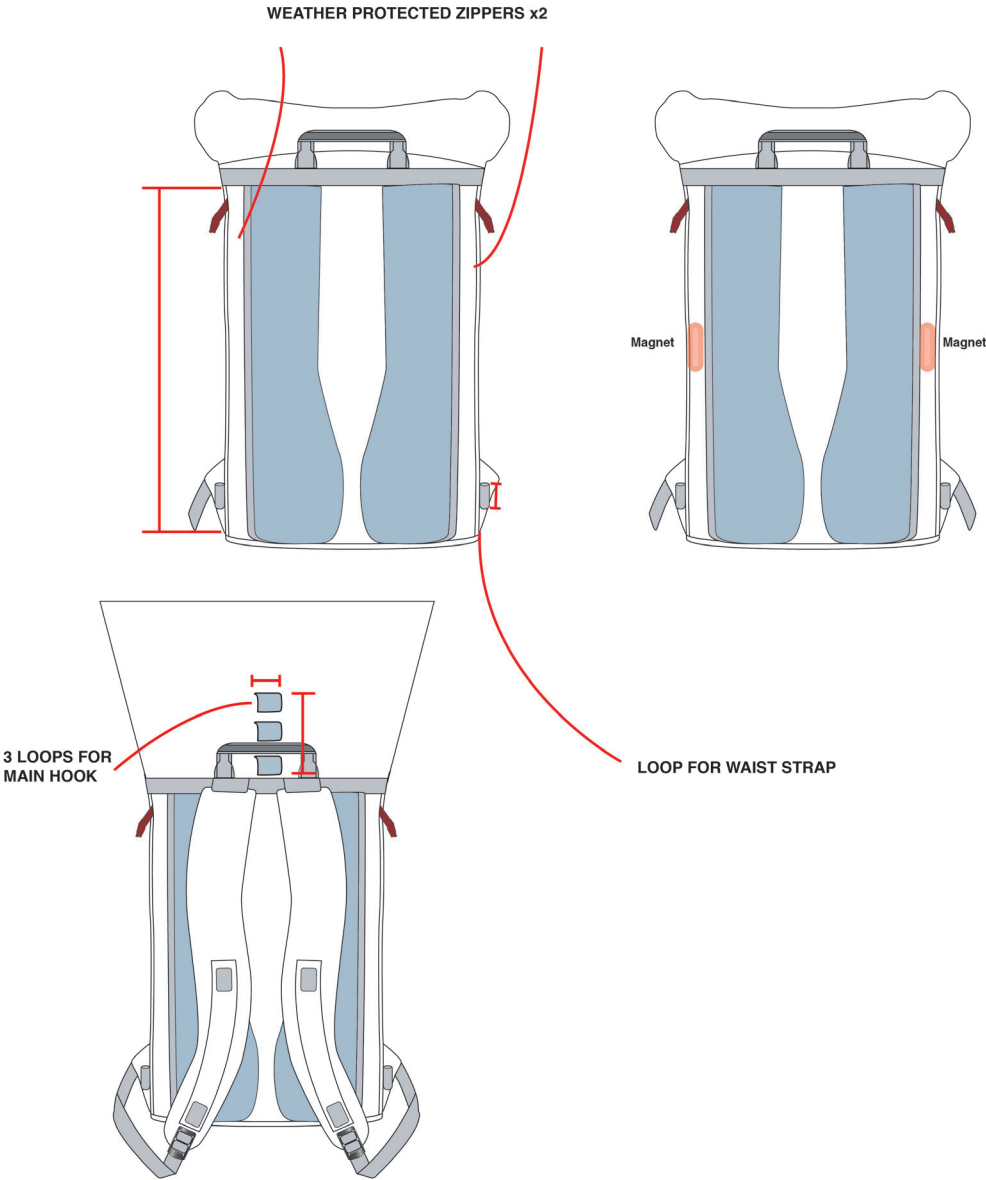


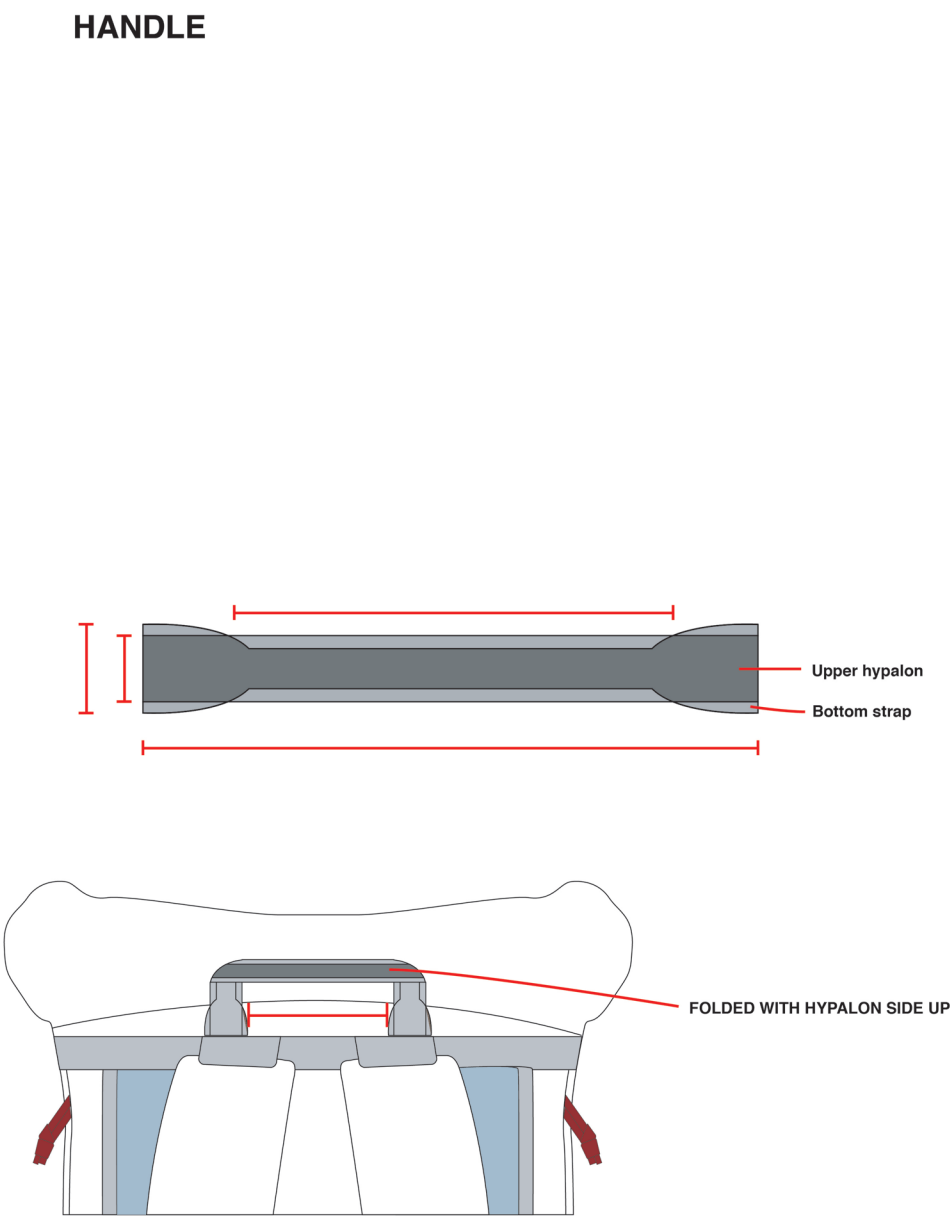
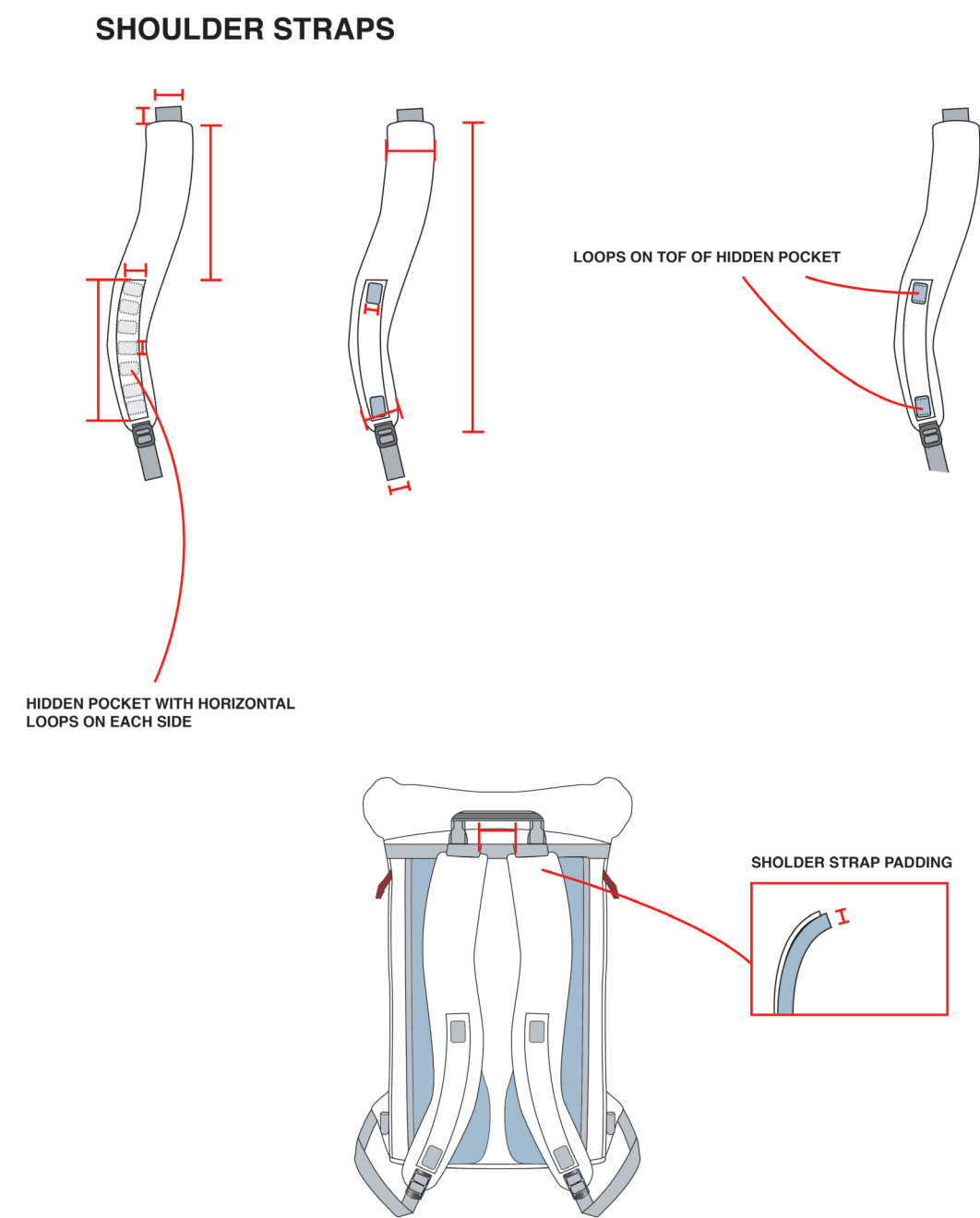


SIDE VIEW

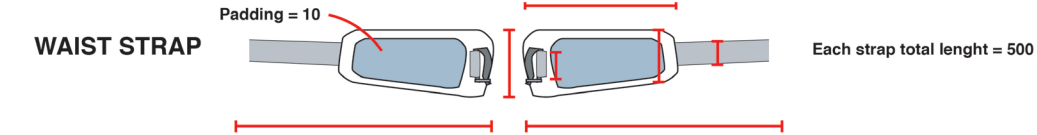
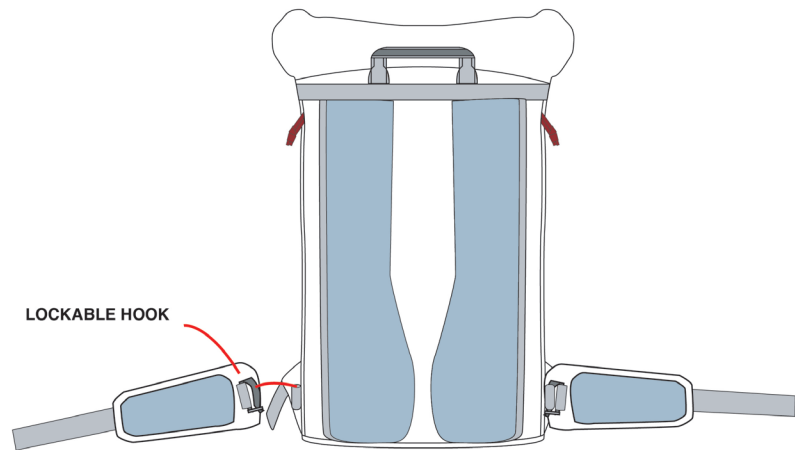


BACK

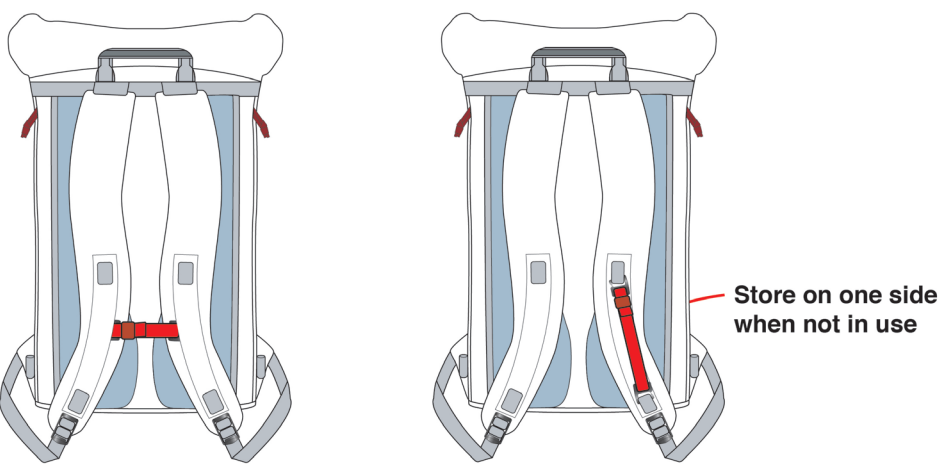




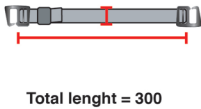
WAIST STRAP



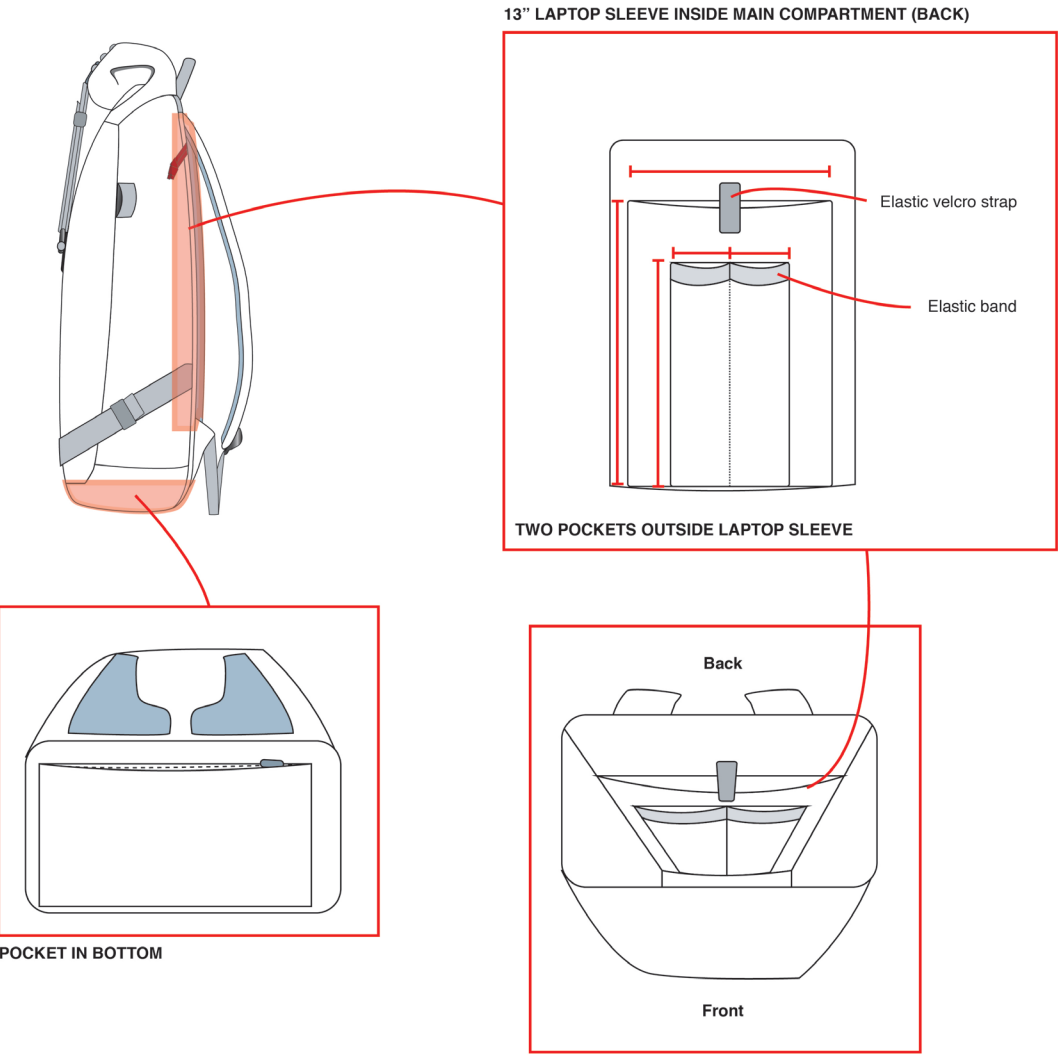
CHEST STRAP



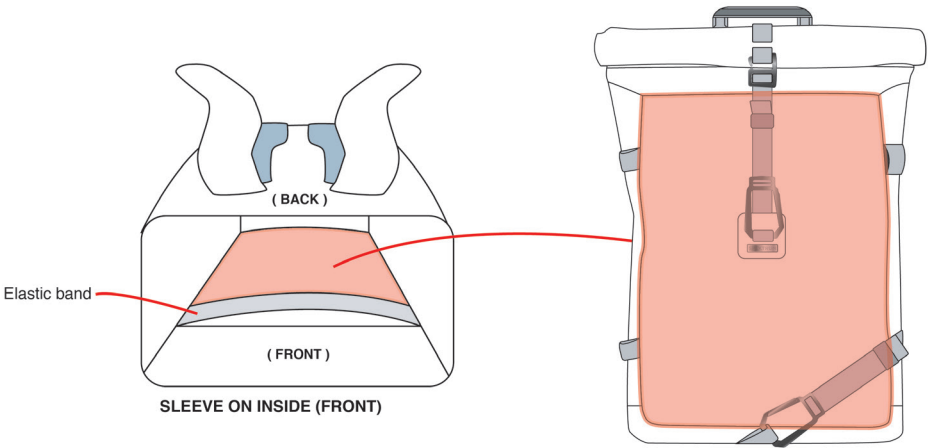
CHEST STRAP



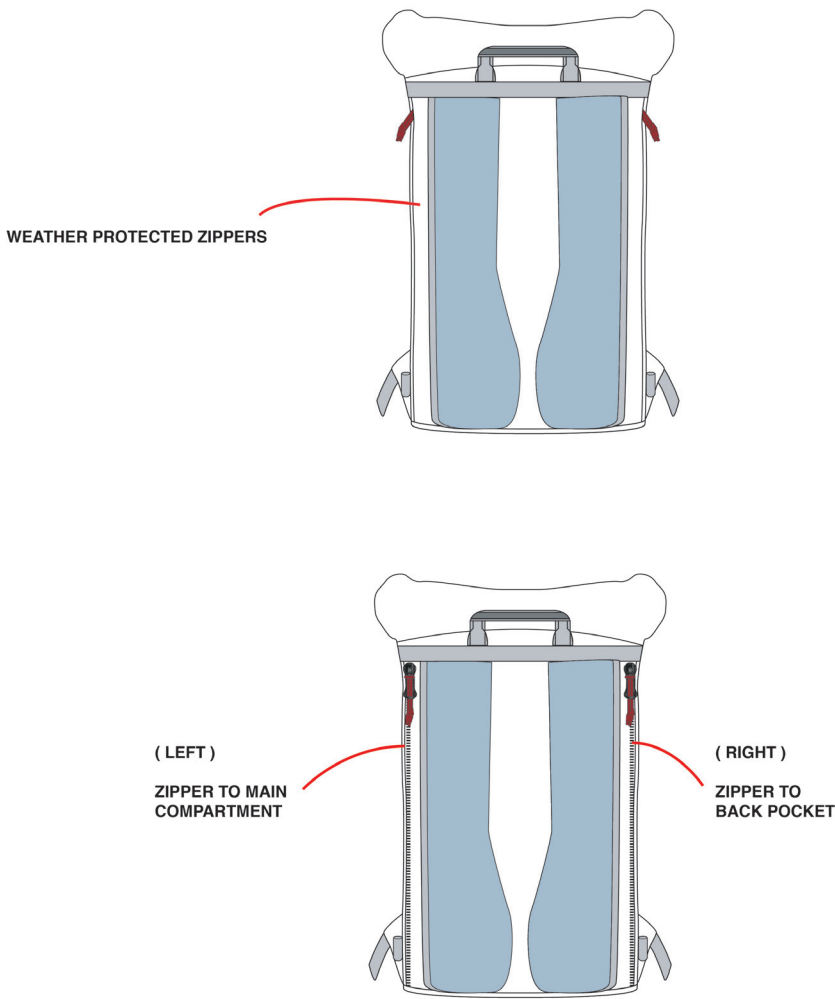
POCKETS



POCKETS

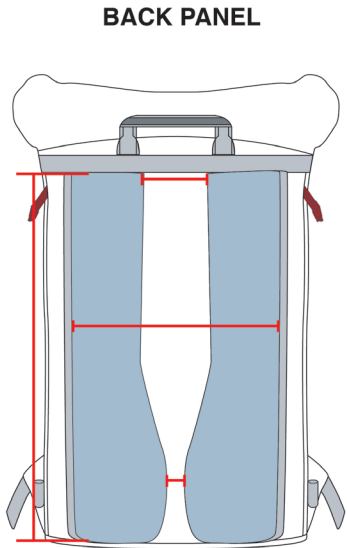


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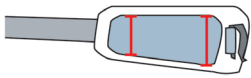


PADDING

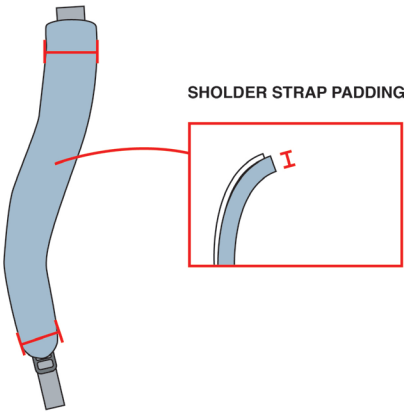
ALL PADDING THICKNESS = 10



WAIST STRAP

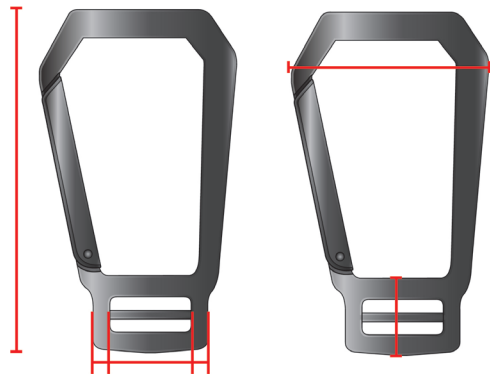


BACK SHOLDER STRAP

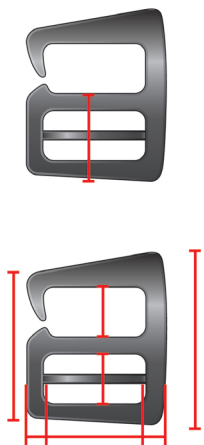


ZIPPERS & HOOKS

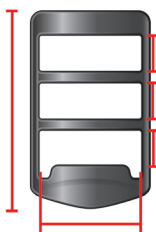
CARBINE HOOK



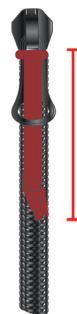
REGULAR HOOK



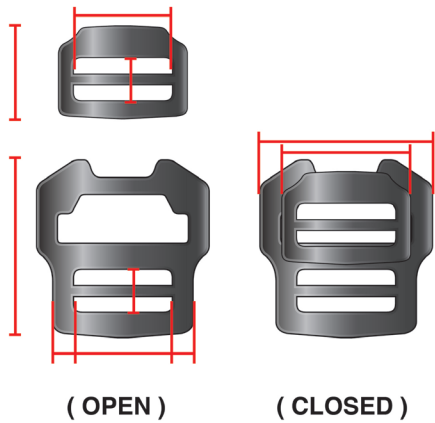
SHOLDER STRAP



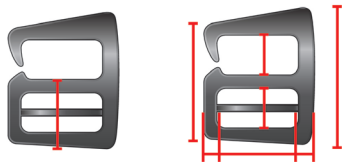
ZIPPER WITH PULLER



WAIST BUCKLE

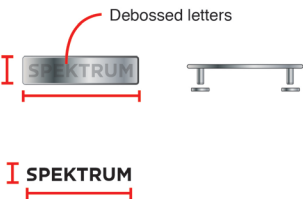


CHEST BUCKLE

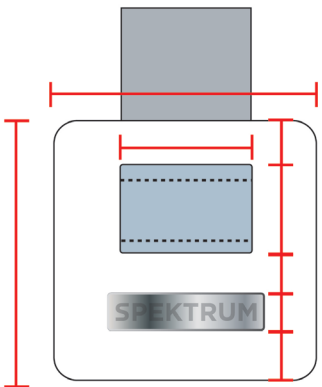


LOGO (METAL)

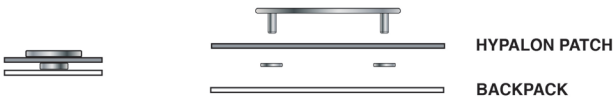
METAL LOGO



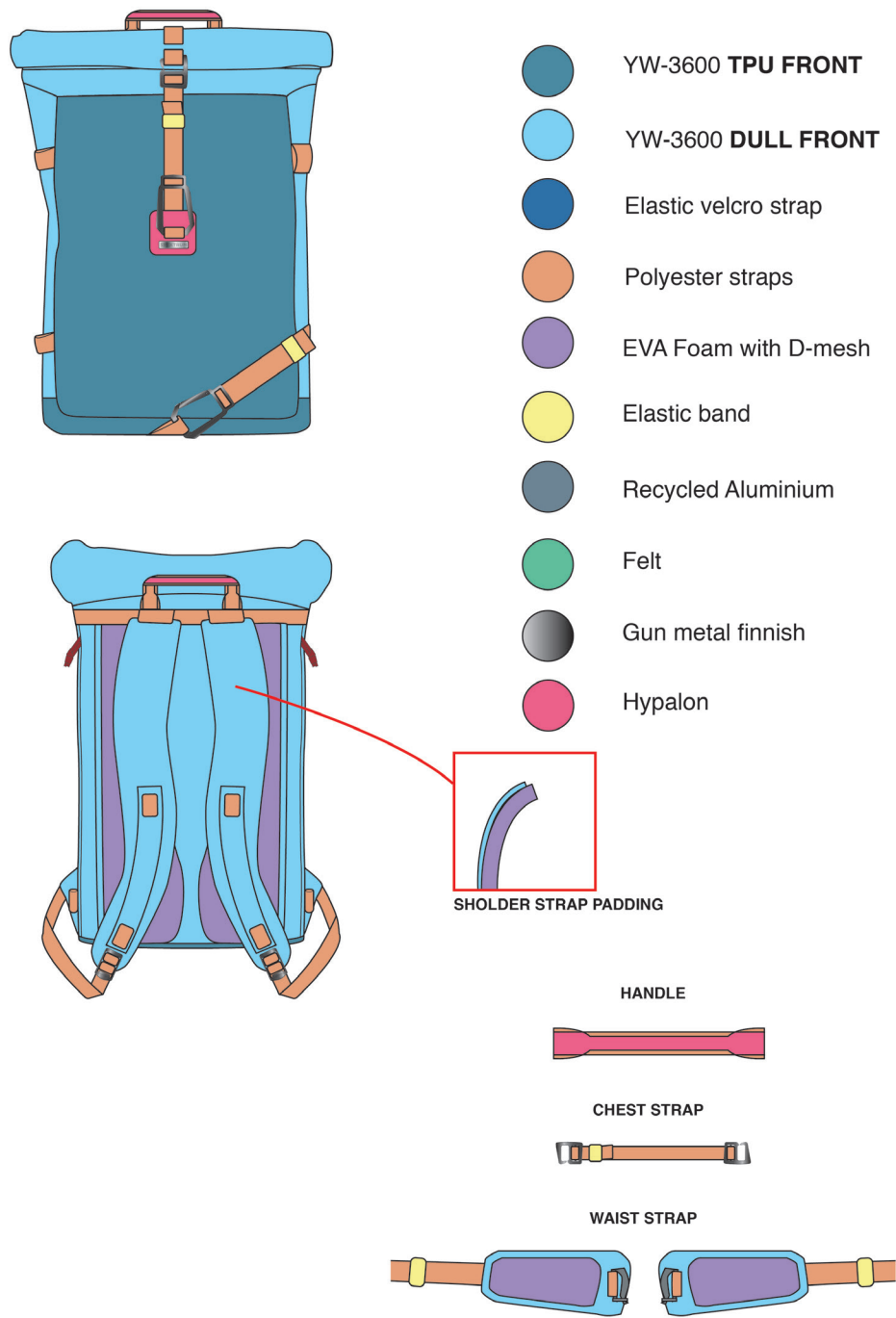
FRONT VIEW



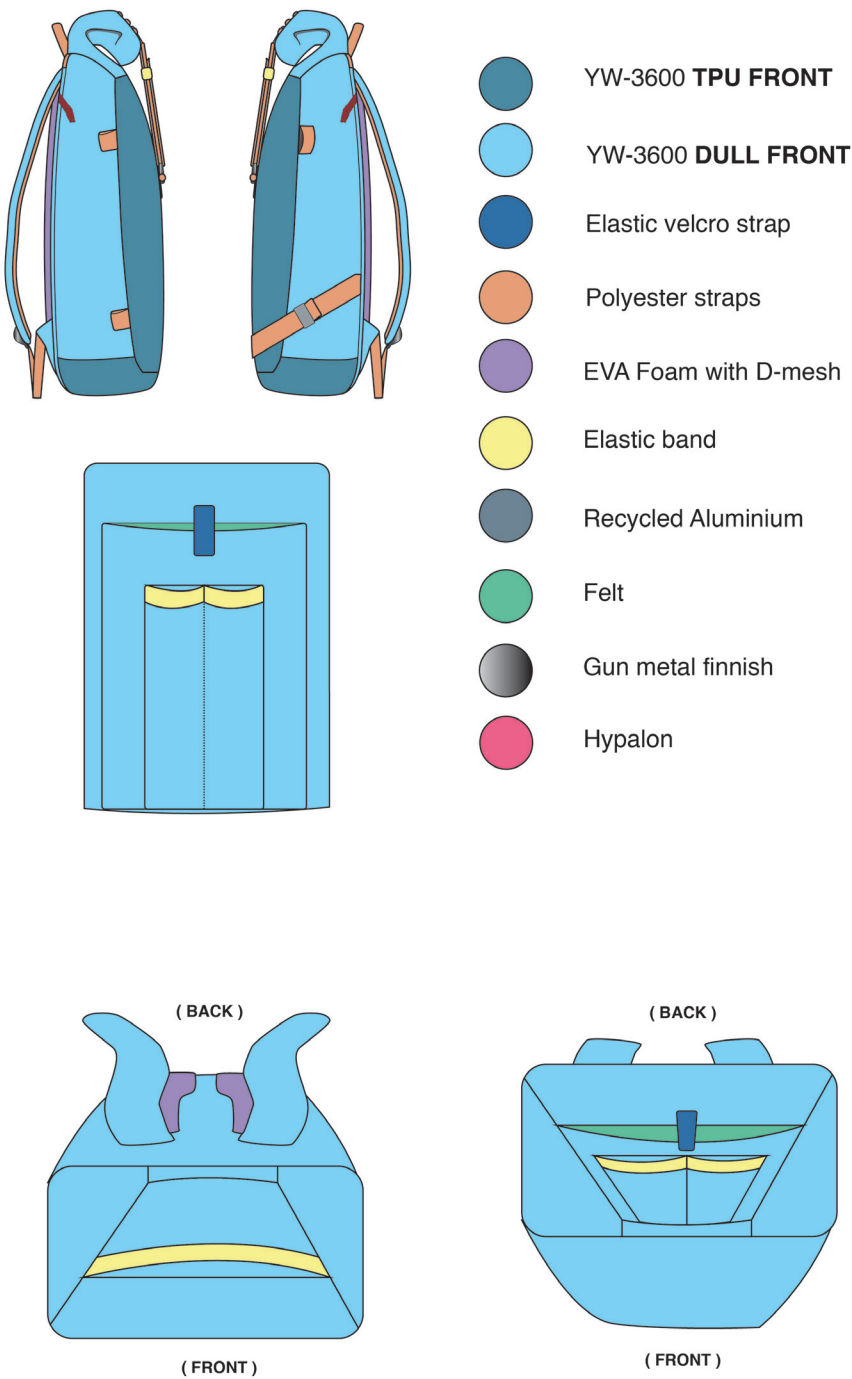
SIDE VIEW



MATERIALS



MATERIALS



Appendix H displays the technical drawings of the duffel bag that were sent to Baruma for alpha prototype manufacturing. The measurements are out edited due to copyright reasons.

SPEKTRUM

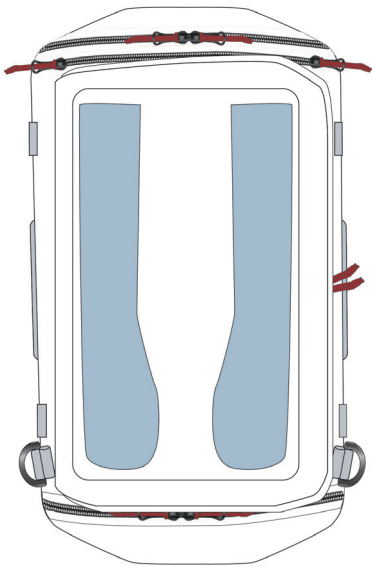
DUFFELBAG



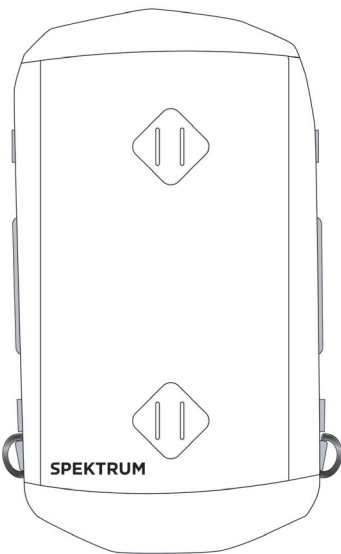
All measurements in [mm]

OVERVIEW

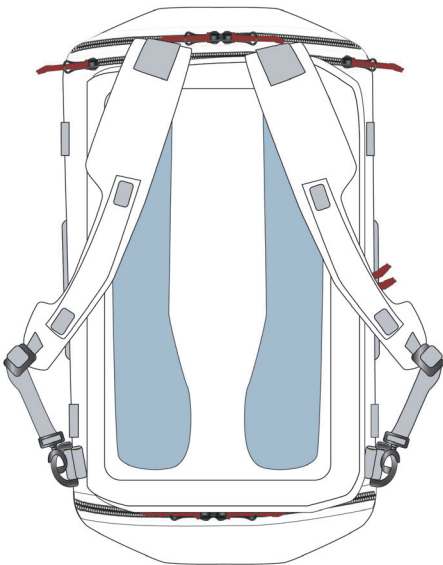
TOP



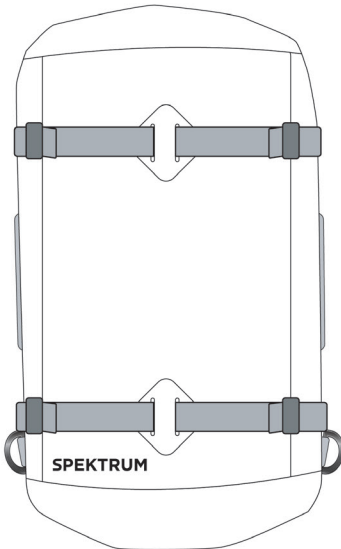
BOTTOM



TOP WITH SHOULDER STRAPS

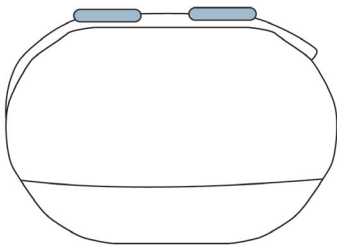


BOTTOM WITH STRAPS

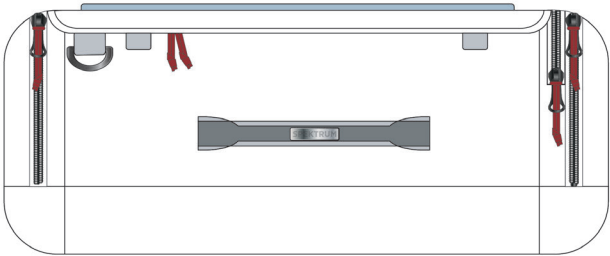


OVERVIEW

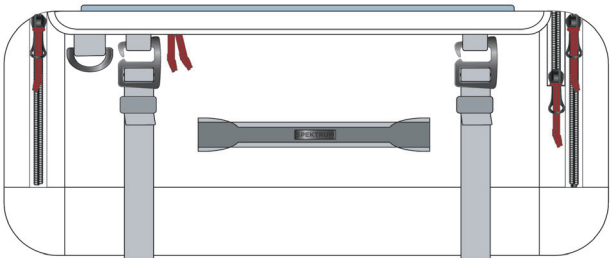
FRONT



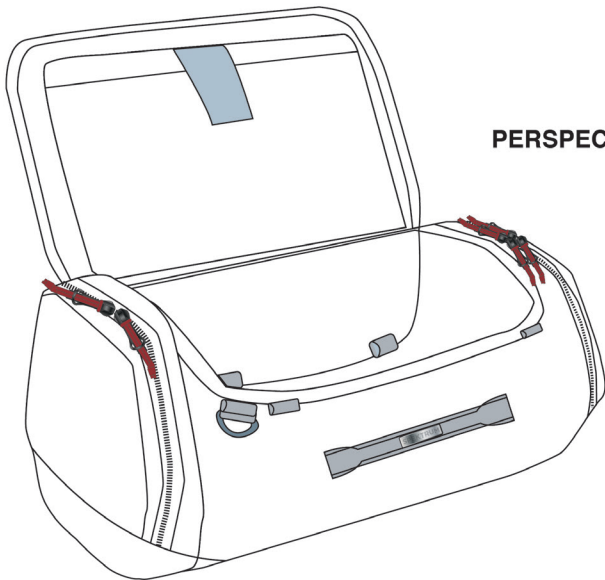
SIDE



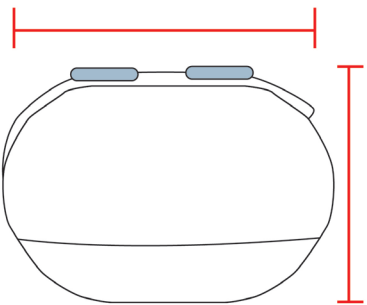
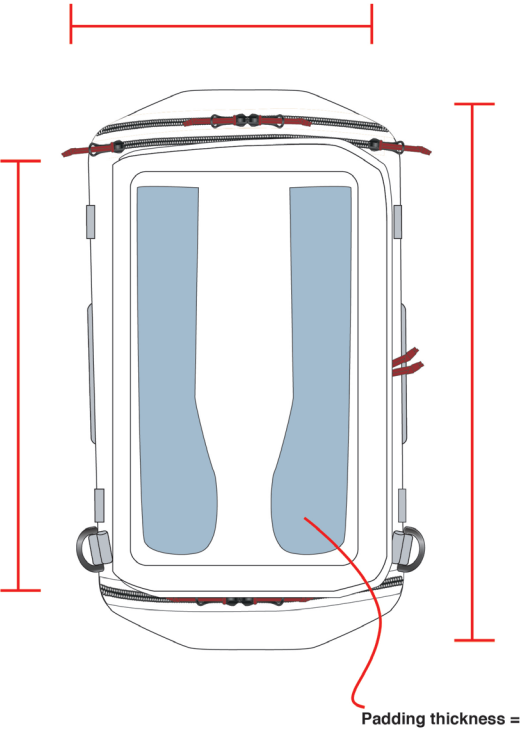
SIDE WITH STRAPS

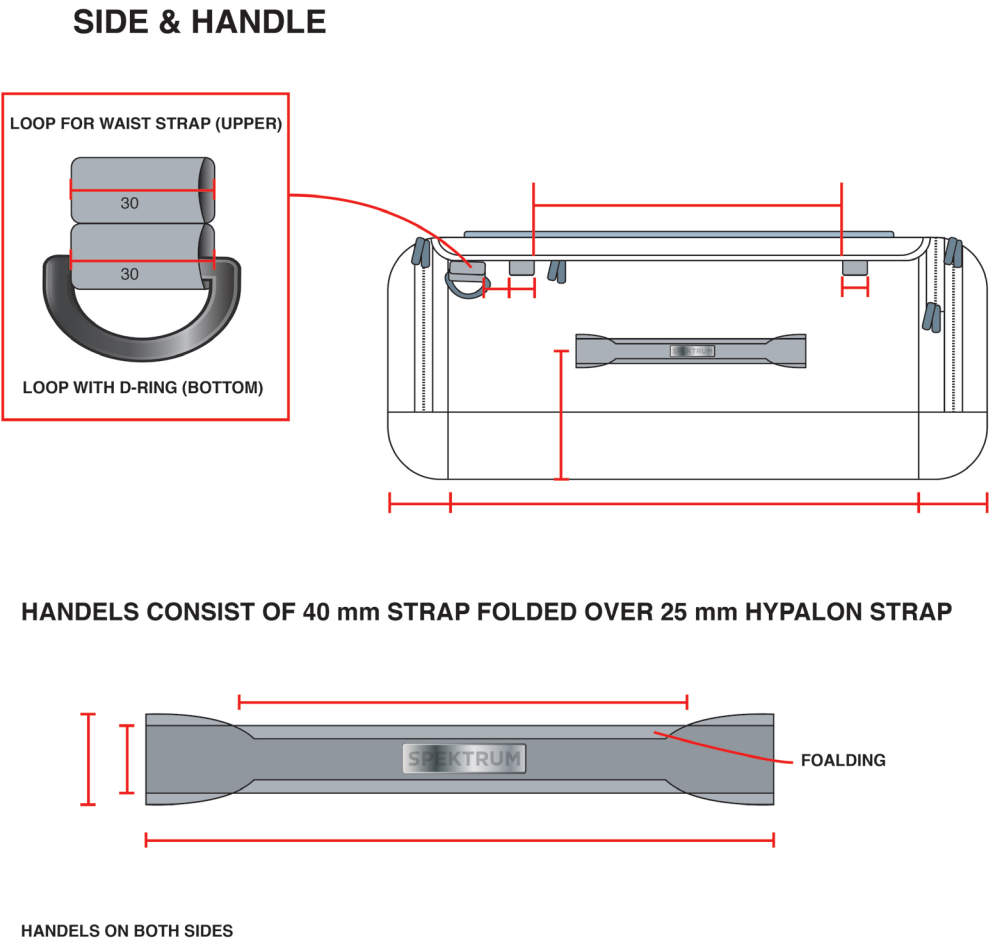
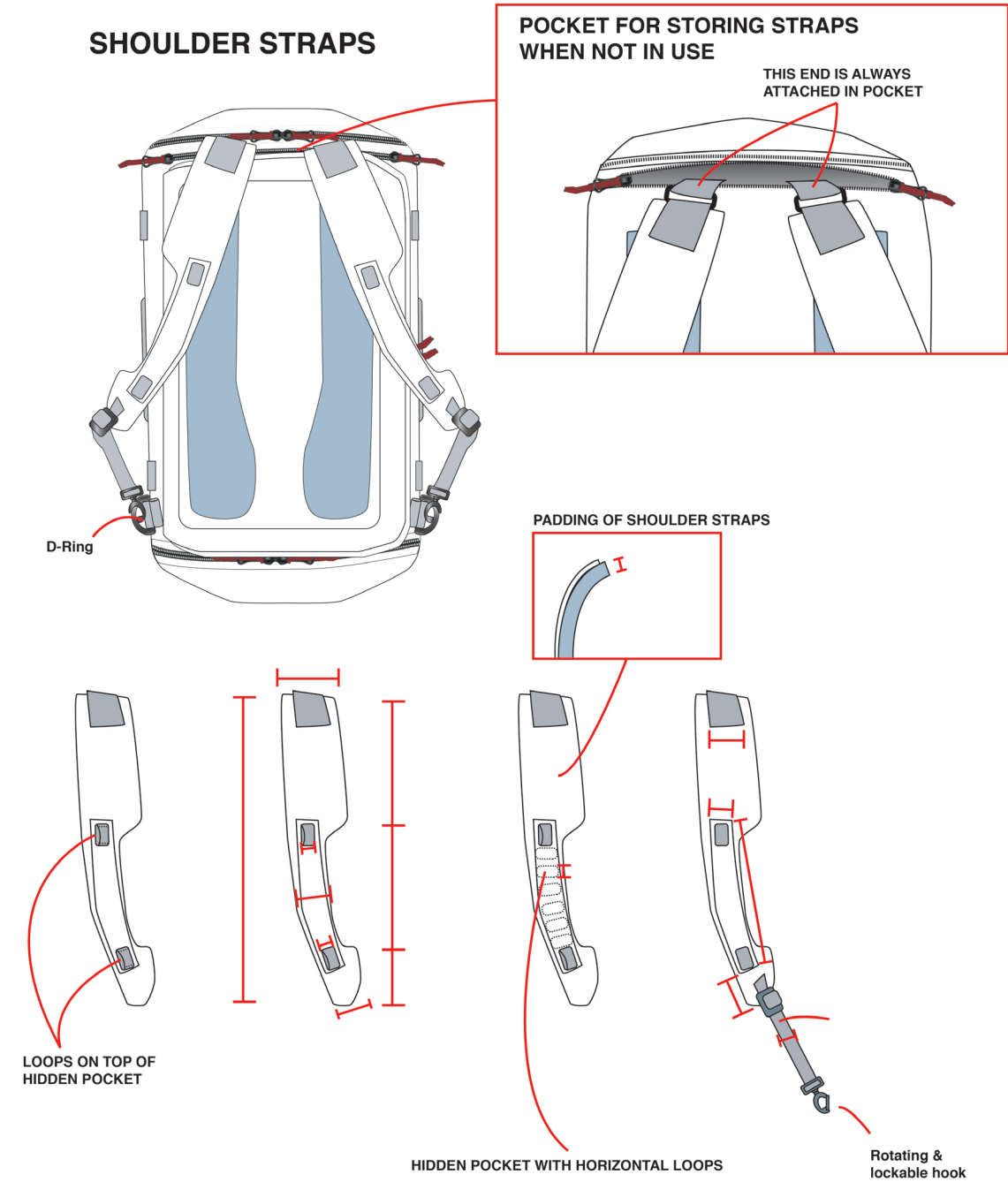


PERSPECTIVE

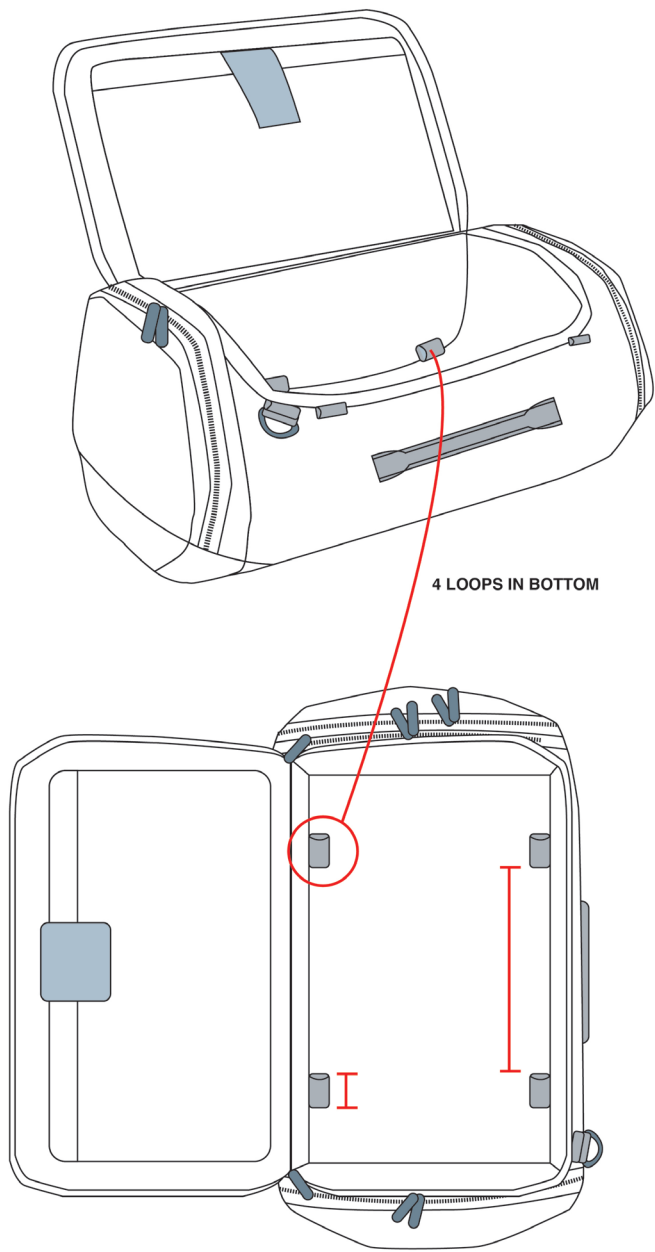


TOP & FRONT

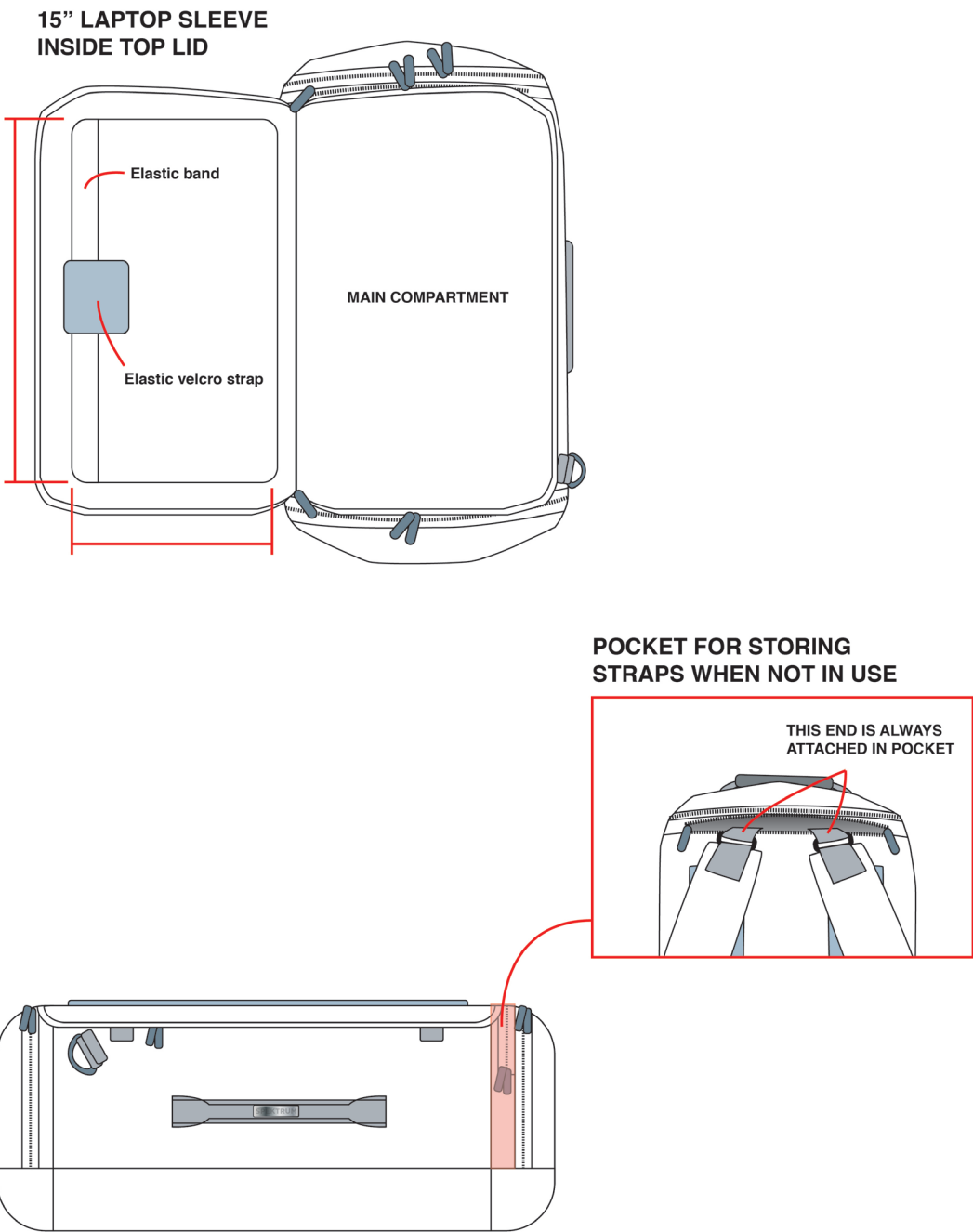




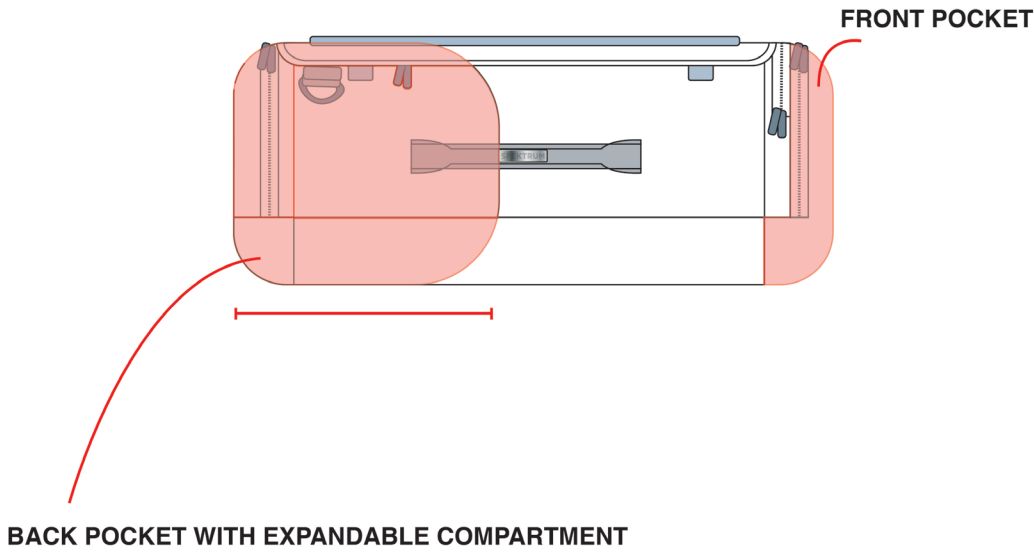
INSIDE



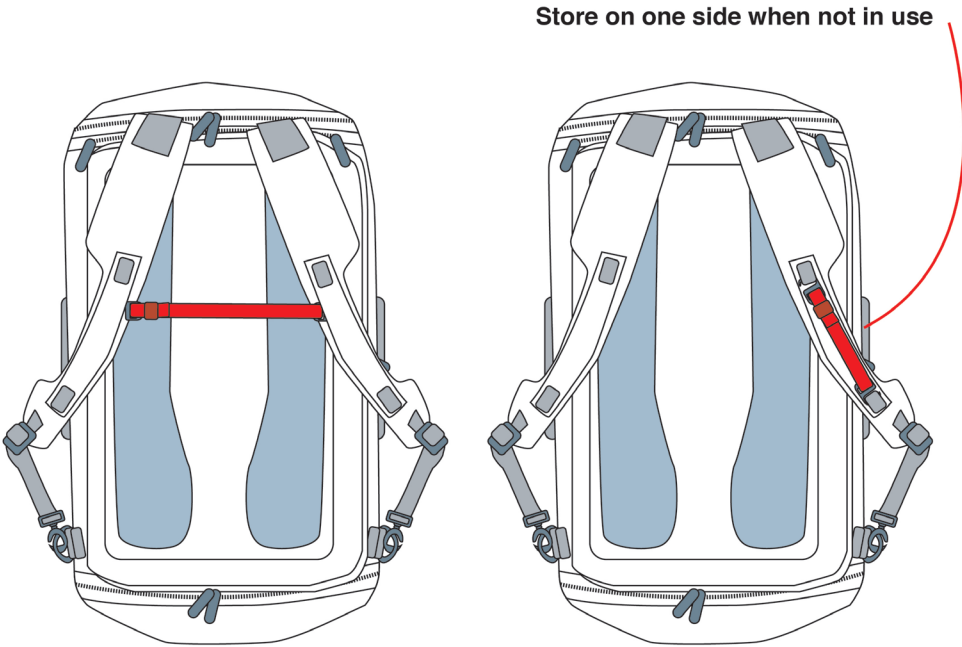
POCKETS



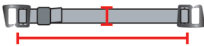
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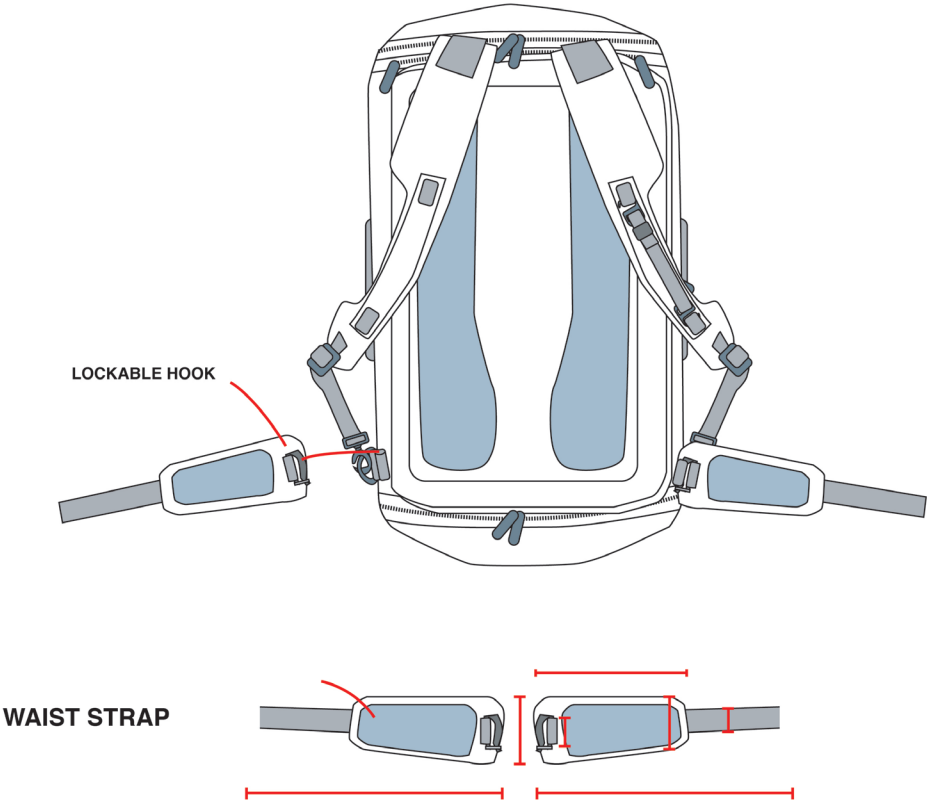
CHEST STRAP



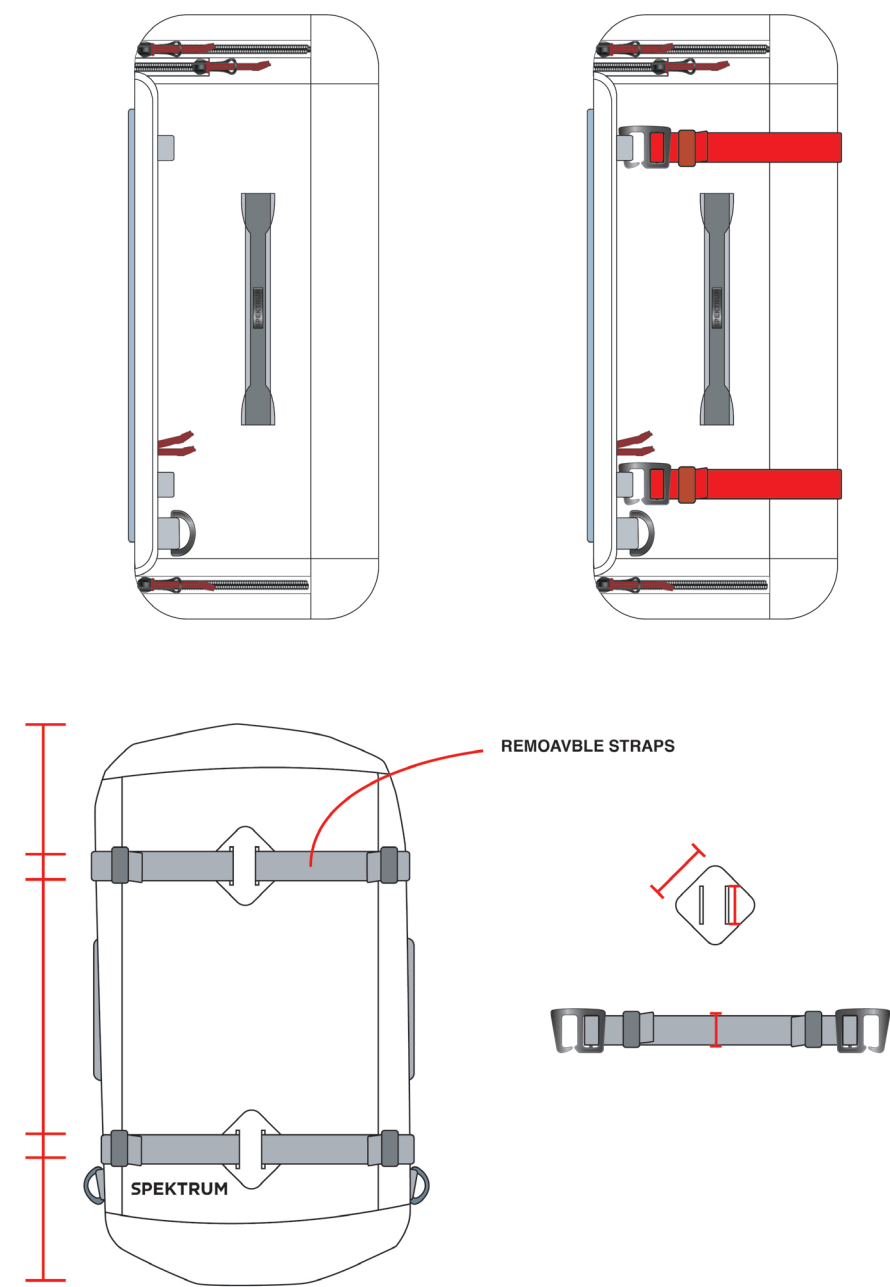
CHEST STRAP



WAIST STRAP

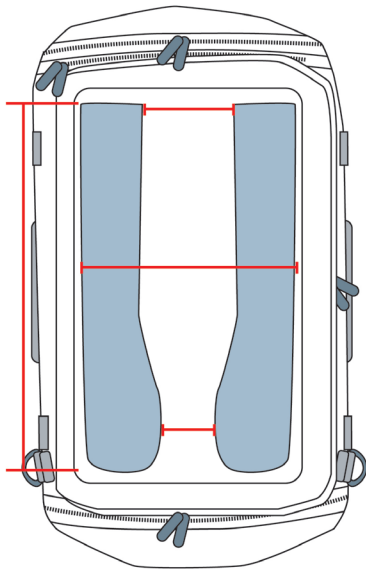


OUTSIDE DETAILS

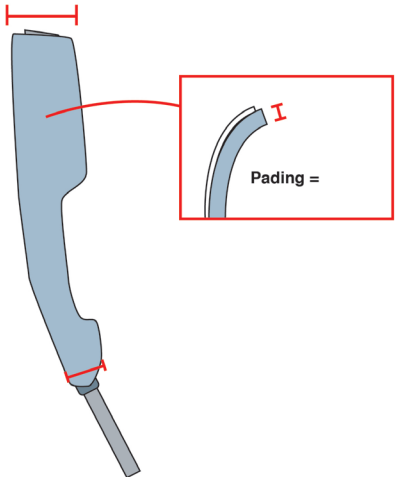


PADDING

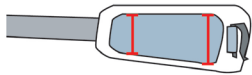
BACK PANEL



BACK SHOULDER STRAP

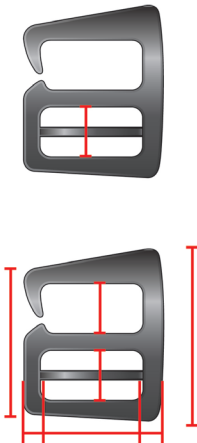


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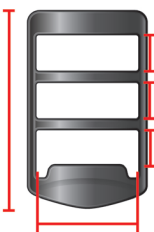


ZIPPERS & HOOKS

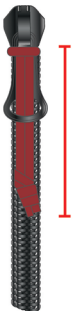
REGULAR HOOK



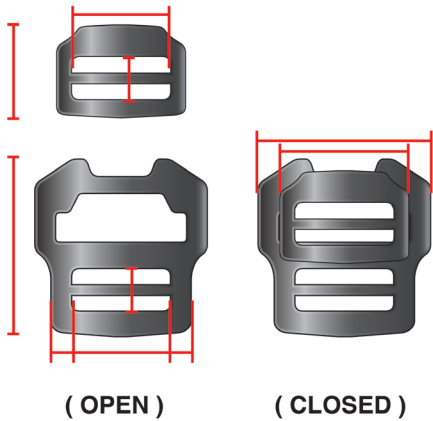
SHOLDER STRAP



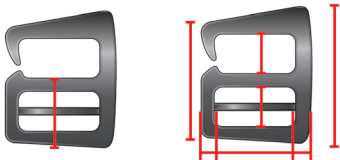
ZIPPER WITH PULLER



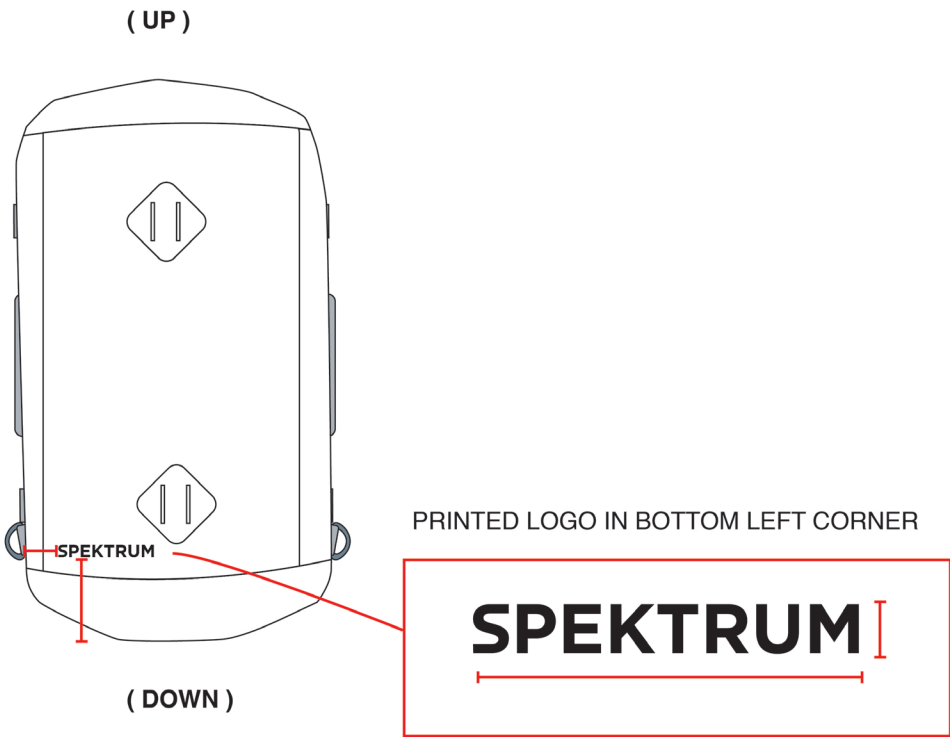
WAIST BUCKLE



CHEST BUCKLE



LOGO (PRINTED)



LOGO (METAL)

