Universidad de Valladolid

UNIVERSIDAD DE VALLADOLID

ESCUELA DE INGENIERIAS INDUSTRIALES

Grado en Ingeniería en Diseño Industrial y Desarrollo del Producto

Punto de asistencia médico móvil para desastres naturales.

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HOCHSCHULE DER BILDENDEN KÜNSTE SAAR

Valladolid, Agosto 2015.

TFG REALIZADO EN PROGRAMA DE INTERCAMBIO

TÍTULO: Mobile healthcare point for natural disasters

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FECHA: 29/07/2015

CENTRO: HOCHSCHULE DER BILDENDEN KÜNSTE SAAR

TUTOR: Brandolini, Andreas

Universidad de Valladolid

ESCUELA DE INGENIERÍAS INDUSTRIALES

RESUMEN Y PALABRAS CLAVE (ABSTRACT Y KEYWORDS):

RESUMEN: Vehículo motorizado capaz de moverse por el terreno hostil que transportará material sanitario suficiente para poder curar a los heridos de más urgencia en el propio vehículo (evitando esperas que podrían acarrear el empeoramiento de los heridos), medios básicos de supervivencia tales como agua o alimentos no perecederos, suministros para el propio sustento del vehículo, etc.

PALABRAS CLAVE: Hospital, catástrofe, vehículo, supervivencia, heridos.

WOA

Mobile healthcare point for natural disasters

Atelier Project 2015

Jimena Casas Pérez

Prof. Andreas Brandolini

DESIGN PROJECT

Mobile healthcare point for natural disasters

Degree in Engineering in Industrial Design and Product Development

Atelier Project

2015

Jimena Casas Pérez

Prof. Andreas Brandolini

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BRIEFING

1. PRESENTATION OF THE PROJECT

INTRODUCTION

THIS BELONGS TO REPORT FOR WORK PROJECT END OF DEGREE OF ENGINEERING IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT. THIS REPORT CONTAINS THE STATEMENT OF THE PROJECT ITSELF, THE AUTHORS OF IT AND AN EXHAUSTIVE DESCRIPTION OF THE DEVELOPMENT PROJECT.

OBJET OF RESEARCH

THE PURPOSE OF THIS PROJECT IS TO DESIGN A MOBILE POINT SUPPORT HEALTH FOR EXTREME SITUATIONS SUCH AS NATURAL DISASTERS, FOLLOWING THE RIGHT PRODUCT DEVELOPMENT PHASES. FOR ITS REALIZATION THEY HAVE BEEN APPLIED KNOWLEDGE LEARNED THROUGHOUT OUR TRAINING AS ENGINEERS.

AUTHOR OF THE PROJECT

AS AUTHOR OF THE PROJECT IS PRESENTED THE FINAL YEAR STUDENT OF INDUSTRIAL ENGINEERING DESIGN AND DEVELOPMENT OF THE TECHNICAL SCHOOL OF INDUSTRIAL ENGINEERING AT THE UNIVERSITY OF VALLADOLID, JIMENA CASAS PÉREZ, CURRENTLY STUDYING ERASMUS MOBILITY IN THE UNIVERSITY "HOCHSCHULE DER BILDENDEN KÜNSTE SAAR" (HBK) SAARBRÜCKEN, SAARLAND, GERMANY.

LOCATION

THE PROJECT WILL BE HELD AT THE HEADQUARTERS HBK SCHOOL, LOCATED IN THE STREET KEPLERSTRAßE 3-5, D 66117 IN THE CITY SAARBRÜCKEN, FROM WHERE THE DEVELOPMENT OF THIS PROJECT IS DONE.

2. STATEMENT AND PROJECT JUSTIFICATION

Due to the earthquake suffered by Nepal's April 25, 2015, born concern about first aid to those injured in this disaster. This disaster has left many areas unreported, which in turn have suffered great difficulties to treat the wounded. The massive destruction and lack of resources have made the earthquake a humanitarian crisis.

This situation occurs in many natural disasters, so it is of general interest to design a mobile point to improve the quality of care. This mobile point is made up of a motor vehicle capable of moving through hostile terrain left by these natural phenomena. This vehicle will transport enough to heal the wounded more urgency in the vehicle itself (avoiding expect could lead to the worsening of the wounded), basic means of survival such as water and non-perishable food, supplies to sustain the proper vehicle, etc.

To carry out this project has contacted several organizations in order to get accurate information of what is necessary in these disasters.

Some of the clear aims of this project are listed below:

- Vehicle mobility in the widest possible range of land needed.
- Easy to use medical areas.
- Ability to perform necessary health operations.
  - Operating rooms equipped professionally for advanced surgeries
  - Water treatment
  - Power supply
  - Training and support doctors

The price of a project is really important, and although the budget may not know until very advanced the various stages of design, in this case we can expect that the cost will be high, and we cannot skimp on expenses, for being a health project and in the case of a vehicle that will transport a small operating room, because this would affect the proper functionality of the service and even the wounded.

The medical supplies will be acquired to companies of excellence and complying with current regulations on health. The surgical and general material that will be gained, should be the necessary for the proper functioning of each and every one of our vehicle functions.

Regarding the use of the vehicle, particularly in health areas, this should be as easy and intuitive as possible, because in the conditions in which this vehicle will be used will be difficult to have outside help.

Given that the distribution of health care service will be held on the vehicle itself, this significantly lowers distribution costs, i.e. the cost of travel of the medical assistance to the affected areas.

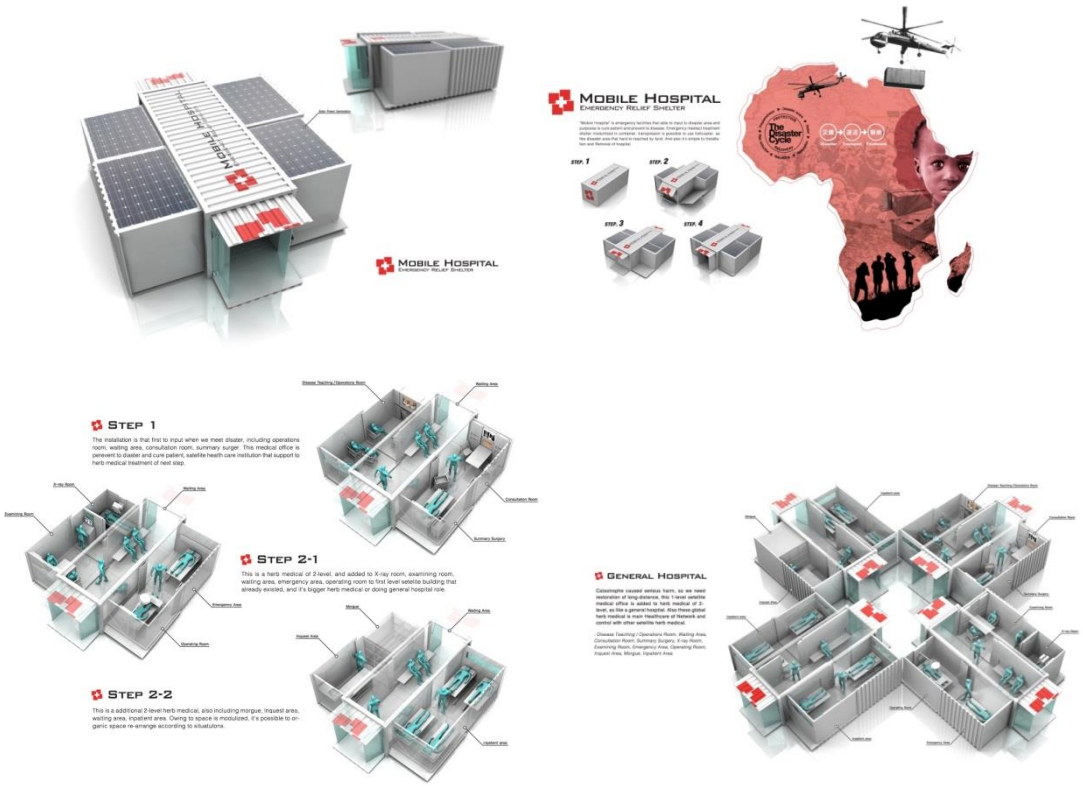
From this overview of the project development, we will detail each step of the design herein.

BACKGROUND AND CURRENT SITUATION

Currently there are several types of mobile hospitals, but these are designed to accessible areas.

In the case of natural disasters, it is very difficult to get access to the most critical and affected areas, that is why the development of this project focuses on facilitating and improving the health care of these situations.

In the above examples we can see different design lines for same solutions. In our project we can see similarities in the basic design, since it is part of the preoperative room which will be designed more novel way, since other current products do not have this.



It is often common implementing fields of healthcare, but this only happens once the disaster is more or less controlled, however there is still a very critical depopulation which is what we try to cover.

It is noteworthy that the design of this mobile medical point intended to cover such surgical operations necessary in critical situations of immediate operations.

To have all the functions that we see in these current designs are covered, it was considered necessary to correct the problems of movement of the container.

That is why also in the container, which corresponds to the operating room, will feature a removable roof bulkhead subject all medical equipment during transportation, offering comfort in its use and any concerns about potential land in poor condition.

JUSTIFICATION

Under order of the realization of a project, the final decision is running a design point of healthcare for countries affected by natural disasters. The reason for carrying out this project approach is due to the severe damage suffered by these countries when a natural disaster occurs, and the difficulty encountered to deal with damage in people. We want to satisfy one of the basic needs of everyone, whatever their country of origin, since it is not we who choose where we are born. Therefore we believe in the opportunity we offer with this project to improve the quality of life of many people wherever they are.

IN PROJECT

The purpose of this project is to create a point of mobile healthcare for the situations that occur in natural disasters. In natural disasters it is really difficult to get access to the most critical points, and is right in these locations where health assistance is often more necessary, therefore, the new design promises to reach these areas and provide basic medical care.

For the development of this project we have contacted various organizations that have given us information about basics of acting in these situations. In particular MSF (Doctors without Borders) has provided information about basic protocols for getting aid to the affected areas.

The project describes the way in which the new design is brought to reality. WOA has two basic parts that makes a new, simple and intuitive design, basic objectives of our design. As we shall see, the processes that we will basically take care of are installation and assembly; first we will assembly the two parts of the preoperative room and on the other side the preoperative room with the container.

The budget for this project is significant for the high price of medical and surgical equipment. However subcontractors have a program of Lean Manufacturing, making the waste of material and time minimized and equal production constant and maximum.

Another of the most important aspects of our product is that it must be easy to use, operate, clean ... That is, must be in general terms, easy, so in some cases we will build on the technique of Poka-Yoke for the design of the various parts that make up the point of care.

In this case it will seek to have a final solution of functional design, as in this case the attractive appearance no premium at the same level of functionality.

CHARACTERISTICS OF THE ENVIRONMENT

The environment in which this project has been developed is primarily academic, however gradually has become a personal project, where the effort and involvement have taken the lead role in this project.

On the other hand the characteristics that have led to the possibility of WOA were as follows:

- Educational Environment
- Academic training on industrial projects
- Continuous improvement methodology
- Constructive reviews
- Interest in the project

Moreover one can speak of the characteristics of the environment in which it is intended to carry out the project. First, and as mentioned before, the idea of this project was created with the goal set on the countries that have more risk of disasters, so obviously the characteristics of the project in question, namely, mobile point of care health, are limited by the characteristics of these environments.

3. JUSTIFICATION AND DESCRIPTION OF THE SOLUTION ADOPTED

3.1. JUSTIFICATION COMPARED TO OTHER SOLUTIONS

The solution adopted solves the conditions marked from the beginning of the design process. The end result of the project carried a functional and versatile design. It could be used anywhere by qualified personnel. However the manner in which it is designed does it a segment dedicated to a particular design. Compared to other designs with a similar concept, we can say that due to space savings and reduced time manufacturing processes it offers a unique solution.

3.2. DESCRIPTION OF KEY ELEMENTS

The fundamental aspects of the project are listed below:

- Stronger and lighter materials
- Easy manufacturing, easy installation, easy use and easy cleaning
- Minimum time of unfolding
- Optimization of space
- Minimum weight
- Minimum price

We consider these elements as the strongest points of our design that enhance the general concept of a mobile hospital.

3.3. REFERENCE TO DOCUMENTS, CALCULATIONS, AND PLANS

It has carried out a document of planes in which all parts of the new design are defined.

At the same time we have made the calculations required to find the final weight of the vehicle as well as finite element analysis to determine the stresses that supports the design and allow us to ensure the safety of end use.

There has also been a series of calculations concerning the budget, in order to obtain both the manufacturing cost and the selling.

4. DESCRIPTION OF THE FINAL SOLUTION

4.1. CHOICE OF DESIGN

During the creative phase of the project we have managed to transform the initial idea of designing a basic point of health care in a defined project. Through research, information search and shuffling and analyse different design possibilities, we have succeeded in implementing a viable solution that will satisfy the previously identified needs.

Three premises that must fulfil our final design are set. These criteria are:

- DIFFERENTIATION AND INNOVATION

In this project raw innovation, since it is a new concept of assistance. Although there are other models that can be likened to this idea, is the first vehicle smaller more easily move through the rubble.

- EASE MANUFACTURE, ASSEMBLY, USE AND CLEANING

Given that this is a moving point of health care, it should be as accessible as possible, have the best medical benefits, be as simple as possible to deploy and be built by very hygienic and easy to clean surfaces

- REDUCED COST

As already stated, this project will have a significant cost because medical equipment that significantly increases the final price of the project is needed. Consequently it has subcontracted the manufacturing of the container and the preoperative room, which will form the point of health care, to more trained companies.

Based on these assumptions we reach the final choice of the design of this project.

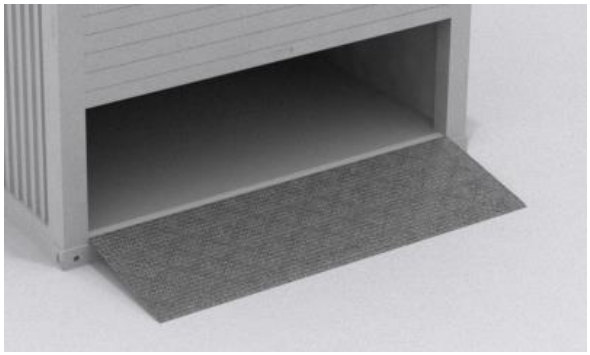
4.2. DETAILED DESCRIPTION OF THE ELEMENTS

The parties that make WOA are:

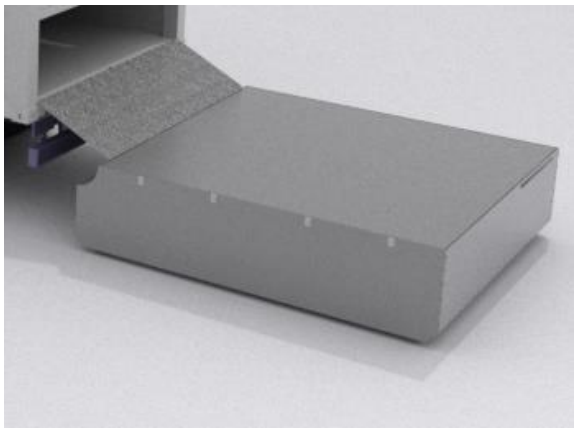
First we have the container that corresponds to the portion of the operating room. Attached to this is a folding box that features an inner drawer in which all the material on this own preoperative room saved.

This folding room folds through a gas spring system that positions on the floor. This subject also to go with the gas spring during movement of the vehicle, has ratchet tie down straps to secure it. At the base of the drawer there are adjustable feet that fit the terrain. These legs are regulated by a gas piston system, and in turn the base has a head that allows you grip the ground depending on the terrain and the angle.

The folding box is the one containing the preroom to enter the operating room. This has a removable ramp for stretchers can access easily. It is noteworthy that to connect this preroom surgery and the container doors are folded. The top of the container door is a sliding door that goes up and is introduced into a upper ceiling. On the other hand the lower door folds down and a ramp connection is created. This ramp is adjustable, so depending on the terrain it will fit. The method to regulate it is thanks to a double removable plate. To fold the preoperative room one gas spring is used.



The operation of the pre room is simple. It has an engine that goes inside hinged drawer box. We turn on this engine and in less than three minutes the structure is swollen.



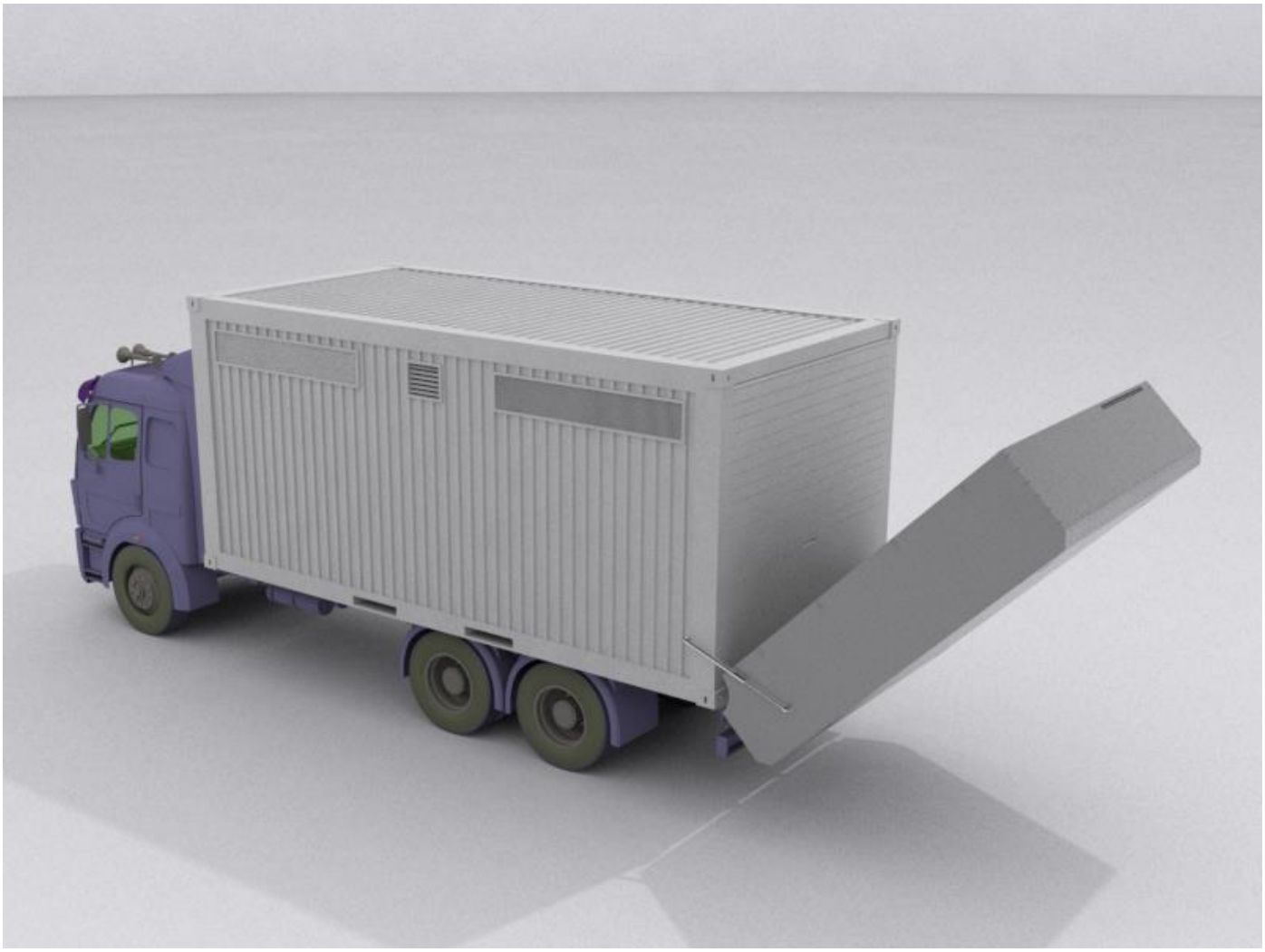
There are small extendable tarpaulins the same material as the inflatable tent, which fit container.

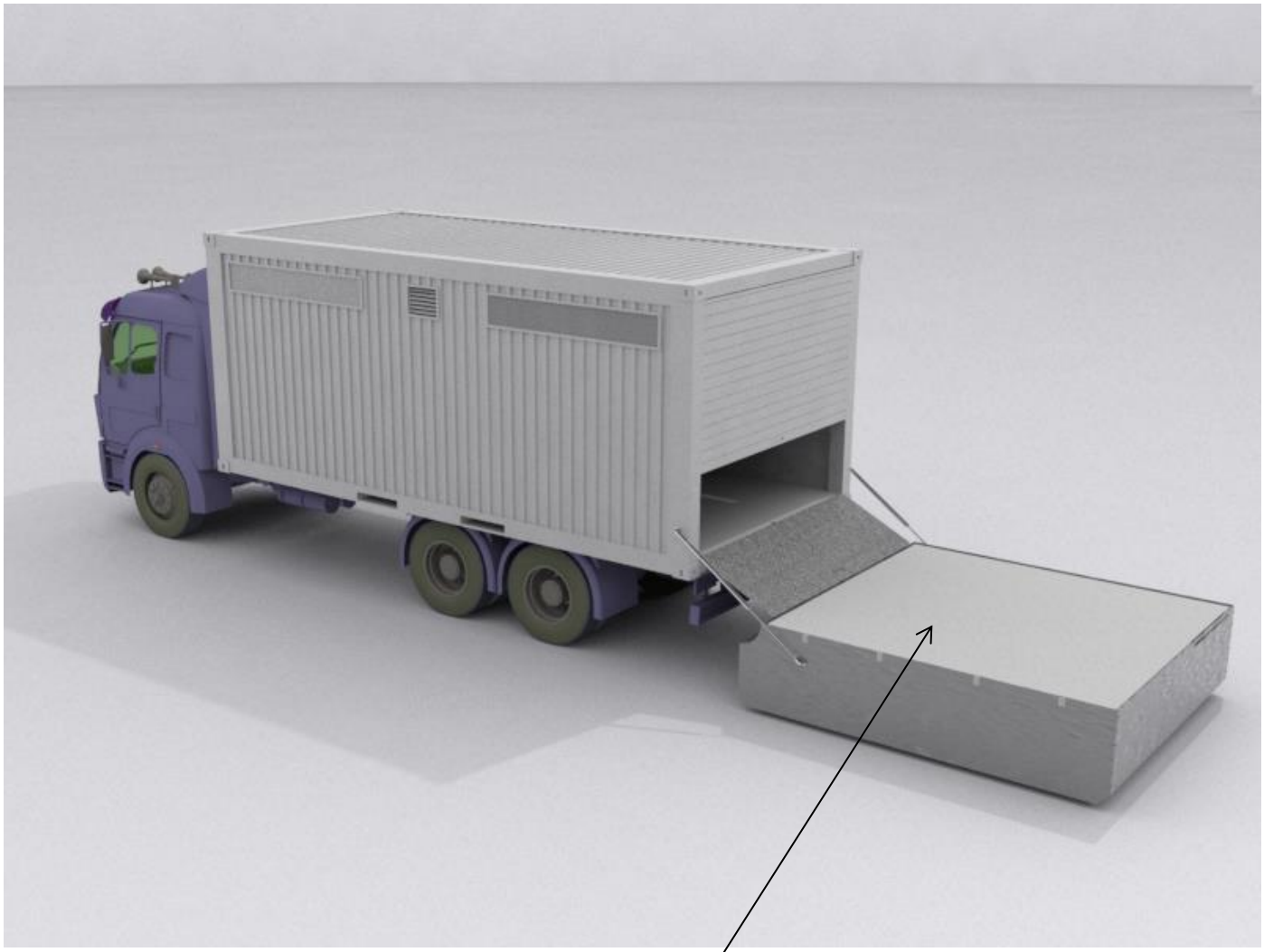
On the other hand the front door of the tent is hinged and also turns on the inside to hold the corner once travelled 180.

4.3. TRADENAME

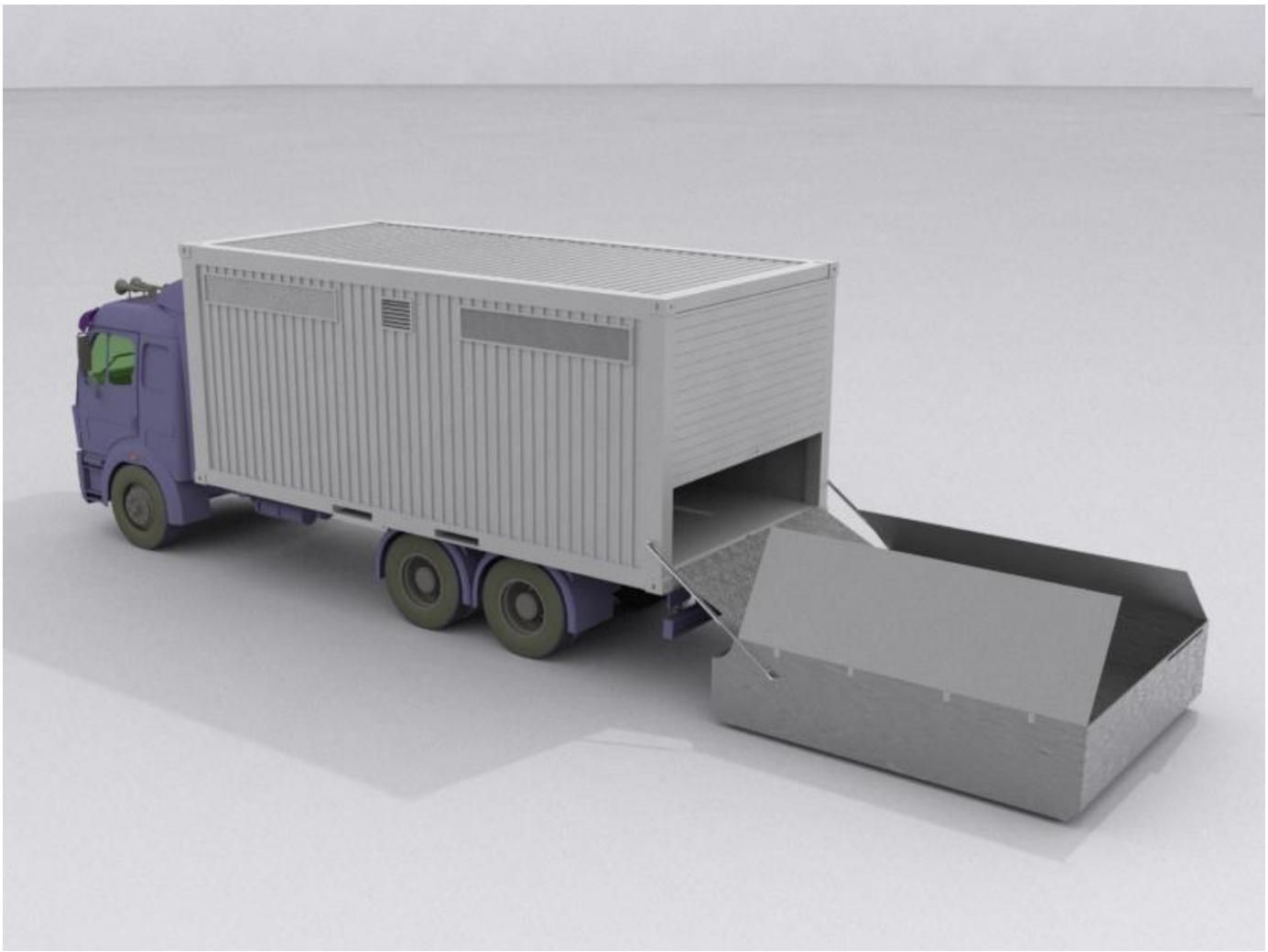
The brand name of this hospital will be WOA, corresponding to World Of Assistance, referring to the very basic functions and its main task, offer medical aid. For this we have used a symbol of medicine which makes it recognizable and gives you a point of attachment to the product.

4.4. FINAL RESULT

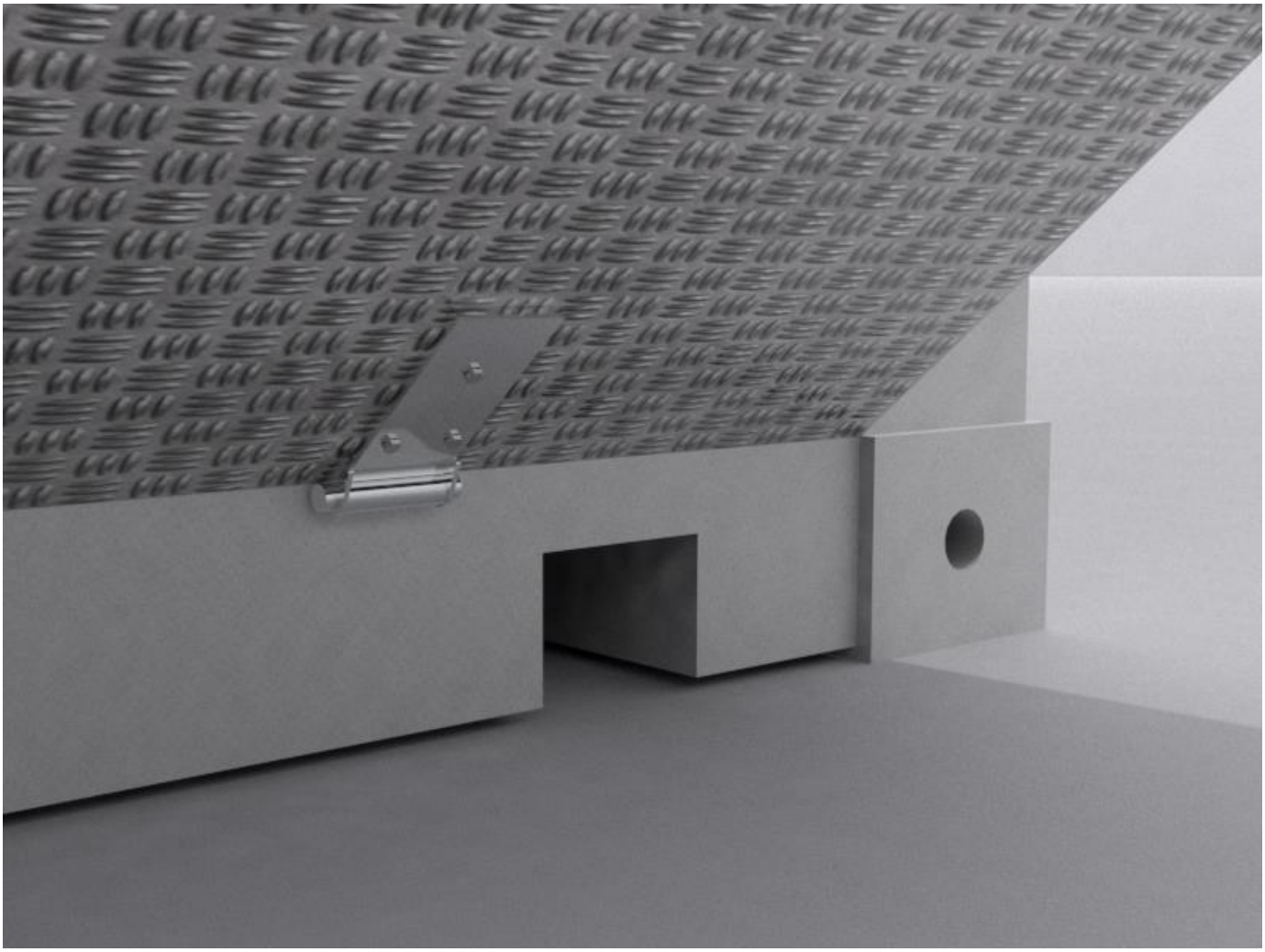


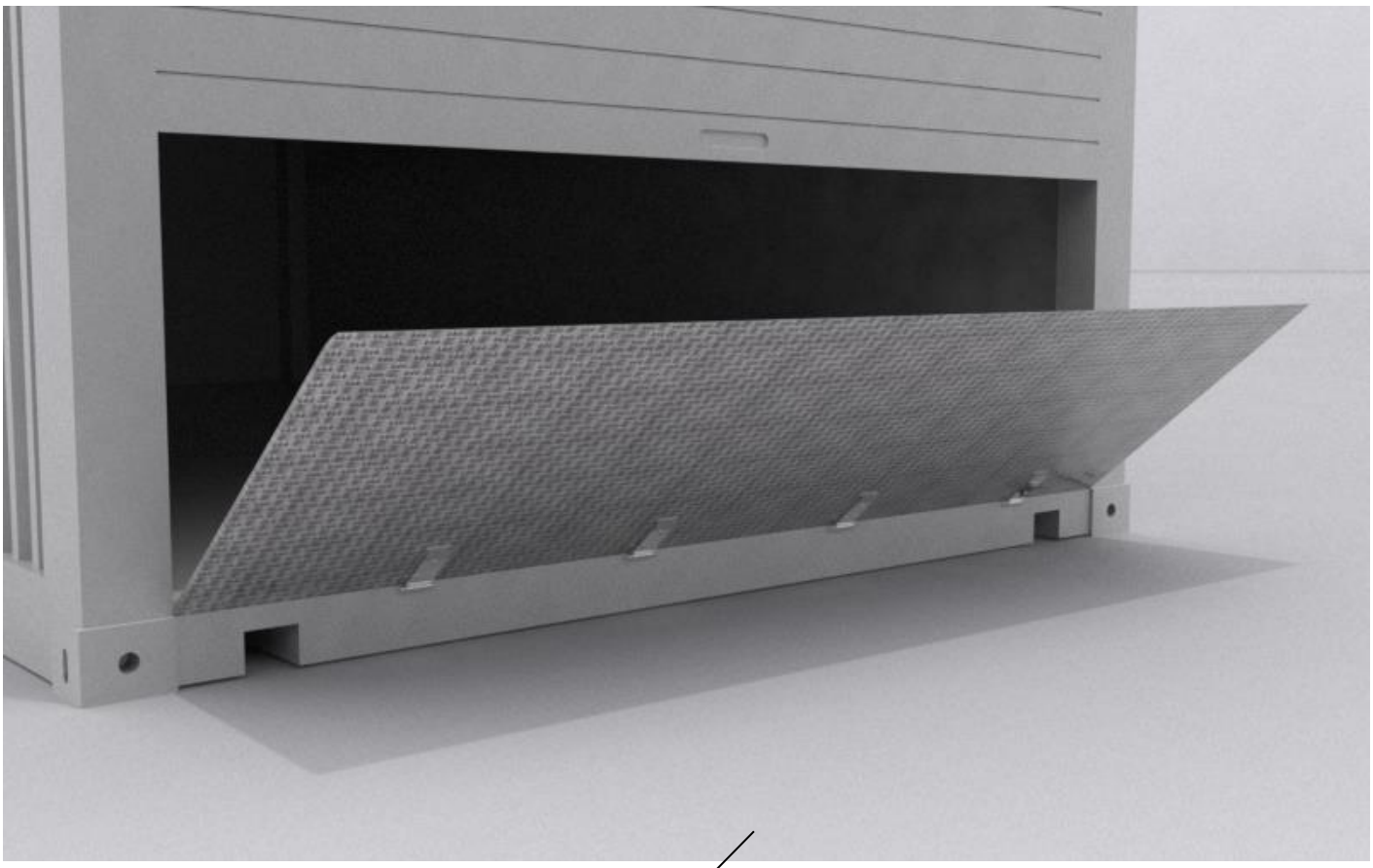


INNER DRAWER; Inside the inner box is a motor that inflates the tenth as we see in the next render.

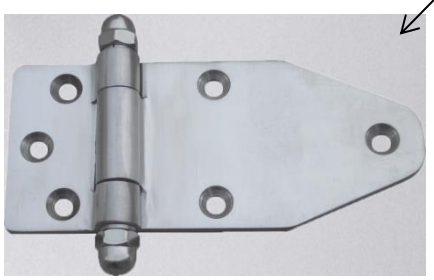


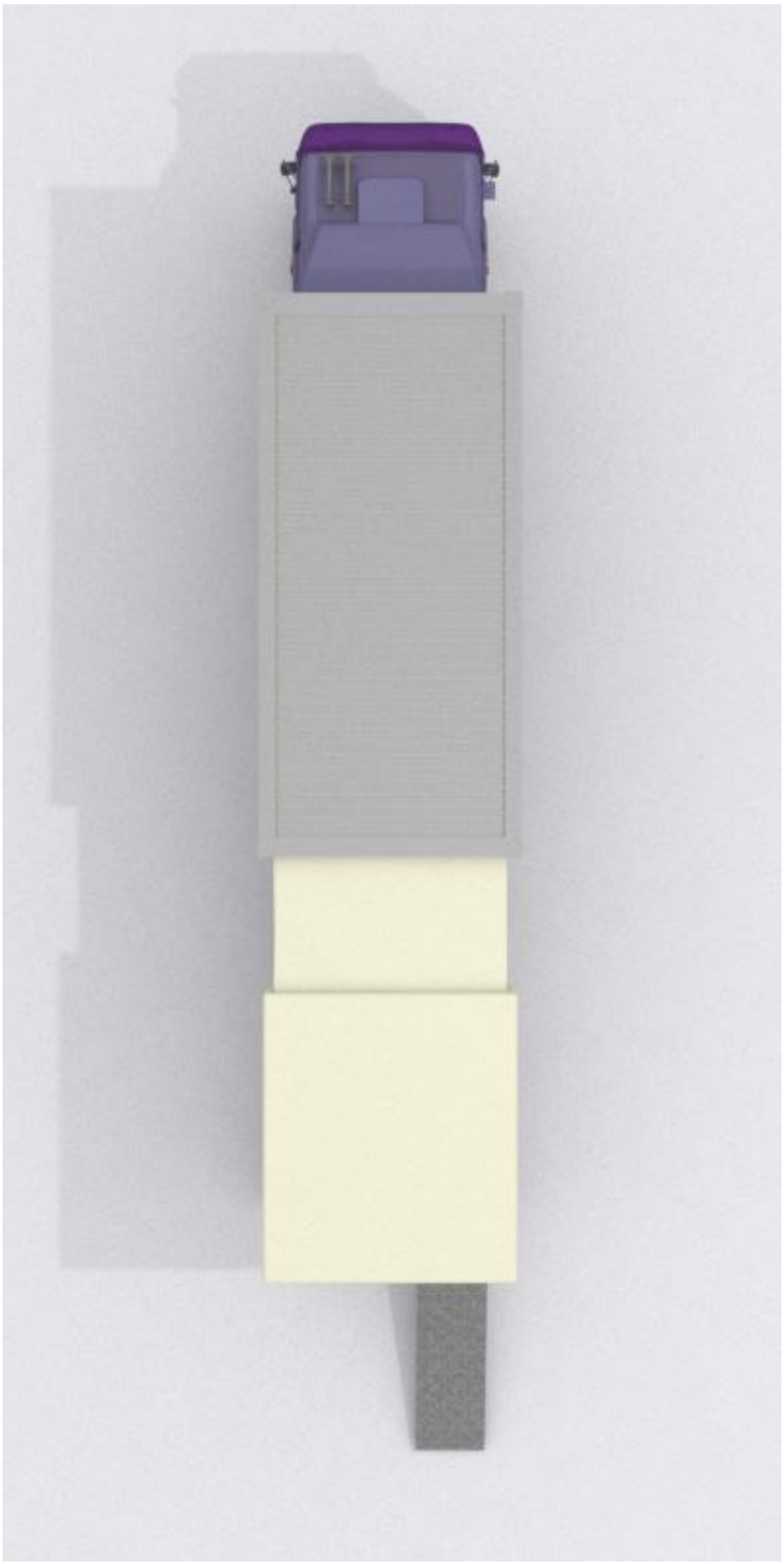
It’s inflated in such tubes.

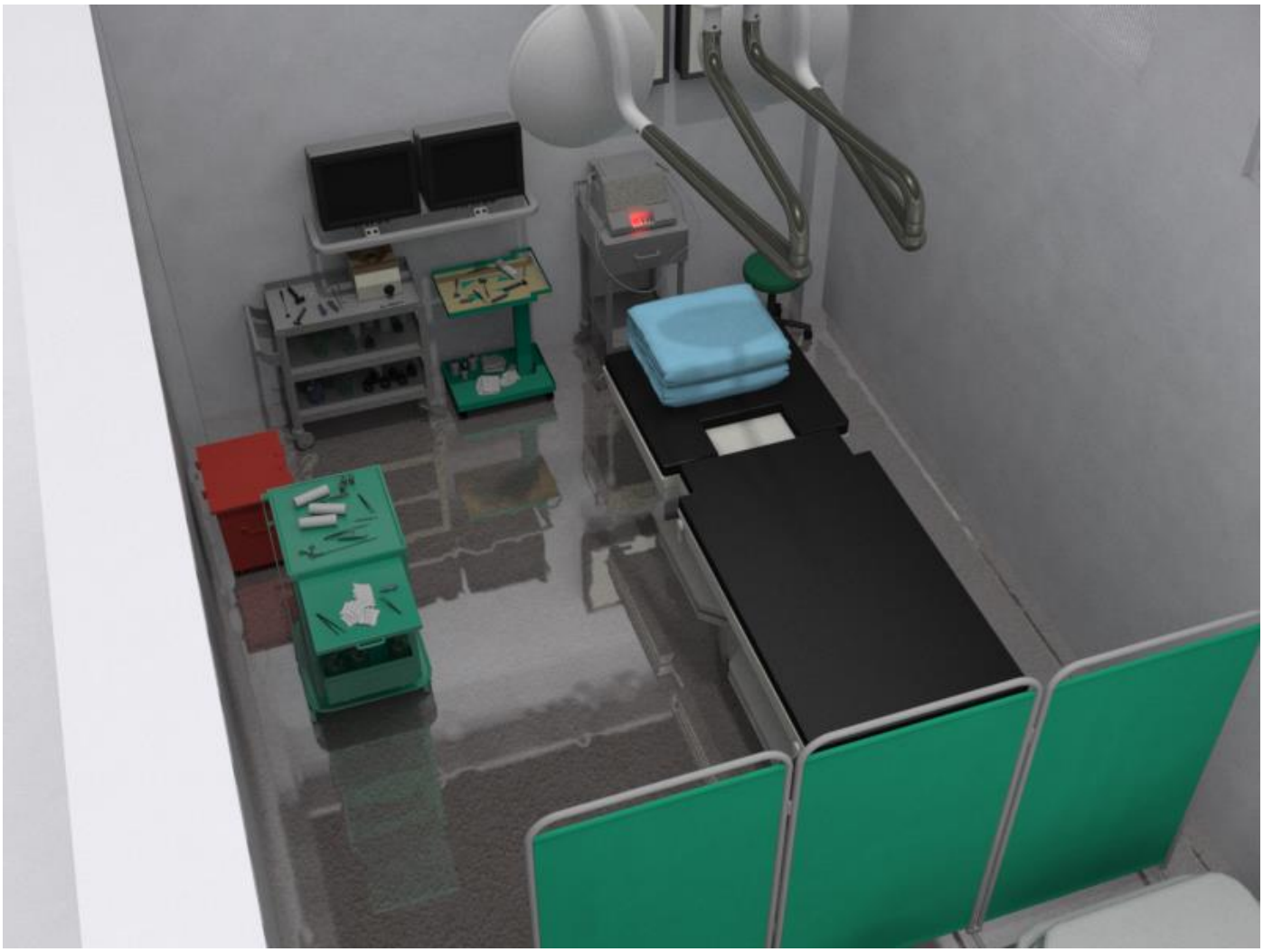


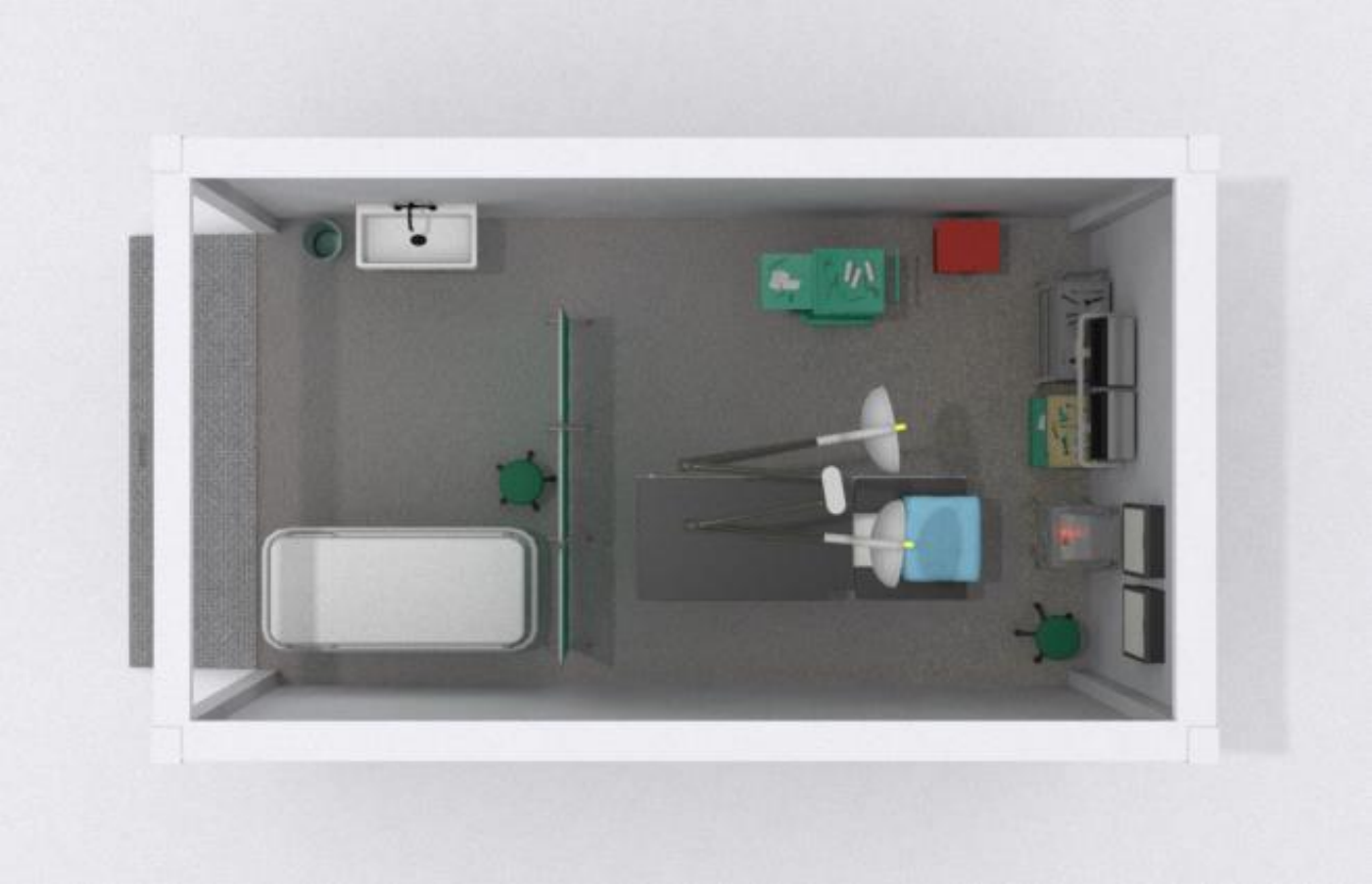


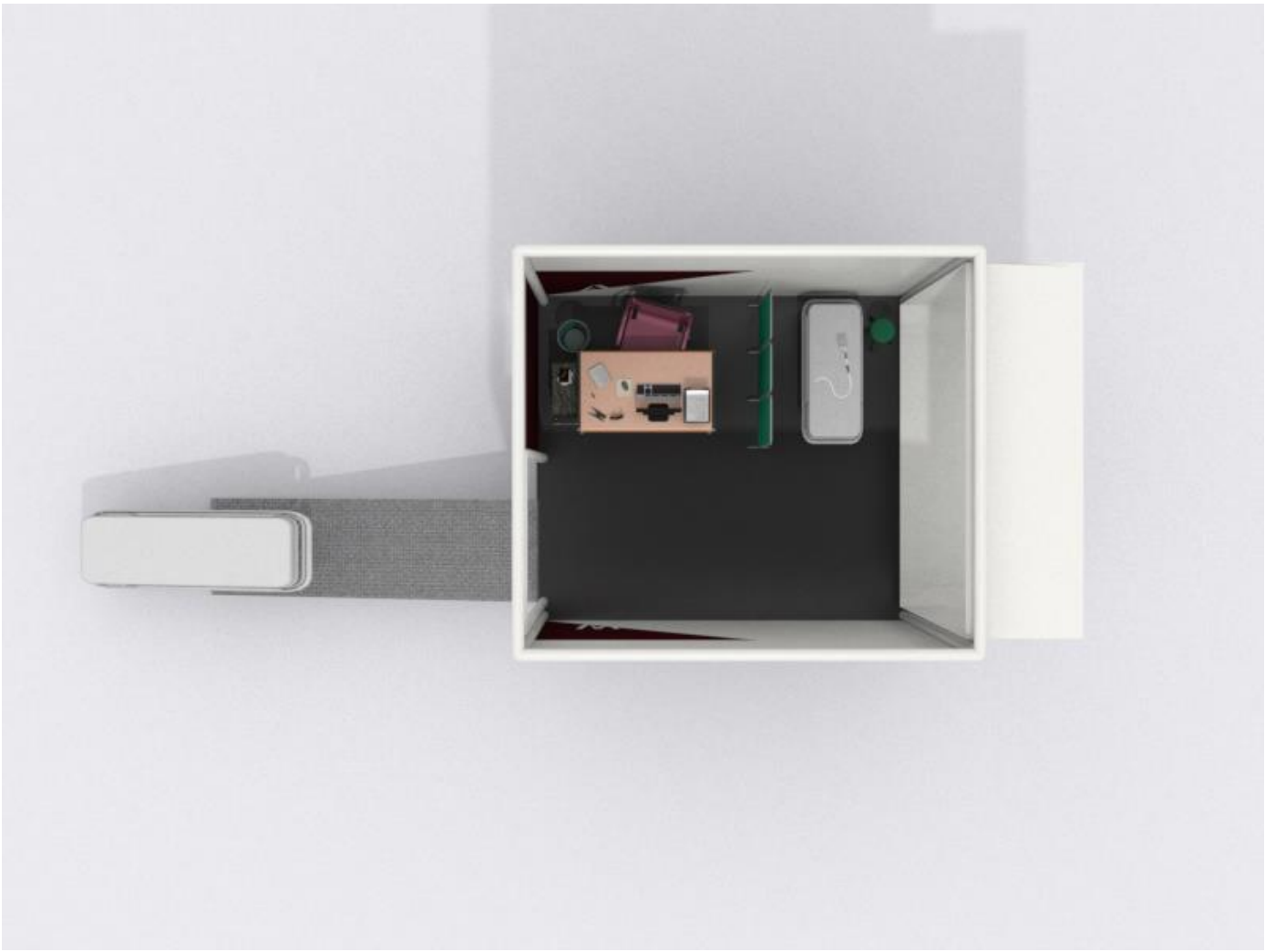
INDUSTRIAL HINGE

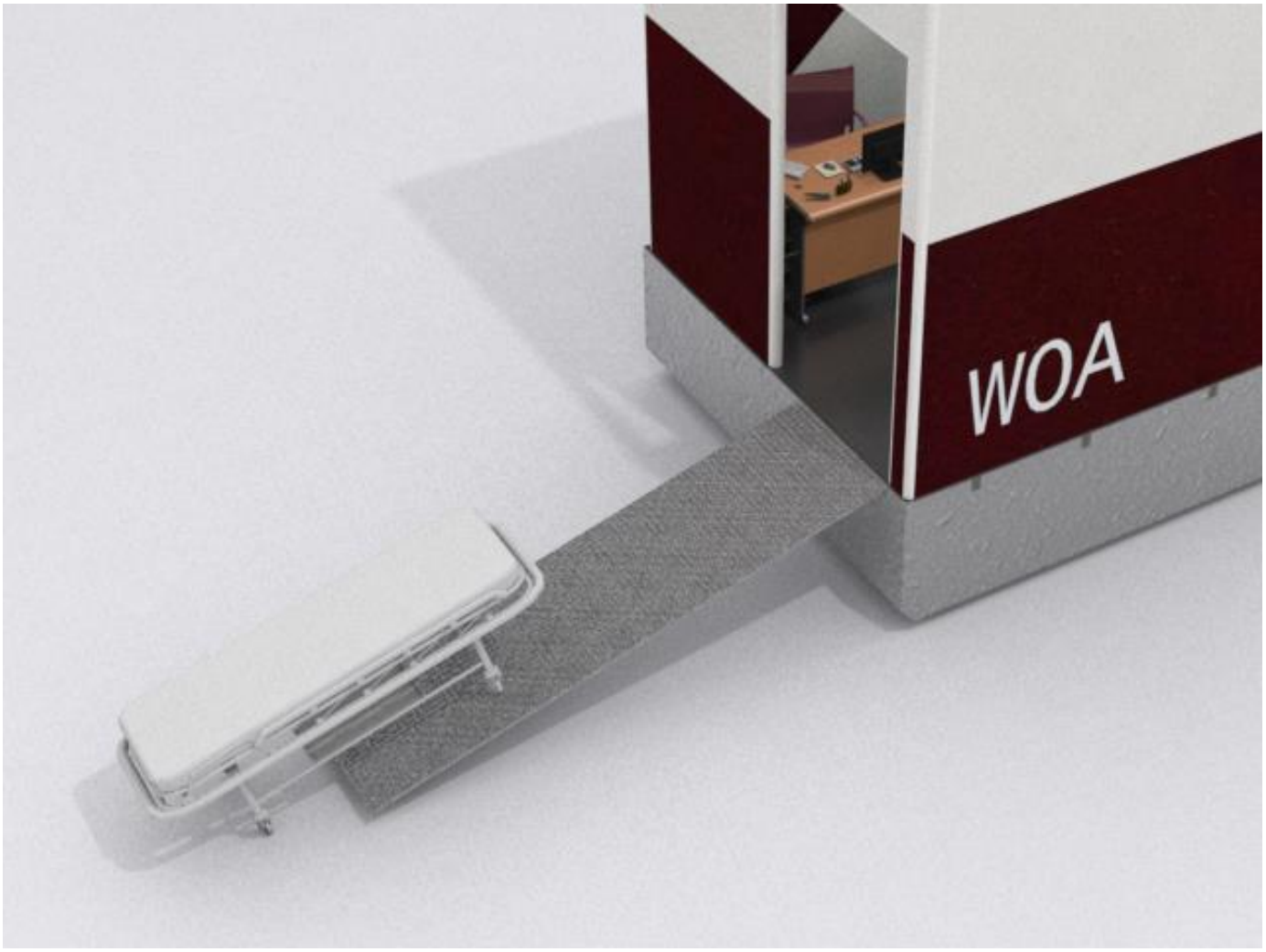


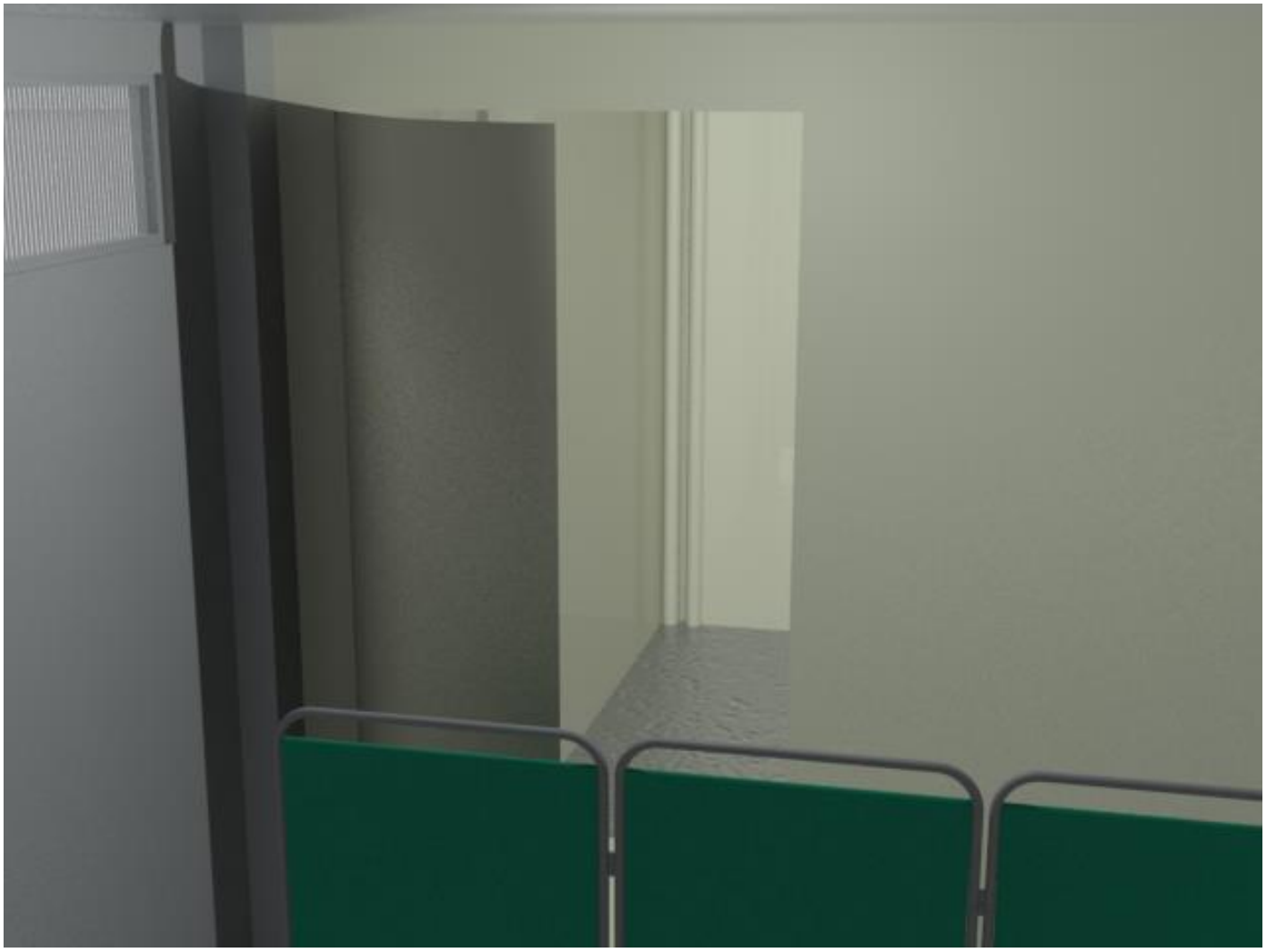


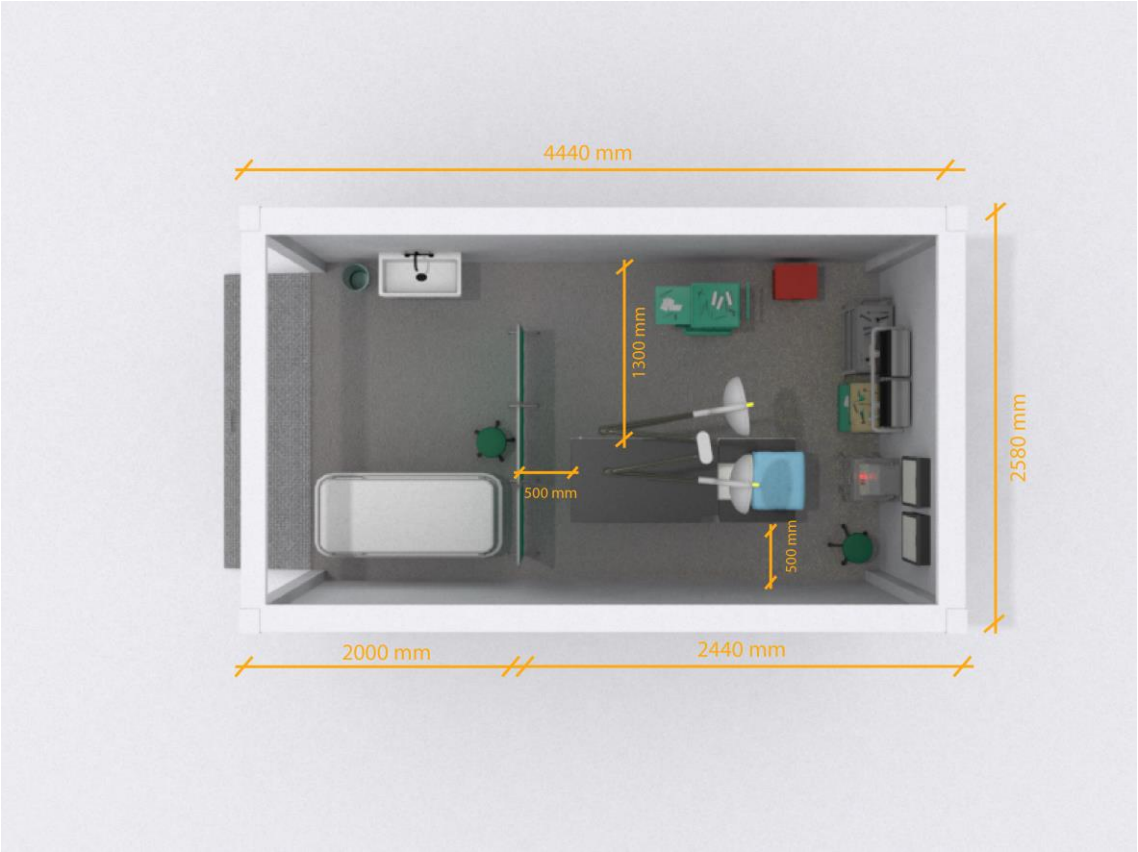


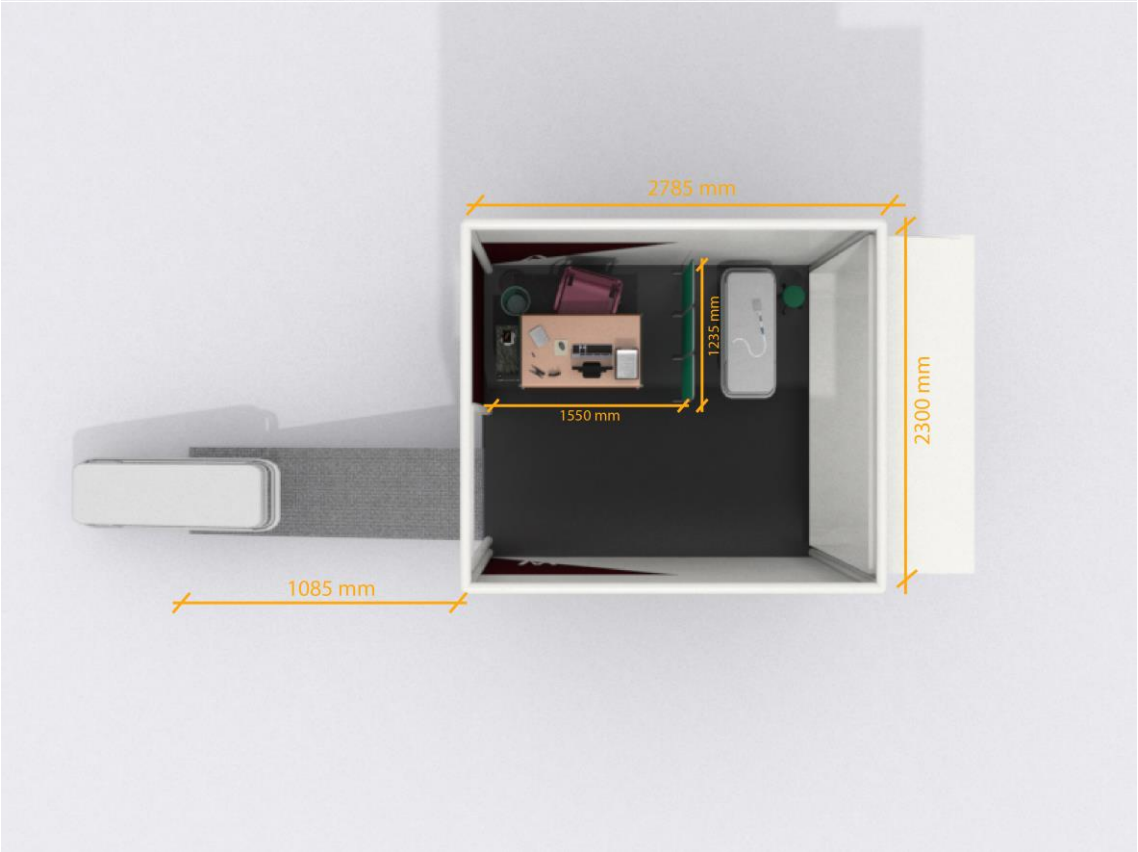


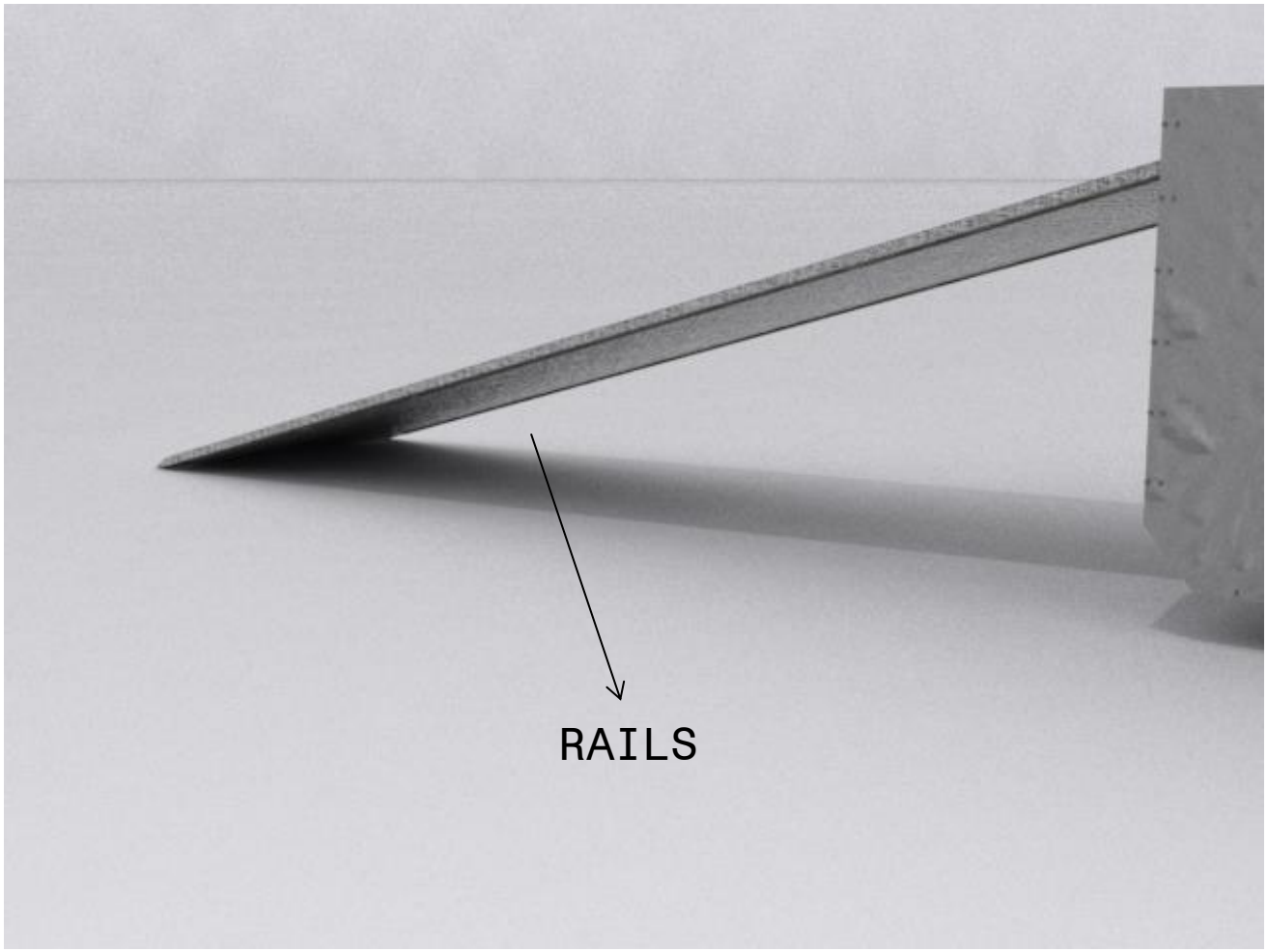


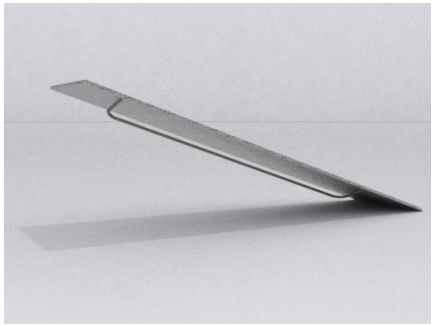

WOA

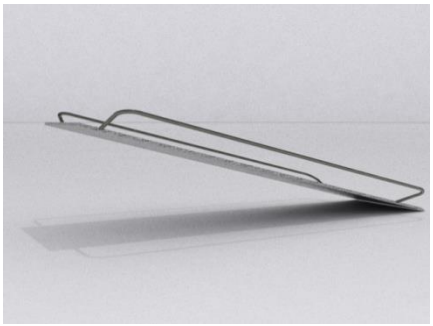


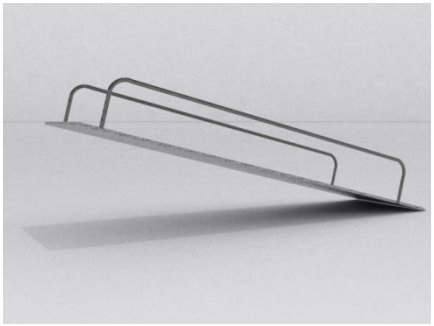

4440 mm
1300 mm
500 mm
500 mm
2580 mm
2000 mm
2440 mm


2785 mm
1235 mm
1550 mm
2300 mm
1085 mm









*On the bottom are the rails, as seen in the photograph. Right there are also a small hinged handrails.

**The doctor inventory can be seen in the budget document, in the part called MEDICAL EQUIPMENT.

5. *MARKETING CAMPAIGN*

For the marketing campaign the basic idea is to offer from a non-profit organization and solidarity.

As host or sponsorship campaigns for children, in this case they make our message is: sponsoring a life. With this motto we intend that donations are to cover the operations would be carried out.

Each donation will be used to pay for one operation, and the remaining money will be used to support the production of this vehicle.

6. CONDICIONS OF EXECUTION

6.1. REFERENCES TO SPECIFICATIONS

The execution of all operations and necessary inspections for the manufacture and safety of the project will be explained in the document on the Specifications. In this section we will treat these issues:

- Conditions and technical specifications
- Conditions of materials
- Procedure and execution of the work
- Testing and safety conditions

6.2. PLANNING

Then a Gantt chart, which has been made to organize the planning of the total project and provide the duration of the processes is shown.

	ACTIVITIES	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
	INITIAL PHASE					
1	Information Search					
2	Market Research					
	DESIGN PHASE					
3	Generating Ideas					
4	Selection and Final Definition Notion					
5	Development of Final Design					
6	Project Development					
	PRIOR TO MANUFACTURING WORK					
7	Agreement Selection and Manufacturers					
8	Purchase of Materials					
9	Receiving Materials					
10	Issue Orders to the specification					
11	Order dictating start of manufacturing					
	MANUFACTURING AND ASSEMBLY					
12	Prepare little box of preoperative room					
13	Fit this box in the preoperative room					
14	Introduce medical equipment in container					
15	Fit gas spring					
16	Join cointaner with preoperative room					
	QUALITY AND SAFETY AND HEALTH					
20	Quality Control					
21	Security and Health					
	END-PRODUCT					
22	Packaging					
23	Distribution					

7. ENVIRONMENTAL POLLUTION

The project undertaken is committed to the environment. At the design stage it was established that this factor is important, so will project with sustainable materials and recycled or reused materials when possible.

7.1. WASTE PRODUCED

As for the waste produced we can differentiate according to the origin, that is, if they originate in our assembly facilities, or otherwise, are the residues of the subcontractors who supply us.

In the latter case the responsibility for waste management will be of the companies concerned, but due to our commitment to sustainable management, we have decided to hire only those companies with a complete system of Environmental Management and perfectly fulfilled. This means that only companies that share a level of environmental commitment like ours will be subcontracted.

It notes that in the case that these companies subcontracted to other companies, these should in turn comply with the same commitment.

In terms of managing our own waste, they will be depending on the Sustainable Management System we have done for our project.

The implementation of this system concerns only the facilities because the only process that will take place on our own will be the preparation of assistance units to be able to sell.

7.2. EVACUATION

The disposal of waste will be based on each subcontractor, that is, with the Environmental Management Plan available to each company. In our case we will not waste, because only take care of mounting the container and the presurgical room on offroad truck.

This plan will be conducted according to the UNE-EN ISO 14001.

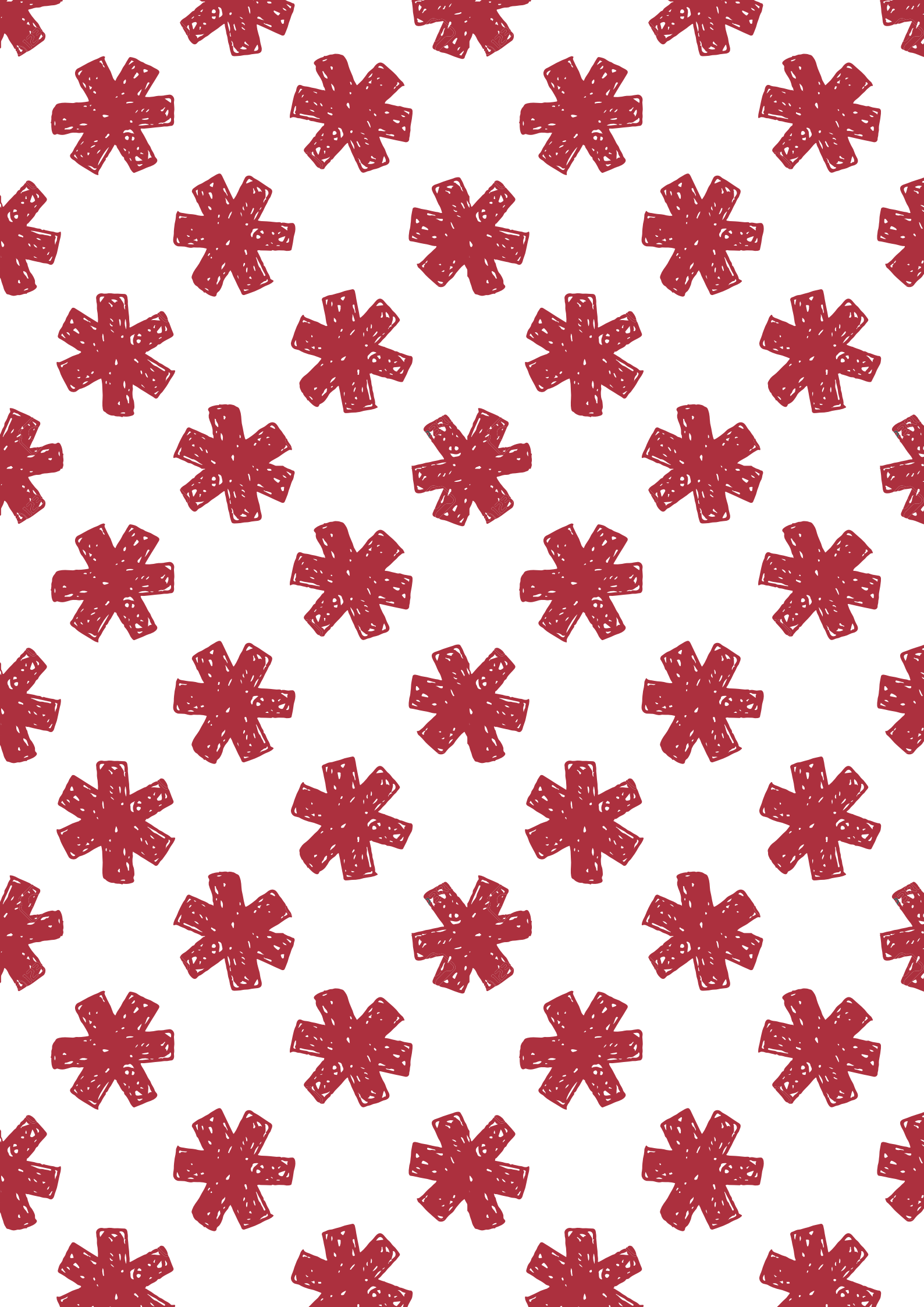
"This plan offers the possibility to systematize, simply, the environmental aspects generated in each of the activities taking place in the organization, and promote environmental protection and the prevention of pollution from a point of view balance with socio-economic aspects."

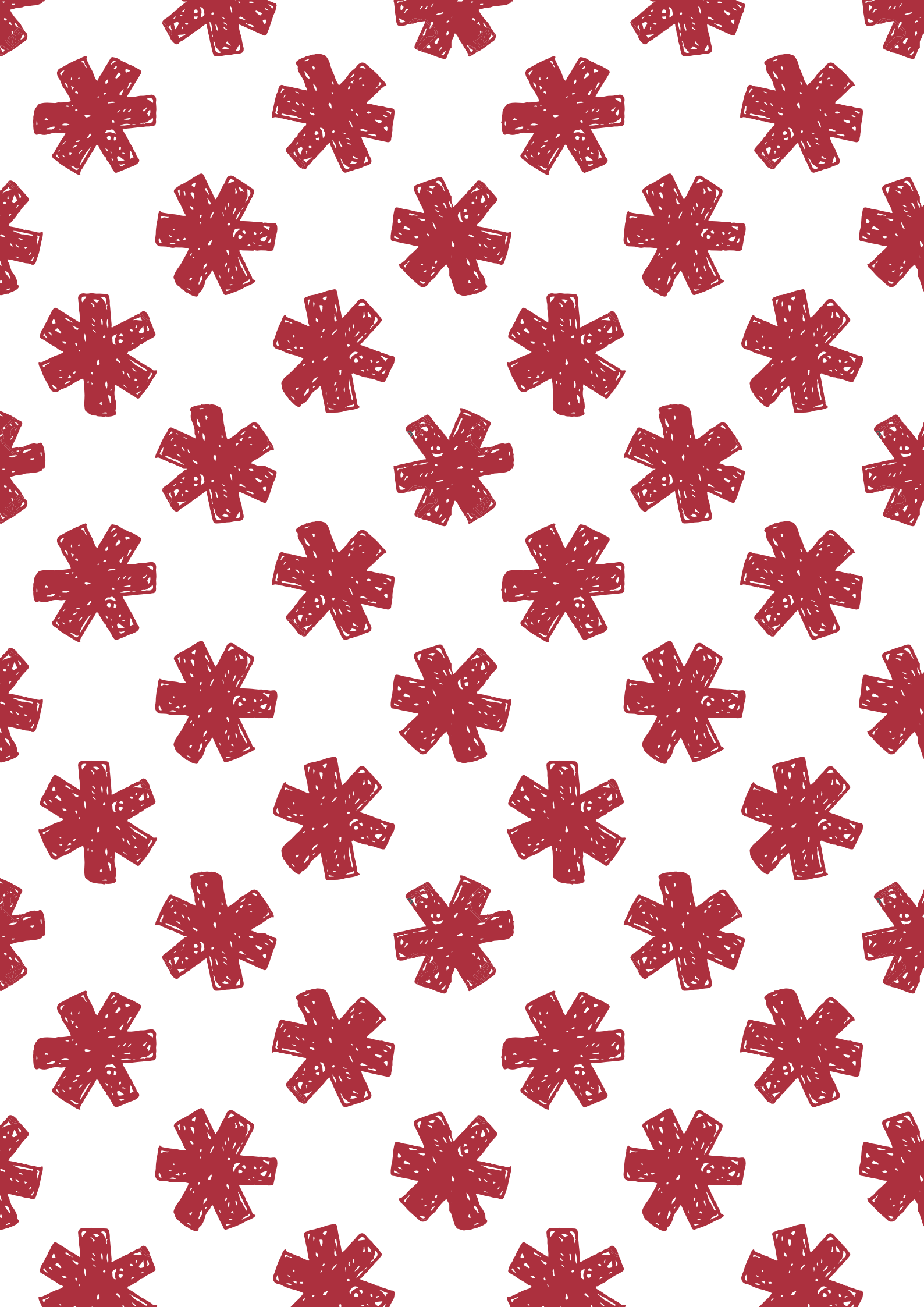
"Thanks to the implementation of an Environmental Management System according to international standard ISO 14001, your organization will be positioned as socially responsible, differentiating and strengthening competition in a positive way, its image to customers and consumers."

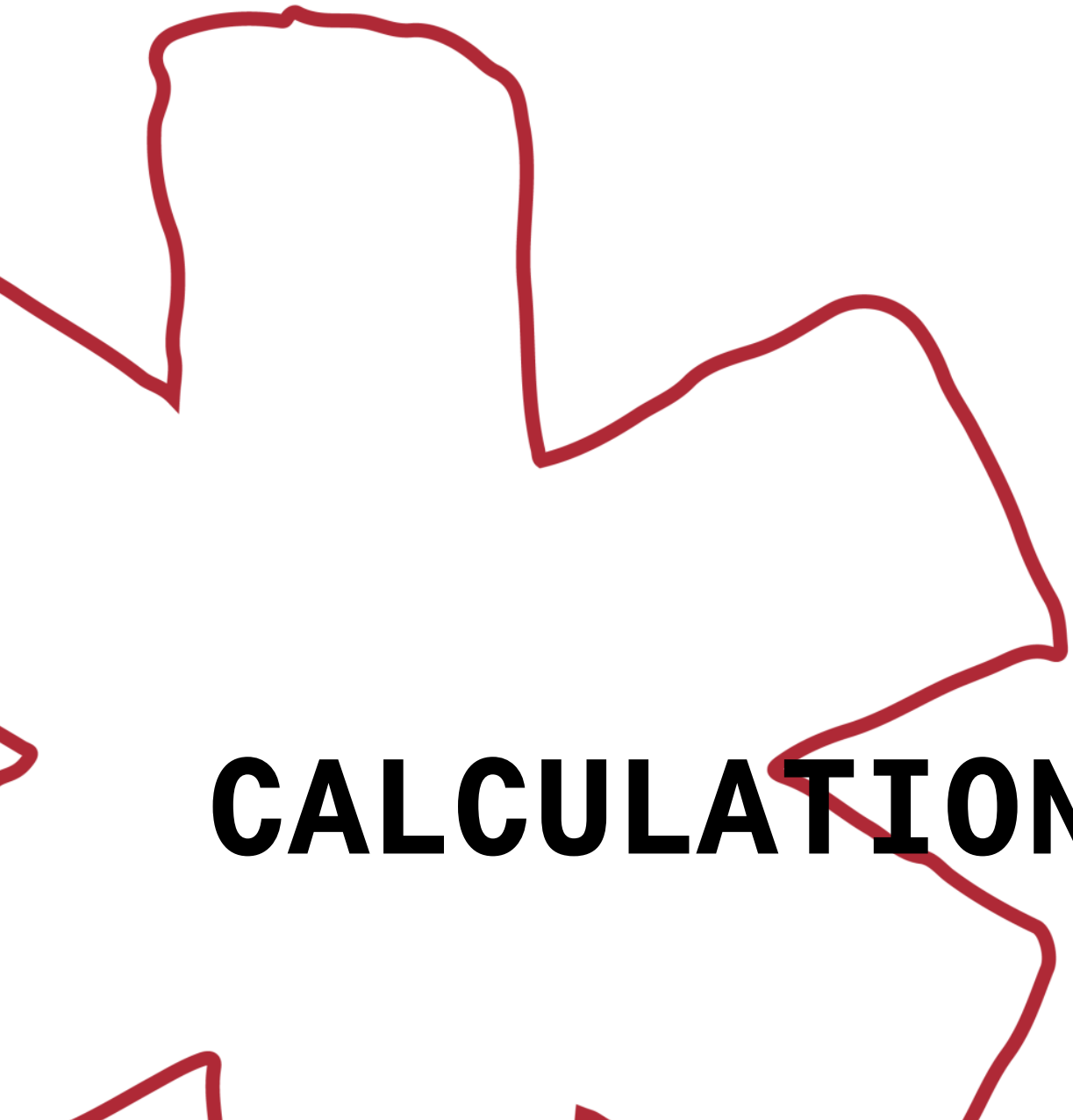
Saarbrücken, 20th July, 2015

Engineer in Industrial Design and Product Development:

Jimena Casas Pérez







CALCULATIONS

INDEX

1. GAS SPRING

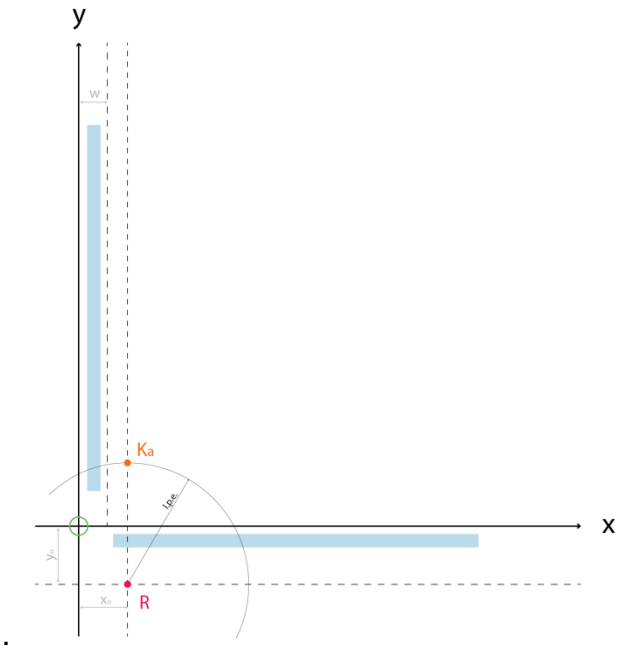
It has automatic opening, because we need that the lid is locked in the closed position. *[1]*

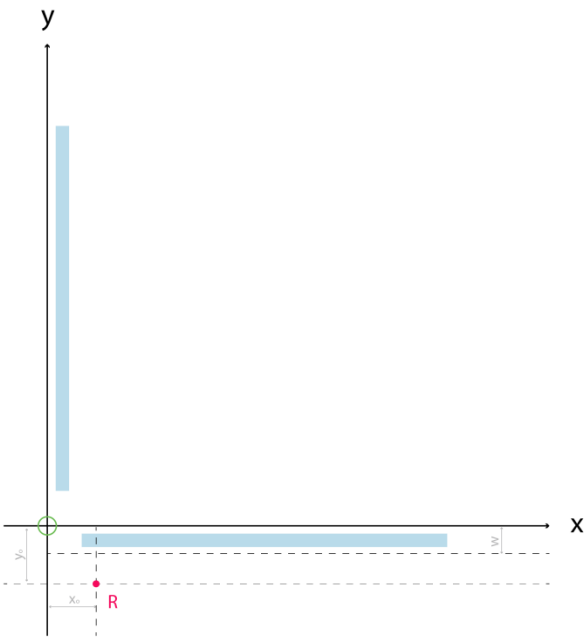
Locking gas spring calculation

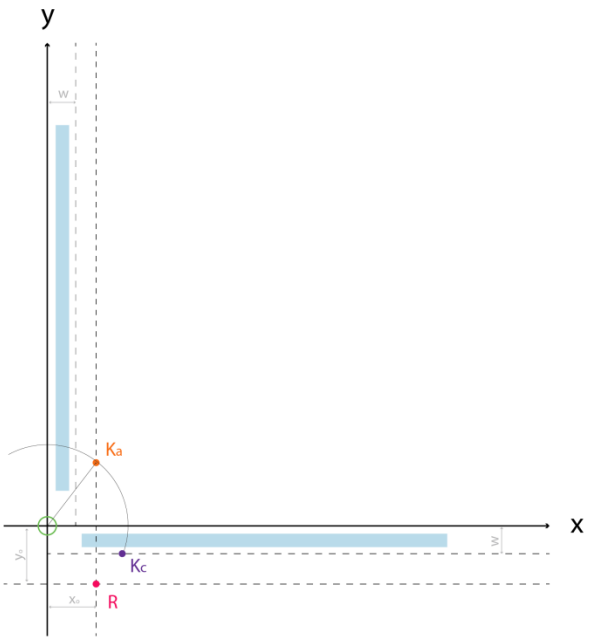
R (400,-800) aprox.

Ka (400, 1700) aprox.

Kc (1700,-400) aprox

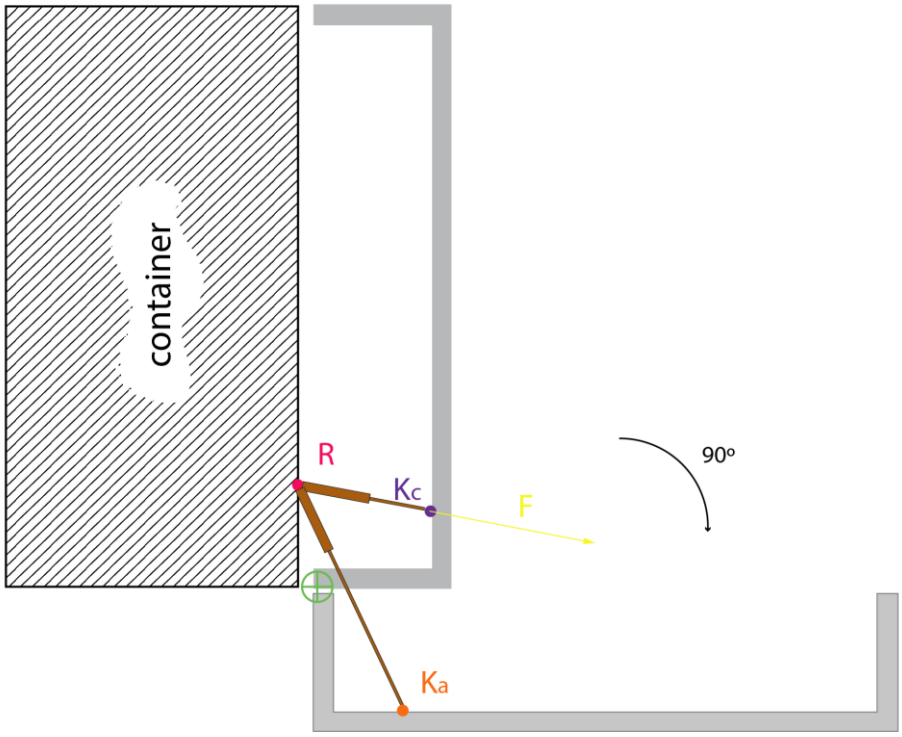






Direction of the action

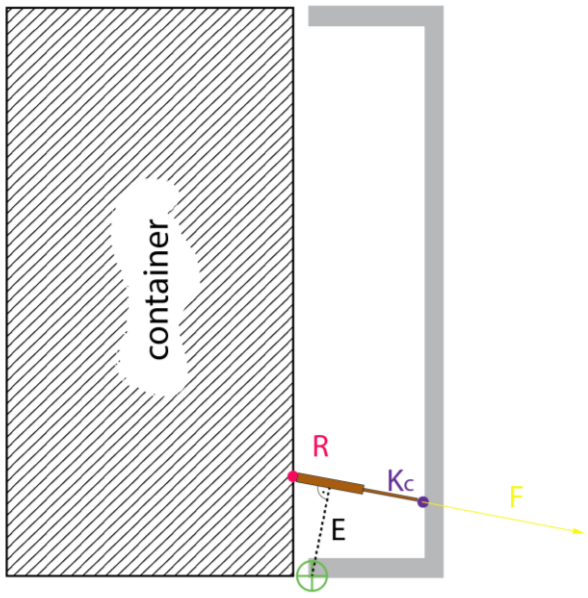
The direction of the force is R-Kclosed



Lever action

$$E = 882{,}116\ m$$

$$M = FxE = 21539{,}1173Nx882{,}116m = 19.000.000\ Nm$$



The weight force of the lid

The weight force of the lid is SxJ [Nxm]

Weight approx. lid is 10.00kg

$$J = \frac{3800m}{2} = 1900\ m$$

$$SxJ = 19.000.000\ Nm$$

Relation of forces

The weight force of the lid is SxJ [Nxm]

$$F > \frac{SxJ}{E}$$

$$SxJ = 19.000.000\ Nm$$

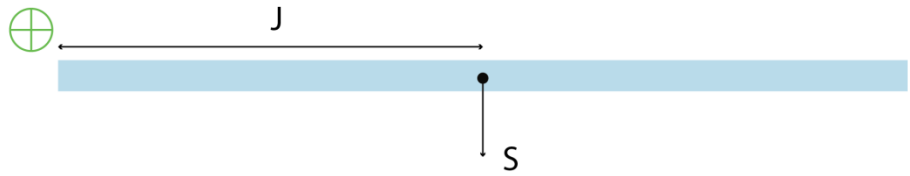
$$E = 882{,}116\ m$$

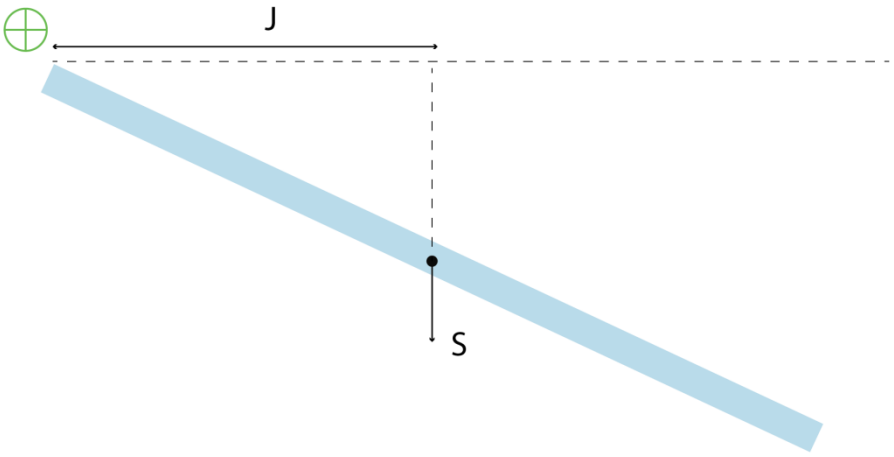
$$F > 19.000.000 \frac{Nm}{882{,}116m} = 21.539{,}117\ N$$

The force of the gas spring

Extended offspring force (Fa) -> Fe = Fnominal · 1.33

$$Fe = 21.539{,}1173Nx1{,}33 = 28647{,}026N$$





2. COMPRESSOR POWER

To calculate the power of the compressor that need to inflate and maintain the structure of the fourth presurgical a piston-cylinder stable system is assumed, considering the center of gravity to half of the maximum height reached by the structure were calculated size of a compressor: *[2]*

Center of gravity:

$$h = 2{,}4\ m$$

$$ho = \frac{2{,}4m}{2} = 1{,}2m$$

Weight fourth structure preoperative

$$p = 17\ kg$$

$$F = 17kg \cdot 9{,}81m^2 = 166{,}7\ N$$

Inflation time:

$$t = 3min = 180s$$

Thus we find the work required to inflate the structure

$$dW = F \cdot dr$$

$$W = 166{,}7N \cdot 1{,}2m = 200{,}04\ J$$

So then we can find the theoretical average power needed by our compressor:

$$P \equiv |P| = \frac{W}{\Delta t}$$

$$P = \frac{200{,}04J}{180s} = 1{,}111333\ W$$

$$1\ CV = 735{,}35375\ W$$

$$1{,}111333W \cdot \frac{1CV}{735{,}35375W} = \ 0{,}015\ CV$$

3. RAMP

In order to calculate the slope of the ramp which will have to raise the stretchers we have made some basic calculations, the length in horizontal and vertical that will move the couch with this and taking into account the rules on the calculation of pending vehicular access ramp, so we have had to gather information Technical Building Code, in particular on the basic document of use and accessibility.

"The ramps have a slope of 12%, at most, except:

a) those belonging to accessible routes, whose slope is at most 10% when its length is less than 3 m, 8% when the length is less than 6 m and 6% in other cases." *[3]*

For this reason and taking into account the need to save a height of 70 cm, the slope of the ramp is 12%.

4. REFERENCES

[1] Dictator Technik, Gas Spring. Retrieved Juny 10, 2015 in, http://es.dictator.de/

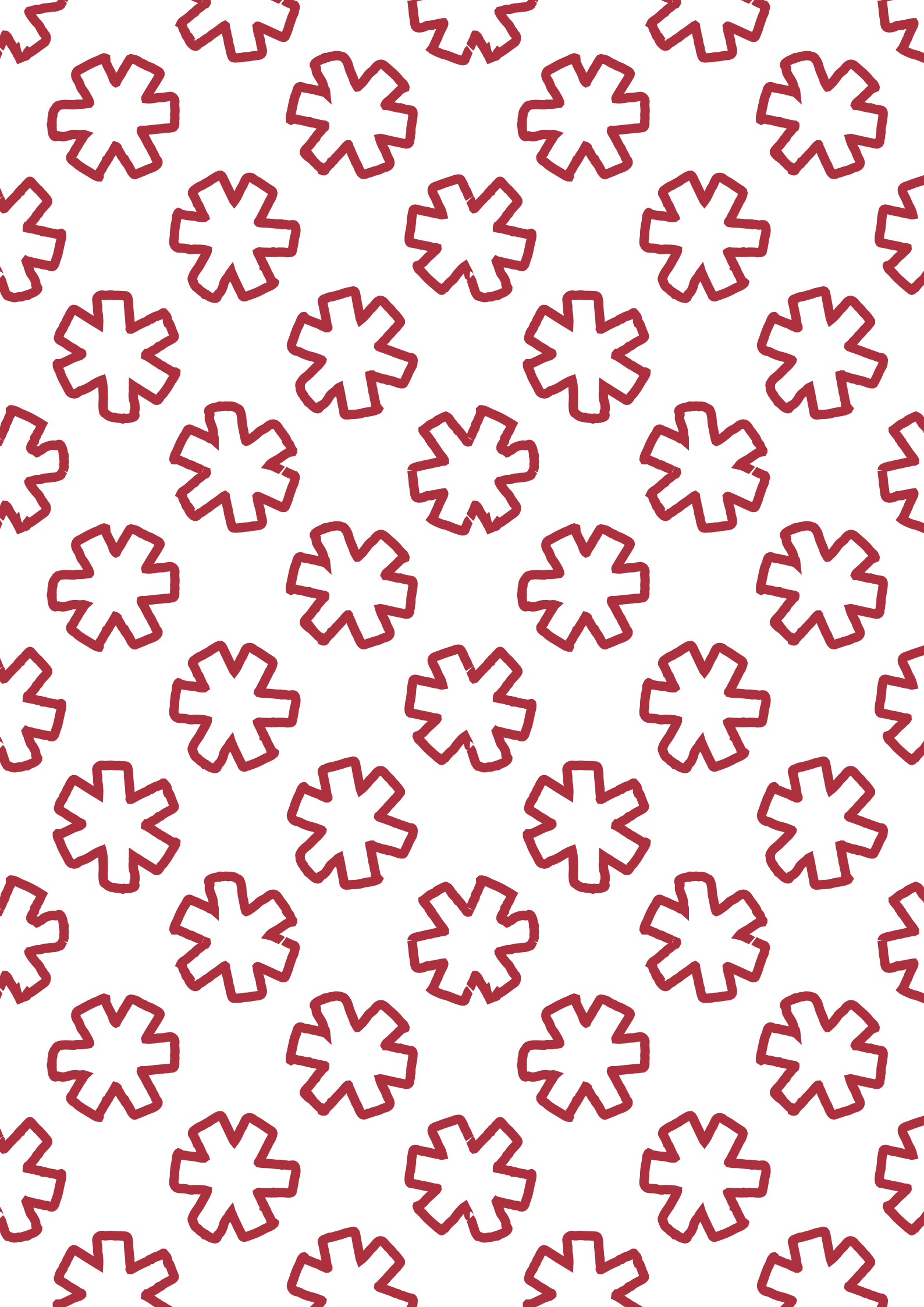
[2] Universidad Iberoamericana Mexico. Physics, compressor power. Retrieved July 10, 2015 in, http://www.up.edu.mx/es/mexico

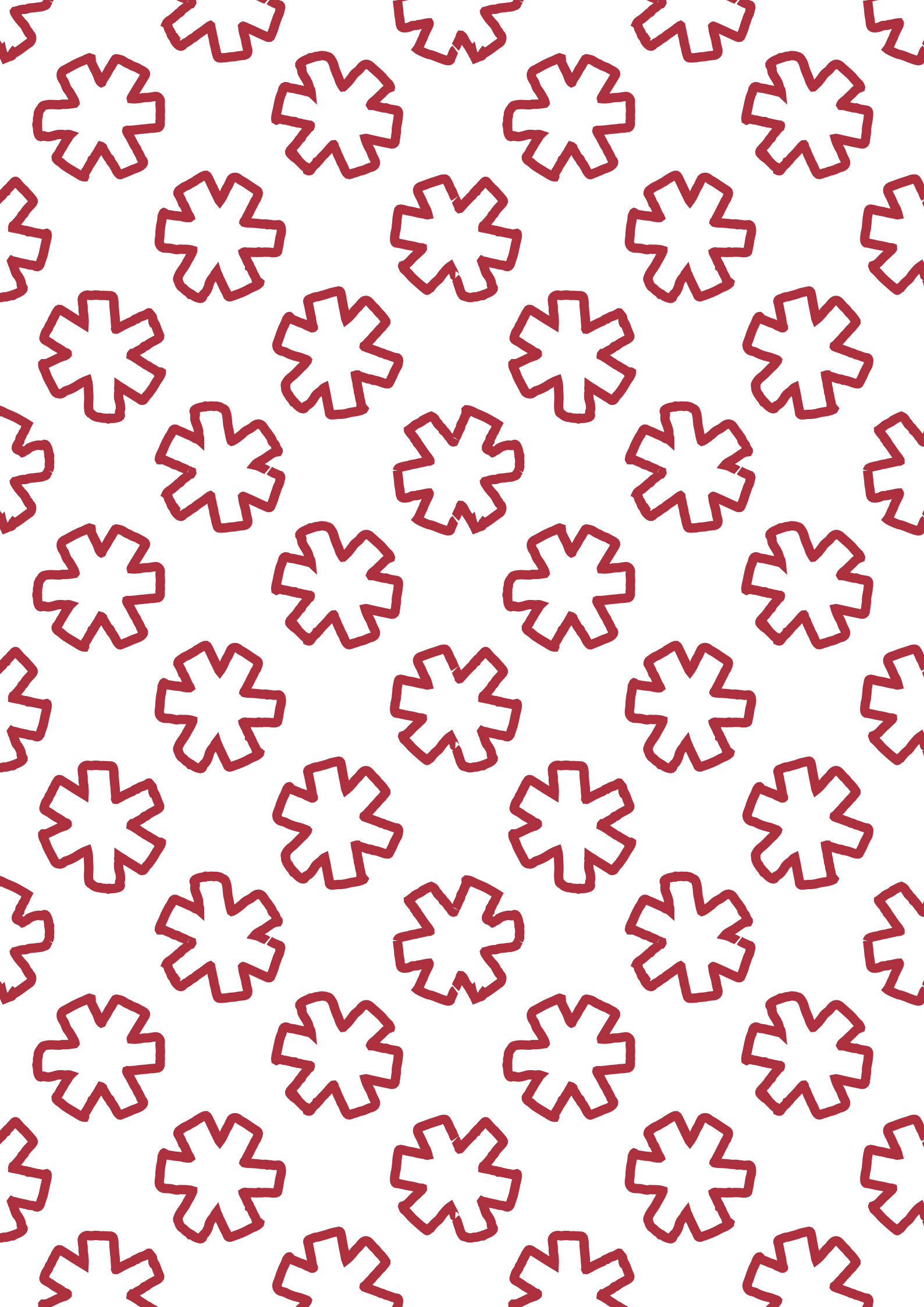
[3] Calculation inclination ramps. Retrieved July 15, 2015 in, http://www.mundorampas.com/

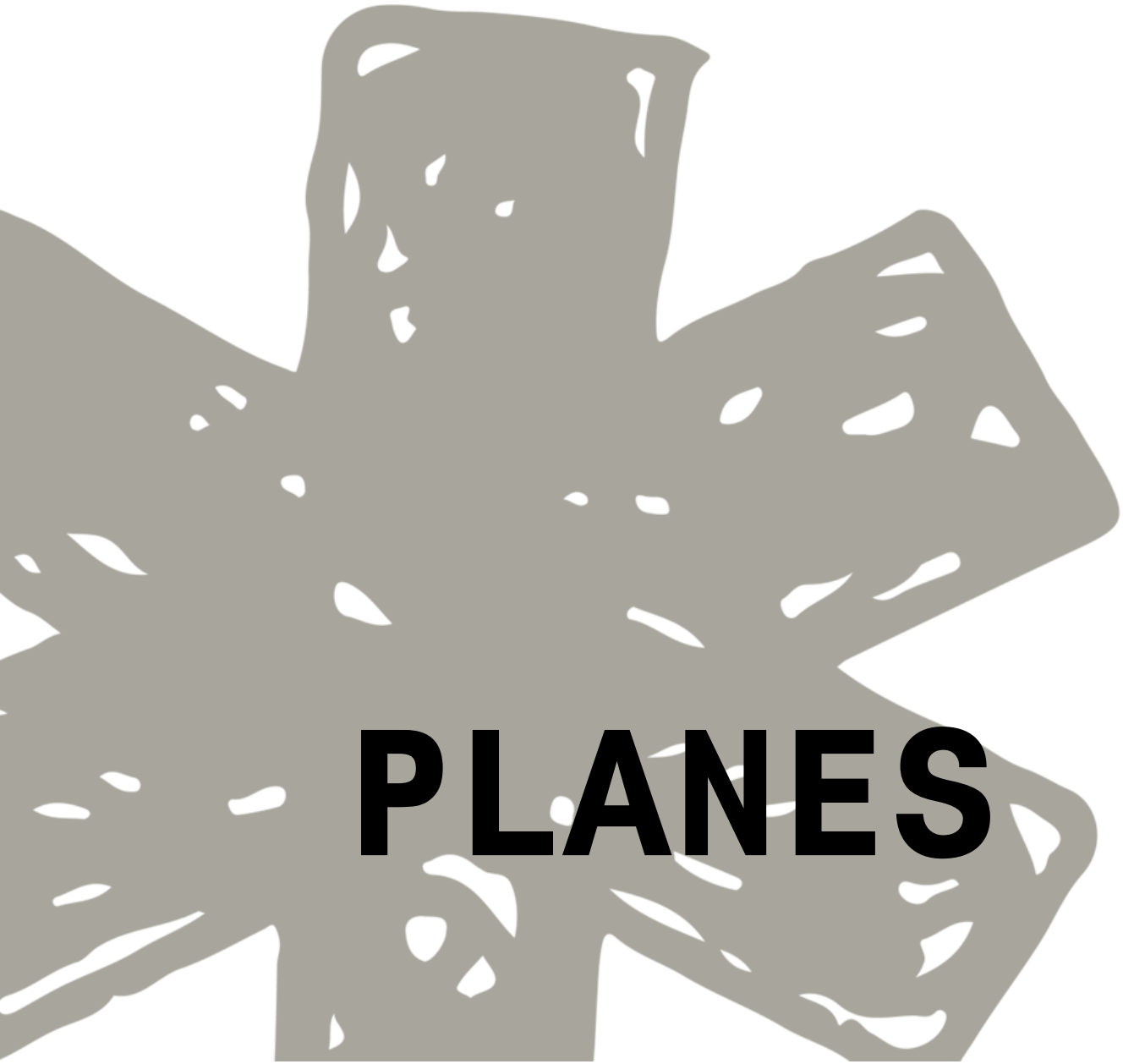
Saarbrücken, 20th July, 2015

Engineer in Industrial Design and Product Development:

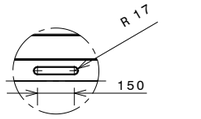
Jimena Casas Pérez



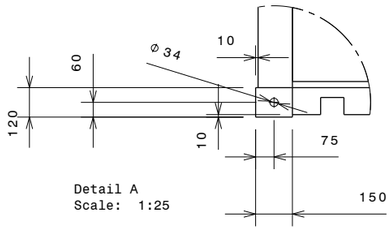




PLANES

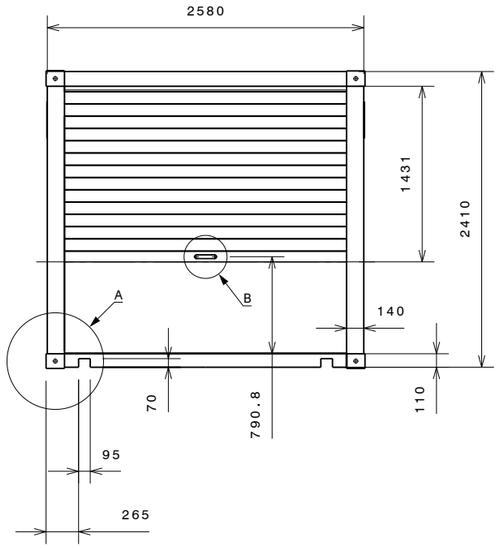


Detail B
Scale: 1:25

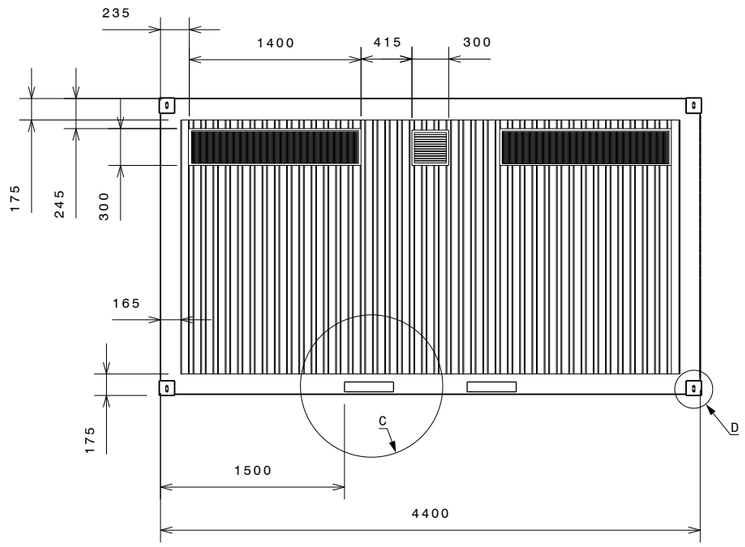


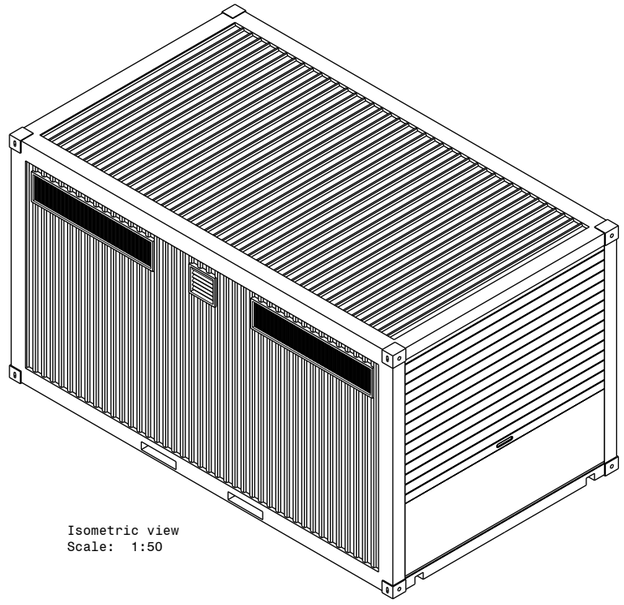
Detail A
Scale: 1:25

Front view
Scale: 1:50

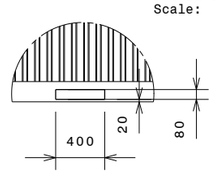


Left view
Scale: 1:50





Isometric view
Scale: 1:50



Detail C
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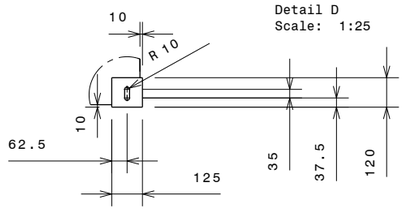


Detail D
Scale: 1:25

HOCHSCHULE DER BILDENDEN KÜNSTE SAAR

TITLE OF THE PROJECT:
Designing a mobile health care point for natural disasters

PLANE: Container

AREA PRODUCT DESIGN
ATELIER PROJECT

DATE: 07- 2015

No. PLANE: 1

ESCALE: 1:50

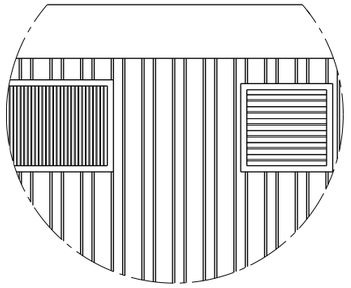
SIGN:
STUDENT:

PROMOTER: HBK

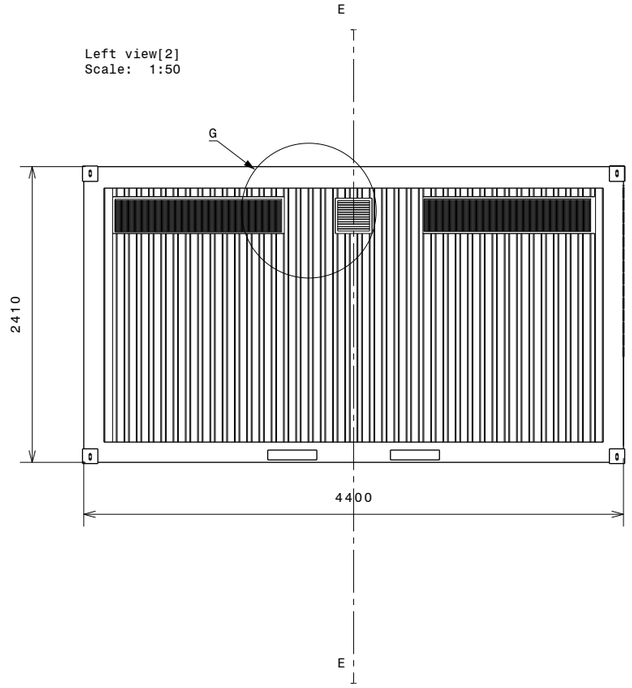
Degree In Industrial Design

Jimena Casas Pérez

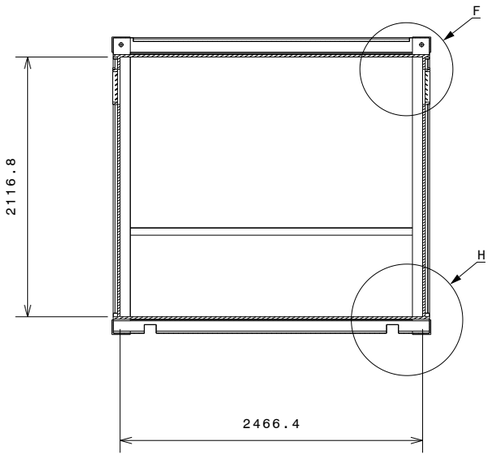
Detail G
Scale: 1:20



Left view[2]
Scale: 1:50



Section view E-E
Scale: 1:50



Detail F
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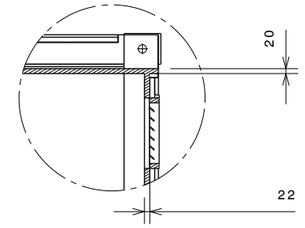
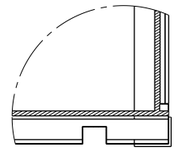
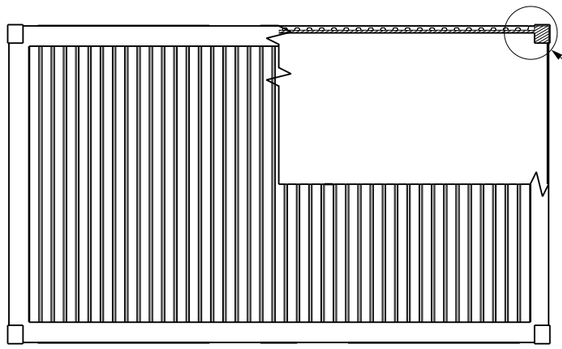


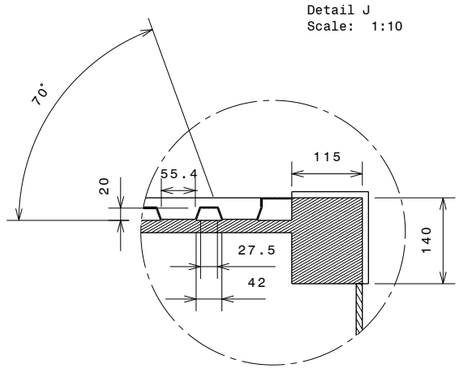


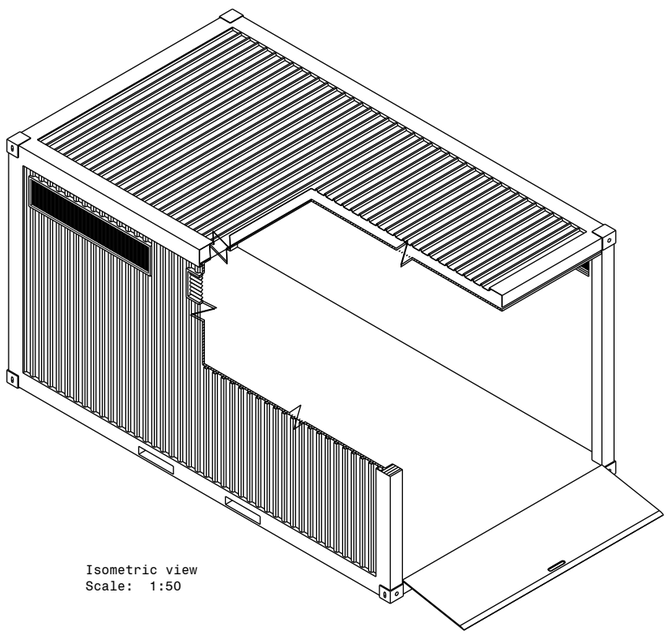
Detail H
Scale: 1:25



Auxiliary view I
Scale: 1:50

Detail J
Scale: 1:10





Isometric view
Scale: 1:50

HOCHSCHULE DER BILDENDEN KÜNSTE SAAR

TITLE OF THE PROJECT:
Designing a mobile health care point for natural disasters

PLANE:
Container

AREA PRODUCT DESIGN
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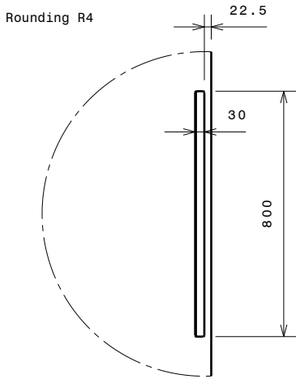

Detail F
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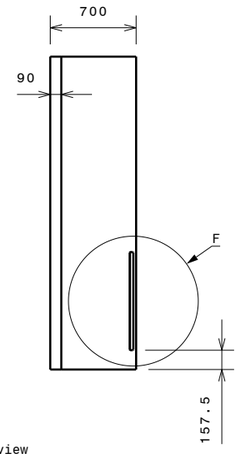
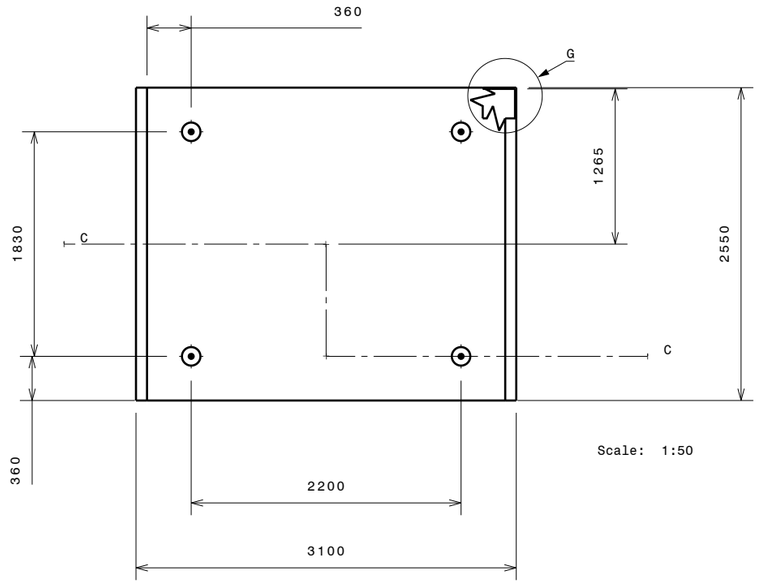


Right view
Scale: 1:50



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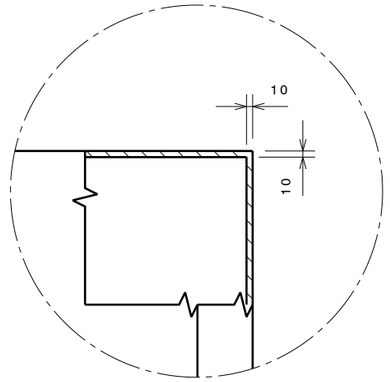

Detail G
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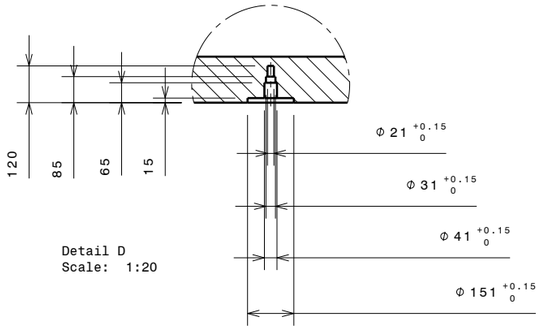

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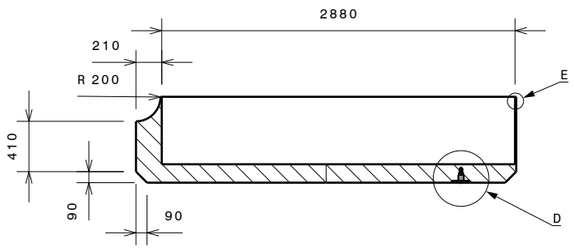

Section view C-C
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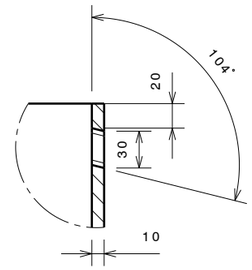

Detail E
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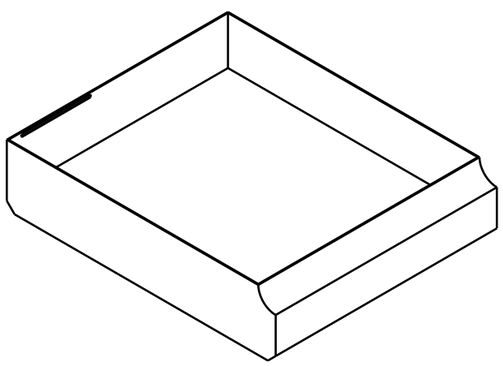


Isometric view
Scale: 1:50

HOCHSCHULE DER BILDENDEN KÜNSTE SAAR

TITLE OF THE PROJECT:
Designing a mobile health care point for natural disasters

PLANE: Main Box

AREA PRODUCT DESIGN
ATELIER PROJECT

DATE: 07- 2015

No. PLANE: 3

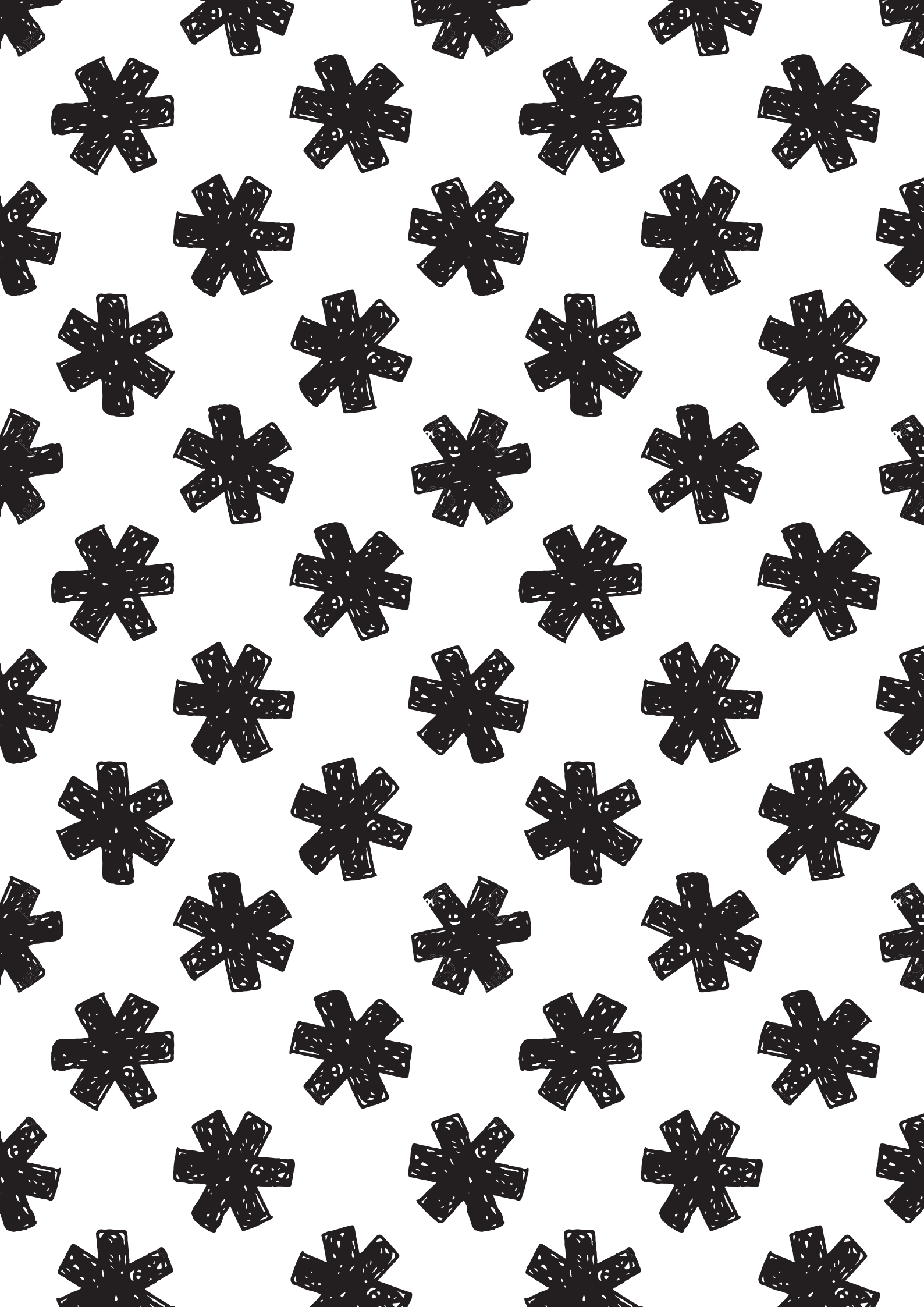
ESCALE: 1:50

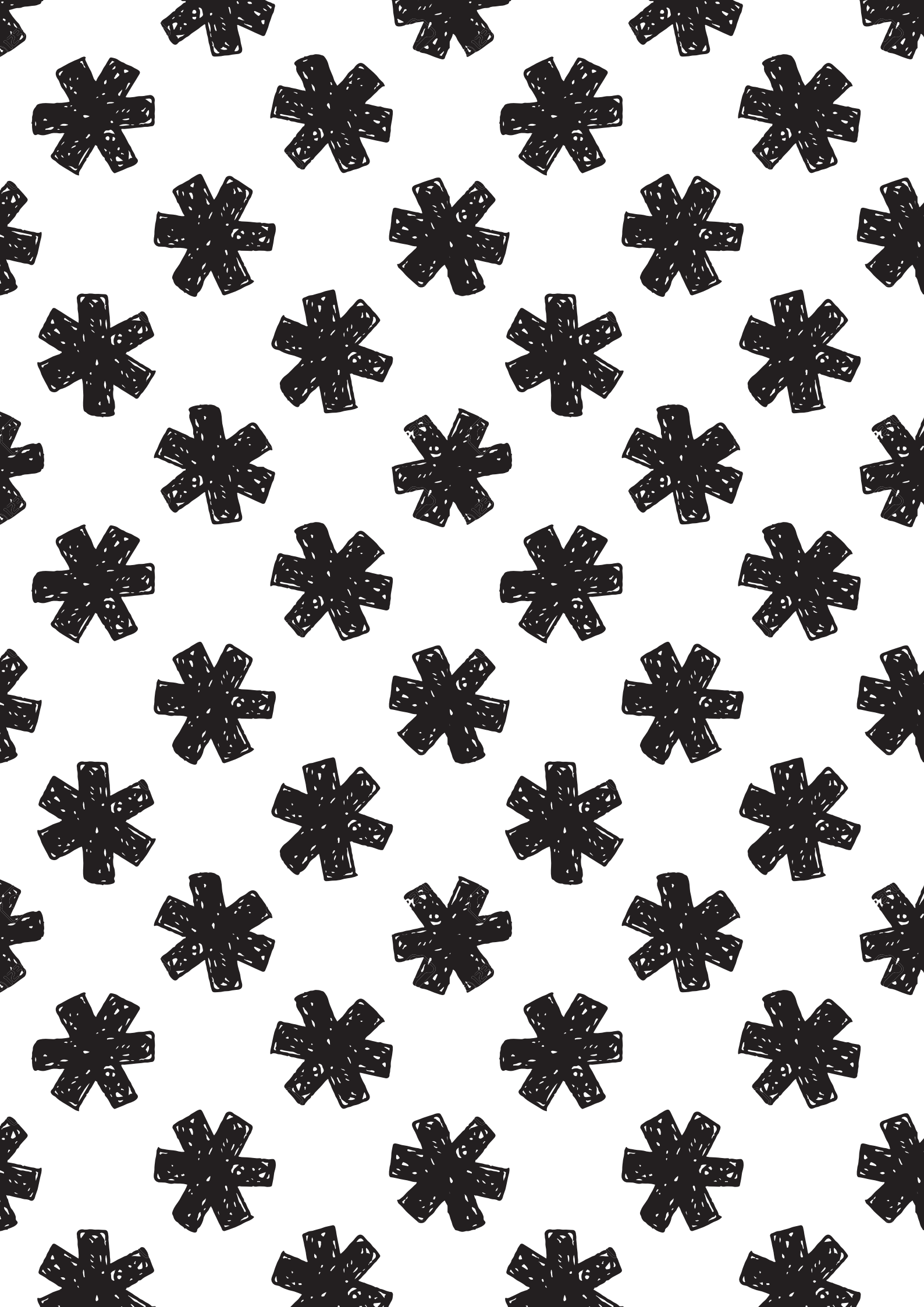
SIGN:
STUDENT:

PROMOTER:
HBK

Degree In Industrial Design

Jimena Casas Pérez





SPECIFICATIONS

INDEX

1. STATEMENT AND PROJECT JUSTIFICATION

In this Specifications Document all the necessary requirements and specifications will be defined to perform the project at hand.

This document will be clear, concise and comprehensive, with the intention of covering each and every aspect that certain to this project.

The technical specifications will be linked with the provisions that generally have been published by government agencies and are in force on the date of execution of the project.

As for the type of business organization that we have established, we considered that outsourcing is the most appropriate way to realize this project, since this way the materials and parts that we receive will be of the highest quality, able to focus our work on the preparation and product distribution.

1.1. AUCTION CONTEST

In this case we have the proposal of an academic work, despite their origin, it shall be resolved in a professional manner.

As explained in the report, this project stems from the idea of projecting a point of mobile healthcare, and as we have seen so far, it represents a breakthrough in medical aid to third world or natural disaster-prone countries.

1.2. ECONOMIC

As for the economic constraints, in this case they have been determined by the necessary equipment itself. The intention of this project is clearly getting this project at the lowest possible cost, while maintaining high value, because we can not forget that our users mainly be hurt, and in no way the price can adversely affect the safety and health of them.

1.3. PERFORMANCE

The execution of this project must be carried out based on the conditions stipulated herein, in a strict and meticulous way, and always avoiding possible accidents. For this first establish a series of preventive measures, and if prevention is not possible, corrective measures will be used.

1.4. GENERAL PROVISIONS

– Article 1:

All manufacturing processes of this project must be accompanied by the necessary measures for their achieving poses no risk to anyone, thus avoiding property damage and personal.

– Article 2:

The descriptions of these processes are detailed in full in an attempt to prevent any conceptual problem when it comes to understand. In case of any doubt it will attend the information provided both in the Report and in the Specifications and Drawings.

– Article 3:

In case of doubt and ultimately it will be contacted designers to resolve any difficulties that have arisen.

– Article 4:

As for the materials, and in the event that these are standardized, patterns indicated by the standard should be followed.

Special care to avoid damaging the material neither transport them nor handling to avoid compromising the quality of the parts will be provided.

Furthermore, all materials will have a manufacturer's warranty, up to the time of receipt of the contractor, and so will all those commercial parts that are acquired.

– Article 5:

In the unlikely event that the materials received did not meet the specifications of the tender documents will be the responsibility of the engineer to decide if these materials are admissible and to set the final price because of imperfections which have or on the other hand, return them to receive materials with the conditions that were required beforehand.

– Article 6:

The manufacturer must ensure the quality of assorted materials or commercial parts. Despite this guarantee certain quality controls are conducted to ensure the successful completion of the project and the relevant tests.

– Article 7:

The Contractor shall not hinder in any way the performance of the medical staff in any of the manufacturing processes.

– Article 8:

The budget for this project shall not be exceeded in any case.

– Article 9:

All those measurements carried out in order to check the costs of the budget sheets will be made in the same units in which the amounts of such sheets are defined.

– Article 10:

The prices shown in the budget correspond to those agreed with the contractors concerned, being able to not exceed.

At higher rates of social security contributions, MOD and MOI will be considered.

– Article 11:

They must be complied, each and every one of the standards set by our organization, as well as by private contract.

– Article 12:

Once finished products a number of checks are conducted for quality in their commissioning, in order to ensure the proper functioning and that there is no possible danger in using it.

_ Study cyclic loading lid opening

_ Study of mechanical strength

_ Study against external atmospheric agents

It will correspond to perform these failure analysis 2% of each batch.

– Article 13:

Tests, which carried out by the subcontractors about their products, will be reviewed, ensuring that the products meet the requirements set forth above.

– Article 14:

The Technical Director will be responsible for receiving materials and ensure that they meet all the conditions set out in this specification.

– Article 15:

This in turn, will have to have the ability to reject the materials in the event that they do not fulfil the necessary requirements.

– Article 16:

If all activities in the tender documents were not made properly, it will also be the Technical Director who should announce it and taking the most appropriate considerations regarding the situation.

2. SUPPLY OF COMPONENTS

Project implementation is divided by two types of components, which are designed to mark the product development and others that will be ordered directly from suppliers, provided that they conform to the requirements.

2.1. OWN PIECES

A part of the components that make WOA are made of materials corresponding external engineering companies dedicated to the sector of interest. Once the design, they will be sent to each of these planes that define all of the pieces as well as the agreed conditions and requirements for implementation.

The components that send us design and manufacturing to outside companies are:

- The container
- The folding box
- The inner drawer
- The tent

It is noteworthy that the screen leaving the roof to collect all the objects in the vehicle movement is already installed in the container.

Product packaging will also be entrusted to a company dedicated to the development of packaging.

2.2. COMMERCIAL PARTS

Moreover WOA components will directly purchase orders to take charge of providing us the pieces at the right time to assemble them. Selected suppliers must comply with the requirements and conditions established for the good development of the product.

These are:

- Ratchet tie down straps
- The Gas Spring
- The Air Compressor
- Medical, surgical equipment
- Equipment for the container

2.3. FINAL PRODUCT

Once we have all the parts listed above, we will have to finish and final assembly. These two operations are the only way that we will own, hiring workers and with the necessary facilities.

To achieve adequate resistance to adverse weather conditions or to different external agents, containers will come with the appropriate coating.

Once this process is finished, meeting the established completion times, the assembly process will be held, which was explained hereinbefore in the introduction and disposal of all packing pieces, preparing it for distribution.

2.4. COMPANIES MANUFACTURERS

Companies engaged in the development of parts previously described must meet a series of requirements that will be necessary for the proper development of the project. The requirements which must meet are set out below:

– These companies responsible for creating some of the components must have the necessary experience in this sector. Within his working material it will be needed for the manufacture of the elements outlined in the proposed technology.
– Should have qualified personnel to perform the type of work for and be capable to understand the plans and documents that are assigned to the project.
– The workers must meet the requirements established prevention.
– All staff should be registered in the social security and collect at least the minimum wage established in the agreement.
– All staff must comply with the standards of safety and hygiene.
– These companies must to have the ISO 9000 quality certificate that guarantees the quality of their products in order to ratify the customer satisfaction.
– The way the company will work to ensure the proper production and delivery of finished products is established within their corresponding features previously imposed.
– Should ensure compliance with the current standard of industrial production and meets all requirements as a company, ensuring commitment to the environment.
– Shall comply with all aspects of legal and administrative character in force.
– Must comply with health and safety standards set out in the German legislation.
– Have a test laboratory to ensure the quality of their products. In case you do not have it, you need to instruct another company testing the same as they have been established.

2.5. SUPPLY COMPANIES

The suppliers of parts previously described must meet a series of requirements that will be necessary for the proper development of the project. The requirements which must meet are set out below:

– You must hire providers with the necessary experience, and certifying their good delivery commitment.

– These companies must to have enough qualified staff as there is no problem in understanding materials that may cause financial and time lost in the project.

– These companies shall ensure that suppliers comply with all applicable rules and that their products have the quality seal to verify its authenticity and good performance.

– The form of delivery of such products shall be determined.

– All products delivered must be properly packed and sealed to avoid any damage during transport.

3. TECHNICAL CONDITIONS

3.1. ADDITIONAL SPECIFICATIONS

Under this document, the plans document is attached, which complements the understanding of this. The specification stipulates the definition and implementation of the project in terms of its constitution and nature. The drawings are graphic documents that define it geometrically.

3.2. GEOMETRICAL AND DIMENSIONAL TOLERANCES

As we can see in the drawings, they have considered a number of tolerances in accordance with ISO 286-1988, to ensure smooth operation. *[1]*

The rule indicates that it is recommended that for a given quality of a hole, you must associate a quality shaft immediately exceeding the scale.

For all axes disabled have considered an IT 7, and to the respective holes one IT6.

In the drawings such dimensional tolerances are observed.

3.3. SURFACE STATES

Surface states have been extensively studied, and due to the very demanding needs of this product, and have instructed the company PVC coatings for walls and floor of the container, which contact the company of container, will make the product with best features.

3.4. CONDITIONS OF MATERIALS

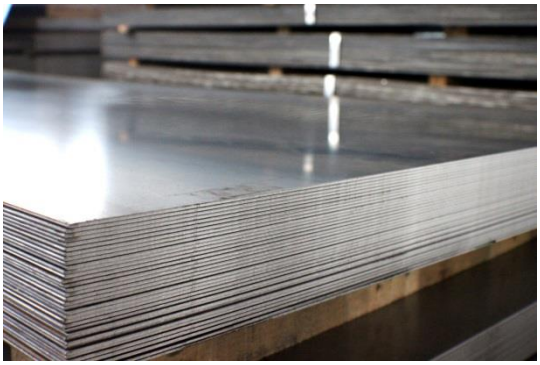
The goals we set when selecting materials for our project were that these were to the extent possible sustainable, but in no time product safety is compromised. We now describe the materials chosen for the development of this.

In each definition will discuss the origin and explanation of the decision to use.

In Articles 4, 5 and 6, previously developed, the quality criteria required and necessary procedure in every possible situation are explained.

3.4.1. DEFINITION

The following materials will be used in the construction of containers.



Part specification
Parts Materials

- Door panels →Anti-corrosive steel. SPA-H or equivalent

Roof panels Y.P.: 343 N/mm2
Side panels T.S.: 481 N/mm2
Front panels

- Door header (upper & lower) →Structural steel. SS41

Front top end rail Y.P.: 25kg/mm2
Front bottom end rail T.S.: 41kg/mm2
Lower plates of forklift pocket
Door horizontal frames
Floor center rail
Door gasket retainers
Bottom side rails (right)
Inter top end rail
Gussets

- Cross members →Rolled high tensile steel. SM50A

Rear corner posts (outer & inner) Y.P.: 33 kg/mm2
Front corner posts (outer &inner) T.S.: 50 kg/mm2
Door sill
Bottom side rails (left)
Upper plates of forklift pocket
Top side rails (right)

- Top side rails (left)→ Structural steel rectangular pipe.STKR41

Door vertical frames Y.P.: 25 kg/mm2
T.S.: 41 kg/mm2

- Door locking bars →Structural steel round pipe. STK41

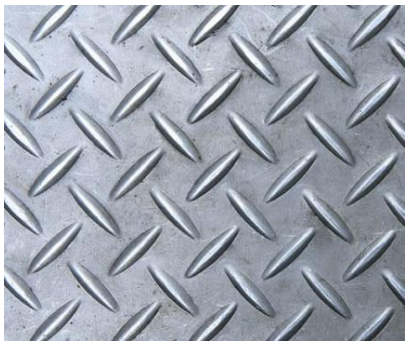
Y.P.: 24 kg/mm2
T.S.: 41 kg/mm2

- Corner fittings →Casted weldable steel. SCW49

Y.P.: 28 kg/mm2
T.S.: 49 kg/mm2

– Locking gear cams and keepers→ Forged weldable steel. S20C
Y.P.: 25 kg/mm2
T.S.: 41 kg/mm2

– Door hinges →Structural steel S25C
Y.P.: 27 kg/mm2
T.S.: 45 kg/mm2

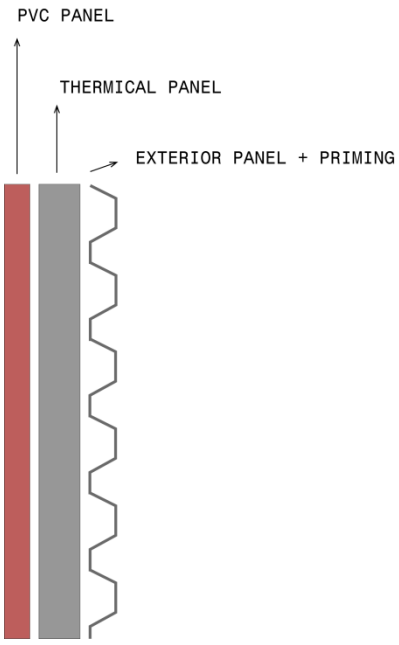


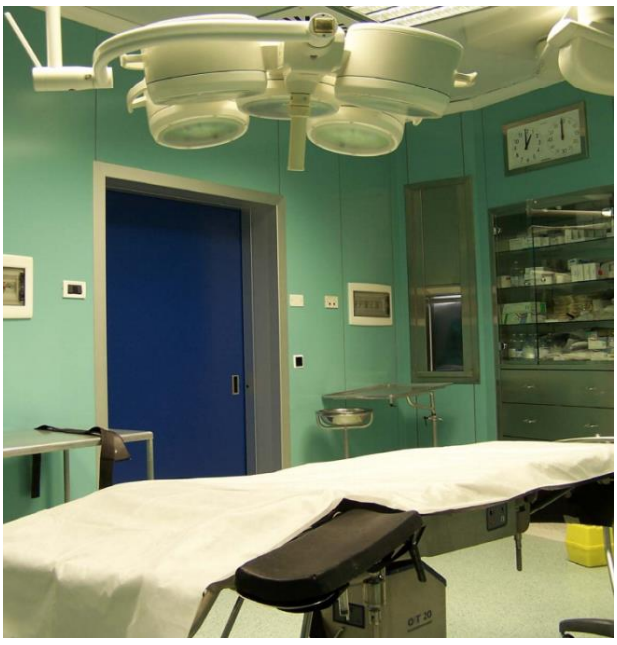
– Door hinge pins →Stainless steel.
– Door gasket→ EPDM
– Ramp
Y.P.: 28 kg/mm2
T.S.: 49 kg/mm2

* Note: Y.P. - Yielding Point
T.S. - Tensile Strength

It has taken special care in selecting materials. The container consists of various types of steel to withstand various types of stress, as discussed below. Besides the material applied to the container floor could not have pores not possible to absorb bacteria and easy to clean. It had to also consider the walls, so it was decided to have a PVC coating. This material offers very good properties and is also the cheapest solution. *[2]*

The PVC will make the surgical area a much more hygienic and disinfected area.





The inner drawer of the preoperative structure will be made of polypropylene PP. This material will provide the structure of the inner drawer high resistance to stress cracking. We chose this material because it has very good thermal and mechanical properties that will give the required properties at an acceptable price and being considerate of the environment. *[3]*

Inflatable tents are usually constructed, mostly by tarpaulins of various brands but in all cases; provide guarantees high performance and resistance to tearing, abrasions and punctures. The most commonly used brands are Nildatex canvas and Guaira, and these tarpaulins are composed of polyester yarn and PVC resin that must comply with the safety standards established in the various countries of manufacture. As for vertical networks, they are made from nylon and have two to four reinforced seams depending on whether they are in the lower area, where further strengthening due to the impact caused by the use in that part will require; or uptown. Finally, specific adhesives are used for such structures and they are usually nontoxic liquid PVC. *[4]*

- Inflation methods

In filling, these structures take the way they intended. For this compound a motor equipment is used such as turbines or blowers, which manage inflation quickly and decreasing the effort.

- Safety rules

It is important that both the design and the shape and the materials that make these tents guarantee the safety of users. There are regulations governing safety and quality for the proper enjoyment of users. Of these regulations, the most important is the European standard UNE EN 14960: 2014 inflatable play equipment. Safety requirements and test methods; although there are others.

3.4.2. NECESSARY TOOLS

It will have the necessary tools to optimize the performance of the operations of the manufacturing process, to run operations in a controlled manner. The provision of tools and machinery necessary is guaranteed to reduce manufacturing times, reduce production costs and to meet production targets.

3.5. FABRICATION

The part to be produced will be the preoperative room and container, as this will be the first hooked on the second, and this in turn in the truck. Importantly, we will hire the service of the construction and supply of both, in order to get a higher quality product and best price.

– Preoperative room

Design and Assemble

The presurgical room will also be manufactured by two specialist companies. This in turn consists of two parts, one corresponding to the inflatable portion, and another is the base that attaches to the container.

Manufacturing inflatable tents is performed such that when the 3D design is made, a program development deployment of these forms, which shows the patterns to be sewn, is used.

Once you have all the patterns of each part of the 3D design, the plastic sheets are placed on a cutting table, which is firmly secured to prevent movement while they are cut. The 3D computer design is sent to the CNC cutter collecting points and begins its work.

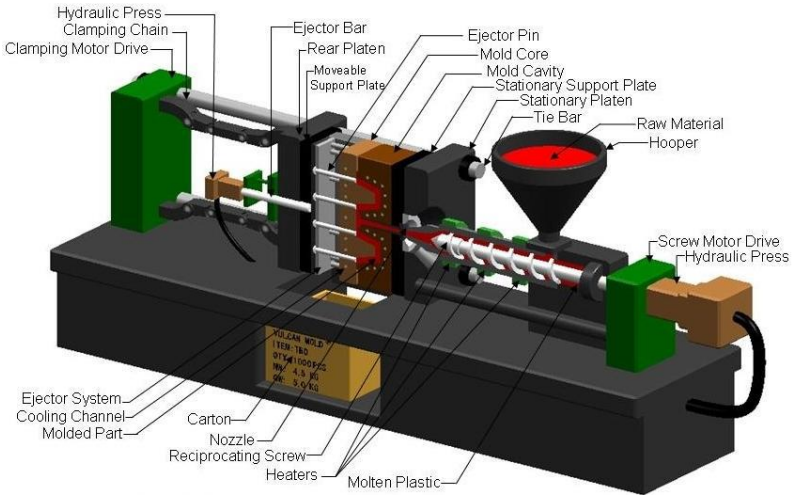
When all the pieces are cut and in case that a part needs to be paste something on the main sheets as decoration, a non-toxic liquid glue PVC is used.

Then the final parts are sewn forming the final design of the inflatable tent.

This store has to be tested to avoid any unforeseen failure and ensure safety. Weight resistance, strength, consistency of the structure will be tested.

On the other hand we have to fabricate the main box and the box which goes inside of this one. *[5]*

Both of them are manufactured by the injection molding process polypropylene.



For more information: http://www.technologystudent.com/equip1/inject1.htm

– Container

The base material is a large roll of steel, from which sheets are cut to will be used later to make the walls and the roof. These same sheets are treated using two techniques, sandblasting* and priming. First we apply the sandblasting in order to smooth and improve the characteristics of surfaces with a jet of sand under high pressure. Then apply the priming on these surfaces, which leads to better adhesion of paint to the surface, increases the durability of this and gives extra protection to the material before painting.

Once the sheet's surfaces are ready, there are two types of uses, the sheet for the ceiling, and the sheets that will be walls. The sheets of the walls are arranged for corrugating, shaping into pleats, ridges or grooves, producing a wavy line pattern. The corrugations increase the flexural strength of the sheet in the direction perpendicular to the corrugations, but not parallel to them. Normally each sheet is manufactured longer in its strong direction. Generally it's used this technique with galvanized steel to prevent corrosion, but after a while oxidation is inevitable. To prevent this from happening is priming.

In the case of sheets for roofs of containers other manufacturing processes are applied. These come into the embosser and will ready.

Moreover ground arms, which form a supporting frame, must be manufactured. These arms are U-shaped profiles depending on the company that will be commercial or made by themselves. It is noteworthy that all parts of the container shall be previously sandblasted and primed.

That's when the walls lower arms are welded, and in case of different sheets to one wall, also have to weld.

Also the under frame of the floor must be mounted, for that all the arms and outer frames are caught and welded to form a frame to the floor.

For the container door arms bases are welded to the corrugated steel sheet.

Once all essential parts for the container are formed, mechanisms relevant opening and reinforcements are added. That's when the doors are mounted in the final frame and then these ones are fixed in the frame along the walls. The last thing is the roof welds, and when it is already shaped, blocks are prepared and the container get painted, besides painting, a liquid ceramic insulation for thermal insulation and temperature control will be applied. *[6] [7]*

Finally the floor panels are placed and properly secured.

Once assembled the container, thermal insulating panels will be included.

*The sandblasting is an abrasive technique used to smooth or shape the surface by applying a jet of sand under high pressure. This technique is traditionally used in the construction industry to treat metal and ceramics, among others. Natural sand contains silica. Despite the health risks involved, a European directive allows the use of this technique as long as the abrasive materials containing less than 0.5% silica; in the United States it is allowed up to 1% if adequate protection is used.

3.6. CERTIFICATION OF UNITS OF WORK

Each worker in the workplace should make the appropriate quality control of the pieces performed. For this to be done in the most effective manner, it first has to know what qualities are acceptable to give the nod to such parts.

In the event that any of the parts does not meet the requirements, the worker has the obligation to exclude from production. Quality control is done on a percentage of production picked randomly.

3.6.1. TESTS

All randomly selected pieces will be tested under the procedures established by law in each of the subcontractors, in order to ensure the safety and viability of the same.

Furthermore finishes are required with certain qualities. Those products not complying with the right qualities should be excluded.

Therefore the parts to be made should go through a thorough quality control to verify that they are in good condition.

Once you have all the parts and assembly can be executed, were carried out tests of the whole design prior to its distribution.

3.6.2. RECEPTION

The reception of the components provided by suppliers must meet established delivery times for this way to check the deadlines for the assembly process, quality control and distribution.

These orders are carried out at the time you are riding final drives work.

3.6.3. PENALTY

All those companies engaged in the manufacture or supply of component elements of our project, have an obligation to carefully execute manufacturing processes and strict compliance with the stipulated conditions and with all orders or modifications will have been delivered in the documents related to the draft.

Before the refusal or failure of these requirements or conditions of the covenant, it will be penalized with the legal sanction, being excluded from the project.

4. FINAL PROVISIONS

4.1. PLANNED TESTS (RECEIVING END)

The examination or approval of all the listed material and not listed in the tender documents is understood to be of the highest quality and will be submitted for acceptance Technical responsible for those materials. This approval does not review or final acceptance thereof, since the ultimate responsibility rests with the project implementers.

After receipt of all materials and components has reached its assembly phase, the technical project manager must submit all materials it deems appropriate tests to ensure and guarantee such good quality and condition, verifying tests special laboratory tests to run.

Once past these exams will be held the final acceptance of the materials previously supplied.

4.2. WARRANTY PERIOD

The warranty period for the project, given its characteristics, will last for two years for cases in which the failure of a technical and not a reckless user error due.

5. REFERENCES

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[2] Surgical Coating. Retrieved on June 4, 2015 to, http://www.medical-engineering.es/revestimiento-quir%C3%B3fano.htm#PVC

[3] Inner drawer. Retrieved on June 9, 2015 to, http://www.ijasa.com/pdf/PLASTICOS%20DE%20INGENIERIA.pdf

[4] Tent Information. Retrieved June 26, 2015 to, http://www.display-max.de/de/unternehmen

[5] Molding Injection Process. Retrieved on June 11, 2015 to, http://www.pf-mold.com/article/Plastic-Injection-molding-process.html

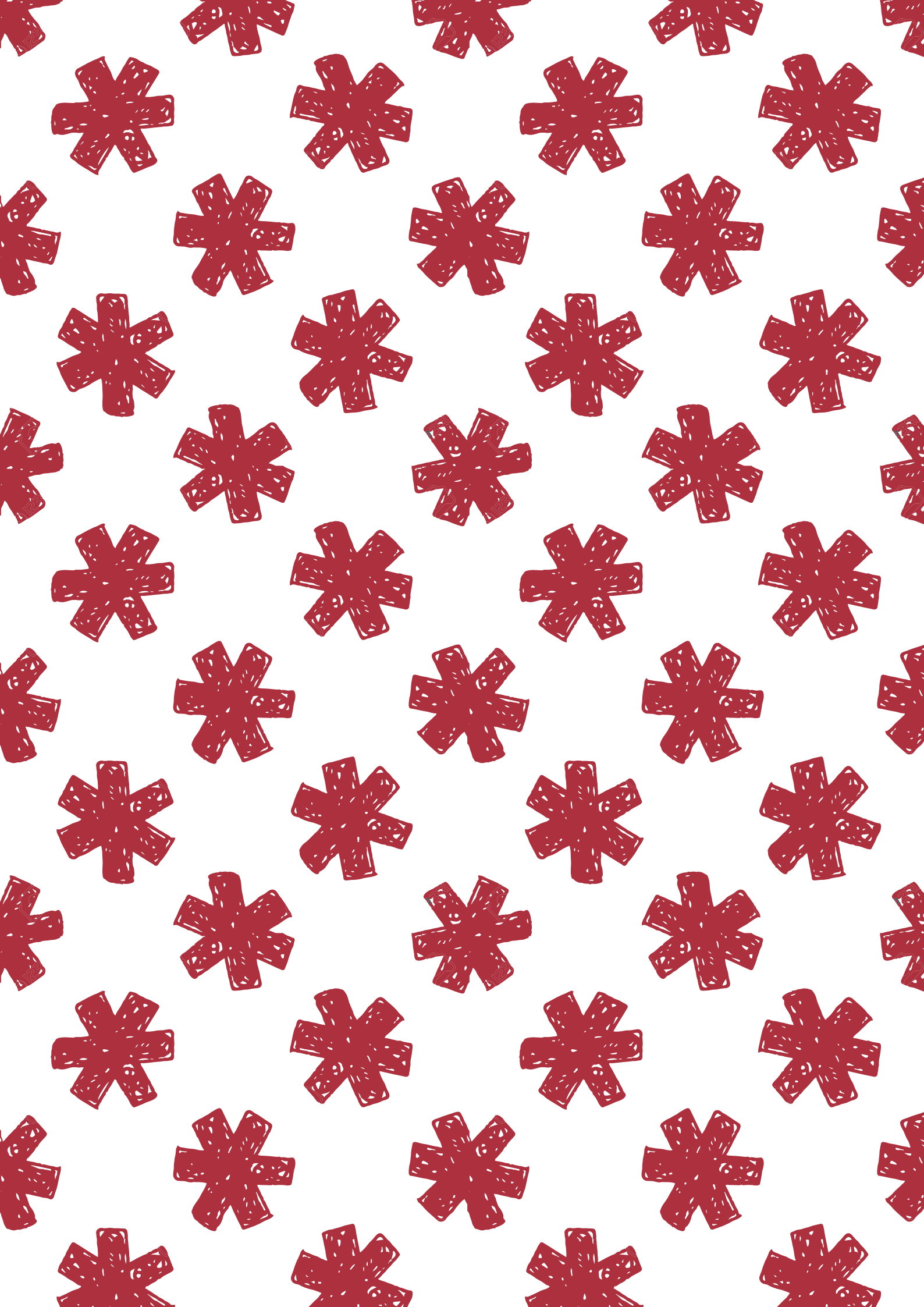
[6] Surface Preparation and Priming - Steel Hot & Cold Rolled. Retrieved on June 9, 2015 to, http://www.awlgrip.com/support-and-advice/surface-preparation-and-priming-steel-hot-cold-rolled.aspx

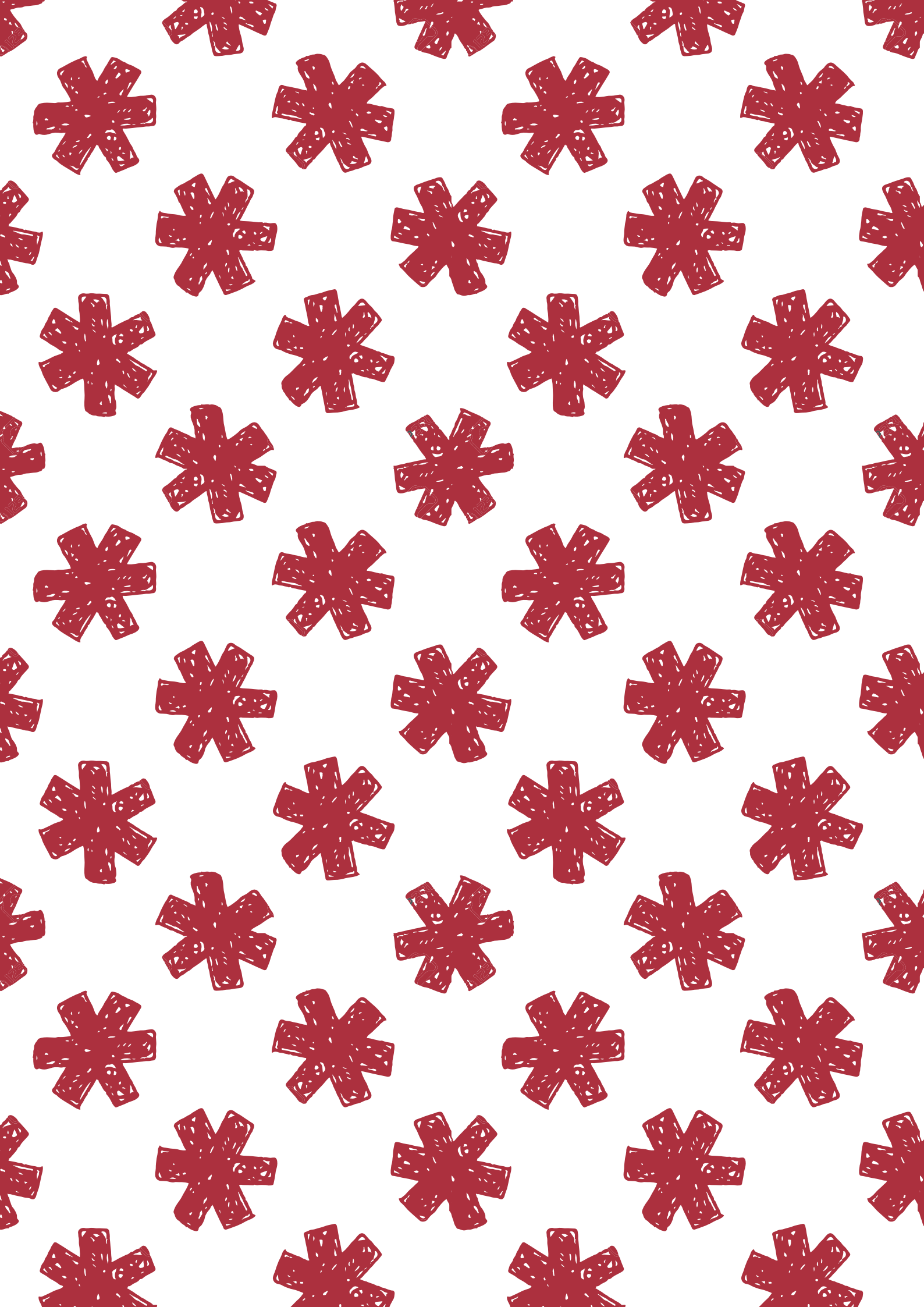
[7] Container Coating. Retrieved on June 8, 2015 to, http://www.thcoat.com/aislantes-termicos/aislamiento-termico-en-contenedor-de-acero/

Saarbrücken, 20th July, 2015

Engineer in Industrial Design and Product Development:

Jimena Casas Pérez





HELTH AND SAFETY STUDY

INDEX

1. BACKGROUND AND GENERAL TERMS

1.1. OBJECT AND AUTHOR OF BASIC HEALTH AND SAFETY STUDY

This Basic Health and Safety Study drafted to comply with the regulatory framework on the development of legislation on safety and health in the Law on Prevention of Occupational Risks supported. *[1]*

Its authors are the same people responsible for the project, and its development has been commissioned by the promoter of this.

The purpose of the Safety and Health Basic Study is to be useful for the contractor in order to prepare the corresponding Safety and Healthy Work. This Plan will analyze, study, develop, and complement as well the provisions included in this document, depending on its own activity execution system. The study can be used to provide the manufacturer with basic guidelines under the supervision of the Project Management Team, thus implementing the mandatory inclusion of the Safety and Healthy Work Basic Study, in order to carry out their obligations in the field of prevention of labor risks. These can be avoided by indicating the required technical measures and the labor risks that cannot be eliminated, according to the conditions stated above. Likewise, specifying the preventive measures and technical protections that are likely to control and reduce risks by assessing the effectiveness, and the predictions and information useful to achieve in a particular moment, and in the right conditions for predictable future work.

1.2. COORDINATOR AND OBJECT OF THE SAFETY AND HEALTH STUDY

To achieve the aim of promoting safety and health of workers, the Act provides a set of general principles which allow to get a safe working environment and with sufficient guarantees for the health of workers is not affected. Information, consultation, balanced participation and training of workers in prevention commodities to be met to achieve the elimination or reduction of risks arising from work early.

Coordinator for safety and health during project execution, should perform the following functions: *[2]*

- Coordinate implementation of the general principles of prevention and safety.
- Coordinate activities to ensure that companies and active personnel applied consistently and responsibly the principles of preventive action as reflected in Article 15 of the Law on Prevention of Occupational Risks in the execution of the work.
- Approve the Health and Safety Plan prepared by the contractor and, when appropriate, amendments to it.
- Organize the coordination of business activities provided in Article 24 of the Law on Prevention of Occupational Hazards.
- Coordinate actions and control functions for the correct application of the methods of work.
- Take the necessary measures to ensure that only authorized persons have access to the facilities used for execution.

1.3. REFERRED TO PROJECT

This Basic Health and Safety Study refers to the Project whose general data are:

REFERENCE'S PROJECT	
Implementation Project	WOA
Author of the project engineer	Casas Pérez, Jimena
Ownership of the order	Design project about health care
Location	HBK
Budget Execution	55.000,00€

2. DEVELOPMENT OF HEALTH AND HYGIENE

The following data refer to the place where the manufacturing processes punbto mobile assistance, that is, they are made at the factory.

2.1. FACILITIES SERVICES

According to paragraph 15 of Annex 4 RD1627 / 97, the work will have restrooms that are listed in the following table:

SANITARY FACILITIES
Locker room with individual lockers and seats complete with key.
Sinks with cold water, hot water, and mirror.
Showers with hot and cold water.
Toilets.

Workplaces will have changing rooms when workers have to wear special work clothes and cannot ask them for reasons of health or propriety, they are changed in other units. The changing rooms will be equipped with seats and lockers or individual lockers, which will have sufficient capacity to store clothing and footwear. The cabinets or lockers for work clothes and street to be separated when required by the state of pollution, dirt or moisture from work clothes.

Workplaces provide, in the vicinity of workstations and the changing rooms, local room with mirrors, sinks with running hot water, if necessary, soap and individual towels or other drying system with sanitary guarantees. Besides power showers, hot and cold water provide, when dirty, polluting or that create high performing work is usually sweating. In such cases, workers shall be provided the special cleaning means necessary. If local toilet and changing rooms are separated, communication between them should be easy.

Workplaces will have toilets, equipped with toilets, located in the vicinity of workstations, local rest areas, changing rooms and toilet premises when they are not integrated into the latter. Toilets will have automatic discharge of water and toilet paper. In the toilets are to be used by women special closed containers will be installed. The bathrooms will be equipped with a door lock and inside a hanger. Dimensions of the locker room, local amenities and the respective allocations of seats, cabinets or lockers, hangers, sinks, showers and toilets must allow the use of such equipment and facilities without difficulty or discomfort, taking into account each case the number of workers who will use them simultaneously. The premises, facilities and equipment mentioned in the preceding paragraph shall be readily accessible, appropriate to their use and construction features that facilitate cleaning. The changing rooms, toilets and premises are separate toilets for men and women, or to envisage separate use thereof. They will not be used for purposes other than those for which they are intended.

We have to consider Royal Decree 72/1992, of May 5, laying down technical standards for accessibility and removal of architectural, urban and transportation barriers are approved. *[3]*

2.2. PREVENTIVE MEASURES AND FIRST AID

– Medical Kit

There will be a kit containing the materials specified in the General Ordinance on Safety and Health at Work, the means to effect cures emergency in case of accident and he will be in charge of a qualified person designated by the company.

Each kit will have at least the following elements: hydrogen peroxide, 96 ° alcohol, tincture of iodine, mercurochrome, ammonia, sterile gauze, cotton wool, bandages, plaster, liniment, painkillers and heart tonic emergency tourniquet, rubber bags water or ice, sterile gloves, syringe, kettle, needles for injections and clinical thermometer.

– First Aid

The company is responsible for ensuring the provision of first aid to workers by the person in charge of health care. Then the company will have the necessary medical care for consecutive to sick or injured.

– Assistance to accident victims

It should inform the work of the positions of the various Medical Centers (own services, Patron Mutual, Mutual Labor, clinics, etc.) which should be moved to the injured for faster and more effective treatment. It is highly desirable in the work, and in a visible place, a list of telephone numbers and addresses allocated to emergency centers, ambulances, taxis, etc., to ensure rapid transport of injured possible to Service Centres.

– Medical examination

All staff begins working on site must pass a medical examination prior to employment which will be repeated in a period of one year.

According to paragraph 3 of Annex VI to the RD 486/97, the work will have the first-aid material, further including the identification and the distances to the centers closest healthcare.

2.3. ENVIRONMENTAL CONDITIONS

These factors contribute to improve working conditions, both health and comfort and this will optimize the performance of production.

– Thermal Environment

Improper thermal environment causes reductions both physical and mental performance irritability, increased aggression, distractions, errors, discomfort, etc. Includes both environmental factors (temperature, humidity, air velocity, ...) and individual (type of activity, clothing, metabolism ...) Being thus the thermal environment so important in the proper development of the activity factor labor, the factory should be able to provide workers with the right temperature, between 18- 22 ° C, using the appropriate HVAC equipment at its disposal.

– Visual Environment

The lighting in the workplace must allow employees have visibility conditions suitable for driving on them and pursue them their work without risk to their safety and health.

The lighting is a very important factor to consider one of the purposes is to avoid glare or lack of visibility in the work areas. We can develop two types of lighting in the factory, general or localized, and will try to avoid any kind of glare, recommending the use of diffuse light, it is the most comfortable. Light distribution will take place as uniformly as possible and should not be in the overall lighting uniformity less than 0.8 illumination. For work to develop the production company the light level recommended by the IES (Illuminating Engineering Society) is about 1000 lux, except for jobs that require a special type of lighting.

– Sound Environment

The sound pressure level should not exceed 85 dB for continued exposure of 8 hours. Short exposures must not exceed 135 dB, except for impact noise whose instantaneous level should never exceed 140 dB. If these conditions are not met, the operators should use sound systems protection and be subject to periodic reviews where the correct hearing of the operator is recorded. Inside the plant the noise level will be studied in every job, in particular, establishing the same measures to be followed in accordance with Royal Decree 1316/1989, of October 27, on the protection of workers against risks arising from exposure to noise at work.

– Atmospheric Environment

For proper ventilation of working areas a study for the installation of ventilation and air conditioning may be contaminated by chemicals that discards of transactions as well as the equipment used will be made.

– Chromatic Fitness

This section is for use when different colors based on color theory and try to allow operators besides being in an atmosphere of comfort, can instinctively recognize various points or areas in certain situations.

It is recommended not to use, except signaling, too quick and too strong or sedatives colors, preferring the use of matte colors, to avoid glare. Nor is it advisable to use very dark, gray, green or black for their ability to hide dirt and dust colors. For mobile elements of the company's use of yellow with black stripes diagonal parties may contact persons recommended, machinery and medium gray-green or green highlighting controls and work planes.

As for the signaling to use the rules set forth in Royal Decree 485/1997 of 14 April on minimum requirements will continue in the field of health and safety signs at work.

2.4. MACHINERY MANUFACTURING PRODUCT

Expected machinery used in the execution of the work shown in the table below:

MACHINERY PROVIDED
Mounting tables
Gas Spring Testers
Testers compressors

3. OCCUPATIONAL HAZARD COMPLETELY IRREMOVABLE

This section contains identifying workplace hazards that can not be completely avoided, and preventive measures and technical protections to be taken to control and reduce these risks.

	MANUFACTURING PROCESSES	
	RISKS	
	Falls operators	
	Falling objects on operators	
	Falling objects on third	
	Collision or striking objects	
	Work in wet conditions	
	Direct and indirect electrical contacts	
	Foreign bodies in the eye	
	Overstrain	
	PREVENTIVE MEASURES AND COLLECTIVE PROTECTIONS	**DEGREE OF ADOPTION**
	Order and cleanliness of the roads	permanent
	Order and cleanliness of workplaces	permanent
	Adequate and sufficient lighting (lighting work)	permanent
	Not remain in the range of machines	permanent
	Signage (signs and posters)	permanent
	Training courses and lectures	permanent
	Personal protective equipment (PPE)	**EMPLOYMENT**
	Safety helmets	permanent
	Protective footwear	permanent
	Workwear	permanent
	Safety goggles	Frequent

4. SPECIAL LABOUR RISKS

The following table lists those jobs that remain necessary for the development of the work defined in the Reference project relate, involve special risks for the safety and health of workers, and are therefore included in Annex II of RD 1627-1697. The specific measures to be taken to control and reduce the risks of this type of work are also indicated.

WORK WITH SPECIAL RISKS	SPECIFIC MEASURES
Falls of heavy elements	Use and control of the appropriate PPE

5. TRAINING AND INFORMATION FOR WORKERS

All staff should receive, upon entering the company, a statement of the working methods and the risks they might entail, together with the security measures to be employed. The employer shall ensure theoretical and practical training in prevention, specifically focused on the job assigned to each worker, according to the provisions of the Law on Prevention of Occupational Risks.

Each time a new operator joins the company as well as when an operator will change jobs, will be informed and trained on the working method to be followed and the safety measures to be taken.

6. WORKER'S OBLIGATIONS

The employees of the company will ensure the safety and health at work and those persons who may affect their professional activity, according to their training and the instructions of the employer. *[4]*

Accordance with their training and following the instructions of the employer, the worker must:

- Use properly the machines, equipment, tools, transport equipment and other means with which it does business.
- Using the media correctly and protective equipment provided by the employer.
- Do not put out of operation and proper use of existing safety devices or installed. Immediately inform their immediate supervisor and designated workers, about any situation which they believe presents risk.
- Contribute to the fulfillment of the obligations established by the competent authority.
- Cooperate with the employer so that it can ensure safe working conditions and without risk.

7. RIGHTS OF WORKERS

Contractors and subcontractors must ensure that workers receive adequate and understandable information of all measures to be taken in regard to their safety and health at work.

A copy of the Health and Safety Plan and any amendments thereto, for the purposes of his knowledge and monitoring will be provided by the contractor to the representatives of workers in the workplace. *[4]*

They must also require the assessment of the risks of their jobs and paralyze the activity in case of imminent risk and be informed on the practice of emergency plans for severe risks.

8. INDIVIDUAL PROTECTION

8.1. CONCEPT OF INDIVIDUAL PROTECTION

Personal protective means technique that aims to protect workers against external aggression, whether physical, chemical or biological, that can be represented in the performance of labor activity. By Royal Decree 1407/1992, of November 20, the conditions for the marketing of personal protective equipment is regulated, also called PPE. *[5]*

8.2. CONDITIONS TO BE MET AND FEATURES TO DEMAND

PPE to be considered as such must meet minimum requirements both from a legal point of view as technical standards that affect you, so you must have the appropriate certification ensures compliance with these requirements.

It is generally possible to identify a number of features that must be enforceable both the materials used in its manufacture, and its design and construction.

Terms of the materials used to manufacture the product:

- The physical and chemical properties of the materials used in its construction must conform to the nature of work and the risk of injury is to be avoided in order to provide effective protection.
- The materials used must not cause harmful effects on the user.

Conditions relating to design and construction:

- Its shape will be the one that best suits the greatest number of people considering ergonomic and user health aspects. They are taken into account aesthetic values and reduce the maximum discomfort.
- In terms of design and construction will be easy to use and must be able to perform the work without significant loss of performance and should allow easy maintenance and upkeep.

All PPE used in the company bear the appropriate CE conformity marking, and will be removed and replaced with new ones provided they have reached the end of its useful life or are not in good conditions. Besides the specific PPE for each job, all workers will be provided with appropriate working monkeys.

9. FIRE PROTECTION

To prevent this risk, the company will include among its facilities with an adequate number of portable equipment (fire extinguishers) and fixtures, the latter being understood as those formed by a network of pipelines, storage tanks extinguishing agent terminal equipment and items.

All this equipment must be properly marked, accompanied turn of the signalling necessary to explain how to properly carry out the plans. *[6]*

The optimum maintenance of these equipments is regulated by Royal Decree 1942/1993, and will always be carried out by personnel with knowledge on the subject.

As a general preventive measures to be taken against this type of risk provided that the working day ends the current is cut from the overall picture and ban smoking in areas of special fire risk.

10. LOGBOOK

In every workplace there will be, for the purposes of controlling and monitoring the Plan of Safety and Health, a Book of Trouble consisting of sheets in duplicate and will be facilitated by the professional body of which it is the coach who has approved the Safety Plan and Health.

Have access to the book, the Project Manager, contractors and subcontractors, self-employed, people with responsibilities in the prevention of the companies involved, representatives of workers and technicians with the competent public authorities in this matter, who can make notes in it. They may only make entries in the logbook related to compliance with the Plan.

Made an entry in the logbook, the coordinator must return to within twenty-four hours a copy to the Inspectorate of Labour and Social Security of the province in which the work is performed. He also notified the annotations to the contractor and representatives of the workers.

11. WORK STOPPAGE

When the Coordinator and during the execution of the works, we observe non-compliance with health and safety measures, he advises the contractor and such failure shall record in the Book of Trouble, being authorized to, in circumstances of serious and imminent risk to safety and health of workers, have the suspension of a number of positions, if any, of the whole work.

He will report this fact to be relevant, to the Inspectorate of Labour and Social Security of the province in which the work is performed.

Also notify the Contractor, and if the subcontractors and / or independent of the stoppage affected and worker representatives.

12. PRODUCT SAFETY AND WARRANTY

In this section we mention the security own point of health care and warranty.

First, the inflatable portion corresponding to the preoperative room have a repair kit, which will include parts to repair damage and glue to fix it. This kit will also include instructions for use.

The preoperative room included the inflatable tenth, the blower, the kit repair bag and the ground sheet.

Our inflatable games can be used over two years. If you are injured, you can use glue and material to repair it.

The whole design will feature the CE mark and also cumpliará with all New Approach Directives that concern him.

13. CONCLUSION

For all the above, it is considered explained the Safety and Health, requesting its corresponding approval unless it is amended or improving it if required by the Coordinating Agency responsible for the safety and health of the project.

14. REFERENCES

[1] BOE, Law 31/1995, dated June 5, prevention of occupational risks. Retrieved July 15, 2015 in, https://www.boe.es/buscar/act.php?id=BOE-A-1995-24292

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Saarbrücken, 20th July, 2015

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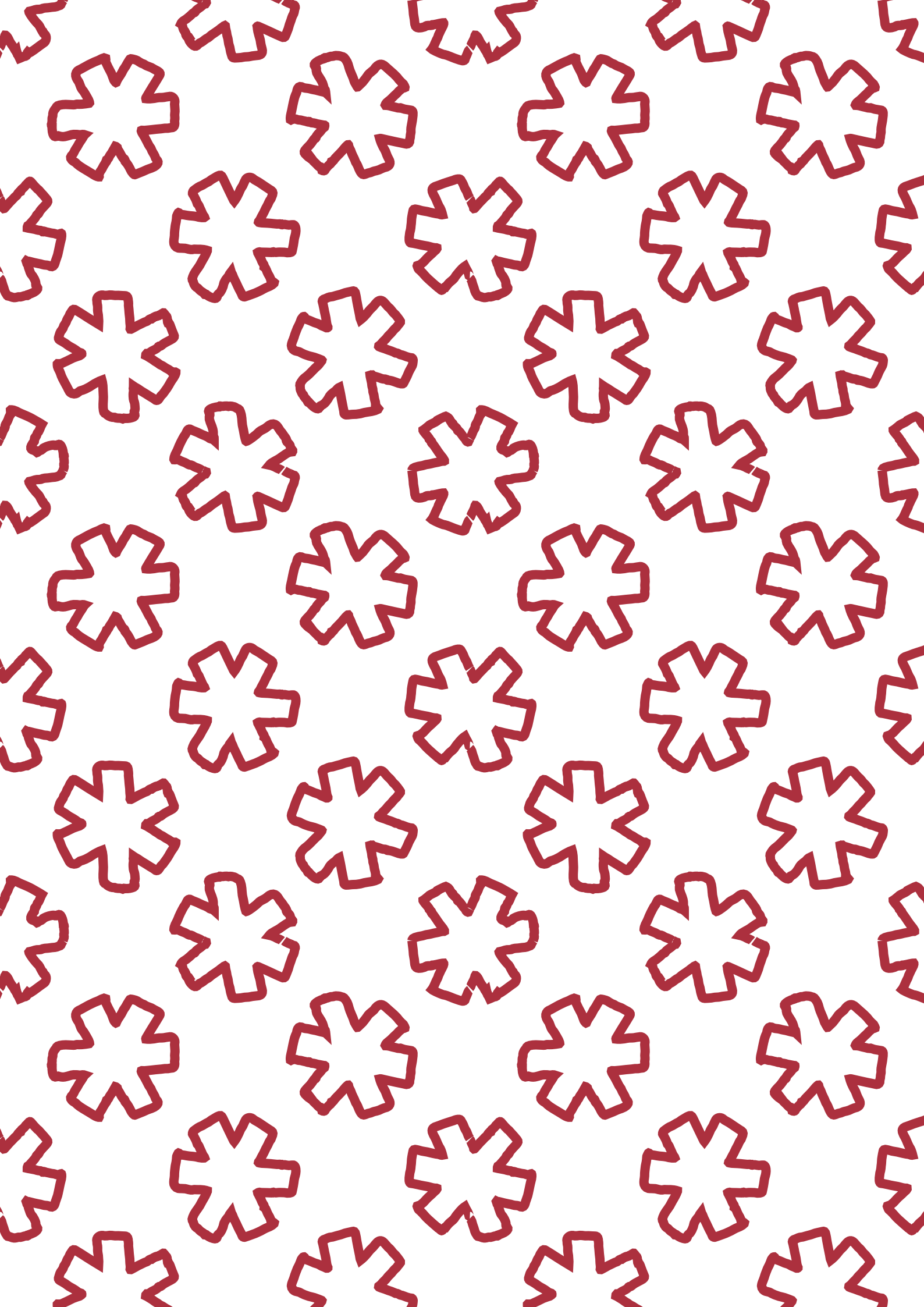

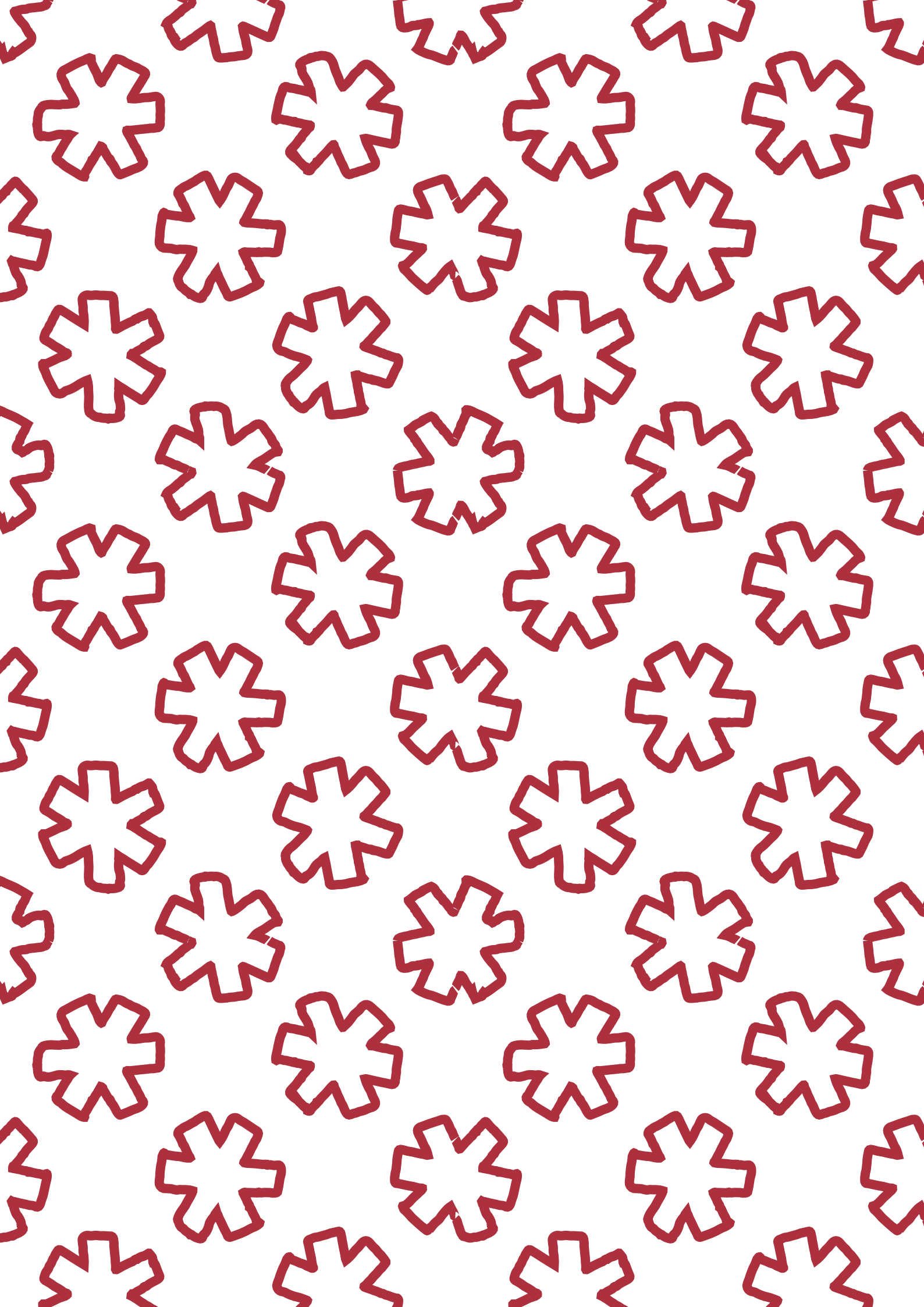

BUDGET

INDEX

In this document all the necessary calculations are included to find the project budget made
to our right we find a small index to guide us in this Schedule Base.
We can not forget that in this case the supply of each and every one of the pieces, both commercial and
machined parts are received through contracts with various companies that we see in this
document.
So in this budget we will not have high expenses related to direct labor, manufacturing cost,
indirect labor, etc. work, because this is inherent in the price that we offer each company.
In addition there will be an own benefit as such, because this project is not profitable, because the idea is born
join a solidarity organization to promote this non-profit project.

TOTAL BUDGET

1. MANUFACTURING COST	PARTS AND MATERIALS	44.274,07 €
	BY DIRECT LABOR	38,00 €
2. DIRECT HANDS OF WORK_M.O.I.	M.O.I.= (20,5%) x M.O.D. /100	7,79 €
3. SOCIAL CHARGES_C.S.	CS= (18%) x (M.O.D. + M.O.I.) /100	7.976,17 €
4. GENERAL EXPENSES, G.G.	GG = (27%) x M.O.D. /100	10,26 €
5. TOTAL COST OF FACTORY, Ct	Ct= Cf + M.O.I. + CS + GG	52.306,29 €
6. BENEFITS, B	0	0
7. FACTORY SALE PRICE		**52.306,29 €**

%M.O.I.	0,255

We have said that the benefits will be 0 because it is a charity project that would take a charity organization

MACHINED PARTS AND TRADE	835,00 €
MEDICAL EQUIPMENT	43.434,25 €
% MACHINED PARTS	38,00 €
PACKAGING	4,82 €

MACHINED PARTS AND TRADE

AMOUNT	REFERENCE		UNIT PRICE	TOTAL
1	FOLDING BODY PRESURGICAL		375,00 €	375,00 €
1	TENT		270,00 €	270,00 €
1	INNER DRAWER		150,00 €	150,00 €
2	RATCHED TIE DOWN STRAPS		20,00 €	40,00 €
			TOTAL:	**835,00 €**

MEDICAL EQUIPMENT

AMOUNT	REFERENCE	COMPANY	UNIT PRICE	TOTAL
1	STRETCHER		3.225,00 €	3.225,00 €
1	OPERATION TABLE		4.000,00 €	4.000,00 €
1	INSTRUMENTAL TABLE		380,00 €	380,00 €
1	INSTRUMENTAL TABLE KIND 2		350,00 €	350,00 €
1	LIGHT		1.700,00 €	1.700,00 €
1	ANESTHESIA TROLLEY		1.800,00 €	1.800,00 €
1	RESPIRATORY EMERGENCY CAR		2.700,00 €	2.700,00 €
1	VITAL SIGNS MONITORS		2.000,00 €	2.000,00 €
1	ELECTRODOS PARA EL CUERPO		150,00 €	150,00 €
1	PULSIOXÍMETRO		800,00 €	800,00 €
1	MANGUITO DE PRESIÓN ARTERIAL		35,00 €	35,00 €
1	MONITOR DE PRESIÓN ARTERIAL		180,00 €	180,00 €
5	SOUNDER INTRAVENOSA		25,75 €	128,75 €
5	SERUM SUPPORT		60,00 €	300,00 €
1	TRASH		100,00 €	100,00 €
1	LAUNDRY BASKETS		116,00 €	116,00 €
1	RACK		120,00 €	120,00 €
1	TRASH WITH WHEELS		30,00 €	30,00 €
1	PRESURGICAL ROOM*			0,00 €
1	ELECTROCAUTERY		560,00 €	560,00 €
1	SURGERY VACCUM		950,00 €	950,00 €

2	VACCUM CONTAINERS			0,00 €
	ARM WITH POWER SUPPLY			0,00 €
	AIR HEATER / HEAT BLANKET			0,00 €
3	PLUGS			0,00 €
1	PORTABLE HANDWASHER		600,00 €	600,00 €
1	TAPS		20,00 €	20,00 €
1	TEMPERATURE AND HUMIDITY METER		25,00 €	25,00 €
1	PLASTERS CAR		150,00 €	150,00 €
1	NEGATOSCPOE		250,00 €	250,00 €
2	STOOL		40,00 €	80,00 €
2	POWER SUPPLY 1			0,00 €
2	POWER SUPPLY 2			0,00 €
2	POWER SUPPLY 3			0,00 €
1	LIGASURE		300,00 €	300,00 €
1	THERMAILDESINFECTOR		6.500,00 €	6.500,00 €
5	RELIEF BACKPACKS		175,50 €	877,50 €
1	MEDICATION		15.000,00 €	15.000,00 €
2	REPAIR TENT KIT		3,50 €	7,00 €
			TOTAL:	**43.434,25 €**

ASSEMBLY

AMOUNT	OPERATION	% PRICE OF PIECES	TOTAL
1	SWING SYSTEM	15,00 €	15,00 €
1	COMPRESSOR	13,00 €	13,00 €
1	FITTING ROOM AND FULL CONTAINER	10,00 €	10,00 €
		TOTAL:	**38,00 €**

PACKAGING

AMOUNT	REFERENCE	MATERIAL	UNIT PRICE	TOTAL
1	box	PP	3,17 €	3,17 €
1	inner box	PP	1,65 €	1,65 €
			TOTAL:	**4,82 €**

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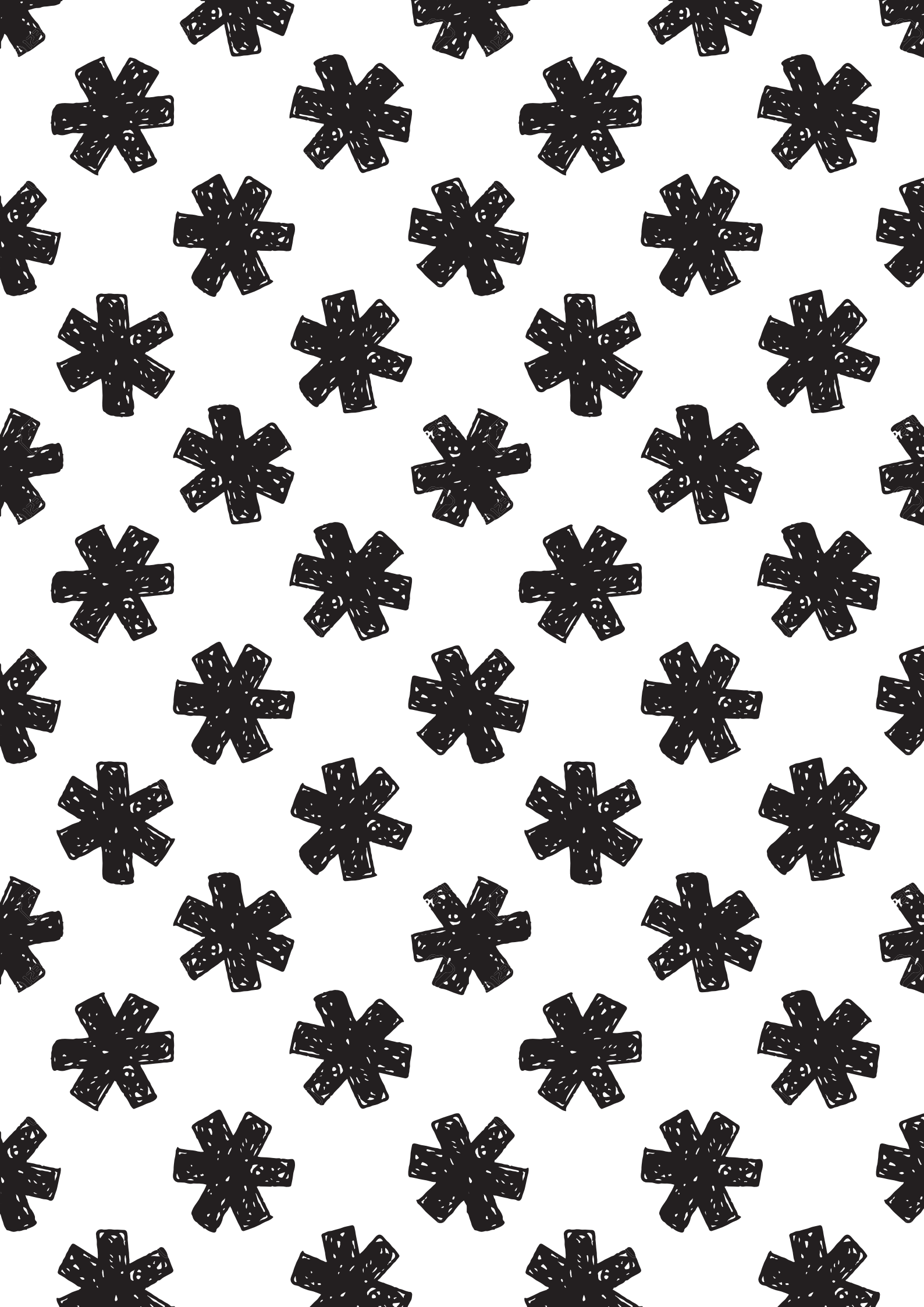

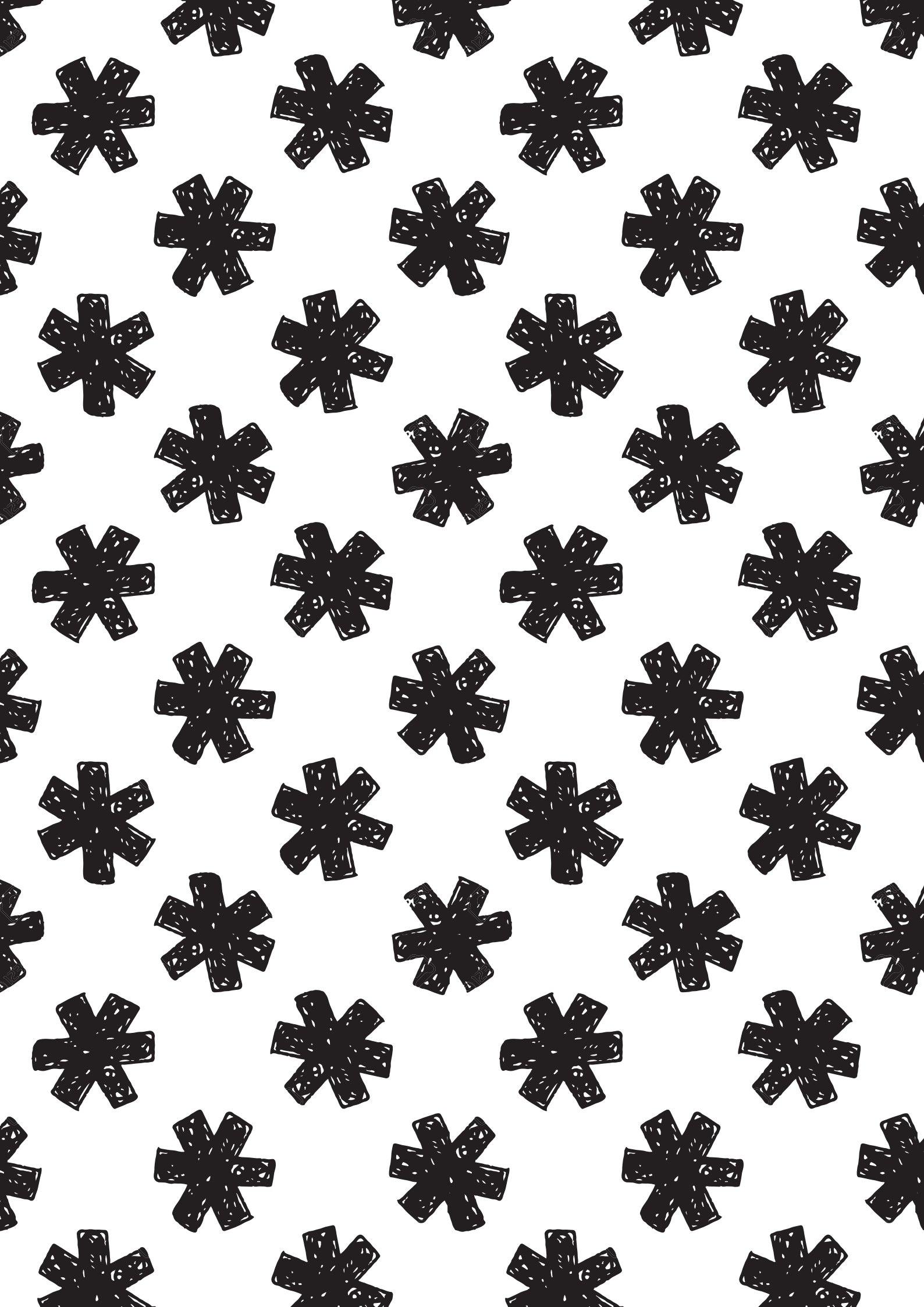

ANNEXES

1. RAMP

We have done this FEM (Finite Element Method) analysis, taking the ramp, one of the most critical areas of this design. First we take the side that is attached to the preoperative room is a recessed area. We have taken as steel material analysis. And we have put a load of 2500 N, the value for the weight of a person with a very high margin and the own weight of the stretcher and the surgical material that this person might be connected to.

Once we made the analysis that displacement will be minimal, and that higher, no plasticizing or buckling, so we design as valid.

MESH:

Entity	Size
Nodes	1068
Elements	2761

ELEMENT TYPE:

Connectivity	Statistics
TE4	2761 (100,00%)

ELEMENT QUALITY:

Criterion	Good	Poor	Bad	Worst	Average
Stretch	2298 (83,23%)	463 (16,77%)	0 (0,00%)	0,149	0,403
Aspect Ratio	585 (21,19%)	1903 (68,92%)	273 (9,89%)	11,154	3,536

Materials:

Material	Steel
Young's modulus	2e+011N_m2
Poisson's ratio	0,266
Density	7860kg_m3
Coefficient of thermal expansion	1,17e-005_Kdeg
Yield strength	2,5e+008N_m2

2. STATIC CASE

Boundary Conditions

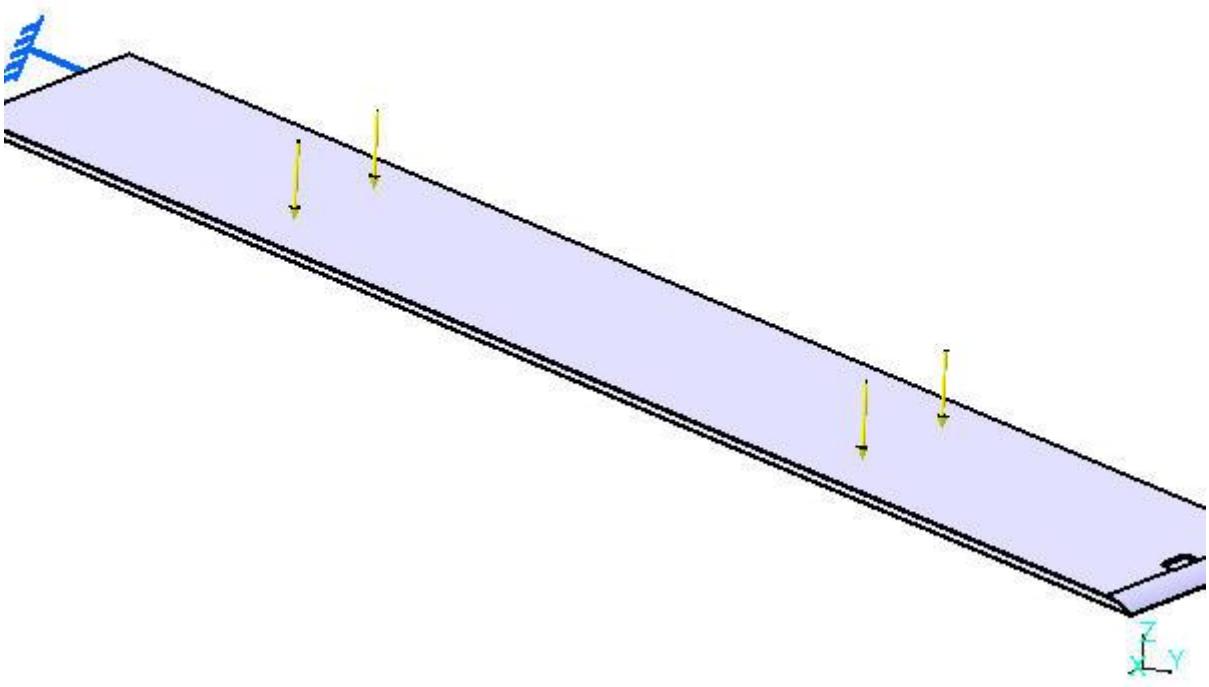

Figure 1

STRUCTURE Computation

Number of nodes	:	1068
Number of elements	:	2761
Number of D.O.F.	:	3204
Number of Contact relations	:	0
Number of Kinematic relations	:	0

Linear tetrahedron	:	2761

RESTRAINT Computation

Name: Restraints.1

Number of S.P.C : 90

LOAD Computation

Name: Loads.1

Applied load resultant:

x				7 35e-009	N
y		3		5 25e-007	N
z		2		5 00e+003	N
x		4		9 77e+003	Nxm
y		6		2 03e-006	Nxm
z				7 17e-008	Nxm

STIFFNESS Computation

Number of lines		204			
Number of coefficients		0283			
Number of blocks					
Maximum number of coefficients per bloc		0283			
Total matrix size				9	Mb

CONSTRAINT Computation

Restraint: Restraints.1

Number of constraints		0	
Number of coefficients			
Number of factorized constraints		0	
Number of coefficients			
Number of deferred constraints			

FACTORIZED Computation

Method	:	SPARSE		
Number of factorized degrees	:	3114		
Number of supernodes	:	460		
Number of overhead indices	:	15135		
Number of coefficients	:	140985		
Maximum front width	:	111		
Maximum front size	:	6216		
Size of the factorized matrix (Mb)	:	1	.	07563
Number of blocks	:	1		
Number of Mflops for factorization	:	8	.	642e+000
Number of Mflops for solve	:	5	.	795e-001
Minimum relative pivot	:	1	.	458e-005

Minimum and maximum pivot

Value	Dof	Node	x (mm)	y (mm)	z (mm)
5.6012e+005	Tz	1068	3.8284e+002	2.5526e+003	5.2613e+001
2.5625e+011	Tz	183	3.9600e+002	1.3965e+003	3.5038e+002

Minimum pivot

Value	Dof	Node	x (mm)	y (mm)	z (mm)
2.7552e+007	Tx	1068	3.8284e+002	2.5526e+003	5.2613e+001
2.3275e+008	Ty	1045	1.6459e+002	9.3495e+002	4.6752e+002
4.2497e+008	Tz	372	2.2708e+002	2.6622e+003	3.6884e+001
4.7102e+008	Tz	567	8.6408e+001	2.3850e+003	8.5390e+001
4.8929e+008	Tz	1063	-3.7991e+002	1.8740e+003	2.2284e+002
4.9164e+008	Tz	448	-3.3483e+002	1.2320e+003	3.7286e+002
5.0754e+008	Tz	1066	7.0131e+001	2.1625e+003	1.4087e+002
6.7006e+008	Ty	1043	8.9677e+001	2.5481e+003	6.5347e+001
7.7334e+008	Ty	1068	3.8284e+002	2.5526e+003	5.2613e+001

Translational pivot distribution

Value	Percentage
10.E5 –> 10.E6	3.2113e-002
10.E6 –> 10.E7	0.0000e+000
10.E7 –> 10.E8	3.2113e-002
10.E8 –> 10.E9	4.1747e-001
10.E9 –> 10.E10	4.7110e+001
10.E10 –> 10.E11	5.0963e+001
10.E11 –> 10.E12	1.4451e+000

DIRECT METHOD Computation

Name: Static Case Solution.1

Restraint: Restraints.1

Load: Loads.1

Strain Energy : 2.853e+000 J

Equilibrium

Components	Applied Forces	Reactions	Residual	Relative Magnitude Error
Fx (N)	1.7353e-009	3.0458e-008	3.2193e-008	1.2012e-012
Fy (N)	-3.5251e-007	4.7998e-007	1.2747e-007	4.7562e-012
Fz (N)	-2.5000e+003	2.5000e+003	-6.7105e-007	2.5037e-011
Mx (Nxm)	-4.9765e+003	4.9765e+003	-1.7917e-006	2.4559e-011
My (Nxm)	-6.2028e-006	6.1236e-006	-7.9201e-008	1.0856e-012
Mz (Nxm)	7.7168e-008	-1.3269e-007	-5.5519e-008	7.6101e-013

Static Case Solution.1 - Deformed mesh.1

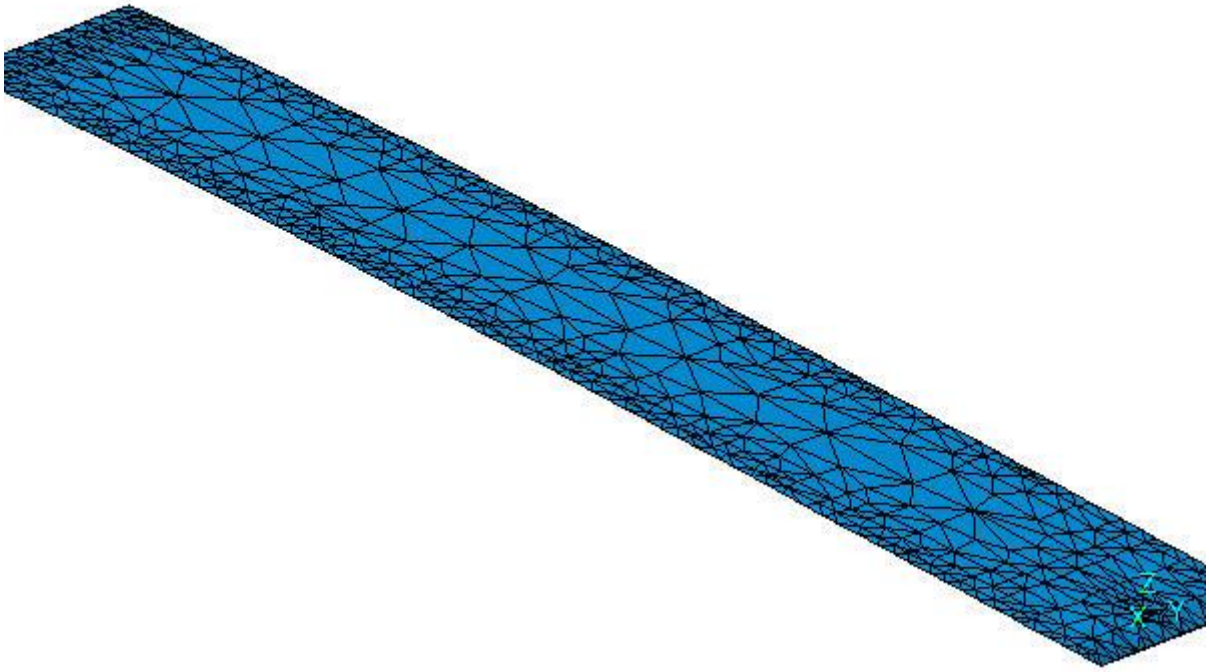

Figure 2

On deformed mesh ---- On boundary ---- Over all the model

Static Case Solution.1 - Von Mises stress (nodal values).1

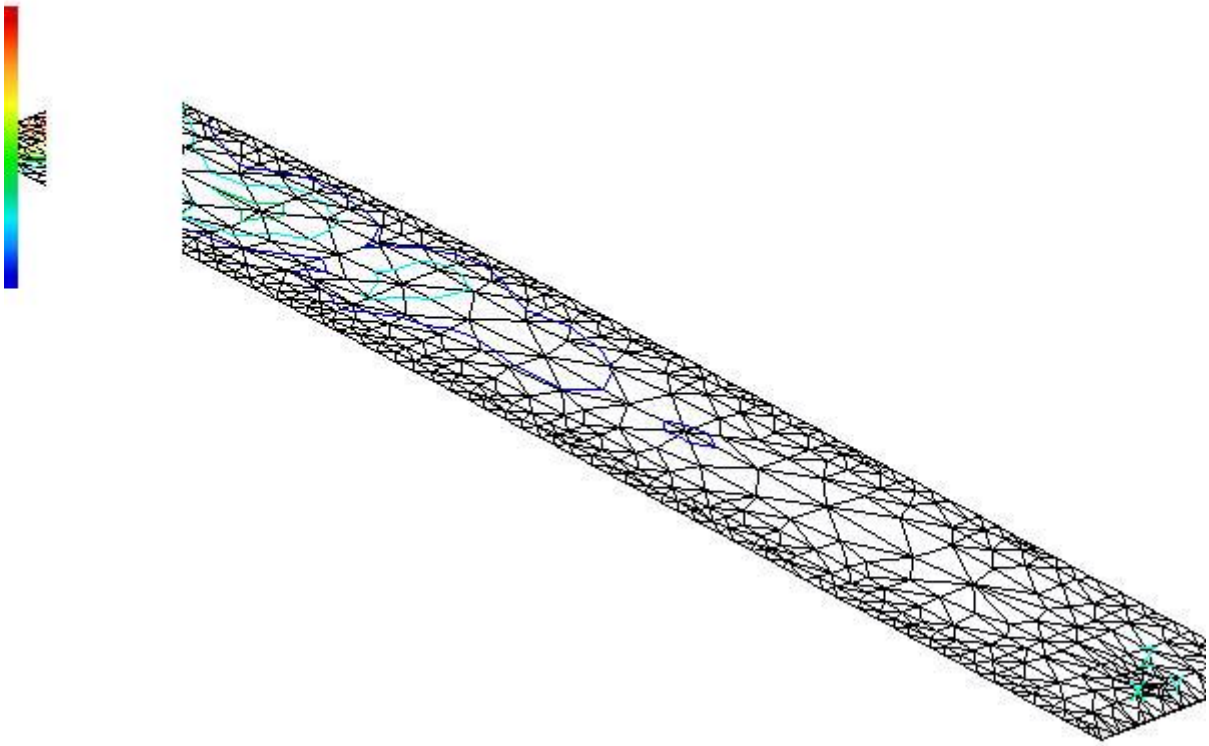

Figure 3

3D elements: Components: All

On deformed mesh ---- On boundary ---- Over all the model

Global Sensors

Sensor Name	Sensor Value
Energy	2,853J
Global Error Rate (%)	65,279884338

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