



**Universidad de Valladolid**



**ESCUELA DE INGENIERÍAS  
INDUSTRIALES**

**UNIVERSIDAD DE VALLADOLID**

**ESCUELA DE INGENIERIAS INDUSTRIALES**

**Grado en Ingeniería en Diseño Industrial y  
Desarrollo del Producto**

**WAM, Full design of a gym power rack**

**Autor:**

Miguel Herreros Diezhandino

**Responsable de Intercambio en la UVa**

Angel Manuel Gento Municio

**Universidad de destino**

Hochschule Albstadt-Sigmaringen

Valladolid, Agosto, 2022

TFG REALIZADO EN PROGRAMA DE INTERCAMBIO

---

TÍTULO: WAM, Full design of a gym power rack

ALUMNO: Miguel Herreros Diezhandino

FECHA: 1/07/2022

CENTRO: Hochschule Albstadt-Sigmaringen

UNIVERSIDAD: Hochschule Albstadt-Sigmaringen

TUTOR: Sven Gherards



**WAM**  
**TRAINING RACK**

# INDEX

<b>1. INTRODUCTION</b>	<b>1</b>
<b>1.1. GYM TRAINING RACK</b>	<b>1</b>
<b>1.2. MARKET STUDY</b>	<b>1</b>
<b>1.2.1. TARGET MARKET STUDY</b>	<b>2</b>
<b>1.3. PATENT STUDY</b>	<b>4</b>
<b>2. PROJECT DESCRIPTION</b>	<b>6</b>
<b>2.1. GENERAL DESCRIPTION</b>	<b>6</b>
<b>2.2. CORPORATE IMAGE</b>	<b>6</b>
<b>2.3. GEOMETRY DESCRIPTION</b>	<b>8</b>
<b>2.3.1. ERGONOMICS</b>	<b>8</b>
<b>3. PROJECT DETAILS</b>	<b>9</b>
<b>3.1. COMPONENTS</b>	<b>9</b>
<b>3.2. PLANES</b>	<b>11</b>
<b>3.2.1. SET</b>	<b>11</b>
<b>3.2.2. AUXILIAR ELEMENTS</b>	<b>20</b>
<b>3.3. MATERIALS</b>	<b>23</b>
<b>3.4. UNIONS</b>	<b>24</b>
<b>3.4.1. MOUNTING</b>	<b>24</b>
<b>3.5. STRUCTURAL RESISTANCE STUDIES</b>	<b>25</b>
<b>3.6. ECODESIGN AND ENVIRONMENTAL IMPACT</b>	<b>27</b>
<b>4. USP</b>	<b>29</b>
<b>5. STRATEGIC MARKETING PLAN</b>	<b>32</b>
<b>6. CONCLUSION</b>	<b>35</b>



# 1. INTRODUCTION

## 1.1. GYM TRAINING RACK

A gym is a club, building, or large room, usually containing special equipment, where people go to do physical exercise and get fit.

A power rack is a piece of weight training equipment that functions as a mechanical spotter for free weight barbell exercises without the movement restrictions imposed by equipment such as the Smith machine. Its general design is four upright posts with two adjustable horizontal bar catches on each side. Many power racks also have accessory attachments, such as a chin-up bar or pegs for storing weight plates.

The power rack serves several purposes. Best among them is safety: for example, in the bench press, placing the bar catches right above the lifter's chest will prevent the barbell from crushing the athlete in the case of muscular fatigue or other loss of control of the bar. In the case of squats, catches placed just below the lowest position of the squat allow the lifter to throw the weight safely. Safety during the exercise will also mean greater confidence for the athlete and therefore better performance.

The power rack is also useful for performing limited-range exercises, often involving heavier weights than their full-range equivalents. These include rack pulls, a variation of the deadlift where the starting point of the bar is higher than a conventional deadlift, and rack lockouts, a bench press variation limited to just the upper portion of the lift.

The most common power rack training exercise is the squat. However, there are many other movements you can do inside or outside this versatile cube of steel, including bench press, close grip bench press, overhead press, rack lockout, rack pull, barbell shrug, inverted row, barbell bent over rows, barbell curl, upright row, pull ups, dips, hanging knee raises, hanging leg raises, etc... For each exercise the barbell needs to be placed at a different height. This ensures maximum safety and minimal energy wasted to get the bar into the right position.

## 1.2. MARKET STUDY

There are plenty of different power racks in the market. Some of the most accessible and popular ones will be studied to analyze their strengths and weaknesses. Data considered relevant will be collected, such as the total dimensions and weight of the product, in addition to its price and main characteristics.

- Fitness Reality 810XLT Super MAX Power Cage. (Figure F.1.) 362 kg of max load weight, 19 different positions for the supports. It has a pull-up bar, no additional bars to perform dips and storage area for discs. Overall dimensions: 118 x 212 x 128 cm. Total weight: 67 kg. 370 €



Figure F.1.

- Capital Sports Tremendour. (Figure F.2.) 300 kg of max load weight, 20 different positions for the supports, pull-up bars as well as dips bars. No storage area for discs. Overall dimensions: 118 x 214 x 165 cm. Total weight: 90 kg. 480 €



Figure F.2.



- Powerline Power Rack. (Figure F.3.) 317 kg of max load weight, 18 different positions for the supports. It has a pull-up bar which allows a single grip, no additional bars to perform dips and storage area for discs. Overall dimensions: 112 x 209 x 117 cm. Total weight: 62 kg.  
550 €



Figure F.3.

- Capital Sports Amazor. (Figure F.4.) 500 kg of max load weight, 15 different positions for the supports. It has a pull-up bar and 10 lateral bars where it is possible to store discs. No additional bars to perform dips. Overall dimensions: 90 x 225 x 172 cm. Total weight: 145 kg.  
540 €



Figure F.4.

- Klarfit Rackotar. (Figure F.5.) 200 kg of max load weight, 20 different positions for the supports. It has a pull-up bar which allows a single grip and two lateral bars where it is possible to store discs. Overall dimensions: 106 x 220 x 119 cm. Total weight: 45 kg.  
140 €



Figure F.5.

-Atletica R4 PowerRack. (Figure F.6.) 700 kg of max load weight, 26 different positions for the supports. It has a pull-up bar which allows a single grip. No lateral bars either additional bars to perform dips. Overall dimensions: 108 x 211 x 118 cm. Total weight: 87 kg.  
400 €



Figure F.6.

-Rogue RML -390F. (Figure F.7.) 700 kg of max load weight, 30 different positions for the supports. It has a pull-up bar which allows a single grip. No lateral bars either additional bars to perform dips. Overall dimensions: 121 x 233 x 124 cm. Total weight: 133 kg.  
1200 €



Figure F.7.

-Technogym Olympic Power Rack. (Figure F.8.) 700 kg of max load weight, 23 different positions for the supports. It has a pull-up bar and additional pegs for storing plates. No lateral bars to perform dips. Overall dimensions: 130 x 246 x 168 cm. Total weight: 380 kg.  
6750 €



Figure F.8.

Analyzing the products shown above, clear conclusions can be drawn about what characteristics are the most relevant, what are the most common dimensions and what price is what the consumer considers normal for this type of product.

The main objective is to end up achieving a versatile power rack capable of supporting acceptable weights, aesthetically attractive and with the possibility of competing economically with existing products on the market.

It is necessary to carry out a study of what the target market is for this type of product. This must be taken into account both for its design and for the marketing strategy that will be carried out.

## 1.2.1. TARGET MARKET STUDY

First, I resorted to a study carried out by the Research Department of the Higher Institute of Physical Education in Catamarca, Argentina, in order to obtain an initial idea of what the profile of people who go to a gym is. Only people who performed physical activities in the weight room of gyms were surveyed in the mentioned study.

Figure F.9. shows the results obtained with the general characteristics of the subjects that make up the sample.

A relevant piece of information that can be extracted from this study is the average age of the sample, which was 24.3 years, and does not differ significantly between one gender and the other. This must be taken into account when studying the ergonomics and economic capacity of the target market.

Total (n)	252
Males (n)	177 (70.2 %)
Females (n)	69 (27.4 %)
Average age	24.3 (+/- 8.0)
Average age males	24.6 (+/- 7.7)
Average age females	23 (+/- 6.9)

Figure F.9.

Another study collected in the book "Fitness in bodybuilding rooms" by Juan Carlos Colado Sánchez indicatively shows what the average client who goes to Spanish fitness rooms is like. The sample for this study comprised of a total of 272 people chosen by stratified random sampling, the confidence level obtained is 95.5% with an estimation error of 7%. Results are shown on the figure F.10.

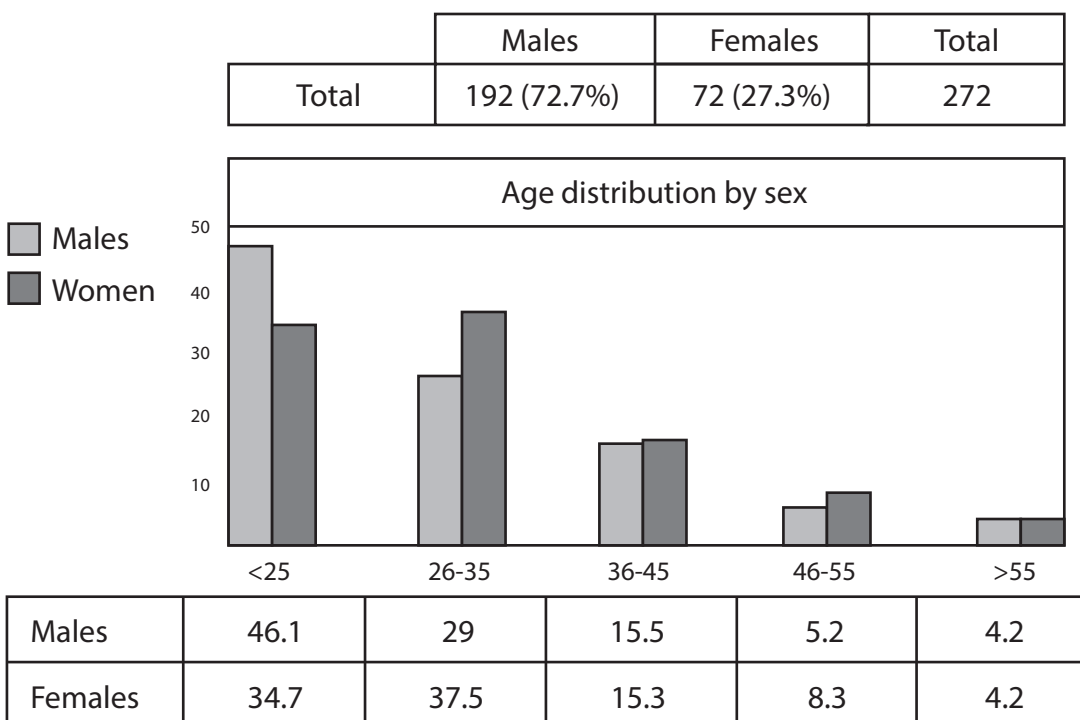


Figure F.10.

It can be seen that the main bulk of assistance is located in people under 35 years of age. Males 75.1%, females 75,2%. Once again, these data show that the young population is more likely to do bodybuilding exercises, and therefore they are the people who will use the machines designed for it the most.

Let's find out more about this type of audience, what motivates and moves them.

They were born at the end of the 20th century and entered the 21st century in their teens. They cover a range of 10 years before and 10 years after the year 2000. They have lived through the first computers and cell phones and have adapted to them at the vertiginous pace at which they have adapted to the market. They aspire to a happy life and the measure of their interests and judge what they consider unfair. They value their opinion and express it freely through social networks, which serve as a loudspeaker for their complaints and their tastes.

They were almost born with a computer in their hands, have grown up with it and know the latest brands, designs and features. They live through social networks and share, communicate and value everything that happens on the net. They are trained and competition in the market has made them specialize, but they also know how to adapt to what is asked of them, have a good level of English and know at least one other language. They use the Internet as a basic source of information and training, nutrition and expression. They are often self-taught and enterprising, and use the Internet to explore their possibilities.

They are in constant communication with the rest of the world. They have accounts on several social networks and use them as their main source of information. They combine digital and physical interaction, although sometimes the former overlaps with the latter. They believe in "do it yourself", in entrepreneurship and in their capabilities and are willing to give up more classic life models to live different experiences.

They seek to make their lives more practical and comfortable, they study the conditions and characteristics of the products they wish to acquire to ensure that they will be a good investment. The eternal search for new emotions and experiences means that they often end up getting bored with the things they already have. They are committed to change as a driving force. They are in continuous evolution and seek to be different from everyone else.

Therefore, it is necessary to obtain a universal brand that is easy to remember and use, that makes a difference in the market, that makes its users feel different from others. With modern features both objectively and subjectively. With a strong presence in the network, using social networks as the main means of dissemination and promotion.

### 1.3. PATENT STUDY

It is always important to carry out a prior art study to know which patents already exist in the proposed sector. Before investing heavily or continuing with the project, it is important to know if the idea is unique, so that its value in the market will be higher.

- US7635322B2. Marco Parrilla. (Figure F.11.). The invention relates to a barbell support which extends adjacent the user's shoulders for supporting the barbell. Specifically, the invention relates to an adjustable suspended squat rack for supporting barbells. "Each support member includes an elongated post with a first end positioned adjacent a floor surface and a second end having an adjustable clamp assembly for engaging the support beam. The clamp assembly suspends the post from the beam and is selectively engaged between a first clamping position and a second movable position."

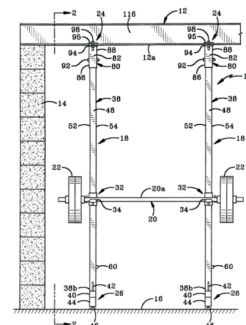


Figure F.11.



- US9333387B2. Erik S. Hopperstand, Brian B. Brasch. (Figure F.12.). The invention relates to an physical exercise device which includes an upper bracket and a lower bracket attachable to a wall, a pair of support members, and a plurality of pivotally arms extending from the brackets and connecting to the support members. One or more actuators are also connected between the brackets and the arms to assist in lifting the structure into a compact retracted position for storage.

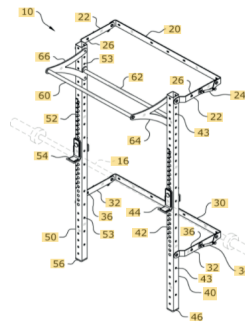


Figure F.12.

- US5433687A. August O. Hinzman, Larry G. Beck, Christopher K. Hinzman. (Figure F.13.). The figure shows a free-weight exercise apparatus that includes a left standard and a right standard that are removably joined in spaced-apart relationship by a cross connector. The left and right standards are triangular in shape, having a back leg and a front leg, and intermediate braces. The generally triangular configuration provides structural stability to the standards, which allows reduction in the weight of the structural members while still achieving stability in the apparatus.

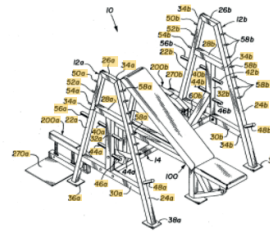


Figure F.13.

- US8834329B2. Sean Kelly. (Figure F.14.). The present invention is a bench press with novel safety features to protect a user's entire body in case the weight lifting barbell is accidentally dropped. The present invention also provide a structure that allows the user to vertically lift the barbell off its racks, eliminating possibility of shoulder injury during the initial lifting.

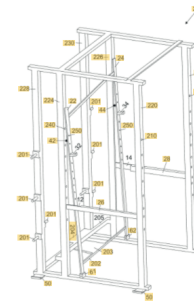


Figure F.14.

- US4729561A. Charles J. Desjardins. (Figure F.15.). The invention is a station which is adaptable for use in weightlifting. The station has a compact form, is relatively easily assembled and disassembled and is adaptable for a wide variety of weightlifting activities. The station comprises a first cage having a substantially rectilinear form with a base and four parallel vertically extending members defining a first open compartment. A second cage has a substantially rectilinear form with a base and four parallel vertically extending members which define a second open compartment. A pair of vertical members of the first cage are connecting with a pair of upright members of the second cage.

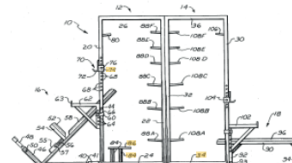


Figure F.15.

There are no obstacles in the sector for currently patented inventions. They present different solutions to a single situation, but in most cases they are too complex or too specific.

# 2. PROJECT DESCRIPTION

## 2.1. GENERAL DESCRIPTION

The final objective of the project is to obtain a versatile training power rack that can be used to perform as many different exercises as possible, capable of supporting acceptable amounts of weight. Easily assembled and disassembled and economical, so that it can be purchased by ordinary users and can be installed both in gyms and in private homes.

The aim is to achieve an aesthetic and different appearance, with the possibility of customization by the user. It is intended to use materials as light as possible, environmentally friendly and with high durability.

In addition to the training power rack itself, there will be designed all essential components that can be used together with the main structure, such as benches, bars, weight discs...

All these aspects will make up an USP, which will be developed and explained in detail in section 4 (4. USP).

A Strategic Marketing Plan will be developed in section 5 (5. Strategic Marketing Plan), which will include the company's strategic analysis, strategic business objectives, operations strategy, commercial strategy and financial strategy, mainly.

The whole project will be complemented with visual and audiovisual promotional material.

As for the brand, we are looking for a universal brand, which the user can identify as modern, simple and easy to remember and pronounce in different languages.

And that is how WAM was created.

## 2.2. CORPORATE IMAGE

		
Isotype	Logo	Imagotype

WAM is the word that will be used to define the graphic representation of the brand, a name that is easy to remember and easy to pronounce. A certain central and axial symmetry can be appreciated in the logo due to the typography used. This is Capital ClickBait, Regular.

The symbolic or iconic part of the graphic representation of the brand will be the isotype shown above. A simplified image using simple shapes that are easy to remember and at the same time unique. This will help the isotype to remind you of the brand at a glance.

Imagotype is just the fusion of logotype plus isotype. The textual part and the graphic part are very well differentiated and not merged into one. It is a set in balance and perfect harmony. Nothing is out of place and everything works visually in unison.

The color in the design of a logo has the objective of reflecting the benefits of the product as well as the personality of the brand and the whole experience it wants to generate in the consumers. The hexadecimal notation of the color used in the corporate image of the brand is #333333, a dark gray tone.

The meaning of this type of tones at a psychic level according to the book "Psychology of color, how colors act on feelings and reason", by Eva Heller, indicates that this kinds of tones evokes strength and resistance, such as steel. In addition, its meaning has to do with calm and composure. It is often used to indicate the elegance and solidity of a brand.

Every logo must have a negative version, that is a translation of the design to white color, for all those occasions in which the background where it is applied is dark or black. That negative representations of the mark are shown on the Figure F.16.



Figure F.16.

Subtraction can be defined as a set according to which an observer grasps the composition as an identifiable whole from which some parts have been extracted. . The process is shown in Figure F.17.

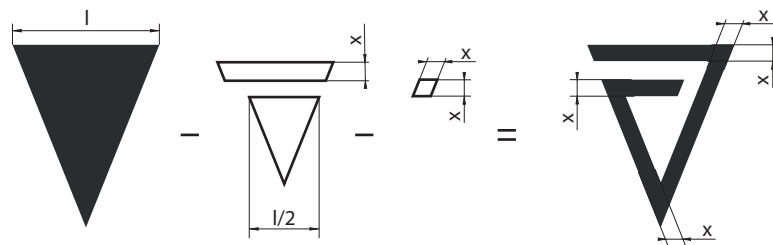


Figure F.17.

The logo can also be presented in different background colors. These models can be used for different punctual occasions. Blue, yellow and red pastel color versions, and military green. Figure F.18.



#99CCCC

#FFFF99

#FF9999

#78866B

Figure F.18.



## 2.3. GEOMETRY DESCRIPTION

The main structure will consist of two semi-solid pieces, which will serve as the base of the product; four vertical pillars that will make it possible to place the hooks at 21 different heights, and will also have additional bars where the discs can be stored when are not in use; and an upper part that, in addition to giving consistency and resistance to the structure, contains pull-up bars. These parts shall be joined together by simple geometric interlocking or by means of U-type elements. Each component will be analyzed in depth in section 3.1. (Project Details - Components).

It will be possible to work on the power rack in different directions, depending on the height at which the hooks or safety bars are needed. The dimensions of the structure have been designed to allow its location in private homes as well as in large enclosures. The overall dimensions of the main structure will be 1274 x 2200 x 1700 mm.

In addition, the product can be assembled without much complication by the user himself and adapts to them thanks to its ergonomic measurements.

The full description of the auxiliary elements to the main structure will be developed in section 3.1. (Project Details - Components).

### 2.3.1. ERGONOMICS

Ergonomics becomes a basic element for design by evaluating which design features impact the performance of the subject and reduce errors. It seeks to facilitate the performance and improve the use of objects.

Since research has already been done on who the end users of the product will be, a study conducted by the National Institute for Safety and Hygiene at Work (INSHT) on the anthropometric data of the Spanish working population will be used to obtain the data to be taken into account when designing the training power rack. The total sample of people between 16 and 35 years were 1723 people, of whom 1130 were men and 593 women.

The data required for the following project have been collected in the Figure F.19.

Designation	Average	Percentiles	
		P5	P95
Set (men and women)			
Body mass, weight (kg)	70.46	51.0	92.7
Height (mm)	1663.23	1525	1803
Shoulder height (mm)	1382.12	1256	1508
Hip width (mm)	343.30	306	385
Hand length (mm)	182.94	163	202
Hand width (mm)	85.29	72	97
Maximum horizontal reach (mm)	698.83	606	785
Biacromial shoulder width (mm)	369.58	304	432

Figure F.19.

In the book "Anthropometric dimensions of the Latin American population" by Rosalío Ávila Chaurand, the most relevant anthropometric measurements of the working population between 18 and 65 years of age are also collected. The total sample of the study was 600 people, of which 204 were women and 396 were men.

The data collected in this study will be used to obtain more reliable results. The most important information is shown in Figure F.20.

Designation	Average	Percentiles	
		P5	P95
Set (men and women)			
Body mass, weight (kg)	68.5	50.5	90.6
Height (mm)	1599.5	1519	1800
Shoulder height (mm)	1382.77	1255	1510
Hip width (mm)	340.56	301	370
Hand length (mm)	180.24	164	200
Hand width (mm)	85.60	73	97
Maximum horizontal reach (mm)	698.75	605	780
Biacromial shoulder width (mm)	365.67	301	429

Figure F.20.

The following data are of interest and will be used for the following reasons:

- Body mass, to determine the material of the structure and to know the minimum weight it must be able to support. Static resistance studies will be carried out including this type of data to check the behavior of the structure.
- Height, shoulder height, biacromial shoulder width and horizontal reach, to determine the height of the structure itself and the minimum dimensions it must have to fit the user.
- Length and width of the hand, to determine the diameter that the bars should have.
- Hip width, to know the minimum width that the support benches that complement the main structure must have.

# 3. PROJECT DETAILS

## 3.1. COMPONENTS

- 1 **BASE.** The base of the main structure will consist of two semi-solid pieces of stainless steel weighing 13.32 kg each. The WAM logo is printed on each of these pieces. The length of each piece is 1700 mm. The shape of this part can be seen in the Figure F.20.

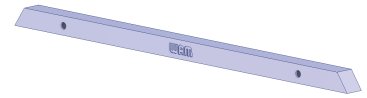


Figure F.21.

- 2 **VERTICAL BARS.** Four vertical stainless steel bars of 11.24 kg each will be attached to the base pieces. Each of them has 2 lateral projections where the discs can be stored when not in use and 21 holes where the hooks or the safety bars can be anchored. The height of each of them is 2200 mm. The shape of this part can be seen in the Figure F.21.

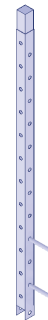


Figure F.22.

- 3 **UPPER PART.** This piece will fit with the vertical bars and give consistency to the structure. At the same time, it contains different pull-up bars that allows the user to use different grips and to practice different types of activities. The weight of this stainless steel upper part is 19.94 kg. The shape of this part can be seen in the Figure F.22.

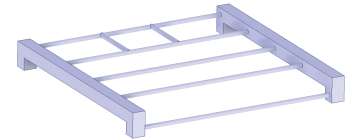


Figure F.23.

- 4 **HOOK.** J-bar stainless steel fastening hooks. The advantage of this type of hook is that, due to their shape, they can support large amounts of weight without the need of an anchoring system. The weight of this stainless steel hook is 1 kg. The shape of this part can be seen in the Figure F.23.

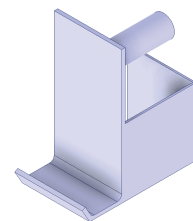


Figure F.24.

- 5 **BASE-VERTICALS UNIONS.** These solid 0.9 kg stainless steel U-shaped pieces will be used to connect the base pieces to the vertical bars. A total of four will be used. The shape of this part can be seen in the Figure F.24.



Figure F.25.

**6** WEIGHT BAR. The non-Olympic stainless steel bar has a weight of 11 kg. Its length is 2.2 metres and its grip diameter is 28 mm. It will be able to support more than 200 kg mounted on it as will be shown below in section 3.5. (Structural resistance studies). The shape of this part can be seen in the Figure F.25.

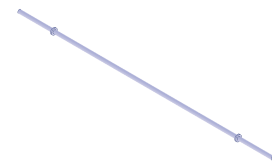


Figure F.26.

**7** WEIGHT DISCS. Weight discs of 2.5, 5, 10, 15 and 20 kg have been designed. All of them are made of stainless steel and have a similar geometry, the only difference between them being their width. The surfaces of these discs have an unevenness to facilitate their grip. The diameter of these discs is 300 mm. The hole diameter is 28 mm, as is the diameter of the weight bar and the storage bars. The shape of this part can be seen in the Figure F.26.

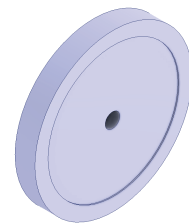


Figure F.27.

**8** SAFETY BAR. Two safety bars may be provided both to support the bars and to protect the athlete in case of fatigue or failure of the exercise. Only U-joints pieces are required to secure these. The weight of this solid piece of stainless steel is 5 kg, which is not heavy to handle. The shape of this part can be seen in the Figure F.27.

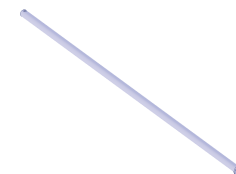


Figure F.28.

**9** SAFETY BAR LOCK. This solid 0.05kg U-shaped piece of steel will be used as a safety bar lock to prevent it from slipping and sliding out of the desired holes. The diameter this piece is matched to the socket of the safety bar. The shape of this part can be seen in the Figure F.28.



Figure F.29.

**10** BENCH. The 15kg polypropylene bench is lightweight due to its hollow interior. Despite this, it is able to support weights of over 200kg with ease, as will be shown in section 3.5. (Estructural resistance studies). The contact surface with the athlete is in turn padded with foam and covered with synthetic leather. The main dimensions of this part are 500mm wide x 1270mm long x 450mm high. The shape of this part can be seen in the Figure F.29.

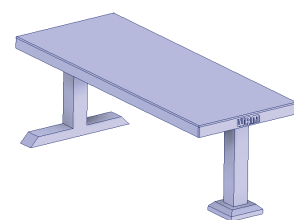
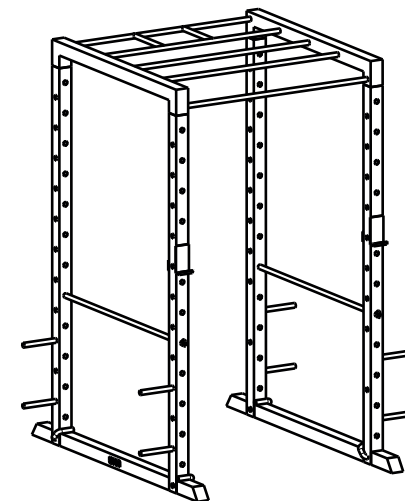
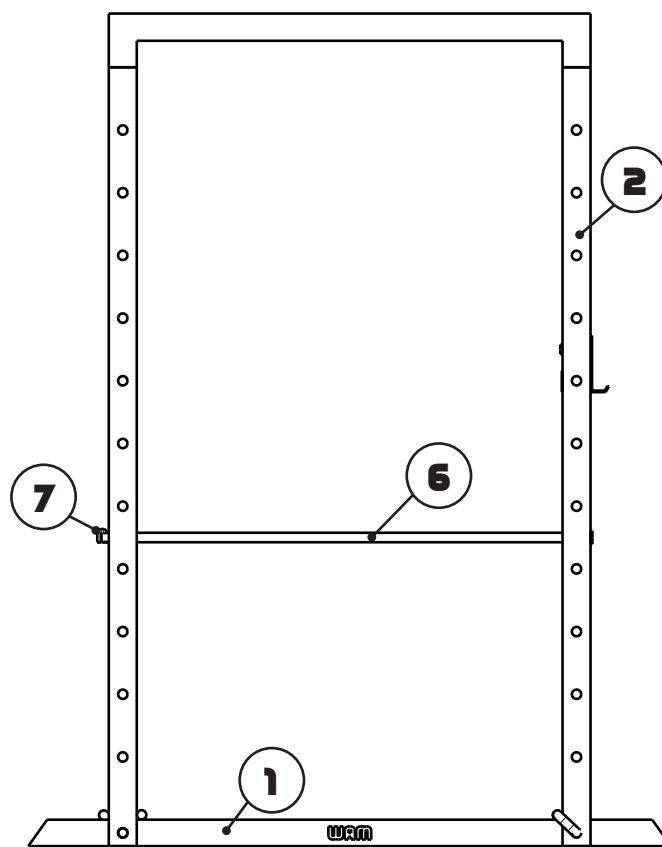
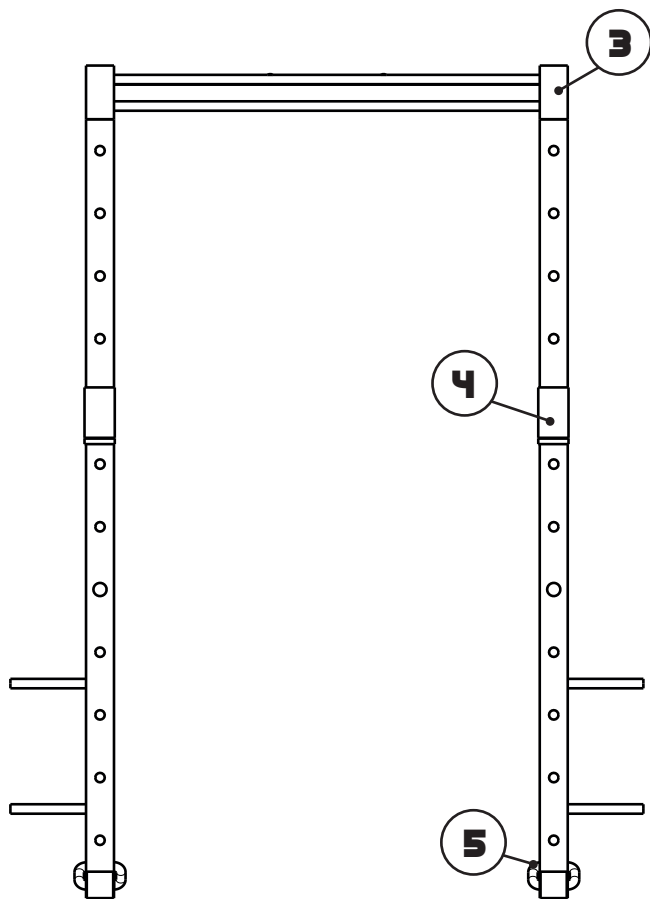
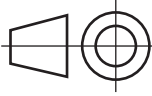



Figure F.30.

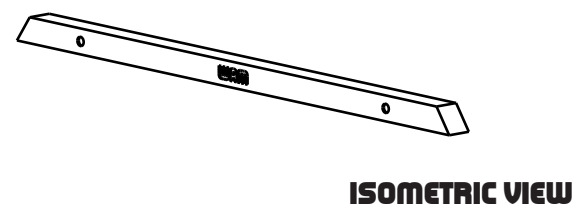
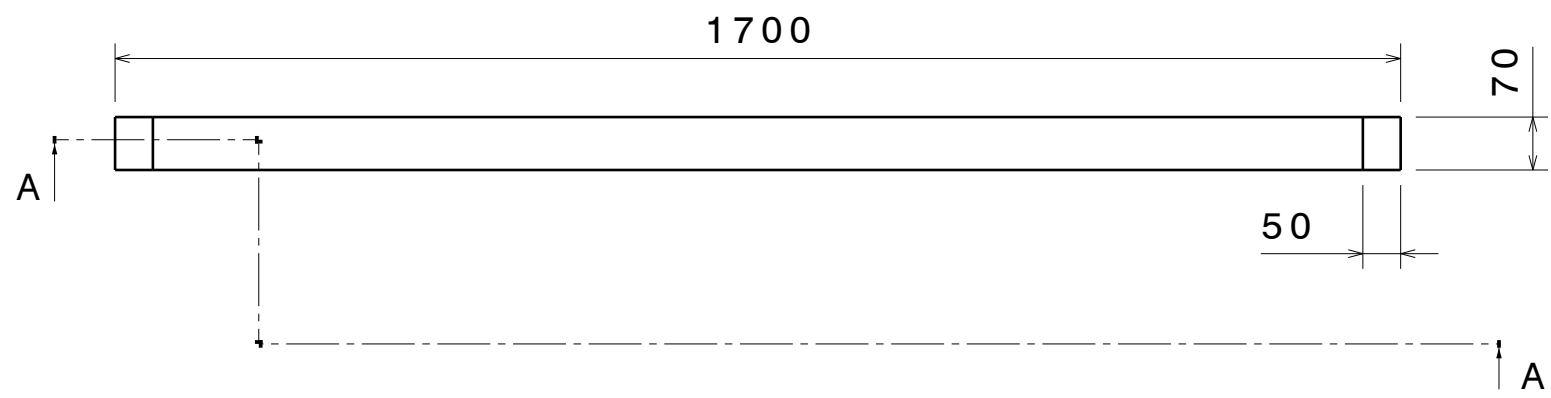
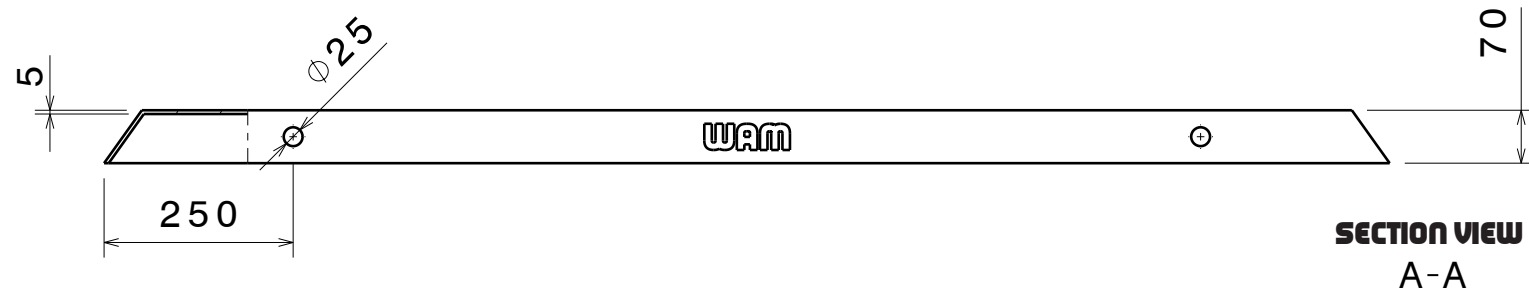


**ISOMETRIC VIEW**

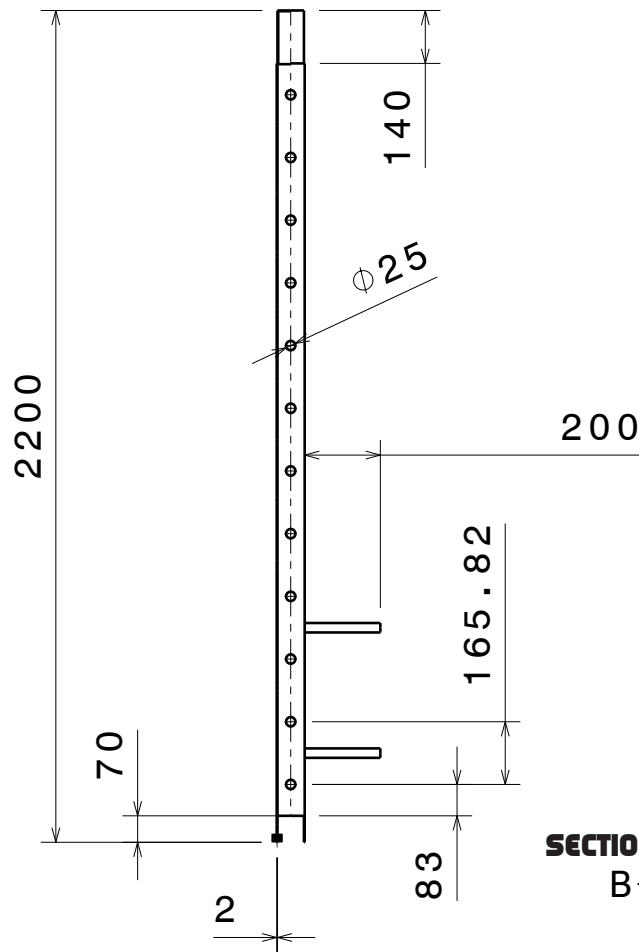
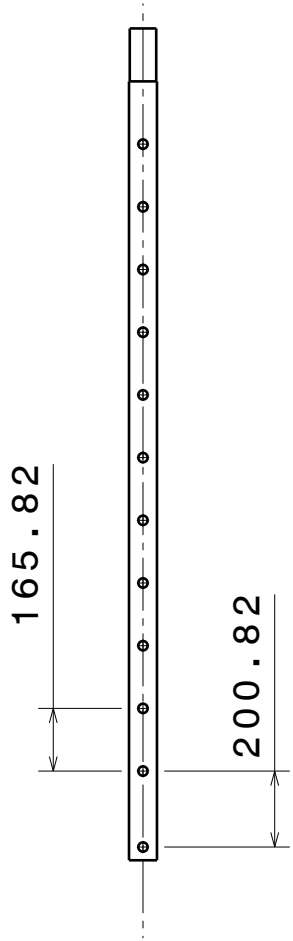
	<b>QUANTITY</b>	<b>MATERIAL</b>
<b>1. BASE</b>	<b>2</b>	<b>STEEL</b>
<b>2. VERTICAL BAR</b>	<b>4</b>	<b>STEEL</b>
<b>3. TOP</b>	<b>1</b>	<b>STEEL</b>
<b>4. UNIONS 1-2</b>	<b>4</b>	<b>STEEL</b>
<b>5. HOOK</b>	<b>4</b>	<b>STEEL</b>
<b>6. SAFETY BAR</b>	<b>2</b>	<b>STEEL</b>
<b>7. SAFETY BAR LOCK</b>	<b>2</b>	<b>STEEL</b>

<b>DESIGNED BY:</b> <b>MIGUEL HERREROS</b>		<b>SET</b>	
<b>SIZE</b> <b>A4</b>			
<b>SCALE</b> <b>1:20</b>	<b>WEIGHT</b> <b>93,82 HG</b>	<b>3.2. PLANES</b> <b>3.2.1. SET</b>	

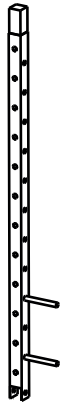
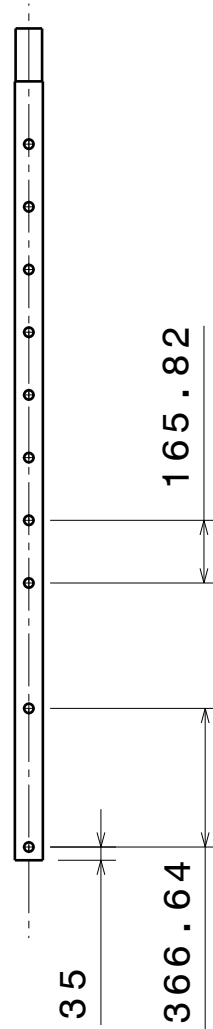




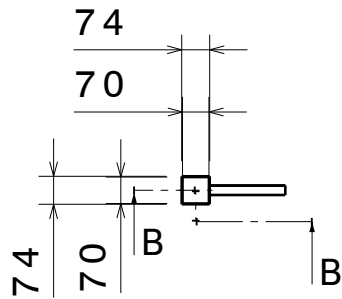
<b>DESIGNED BY:</b> MIGUEL HERREROS		<b>BASE</b>	
<b>SIZE</b> A4			
<b>SCALE</b> 1:10	<b>WEIGHT</b> 13.32 HG	<b>3.2. PLANES</b> 3.2.1. SET	



SECTION VIEW  
B-B

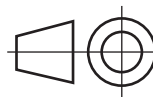


ISOMETRIC VIEW



DESIGNED BY:  
**MIGUEL HERREROS**

SIZE  
**A4**



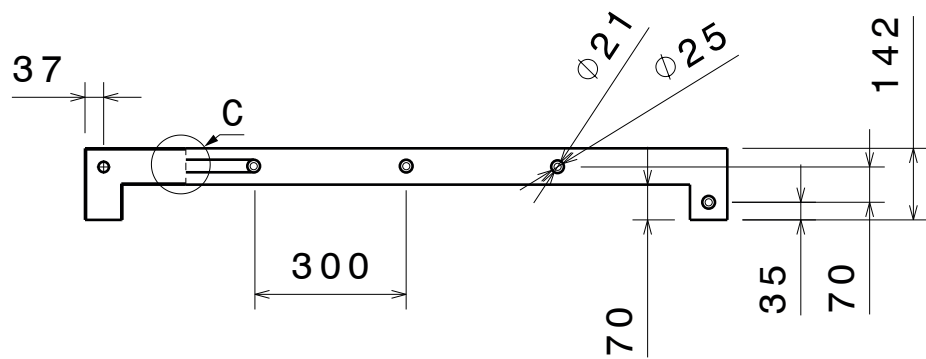
SCALE  
**1:20**

WEIGHT  
**11.24 HG**

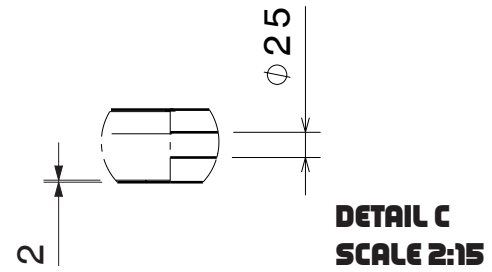
## VERTICAL BAR

**3.2. PLANES**  
**3.2.1. SET**

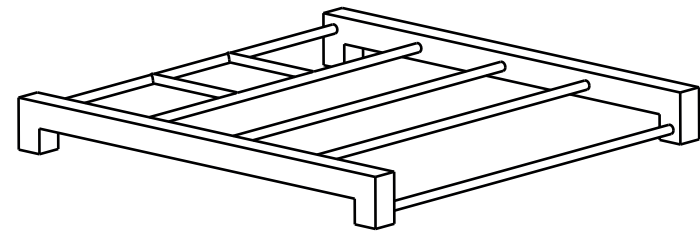
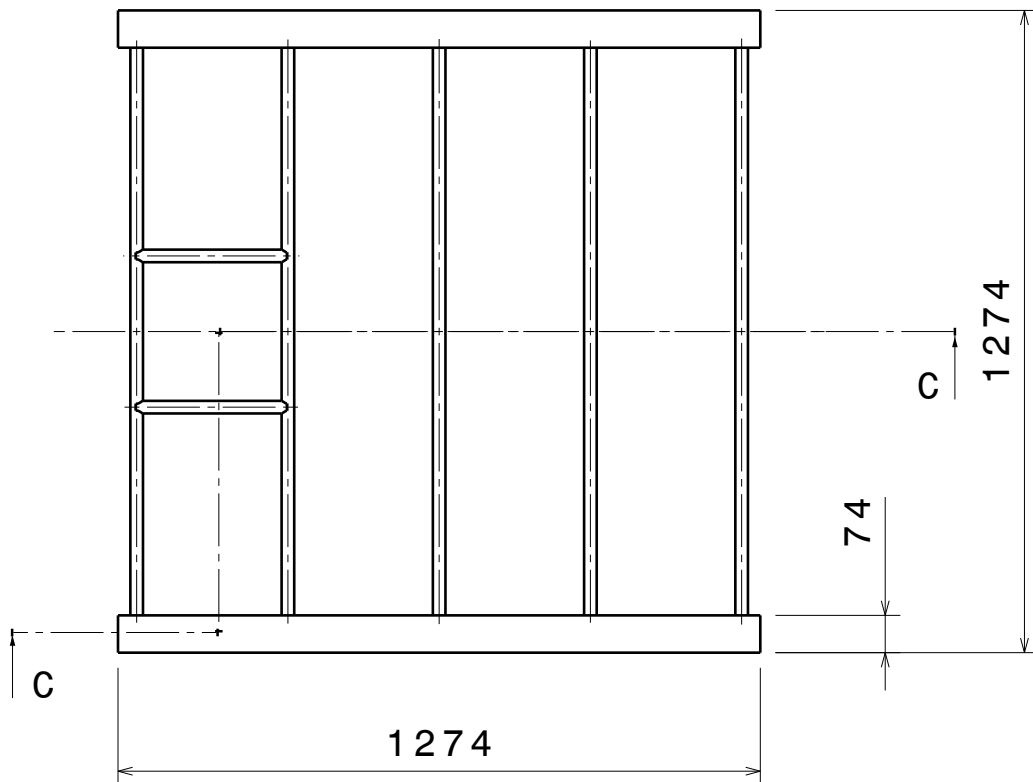




**SECTION VIEW**  
C-C

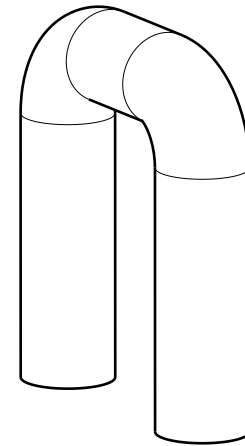
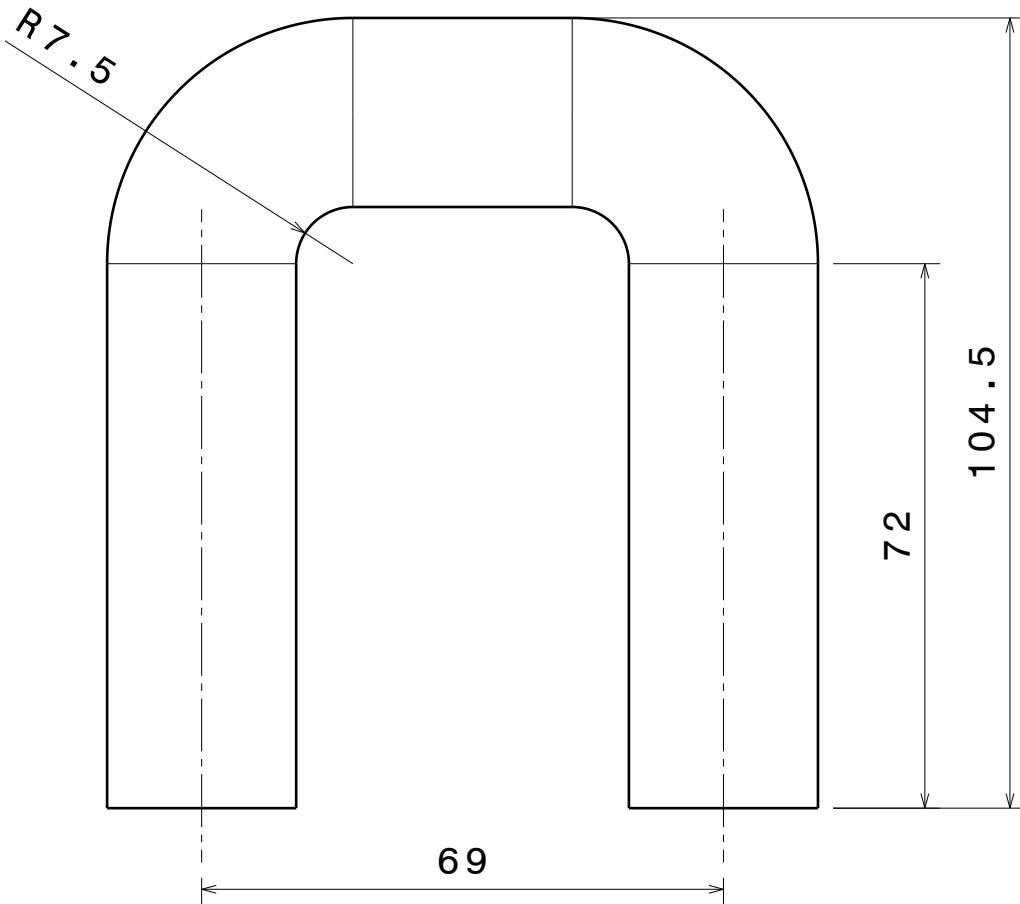
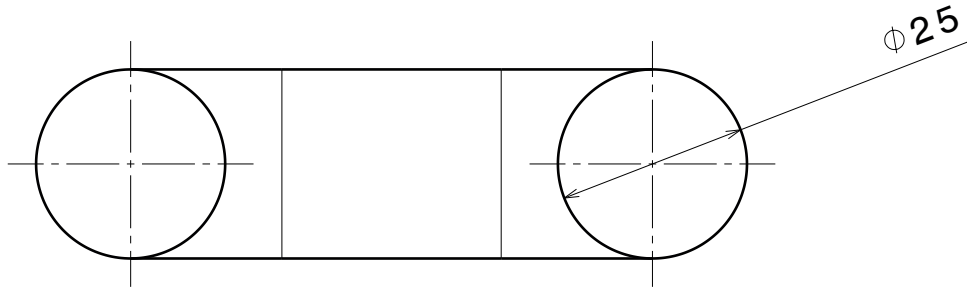


**DETAIL C**  
SCALE 2:15

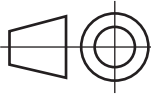



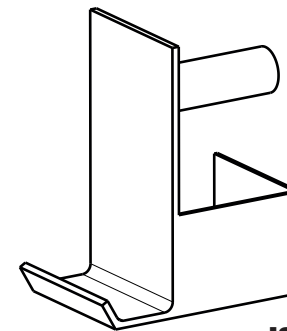
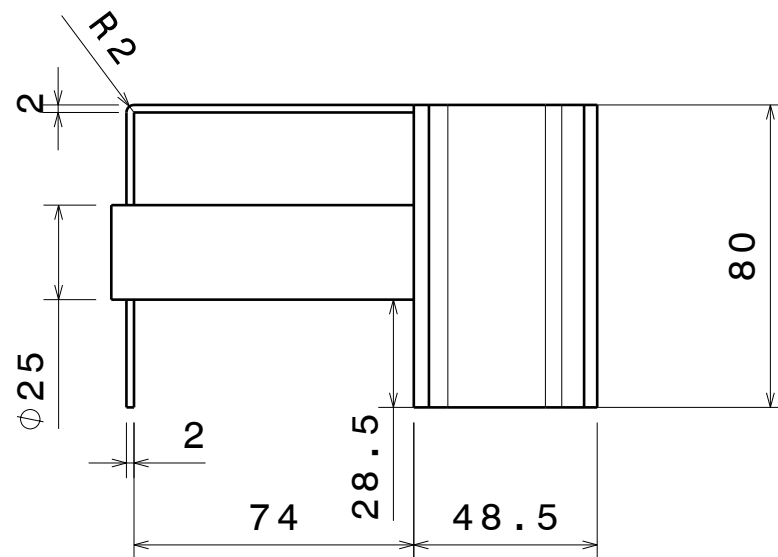
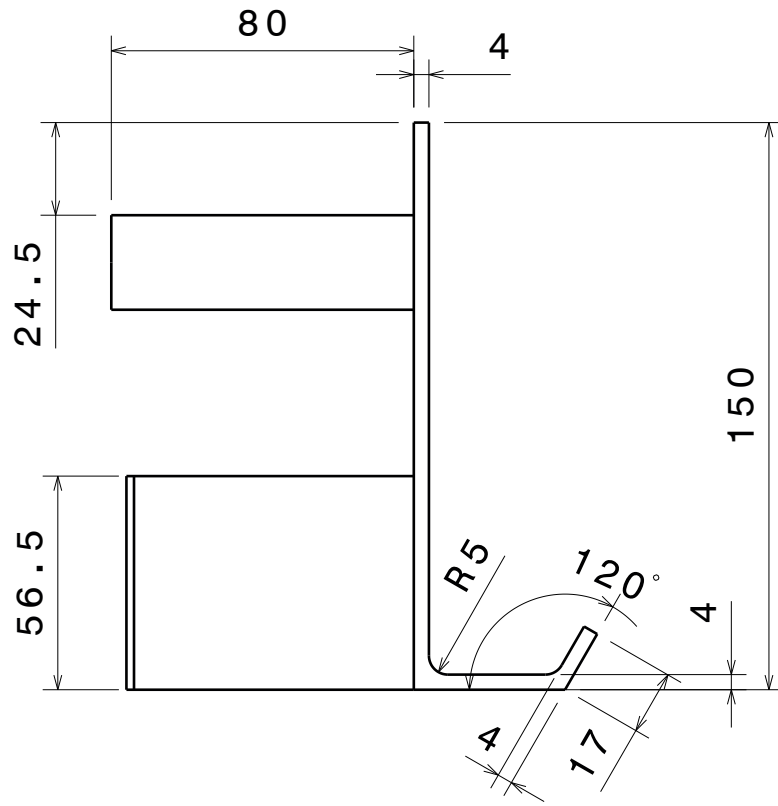
**ISOMETRIC VIEW**

<b>DESIGNED BY:</b> MIGUEL HERREROS		<b>TOP</b>	
<b>SIZE</b> A4			
<b>SCALE</b> 1:15	<b>WEIGHT</b> 19.94 HG	<b>3.2. PLANES</b> 3.2.1. SET	

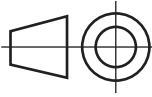



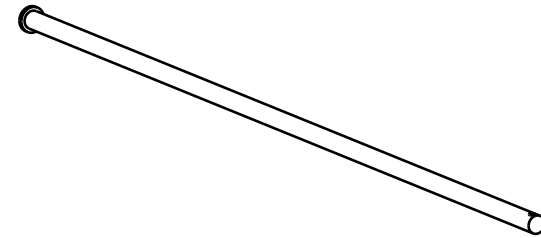
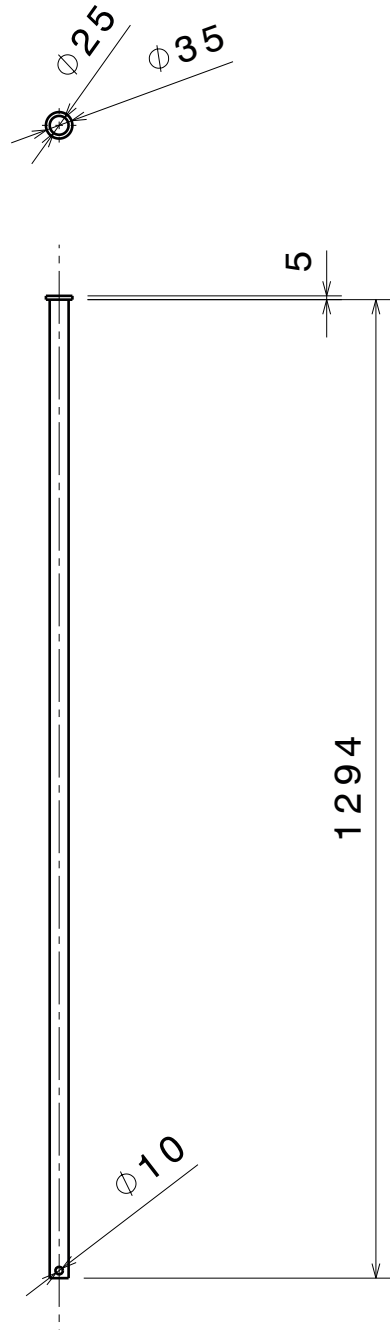
**ISOMETRIC VIEW**

<b>DESIGNED BY:</b> MIGUEL HERREROS		<b>UNIONS 1-2</b>	
<b>SIZE</b> A4			
<b>SCALE</b> 1:1	<b>WEIGHT</b> 0.9 HG	<b>3.2. PLANES</b> 3.2.1. SET	



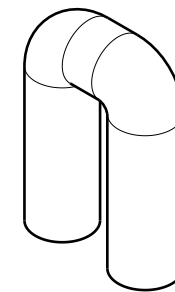
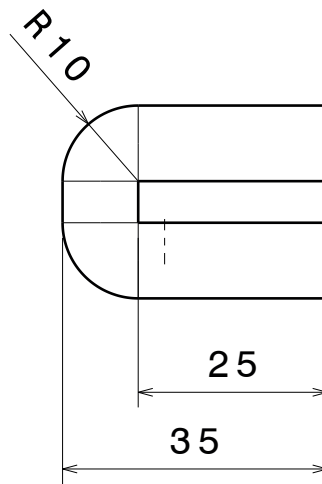
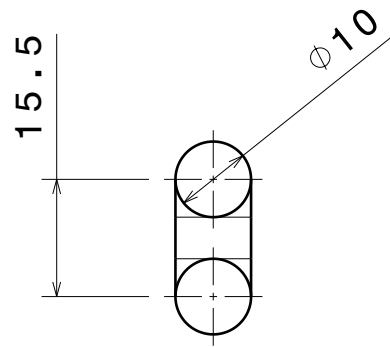
**ISOMETRIC VIEW**

<b>DESIGNED BY:</b> <b>MIGUEL HERREROS</b>		<b>HOOK</b>	
<b>SIZE</b> <b>A4</b>			
<b>SCALE</b> <b>1:2</b>	<b>WEIGHT</b> <b>1 HG</b>	<b>3.2. PLANES</b> <b>3.2.1. SET</b>	



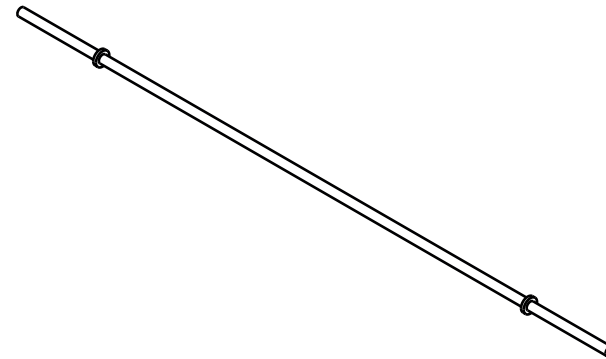
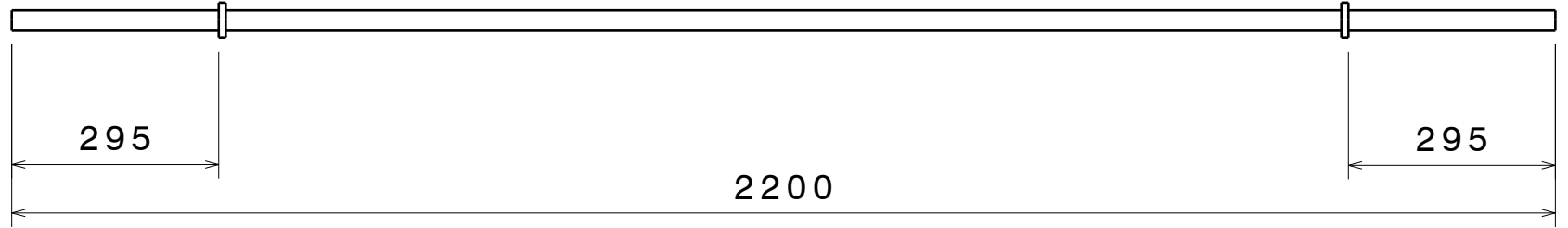
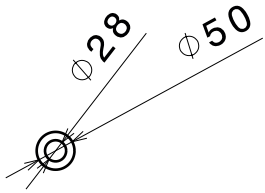
**ISOMETRIC VIEW**

<b>DESIGNED BY:</b> <b>MIGUEL HERREROS</b>		<b>SECURITY BAR</b>	
<b>SIZE</b> <b>A4</b>			
<b>SCALE</b> <b>1:10</b>	<b>WEIGHT</b> <b>5 HG</b>	<b>3.2. PLANES</b> <b>3.2.1. SET</b>	<b>18</b> 



**ISOMETRIC VIEW**

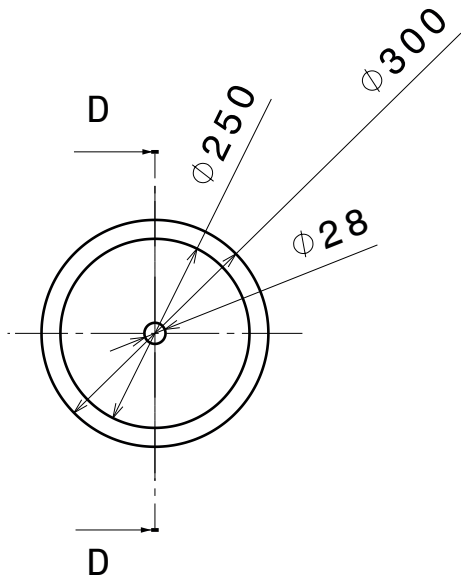
<b>DESIGNED BY:</b> <b>MIGUEL HERREROS</b>		<b>SECURITY BAR LOCK</b>	
<b>SIZE</b> <b>A4</b>			
<b>SCALE</b> <b>1:1</b>	<b>WEIGHT</b> <b>0.05 HG</b>	<b>3.2. PLANES</b> <b>3.2.1. SET</b>	<b>19</b> 



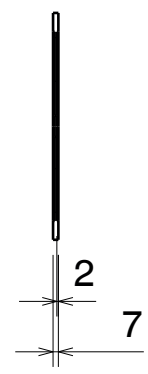
ISOMETRIC VIEW

DESIGNED BY: MIGUEL HERREROS		WEIGHT BAR	
SIZE A4			
SCALE 1:10	WEIGHT 12 HG	3.2. PLANES 3.2.2. AUXILIAR ELEM.	20 

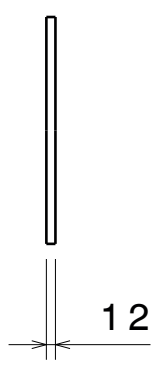




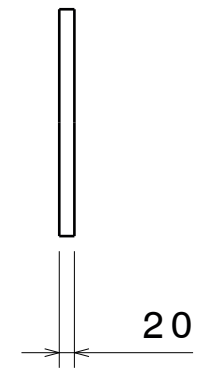
**2.5 HG**



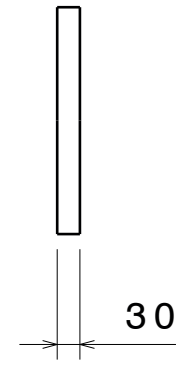
**5 HG**



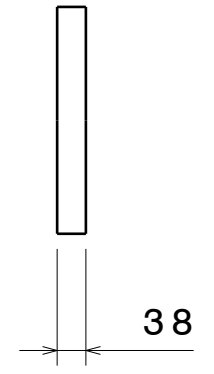
**10 HG**



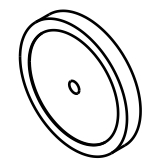
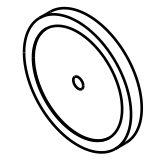
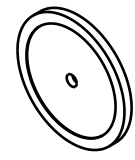
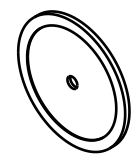
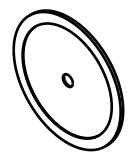
**15 HG**



**20 HG**

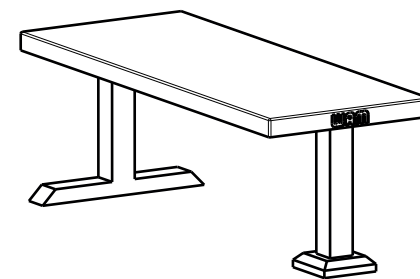
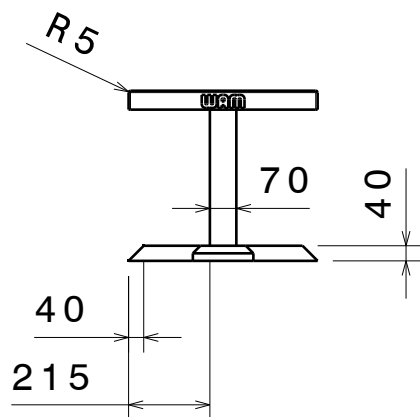
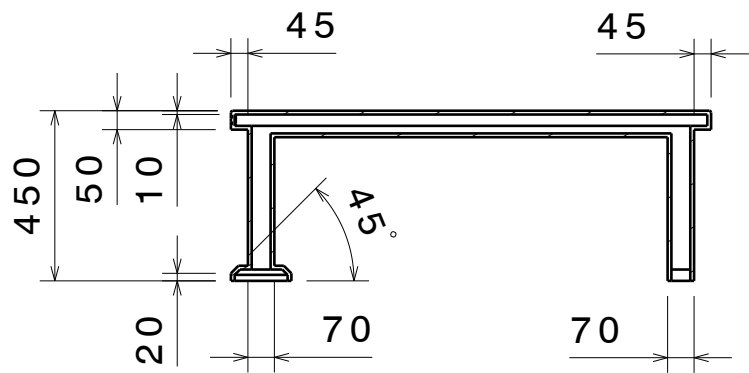
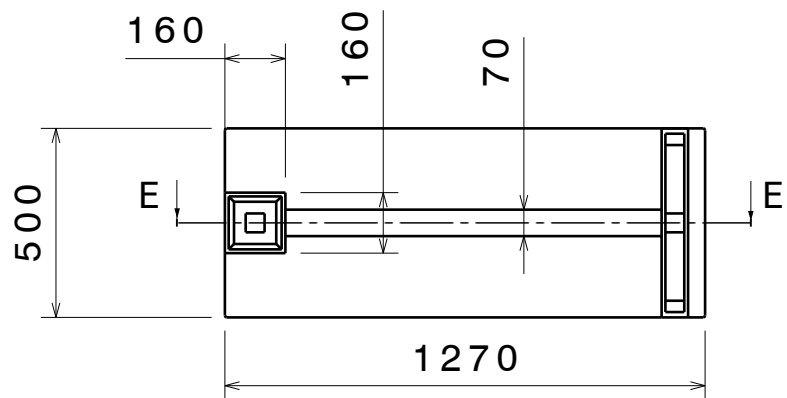


**SECTION VIEW  
D-D**



**ISOMETRIC VIEWS**

<b>DESIGNED BY:</b> MIGUEL HERREROS		<b>WEIGHT DISCS</b>	
<b>SIZE</b> A4			
<b>SCALE</b> 1:10	<b>WEIGHT</b> - HG	<b>3.2. PLANES</b> 3.2.2. AUXILIAR ELEM.	<p>21</p>



ISOMETRIC VIEW

DESIGNED BY: <b>MIGUEL HERREROS</b>		<b>BENCH</b>	
SIZE <b>A4</b>			
SCALE <b>1:20</b>	WEIGHT <b>15 KG</b>	<b>3.2. PLANES</b> <b>3.2.2. AUXILIAR ELEM.</b>	<b>22</b> 

### 3.3. MATERIALS

Both the main structure and most of the auxiliary elements are made of stainless steel. Steel is an alloy of iron and carbon, where carbon is less than 2%. Steel oxidises when it comes into contact with oxygen, forming ferrous oxide and acquiring its characteristic reddish colour. To avoid this situation, a new element must be added to the mixture: chromium. Chromium reacts with oxygen to form a chromium oxide layer which is impermeable and prevents the reaction between oxygen and iron. In this way, atmospheric corrosion is avoided and the object we want to manufacture will not suffer this type of alteration.

But, why stainless steel?

The main characteristics for which this material has been chosen are the following ones:

- High resistance: As mentioned above, one of the main characteristics of stainless steel is its high resistance to atmospheric corrosion and oxidation. In addition, it is also resistant to high temperatures and humidity. Ideal to be able to place our training structure anywhere.
- Durability: Due to its ability to withstand the physical and chemical conditions to which it is exposed, stainless steel is a very durable material. While steel begins to deteriorate after 15 to 20 years, stainless steel can last more than 60 years. So it will be able to obtain a durable product that does not lose quality over the years.
- Hardness: The stainless steel presents a great resistance to abrasive agents, and does not scratch. The more carbon the mixture has, the harder the material will be.
- Ductility: If a suitable force is exerted, the stainless steel can be easily deformed without breaking, which allows diverse modellings and finishes.
- Toughness: Stainless steel is very resistant to shocks. Under impact conditions, it can absorb a large amount of energy before breaking.
- Sustainability: All stainless steels are recyclable and are highly cost-effective because of their amounts of chromium and nickel. Generally, modern stainless steels are made from 60% recycled material.
- Hygienic: Due to its composition and low roughness, external agents such as dust and bacteria do not adhere to its surface, making it easy to clean with traditional cleaning products.
- Aesthetics. Stainless steel has a modern and elegant finish.

This material can also be coated with paint to allow customisation of the product as will be shown in section 4 (USP).

In terms of price, although stainless steel is not the cheapest material on the market, the many advantages it offers make its use profitable.

On the other hand, the training bench will be made of polypropylene. This is because stainless steel is a too heavy material for a product that has to be moved quite frequently.

At the same time, polypropylene is an ideal material to be able to obtain a product with hollow shapes such as those needed by means of rotational moulding. It is a low-cost, water-resistant material with high flexural and fatigue strength and good thermal stability.

As mentioned above, the part in contact with the athlete will be padded with foam and covered with synthetic leather. A really simple and economical finish, but necessary for the use of this product.

## 3.4. UNIONS

As it is not a single piece, the joints of the different parts that make up the final product have to be taken into account. These joints must be comfortable, must not hinder the use of the structure and, of course, must be resistant.

- **BASE - VERTICAL BARS.** Four stainless steel U-shaped connecting pieces will perform this function. One shall be placed for each vertical bar and therefore two for each base piece.
- **VERTICAL BARS - TOP.** The own geometry of the two pieces allows them to fit together in such a way that once the structure is in place and due to the gravitational force, it is impossible to disengage them.
- **HOOK - VERTICAL BARS.** No anchoring system is needed due to the J-bar fastening hooks.
- **SECURITY BAR - VERTICAL BARS.** Each security bar will fit through the holes in two of the vertical bars. The safety bar locks shall be used to prevent the safety bars from moving from this position.

### 3.4.1. MOUNTING

The assembly of the main structure is designed and should be able to be done by two or three people.

1. Match the holes located on the VERTICAL BARS with the holes located on the BASE parts.
2. Insert the UNION pieces into these holes, two of them facing one way and two of them facing the opposite way, in the form of a cross.
3. Fit the TOP piece to the VERTICAL BARS.
4. Insert the HOOKS in the desired positions.
5. Insert the SAFETY BARS in the desired positions, anchor the SAFETY BARS by inserting the SAFETY BAR LOCK into the end hole of the bar.

A graphical representation of the process is shown in Figure F.31.

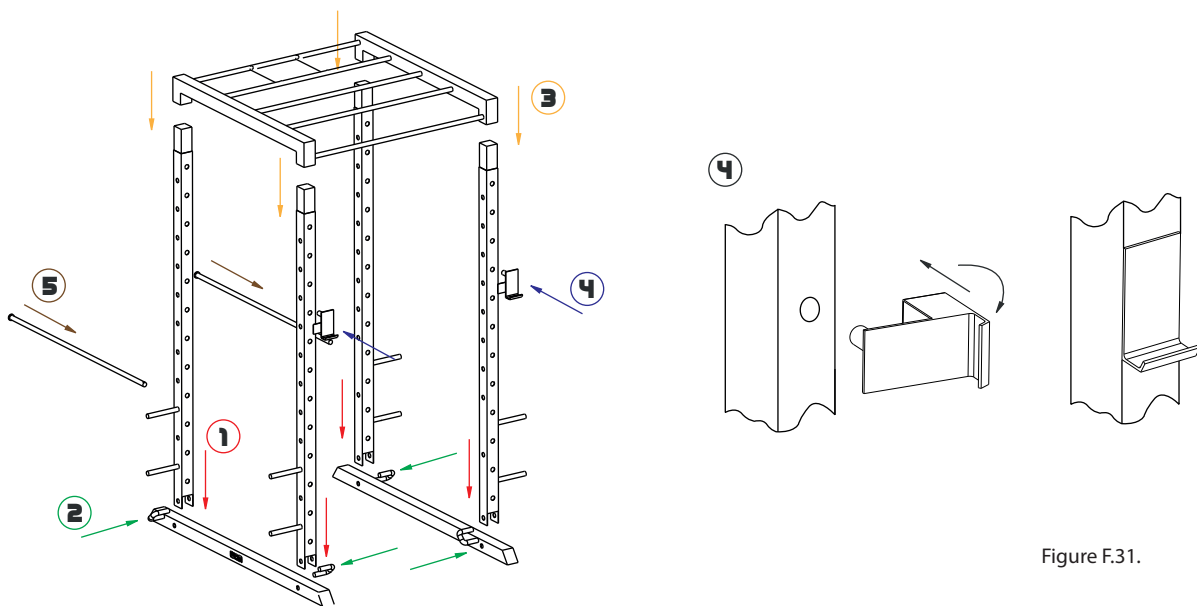


Figure F.31.

### 3.5. STRUCTURAL RESISTANCE STUDIES

Structural strength studies will help us to know if the parts are capable of withstanding the loads necessary for their correct operation. In this way, we will also establish a maximum recommended load for their use.

Firstly, some static studies of the main structure of the WAM training power rack will be carried out. Loads will be assumed on the hooks, the pull-up bars, the lateral bars and the safety bars. Several different studies will be carried out, initially assuming usual and normative use of the product, and then assuming misuse with excessive loads on the structure.

**POWER RACK - STUDY ONE.** In this study, a load of 200 kg or 1960 Newtons is assumed on the hooks in a random position, since, as will be seen later, this is a weight that the weight bar can easily withstand. The total displacement of the structure under these loads is 0.2 millimetres, so the structure behaves adequately in this situation. The maximum tension is located in the hooks themselves, but they still resist it. Results are shown in Figure F.32.

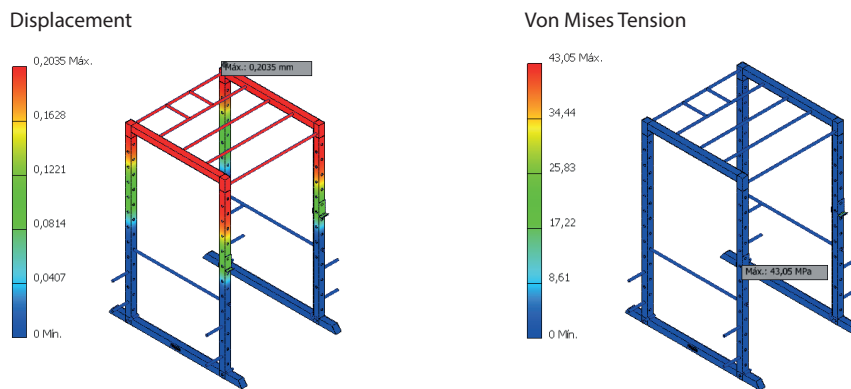


Figure F.32.

**POWER RACK - STUDY TWO.** In this study, assumes the 95th percentile weight calculated in section 2.3.1. (Project description - Geometry description - Ergonomics), equivalent to 92.7 kg or 908 Newtons. This load is placed on different bars in order to simulate different types of grips. The maximum displacement is 1.95 millimetres, the material still holds perfectly. Results are shown in Figure F.33.

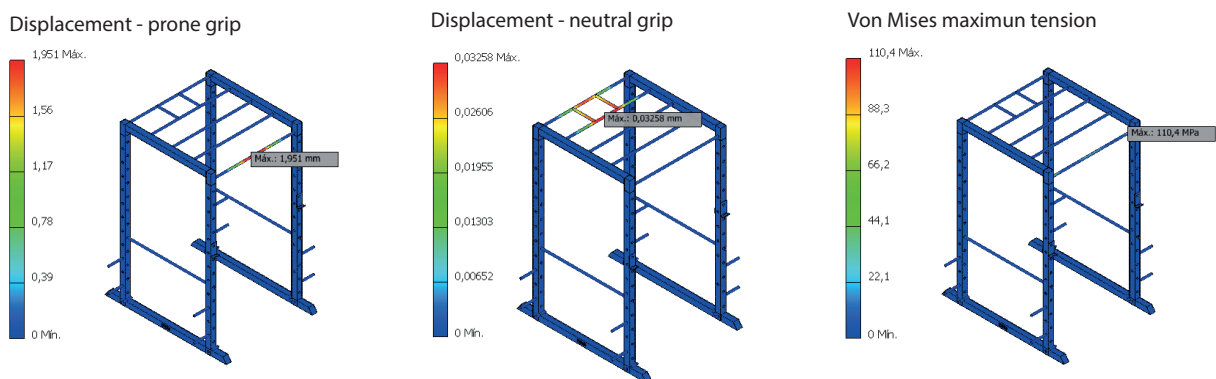


Figure F.33.

**POWER RACK - STUDY THREE.** In this study again a load of 200 kg or 1960 Newtons is assumed but in this case located on the safety bars. The maximum displacement is 1 millimetre. The results are shown in Figure F.34..

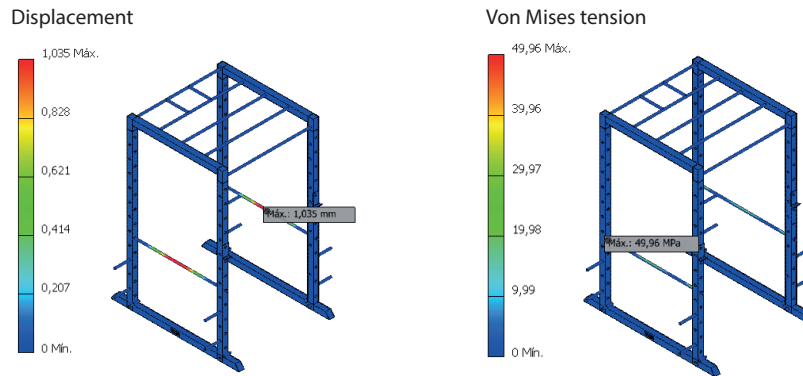


Figure F.34.

POWER RACK - STUDY FOUR. In this study, 40 kg or 392 Newtons of weight is assumed for each of the side bars, for a total of 320 kg or 3136 Newtons. The maximum displacement is 0,3 millimetre. Results are shown in Figure F.35.

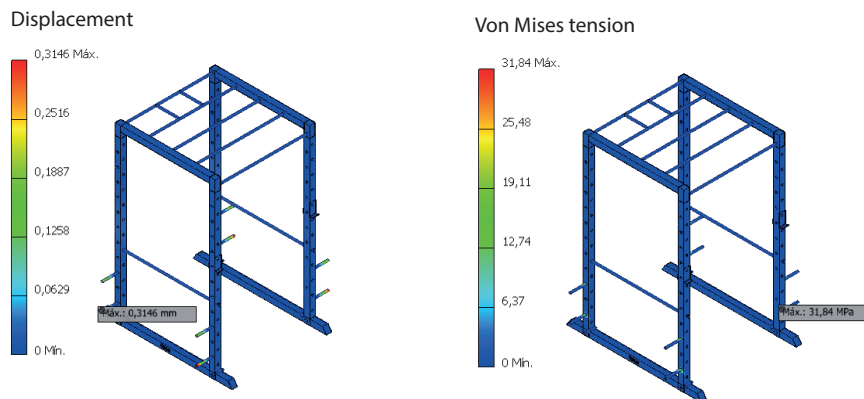


Figure F.35.

POWER RACK - STUDY FIVE. In this study all loads will be combined, so 320 kg of weights will be placed on the side bars, 200 kg will be attached to the hooks, and a 90 kg person will be hanging from the pull-up bars. Despite all the weight that is supported by the structure, the only displacement is in the pull-up bars and it is only 1.7 millimetres. The results are shown in Figure F.36.

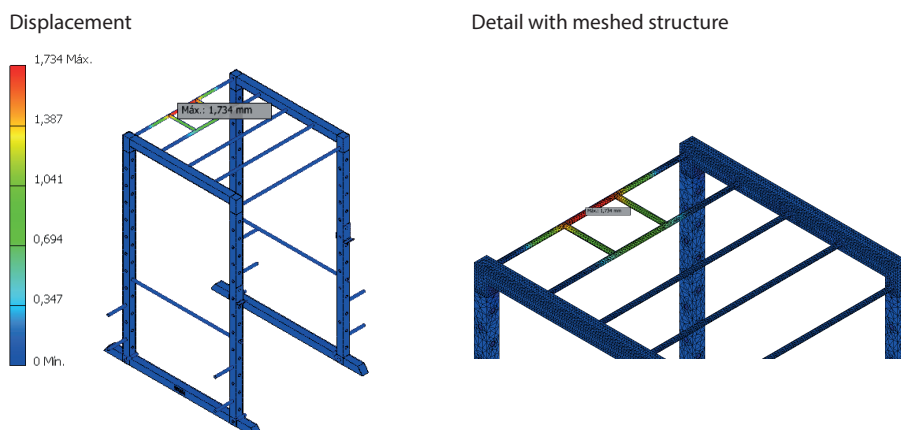


Figure F.36.

WEIGHT BAR. This small study is carried out to prove that the weight bar can easily support 200 kg. The maximum displacement is 1,5 millimetres. Results are shown in Figure F.37.

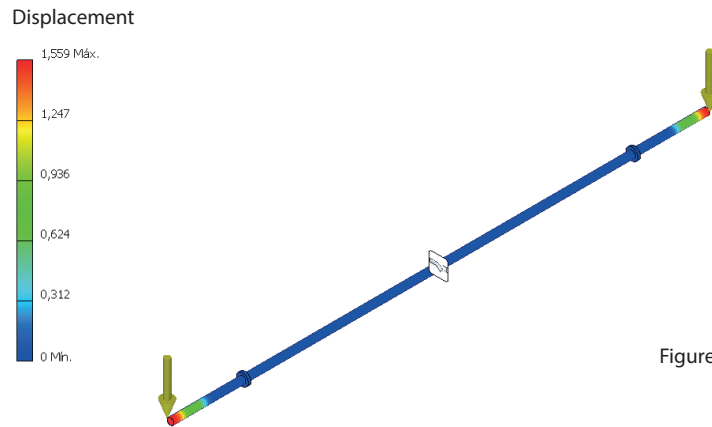


Figure F.37.

BENCH. This small study is carried out to prove that the training bench can easily support 300 kg. Wich could be the case of a 100 kg athlete holding a 200 kg weight bar. The maximun displacement is 0.15 milimetres. Results are shown in Figure F.38,

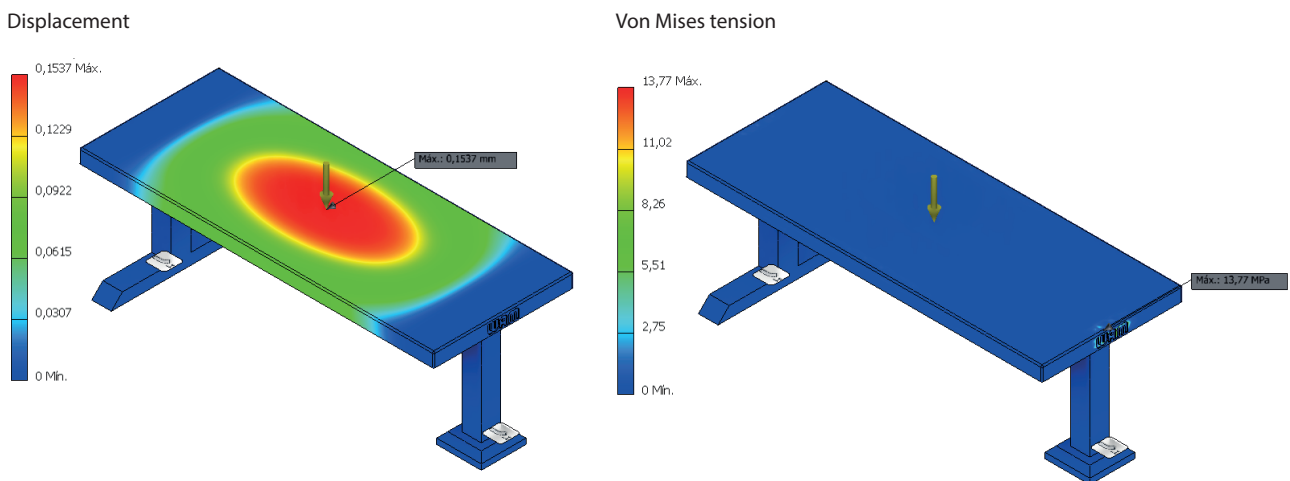


Figure F.38.

### 3.6. ECODESIGN AND ENVIRONMENTAL IMPACT

The old paradigm of buy-use-throw away of the linear economy has become obsolete and is leading us into an uncertain future. It is in this framework that eco-design is born, sustainable products that incorporate environmental criteria in all their phases: conception, development, transport and recycling.

The most important features of this sustainable product are the following:

□ Less material. When it comes to production, the amount of materials and energy must be optimised. In this way, resources can be conserved and emissions reduced. Virtually all parts used for the power rack are hollowed out, thus reducing the amount of material used for each individual part.

Easy recycling. Avoid aspects that hinder dismantling and use materials that are easy to identify, reuse or recycle. Parts can be easily disassembled. Stainless steel is 100% recyclable and does not lose any of its original physical properties during the process. Polypropylene is the most versatile polymer and the easiest to recycle.

Durability. Sustainable shapes and materials should be long-lasting to extend the life of the product as much as possible. The materials used are durable and can withstand a great deal of stress.

Emission reductions. The right sizing of products saves material and consumption during transport, thus reducing CO2 emissions. Unassembled parts are easy to store and do not take up large amounts of space.

The LiDS wheel is a tool for eco-design that suggests a way of classifying the different strategies used in the field of eco-design into eight main blocks. The LiDS wheel for the WAM product is shown in the Figure F.39.

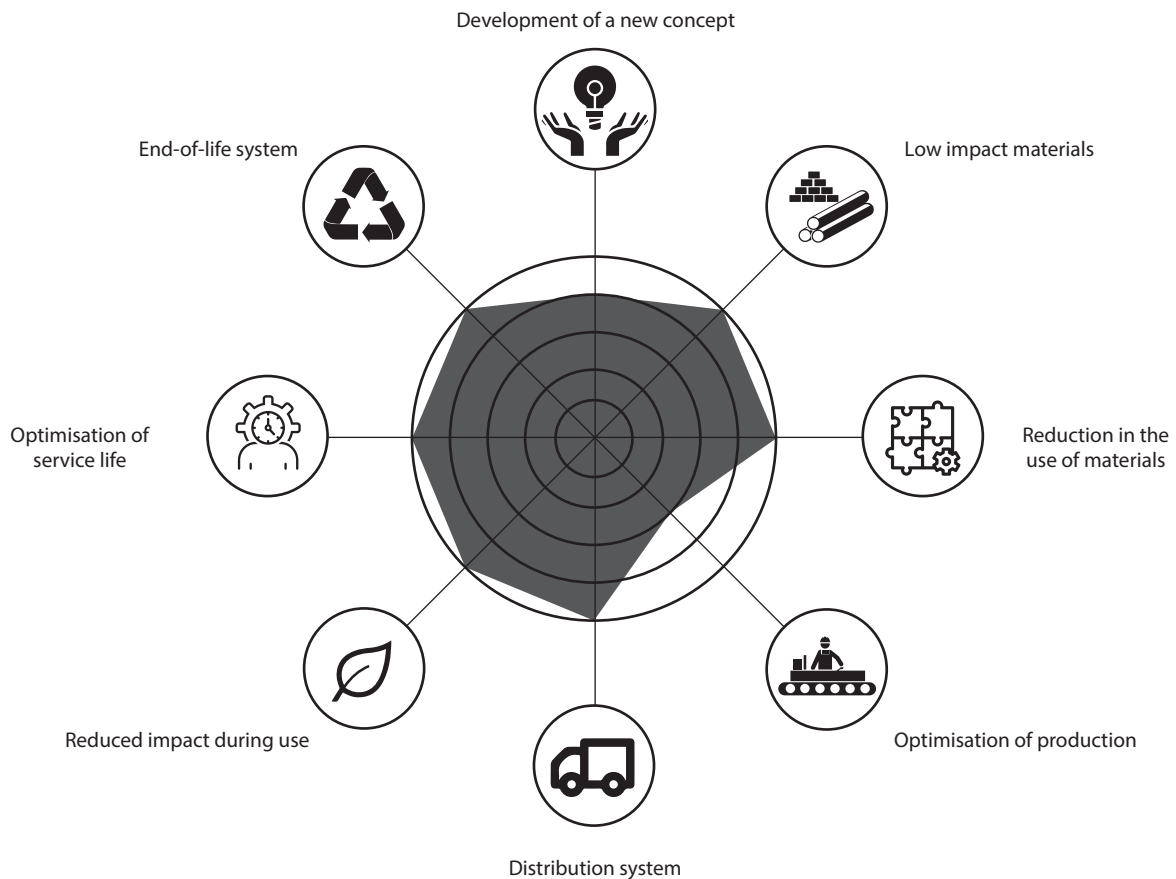


Figure F.39.



## 4. USP

A unique selling proposition, more commonly referred to as a USP, is the one thing that makes your business better than the competition.

The USP contains the brand's strengths and should be based on what makes the brand or product uniquely valuable to its customers. The product must be differentiated around some aspect of interest to the target audience, otherwise the message will not be as effective.

As mentioned earlier in the target audience study, one of the objectives of the product is that it should make the consumer feel different. To this end, and because the structure is made up of different individual pieces, the product will have the possibility of color customization.

The concept of product customization is very powerful. It is selling the customer something unique and exclusive. The message is "nobody has another one like it", people like that because we want to differentiate ourselves from others.

In today's globalized world where all products are being standardized, customization allows us to offer exclusivity and to amplify the value of the product, and likewise, that will make the consumer more willing to pay for it.

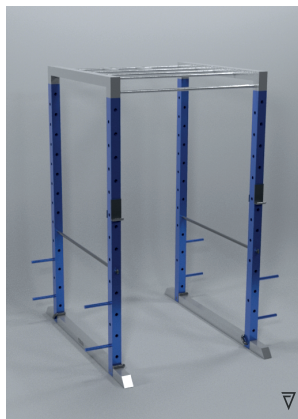
Product differentiation can also be key to a consumer's decision to choose one brand over another. If several products have similar characteristics, the fact that the consumer can participate in the design of the product creates an emotional involvement that will give the product a value that goes beyond its price.

Realistic images of different examples of the customized power rack are shown in Figure F.40.

Full Black



Blue-White-Black



Black-Red-White



Figure F.40.

On the other hand, the versatility of the structure itself allows a multitude of different exercises, as already observed during the market study, this is a very important factor.

It allows the execution of pull-ups with two different grips as well as other calisthenics exercises. Bench press, close grip bench press, overhead press, rack lockout, rack pull, barbell shrug, inverted row, barbell bent over rows, barbell curl, upright row, pull ups, hanging knee raises, hanging leg raises... all these exercises can be performed on the structure with only the height of the hooks and safety bars changing.

A large number of weight discs can be stored on the side bars.

On top of that, as previously studied, the entire structure and its components are capable of supporting high weights, above their hypothetical usual use.

Another great advantage of this power training rack is the ability to assemble and disassemble it with relative ease. There are no permanent joints unlike many competitive products. This will allow the consumer to more easily move the placement of the structure if it is necessary, and as previously mentioned, this will facilitate recycling at the end of the product's life cycle. Realistic images of the unions are shown in the Figure F.41.

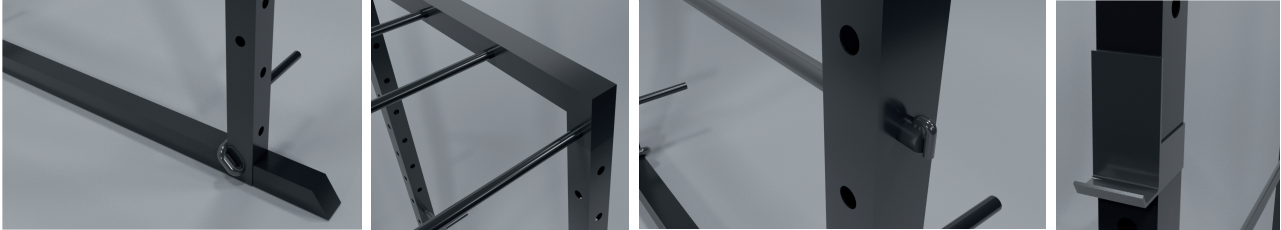


Figure F.41.

In terms of cost-effectiveness, stainless steel will make the product very durable. According to the classification of types of goods in economic theory, a durable good has the main characteristic of being able to be used by the user or consumer on a large number of occasions and over an extended period of time.

This is a characteristic that any quality training power rack must possess, since both the price and the purchase process is longer than usual and requires much more care than in the case of non-durable consumer goods.

As discussed in the materials section, because of its ability to withstand the physical and chemical conditions to which it is exposed, stainless steel is a very durable material. While steel begins to deteriorate in 15 to 20 years, stainless steel can exceed 60 years.

WAM. A name that is easy to remember, with an attractive logo that is also easy to remember. As we have already seen in the Target Audience Study section, the brand must have a strong presence in social networks, using realistic images that evoke feelings, sensations and positive memories in the viewer.

An example of this is shown in Figure F.42.



Figure F.42.

As for the shape and dimensions of the parts of both the main structure and the auxiliary elements, after an ergonomic analysis of the target users, it was possible to adapt them to their needs. This will facilitate the athlete's performance.

No part contains sharp or cutting elements or elements that could pose a danger to the user when dealing with them.

In summary, the main advantages of WAM over its competitors can be summarized in a simplified manner:

- Diferentiation
- Aesthetic
- Versatility
- Resistance
- Easy assembly and disassembly
- Durability
- Rememberable
- Adaptation
- Network presence

# 5. STRATEGIC MARKETING PLAN

The essence of strategic planning is the systematic identification of opportunities and dangers that arise in the future, which combined with other important data provide the basis for a company to make better decisions in the present to exploit the opportunities and avoid the dangers.

The strategic marketing plan is a process that allows structuring marketing techniques to organize detailed and budgeted commercial actions. Marketing planning is based on situational analysis that allows us to analyze the variables of the environment. The internal and external analysis is the basis for developing the formulation and definition of generic, competitive, segmentation and positioning strategies, as well as planning tactics that will allow us to achieve commercial objectives in order to fulfill the corporate vision.

## ANALYSIS OF THE SITUATION

**EXISTING COMPETITORS.** They are those that manufacture the same product and the market has the capacity to decide between one or the other. Mentioned already during the Market Study, the main brands that market and that represent a major competition in terms of training Power Racks are TechnoGym, Rogue, Atletica, Klarfit, Capital Sports, PowerLine and Fitness Reality.

**WEAKNESSES, THREATS, STRENGTHS AND OPPORTUNITIES.** The main weakness in entering a pre-existing market is obviously the need to make a name for yourself and your company, since existing companies have more experience and recognition. The main opportunity is based on offering a product with unique characteristics as already mentioned in the USP section, the most important being differentiation.

**PRODUCTS, PRICES, SALES POLICIES.** The characteristics of the most successful products have already been analyzed in the Market Study section, so we know the average size of the existing products, the characteristics that all of them provide and those that are not so common but would be a great asset for WAM. The prices depend a lot on the type of product, but knowing the lowest prices we can get to know if the product will become competitive in that aspect as well.

**MARKET SITUATION.** A booming market due to the increasing importance given to the world of fitness and therefore the increase of gyms and people's interest in this type of physical training.

**POSSIBLE MARKET DEVELOPMENTS.** It does not seem that the market is going to evolve for the worse, quite the contrary. In the past, it was not necessary to dedicate part of our time to exercise, because all the movement we did naturally was enough. But as civilization made our daily lives easier and easier, we have reached a point where if we don't put our will to it, we can spend our entire lives practically from chair to bed and from bed to chair. It has become evident that exercise is an indispensable necessity to maintain the health of our body, and as I can attest, of our mind as well. More and more visibility is being given to it, resulting also in more influential figures and many more total users.

**SITUATION OF THE COMPANY.** Since it is a start-up and only the product idea is available, there is not much knowledge of what WAM's production capacity, R&D, personnel, etc., would be like.

**TARGET MARKET.** As already observed in the Target Market Study section, it is known that the end user of the product will be mainly the young population between 16 and 35 years old. Who buys? It could be a business owner of a gym or a sports center, or it could be the end user who wants the product for use in their own home. Why do they buy? Because there is a need for the product, either for their own use or for someone else's. When do they buy? When the product is required, either during the start-up of a gym or when renewing the machines in the gym, when a person wants to set up their own training area at home. Where do they buy? Mainly online, there are also physical stores specialized in this type of products where you can go to make the purchase. How much do they buy? Rarely will they buy more than one unit of this type of product. How often? As these products are long-lasting and relatively expensive, it is not a product that is purchased frequently by the same user. Normally, this type of purchase requires more time and information from the user before making the final purchase.

**HYPOTHETICAL OBJECTIVES.** The goal of the project was clear, to achieve a versatile, resistant and aesthetic product that could compete with others in the market. The hypothetical objective of the company would initially be to gain market recognition, first by making itself known and gaining the trust of consumers and distributors, since during the introduction of a product these are characteristics that have to be earned.

This section of objectives may also include quality, price, deadlines, time, advertising and promotion objectives. Quality must be optimal, since in the initial stage of the product, as mentioned above, the aim is to achieve consumer loyalty. Quality must be considered as one of the fundamental elements when it comes to achieving high levels of customer loyalty. Prices must be competitive and adapted to the target public. Production and delivery times should be short, and in no case should they exceed 10-15 days from the time of the order to the final delivery of the product. Advertising and promotion should play a key role in the early stages of the company, and should have a strong presence in social networks.

## **STRATEGIES**

The term strategy comes from military language. Charles O. Rossoti says that strategy is "The engine that increases the organization's flexibility to adapt to change and ability to meet new and creative views."

**PRODUCT STRATEGY.** The product to be marketed is the WAM Power Rack, both the main structure and all its auxiliary elements (bench, weight bars, weight discs...). All the features of this product have been shown throughout the project, giving priority to those shown in the USP section. The brand has also been presented in the Corporate Image section.

Taking into account, as mentioned above, that most of the purchases of this type of products are made online, we have to think about the packaging for the product. The fact that the main structure can be divided into the small parts that compose it will facilitate this task. The packaging would be totally environmentally friendly, in accordance and in line with WAM's policy. That is, it should be made of materials that can be fully recycled, such as glass, aluminum or cardboard. Each of the pieces would be packed in cardboard boxes whose dimensions do not exceed the dimensions of the pieces themselves. This will facilitate the logistics at the time of transport and also less material will be wasted.

**PRICING POLICIES.** Simple, a price that suits the market and that the consumer is willing to pay. In addition, discounts could be made in case of the acquisition of more auxiliary elements, discounts in cases of coming by recommendation..... It is one of the most important ingredients for marketing, as it is focused on generating and increasing revenue. In the long run, it will be the factor that brings profit to the company.

The launch price should be somewhat lower to get more attention, as the number of loyal consumers and buyers in general will increase, the price will be increased without leaving competitive market values. Psychological pricing strategies such as charging 9.99 for a product instead of 10 will also be applied.

**DISTRIBUTION POLICY.** It should be noted that most orders will be placed online. And even more so at the beginning, since it would be very difficult to find physical stores willing to put a new product on sale without previous references. The packaging should be designed to facilitate transportation, making the greatest number of deliveries with the least amount of equipment necessary. As with consumers, loyalty should be established with distribution companies so that in the future deliveries will be better and more economical.

**ADVERTISING AND PROMOTION POLICIES.** They will be based mainly on social networks. To do this, WAM must have a presence in the main social networks currently existing, including: Instagram, Facebook, Snapchat, TikTok and Twitter, where it can publicize the product and the company, and interact with those interested. WhatsApp, mainly as a means of questions and answers with those interested on the company. YouTube and Twitch , where it will be possible to show promotional videos and live videos of the company.

## **CONTROLS TO USE**

Control procedures must be established, they will allow us to measure the effectiveness of each of the actions, as well as determine that the scheduled tasks are carried out in the foreseen manner, method and time.

There are three types of control:

-Preventive. They are those that we determine in advance due to their possibility to cause error or delay. They allow to have a corrective action established in the event that it might occurs. For example, having agreements with two different distribution companies, so that in the event that one of them ends up failing, the other will remain.

-Correctives. They are done when the problem has happened.

-Late. When it's too late to correct them.

## **FEEDBACK**

As we are implementing the marketing plan, it may happen that some initial conditions change. This implies that we must correct the strategic marketing plan as appropriate. The strategic marketing plan should not be rigid and immovable. On the contrary, it must show some flexibility in its application.

# 6. CONCLUSION

The objectives of the project were clear from the beginning.

To design a training Power Rack that could somehow surpass those currently on the market. To do this, it had to be not only aesthetically pleasing, but also versatile and resistant.

The design process must go through several stages. First of all, once a need has been found, it is necessary to study what products are on the market that can satisfy it. In this way it will be possible to know if the product to be presented is really innovative and will generate greater interest in the market.

Next, the market in question should be studied. Know exactly their needs and behaviors, know their physical attributes in order to make the product more comfortable and ergonomic.

The whole project must go under a name, a brand that transmits sensations and confidence to the market. The brand is the experience that people have when they come into contact with our company, WAM. A brand is a communication strategy that must be followed to connect emotionally with our potential clients.

Once all the components have been designed, it is necessary to study which materials can be used to obtain the desired characteristics. Study how the joints of these should be to achieve a connected result and not lose capabilities. In addition, it is essential to carry out resistance studies to verify that the selected materials are capable of supporting the minimum necessary weights, and in this way also to carry out the corresponding redesigns to improve the behavior of the material.

In today's society, the environmental aspect must be taken into account at all times during design.

Once we know all of the above, we can easily highlight the strengths of our final product, and we can propose a strategic marketing plan in anticipation of its hypothetical launch on the market.

The Final Project is the work that must summarize the knowledge acquired in the degree. In my case, I have been studying Industrial Design and Product Development Engineering for four years. Four years that have helped me to learn about practical aspects of design such as computer design tools needed in today's industry, as well as more theoretical aspects that lay the foundations of the designs to be made.

With all this, I feel very grateful for the opportunity that I have been offered to carry out this project, and I feel totally satisfied with the result obtained.





**WAM**  
**TRAINING RACK**