Mestrado em Engenharia e Gestão Industrial

Reynaers Aluminium CR120 – Conservatory Database

Trabalho de Projeto apresentado para a obtenção do grau de Mestre em Engenharia e Gestão Industrial

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Coimbra, Abril, 2018

“Do things as simple as you can, but do not restrict yourself to the simplest ones.”

Albert Einstein

“What we know is a drop; what we ignore is an ocean.”

Isaac Newton

Acknowledgements

This work would not have been possible if it hadn't been for the patience and help of my professor, Professora Doutora Deolinda Rasteiro.

I want to thank my family for all the support and help during these two years of master's degree, especially to my mother and my husband, without them I would not have been able to finish.

To my friends, above all by the companionship and strength transmitted in the most complicated hours.

To my supervisor within the company, Gonçalo Rodrigues and Wim Van Ranst, for all the support and friendship transmitted during the last years of my career.

Resumo

No âmbito do Mestrado em Engenharia e Gestão Industrial na especialização em Gestão de Dados no Instituto Superior de Engenharia de Coimbra, foi realizado um projeto na empresa Reynaers Aluminium.

No decorrer do projeto houve necessidade de aprofundar os conhecimentos obtidos durante a licenciatura e mestrado de entre os quais se destacam os trabalhos em software 3D (Inventor) para criação de peças 3D e melhor compreensão do software 3D utilizado, as bases de matemática destacando-se a trigonometria foram essenciais.

Para além disto, também foi necessário a aquisição de novos conhecimentos como o uso do programa Cover, onde foi feito todo o input da base de dados da Reynaers Aluminium e toda a nomenclatura necessária na área do alumínio e formações práticas de montagens dos diferentes sistemas.

Depois de consolidados os conhecimentos, o foco principal do trabalho foi, o input de todo o sistema de jardins de inverno usando o programa 3D Cover.

Palavras-chave

Cover, Reynaers Aluminium, CR120, .

Abstract

In the scope of the Master in industrial engineering and management in the specialization of data management, and offered by Superior Institute of Engineering of Coimbra, a project was made in the company Reynaers Aluminium.

During the project, it was necessary to deepen the knowledges obtained during graduation and master's degree, among which the works in 3D software (Inventor) to create 3D parts and better understand the 3D software used, and the bases of mathematics especially trigonometry.

In addition, it was also necessary to acquire new knowledge such as the use of the Cover program, where all the input of Reynaers Aluminium database was made, all the necessary nomenclature in the area of aluminium and practical's trainings of assemblies of the different systems.

After consolidating the knowledge, the focus of the work was, the input of the entire conservatories system using the 3D Cover program.

Keywords:

Cover, Reynaers Aluminium, CR120, .

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Chapter 1

Framework

1.1 - Introduction

The aluminium Industry is an increasingly demanding industrial sector, where products offer and solutions are very competitive.

For a company in this sector to survive, it must adopt and advance according to market requirements, both in terms of diversification of solutions and in the increasingly specialized workforce or even in the presence of globalization and generalized internationalization.

Only a company capable of following the evolution of national and international markets will have the capacity to remain in an increasingly demanding market, both in terms of delivering times and quality. In the aluminium market, the high quality is without any doubt one of the most important factors of competitiveness, but the key for success is globalization, the response time for a particular market.

The relocation in the different markets is associated with an increase of costs in the value of the final product or sometimes the market in question does not make the product competitive.

To counteract these final price differences, some companies choose to focus on highly competitive and sometimes unique product solutions, that is, tailor-made, project-specific solutions for each market.

In order to have a quick solution response, the engineer plays a key role in determining the most efficient solutions for providing a service or manufacturing a product, using sector-specific software.

This is the result of the conjunction between the goals proposed by the management and the operational performance, always looking for increased productivity through the use of people management, methods, distribution systems and technology organization.

The work that follows is related to the main activities that were developed during the last 3 years of my professional activity, which runs from May 2014 until the present moment, where the input of the database in the software allowed the company to offer a competitive solution to customers, developing the product offered, reducing manufacturing times and increasing the number of sales.

1.2 - Work Goals

The main focus of this work was the parameterization and update of a specific range for a specific solution with increasing demand in the aluminium market.

This work has 2 main objectives:

First and foremost, provide customers with intuitive, quick-to-use software to increase sales without investing in much equipment or learning time.

Secondly, to update existing solutions by creating a new version that is more adapted to new requirements and with a more modern style.

To achieve these objectives, this work was divided into four phases, the first phase of which focuses on developing new solutions. This phase began before I joined the project.

The second phase, which was my focus, consisted of creating a database, further developments in the software itself for the purpose.

The third phase depended on the presentation and availability of the database, in order to raise as many clients as possible (this phase is still ongoing).

The fourth and last phase will consist of supporting the client and a constant updating of the database.

This work can never be taken for granted, since we are facing a constantly changing market, where the need for new solutions, constant support and adaptation to market changes are the main factors.

1.3 - Document Structure

About the structure of the document, it is divided into four chapters.

In Chapter I, the objectives and a summary of the project structure are proposed.

Chapter II focuses on the presentation of the company where the project was written, highlighting the company's evolution, its worldwide presence and the goals / objectives that the company intends to achieve in the medium / long term in general and with this project specific.

Chapter III contains the entire development of the project, from the phase of entry into the company to the availability and support of the database to external customers, giving emphasis to all steps to create this database. This chapter also presents an overview of the state of the project, the results obtained vs. the intended results. Possible adjustments and improvements, also containing a brief suggestion of possible steps for a later phase.

Finally, Chapter IV shows all the conclusions of the presented project.

Chapter 2

The Company – Reynaers Aluminium

2.1 - Introduction

Innovation is undoubtedly the watchword in all productive sectors. And one of the new trends in engineering is the use of aluminium in the most diverse industries due to its advantages such as lightness, high resistance, electrical and thermal conductivity, resistance to corrosion and being infinitely recyclable.

Their applications in different industries are innumerable: is used in the automotive industry in various components used in vehicle manufacturing; in consumer goods and in the pharmaceutical, food, cosmetics and hygiene sectors, since it is used in packaging (e.g. in soda and beer cans), besides being light and practical, help in the conservation of foods as they protect them from the action of light, moisture and air. Besides these qualities, after their use, they can be recycled, contributing to sustainability.

In addition to these applications, aluminium is increasingly used in civil construction. The increased environmental requirement and consumer awareness created a need for construction companies to renew their infrastructure projects and works, innovating in more modern and economical alternative practices, thus contributing to the reduction of maintenance costs.

The aluminium profile is extremely durable and resistant to corrosion, especially due to anodizing and painting. This allows architects to explore all their creativity by combining it

with other elements of the building. Therefore, facades made with metal value buildings for their high aesthetic performance and guaranteed functionality.

The demand for sustainable construction makes the material ideal because it can be used in the construction of buildings with low energy demand, and even buildings that produce energy.

Aluminium facades function as protection against the sun, provide shade and produce energy.

Due to the fact that it is 100% recyclable, both the aluminium profile and the other items produced are sustainable. Therefore, the use of its derivatives in buildings contributes with greater use, competitive costs and still reduces the extraction of natural raw materials.

2.2 - Reynaers Aluminium

2.2.1 - History

In 1965, Jan Reynaers created an aluminium construction company in Duffel, Belgium. He produced Windows and doors using the Classic system, an aluminium system he had designed. This new high-quality system was easy to process, resulting in other aluminium joiners buying from him.

In 1973, after Jan Reynaers death, his family took over the company. Together with a team of creative employees, it further developed into a successful organization.

Currently the organizational structure of the Reynaers group is defined as follows:

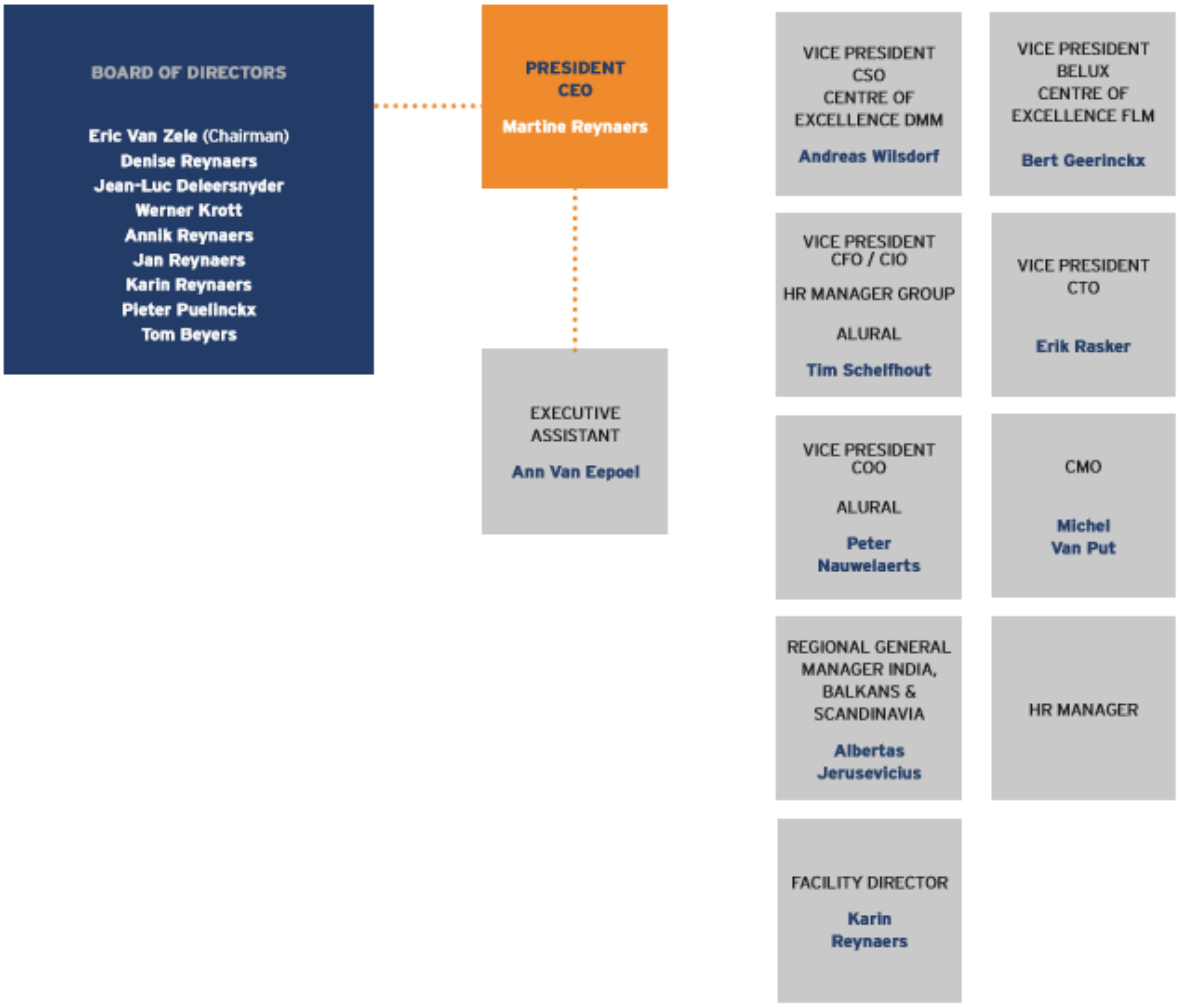

Figure 1- Organizational structure of the Reynaers group.

In the mid-70s energy-saving a thermal break insulation became important keywords. So, in 1978, Reynaers started developing a thermal break profile series.

Between 1980 and 1992 the company grew exponentially, taking as a starting point the success of its Thermo system.

After this successful start, Reynaers Aluminium started activities in Ireland and Germany. In 1985 a subsidiary was created in France and in 1989 it was the turn of the United Kingdom.

Exceptional export results were crowned with an “Export Oscar” presented by the Belgian Foreign Trade Service.

In the early 90s, Reynaers Aluminium headed east. After Poland, sales activities were launched in the Czech Republic, Hungary, the Baltic States, Romania, Russia and Ukraine.

Following the takeover, in 1993, of the Spanish system company Aluminos del Vàlles, the number of employees in the Reynaers group rose to 322. The same year, the company was one of the first companies in the building sector to receive the ISO 9001 quality certification.

In 1995, the company continued his expansion, opening several offices and subsidiaries in the east of Europe. In the same year a cooperation agreement was signed in China with the Donglin Group in Yingkou.

In 2003, the company launched the innovative CW 86 “cassette façade system”, the CR 120 conservatory system and BS shading systems. That year, they also opened a new office in Shanghai.

Between 2004 and 2015, Reynaers Aluminium entered a process of globalization, increasing its geographic expansion, opening offices and subsidiary’s all around the world, from Asia to Australia, from the Middle East to Africa, continuing with growth in Europe, coming in 2014 to the United States.

In 2016 Reynaers Aluminium made a huge investment in is headquarters in Duffel, increasing their operation center ERAP (before 2900m² and now 6000m²) and installed new machines as Aluroller X and Swift machine. Created a new accessories warehouse with 11.797m². They also have created an Experience Center consisting of a 3D experience room, AVALON. There was a complete renovation of the Training Center, the Automation Center and Tecnology Center.

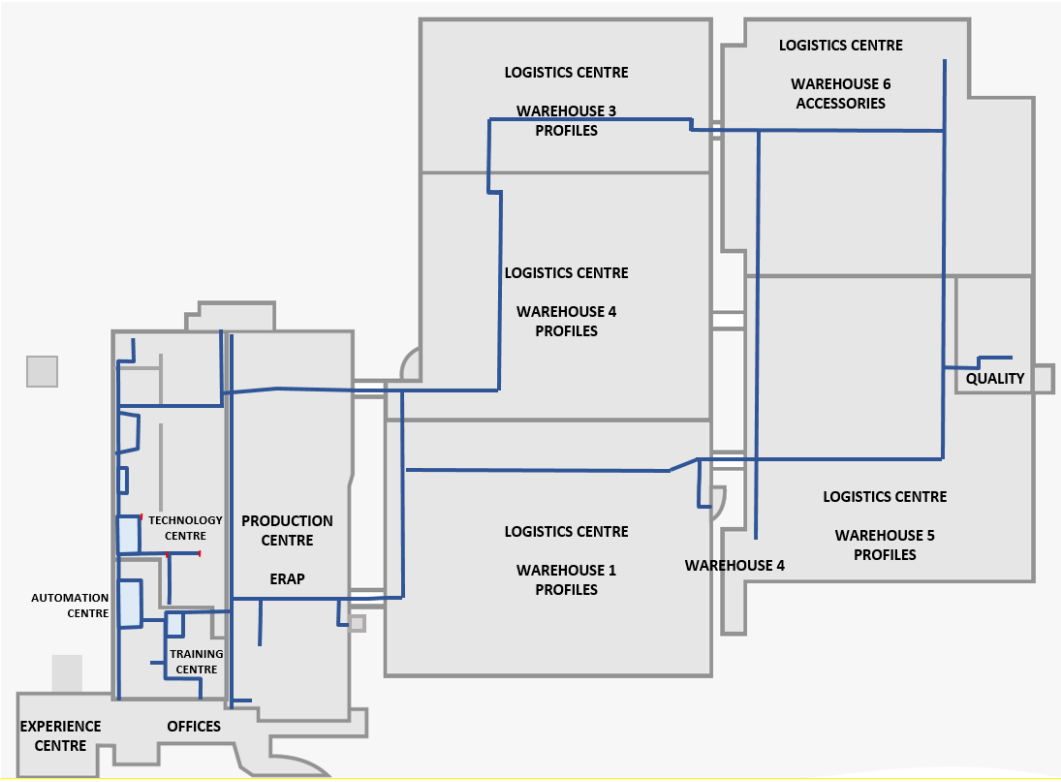

Figure 2- Layout of the company.

2.2.2 - Facts & Figures

Since 1965 the growth of the company has been steady and healthy until today and the result of that growth is the presence in over 40 countries and exports to more than 70 countries worldwide.

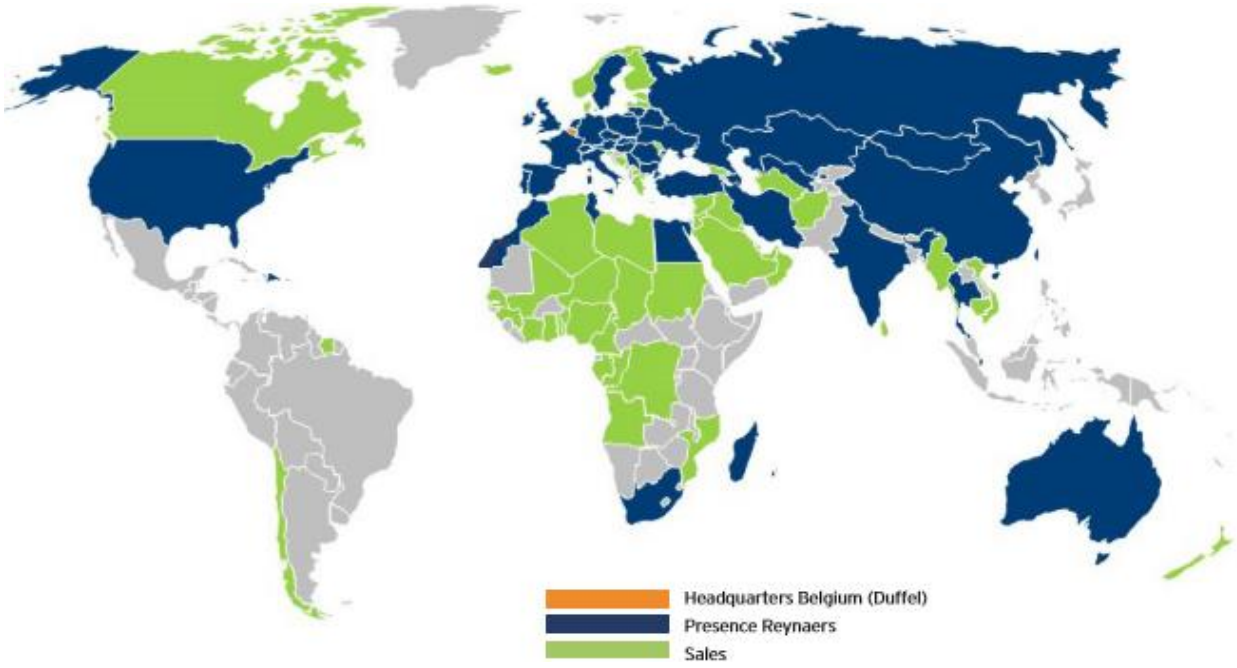

Figure 3- Presence of the company in the world.

The Reynaers group has experienced massive growth in the last 20 years. Having grown more than 200% over the last 10 years. Reynaers is considered by all players in the industry as one of the leaders in its business. In 2016 Reynaers group achieved a turnover of 387 million euros and has 1770 employees throughout the world.

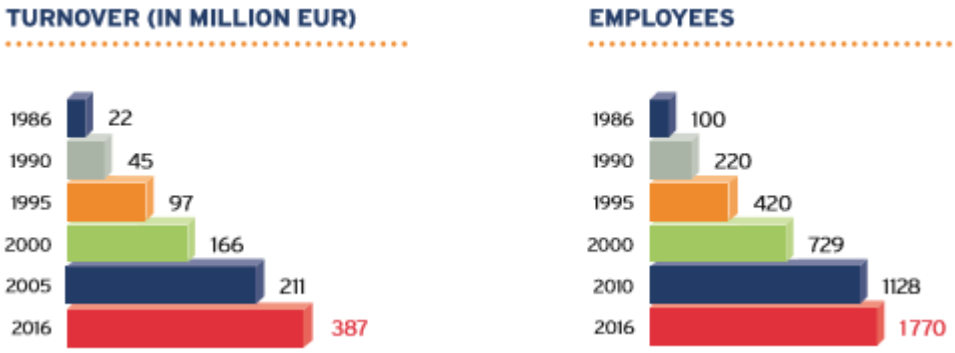

Figure 4- Turnover and employees of Reynaers Aluminium.

Below, a chart representing the contribution of different products to sales of the company.

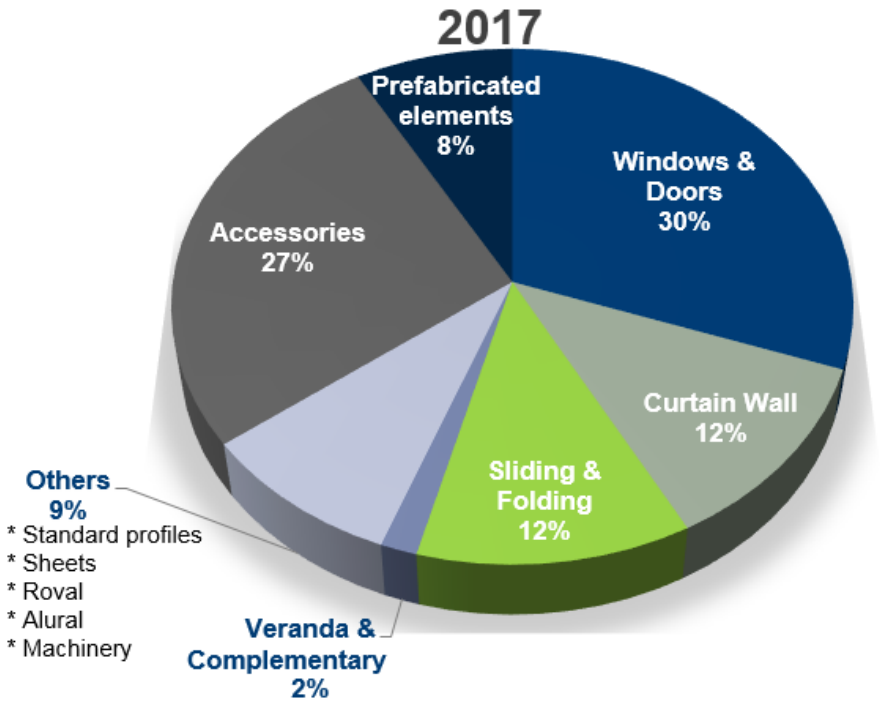

Figure 5- Contribution of different products to sales.

2.2.3 – Reynaers Activities

- Research and Development

Reynaers Aluminium puts enormous investment into research and development to maintain its position at the forefront of the industry. We work closely with architects and building contractors all over the world, developing systems and solutions for total facade construction – from the design concept through to manufacture and installation.

Reynaers Aluminium's high-performance window, door and curtain-walling systems are developed with the aim of enhancing the energy-efficiency, design, comfort, and safety of buildings. All our systems are all tested to the relevant standards for thermal performance, as well as air, wind and water tightness. The product range also includes specific fire-resistant, burglar-resistant and bulletproof solutions.

- Insulation and Surface Treatment

The insulation of aluminium profiles requires a lot of know-how and experience. In order to ensure the highest quality, Reynaers created its own insulation company, ERAP. For the surface treatment of the profiles we collaborate with selected painting companies that strictly adhere to our standards and regulations.

- Logistics

Our customers benefit from our strong logistics organization, which enables us to quickly deliver products from our various distribution centres worldwide.

Figure 6- Logistics of the company.

2.2.4 - Reynaers Institute

Since the company's creation in 1965, Reynaers Aluminium has been playing a leading role in the construction industry. Its profile systems have evolved from aesthetic modules to state-of-the-art building components.

In order to optimally meet the requirements of the international building market, Reynaers Aluminium always teams up innovative ideas with the most current processing methods, resulting in a board standard system range: windows & doors, sliding systems, curtains walls, sunscreening, conservatories, BIPV (Building Integrated Photovoltaïcs) and complementary systems. For specifics projects, their dedicated project department develops tailor-made solutions to perfectly match the desired requirements.

To facilitate all of this, the Reynaers Institute was established in 2004. This unique institute focusses on sharing the know-how and experience with architects, fabricators, contractors and other building partners. Moreover, the Reynaers Institute provides the following services to its partners:

- Training centre

Figure 7- Training centre.

- Automation centre

Figure 8- Automation centre.

- Test centre

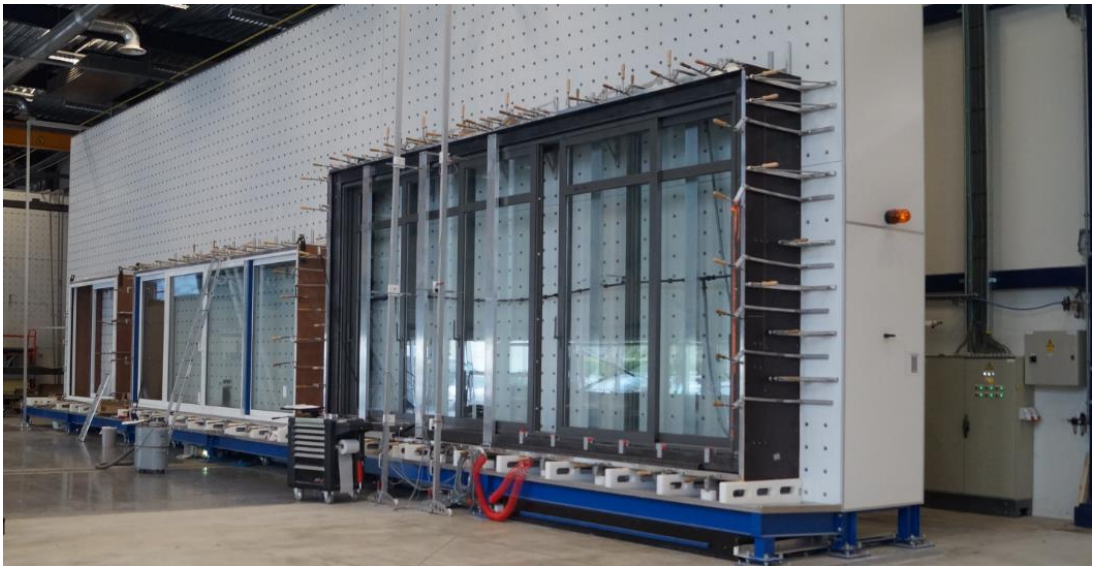

Figure 9- Test centre.

The Reynaers Institute is much more than just a building. It is a state of mind and a permanent incentive to implement core values such as partnerships and innovation. It is an international communication forum and a source of inspiration for all those involved in the building process.

2.2.4 - Types of product and portfolio

Reynaers Aluminium as previously mentioned is a leading supplier of innovative and durable aluminium joinery systems for the construction industry at European level. Reynaers profiles are transformed into windows, doors, facade systems, sliding elements, sun protection and conservatories.

There are numerous ranges in constant evolution for the manufacture of the different products that are part of the portfolio of Reynaers Aluminium, so below are mentioned only the most wanted.

For doors and windows, the Concept System range is nowadays a reference and a very complete range. The Concept Systems are designated by the letters CS, followed by a number (e.g. CS77), which means, in millimeters, the depth of fit of the profile. The bigger the depth of fit the better the insulation of the profile of the window or the door.

Figure 10- Example CS77 - Narvil Hotel, Serock Poland.

The Slim Line (SL38) system from Reynaers Aluminium is a specific system of ultra-thin profiles for the construction of doors and windows in ultra-thin aluminium.

Figure 11- Example SL38 - The One Charles de Gaulle, Romania.

Masterline 10 is the window system of the future, its profiles will be available on all levels of insulation and with different designs. This system will be available in 2018.

All CS and SL series systems are available in different styles and with more than four hundred RAL colors.

Figure 12- RAL colors.

For the sliding elements, there is the Concept Patio (CP) range, which includes numerous sliding systems developed for new constructions and also suitable for renovation projects. All systems in the CP range are available in several configurations: monorail, birail and trirail.

Figure 13- Example CP - Transparent Home, Portland USA.

Hi-Finity is Reynaers Aluminium's most minimalistic sliding system. All profiles are completely hidden on the floor and inside the walls allowing for transparent surfaces and incredibly thin designs.

Figure 14- Example Hi-Finity - Modern woodland villa, Voorschoten Netherlands.

For these sliding systems Reynaers Aluminium offers the possibility of including an electrical system allowing greater convenience and ease of access for people with reduced mobility.

Facade systems are increasingly being used in modern buildings. They are generally used in projects of large office buildings but also in family homes with large glass surfaces. Concept Wall systems (CW) are the specifics for this type of facades being also available in different finishes and colors.

The facade systems allow to create walls of glass and large open spaces.

These systems in combination with super-insulated glass, with an efficient sun protection, can favorably influence energy consumption. It can keep the heat during the winter months and the mild temperature on sunny summer days.

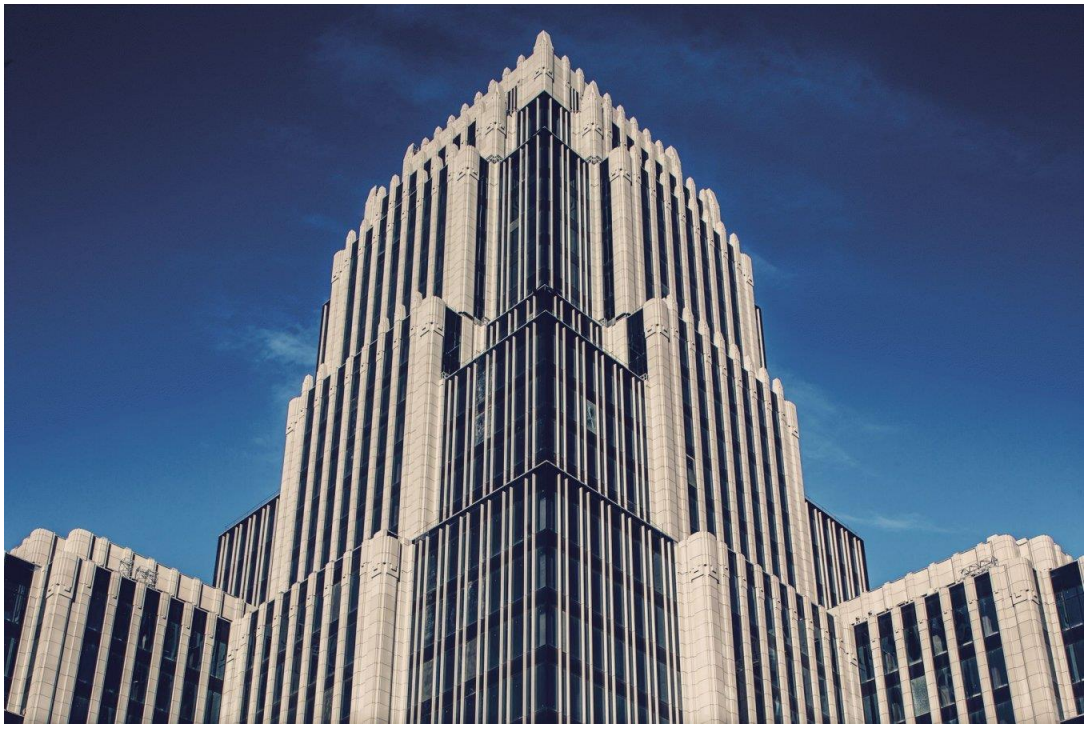

Figure 15- Example CW - Monumental art deco style, center of Moscow.

The Concept Roof (CR) range from Reynaers Aluminium is made up of specially designed profiles for the manufacture of custom-made conservatories.

Reynaers Aluminium has a team specializing in the development of conservatories, ranging from concept to finish of profiles. The profiles of the CR120 have special insulation, the profiles are super insulating and possible to combine with double or triple glass, ensuring a high thermal and acoustic insulation. This thermal calculation is very important and often overlooked and when it is cold, it is frequently possible to observe condensation in the metal sections of the conservatory, even when they have a thermal break. Another very important aspect according to SNAF (SNFA is the representative professional organization of designers, manufacturers and installers specialized in exterior joinery made of aluminum profiles in France) is the ventilation of the conservatory, to prevent condensation.

The profiles Reynaers Aluminium are also created based on European standards, like the European standards EN 573-3 "Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition and form of products", but sometimes some profiles are also specific are created for each market.

However, all the profiles are possible to fully match the profiles of the other ranges available on Reynaers Aluminium, such as doors, windows, sliding windows and even the Hi-Finity range. The CR120 is also available in different styles: *Renaissance* or *Orangerie*, to better adapt to the existing construction type.

Figure 16- Example CR120.

To help visualize this system and possible variants Reynaers Aluminium has an online tool where customers can "create" their structure corresponding to their expectations and desires.

Figure 17- Online Veranda Configurator.

Each of the different ranges has available a catalog where all the information about the range is gathered: profiles available, assembly and respective cuts, accessories used in the specific range.

Within all ranges offered by Reynaers Aluminium, this work will focus especially on the conservatories.

Chapter 3

The project

3.1 - Introduction

A conservatory offers numerous advantages. The main one is the creation of an additional space in the house that can be used as an office, a living room, or even a kitchen.

The according with SNFA an "veranda designates a room of a dwelling whose origins are found in India and the Far East and whose walls are largely glazed."

In countries such as France, Belgium or Switzerland, the construction price per m² is too high, leading people to turn to other less expensive solutions such as conservatories. Besides being cheaper is not needed so much work installation / construction, making it ideal both in terms of price and time level of manufacture and installation.

However, for the construction of a conservatory it is also essential to respect the national and regional laws of urbanism. It is necessary to have an authorization for works, to be in accordance with the local urban planning, with coefficient of occupation of the ground and with the civil code. For example, for the French market, the *menuiserie* companies must follow the rules of SNFA.

Apart from these advantages, the conservatories end with the boundaries between the interior and exterior of the house, allowing you to enjoy the space with plenty of light and overlooking the garden, both in summer and winter, creating the illusion of being in the exterior.

The conservatory can be created with different styles and shapes and Reynaers Aluminium for the CR120 range has so far available eleven base models that are possible to adapt to the space available for construction.

Each model has a different name that matches the name of flowers in French. Below there is a figure with the models available and their names.

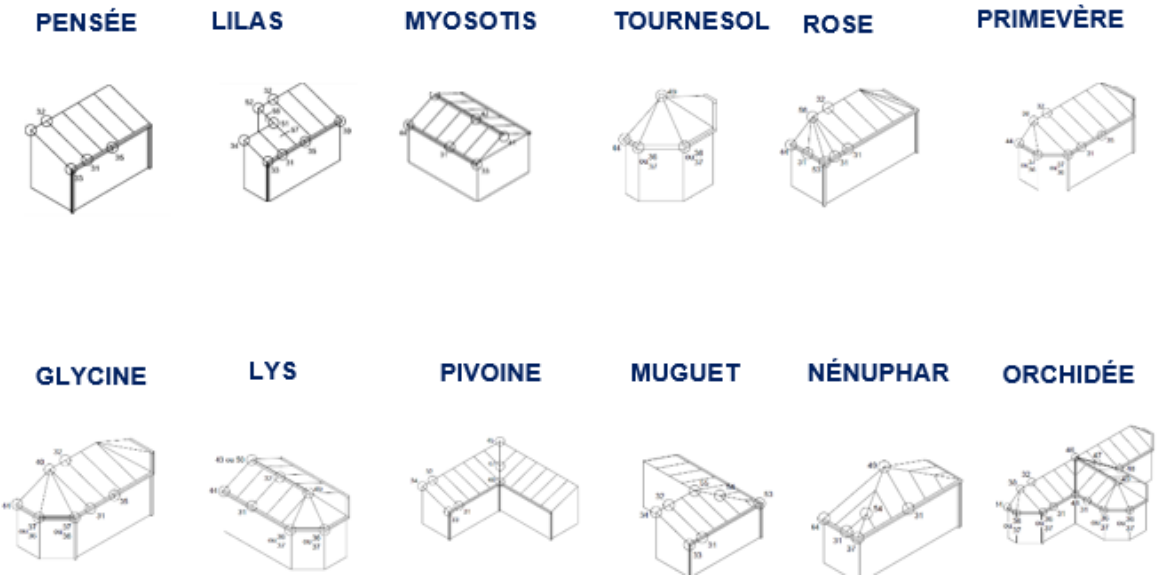

Figure 18- Models CR120.

To calculate a conservatory, Reynaers Aluminium uses a specific software called Cover, made available by the Cover Group company.

It is a Belgian company specializing in 3D computing whose focus is exclusively on the development and distribution of the Cover program in the business world of the *menuiserie*.

Cover is an application for the *menuiserie* companies of aluminium and PVC. It is available in two versions, one commercial version and a manufacturing version.

Both versions have multiple standard functionalities, such as the management of an order, customers or suppliers.

However, the commercial version has not included the necessary and correct dimensions and cuts for the construction of a conservatory. This is why the license required is cheaper and that Reynaers Aluminium makes available for demonstrations to customers for a better understanding of the program and the range.

Being that in the version of manufacture are available all the necessary information for the total construction of a conservatory.

It is in this version that lies the main focus of my work, to provide a correct database to customers.

In addition to the correct dimensions and cuts, Cover offers material optimization; this is available in different languages and automatically provides technical and analytical documents such as:

- Commercial report;
- Manufacturing order;
- Cutting list;
- Sections and assembly drawings;
- Order note;
- Static calculation;
- Thermic calculation.

In Cover it is also possible to calculate the stability and do a thermal analysis of the structure for different countries. It is also possible to integrate a photograph of the house where the conservatory will be attached or include furniture.

Figure 19- Example of an integration of a conservatory.

Following the completion of this project which consisted of the integration of all CR120 range database, customers have an immediate result from their conservatory.

With Cover it is possible to choose from the model that they want, and that are available in the model library, until the basic choice of different profiles and their respective colors. All this is possible to visualize in 3D in a detailed and precise way.

For this project to be possible, different stages were defined:

1. Basic training of the program;
2. Study of the different components constituting a conservatory;

3. Creation of a guide / bible with the choices for the different options;
4. Elaboration of the Reynaers library
5. Parametrization of the models in the Cover;
6. Test and correction in parameterization and providing the database to customers for different countries;
7. Corrections and customer support, training;

In the following chapters we find the different stages detailed.

3.2 - Stages of the project

3.2.1 - Practical training of the program

This training was divided into two parts. The first one took place the second week I started the project and it was five days to learn how the program worked and the first steps of how to parameterize Cover XLib.

After this training, the next two months consisted of practicing in the program and beginning to parameterize the main bars.

The second part of the training took place after these two months, having another five days to clarify doubts so far and to learn / discuss complicated situations.

These trainings took place at the company's program in Belgium.

Apart from these formations, the existence of a remote siege was agreed upon for questions that might arise.

3.2.2 - Different components of a conservatory

We can say in a general way that a conservatory is divided into three important parts:

1. Roof profiles

The choices of these profiles depend on several criteria:

- Dimension and shape of the structure;
- Type of glass and its weight per m²;

- Region of installation due to exposure to wind and snow;

The roof profiles include the rafters, the wall connection profiles and the lateral rafters.

2. The Gutters

Gutters allow the evacuation of rainwater and support the roof profiles and also determines the final appearance of the conservatory.

3. The Posts

All the profiles of the structure of a conservatory of Reynaers Aluminium have thermal rupture (the inner and outer profiles are separated by the interposition of an insulating layer in polyamide).

The posts allow the realization of joints at 90 degrees, 135 degrees or variable angles. They are also important because they allow the integration of a water descents and improve the aesthetic aspect of the conservatory.

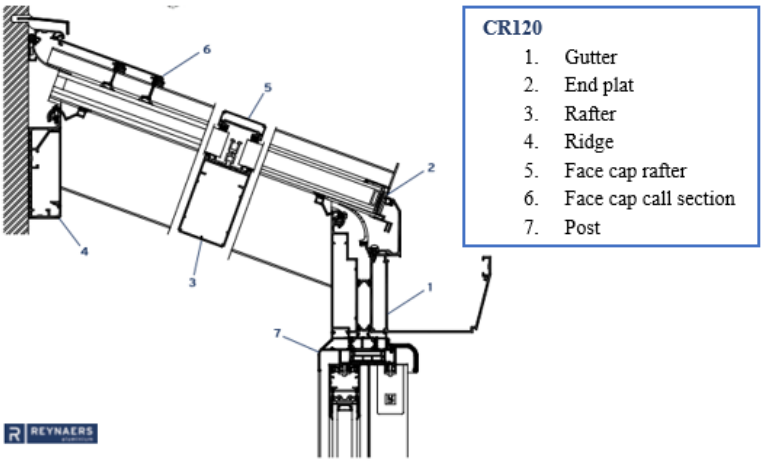

Figure 20- CR120 profiles.

Examples of all components are given in Annex I.

For a better understanding of how the assembly works and the connection between the profiles, a practical training was done where the *Pensées* model was assembled with an attic window.

Below are some images of the different stages of formation.

Figure 21- Images of the formation.

3.2.3 - Creating the guide

The guide was created based on catalog CR120 and was divided into different groups:

- Group A – Rafter;
- Group B – Gutters;
- Group C – Wall Connections;

- Group D – Lateral Profiles
- Group E - Post

The CR120 catalog is divided into 5 types of assembly, of which only 3 types have been selected for this project. The differences between the types of assembly relate to the connections between the rafters and the wall profiles and the different rafter's choices. These differences will be explained in the different groups below.

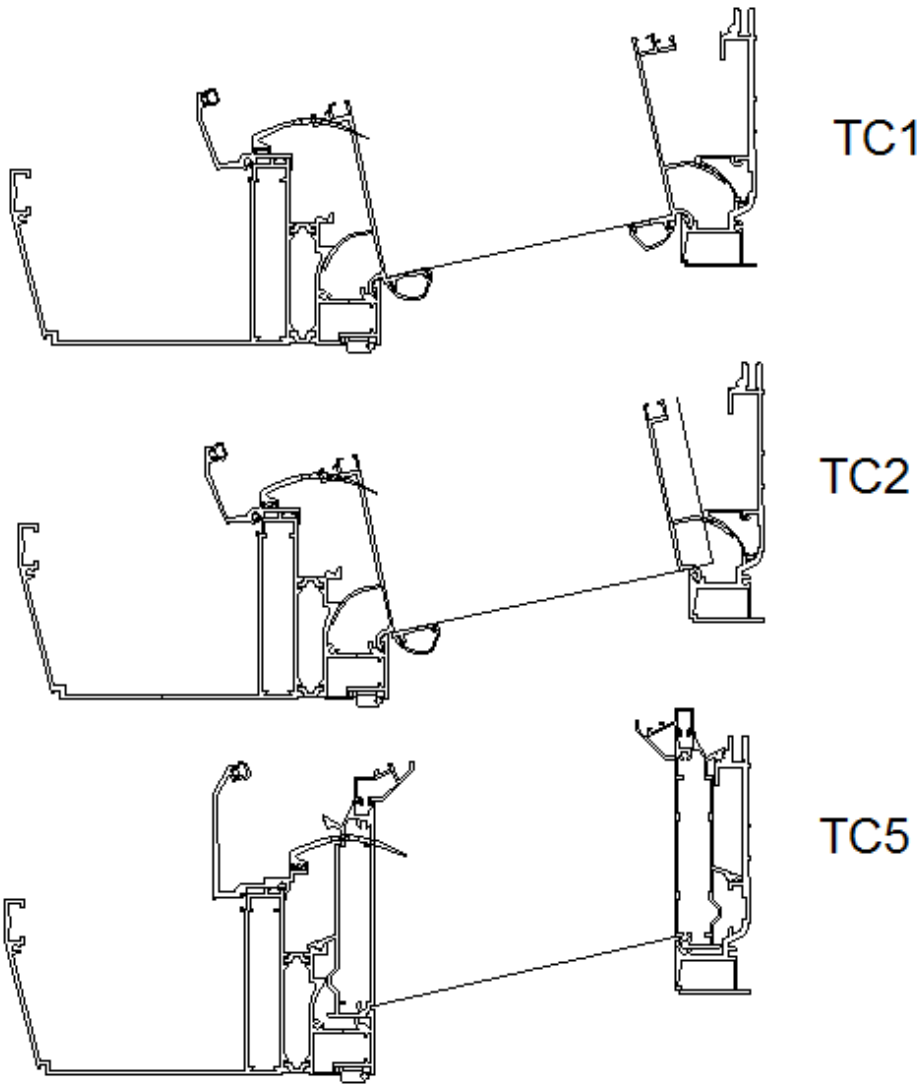

Figure 22- Types of assembly.

Group A consists of the rafter's choices, depending on the type of assembly:

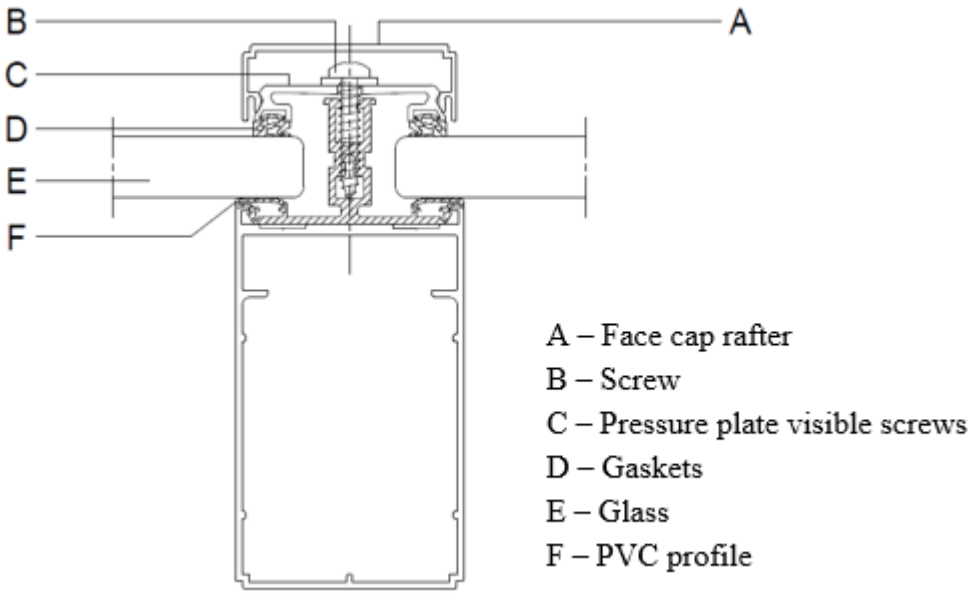

Figure 23- Rafter cut.

In Type 1 it is possible to use the following references:

1. 007.0800
2. 007.0814
3. 007.0815
4. 007.0813
5. 007.0797
6. 007.0803
7. 007.0810
8. 007.0798

In type 2 it is possible to use all previous ones except reference 8. (007.0798).

In these two types of assembly the rafters don't need to have an exact cut in the connection with the wall, that is, very important in case of having an irregular wall.

In type 5 it is necessary that the rafter have an exact cut since they are connected to the wall profiles through an accessory which requires an exact dimension. in addition to this difference, in type 5 are included three possibilities beyond the rafters that are stipulated in type 1:

1. 007.0802
2. 007.0817
3. 007.0799

These three rafters allow to support a larger weight of glass, that is, they are more resistant than the previous ones. Here is an image with the different rafters and the respective types of assembly:

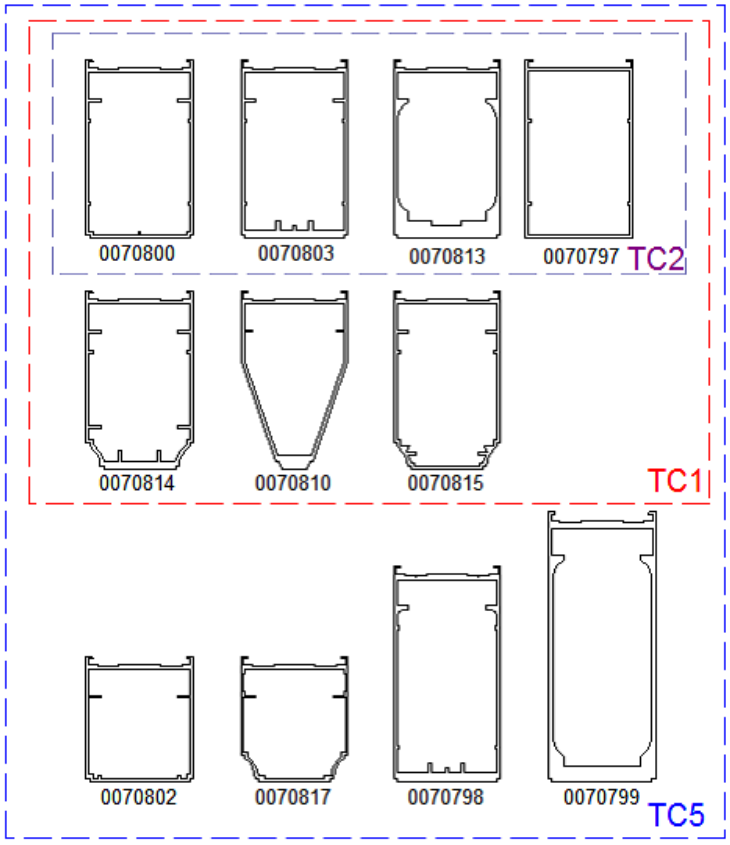

Figure 24- Different types of rafters.

In addition to the references presented earlier, the rafter is composed of two more parts:

The central part made of PVC in which there are two options:

1. 007.0804 - which already includes the gaskets;
2. 007.0805 - more gaskets, the choice of these gaskets depends on the thickness of the glass, as can be seen in the following table:

Table 1- Gaskets rafters.

THICKNESS (mm)	GASKETS
24	080.9741
26	080.9740
28	080.9740
30	080.9740
32	080.9742
>32	080.9742

The top where there are 4 options:

1. 007.0801 + 034.1060 + 080.9114
2. 007.0811 + 034.1060 + 080.9114
3. 007.0816 + 034.1060 + 080.9114
4. 0809560

As we can see in the figure below:

Figure 25- Cover rafter profile.

In this group, there is still another option, the possibility of using steel reinforcements inside the rafter's profiles, and there are four references available:

1. 0S0.8015 (80x15)
2. 0S8.0405 (80x40x5)
3. 0S8.0403 (80x40x3)
4. 0S7.0503 (70x50x3)

These reinforcements are used when the structure is oversized or when the snow or wind load is too great.

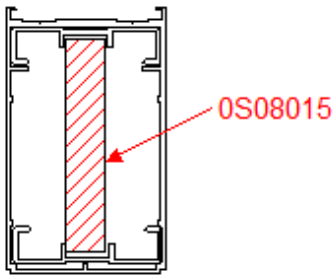

Figure 26- Example reinforcement.

It is also important to mention that the created models are not possible to do in all types of construction. Only the *Pensées*, *Lilas* and *Myosotis* models are possible to create in the three types, all the others as they are more complex they require exact dimensions in the different bars with no margin of error.

The next group, **group B**, concerns the choice of gutters.

There are seven options with different combinations of raising, as we can see in the following image.

PROFIEL PROFILE PROFILE PROFIL		OPZETPROFIEL PROFILE AUXILIAIRE AUXILIARY PROFILE ZUSATZPROFIL				
		007.0869.XX	007.0882.XX	007.0883.XX	007.0896.XX	-
	007.0880.XX	-	071.6843.04 071.6844.XX	071.6846.04 071.6847.XX	071.6764.04 071.6765.XX	071.7025.04 071.7019.XX
	007.0878.XX 007.0879.XX 07.0880.XX	-	071.6843.04 071.6844.XX	071.6846.04 071.6847.XX	071.6764.04 071.6765.XX	071.7025.04 071.7019.XX
	007.0889.XX 007.0879.XX 07.0880.XX	071.6758.04 071.6759.XX	-	-	-	071.6755.04 071.6756.XX
	007.0875.XX 007.0873.XX 007.0872.XX 007.0874.XX	-	071.6741.XX	071.6744.XX	-	-
	007.0897.XX	071.6758.04 071.6759.XX	-	-	-	071.6755.04 071.6756.XX
	007.0862.XX	-	-	-	-	071.6761.04 071.6762.XX
	007.0876.XX	-	071.6843.04 071.6844.XX	071.6846.04 071.6847.XX	071.6764.04 071.6765.XX	071.7025.04 071.7019.XX

Figure 27- Overview end piece gutter,

The raising profiles are used to provide different designs to the conservatory.

To support the glass, the gutter still has two extra profiles:

1. 007.1894 + 080.9452

Here is an example of a 2D cut of an assembly of a gutter.

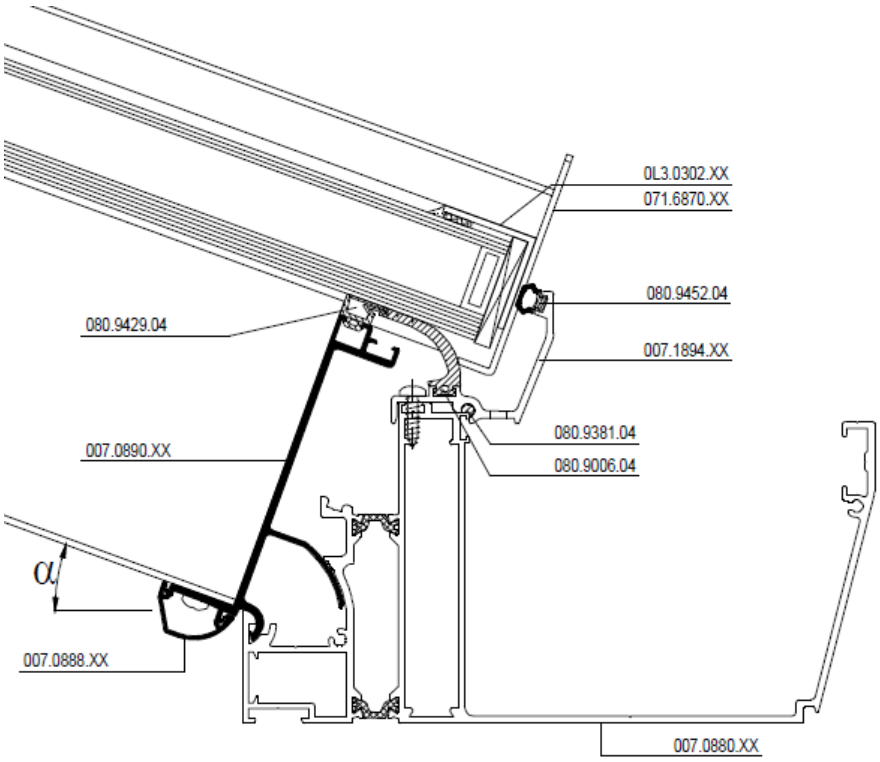

Figure 28- Section gutter.

Group C concerns the connections to the Wall.

For type 1 we have three references available:

1. 007.1828
2. 007.1824
3. 007.1823

The last one is also used in construction type 2.

The profiles that allow to assist the angle of inclination and the different thicknesses of glasses are called rafter holder. In the following table we find the references used according to the angle of inclination and the type of construction.

Table 2- Profiles used with different inclination.

	5° to 28°	28° to 45°
Type 1	007.0890 + 007.0899	007.0891 + 007.0898
Type 2	007.0892 + 007.0899	007.0891 + 007.0898

For Cover profiles there are two options being 007.1821 + 080.9426 + 007.0888 the first, as can be seen in the following image.

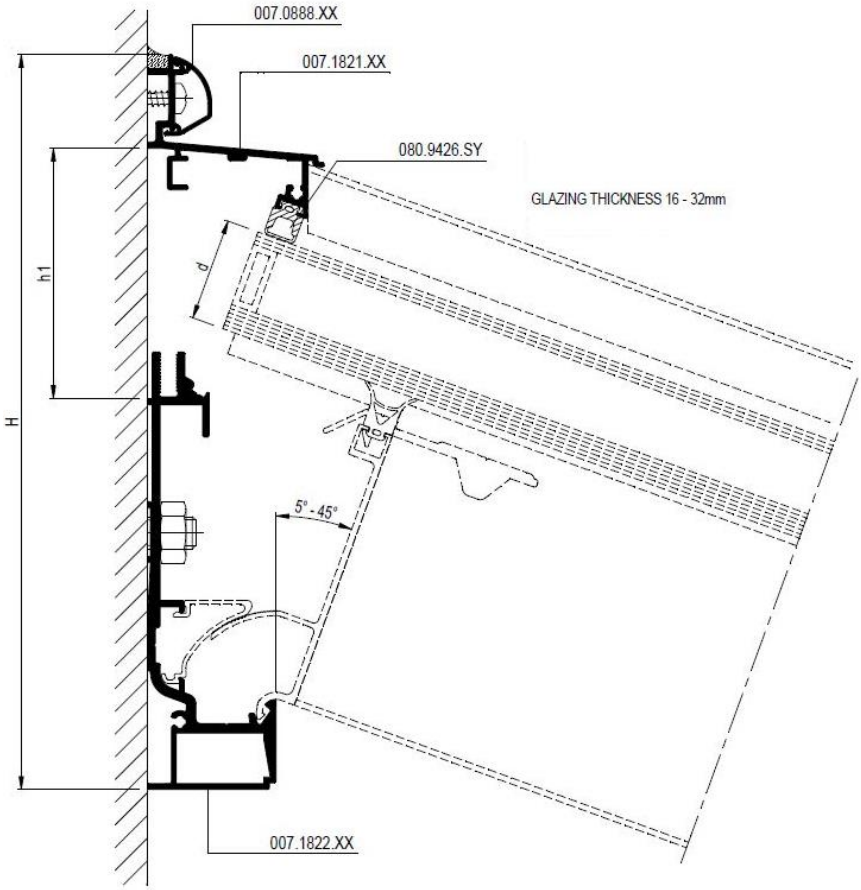

Figure 29- Wall section, 007.1821.

In this option, both profiles are fixed directly to the wall. In the following option - 007.1820 + 080.9005 you need a spacer to connect the bottom to the top (cover), as we can see in the following image.

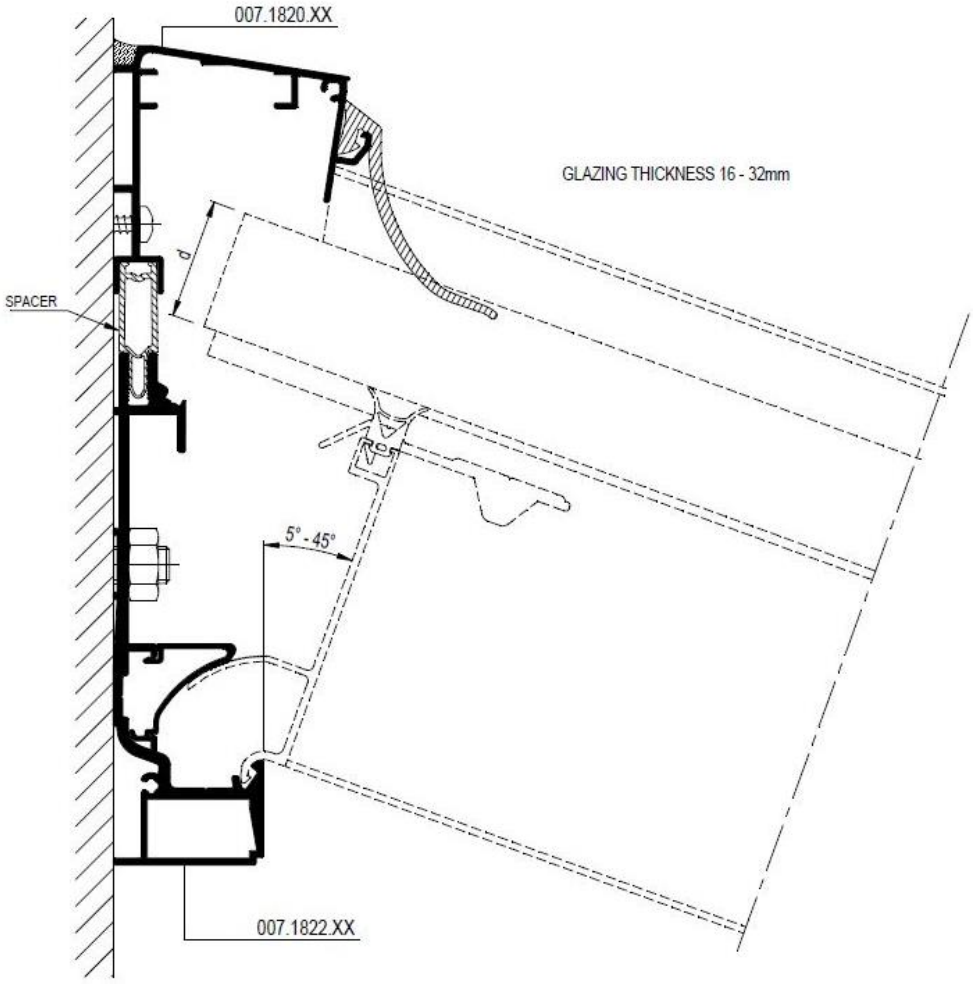

Figure 30- Wall section, 007.1820.

The choice of which spacer to use is dependent on the thickness of the glass being used and the slope of the same, for it was necessary to create the following tables.

Table 3 - Wall spacer.

	d=16mm	d=20mm	d=24mm	d=32mm
SPACER				
5˚	034.0073	034.0073	034.0073	034.0074
10˚	034.0071	034.0072	034.0072	034.0074
15˚	034.0072	034.0071	034.0072	034.0074
20˚	034.0071	034.0072	034.0073	034.0074
25˚	034.0070	034.0070	034.0071	034.0073
30˚	034.0070	034.0071	034.0072	034.0074
35˚	034.0071	034.0072	034.0074	034.0076
40˚	034.0073	034.0074	034.0076	034.0071+034.0107
45˚	034.0076	034.0070+034.0107	034.0071+034.0107	034.0071+034.0107

Group D consists of the lateral profiles that connect the roof and the lateral parts that refer to the used windows and doors.

As noted above, a CS77 range means that the window thickness is 77mm. Thus, the profiles of connection to the windows depend on the thickness used, being next a table with the used references, depending on the thickness of the windows.

Table 4- Edge profiles.

	59	68	77
Lower part	007.0825	007.0826	007.0827
Upper part (Cover profile)	007.0831 + 034.1060 + 080.9114	007.0816 + 034.1060 + 080.9114	007.0811 + 034.1060 + 080.9114

The PVC profiles that support the glass, as in the case of the rafter, have two options:

1. 007.0806 - with gaskets included;
2. 007.0807 - for different glass thicknesses, with different gaskets (the same ones used in the rafter);

Like the gutter, there are two profiles of finishing, merely checking external design to the conservatory, being:

1. 007.829
2. 007.830

In the following image are two examples of assembly:

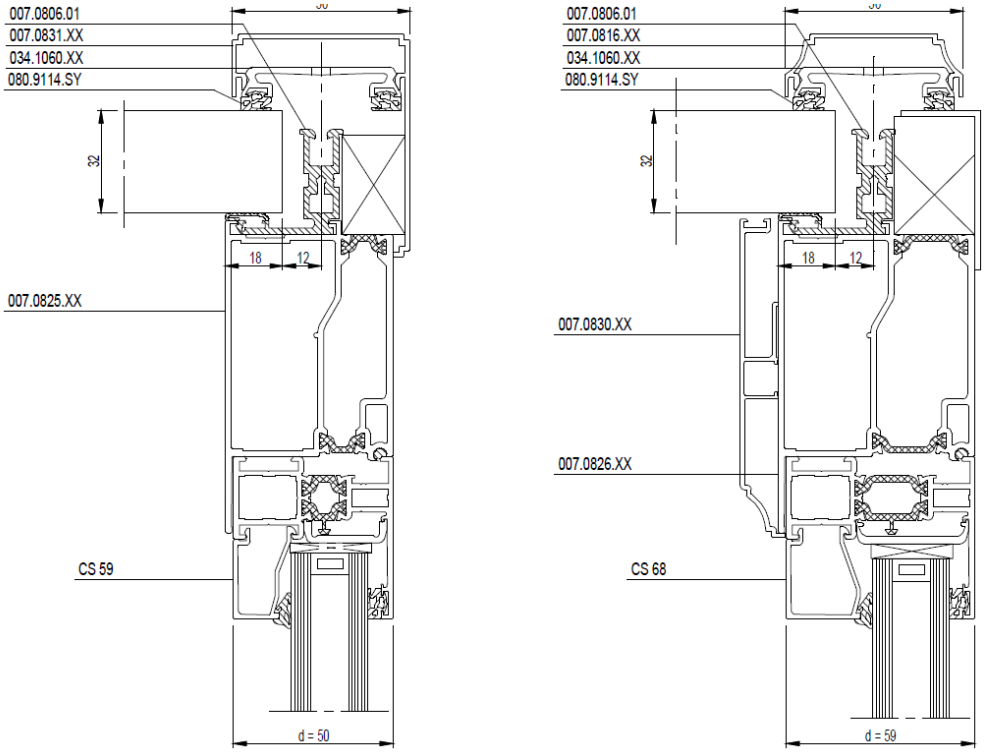

Figure 31- Edge section.

In case the conservatory is fixed laterally to a wall, the profiles used in the upper part are different, the correct references being: 007.0801 + 034.1060 + 080.9114 and in the lower part the references of the rafters are used, as we can see in the following image**.**

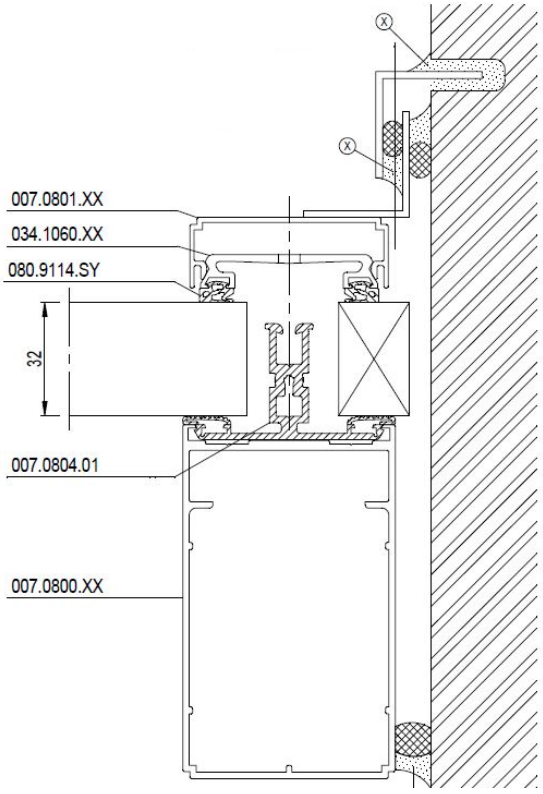

Figure 32- Edge section against the wall.

Finally, the last group, **group E**, concerns the posts, we have three options for 90° links:

1. 007.0550
2. 007.0905
3. 007.0870
4. 008.3132+008.3897
5. 008.3132+007.0936

With the option to include or not water descents, if the customer does not want or is not required in all pillars, there is a right profile only to cover the previous profiles, 043.1010. To use water descents there are two references in which the only difference is the design, 007.0845 and 007.0847.

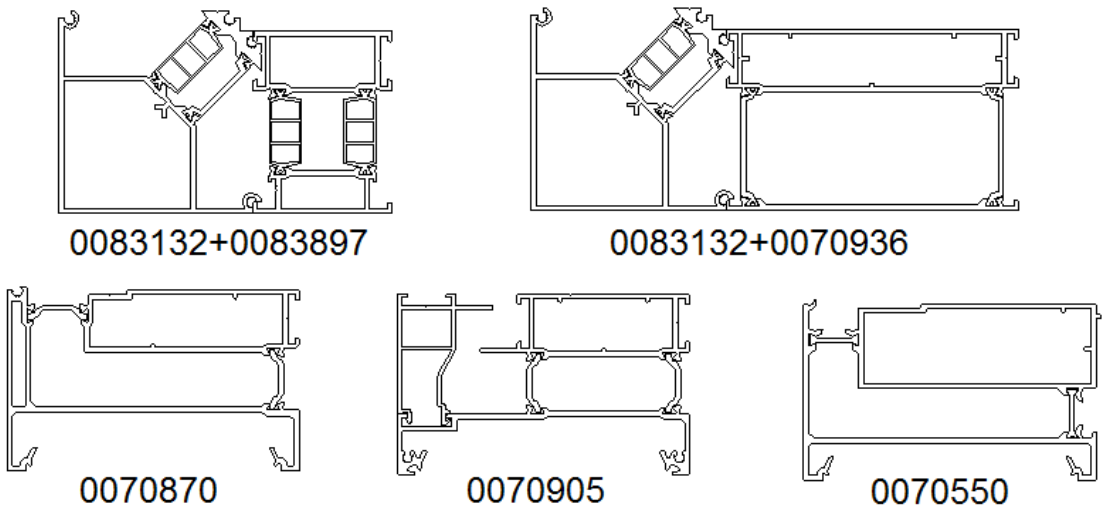

Figure 33- Posts options.

In the following image is an example of assembly:

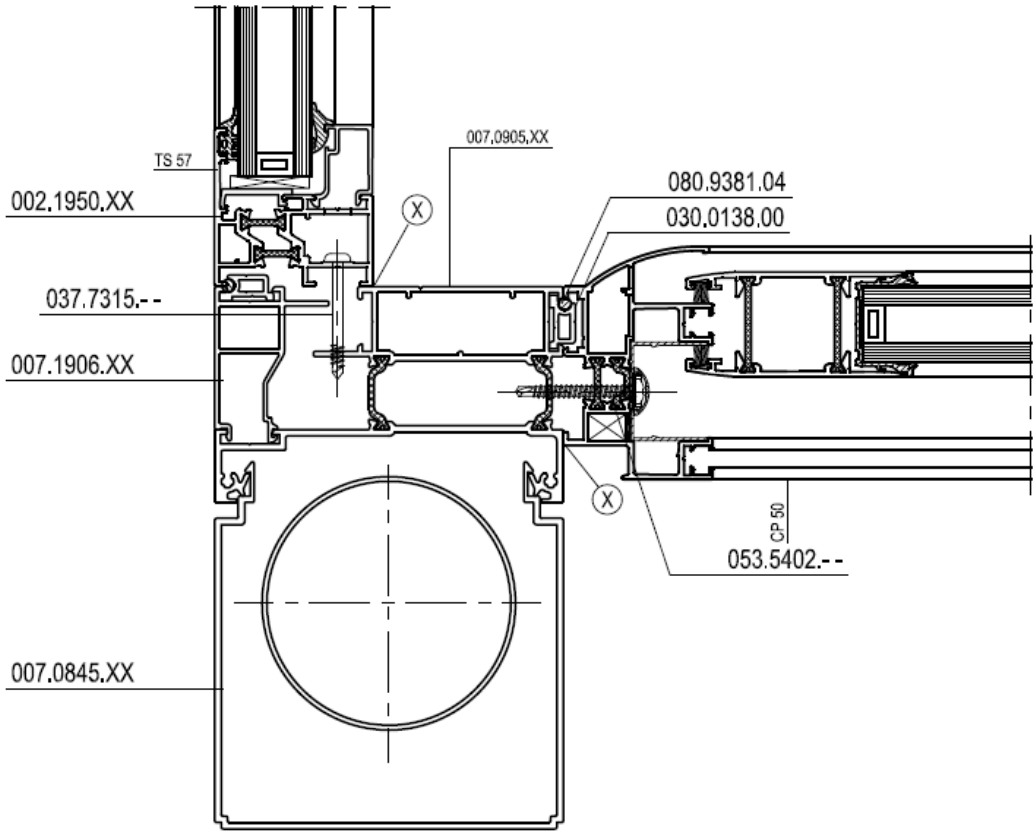

Figure 34- Posts section.

3.2.4 - Elaboration of the Reynaers library

As shown in the beginning of this chapter, 12 models were chosen to be part of the library provided by Reynaers Aluminium. Each of these models was sub-divided into variants of the original.

In the following table we can find all models. You can also find the respective images of the sub-models in Annex II.

Table 5- Sub-model.

Model	Sub-model
Pensées	Pensées-base
	Right side wall
	Left side wall
	Right partial wall
	Left partial wall

Lilas	Left front panel
	Right front panel
	Left wall removal
	Right wall removal
Rose	Rose-base
	Rose-base-with 1 rafter
	Rose-base-with 2 rafter
Primevère	Primevère-base
	Primevère-base-with 1 rafter
	Primevère-base-with 2 rafter
Glycine	Glycine-base
	Glycine-base-with 1 rafter
	Glycine-base-with 2 rafter
Myosotis	Myosotis-base
Pivoine	Pivoine model L
	Pivoine model U
Muguet	Muguet model L
	Muguet model U
Nénuphar	Nénuphar-base
Tournesol	Tournesol- with 3 rafters
	Tournesol- with 4 rafters
	Tournesol- with 5 rafters
	Tournesol- with 6 rafters
Lys	4 rafters
	5 rafters
	6 rafters
	7 rafters
Orchidée	Orchidée-base
	Orchidée-model B
	Orchidée-model C
	Orchidée-model D

Each of these models was designed in the program and allows the user to change the measures as the height and width of the structure (e.g. figure 34) without having to create a drawing each time it needs to make a new project, allowing him to save time.

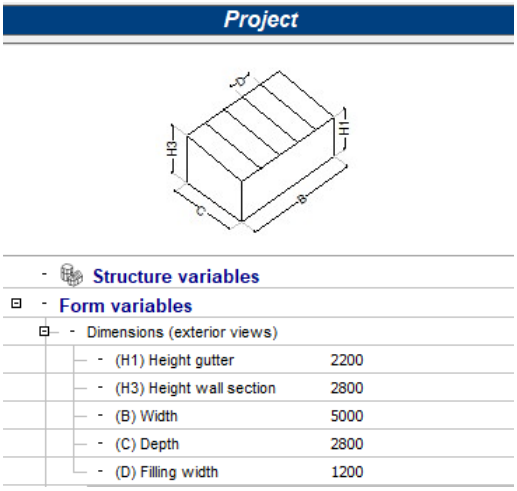

Figure 35- Scheduled model.

It is important to point out that each project is unique, and it is not always possible to use the standard models and it is necessary to do it from scratch or make small changes.

3.2.5 - Parametrization of the models in the Cover

After the models were created, XLib was used to parameterize each bar and its connections. In this sub-chapter the method used is described using a specific example of each step.

Correction of the drawings

The first step is to collect all the necessary profiles in AutoCad in a way of "cleaning it up", leaving only the most important (e.g. Annex III).

Later it is necessary to import the profiles to XLib. In the XLib exist a tool to manipulate 2D drawings.

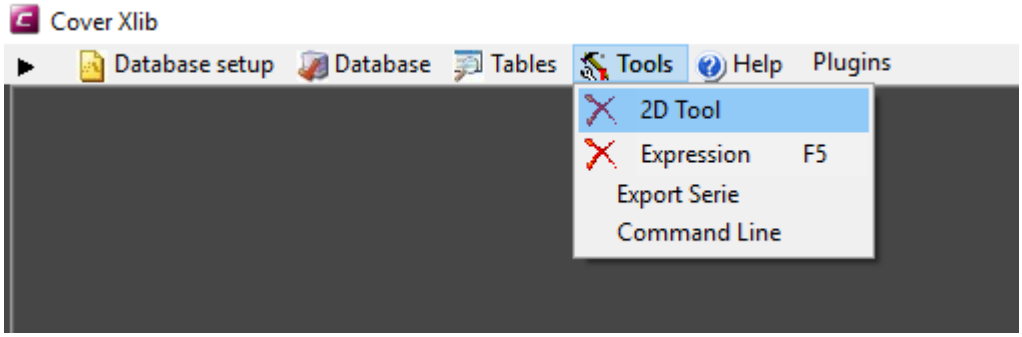

Figure 36- Tool to manipulate 2D drawings.

This step is very important to convert the files *.dxf in *.X2D, because the program doesn't recognize the file format *.dxf.

After import the drawing, there is a set of necessary steps to follow:

1) Ungroup the profile;
2) Give thickness to the section with tab segments in polygon (press entered several times);
3) Property Menu Insert Level 0 for Detailed Profile and Level 1 for Simplified;
4) Put the simplified profile on the detailed profile (with the move button);
5) Save the file in the X2D folder (ex: cover / xlib / providers / reynaers ../ X2D).

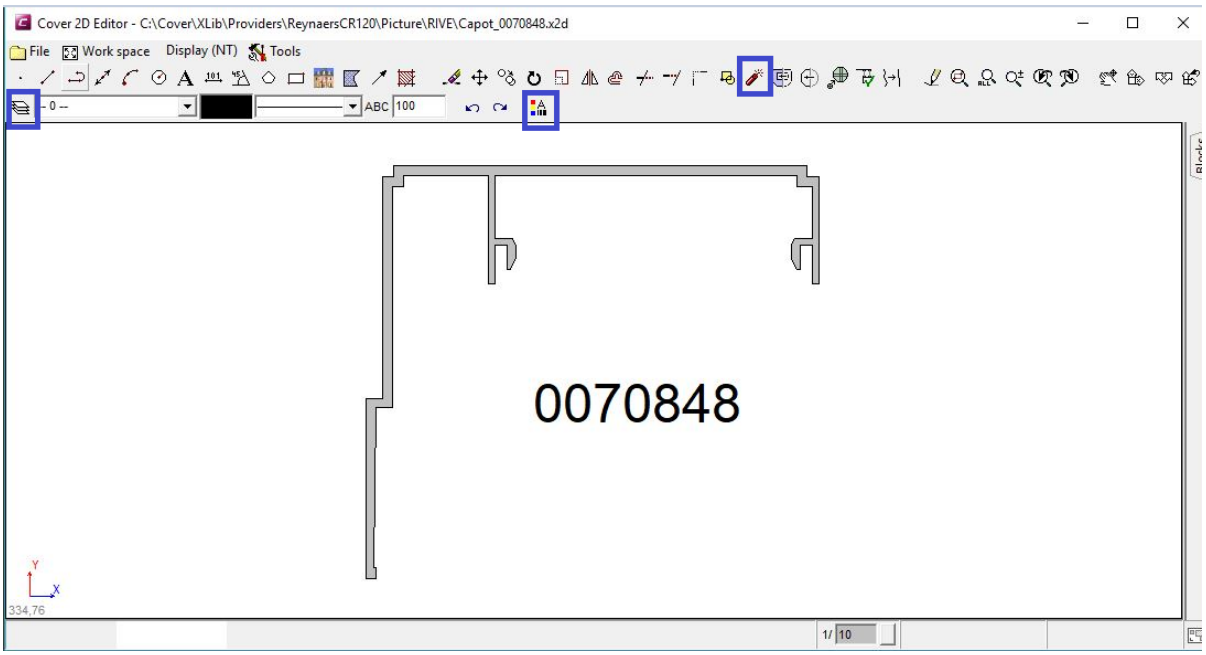

Figure 37- Tool to manipulate 2D drawings.

After having all drawing in the same format *.X2D, it's necessary to create the XLib sections. These are the drawings that will show up in Cover.

Creation of the sections

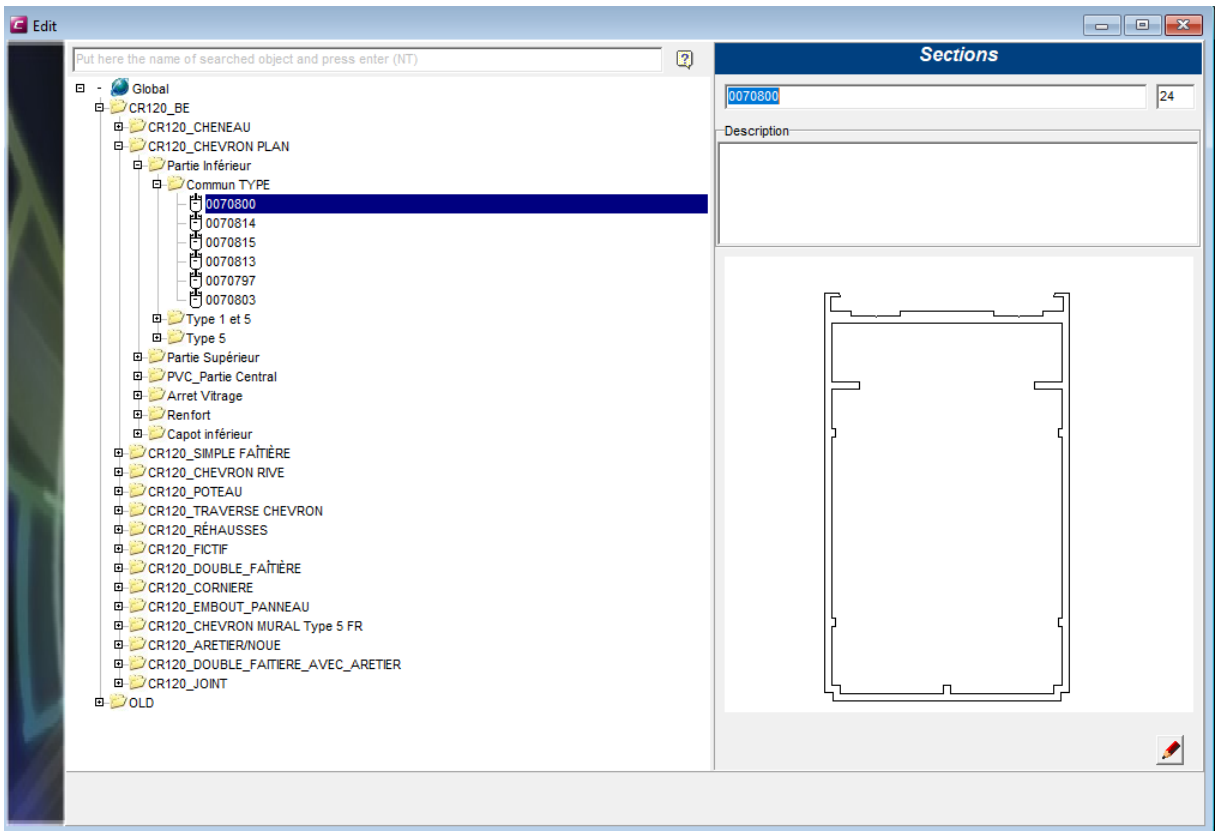

Figure 38- XLib sections.

1) Create a group;
2) Create an object -> click on pencil and open the X2D;
3) Import both normal and simplify sections, in CR120 was used the same drawings;
4) Insert the section parameter (Family and Material);
5) This step is very important because it allows Cover to identify if it is as aluminium profile, steel or a gasket.
6) Usually, an aluminium profile is divided in 3 pieces, internal aluminium, polyamide and external aluminium.
7) These distinctions are important when you select a color for the profiles and when we calculate static and thermic values of a structure.
8) It is here that we insert the Point Position -> right click on point and click on add -> put the point position. This point defines the profile position on the bar.

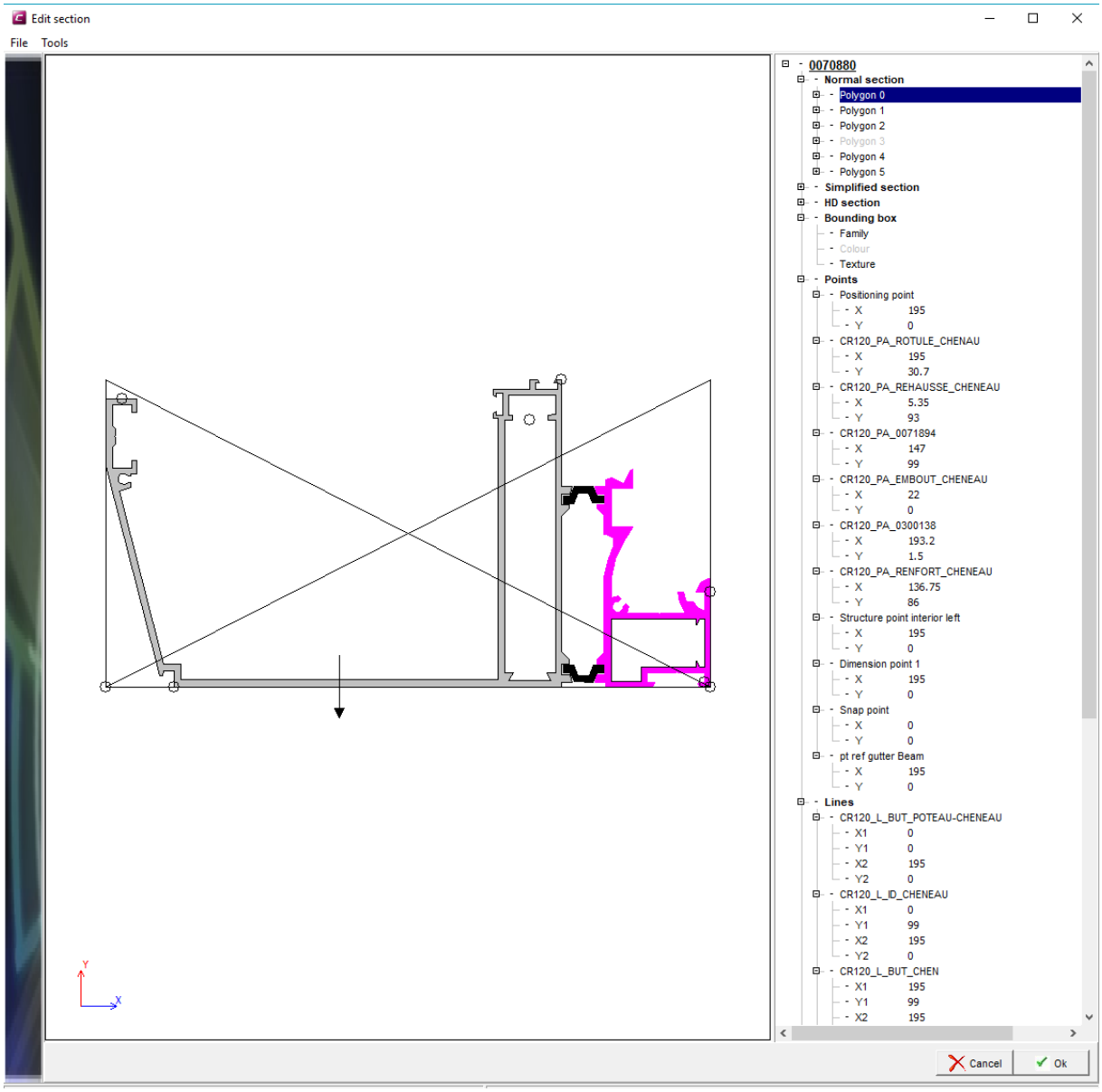

Figure 39- XLib sections (points, lines and sections).

Following the sections creation, it is necessary create an article where we are going to include the section drawing.

Correction of the article

1) Insert the profile in the database-> click database-> Article-> Edit;

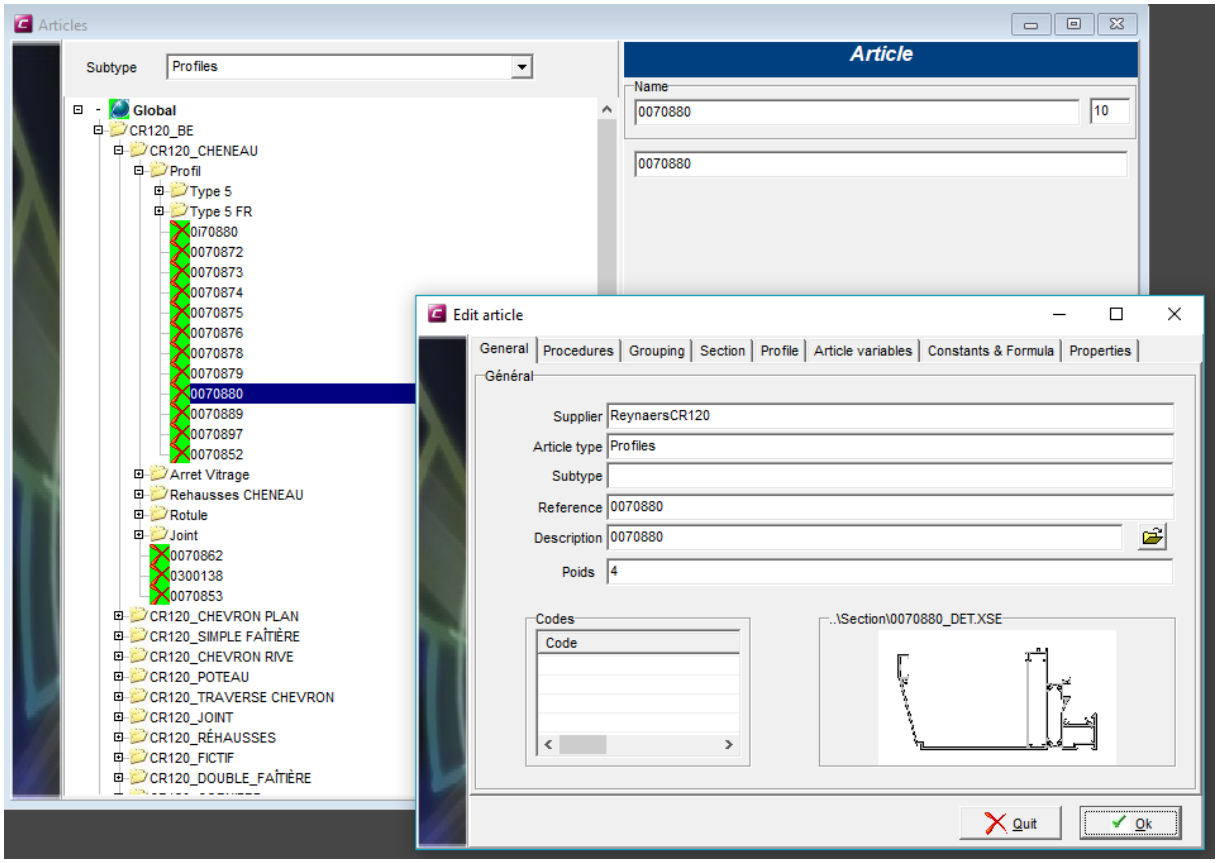

Figure 40- XLib articles.

2) Create group -> add an article -> click on pencil;

In this set of articles is where we are going to define the type of article, the reference to order, if it is sold by Reynaers Aluminium and if it is important to make the static and thermic calculations.

Besides that, it is here that the procedures will come together, which means, if the profile in question has “stacked” more profiles, this is where the connection is made. (This step will be explained in more detail at the front).

Creation of the action – Profile Position

Consequently, of having the article, it is necessary to create an action, is this one that will position our profile in Cover.

There are many kinds of action depending on what we want to do:

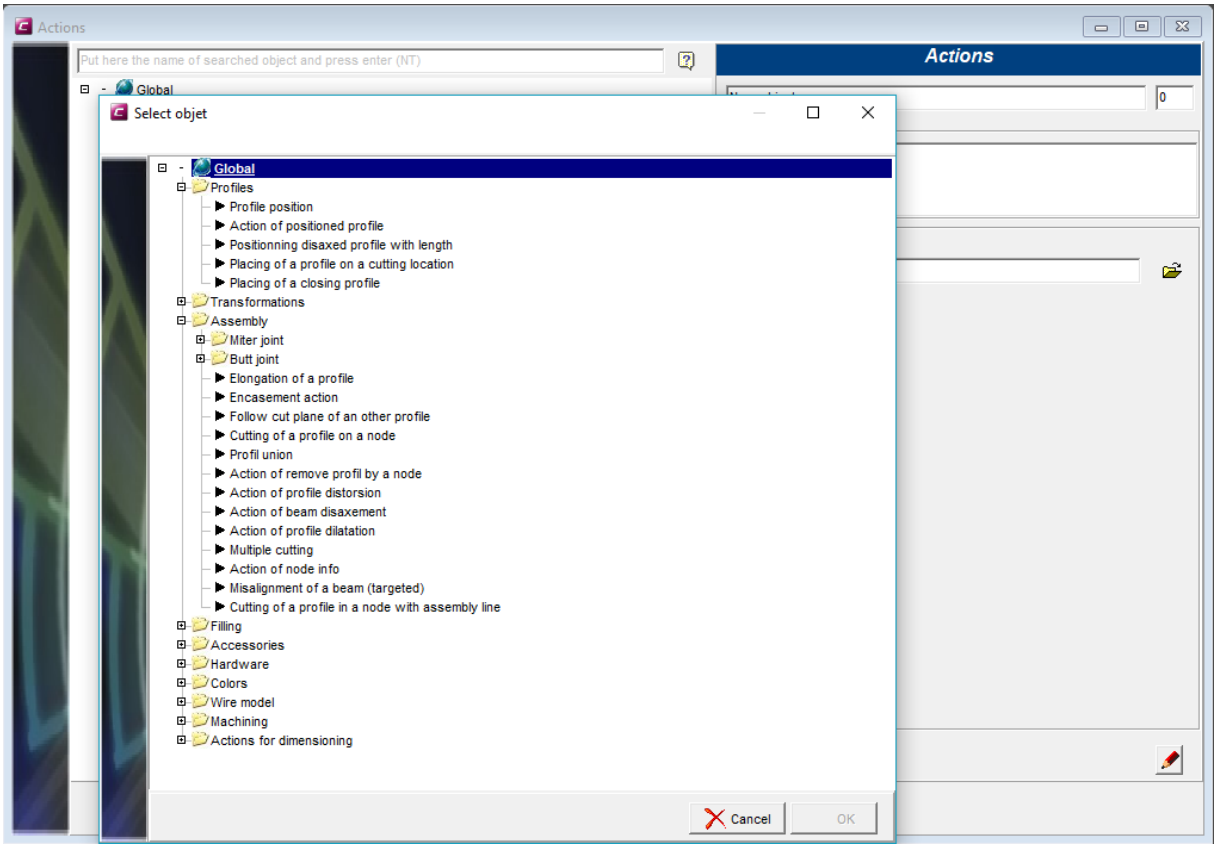

Figure 41- Different points.

At this point, we are going to focus in two kinds:

Profile position action – in this action we will define the positioning point and the snap point which were created in the section.

If you need to move the profile, it is possible to do it here without being necessary create a new action.

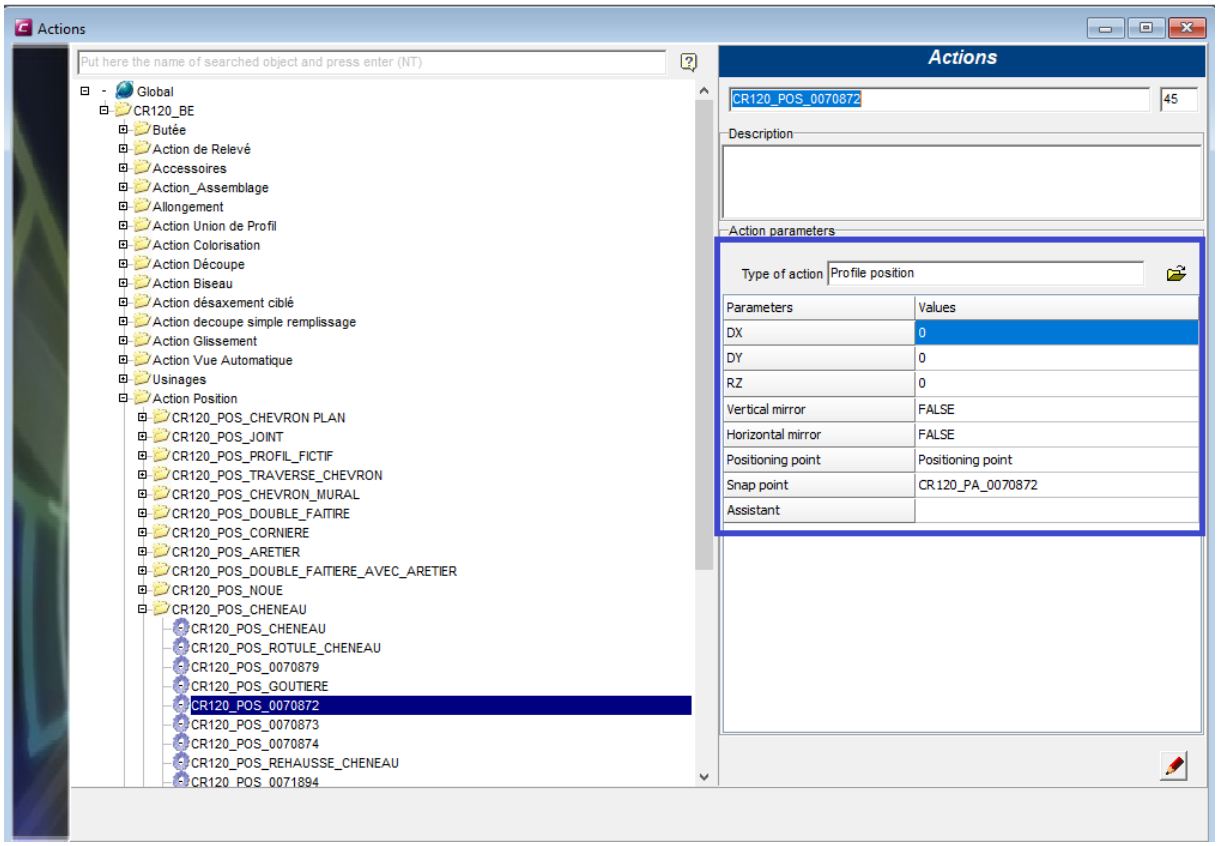

Figure 42- Action Profile Position.

For example, the lateral profiles are completely the opposite of each other, instead of creating a new action, we can make a "mirror" here.

Creation of the action – Positioned Profile

In the previous action, as previously mentioned, we defined the position of the profile. After creating this action, we will have to create another action where we will know which profile corresponds to the previous action, this action is called action of positioned profile.

An example is shown in the figure below:

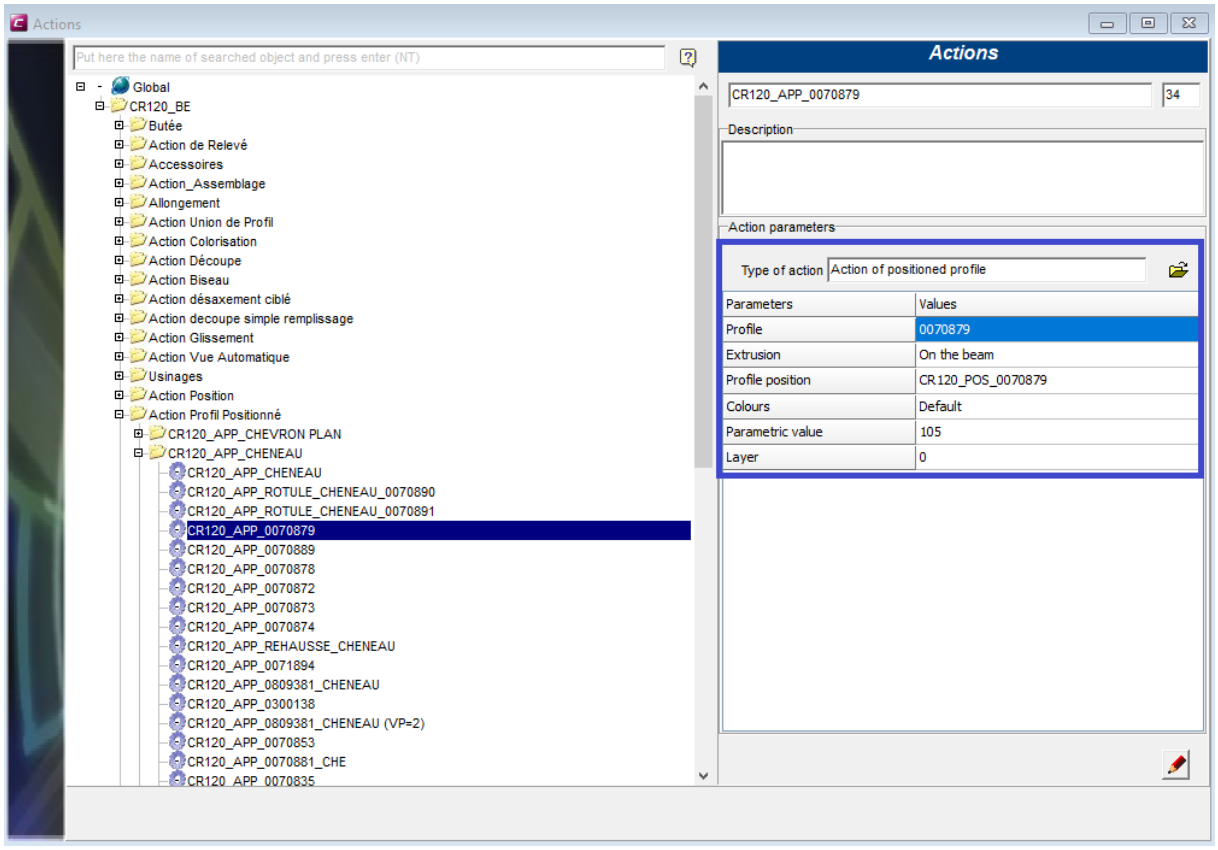

Figure 43- Action of positioned profile.

Creation of the Stacking Bar

Following the actions, it is necessary to give the attributes to the bar were the profile will be positioned.

For that reason, there is a new menu that refers to the Bar piling-up.

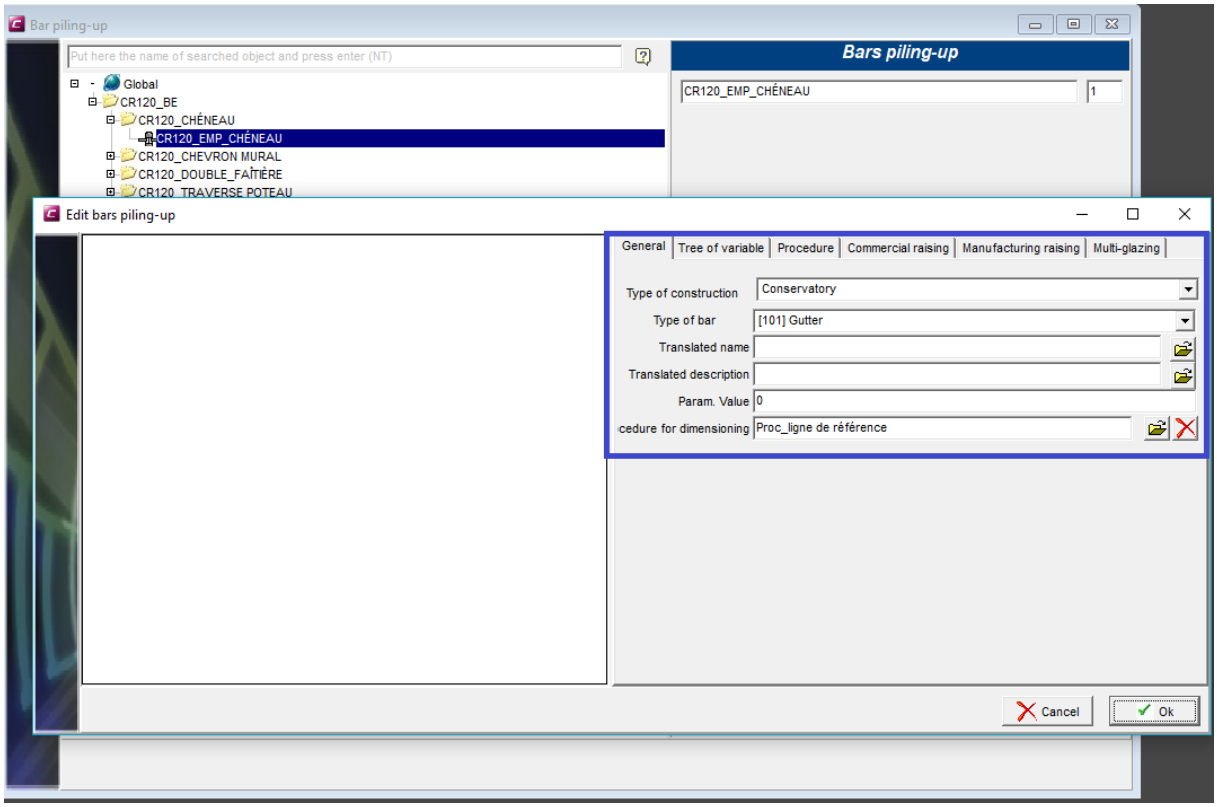

Figure 44- Xlib bars pilling-up.

It's here that all kinds of bars are defined, without this, Cover does not recognize an article as being a gutter or a rafter. Each bar has a code and it is here that they are defined.

Then the steps are as follows:

1) Create a group-> new object -> pencil click
2) In the general tab choose type of construction and type of bar;
3) In the procedure tab insert the actions, condition and procedure as necessary.

Construction model:

The last step is to introduce the previous step in the "models of construction".

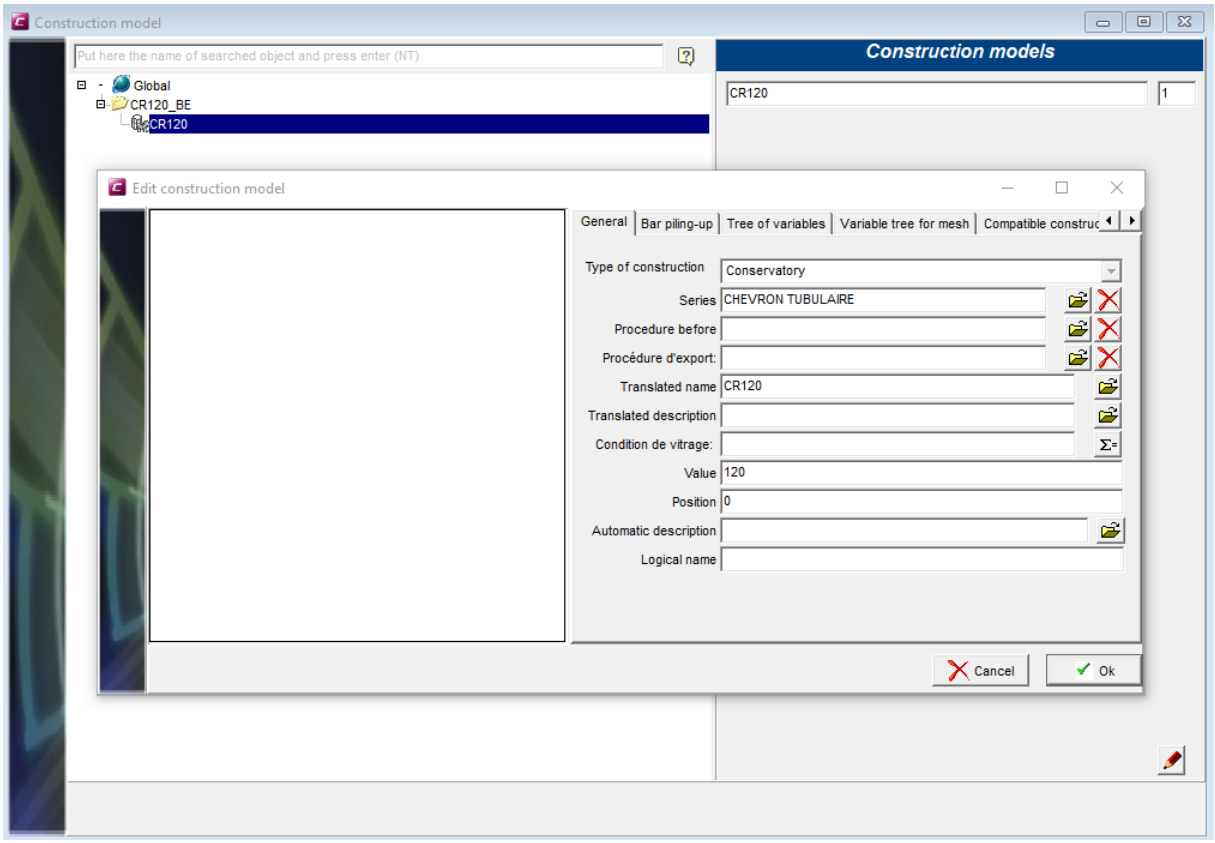

Figure 45- Xlib construction models.

1) Create a group -> create an object -> click pencil;
2) Edition model construction -> choose type of construction and series;
3) Stacking bar tab -> insert object.

It is in this menu that we will also create the menu of options that can be seen in the Cover, as you can see in the next picture:

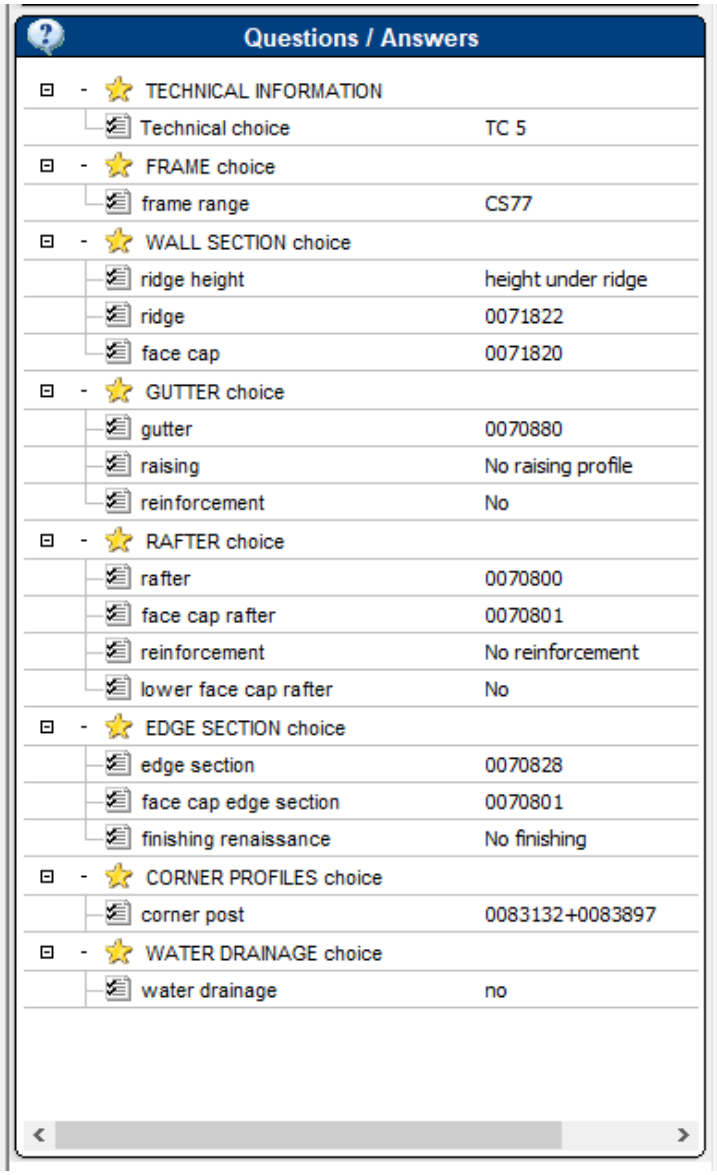

Figure 46- Menu Cover.

To create this menu, it was necessary to create different texts, where it is possible to translate to different languages. In the following pictures you can find several examples.

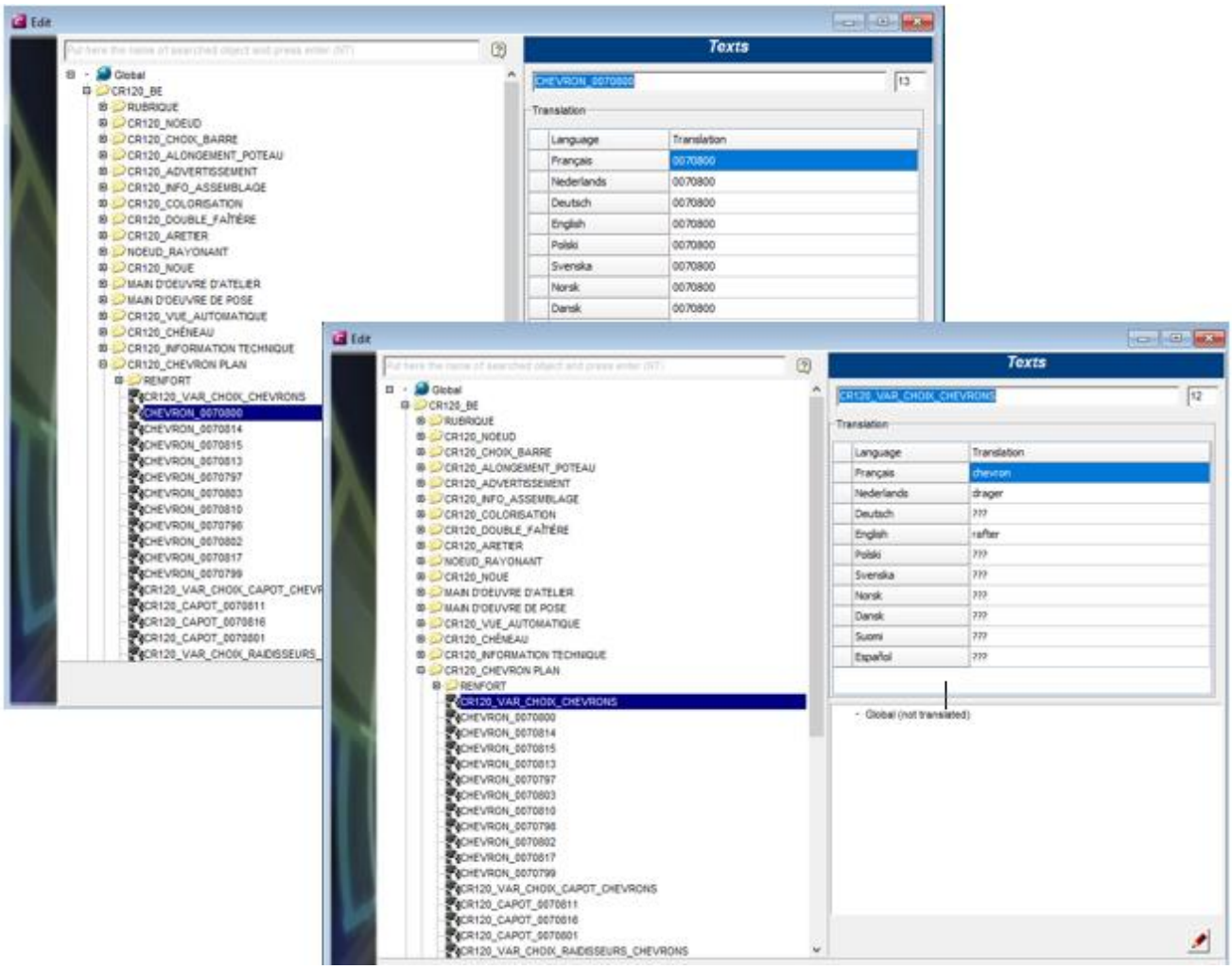

Figure 47- E.g. texts.

Cover verification

After repeating the previous steps for the different bar styles and different profiles, it must be all checked in the Cover.

These checks are important to detect possible errors with different options and images.

But the most important part is the dimensions of the bars and their cuts, because this information will be used for the fabrication of the structure, in some cases sent to CNC machines automatically.

In the following image you can see an example of a final structure in Cover.

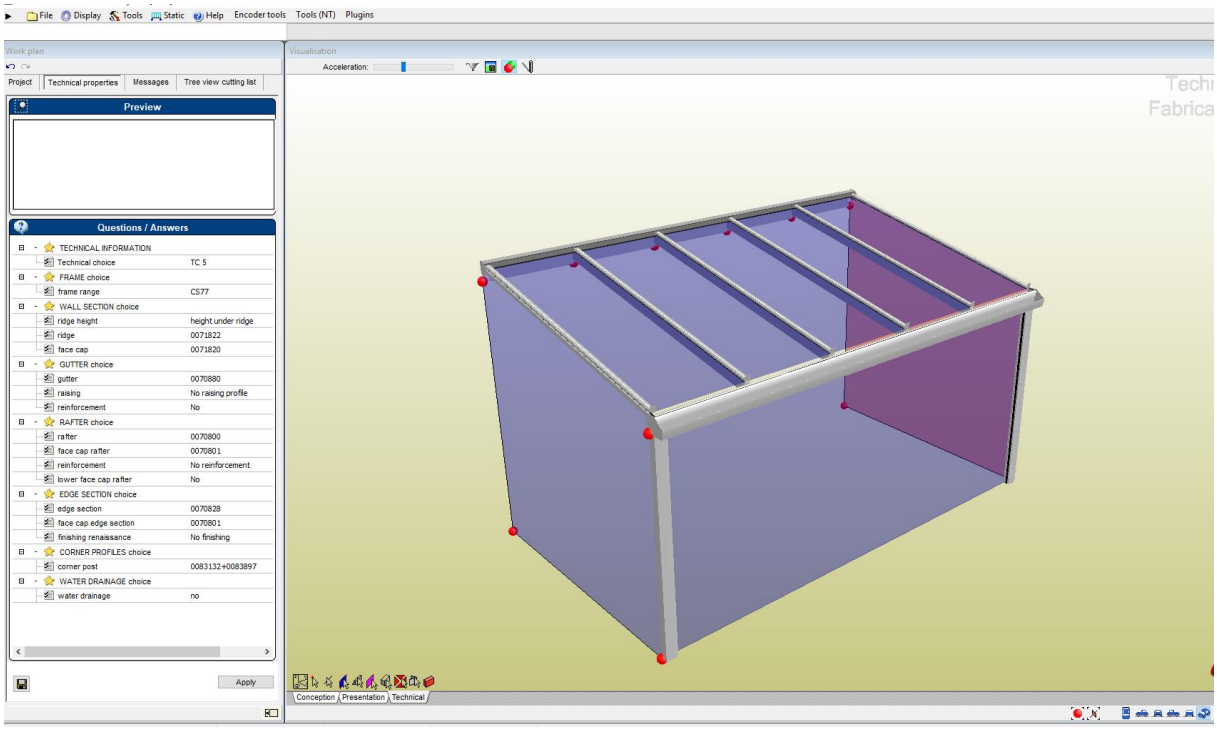

Figure 48- Final structure in Cover.

In addition to the need to stack all the profiles, there is another important step that is to create the links between the different styles of bars, for this are created nodes, as can be seen in the following steps:

1) Check if the Node exists-> Open Cover -> Click on the node-> Technical menu -> Technical property;

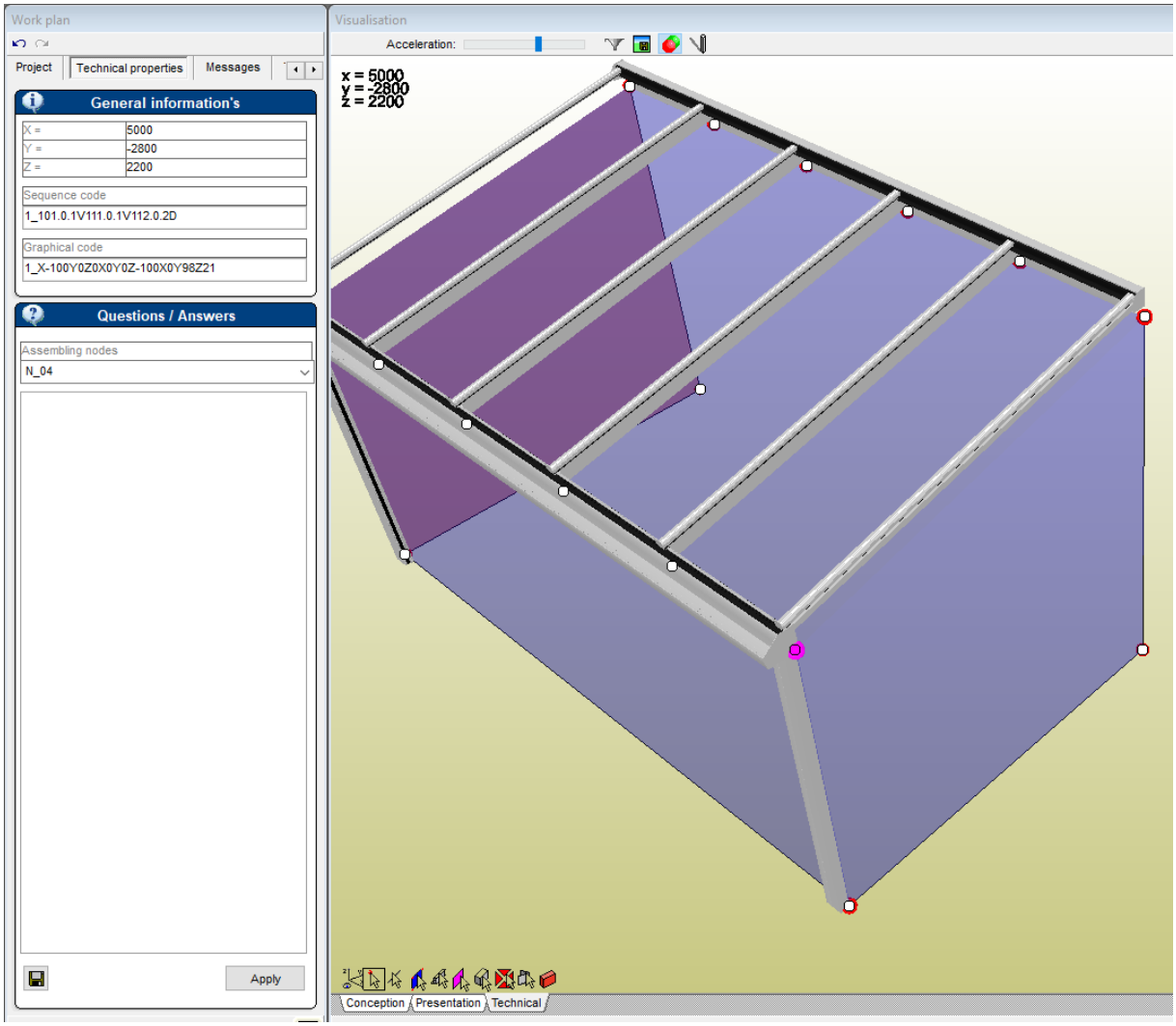

Figure 49- Node Cover.

2) Create a node: Parameter-> Assembly node-> Add group and object-> Click on pencil-> Edit Node-> Go to cover, select the node to parameter, return to XLib and click yes in the window;
3) Parameter -> Construction Model -> Edit Construction Model -> Assembly Menu-> Add Node Selection.
4) Check in Cover.

After creating the different nodes, you can already create "an assembly".

The design of the characteristic nodes and the connection of the elements between them is required for certification, for CSTB the “Centre Scientifique et Technique du Bâtiment” is one of the required points.

1) Parameter -> Action -> Create assembly group -> "Group BUTEE" for example Parameter -> Create a Point and Line -> Add group and object -> “L_ID_chevron”;
2) Parameter -> Section -> Edit-> Draw the line ID on the profile;
3) Parameter -> Action -> Create action “Butee” -> Add a group and a object -> Choose action type assembly -> Define bar index, profile line…

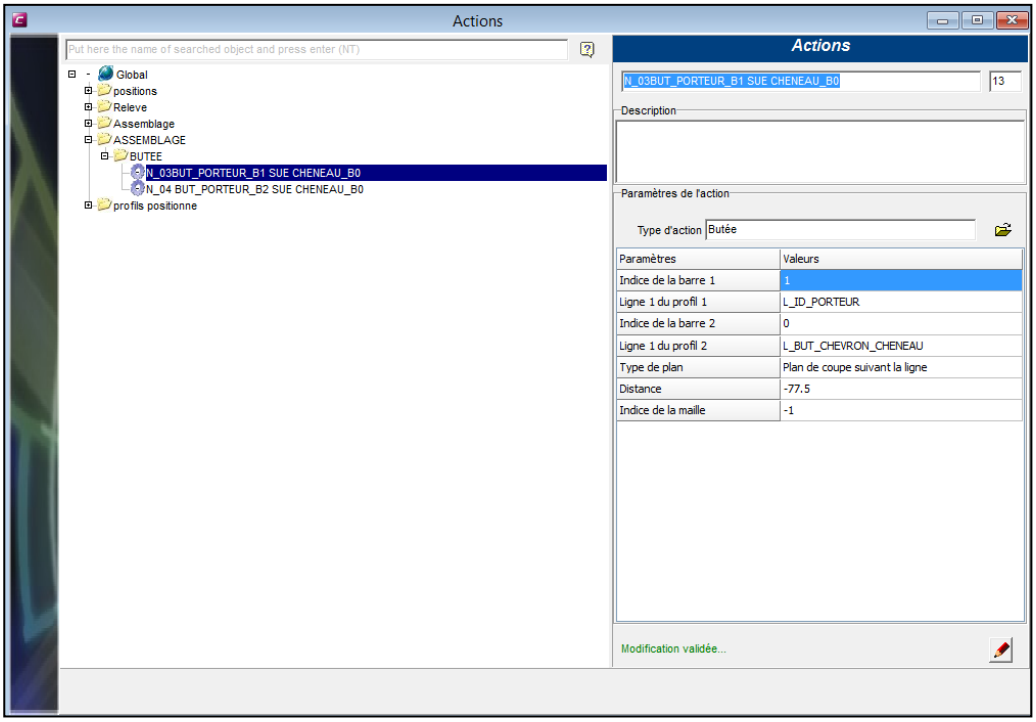

Figure 50- Assembly node.

4) Parameter -> Assembly Nodes -> Choose Node -> Procedures -> Add Action -> 2 click to fetch the action -> OK;
5) Check in Cover.

It is also here that the connection fittings between the different connections (e.g. Gutter - Rafter) are added, if required.

These actions are very important because this is where we tell the different profiles where they should stop. Sometimes there are different distances and types of cuts, that is, if it is a cut of 90º or different.

In the Annex IV you can found a chart of XLib to help you better understand how the program works.

3.2.6 - Test and correction in parameterization and providing the database to customers for different countries;

This stage was very important and in an initial phase it counted with the collaboration of two colleagues.

Each model created was sent to the database and elaboration of tests. These tests consisted of verifying menu options at the menu level, and the most important was checking the assembly of the profiles, the correct dimensions of the profiles and the cutting angles. These values were matched to those of the CR120 catalogs which were used as reference in the parameterization.

After these checks and in a first phase, the database was made available for internal use only.

The availability to customers began after the completion of the two models.

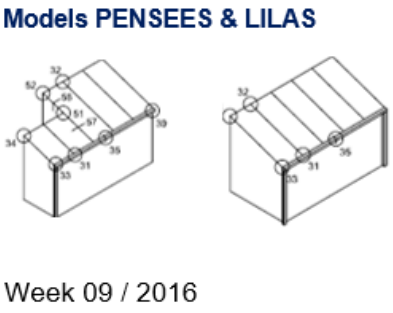

Figure 51- Example first two models.

Following the "release" of the first six models, one of the leading Conservatories customers was asked to test the databases and report as a user, possible corrections and improvements.

This subject was very important, allowing making substantial improvements, that end up being very important for other users.

The database, at an early stage, was only disclosed to customers in France, followed by Portugal and Belgium.

In the last quarter of 2017 there has been an increase in demand from other markets such as Ireland, Switzerland, Serbia, Ukraine and Kazakhstan.

3.2.7 – Corrections and customer support, training

As in any other database, information (data) is never complete.

That is why the last phase of this project has consisted of changes and improvements identified or requested, both by members of the Reynaers team, or by customers, and never forgetting that a common database was created for all markets, and therefore it cannot have specific requirements and there is a need to sort the requests.

In addition to these changes, there is also daily support, both internal and external to the company, most of which are given to Reynaers Aluminium colleagues from other countries and some of the most important clients.

Each client, whether internal or external to the company, must follow a theoretical training that consists of learning the program and a practical training that consists in the elaboration of a model “Pensée”.

To help in understanding the database a tutorial was created, initially only for the French market, since it includes different options.

The objective is to create one in English for the remaining markets, which until now has not been possible.

Chapter 4

Conclusion

It was a long way of learning and working until we reached the current point of the project, however, we cannot give it as completed.

We are faced with a market that is constantly growing and where the demands are increasing and to be up to the moment a constant evolution is necessary.

At the moment, along with training and customer support, the thermal calculation of the conservatory structure is being integrated, which due to the new legislation in France, this calculation becomes mandatory from 2018.

In addition, it is also planned to incorporate all the necessary information for the use of CNC machines. In the first phase a test will be carried out on one of the most important customers in the Belgian market, with a simple structure "Pensée" and later for the other models.

Following the request of several markets, it is also planned for the beginning of next year, the incorporation of an attic window in a conservatory.

The possibility of integrating in the Cover program some of the different window and door solutions is also under study. This integration will depend on the number of sales and the response of the markets, because it requires a lot of parameterization time for each of the ranges

and as was mentioned at the beginning of this work, Reynaers Aluminium has a huge range of possibilities.

In addition to the integration of information into the program, a need is also being identified to create explanatory documentation over the program and CR120.

In this work was exposed the initial and most important part of the project, but it is clear that this is a project with capacity for growth and propitious to the emergence of innovative novelties for the market.

Bibliography

https://www.reynaers.com/home, accessed in 17/10/17

Sabrina

http://www.cover3d.com/en/, accessed in 17/10/17

Sabrina

http://www.snfa.fr/, accessed in 04/04/18

Sabrina

SNFA - Règles Professionnelles Vérandas, http://www.fenetrealu.com/uploads/documents/regles-professionnelles-verandas-structure-aluminium-2011-.pdf, accessed in 04/04/18

Sabrina

http://www.cstb.fr/, accessed in 08/04/18

Sabrina

http://www.la-veranda-alu.com/veranda-aluminium, accessed in 08/04/18

Sabrina

http://www.rensonfrance.fr/partenaire-france-snfa.html, accessed in 08/04/18

Sabrina

http://webapp.cstb.fr/verandas/docs/Publication-Regles-homologation-veranda_Revision01.pdf, accessed in 08/04/18

Sabrina

http://www.batiactu.com/edito/nouvelles-regles-professionnelles-verandas-aluminium-32155.php, accessed in 08/04/18

Sabrina

http://www.kaconstruct.be/images/downloads/kwaliteitseisen-en-adviesen-FAC-uitgave-2016.pdf, accessed in 10/04/18

Sabrina

Aluminum and Aluminum Alloys, J.R.Davis, https://www.scribd.com/document/372019873/NF-EN-573-3-Aluminium-and-Aluminium-Alloys-pdf, accessed in 10/04/18

Sabrina

http://www.aluminiumcenter.be/FR/home.htm, accessed in 10/04/18

Sabrina

EN 573-3, “Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition and form of products

EN 1991-1-4, Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions

NBN EN 755-1, Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 1: Technical conditions for inspection and delivery

Eurocode 9 - Design of aluminium structures

Annex

Annex I

Examples of all components

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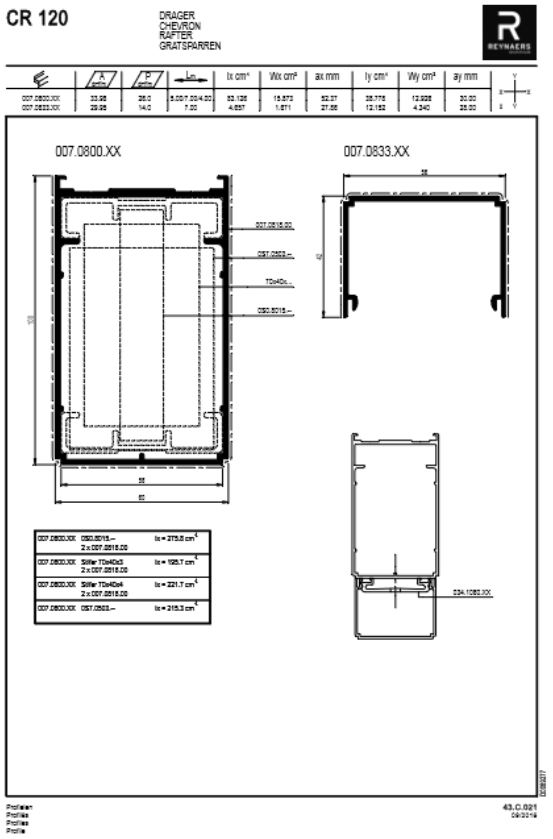
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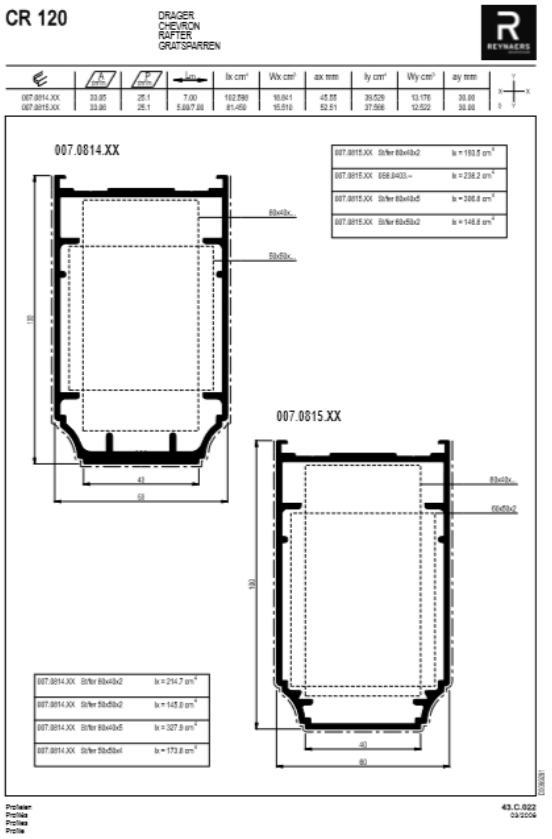
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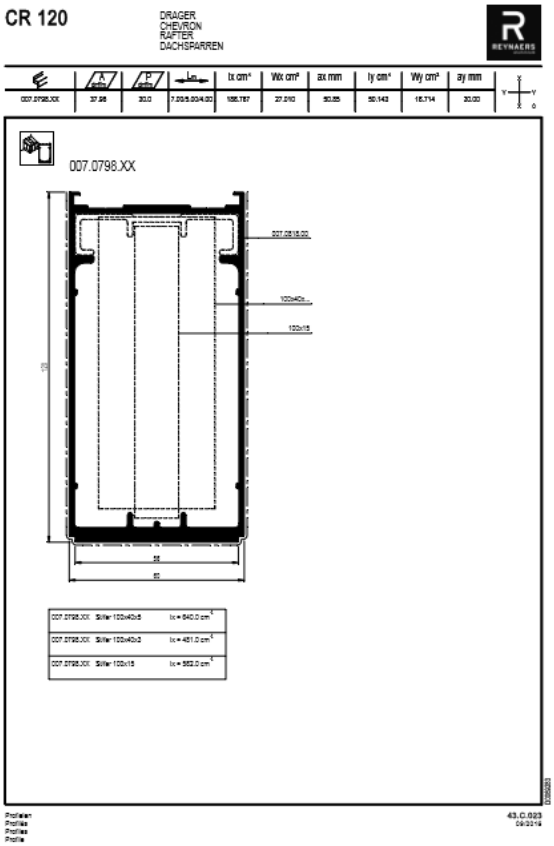
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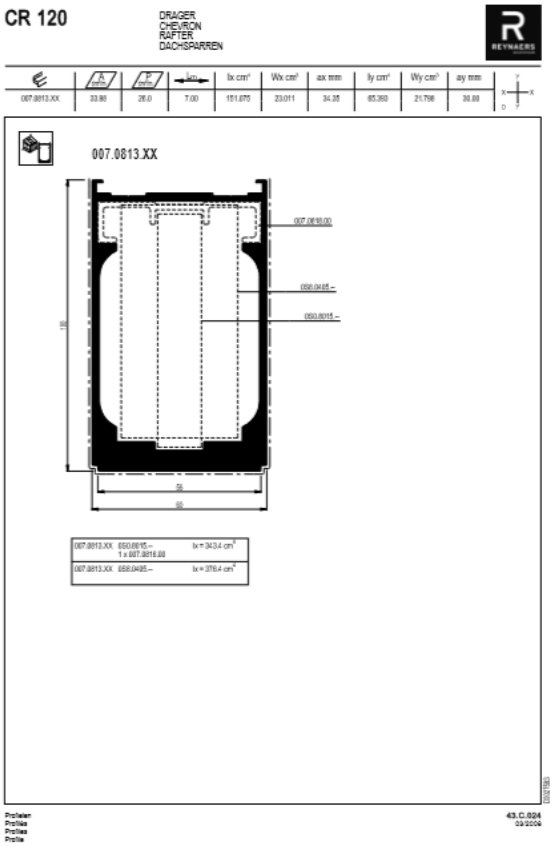
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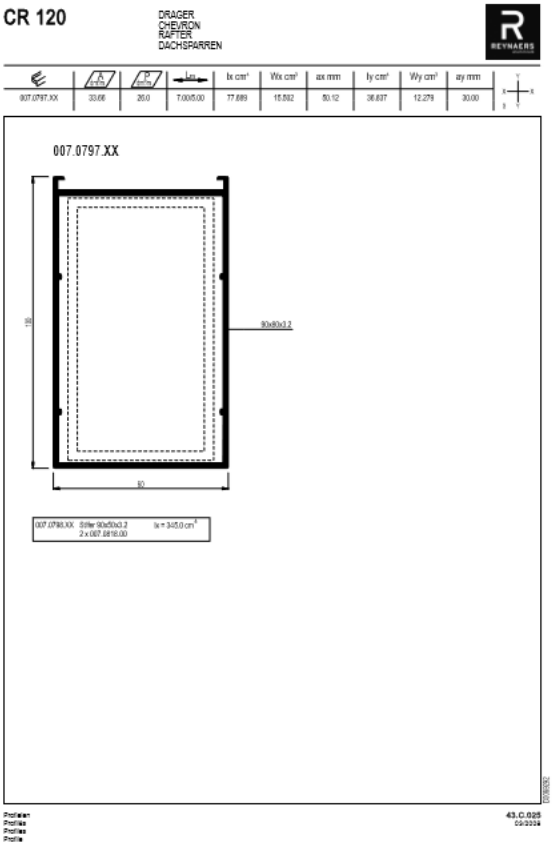
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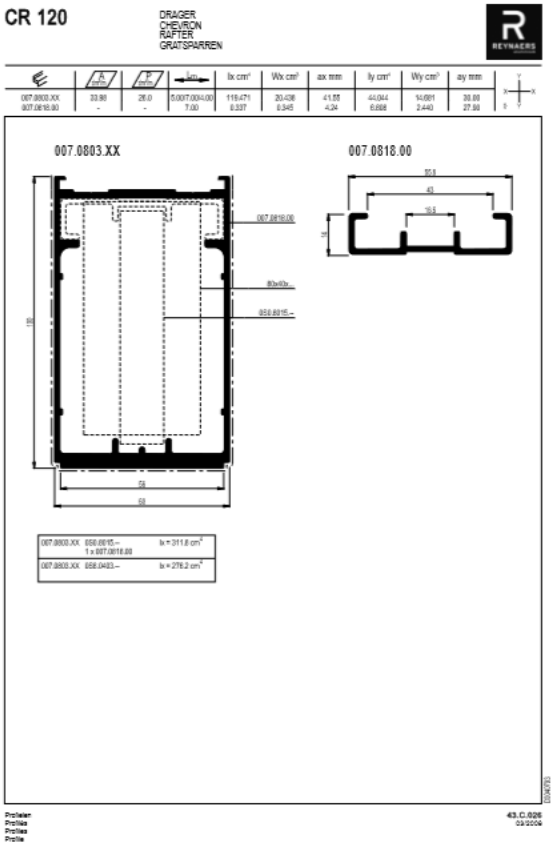
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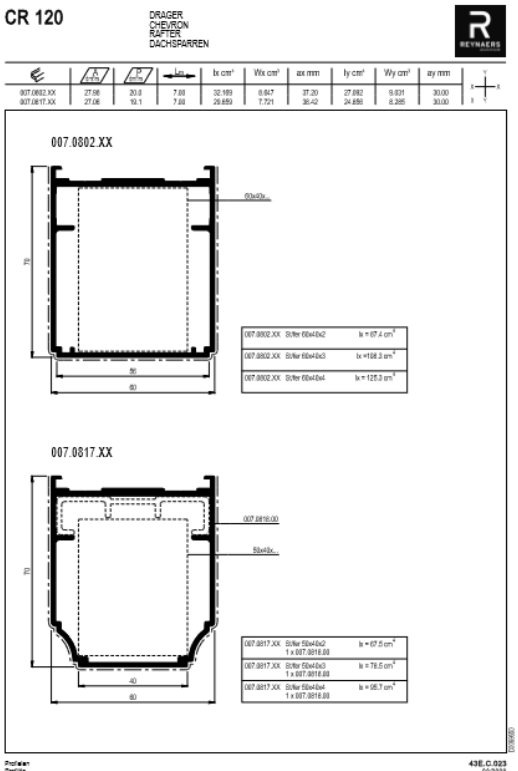
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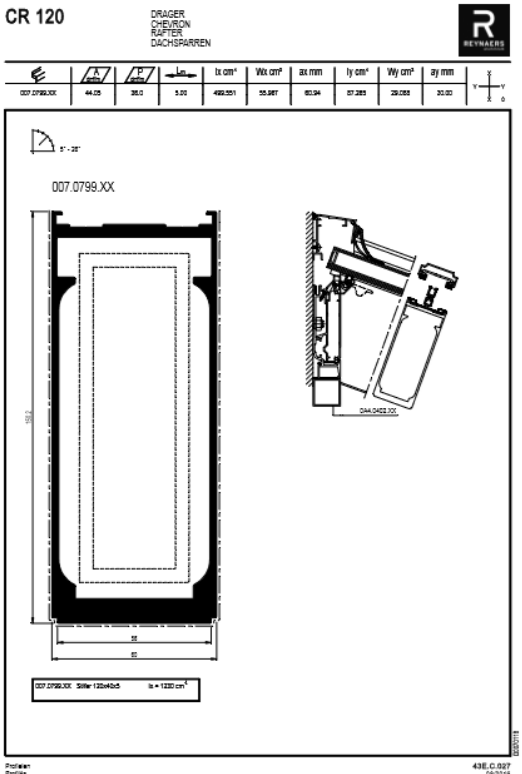
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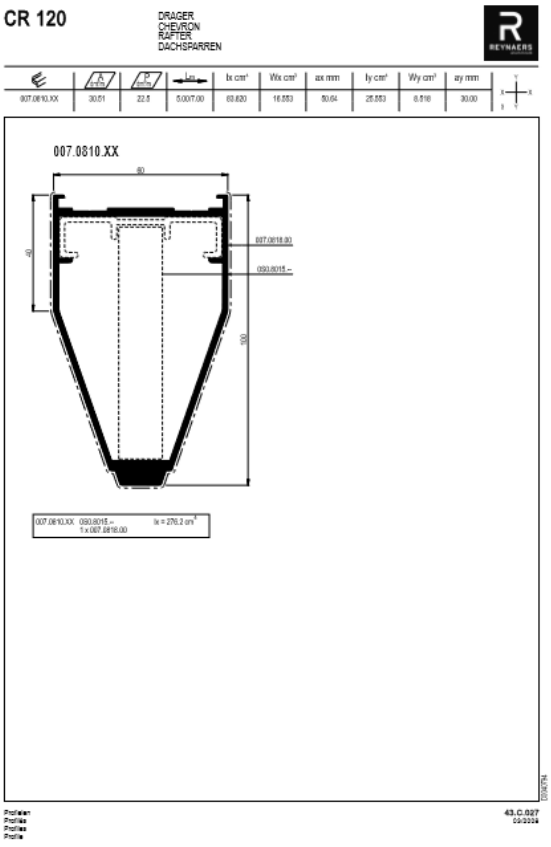
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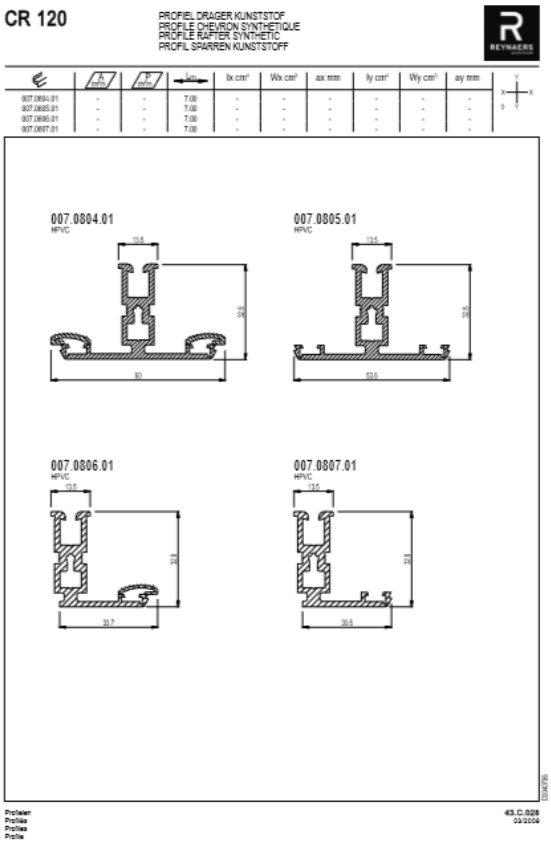
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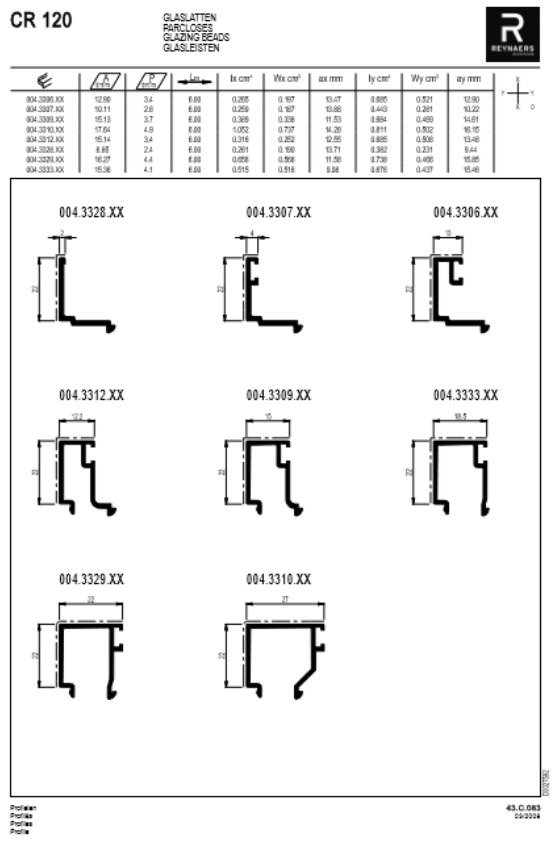
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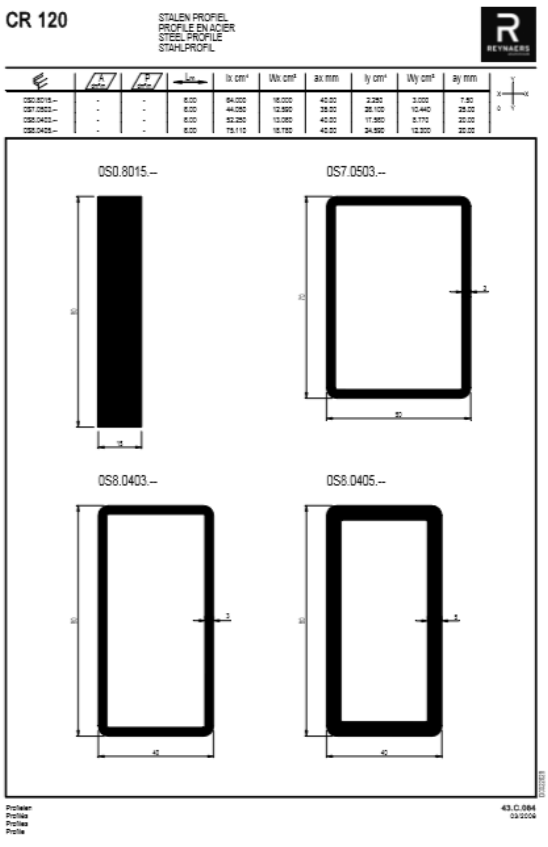
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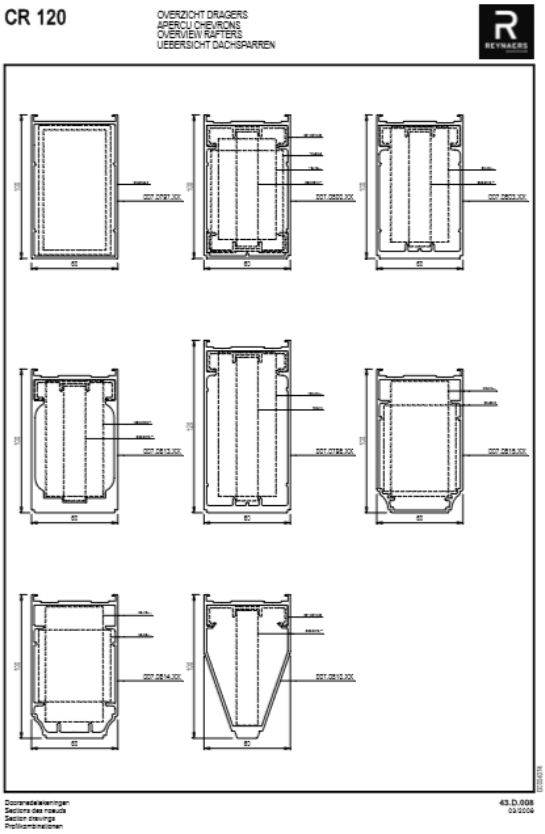
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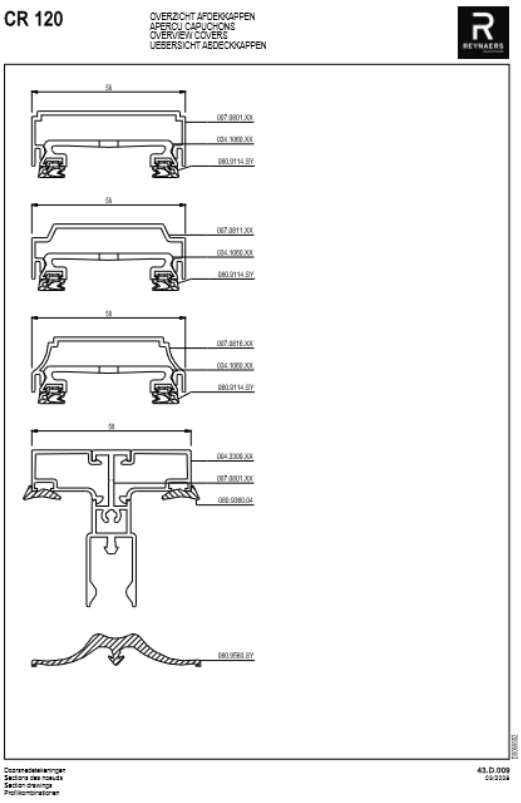
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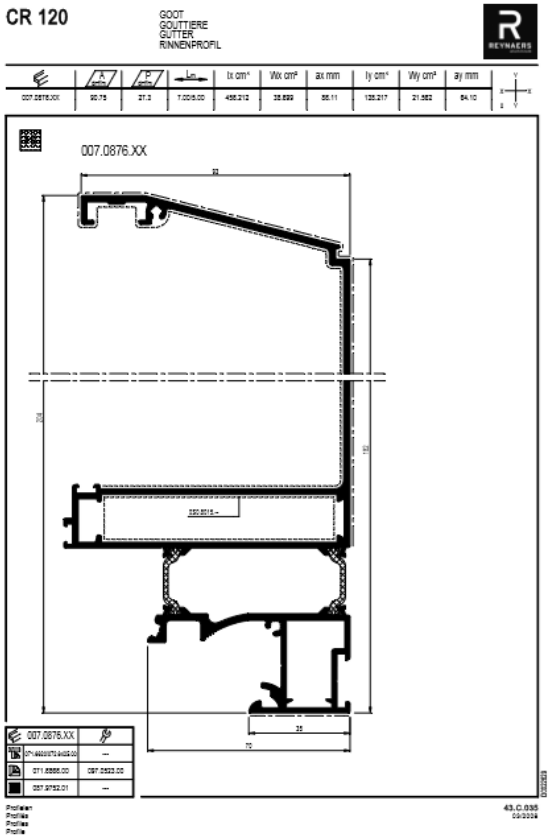
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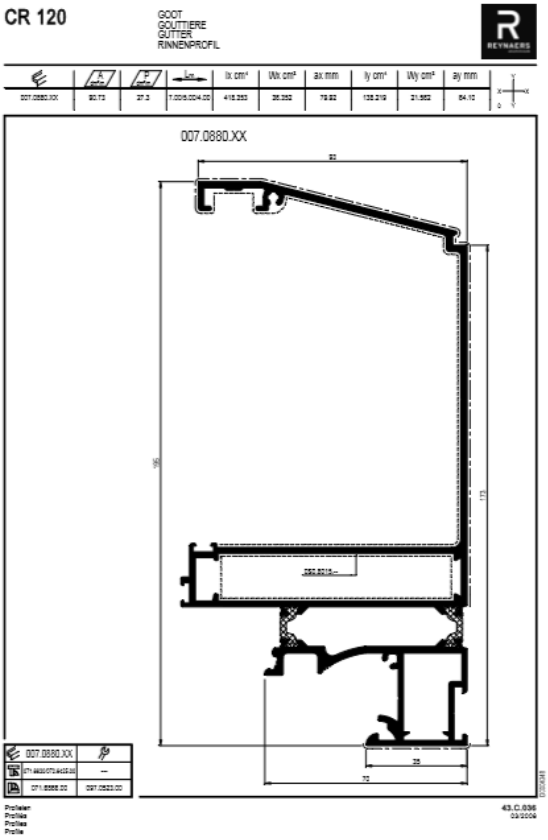
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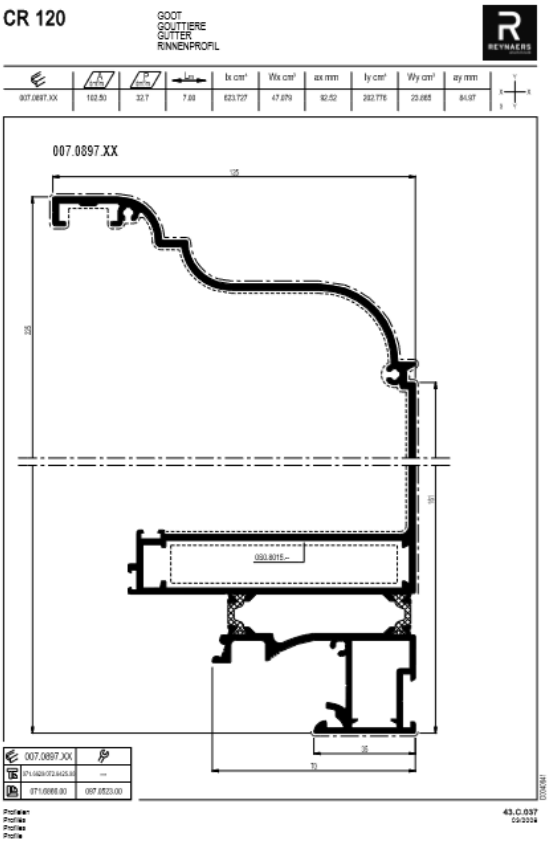
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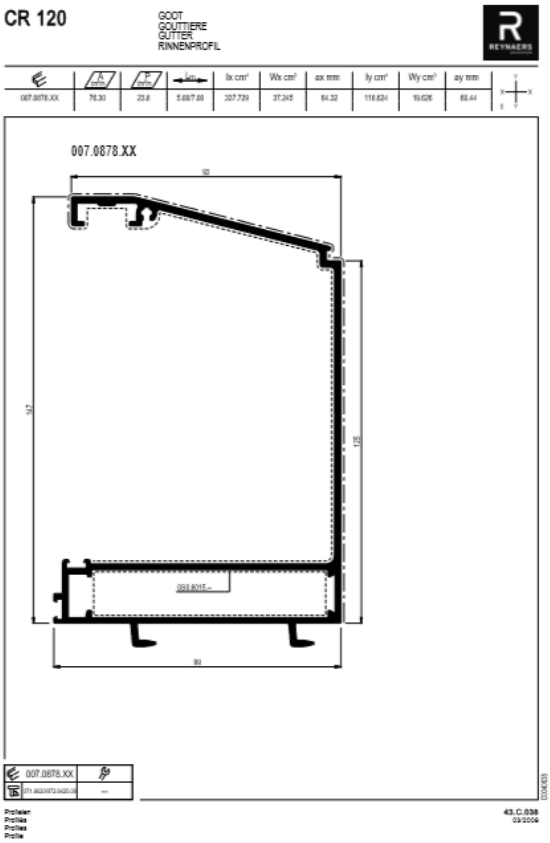
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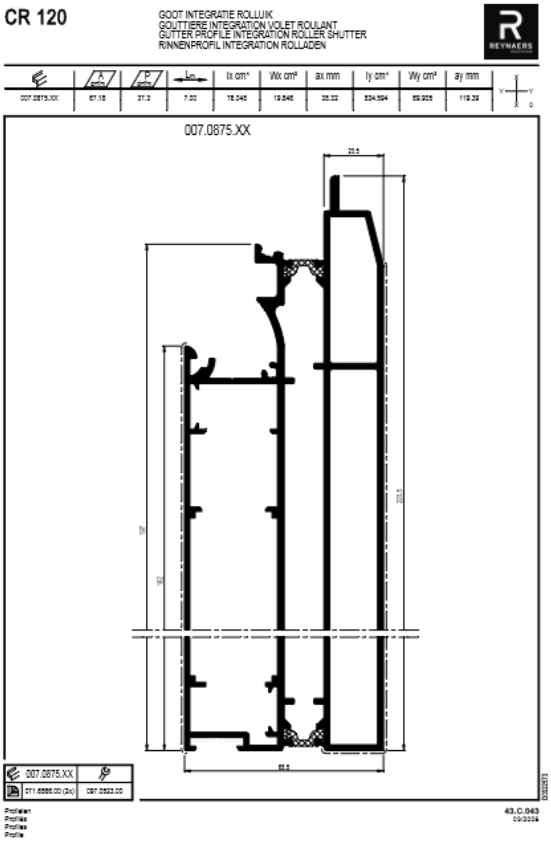
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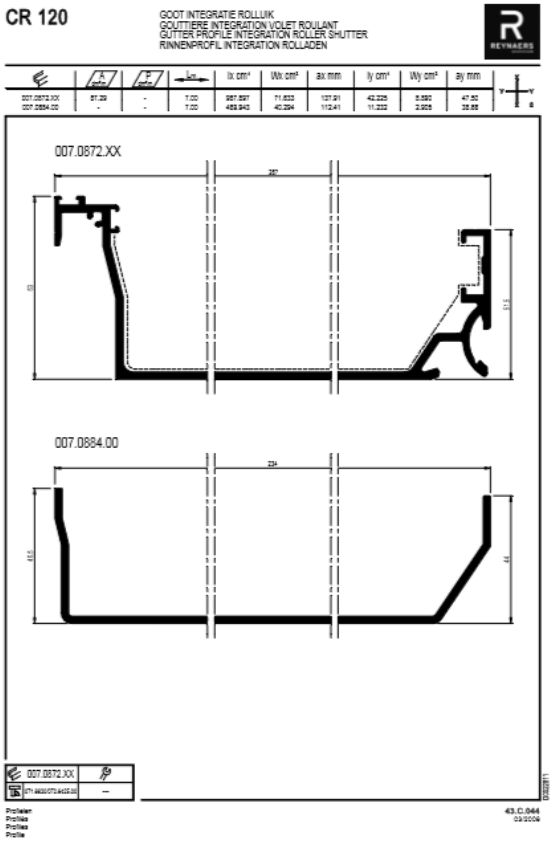
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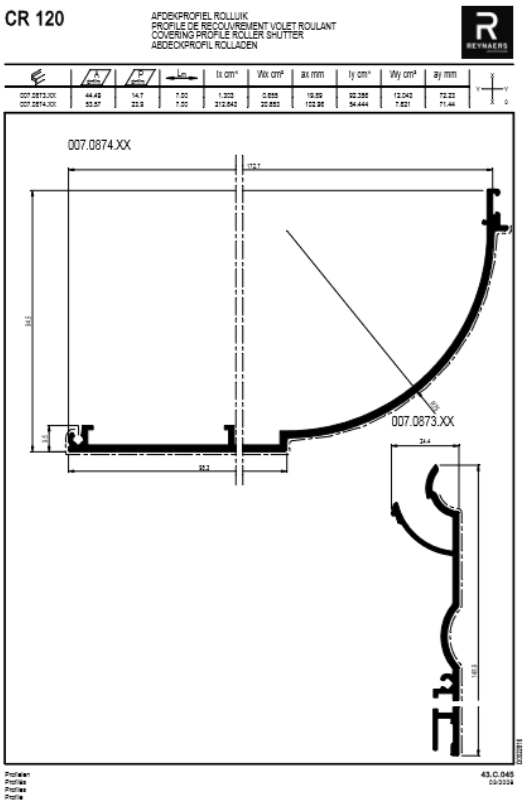
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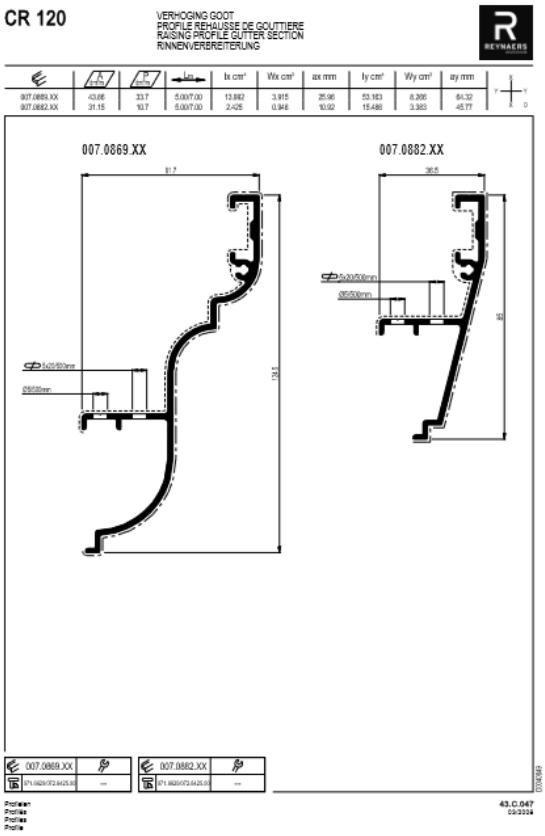
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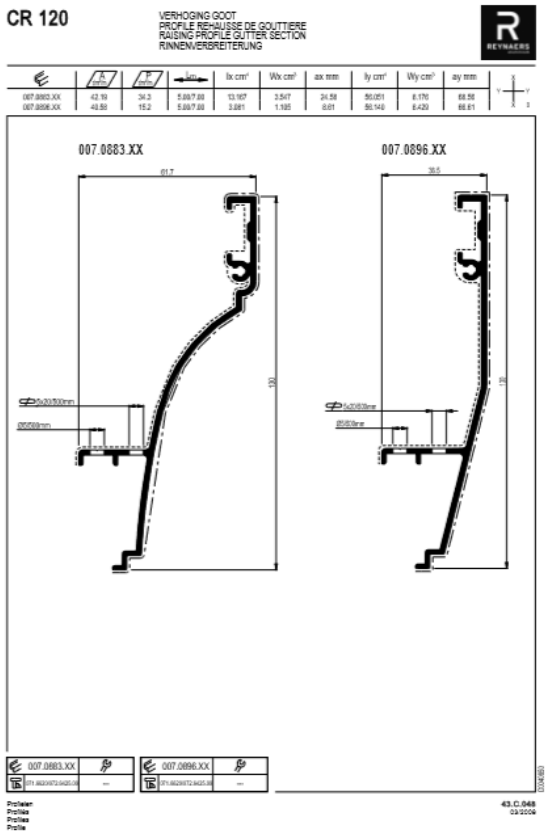
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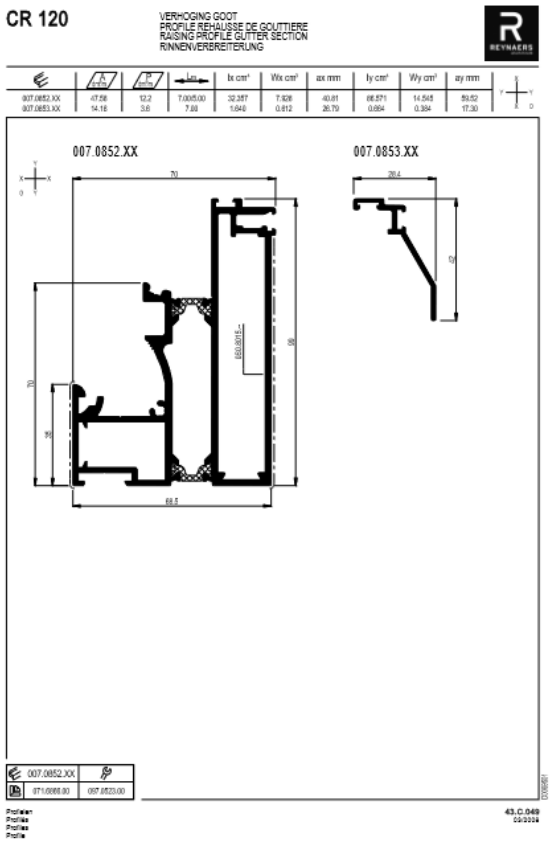
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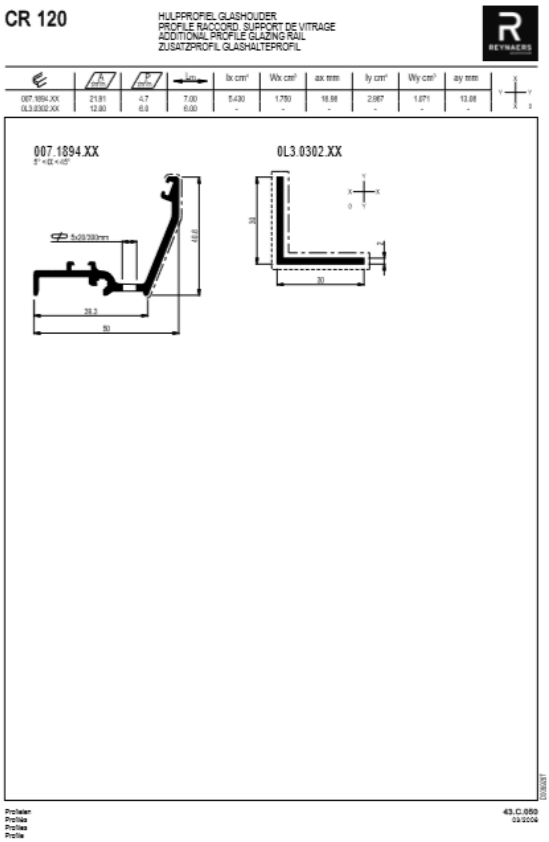
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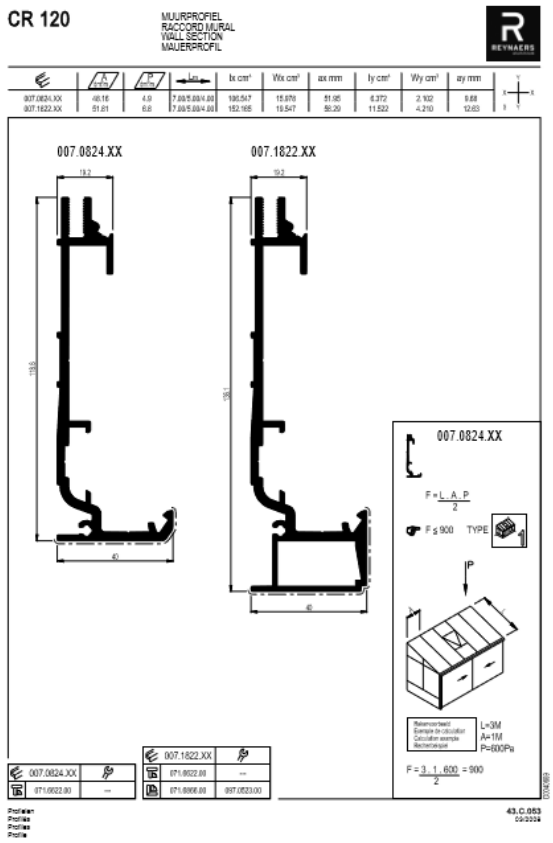

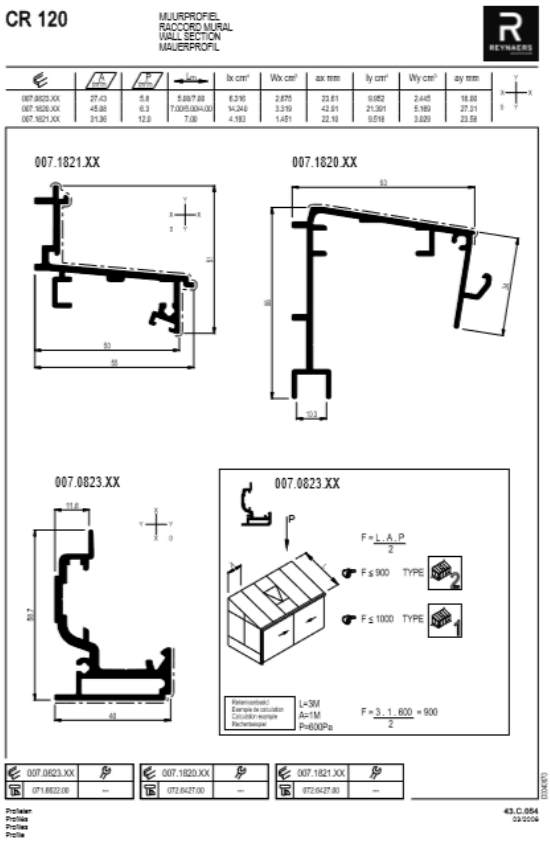

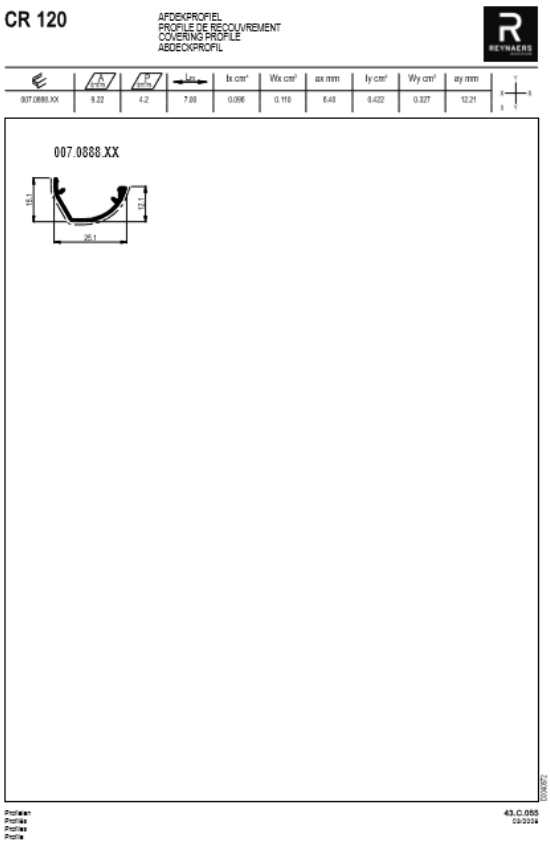

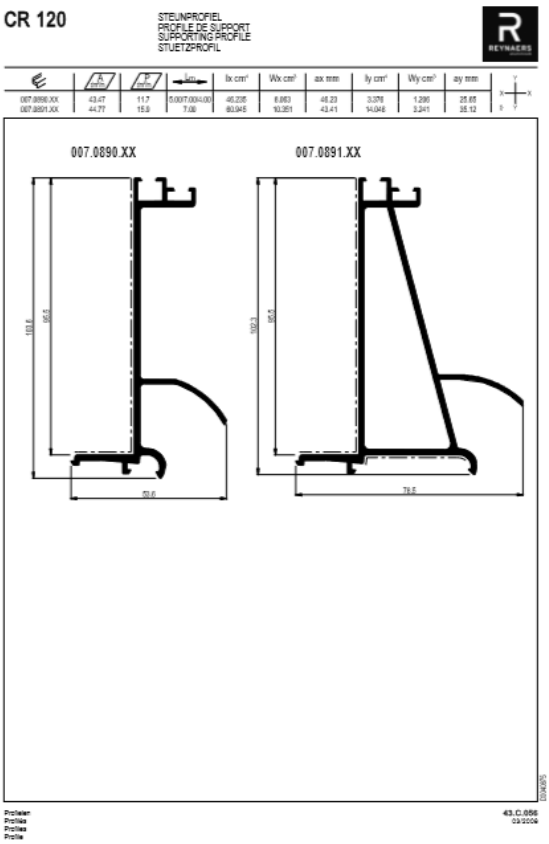

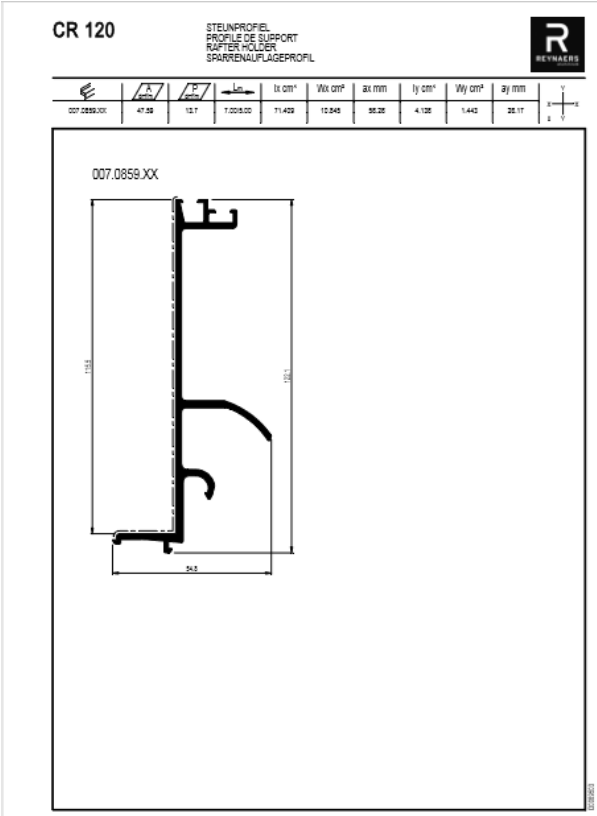
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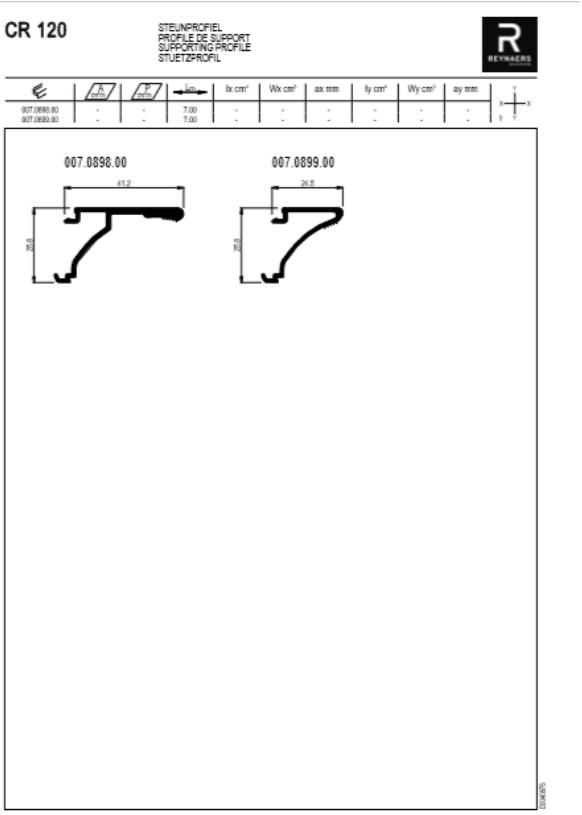
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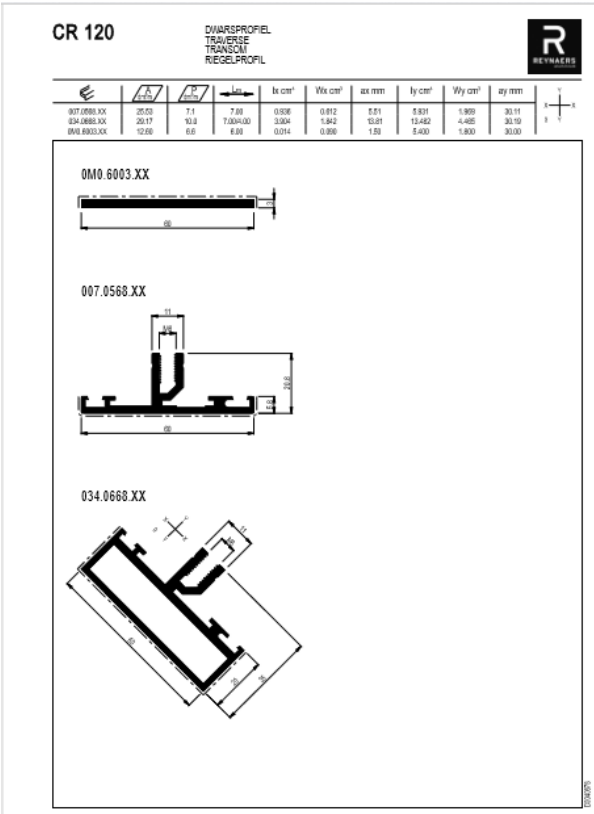
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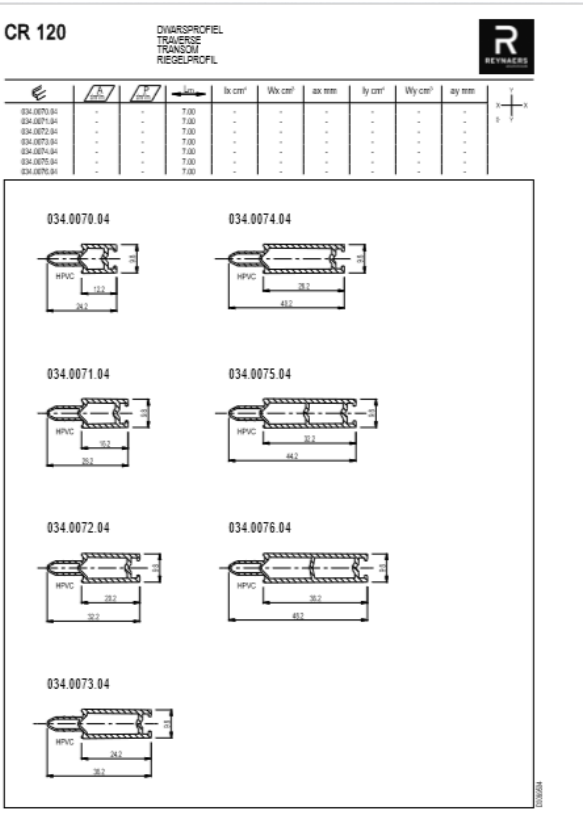
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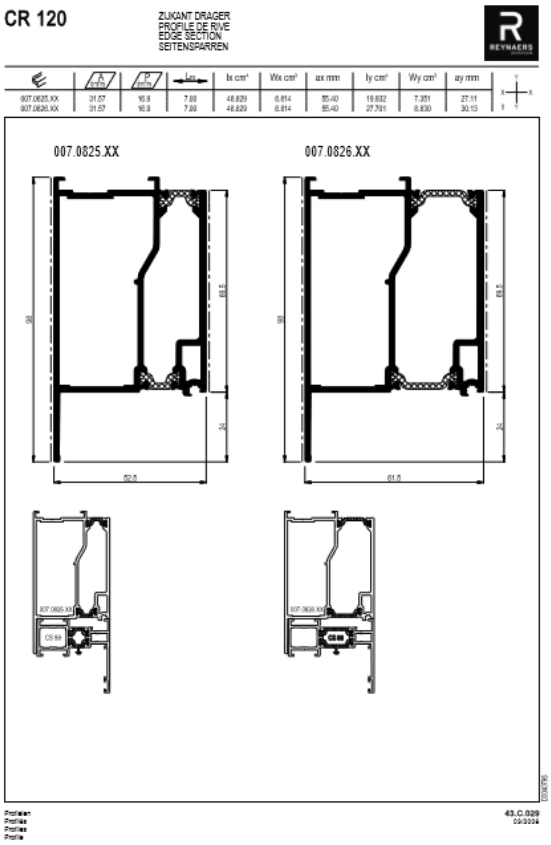

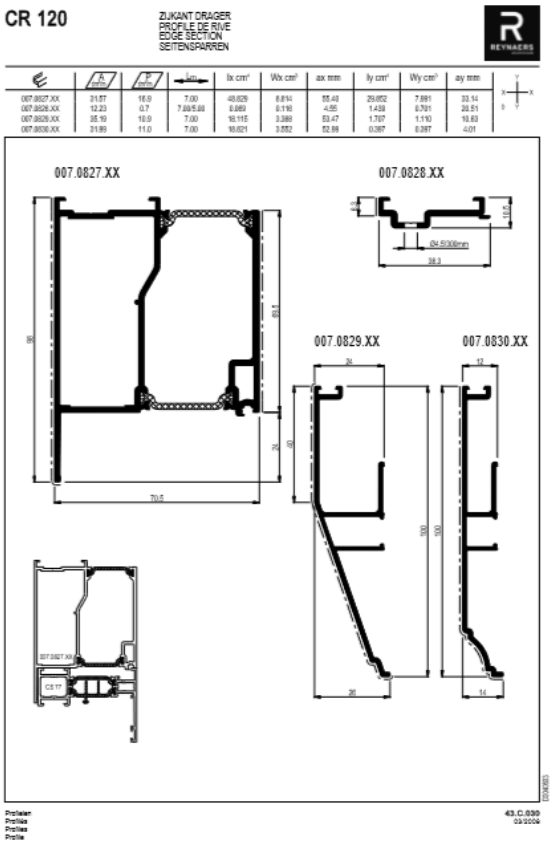

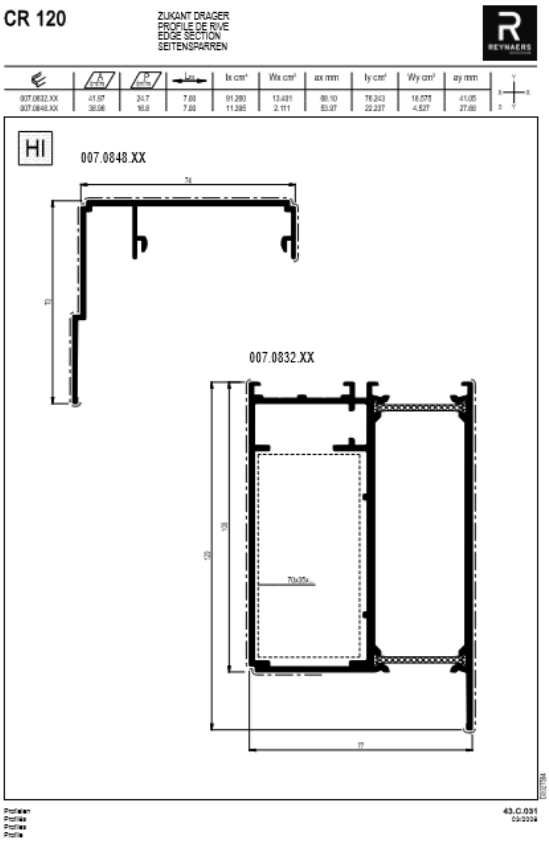

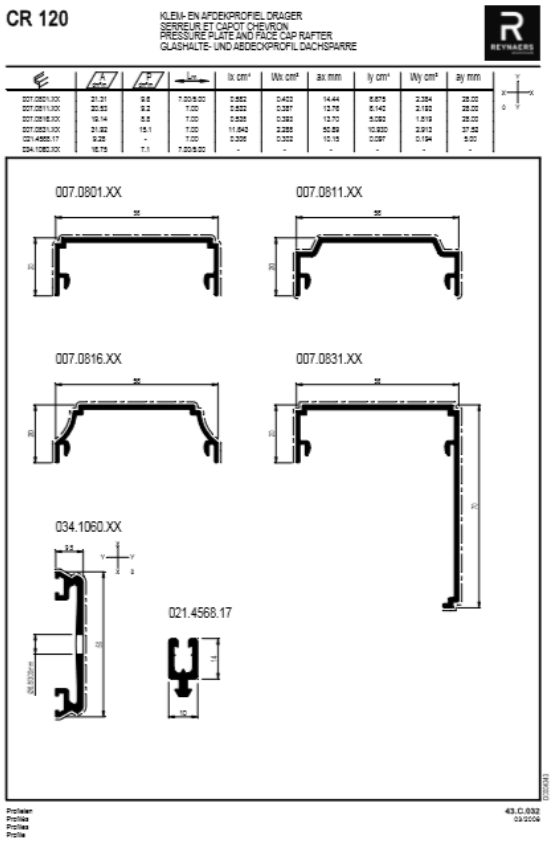

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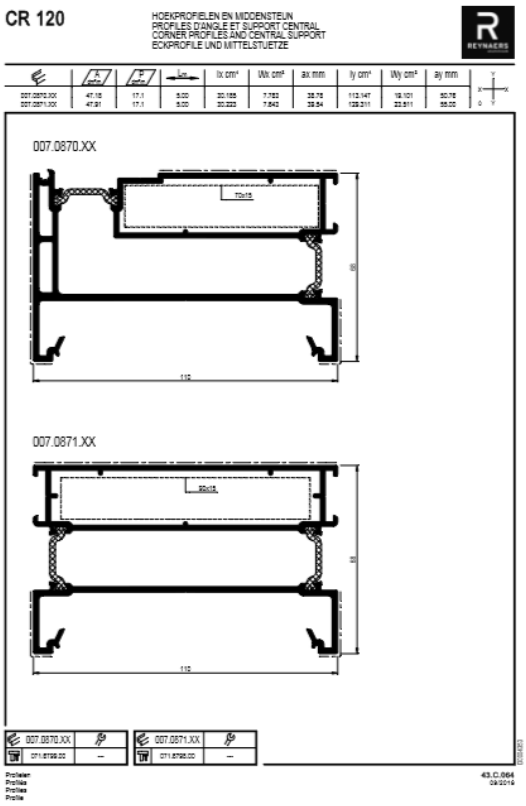
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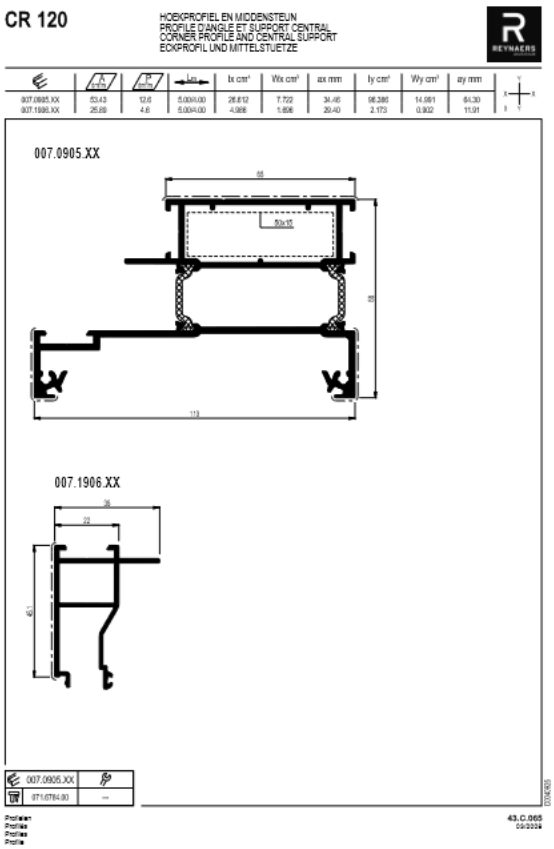
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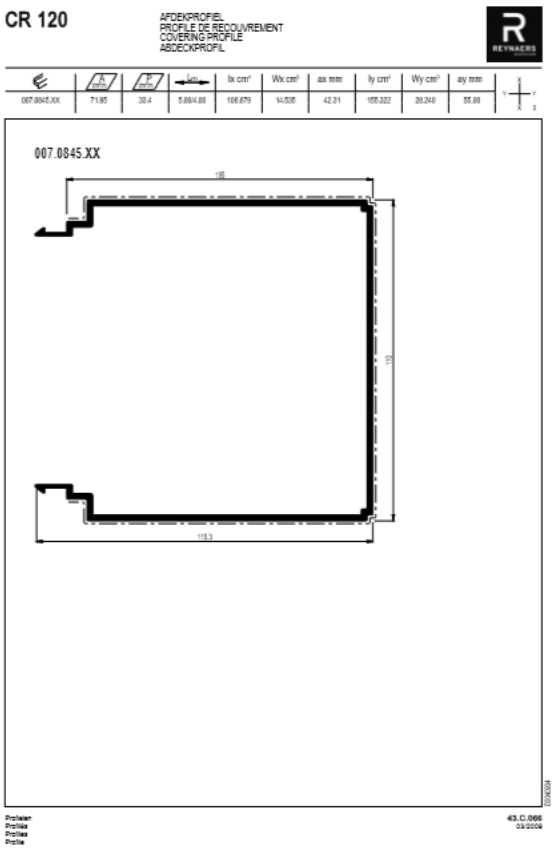
CORNER PROFILE AND CENTRAL SUPPORT
ECKPROFIL UND MITTELSTUETZE
007.0905.XX
007.1906.XX
43.C.065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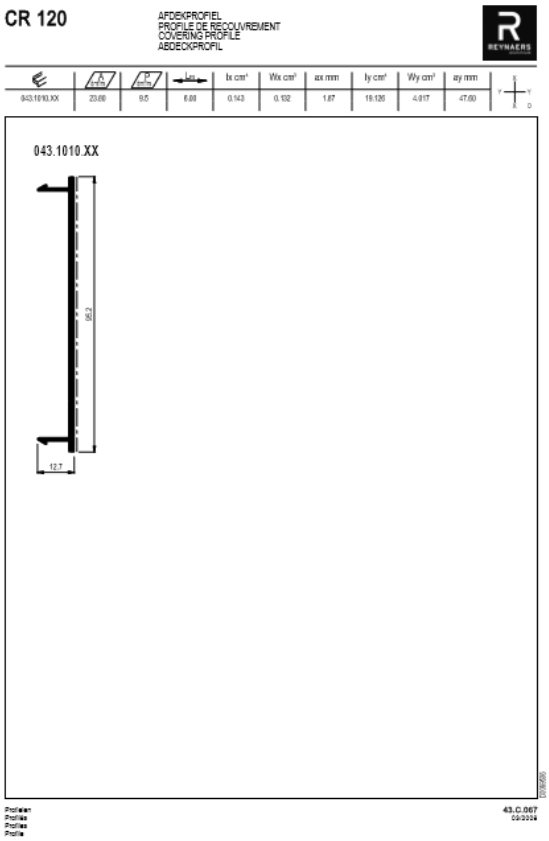
AFDEKPROFIEL
PROFILE DE RECOUVREMENT
COVERING PROFILE
ABDECKPROFIL
007.0845.XX
43.C.066



CR 120

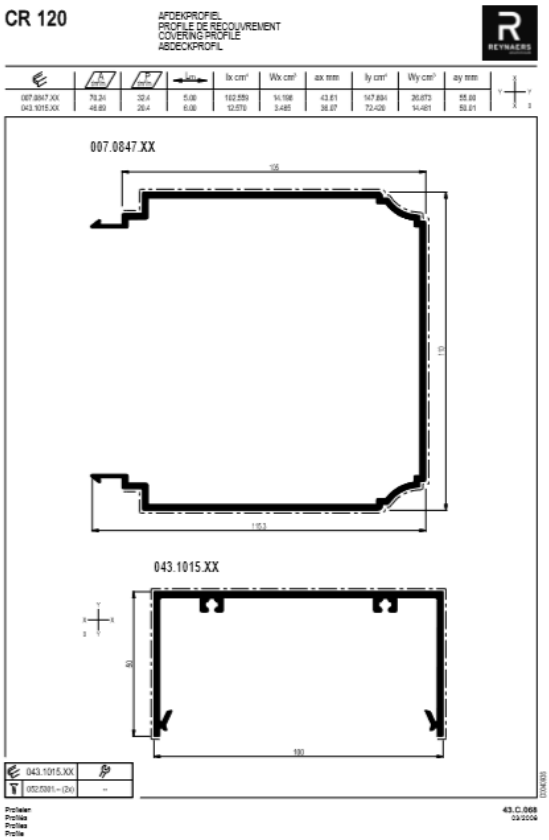
AFDEKPROFIEL
PROFILE DE RECOUVREMENT
COVERING PROFILE
ABDECKPROFIL

				Ix cm⁴	Wx cm³	ax mm	Iy cm⁴	Wy cm³	ay mm
043.1010.XX	23.66	9.5	6.00	0.143	0.102	1.67	19.126	4.017	47.60

043.1010.XX

Profielen
Profilés
Profiles
Profile

43.C.067
03/2004



CR 120

AFDEKPROFIEL
PROFILE DE RECOUVREMENT
COVERING PROFILE
ABDECKPROFIL

				Ix cm⁴	Wx cm³	ax mm	Iy cm⁴	Wy cm³	ay mm
007.0847.XX	70.24	32.4	5.00	102.559	14.198	43.61	147.894	26.673	55.69
043.1015.XX	48.69	26.4	6.00	12.570	3.485	36.07	72.429	14.481	50.01

007.0847.XX

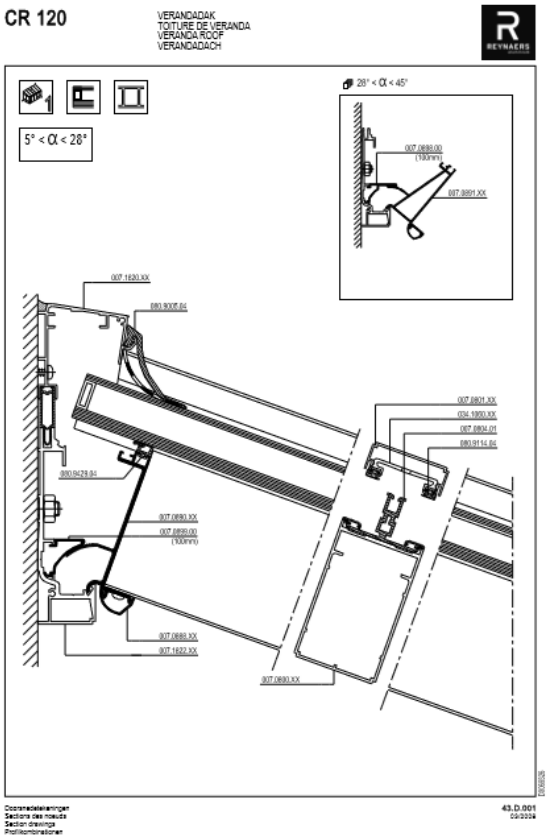
043.1015.XX

043.1015.XX	
052.5301 – (2x)	–

Profielen
Profilés
Profiles
Profile

43.C.068
03/2004

Cuts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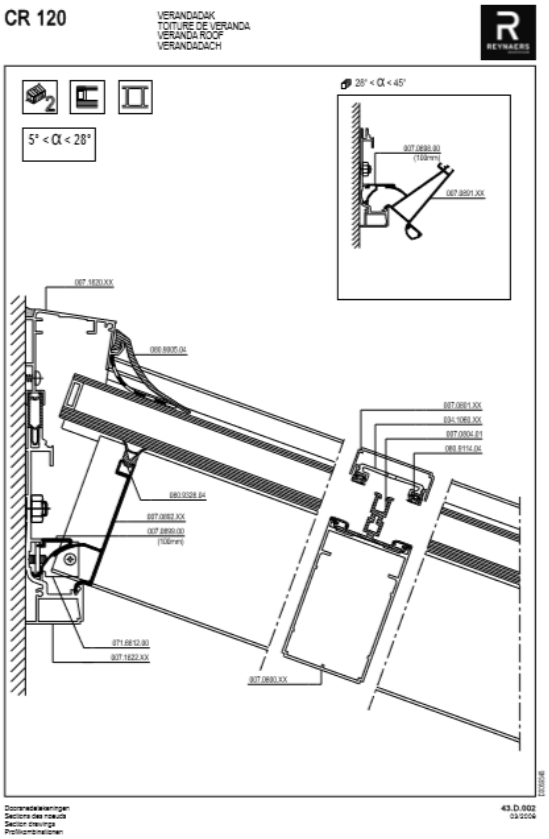
VERANDADAK
TOITURE DE VERANDA
VERANDA ROOF
VERANDADACH
5° < α < 28°
28° < α < 45°
43.D.001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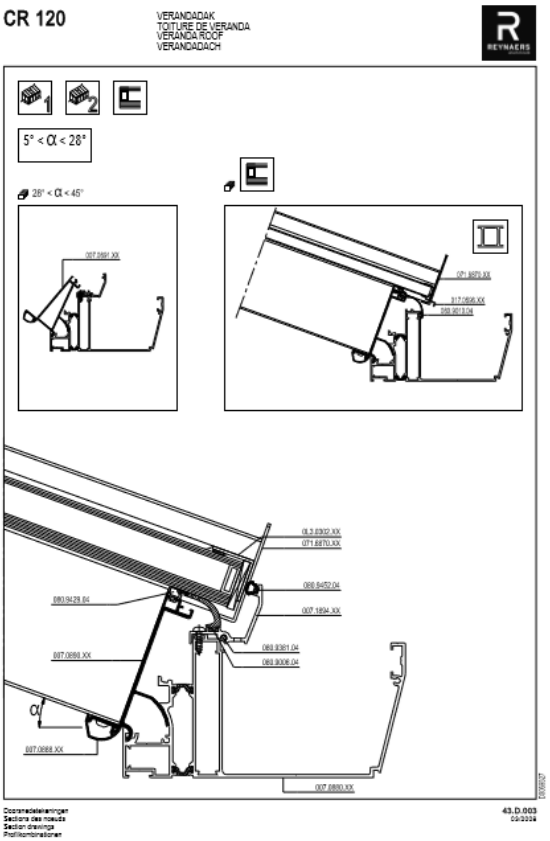
VERANDADAK
TOITURE DE VERANDA
VERANDA ROOF
VERANDADACH
5° < α < 28°
28° < α < 45°
43.D.002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VERANDADAK
TOITURE DE VERANDA
VERANDA ROOF
VERANDADACH
5° < α < 28°
28° < α < 45°
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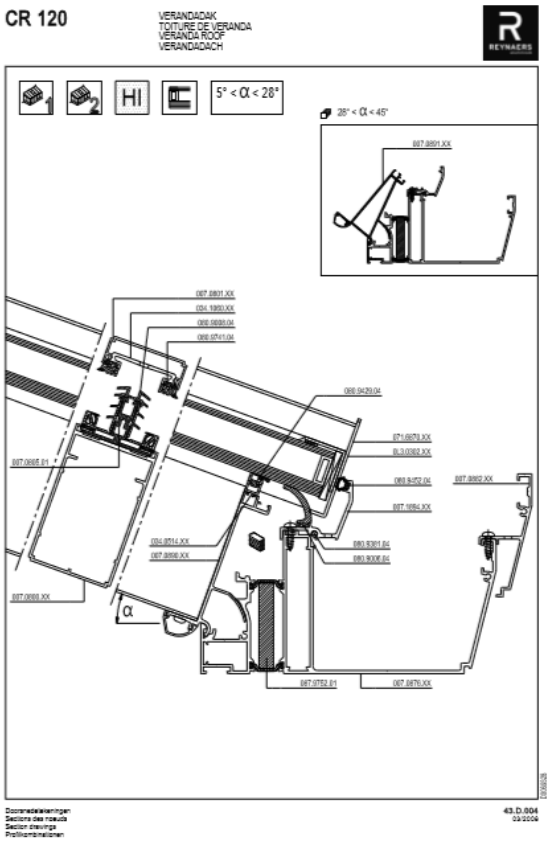
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TOITURE DE VERANDA
VERANDA ROOF
VERANDADACH
HI
5° < α < 28°
28° < α < 45°
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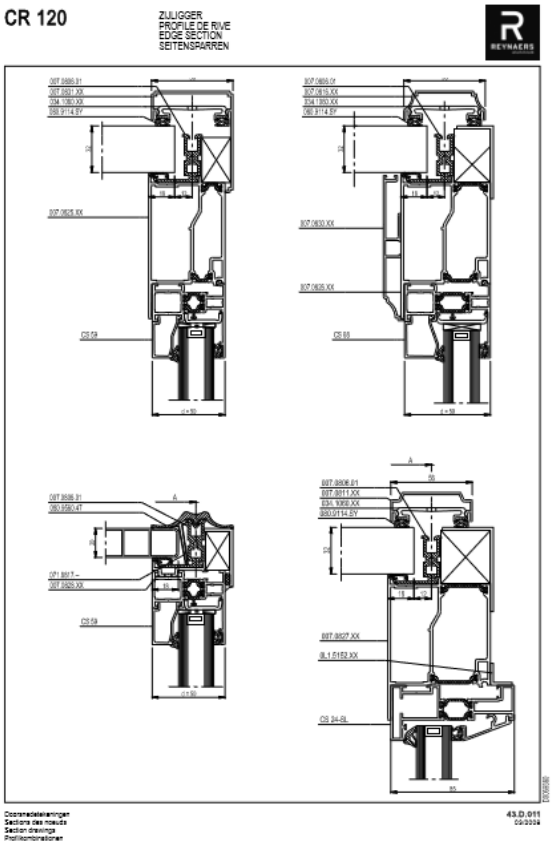
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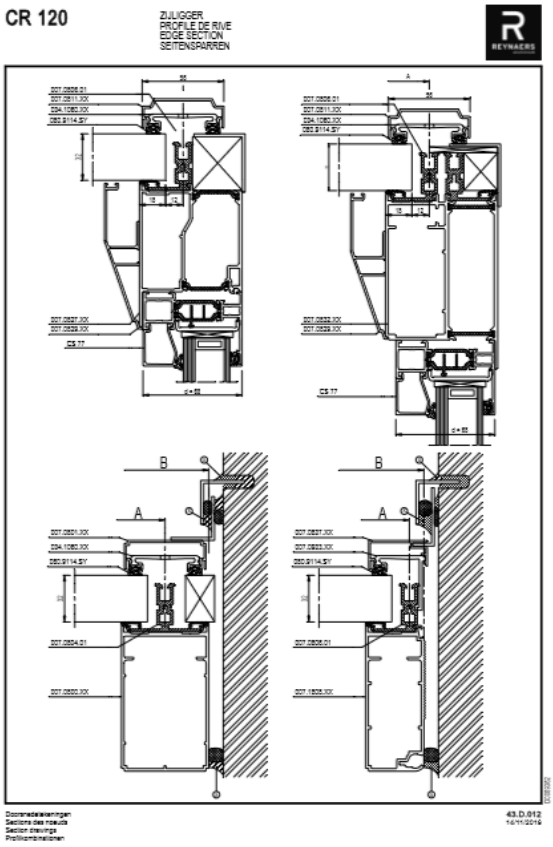
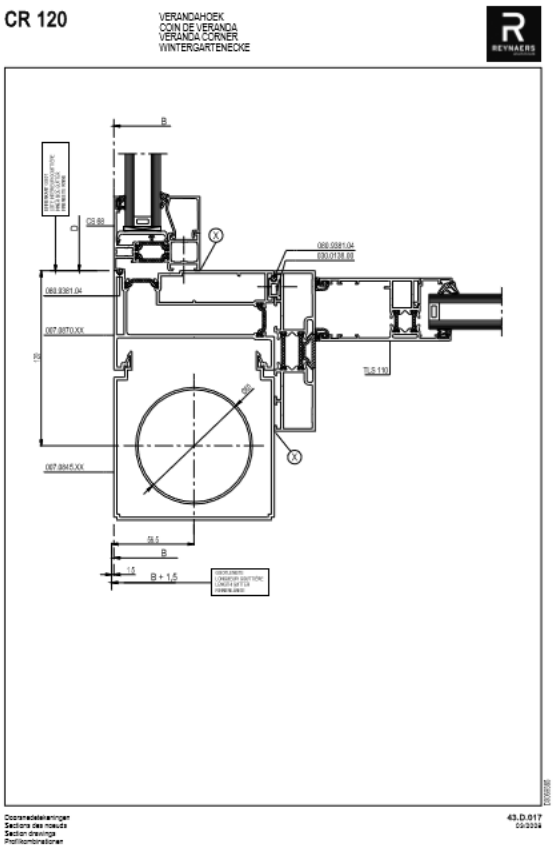
ZIJLIGGER
PROFILE DE RIVE
EDGE SECTION
SEITENSPARREN
REYNAERS
Doorsnedetekeningen
Sections des noeuds
Section drawings
Profilkombinationen
43.D.011
03/2004


CR 120
ZIJLIGGER
PROFILE DE RIVE
EDGE SECTION
SEITENSPARREN
REYNAERS
Doorsnedetekeningen
Sections des noeuds
Section drawings
Profilkombinationen
43.D.012
16/11/2015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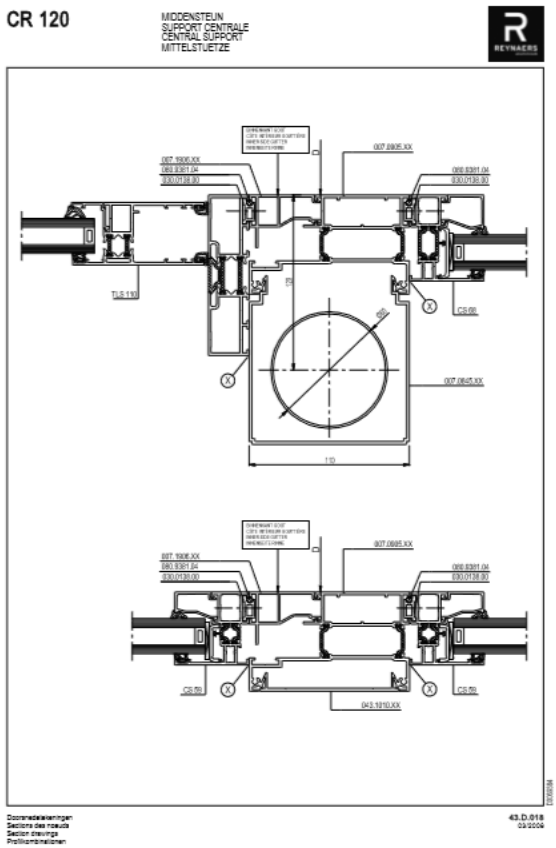
VERANDAHOEK
COIN DE VERANDA
VERANDA CORNER
WINTERGARTENECKE
REYNAERS
Doorsnedetekeningen
Sections des noeuds
Section drawings
Profilkombinationen
43.D.017
03/2004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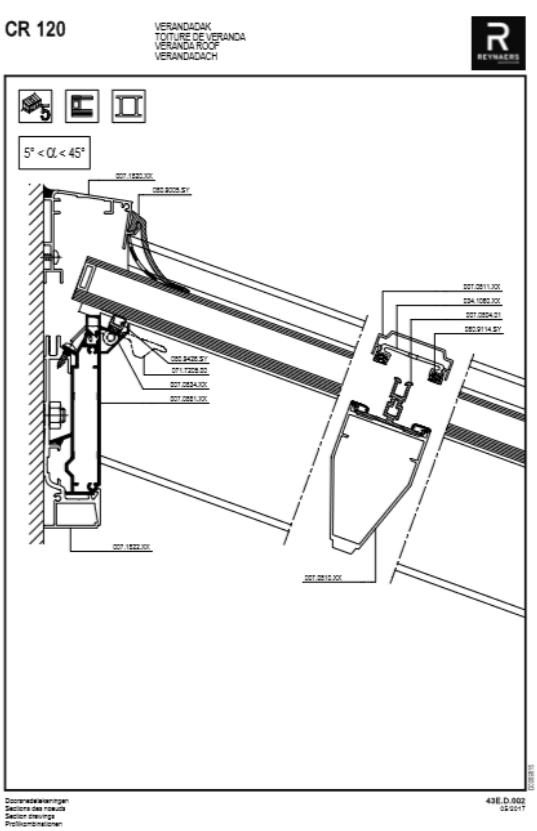
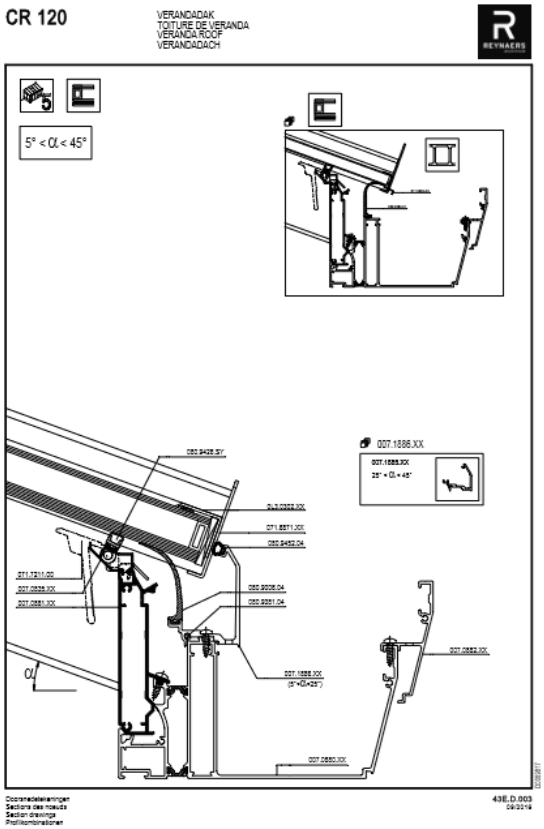
MIDDENSTEUN
SUPPORT CENTRALE
CENTRAL SUPPORT
MITTELSTUETZE
REYNAERS
Doorsnedetekeningen
Sections des noeuds
Section drawings
Profilkombinationen
43.D.018
03/2004

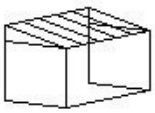

CR 120
VERANDADAK
TOITURE DE VERANDA
VERANDA ROOF
VERANDADACH
5° < α < 45°
43E.D.002
02/2017


CR 120
VERANDADAK
TOITURE DE VERANDA
VERANDA ROOF
VERANDADACH
5° < α < 45°
007.1686.XX
25° < α < 45°
43E.D.003
09/2016

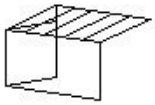
Annex II

Sub-models Reynaers library

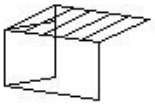
Pensée



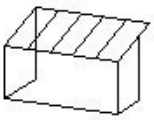
PENSÉE



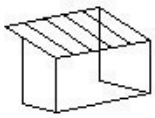
PENSÉE - mur latéral droit



PENSÉE - mur latéral gauche

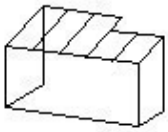


PENSÉE - mur partiel droit

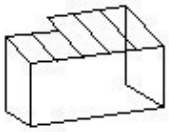


PENSÉE - Mur partiel gauche

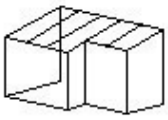
Lilas



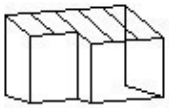
LILAS-retrait mural droit



LILAS-retrait mural gauche

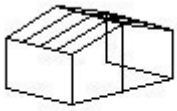


LILAS- retrait Façade Droite



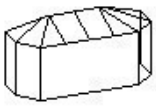
LILAS-retrait facade gauche

Myosotis

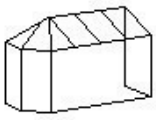


MYOSOTIS- Base

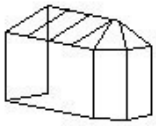
Glycine



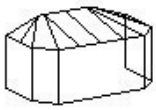
GLYCINE de Base



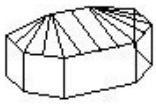
GLYCINE-mur latéral droit



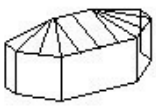
1/2 CLYCINE DROIT



GLYCINE-Base-1 chevron sur façades latérales

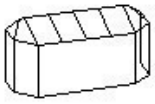


CLYCINE-Base-1 chevron sur facades latérales et...

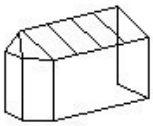


GLYCINE-Base-1 chevron sur pan coupé

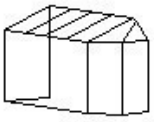
Primèvere



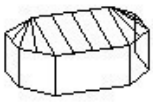
PRIMÈVERE base



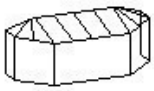
1/2 PRIMEVÈRE GAUCHE



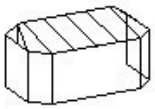
1/2 PRIMEVÈRE DROITE



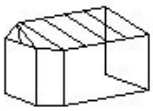
PRIMEVÈRE-Base-1 chevron sir pan coupé et 1 chevro...



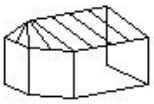
PRIMEVÈRE-Base-1 chevron sur pan coupé



PRIMEVÈRE- 1 chevron sur façades laterales

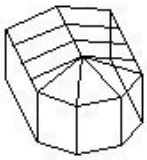


1/2 PRIMEVÈRE GAUCHE- 1 chevron sur façade latérale

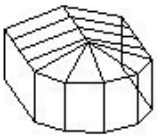


1/2 PRIMEVÈRE GAUCHE- 1 chevron sur façade lat"ra...

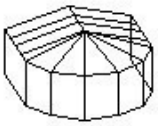
Lys



LYS- 4 aretiers



LYS-5 aretiers



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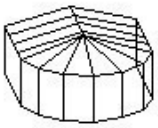
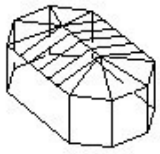
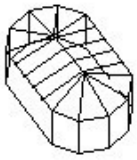


LYS-7 aretiers



LYS_DOUBLE_4A



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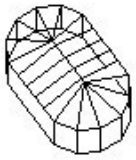
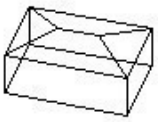
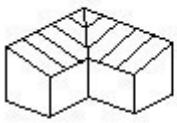


LYS_DOUBLE_6A

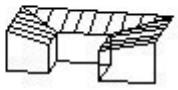


LYS_1

Pivoine

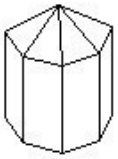


CR120-PIVOINE-A

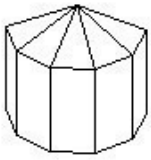


CR120-PIVOINE-B

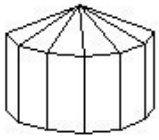
Tournesol



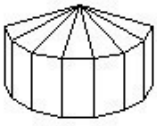
TOURNESOL- avec 3 aretiers



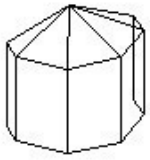
TOURNESOL-Faitière Alignée-4 aretiers



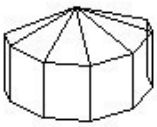
TOURNESOL-Faitière alignée- 5 aretiers



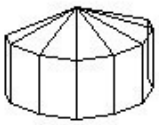
TOURNESOL-Faitière alignée-56 aretiers



TOURNESOL-Faîtière décalée- 4 aretiers

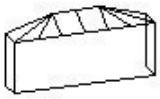


TOURNESOL-Faitière décalée-5 aretiers

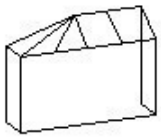


TOURNESOL- Faîtière décalée- 6 aretiers

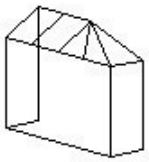
Rose



ROSE-BASE



1/2 ROSE GAUCHE



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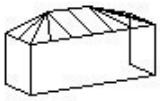
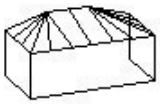


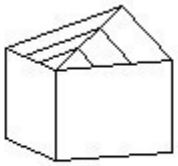
ROSE-base- avec 1 chevron sur facades latérales



ROSE-base-avec 2 chevrons sur façad...

Nénuphar

NÉNUPHAR-Base



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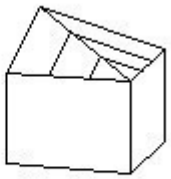
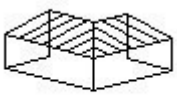
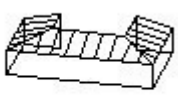


1/2 NÉNUPHAR DROIT

Muguet



MUGUET Modèle A

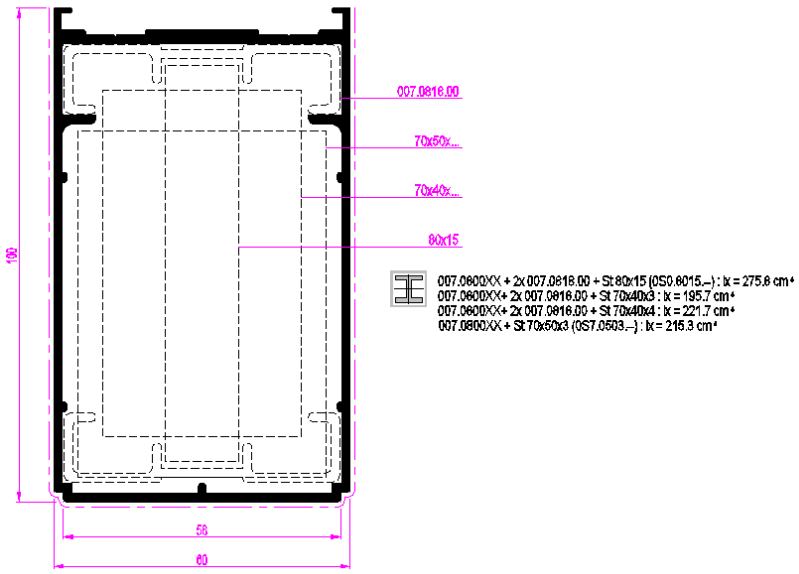


MUGUET Modèle B

Annex III

Example profiles in AutoCad

007.0800.XX



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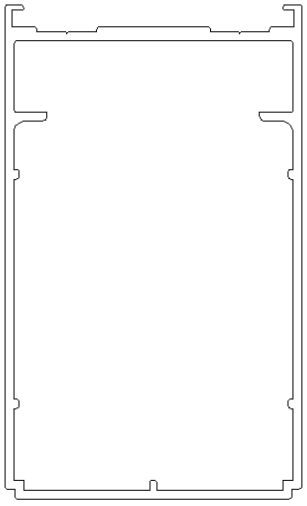

Annex IV

Organizational chart Xlib

Organizational chart Xlib - Conservatory settings: main links between objects