E.T.S. de Ingeniería Industrial,
Informática y de Telecomunicación

COCKPIT ASSEMBLY LINE FOR THE MODEL 3, TESLA

Grado en Ingeniería
en Tecnologías Industriales

Trabajo Fin de Grado

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A. SOLICITATION DOCUMENT

ASSEMBLY LINE-NEWARK FOR THE MODEL 3, TESLA

CONTENTS INDEX

1. DEFINITION AND SCOPE OF APPLICATION

1.1. DEFINITION

The purpose of this statement is to describe the design, construction and operation of the standard assembly line of cockpits that will be building in the Plant of Newark. This document explains the specifications for the proper functionality of the assembly line. The design and installation of the assembly line will be according to the North American normative, UL (Underwriters Laboratories Inc.).

The client who ordered the project is SAS Automotive, but it is not the final client. They produce the cockpits for TESLA Inc.

1.2. SCOPE OF APPLICATION

The following solicitation document will be applied on the Newark's assembly line.

This Assembly line has, mainly, three areas. The first area belongs to the cockpit assembly. The electric control area of cockpit is next to it. After, there are the e-check stations designated to do the final review. There, the operator checks up if the cockpit has quality defects. Finally, there is the load and unload of cockpits area.

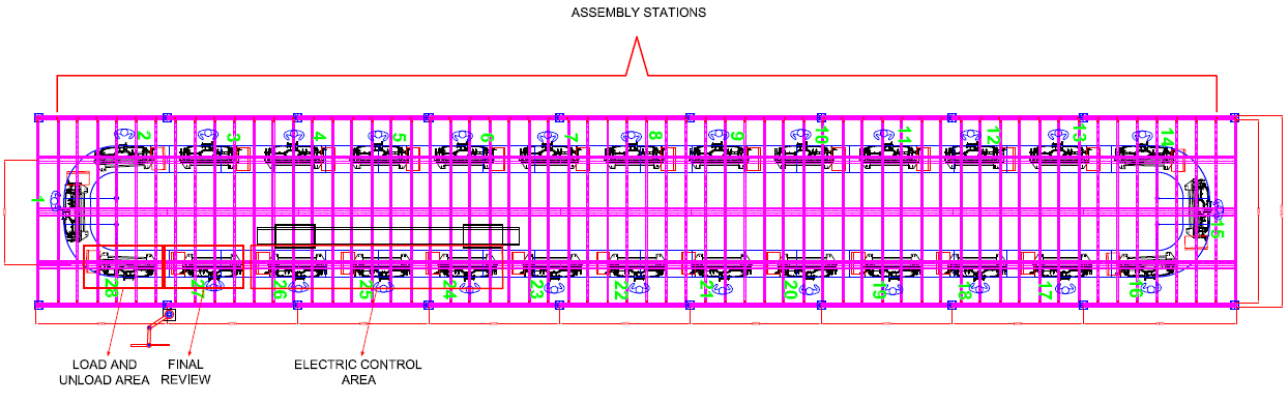

Figure 1.1: Example of an assembly line and its areas.

2. GENERAL PROVISIONS

The main components of the line are:

- Structure
- Dragging system
- Trolley
- Electric system
- Control system

Those components will be described in the following sections.

2.1. STRUCTURE

The function of the main structure of the assembly line, is to support and secure the drive systems of the trolley, light fixtures, air distribution, assembly tooling and test electrical systems. The main structure is composed of modular frames, whose elements must be screwed in their boards and unions. It seeks to avoid, as far as possible, making welded unions in structure. If welded unions have to be made previously, it must be approved by SAS Automotive systems.

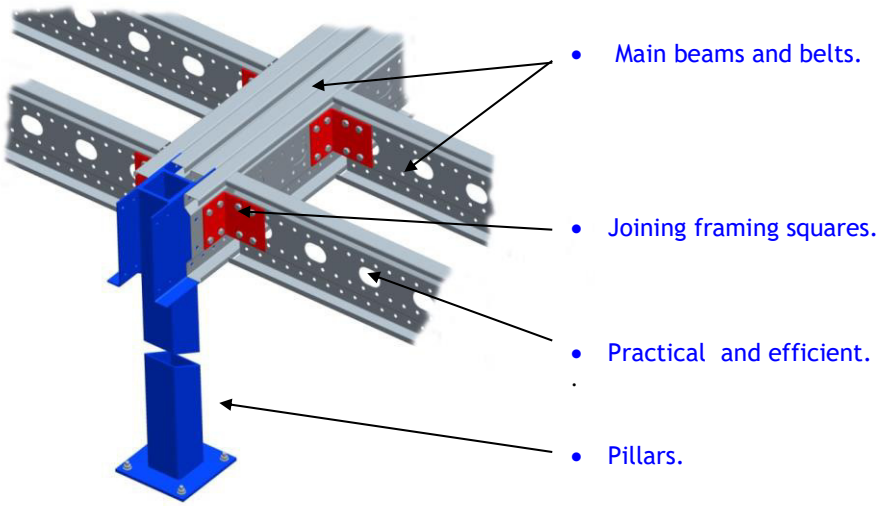

Figure 2.1: Beams, crossbeams and columns

The main beams and belts used are manufactured in cold galvanized laminated steel, with a minimum covering mass of 275 g/m², certified according to approved tests in the state regulations.

The steel used has a very high elastic limit (quite higher than the one normally used) and meets the S350GD Z 275 quality standard.

This system can be very easily dismantled or assembled.

2.2. DRAGGING SYSTEM

Dragging systems allows moving trolleys all around the circuit. The components of the systems are: guide or rail, chain and caterpillar.

Caterpillar is a gear motor with frequency variable.

Here are some photos of the previous project in Pernambuco (Brazil).

Figure 2.2: Guide or Rail

Figure 2.2: Chain

Figure 2.3: Caterpillar

2.3. TROLLEY

The assembly trolley is an element used to carry the different pieces, which hold the cockpit, while these is assembled along the line.

This trolley is designed and adapted for any cockpit manufactured in the line and allows the movement and rotation of the cockpit for making easier the assembly of the its different components.

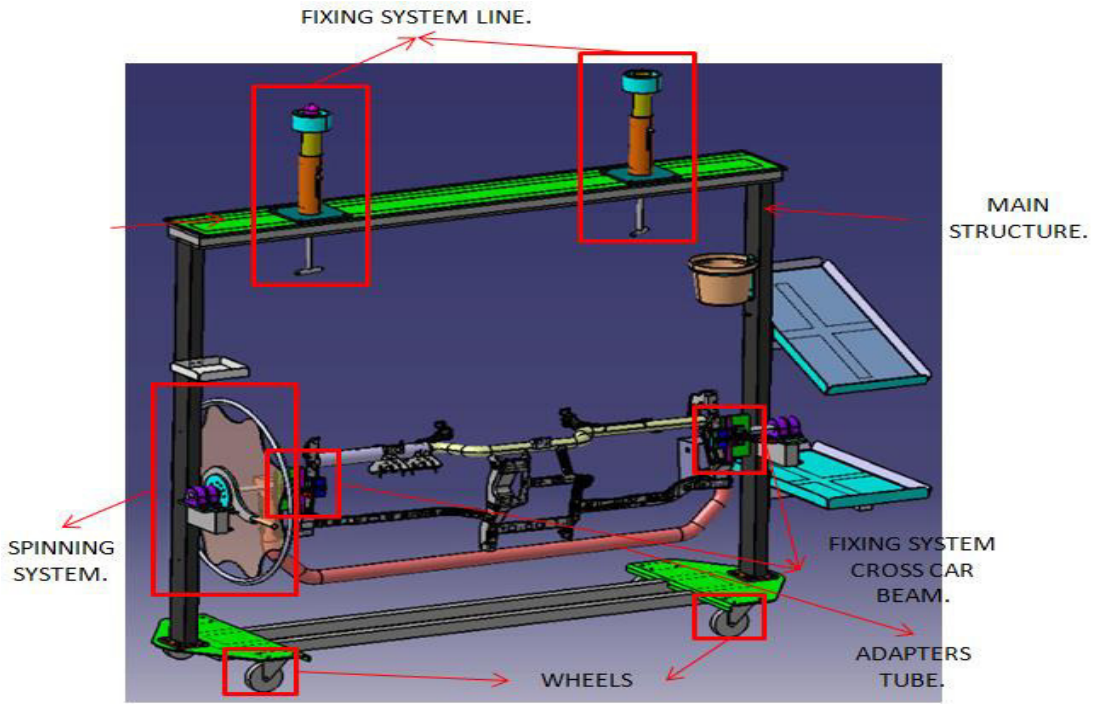

Figure 2.4: Trolley

2.4. ELECTRIC SYSTEM

The electric installation of assembly line must fulfil the following specifications:

- General electric cabinet capacity will be equal to 1.5 times the maximum expected value to avoid a possible voltage drop.
- Siemens S7 automat.
- Touch screen, color, memory capacity and alarm log, located in the front of the electric cabinet.
- Auxiliary power connection boxes in each column including most normal outlets, 10 A each, 100% simultaneously.
- All wiring labeled on both ends. Labeling according to electrical diagram.

- Power outlet boxes and illumination control will be able to operate even when the line is in off condition, not running.
- The sockets or outlets, in primary level, are protected by type B curves.
- Protections header are type C curves.
- System for protection against electrical and mechanical overloads.
- The distribution trays wiring, will be at the highest part of the structure.
- Voltage and frequency according to local electric fluid condition of the area.
- Preventions will be considered for power factor and local voltage quality.
- Facility will be supplied with a light indicating system to show the area of the line on which an emergency or line stop has been executed
- The automat will keep a log of stops and errors in the line.

Within the electrical installation of the assembly line the electrical cabinet, network sockets and lighting are included.

Figure 2.5: Example of an electrical cabinet with the HMI and the push buttons

2.5. CONTROL SYSTEM

To control the assembly line, it is installed a control panel in the electrical cabinet door.

This panel allows activate and deactivate all the systems of the assembly line and to modify and check all the parameters of the machine.

Also, you can check the production data and collect historic data stored in the panel memory. For example, the number of stops, the average of its length…

It controls the modes of the assembly line:

- Manual mode
- Automatic mode
- Maintenance mode
- Production management mode
- Lighting mode
- Stop management mode

It also ensures the safety, with an “emergency stop” push button (on the columns of the line) and a “stop line” push button (on the electric cabinet).

The HMI control screen uses images to handle the line:

- Welcome
- Main
- Production
- Alarms
- Stops
- Clever

And there are push buttons situated under the HMI that have the functions:

- Run
- Stop
- Acknowledge
- Rearm

At all the images of the HMI, you can view the basic functions detailed bellow:

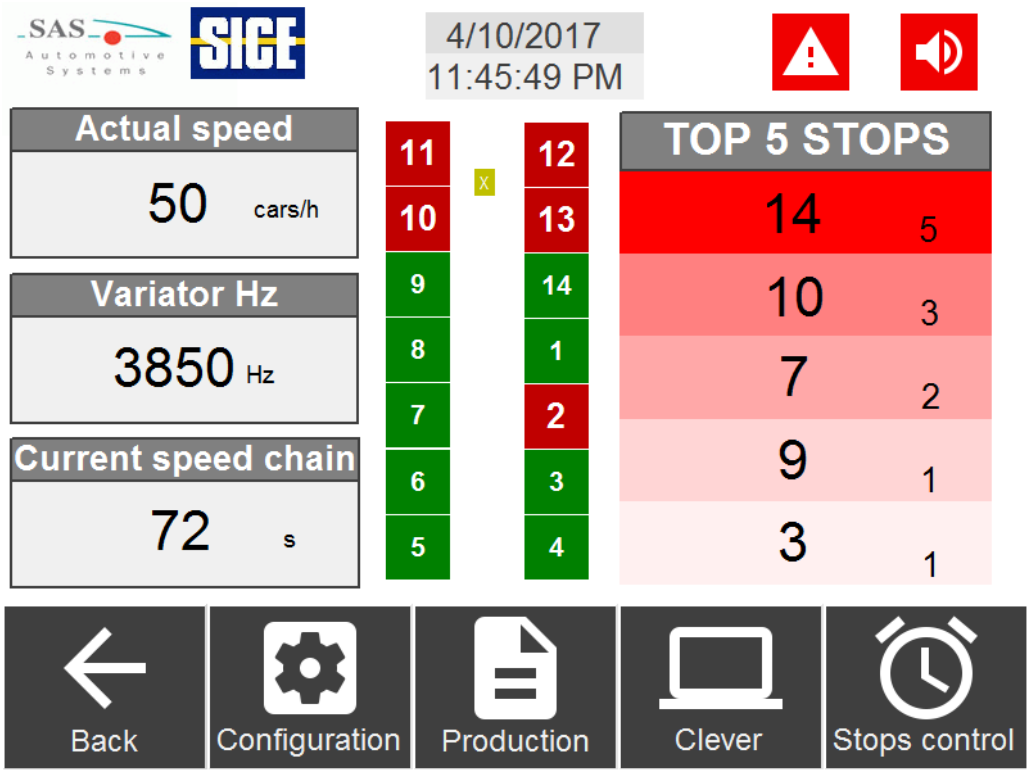

Figure 2.6: Main screen of the HMI

3. NORMATIVE

It must follow the UL-508A, Standard for Industrial Control Panels.

The Standard Covers Industrial Control Panel which may contain:

- Motor controllers
- Overload relays
- Fused Disconnects / Circuit Breakers
- Buttons, Switches, Timers & Controllers
- Wiring
- Terminals
- Enclosures

Those industrial control panels are intended for general industrial use, operating from a voltage of 1000 volts or less. This equipment is intended for installation in ordinary locations, in accordance with the National Electrical Code, ANSI/NFPA 70, where the ambient temperature does not exceed 40°C (104°F) maximum. These requirements also cover industrial control panel enclosures and industrial control panels primarily intended for flame safety supervision of combustible fuel type equipment, elevator control, crane or hoist control, service equipment use, marine use, air conditioning and refrigeration equipment, equipment for load management applications, fountain control, irrigation equipment control, and for control of industrial machinery including metalworking machine tools, power press controls, and plastic injection molding machinery. Also covered are industrial control panels intended for control of permanently installed electrical equipment for aquatic playgrounds, permanently installed electrical equipment associated with commercial water park rides, wave pools and similar installations, and permanently installed electrical equipment associated with commercial and large residential swimming pools and in-ground spas.

As it is told before, it includes Industrial Machinery, the following types of machines which are identified as industrial machinery are:

- Metalworking machine tools, machines that cut or form metal
- Plastics Machinery, including injection molding, extrusion, blow molding, specialized processing, thermoset molding and size reduction machines
- Wood machinery, woodworking, laminating and sawmill
- machines

- Assembly Machines
- Material handling machines, including industrial robots and transfer machines
- Inspection and testing machines including coordinate measuring and in-process gauging machines”

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B. PROJECT REPORT

COCKPIT ASSEMBLY LINE FOR THE MODEL 3, TESLA

CONTENTS INDEX

1. OBJETIVE

The objective of this project is to design and assemble a cockpit assembly line for the Model 3 of Tesla. The line will be at Newark, California, United States.

This project report explains the specifications for the proper functionality of the assembly line. The design and installation of the assembly line will be according to the North American normative, UL (Underwriters Laboratories Inc.).

Figure 1.1: Model 3 of Tesla

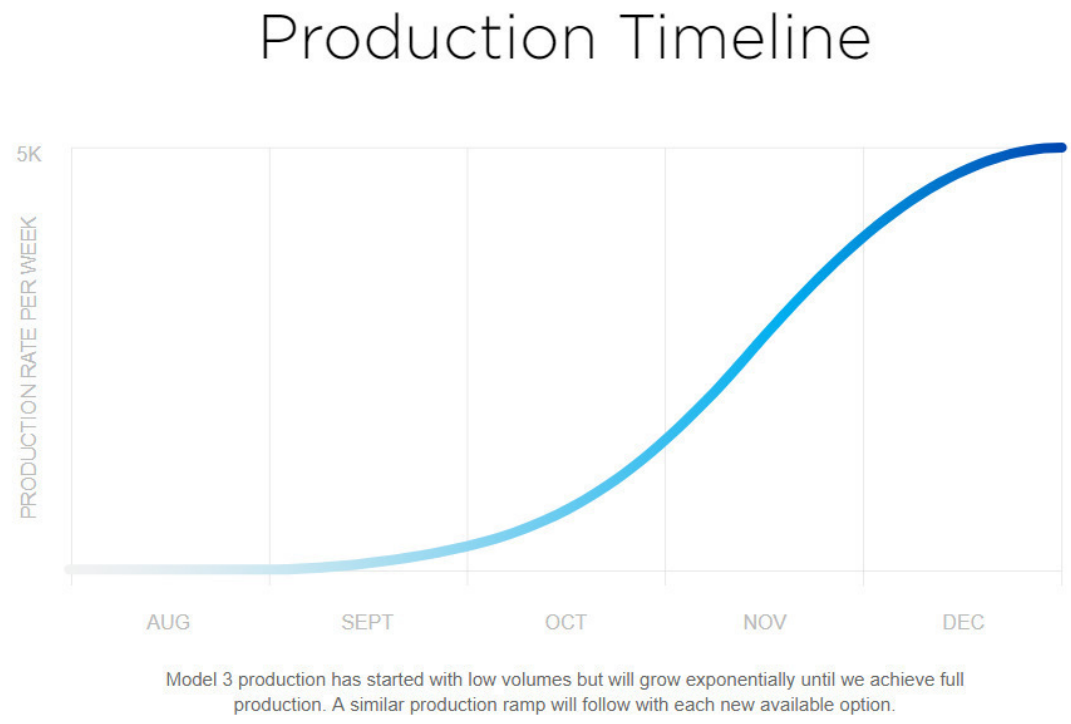


Figure 1.2: Production timeline (by Tesla Inc.)

The production plant will be divided in two plants, as it was asked by Tesla. So, it fits better with their production. Each line will be able to produce 50 cockpits per hour.

Each line will be composed by 18 work stations.

In the following sections, it will be described how the project has been design (structure, trolley, dragging system, electric system and control system) and how the production plant is.

2. BACKGROUND INFORMATION

2.1. ELON MUSK

Figure 2.1: Ellon Musk (Wikipedia)

Elon Musk (born as Elon Reeve Musk on June 28, 1971) is a South African-born Canadian-American business magnate, investor, engineer, and inventor.

Elon Musk is the co-founder, CEO and Product Architect at Tesla, overseeing all product development, engineering, and design of the company's electric vehicles, battery products, and solar roofs.

Elon is also the co-founder, CEO, and lead designer of Space Exploration Technologies (SpaceX), where he oversees the development and manufacturing of advanced rockets and spacecraft for missions to and beyond Earth orbit, with the goal of creating a self-sustaining city on Mars. He is also the co-founder and chairman of OpenAI, a non-profit research company working to build safe artificial intelligence and ensure that AI's benefits are as widely and evenly distributed as possible.

Previously, Elon co-founded and sold PayPal, the world's leading Internet payment system, and Zip2, one of the first internet maps and directions services, which helped bring major publishers like the New York Times and Hearst online.

Musk has stated that the goals of SolarCity, Tesla, and SpaceX revolve around his vision to change the world and humanity. His goals include reducing global warming through sustainable energy production and consumption, and reducing the "risk of human extinction" by "making life multiplanetary" by establishing a human colony on Mars.

In addition to his primary business pursuits, he has also envisioned a high-speed transportation system known as the Hyperloop, and has proposed a VTOL supersonic jet aircraft with electric fan propulsion, known as the Musk electric jet.

2.2. TESLA

Tesla’s mission is to accelerate the world’s transition to sustainable energy.

Tesla was founded in 2003 by a group of engineers who wanted to prove that people didn’t need to compromise to drive electric – that electric vehicles can be

Figure 2.2: Tesla's logo

better, quicker and more fun to drive than gasoline cars. Today, Tesla builds not only all-electric vehicles but also infinitely scalable clean energy generation and storage products. Tesla believes the faster the world stops relying on fossil fuels and moves towards a zero-emission future, the better.

Launched in 2008, the Roadster unveiled Tesla's cutting-edge battery technology and electric powertrain. From there, Tesla designed the world's first ever premium all-electric sedan from the ground up – Model S – which has become the best car in its class in every category. Combining safety, performance, and efficiency, Model S has reset the world's expectations for the car of the 21st century with the longest range of any electric vehicle, over-the-air software updates that make it better over time, and a record 0-60 mph acceleration time of 2.28 seconds as measured by Motor Trend. In 2015, Tesla expanded its product line with Model X, the safest, quickest and most capable sport utility vehicle in history that holds 5-star safety ratings across every category from the National Highway Traffic Safety Administration. And to complete CEO Elon Musk's "Secret Master Plan," in 2016, Tesla announced Model 3, a low-priced, high-volume electric vehicle that began production in 2017.

Tesla's vehicles are produced at its Fremont factory in California, where the vast majority of the vehicle's components are also made. As Tesla continues to expand its product line, Tesla's production plan is also set to increase to a rate of 500,000 vehicles a year by 2018.

To create an entire sustainable energy ecosystem, Tesla also designed a unique set of energy solutions, Powerwall, Powerpack and Solar Roof, enabling homeowners, businesses, and utilities to manage renewable energy generation, storage, and consumption. Supporting Tesla's automotive and energy products is the Gigafactory – a facility designed to significantly reduce battery cell costs and, by 2018, produce more lithium-ion batteries annually than were produced worldwide in 2013. By bringing cell production in-house, Tesla manufactures batteries at the volumes required to meet production goals, while creating thousands of jobs.

And this is just the beginning. With Tesla building its most affordable car yet, Tesla continues to make products accessible and affordable to more and more people, ultimately accelerating the advent of clean transport and clean energy production. Electric cars, batteries, and renewable energy generation and storage already exist

independently, but when combined, they become even more powerful – that's the future we want.

2.3. MODEL 3

The Model 3, is the car for which we are making the cockpits.

Figure 2.3: Model 3

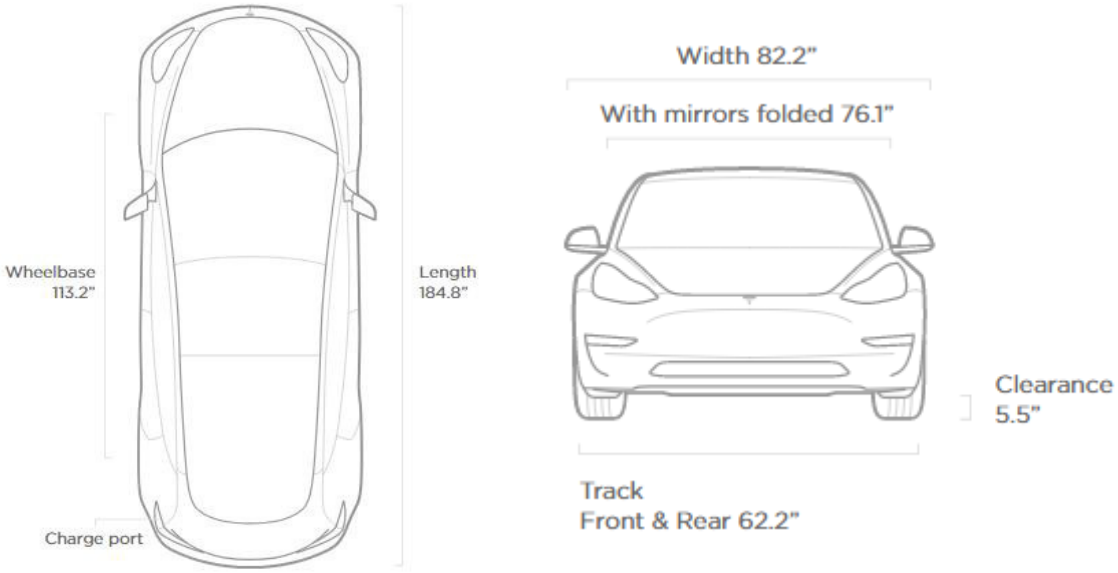


Figure 2.4: Model 3 measurements

The specifications of the Model 3 given by Tesla are:

Safety

- Automatic emergency braking and collision avoidance
- Eight airbags
- Electronic stability and traction control

Convenience

- 15" touchscreen with onboard maps & navigation
- Wi-Fi and LTE internet connectivity
- Keyless entry and remote climate control with app
- Voice activated controls
- 60/40 split folding rear seats

Standard Interior

- 15" touchscreen display
- Dual zone climate control system
- FM/Internet streaming radio
- Textile seating
- Center console with open storage and two USB ports

Premium Upgrades

- Premium heated seating and cabin materials throughout, including open pore wood décor and two rear USBs
- 12-way, power adjustable front seats, steering column and side mirrors, with custom driver profiles
- Premium audio system with more power, tweeters, surround speakers and subwoofer
- Tinted glass roof with ultraviolet and infrared protection
- Auto dimming, power folding, heated side mirrors
- LED fog lamps
- Center console with covered storage and docking for two smartphones

Warranty

- 4 years, 50,000-mile limited vehicle warranty
- 8 years, 100,000-mile battery warranty (Standard)
- 8 years, 120,000-mile battery warranty (Long Range)

The Tesla Model 3 is one of the most anticipated vehicles of all time. The Californian company received nearly 400,000 pre-orders worth upwards of $10 billion simply by showing off a close-to-production prototype. No other automaker has ever pulled off such a feat.

That's because the all-electric Model 3 is the car motorists all over the globe have been waiting for since the launch of the original Roadster — a Tesla designed and built for the masses. Production started ahead of schedule, and on July 28, Tesla delivered the first 30 cars during a special event at its headquarters.

The Tesla Model 3 benefits from advances in battery technology that were recently inaugurated by the ultra-quick P100D versions of the Model S and the Model X. The company's newest battery pack is much denser than its predecessor, and it gets a comprehensively updated cooling system. Battery production takes place in the Gigafactory, a massive complex located on the outskirts of Reno, Nevada.

Model 3 owners can use Tesla's network of Supercharger stations, but there's a catch. Unlike Model S and Model X owners, they need to pay every time they plug their car into a Supercharger. Tesla says the service will "cost less than the price of filling up a comparable gas car," though rates haven't been announced yet. The company is expecting high demand, so it's been increasing the size of its charging station network over the past few months.

Figure 2.5: Cockpit of the Model 3

Technology is an integral part of every Tesla, and the 3 is no different. A 15-inch, TV-like touchscreen on the dashboard groups all of the car's key functions into a single unit in order to reduce distractions to the strict minimum. It takes the minimalist cabin design automakers have been moving towards over the past few years to unprecedented heights. Other standard features will include cloth upholstery, Wi-Fi connectivity, an auto-dimming rear-view mirror navigation, voice controls, a back-up camera, 60/40 rear seats, dual-zone climate control, and two USB ports in the front console.

2.4. SAS AUTOMOTIVE

SAS is the enterprise who hired SICE for designing the production plant. In the next lines, I will give a brief summary of the company.

Figure 2.6: SAS Automotive Logo

SAS has stood for reliability and innovative expertise in the field of cockpit systems for more than 20 years. They work focused and effectively on new future trends and are regarded as a competent international partner for the automotive sector with high quality and service standards. As a joint venture between Continental and Faurecia, we always reliably supply just-in-time and just-in-sequence.

Since being founded in 1996, SAS has represented safety, stability and the greatest efficiency, which at the same time are the fundamental key requirements of their products. Their non-proprietary cockpit concepts are set apart by their outstanding technical quality in the areas of mechanics, technology and electronics. This also reflects our long-term experience in the field of automotive accessories.

SAS specializes in the assembly, logistics and development of modules for motor vehicles and trucks. They deliver high quality as well as innovative and customer-specific modules precisely when the customer needs them, down to the second. SAS is a leader in quality, performance and reliability for both people and the environment. When developing profitable innovations, they place emphasis on cutting edge technology and modern standards.

Apart from cockpit modules, SAS has also become a competent partner for further innovative interior and front-end modules such as center consoles in the last ten years.

As an international partner for the automotive industry, they are present with their works at over 20 locations in more than 13 countries across the world. They plan, test and realize innovative prototypes and their efficient assembly techniques in their five development centers.

They supply strong solutions and perfectly coordinated logistics which help them to supply more than 4.4 million cockpits per year. This means that SAS is among the most important main players in the constantly changing and growing global automotive industry.

They supply their national and international customers with the highest quality and comprehensive service: from planning and developing customer-specific solutions to assembly on our highly standardized assembly lines and our split-second coordinated logistics – SAS is the perfect partner.

3. STATE OF THE ART

In this section, I will explain how the production plant is.

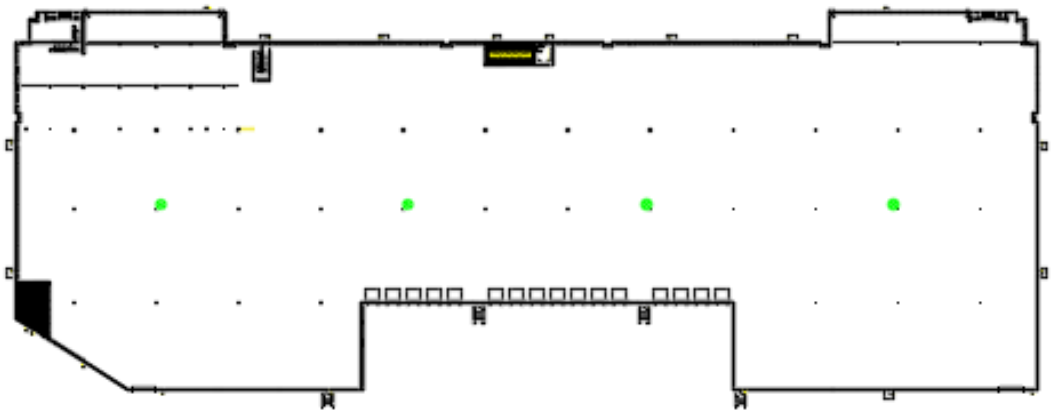


Figure 3.1: Plan view of the production plant

This is the plan view of the production plant, given by SAS Automtive. But not all the space is available for the assembly line.

For example, they have to storage the materials in warehouses.

That is the reason why they gave us the plant view, in which it was drawn the layout of all the elements.

SAS told us too, how they wanted the lines and the measurements. And the position on the production plan.

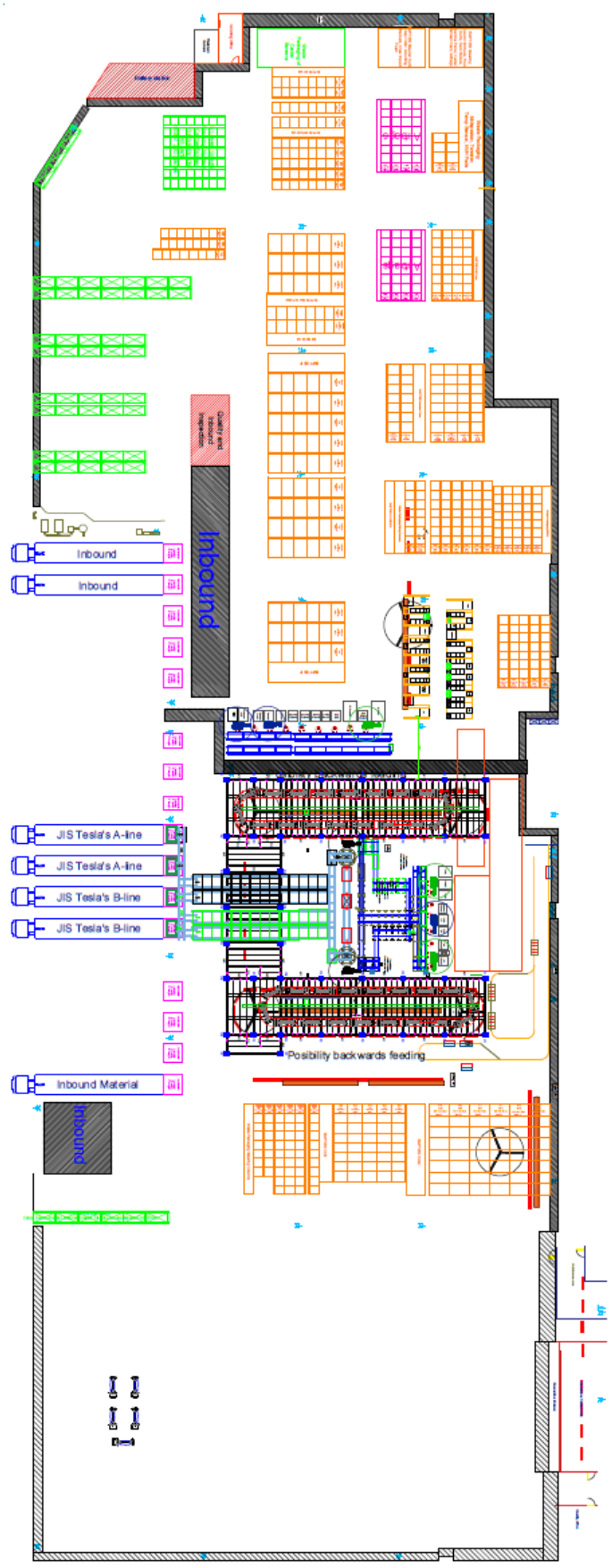


Figure 3.2: Plan view of the production plant with all the elements

Here is a close up of the assembly line:

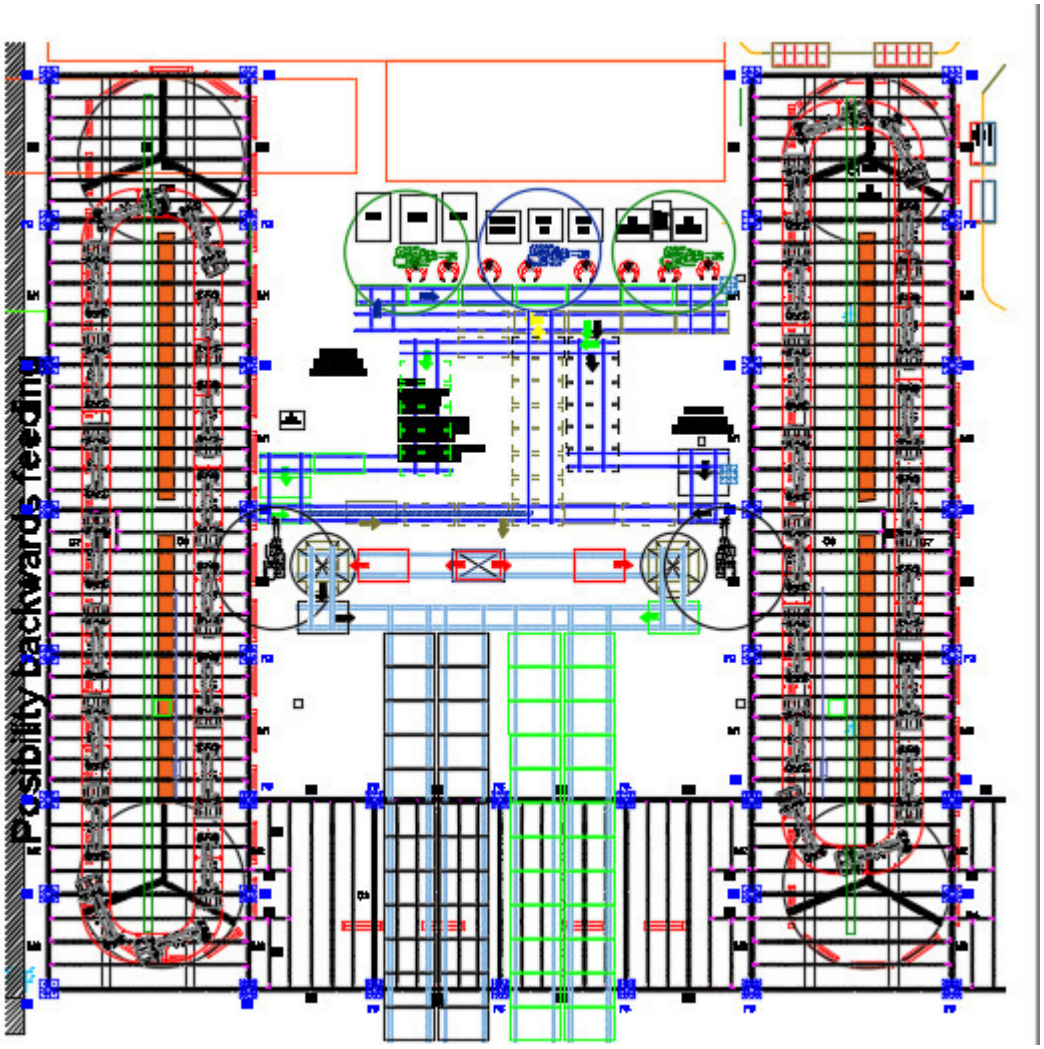


Figure 3.3: Plan view of the assembly line

There are two lines, which are connected by the structure. In the middle there are the conveyors, that is for the next project. They are for doing a pre-assembly of the cockpits.

In order to make the things easier, the lay out has all the components, although they aren't going to be assembly yet.

There are 18 work stations in each line. Tesla decides de speed of the line, so those are the work stations that they need. This will be explained in the section 5, Final description of the assembly line.

This production plant has been created exclusively for the Model 3 of Tesla. So, the lines are adapted to the Tesla's Production Plant.

As they have two lines in their plant, in this plant there are two. So, each line provides a line of the Tesla's Production Plant.

In case a line of Tesla doesn't works, the line which provides it will stop and won't affect to the other line. If there were only one line, and a Tesla line stopped, that would affect to the production of the other line. Because they will have to change the production process.

4. DESGNING PROCESS

SICE has worked before with SAS Automotive. They have done more assembly lines along the world: Brazil, Turkey, Germany, Unite States and Spain.

So, they have experience working with this assembly lines. They have been perfecting the designs of the line among the projects. And visiting the lines already assembled to listen to the operators who work on the line for suggestions, helps to improve the designs too.

For example, visiting the line in Navarre, we learned that in the storage area because there were curves is better to put a rubber patch on the piece to prevent a big impact. The impact between the pieces, was already planned, but sometimes a piece fell because of that impact.

Collecting all that information, we have created a standardized solution. That is the reason why we didn't explore different alternatives for this project. We have the knowledge of the previous projects.

As it was explained in the Solicitation Document, the main components of the line are:

- Structure
- Dragging system
- Trolley
- Electric system
- Control system

Here below, I will explain each of the main components. They will be shown too with the drawings.

The control system, will be explained in the section 5: **final description of the assembly line**.

The project has been a teamwork, between the employers of the office. I have collected all the information to write the project. I have done the electric system drawings and helped to draw the rest of the drawings, when it was necessary.

4.1. STRUCTURE

Figure 4.1: Photo of the Newark's assembly line structure

The function of the main structure of the assembly line, is to support and secure the drive systems of the trolley, light fixtures, air distribution, assembly tooling and test electrical systems. The main structure is composed of modular frames, whose elements must be screwed in their boards and unions. It seeks to avoid, as far as possible, making welded unions in structure. If welded unions have to be made previously, it must be approved by SAS Automotive systems. The elements of modular frames are:

- Columns: they are manufactured apart from square steel tubes S-275-JR, whose dimension are equal to 160 mm and a thickness of 4 mm. The tubes have to be cut allowing getting accurate heights for the assembly line structure. Once, the tubes are cut, the capitals and the bases are added. The charge supported by the column is spread on the floor by squared bases of 300x300 mm and with thickness equal to 10 or 15 mm.
- Beam and crossbeam: the primary beams used are manufactured on galvanized cold rolled steel, with very high elastic limit and quality S350GD Z 275. In this kind of steel several models of sigma beams are manufactured, which changing the thickness and the wing, its

capability of supporting different charges. The sigma beams have better behavior than C beams in the face of bending situations, because the core is in the middle and therefore it respects the symmetry of the outline, avoiding that the profile bends when the beam enters into charge.

Columns and crossbeam are joined together by screws and sheets. Screws are heavy duty with galvanized steel finish quality with 8.8 with minimum breaking tension 800 N/mm2 and minimum elastic limit 640 N/mm2. Besides, they must be self-locking. In terms of steel sheets, which are angle connectors between both of elements, is S-235-JR quality.

The beams are designed to absorb the possible start, stop and obstruction inertias of the chain and avoid deformations for these causes. Besides, its suitability is modular making easier to follow movements if it will be necessary. Finally, the beams are designed so that they make easier suspended lighting systems and electrical distribution of the line, including plugs and electrical connections as well as different elements which process needs such as PC supports, screw machines …

The main structure of the assembly line is, at the same time, composed of three different kinds of mini-structures which are the following:

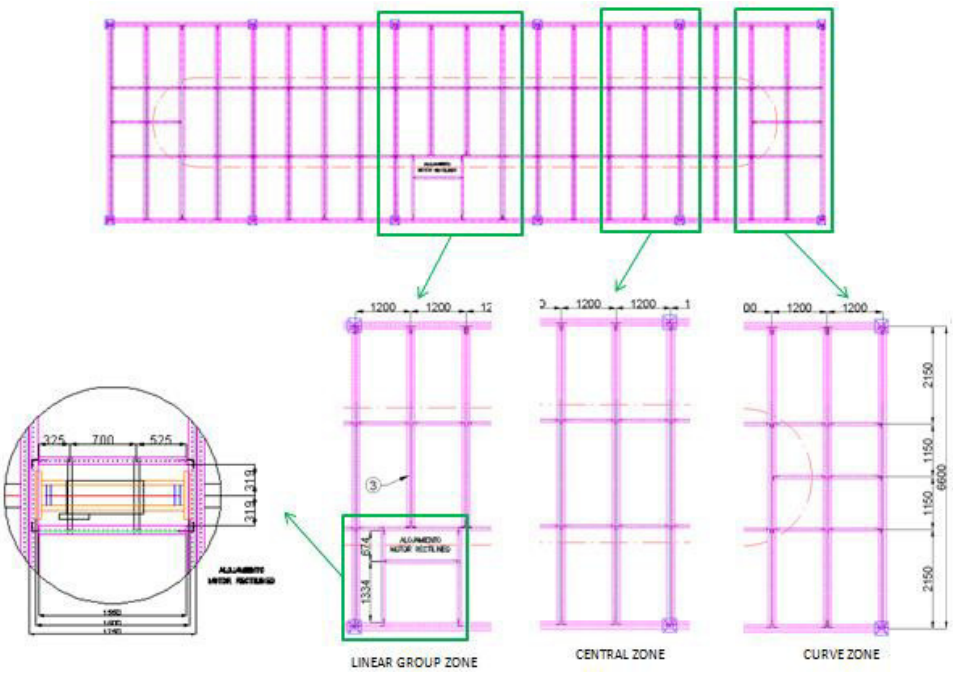


Figure 4.2: Main structure areas

The measures of previous image doesn't match with the designs because it is an example of the different areas.

4.1.1. Specifications of the structural components

All the structural components are made by PERMAR. They have their own software to study the situation and choose the correct elements. Fulfilling the normative of the Region where is the production plant and the specifications given by the client.

4.1.1.1. Beams and belts

The main beams and belts used by PERMAR are manufactured in cold galvanized laminated steel, with a minimum covering mass of 275 g/m^2, certified according to approved tests in the state regulations.

The steel used, has a very high elastic limit (quite higher than the one normally used) and fulfills the S350GD Z 275 quality standard.

Several models of SIGMA-PERMAR beams developed by them are made in this steel quality modifying the flanges and their thickness to deal with different load situations.

This type of beams, SIGMA, works better than the common "C" beams in terms of flexion loading situations since the web of the beam is centered and therefore it respects the profile symmetry, preventing it from rocking when the beam is being loaded.

The main beams are supported by the pillars in order to transmit the load, and are held with capitals screwed with framing squares. Which square and hold the beam in order to prevent the movement due to the side sagging. These beams have drill holes every 50mm. In order to be able to receive the load at any point.

The secondary beams are joined to the main beams by screwed plugs. These plugs vary depending on the type of beams and the design load.

On the next image, is shown the guide profile of the beams shaped in cold used and developed by PERMAR.

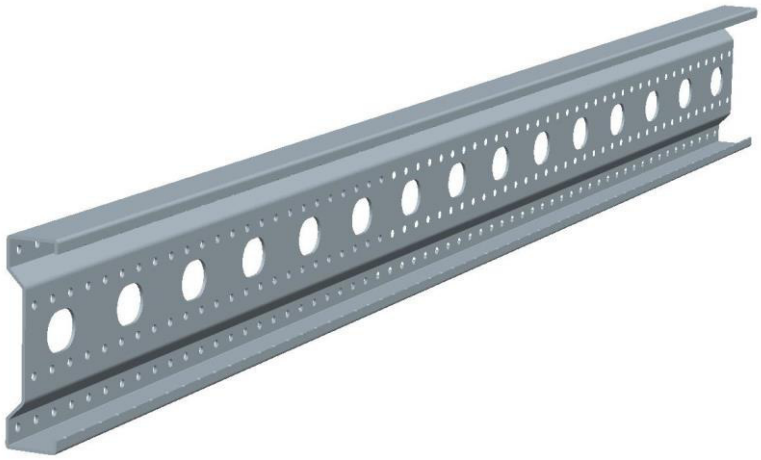


Figure 4.3: Guide profile of the beams

In the following tables, the different SIGMA beam models are described. On the left, there is a SIGMA beam with the measurements, to help interpreting the tables.

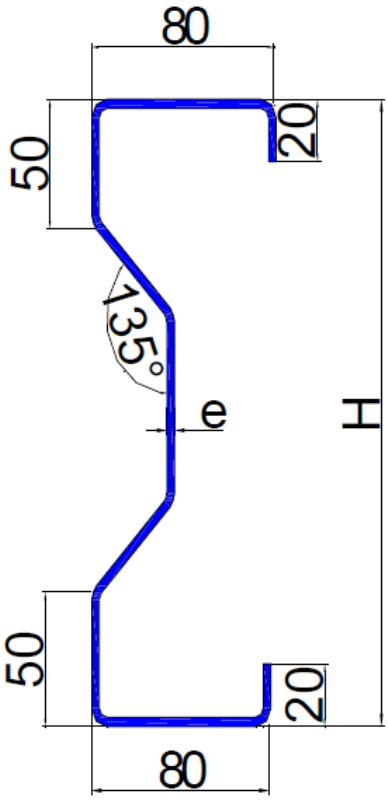


Figure 4.4: SIGMA beam

PERFIL	H mm	e mm	Peso Kg/ml
200x2	200	2,0	6,24
200x2,5	200	2,5	7,81
200x3	200	3,0	9,37
225x2	225	2,0	6,64
225x2,5	225	2,5	8,30
225x3	225	3,0	9,96
250x2	250	2,0	7,03
250x2,5	250	2,5	8,79
250x3	250	3,0	10,55
275x2	275	2,0	7,42
275x2,5	275	2,5	9,28
275x3	275	3,0	11,14
300x2	300	2,0	7,81
300x2,5	300	2,5	9,77
300x3	300	3,0	11,72
300x4	300	4,0	15,35
325x3	325	3,0	12,31
325x4	325	4,0	16,14
350x3	350	3,0	12,90
350x4	350	4,0	16,92
375x3	375	3,0	13,49
375x4	375	4,0	17,70
400x3	400	3,0	14,08
400x4	400	4,0	18,49

Table 4.1: SIGMA beams models (PERMAR), part 1

PERFIL	H mm	e mm	Peso Kg/ml
200x2	200	2,0	5,46
200x2,5	200	2,5	6,82
200x3	200	3,0	8,19
225x2	225	2,0	5,85
225x2,5	225	2,5	7,32
225x3	225	3,0	8,78
250x2	250	2,0	6,24
250x2,5	250	2,5	7,81
250x3	250	3,0	9,37
275x2	275	2,0	6,64
275x2,5	275	2,5	8,30
275x3	275	3,0	9,96
300x2	300	2,0	7,03
300x2,5	300	2,5	8,79
300x3	300	3,0	10,55
300x4	300	4,0	13,78
325x3	325	3,0	11,14
325x4	325	4,0	14,56
350x3	350	3,0	11,72
350x4	350	4,0	15,35
375x3	375	3,0	12,31
375x4	375	4,0	16,14
400x3	400	3,0	12,90
400x4	400	4,0	16,92

Table 4.2: SIGMA beams models (PERMAR), part 2

4.1.1.2. Pillars or columns

For the pillar design, we have used square tubes made of structural steel S275JO, of a maximum height of 12 meters. They are custom made, that makes possible the adaptation to any component or height lower to the maximum height.

The capitals can be integrated at different heights by welding, making possible to have mezzanines at different heights.

The pillars can also be divided in two or more independent sections so that ones are supported by the others with screwed joining plates. With this patented system (by PERMAR) multiple plants can be created.

The load received by the pillars is distributed on the support by means of base plates attached to the floor. These plates are square and their dimensions are 250 x 250 ó 300 x 300 mm., and thickness between 10 and 15 mm., (as suitable depending on the loading). These plates are centered and with stiffeners whenever necessary in order to approximate the pillar to the wall as much as possible.

The use of compound capitals together with the design of the specific connectors for special joining makes possible to interrupt joints between pillars at angles.

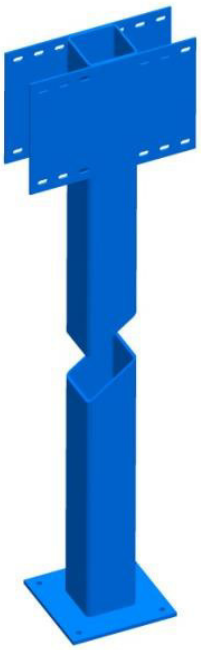


Figure 4.5: Example of a column

The column of the image, shows how are the columns of the first floor where there isn't a second floor. The upper part of the column is a system to attach the column to the beams.

The columns which are in the area where there is a second floor, don't have exactly the same system to attach to the beams. At the height of the second floor's beams they have mounting bracket and rest on them there are the same rectangles than the columns described before.

In the left image is shown the column in blue with the mounting bracket and the rectangles in green.

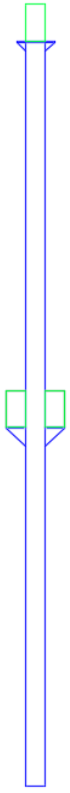


Figure 4.6: Column (up to the second floor)

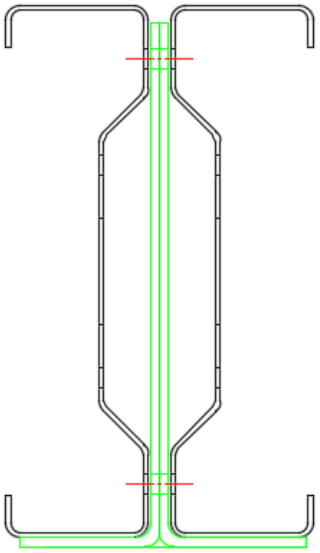


Figure 4.7: Attaching system

On the right image: there are the sigma beams on black, the rectangles and their support on green and finally in red where the screws ae going to be.

4.1.1.3. Joints

The joints are **very important components in the structures**, they are of the same importance or more than the beams; it is proved that most of the failures in steel structures are due to their breaking.

For this reason, **in PERMAR they design and calculate the screwed connectors** with high dedication, knowing the load capacity and resistance of each one of the different types available in our catalogue. To guarantee the lifetime of these connectors they apply a zinc treatment, which prevents it from rusting and guaranties the preservation of their mechanical features.

The materials that make the joints are:

- **Screws**: The screws used in the joints are commercial that respond to 8.8quality (standardized according to ISO) as the normative regarding steel specifies.
- **Steel**: The steel used in the production of the angular connectors, of quality S235JR (according to UNE EN 10025).

The advantage of using this type of joints consists in the perfection of the tabulation in the resistances and they don't depend on the assembly on site (the welding must be examined) because the screws are not enclosed and therefore it is not necessary part of tighten.

Thanks to the wide range of models of connectors, the joining between beams and belts is possible to be in an angle different than 90º, as well as the possibility to lean several primary beams among themselves, eliminating pillars.

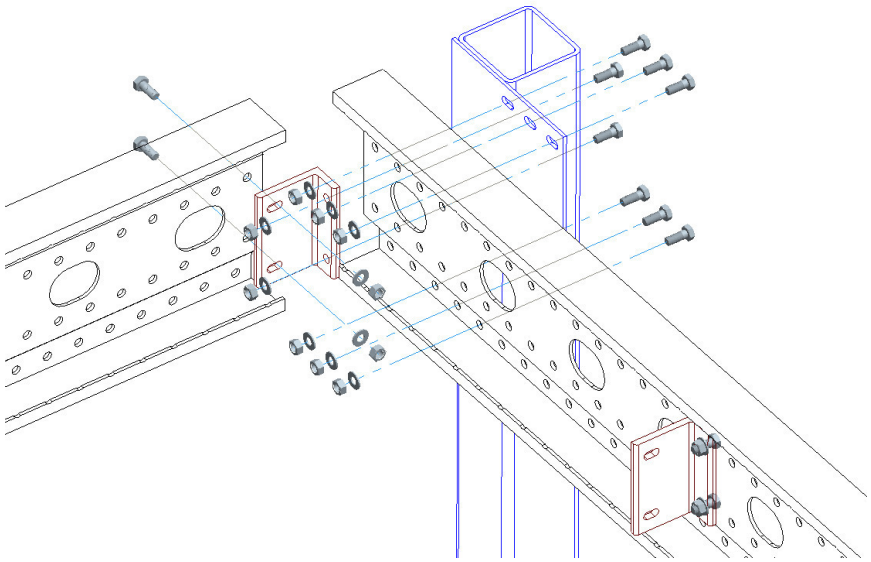


Figure 4.8: Example of the joints in a corner of the structure

4.1.2. Applicable regulations and rules

PERMAR makes internal mechanical behavior studies of its structures based on the current regulations: Technical Building Regulations (CTE).

In PERMAR STORAGE they calculate and design all the components based on the current regulations, giving priority to the safety and quality of the structure at any moment. They are confident in their product and therefore they give a warranty that proves its quality.

PERMAR makes mechanical behavior studies of its mezzanines based on the current regulations: Technical Building Regulations (CTE).

According to this legislation the overloading in use are increased with a value **safety coefficient 1,5** and the limitation regarding vertical distortion, settles the maximum arrow in L/300.

Beams and belts are calculated subjected to a superficial load distributed evenly, with the most restrictive judgment either to resistance or to distortion.

The joints among the different structural components of the mezzanine are made by means of different types of screwed joints perfectly calculated and tabulated, of which limit resistance is perfectly known. The study of the screwed connectors is made according to Chapter 8 of the basic document in steel structural safety DB SE-A Chapter 8 Joints.

The pillars are also studied according to sagging and resistance of materials judgment, guaranteeing the quality, safety and stability.

The calculations made by the Engineering Department in PERMAR, involve the correct use of their sectional structures, that is, the evenly distribution of the loads on them, avoiding isolated loads that should be distributed using platforms or other components. If so, the behavior of beams and pillars will be guaranteed under the established loads.

4.2. DRAGGING SYSTEM

To explain how the dragging system is, this section will be divided by two subsections: Transporter and Plate rolling.

On the next photo is shown a part of the assembly line, where is shown the path followed by the trolleys and the guide.

Figure 4.9: Photo of a part of the assembly line of Newark

4.2.1. Transporter

It is an air transporter which is composed of the following elements: the drive linear group, universal articulated chain, the closed lane, the horizontal curves, the rectilinear gauge and the traction cams.

The transporter model, to be installed in this assembly lines, is D47 model (IMBA). Below, a table is shown with the main characteristics of the model:

TRANSPORTER MODEL D47 (IMBA)		
Linear drag group	Drag speed	5 to 1.7 m/min
	Maximum load to transport	12.000 Kg
Universal articulated chain	Bearing diameter	47 mm
	Axis diameter	14 mm
	Net	30x5 F-114 galvanized
Lane		3 mm double omega with joining plates in 8 mm sheet every 750 mm.

Table 4.3: Main characteristics of the Model D47

As has already mentioned, the transporter model used is D47. The D47 transporter is composed of: the drive linear group, the universal articulated chain model C150 D47 (IMBA), closed lane model D47, the horizontal curves, the rectilinear gauge and the traction cams.

4.2.1.1. Drive linear group

The drive linear group is a group Caterpillar D47 C150 (IMBA). The drag group is composed of a reduction engine brand SWE, a drag group Caterpillar and a speed inverter brand SWE movitrac.

On the next page, is shown a scheme of the engine given by IMBA.

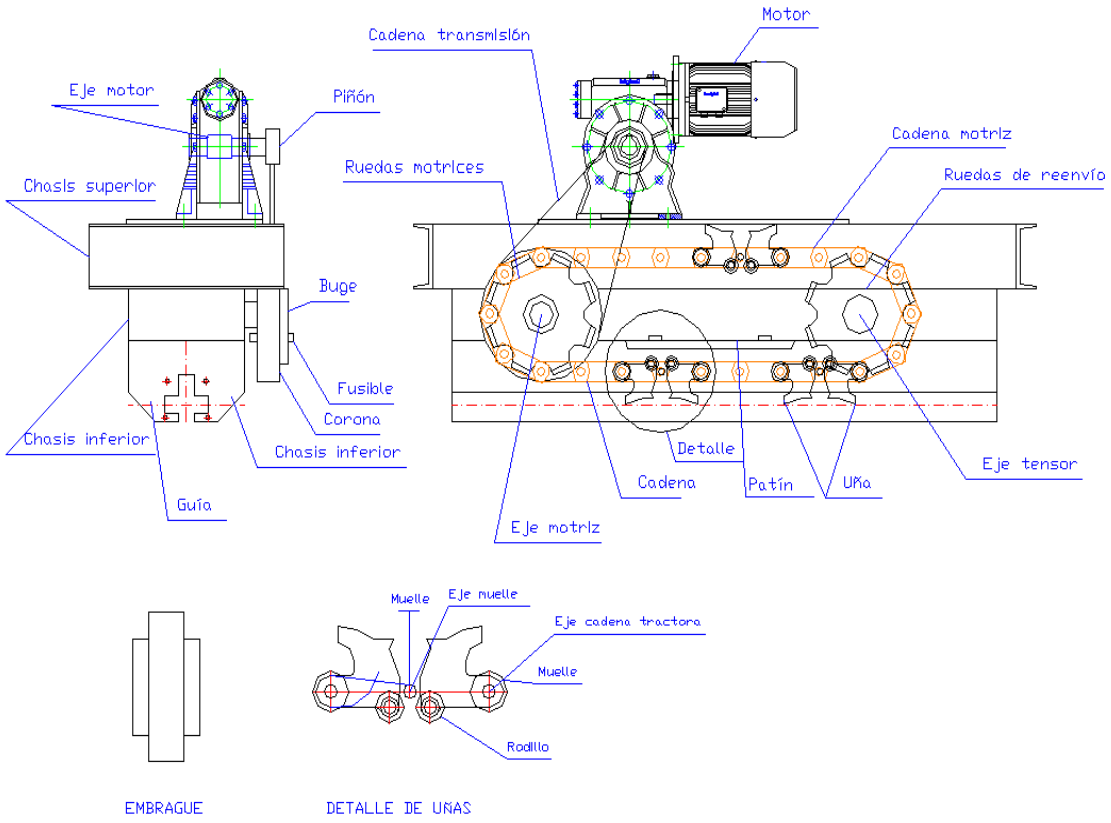


Figure 4.10: Engine parts group (given by IMBA)

The drag group has installed a speed inverter to accommodate the speed of the drag chain. The speed is variable from 45 to 180 seconds/workstation. The maximum load to be carried by the line is 12.000 kg.

The drive system is able to move the drag chain efficiently and without hitches. Besides, it also has incorporated a protection system against obstruction of the movement of the chain.

The motor unit is installed in the upper part of the main structure of the assembly line. First the drag group Caterpillar and above it the electric engine is put. The drag linear group, has designed its own place to prevent movements or fallings.

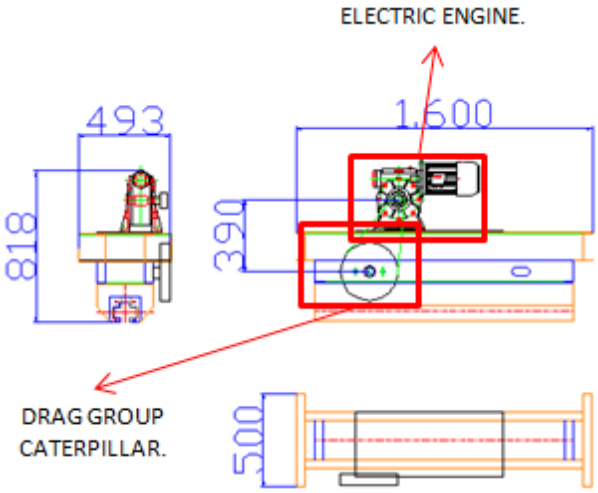


Figure 4.11: Dimensions of linear drag group

4.2.1.2. Universal articulated chain model d47 c150 (IMBA)

The drag chain of the assembly trolley is an articulated chain model D47 C150 (IMBA). This chain has the following characteristics:

- Diameter of bearing 47mm, with dual RS lubricated for life.
- Axis diameter equal to 14mm.
- Mesh 30x5 on f-114 galvanized.
- Mechanised crosshead in F5 to lead.
- The chain pitch is 203,2 mm.

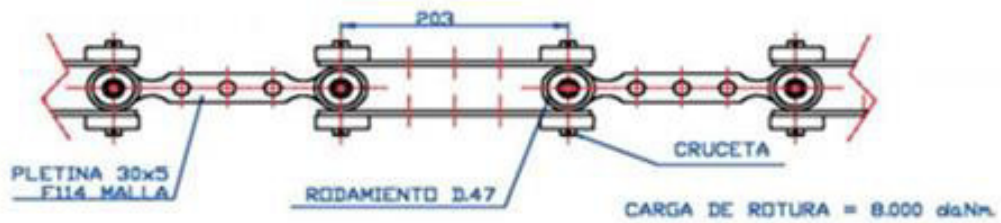


Figure 4.12: Chain model D47 C150 (IMBA)

Besides, double chain tensor groups are installed to counteract the space which appears in the chain due to its use. These devices are built with steel profiles and threaded tensor bars, to allow stretching manually the chain. There will be installed two chain tensor groups.

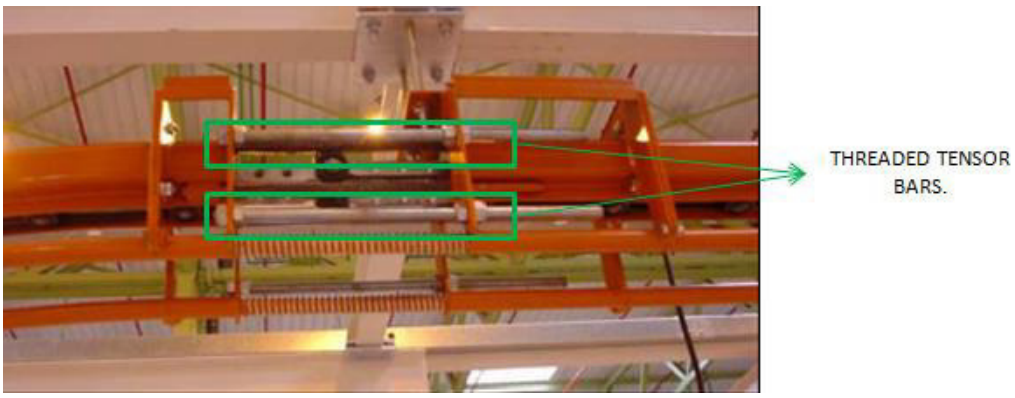


Figure 4.13: Threaded tensor bars

4.2.1.3. Closed lane

The chain is located inside a housing that serves a rolling surface for the four ball bearings. The guided lane, with a galvanized surface coating, is composed of two omega profiles with 3mm thickness. The lower part of the guided lane is a double tube, with diameter equal to 30 mm and thickness equal to 3 mm, whose function is to guide the assembly trolleys.

The internal measures of the guided lane which appear in the following picture, are the measures of the guided lane model D47 C150 (IMBA), belonging to the D47 C150 (IMBA) drag chain.

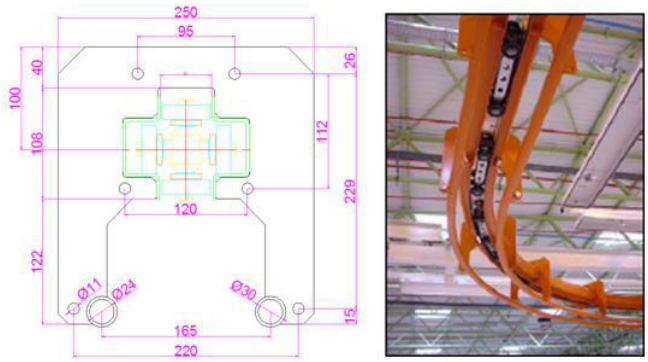


Figure 4.14: Overhead guide

The guided lane is composed of straight and curve sections. The curves radius will be equal to 2.000 mm because that way, the distance between two parallel assembly trolleys will be equal to 4m.

This overhead guide system is suspended under the longitudinal beams by means of threaded bar supports which enable the vertical adjustment of the system. The guided lane can be adjusted regarding the floor a distance equal to ±60 mm. So that there may be 100 mm maximum gap between ends.

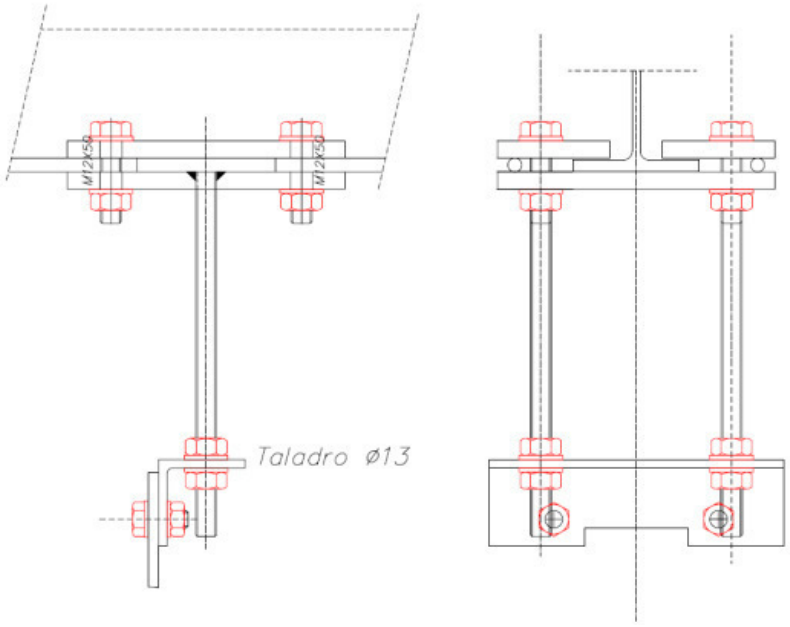


Figure 4.15: Threaded bars support

4.2.1.4. Traction cams

These elements are used to transmit the power from the chain to the trolleys. The drag chain has installed as many traction cams as assembly trolleys there are inside the line. The distance between traction cams is equal to 3.248 mm., this measure is determined by the length of the trolley and by the distance which have to be between two trolleys.

In the next picture, the measures of the tractions cam are shown.

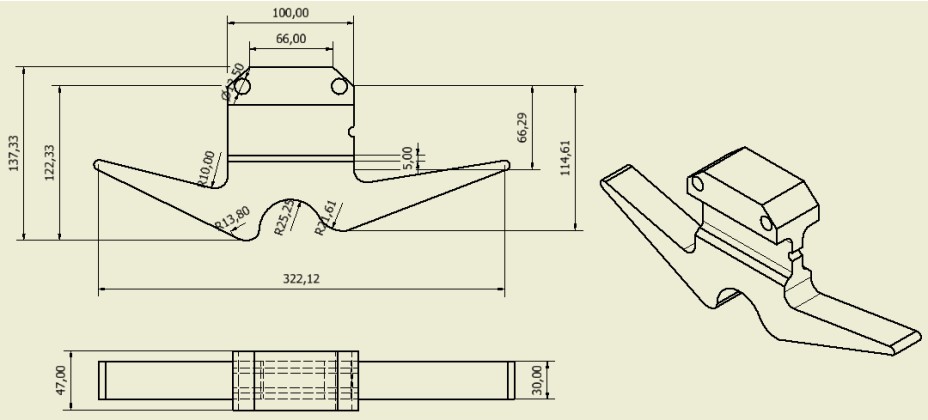


Figure 4.16: Measures of the traction cams

4.2.2. Plate Rolling

The floor of the circuit, where the assembly trolleys must roll, will be composed of galvanized steel plates with 3 mm thickness and whose width is 300 mm more than the width of the assembly trolleys wheels. The floor of the rolling area of the assembly trolleys will have a uniform finish and be unobstructed. The floor will have a difference of height of 5 mm per 5m of length measured in the direction of displacement with uniform slope.

This plate is designed and installed so that the joints between the different parts which form the floor rolling are perfect and without gaps. Each one of the plates is screwed to the floor using flat head countersink screws. Therefore, the galvanized steel plates are mechanized with countersink holes to screw. Finally, the whole plate is grounded.

Steel plates will be rectangular to the straight-line areas and trapezoidal to the curves line areas. As already mentioned, the measures of the plates are directly dependent on measures of the assembly trolley and the assembly line.

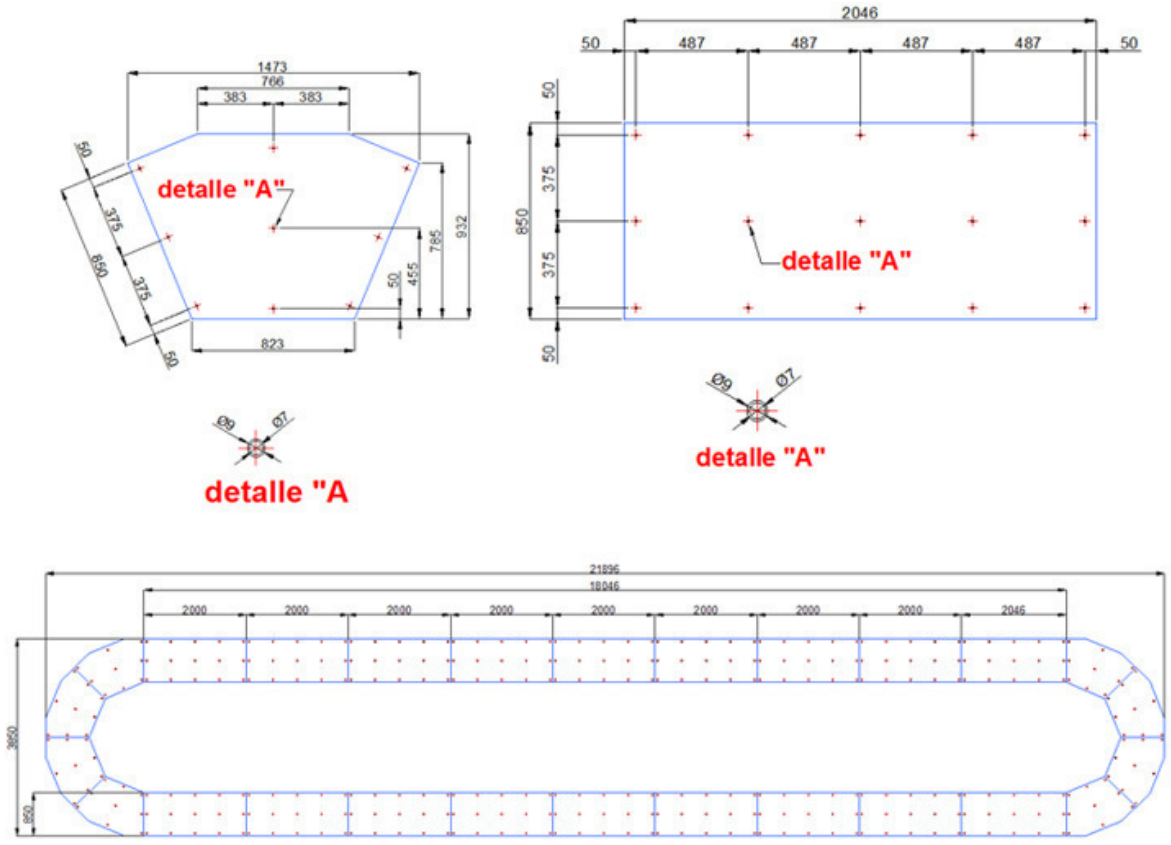


Figure 4.17: Rolling circuit

4.3. TROLLEY

The assembly trolley is an element used to carry the different pieces, which fix the cockpit, while these are assembled along the line.

The assembly trolley is composed of different parts, which are marked in the picture, and which will be explained below separately.

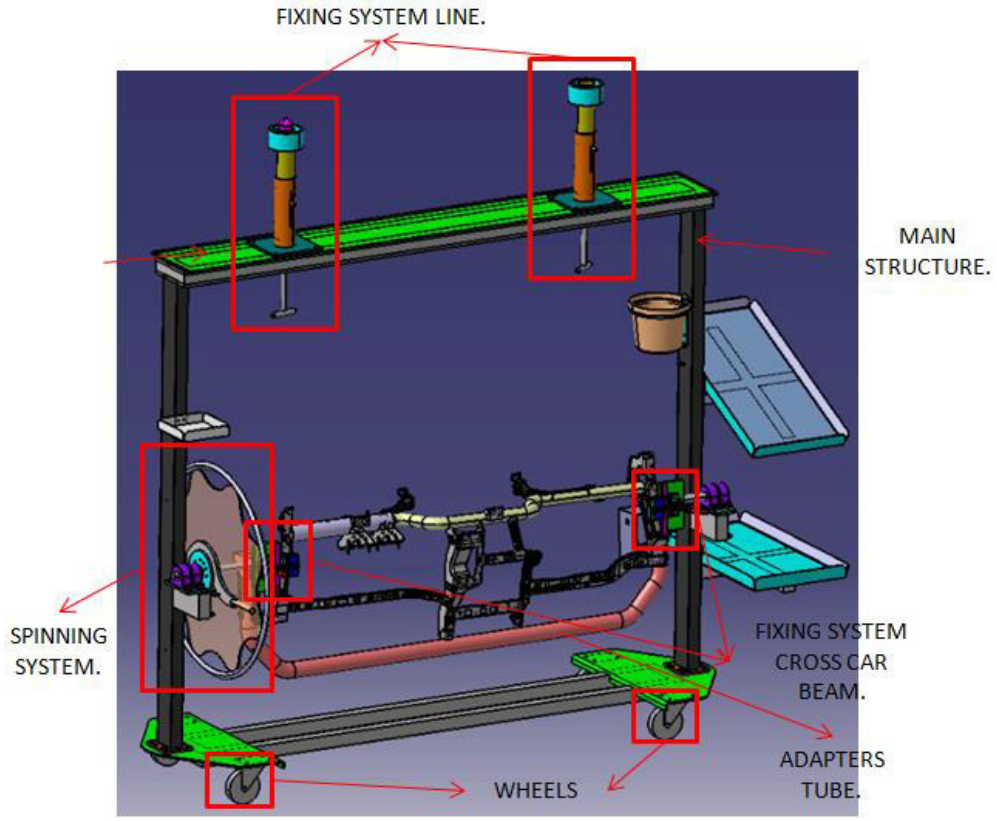


Figure 4.18: Description of the trolley

4.3.1. Main Structure

The main structure of the trolley will be painted white (RAL 9010), with exception of the movable parts which will be painted orange (RAL 2003). On the other hand, the trolley has metal parts which do not depend on the main structure which are black.

Figure 4.19: Real photo of the trolley

The main structure also includes the following elements:

- On one of its vertical posts, there is a circular metal support where the bin is placed.
- Two hooks are placed within the frame of the main structure, if necessary hang any part of the assembly process.
- On the left side, there is a chain with a magnet to hang sheets on the trolley.

4.3.2. Spinning system

The main purpose of providing the assembly trolley of a spinning system is to improve the ergonomics and to make easier both the assembly and the screwed of the different pieces which composed a cockpit. The system must allow the spinning of the cockpit from 0º to 270º, with 30º intervals.

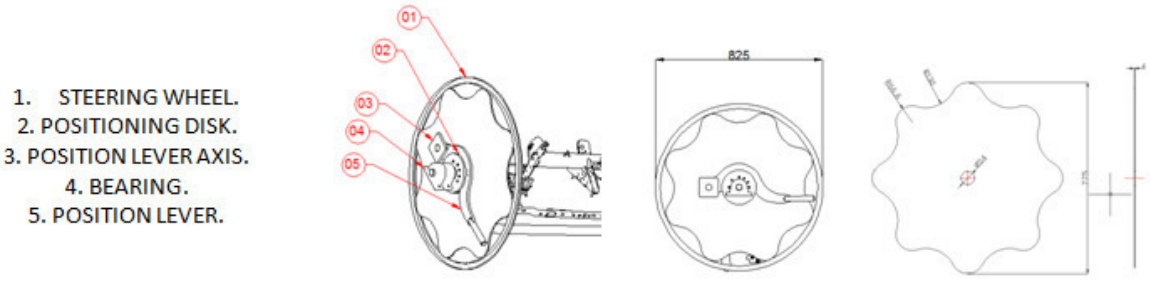


Figure 4.20: Parts of the spinning system

The system must carry out the safeties in order to avoid grips on the operator's hands. If it is necessary this area must be protected, taking into account the ergonomics of the system to the operator.

4.3.3. Fixing system line.

The rollers are the guide and the pull of the assembly trolley items. The vertical rollers are the guides and the small horizontal roller has a traction use. The rollers are placed in two poles and each unit is screwed in the top of the assembly trolley.

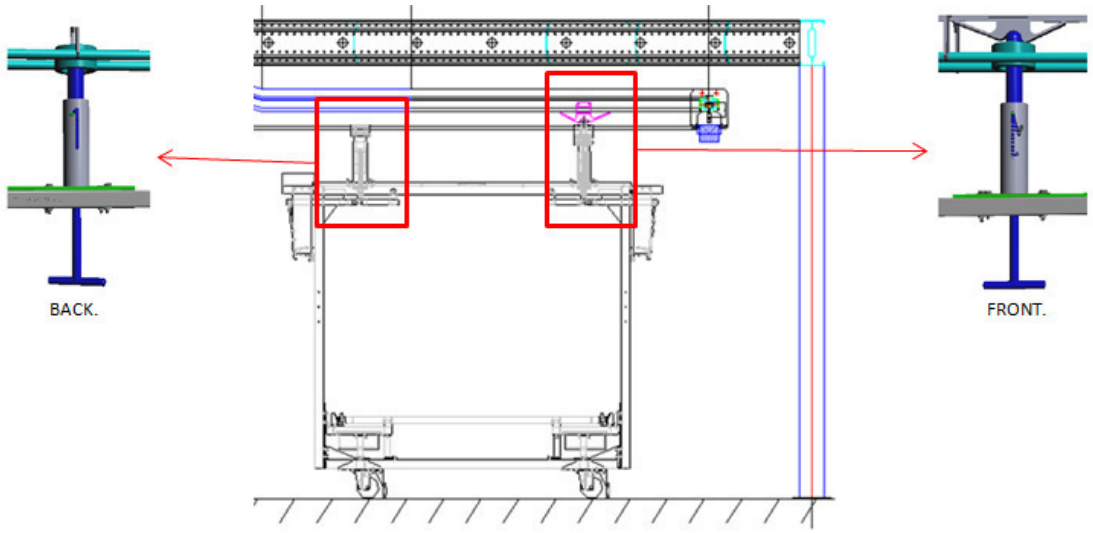


Figure 4.21: Fixing system line

The assembly trolley is fixed in the line by the front roller which is a "spring type" mechanical system. At the same time, the horizontal cylinder is placed within the gripper of the chain, dragging by this point the assembly trolley. The front roller or drive, of the two rollers which compose the fixing system, has three operating positions:

- Up: automatic drag mode.
- Middle: manual drag mode.
- Down: Move the assembly trolley out of the guide lane of the chain.

However, the guide roller doesn´t have spring and it only has two positions:

- Up: automatic or manual drag position.
- Down: move the trolley out of the line.

All the fixing mechanisms will be submitted to an anticorrosion treatment, blue finish. Even, these pieces will be cover with a special spray that protect them from the action of the seawater during the sea transport. Although, at the end, all the elements of the assembly line have been transport by air.

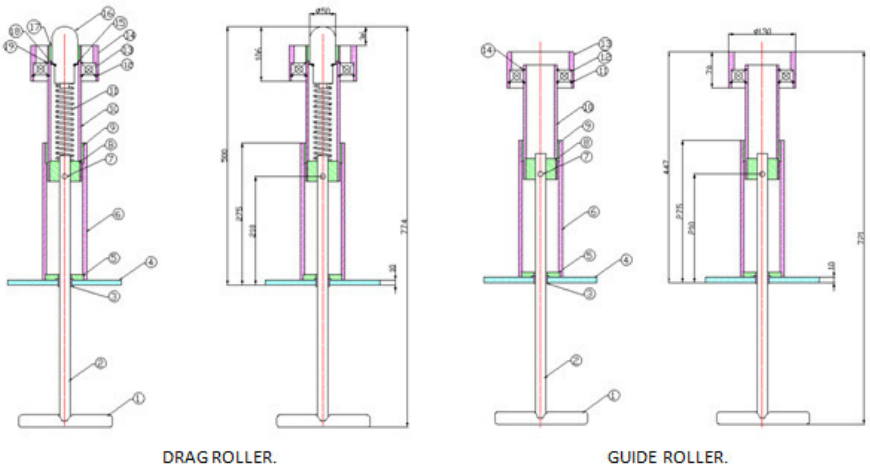


Figure 4.22: Section of the fixing system line

4.3.4. Wheels

The wheels of the assembly trolleys have rotator axes and they are made of polyurethane with a nylon core or similar. More specifically, wheels “168 series Olympia”.

Wheels are items fairly soft, which are vulnerable to lose screw, rubbish and foreign particles which can be easily found on the floor of our installations. For this reason, wheels are protected by a system which avoids that wheels get in touch with these elements.

Figure 4.23: wheels reference

Figure 4.24: Example of wheels protection

4.3.5. Trays

Assembly trolleys have installed a total of two trays to the kitting boxes. Both trays are placed at the left side of the assembly trolley regarding the operator. Such trays will be inclined 30º towards the operator, in such a way that the ergonomics is improved when it comes to put the pieces out of the kitting box in order to be assembled in the cockpit. The tray´s dimensions to put the kitting boxes are as shown in the following figure:

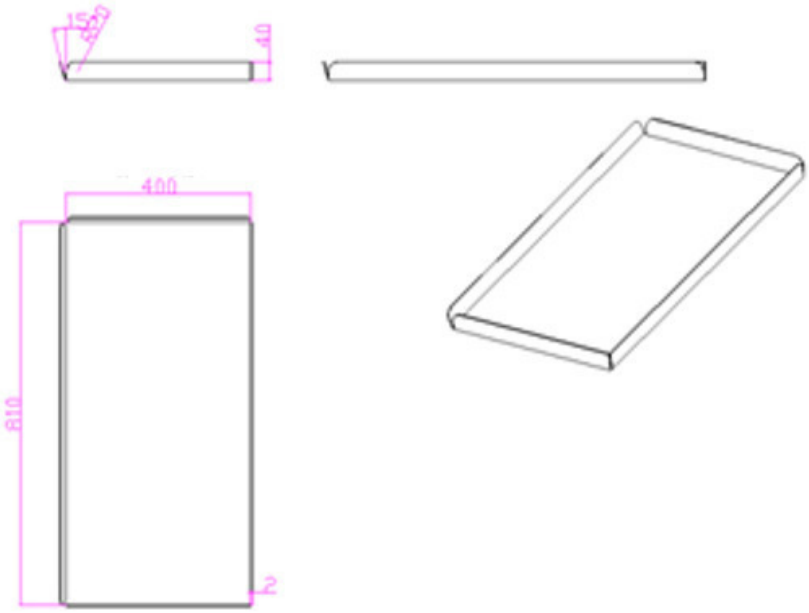
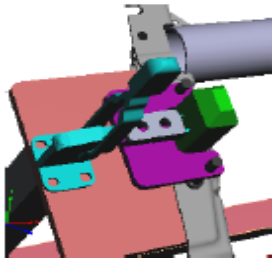


Figure 4.25: Kiting trays

The distance from the floor to the first tray will be 560 mm, and the distance from the floor to the second tray will be 1.100 mm. The angle of the second tray will be 20°.

4.3.6. Fixing system cross car beam



Two supports are put in order to fix the cross car beam, one on each size of the assembly trolley. Cross car beam is positioned and then it is fixed to the trolley by two clampings. The design of the fixing system will change according to the shape of the cross car beam and to assembly process.

Figure 4.26: Clamping

4.3.7. Adapters in trolleys.

In order to be able to install the adapters in the assembly trolleys, for this project, the bar for the wiring will be prepared to host the connectors between the cockpit and the E-check.

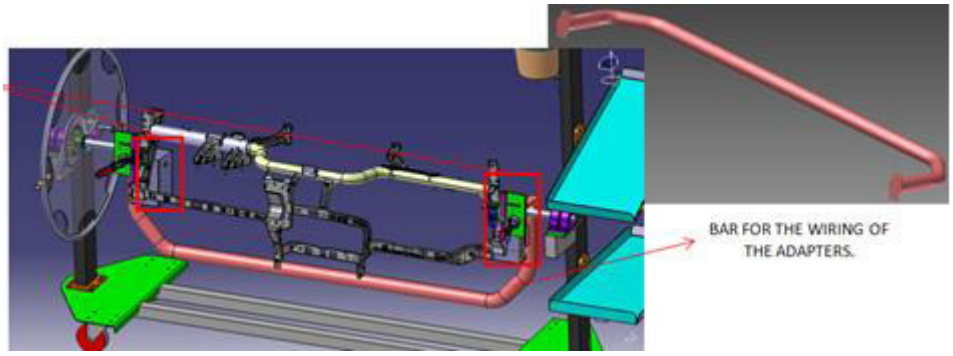


Figure 4.27: Bar for wiring the trolley to place the connectors.

4.3.8. Space between trolleys.

The empty space or gap between two consecutive trolleys in the assembly line will be as near as possible to 500 mm, because it is defined by the length of the link chain. The chain pitch, geometry of the trolley and dimensions of cockpit are factors which have been taken into account when it´s time to establish the necessary gap.

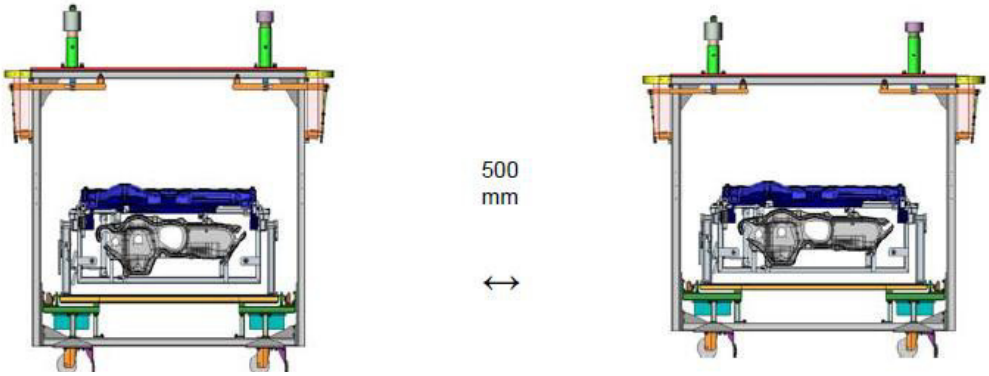


Figure 4.28: Space between trolleys

4.4. ELECTRIC INSTALLATION

As it was explained in the Solicitation document, the electric installation of assembly line must fulfil the following specifications:

- General electric cabinet capacity will be equal to 1.5 times the maximum expected value to avoid a possible voltage drop.
- Siemens S7 automat.
- Touch screen, color, memory capacity and alarm log, located in the front of the electric cabinet.
- Auxiliary power connection boxes in each column including most normal outlets, 10 A each, 100% simultaneously.
- All wiring labeled on both ends. Labeling according to electrical diagram.
- Power outlet boxes and illumination control will be able to operate even when the line is in off condition, not running.
- The sockets or outlets, in primary level, are protected by type B curves.
- Protections header are type C curves.
- System for protection against electrical and mechanical overloads.
- The distribution trays wiring, will be at the highest part of the structure.
- Voltage and frequency according to local electric fluid condition of the area.
- Preventions will be considered for power factor and local voltage quality.
- Facility will be supplied with a light indicating system to show the area of the line on which an emergency or line stop has been executed
- The automat will keep a log of stops and errors in the line.

Within the electrical installation of the assembly line the electrical cabinet, network sockets and lighting are included. In the following sections, they will be described.

4.4.1. Electrical cabinet

All assembly lines will have an electrical cabinet responsible for checking the same and the operation of different elements which composed it. The electrical cabinet will be installed inside the line.

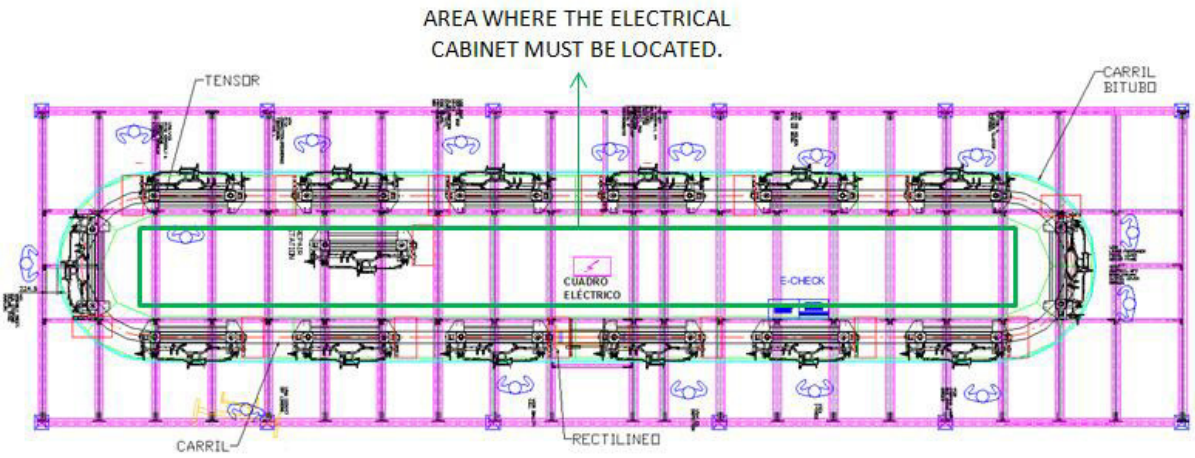


Figure 4.29: Generic line, with the area where the electric cabinet must be

The electrical cabinet has installed a cutoff switch for voltage in an accessible area and an emergency stop switch. In the upper part, it must have a beacon tower, according to normative, which shows when the line is with voltage, when the line is in line or emergency stop; and when the drag chain is operating. On the other hand, beacons are supplemented with an audible alarm which indicates with different tones the start of the line with a 5 seconds audible warning before starting motor group, a line stop and an emergency stop. Furthermore, in the controlling screen of the line, located in the front of the electrical cabinet, shows which button has caused the stop.

The electrical cabinet is equipped with a Profinet interface in order to be able to interact with signals from other installations such as robot, load and unload system, single delivery point …

The electrical installation will be according to the SAS standards and to Electrical Equipment specification FIS PS 2401 / PPS 08/04/04-11-EN but SICE keeps the right to use electrical components from companies like ABB, Phoenix contact, Niessen or others recognized manufacturers of electrical components.

Below, is shown a photo of the electrical cabinet of one of the lines.

Figure 4.30: Newark's Electrical cabinet

Regarding to safety, all the lines have installed an emergency button un front of the electrical cabinet. In addition to this, emergency buttons are installed on the columns of the main structure of the line.

Figure 4.31: Emergency button

4.4.2. Network of sockets

The sockets network of an assembly line is composed of two different systems.

The first is a network of 120 V dirty electricity sockets protected by a RDC and by a circuit breaker for each zones of the line. This network of sockets must be attached to the beams in its side. The number of sockets of the network, generally, will be equal to two units per assembly station put in a box according to normative. Moreover, six units of double socket are installed below each emergency button.

The second system is a network of 120 V clean electricity sockets, like the previous one, will be protected by a RSD and by a circuit breaker. The number of sockets will be two units per assembly station too, put in a box according to normative. The box must be attached to the beam in its side.

Electrical controlled machines and computers which contains the Clever computer system only will be connected to the network of clean electricity sockets. Other devices, which can be found in the line such as battery charges, electric screwdrivers, computers… will be connected to the network of dirty electricity sockets.

To make easier the distinction of the sockets, to avoid possible mistakes, the dirty electricity sockets will be white standard American socket and the clean electricity sockets will be red standard American socket.

In the next image, there is an example of the sockets of the German plant:

Figure 4.32: Example of red and White sockets (Germany)

This photo is to show the difference between the red and white sockets.

4.4.3. Lighting

A lighting system composed dustproof double tube led lamps which produce 900 luxes in working plane is proposed. The number of lamps to install is two per each assembly station, with the exception of end of line stations that it will be double, that is, four lamps per assembly station because 1200 luxes are required in the work plane.

The lamps models installed, will be: tube of 150 cm length led, 31 W inside a STL-L-31 dustproof lamp and two 150 cm length led tubes inside a LTS-L-2T-62W dustproof lamp.

The lighting system is composed of two circuits one internal and other external, on the axis of symmetry of the drive chain. The lighting systems are placed at a distance of 400 mm, one on each side of the drag chain approximate. The distance from the lamps to the axis chain is approximate because the fastening systems, of the lamps, are adjustable.

The external circuit of lamps is independent of the internal circuit. At the same time, each circuit must be divided in sub-circuits. The number of independent lighting zones depends on the number of workstation which the assembly line has, as shown in the following table:

LIGHTING AREAS		
WORKSTATIONS	LIGHTING CIRCUITS	
Up to 16	2 zones	Independent
Up to 32	4 zones	
More than 32	6 zones	

Table 4.4: Lighting zones according to workstations

So, in this assembly line, there will be 4 zones, because there are 18 workstations.

These circuits are independent and are protected by its RDC and its circuit breaker.

The operation of the lighting systems, both external as internal, will be realized from the controlling screen of the line in a simple and intuitive way (see HMI screen chapter). The lighting areas are enabled individually by screen. In addition, the wiring will be designed, so that any voltage loss does not happen at the end of line.

5. FINAL DESCRIPTION OF THE ASSEMBLY LINE

5.1. DESCRIPTION

The assembly line is composed of two lines with 18 work stations each. The assembly line is designed for the Model 3.

Tesla needs the tack time of the line to be 70 seconds, in nominal speed.

Tack time means the time between each delivery, therefore, every 70 seconds a cockpit changes of work station. Every hour a line makes 50 cockpits. There are 18 works stations and the cockpit stays 70 seconds on each. So, it takes 21 minutes to assemble and test a cockpit.

The production plant must have at least the same capacity that the client. So, it can provide the entire demand of cockpits by Tesla. And the production has to be in agreement with Tesla's production. That means, if Tesla decides to slow their production, the assembly line will slow too.

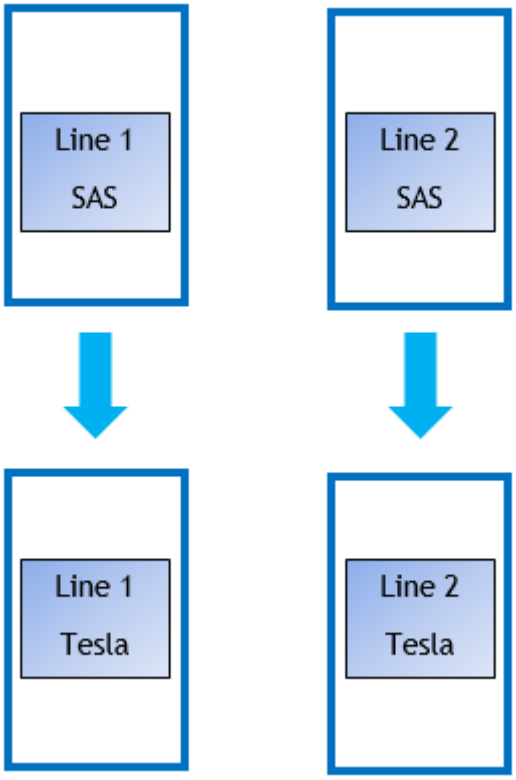


Figure 5.1: Flowchart of the relation SAS-Tesla

That is the reason why there are two lines in the assembly line. If one line changes the speed of production, its equivalent line will change without disturbing the

other line. This wouldn't be possible if there was only one line in the SAS's production plant and two on Tesla's production plant. If one line of Tesla stops, the SAS's line will stop too.

But because the production plant of SAS has more capacity than Tesla's, if a line of SAS breaks, the other line could provide both Tesla's lines.

This way, the production of Tesla won't stop.

The production of cockpits is estimated on 5000 per week and line. But the speed of the line can be changed. The motor that moves the line has a frequency variable.

The lines are orientated so the final cockpit ends in the same sense and it is easier to pick it up.

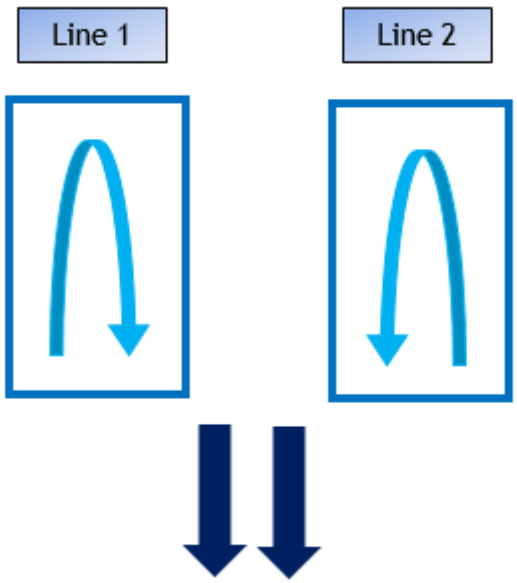


Figure 5.2: Flowchart of sense of production

The dark blue arrows indicate the sense of the cockpits once they have been picked up. They are moved by a system of chain to the trucks which are waiting to be filled up. In the next image, is shown where the lines are and where the trucks are.

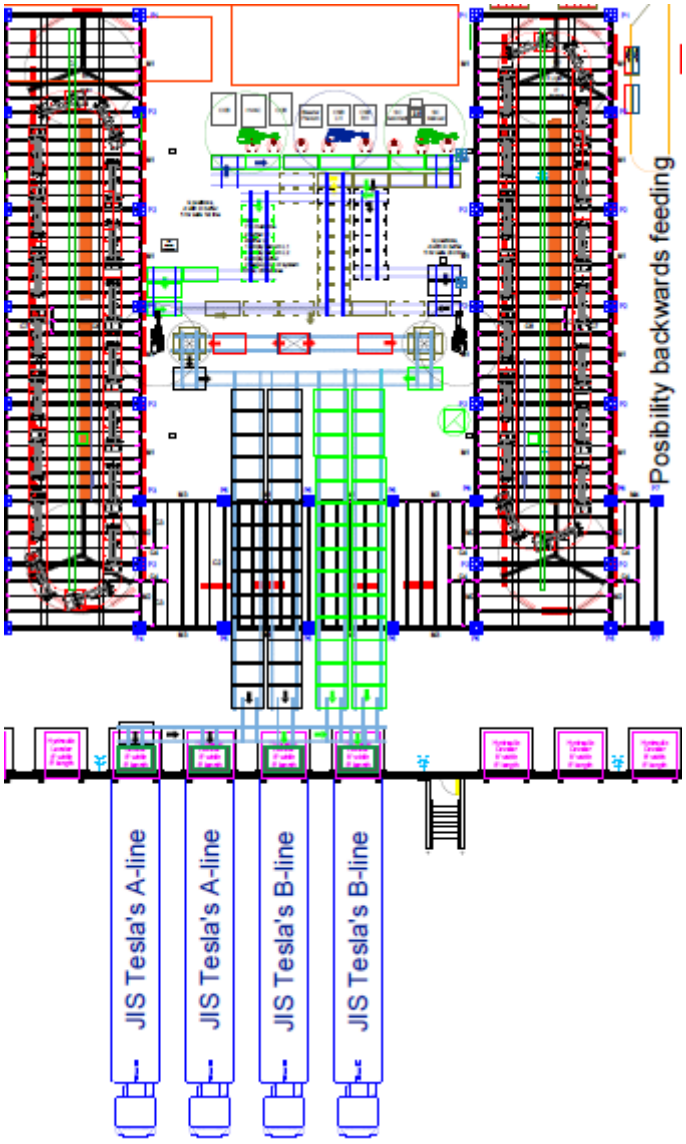


Figure 5.3: Plan view of the assembly line

In the plan view, there are two ways to get to the trucks, green and blue. Each of them is for a line. And each of them have two trucks, as it is shown in the picture.

5.2. CONTROL SYSTEM

For controlling the assembly line, it is installed a control panel in the electrical cabinet door.

This panel allows activate and deactivate all the systems of the assembly line and to modify and check all the parameters of the machine.

Also, you can check the production data and collect historic data stored in the panel memory. For example, the number of stops, the average of its length…

The control system can be divided in three parts, which will be described in the following sections. Those parts are:

- Modes
- Safety
- HMI Control Screen

5.2.1. Modes

The modes of one assembly line are explained below:

- MANUAL MODE: when you are working in manual mode, you can control the starting and stopping of the line both forward and backward.
- AUTOMATIC MODE: when this working mode is enabled, the line works automatically. It can be stopped pushing an emergency button or a stop line button.
- MAINTENANCE MODE: this mode allows the possibility of stopping and starting (both manual mode and automatic mode), lubricate chain procedure and control the speed of the line. To access again to this mode the entry password is necessary.
- PRODUCTION MANAGEMENT MODE: through this mode of operation the speed of the line is controlled and modified. The speed of the line has sec/workstation or cars/h as units. As the maintenance mode, to have access to the production mode is necessary a password.
- LIGHTING MODE: through this mode the lamps status is controlled, either on or off.
- STOPS MANAGEMENT MODE: this mode allows the tabulation of all the stops, with stop and stop time. That is, start time and end time. In addition, a history of all the stops at least one day´s production is included.

All the modes which appear in the previous list is selected and controlled by the main control screen on the font on the electrical cabinet of the line.

The line must be equipped with an Ethernet card which allows the supplier to bring about an intranet programming, that is, work remotely. So that a supplier can

work remotely with the installation, first he will need an access password which the IT department of the plant, where the line is installed, has to provide.

5.2.2. Safety

The first point to take into account, regarding safety issues, is that the line must comply with all requirements of safety and cleanliness current normative of United States, where is installed the line, besides internal SAS´s normative and FMM/Faurecia normative.

To ensure the safety of the workers who are working in the assembly line, the supplier must place, when installing the line, electrical and mechanical protections, which isolate the operator from the hazardous areas under normal working conditions.

In all those installations and areas in which occupational accidents can produce such as trapping, crushing, cutting …, forbidding step cartels and hazard warning must be included.

In an assembly line of production, there are two types of stops: line stop and emergency stop.

At the same time a failure happens, on the main screen of the line on the electrical cabinet must appear the type of stop, either line or emergency, and the button of line stop whose have been pressed. Moreover, from this screen, you can access the database of the stops of the line. These data should indicate the type of stop, the date and the time on which has happened, the total downtime, number of times each type of stop has happened…

All this information can be to extract onto Excel files and they are complemented by graphics.

All the types of stops are explained separately.

5.2.2.1. Emergency stop

To activate an emergency stop, someone has to press an emergency button. An emergency button is the red push button on yellow background. At the moment, an emergency button is pressed, the power of the electrical engine is cut, the drag group stops and therefore the chain.

All lines have installed an emergency button in the front of the electrical cabinet. In addition to this, there are emergency buttons interspersed on the columns of the main structure of the line. The distribution is done by leaving free the first right column closest to the electrical cabinet. Thereon, emergency buttons are placed one yes and other no into the different columns.

Figure 5.4: Emergency button's location

To rearm the emergency, stop the button, which has been pressed to make the stop, has to be unlocked. And besides, the reset from the main screen of the line has to be validated.

Whenever in one of the interconnected installations with the line, such as manipulators, TLR, load and unload system…, an emergency stop happens automatically, in the line is the same. In these cases, the rearm is controlled unlocking the emergency button of the installation attached to the line and validation on the screen line.

5.2.2.2. Stop line

To activate a stop line is necessary to press one of the stop line buttons. The number of stop line buttons will be defined for each specific project. The ream of this type of stops is done by pressing the button from the stop was originated again.

Figure 5.5: Stop line button

There are several causes which may produce a stop line apart from those discussed in the previous paragraph.

In the case of e-check, when the limit switch sensors installed detect that the system is working outside its area, they send a signal to the PLC of the line and a stop line is produced. This stop, despite of being a line stop, is rearmed from the main screen.

A communication protocol is required, which can be activated and deactivated by a code, between the computer system Clever and the PLC of the line. The SAS´s internal system (Clever) sends a signal to the PLC of the line in order to execute a stop line. After a stop line by Clever, it is rearmed by another signal which Clever send to the line again.

Stops by the TLR, occur when sensors do not detect the cam or the trolley in its properly position. It results in a stop line.

5.2.3. HMI Control Screen

The handling of the assembly line, is done by using a touch screen, which is mounted at the door of the control cabinet.

The touch screen offers information about the status and the production of the assembly line.

Near to this screen, there are installed some pushbuttons, used to give commands to the PLC which controls the operation of the line.

In the following lines, there will be explained the different functions of the pushbuttons and the images of the touch screen.

The HMI control screen uses images to handle the line:

- Welcome
- Main
- Production
- Alarms
- Stops
- Clever

And there are push buttons situated under the HMI that have the functions:

- Run
- Stop
- Acknowledge
- Rearm

5.2.3.1. General information

At all the images of the HMI, you can view the basic functions detailed bellow:

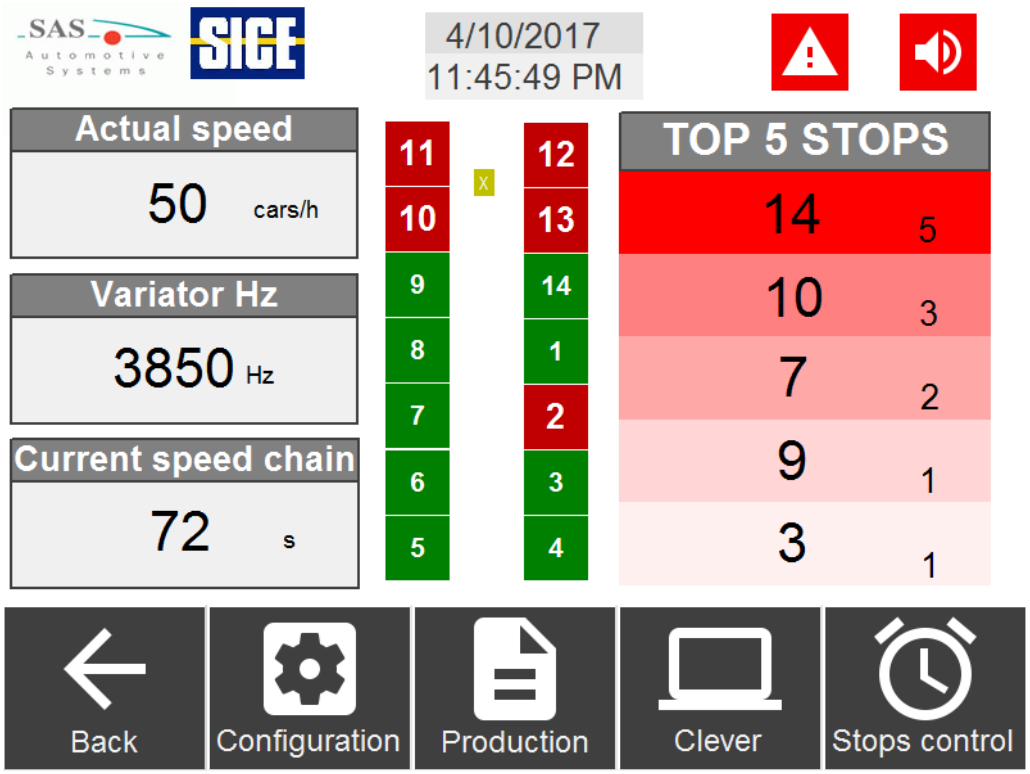


Figure 5.6: Basic functions

Top bar:

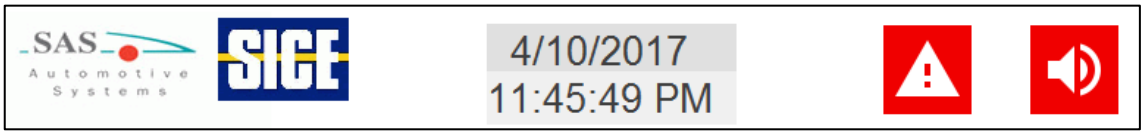


Figure 5.7: Top bar

The top bar displays the following information:

Alarms screen Access.

Acoustic signal Acknowledge.

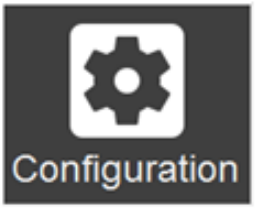
Figure 5.8: Description if the top bar

Bottom Bar:

Figure 5.9: Bottom bar

The bottom bar displays the following information:

Return to previous screen.



Access to the configuration screen.

Access to the production screen.

Access to the Clever screen.

Access to the Stop control screen.

Figure 5.10: Description of the bottom bar

Screen "Welcome":

Figure 5.11: Welcome screen

At the welcome screen, the user can choose the runtime language.

This is the first screen that you can see when energize the HMI.

The runtime starts on the selected language when user presses on the desired flag.

Screen "main":

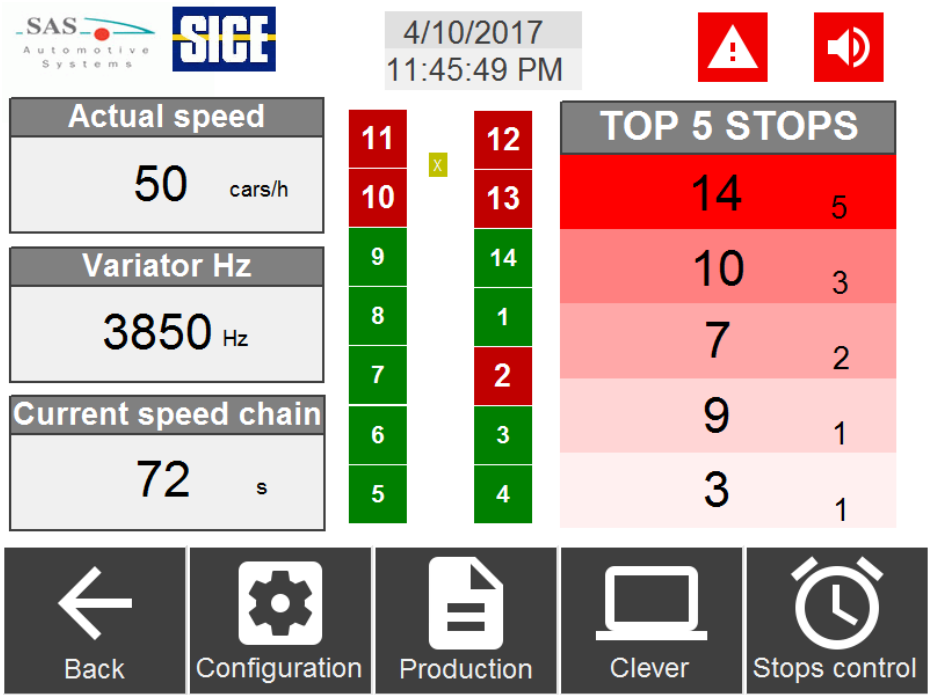


Figure 5.12: Main screen

At this screen, the operator can view the status of the production line.

The information shown corresponds to:

- Actual Speed of Conveyor (cars/hour): shows the theoretical production based on the turn speed of the line.
- Variator Hz (Hz): shows the hertz of the drive engine.
- Current Speed Chain ([s]): shows the seconds between detections "nails" in the chain, is called "nail" to the metal part in the racks that attach the carrier cockpits.
- Stations: shows a scaled map of the different stations that compose the line. When the station is stopped as result of pushing the stop button the station is red colored, otherwise its normal status is green.
- Date and time: shows the system date and time, used by the alarms and events registers.
- Top 5 Stops shows a compilation of the five stations with more stops ordered from major to minor and the number of stops they currently own.

Screen "Configuration":

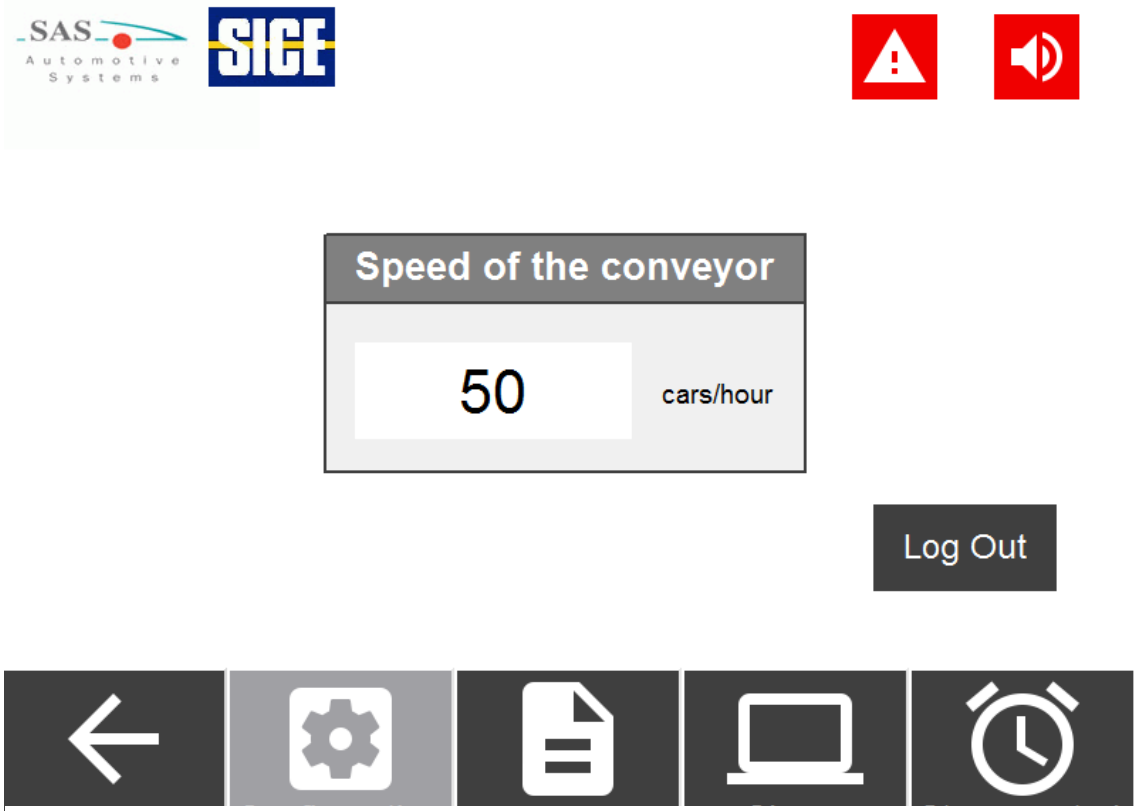


Figure 5.13: Configuration screen

The configuration screen has restricted acces, only is displayed after inserting a valid user and password.

The authorized functions are detailed bellow:

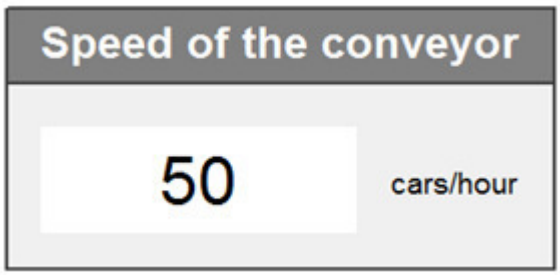


Figure 5.14: Speed of the conveyor

Desired speed of the conveyor, clicking over the yellow numbers on the center of the screen, appears a floating keyboard. With this keyboard, the user can change the value of the conveyor speed.

Screen "Production":

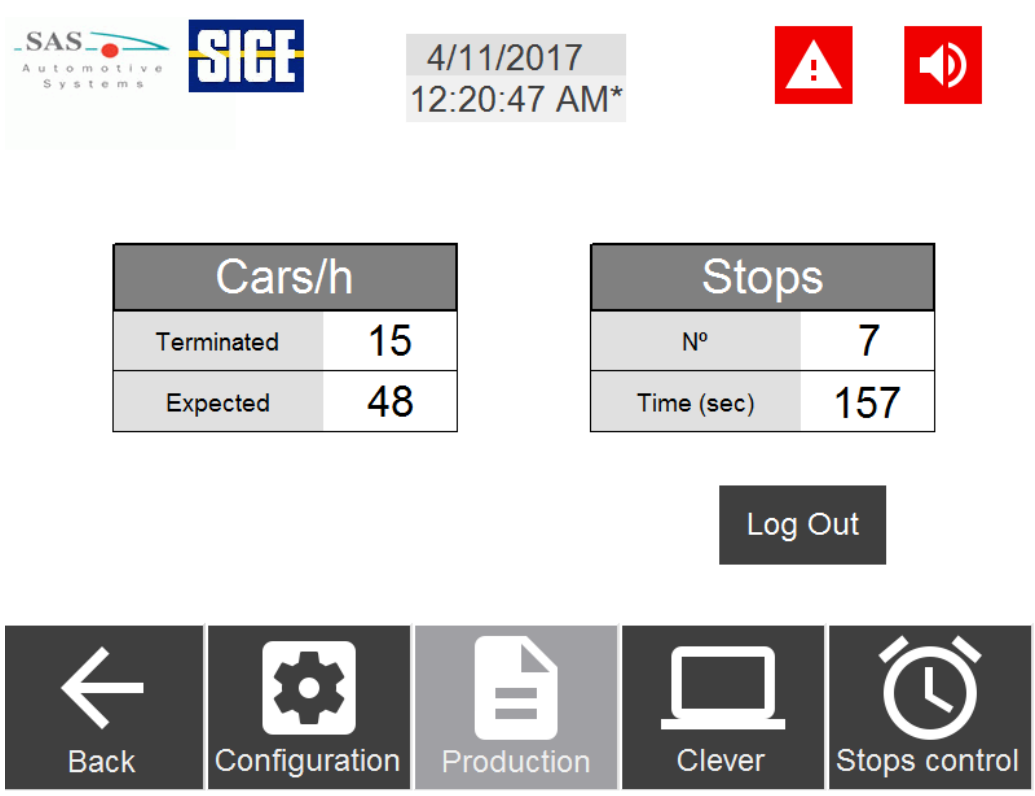


Figure 5.15: Production screen

The configuration screen hasa restricted acces, only is displayed after insert a valid user and password.

The data showed in this screen are detailed below:

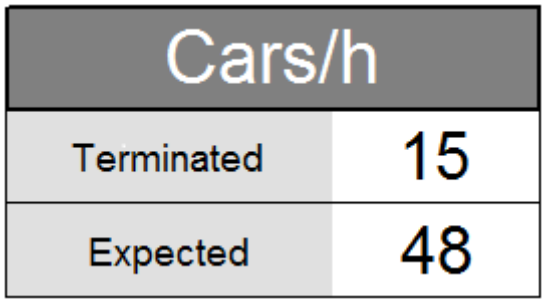


Figure 5.16: Cars/h screen

- Terminated: is number of cars that have been finished from the start of the current hour till now.
- Expected: is the number of cars expected to be produced till the finish of the ongoing hour at the current speed.

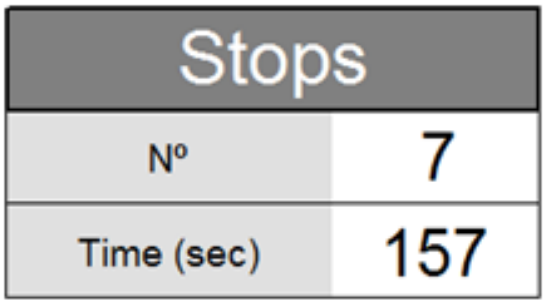


Figure 5.17: Stops screen

- Nº: is the summary of stops made.
- Time: is the total amount of time that the line has been stopped by the operators through the push buttons.

Screen “Alarms”:

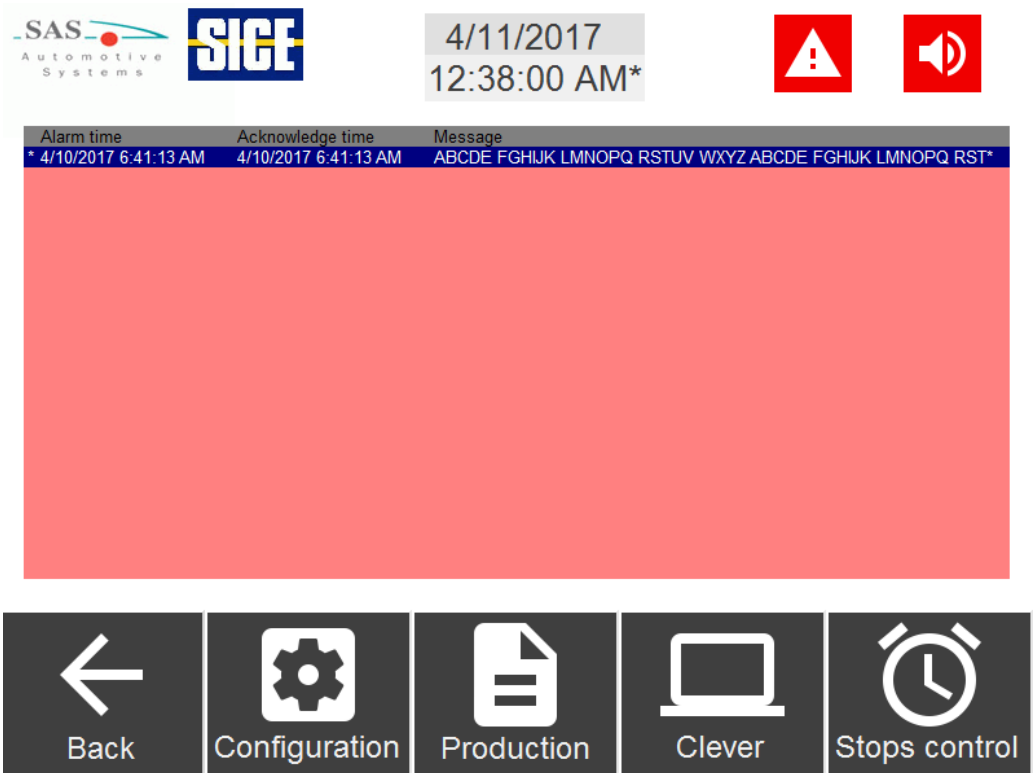


Figure 5.18: Alarms screen

Shows all the alarms. The active ones are painted in blue while the not active are painted in red.

Screen “Stops Control”:

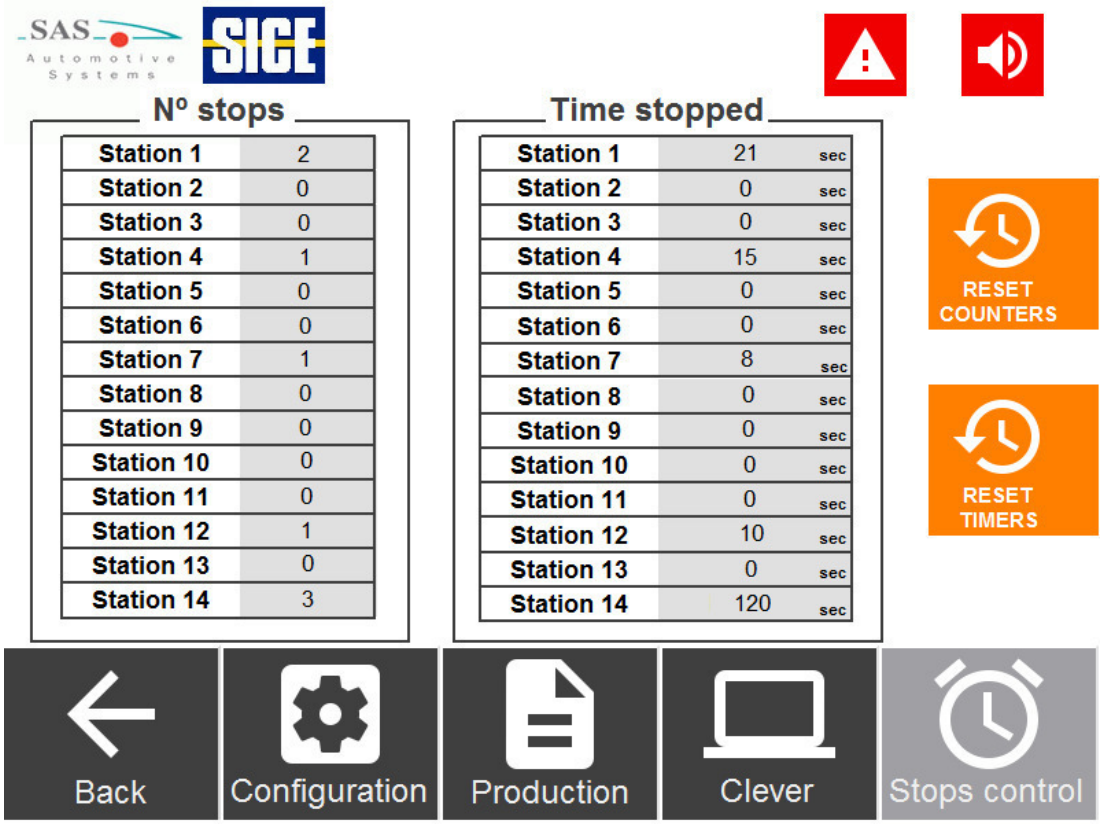


Figure 5.19: Stop control screen

At the Stop control screen, the user can show the number of stops generated at the stations, and the durability of each.

With the Reset buttons, the user can initialize the counters.

Screen "Clever":

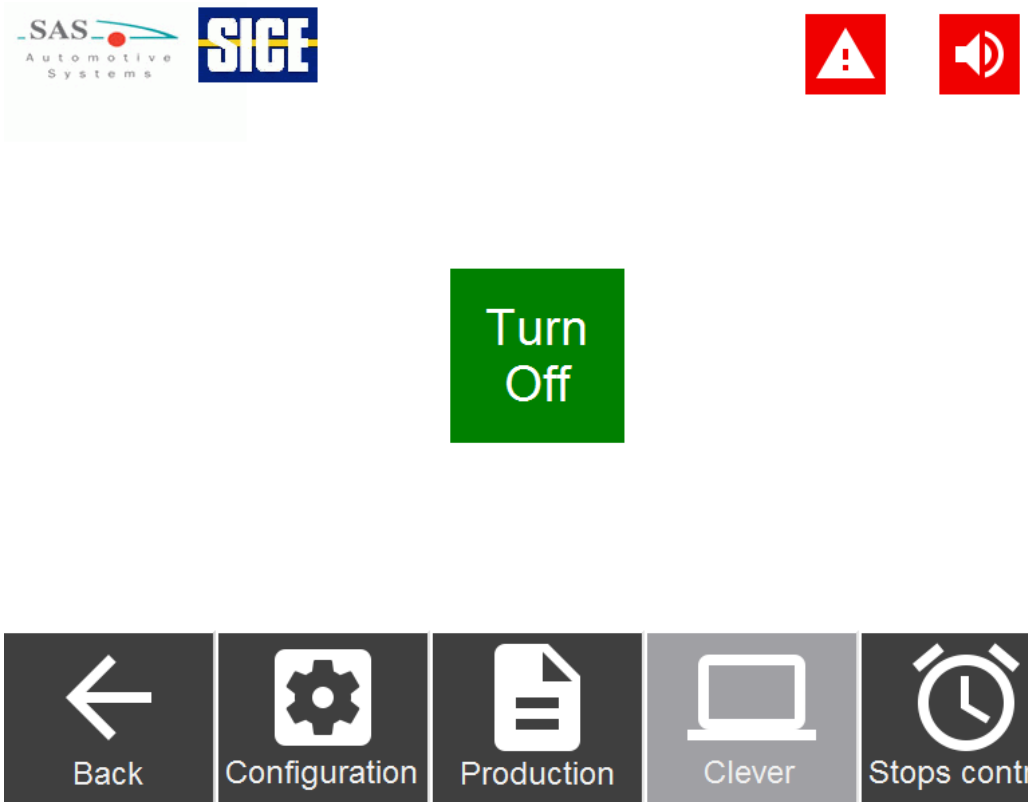


Figure 5.20: Clever screen

With the Clever screen, the user can switch on or off the Clever communication.

Pushbutton functions:

Below of the HMI the user can see four pushbuttons, this are used to operate de line.

The pushbuttons are used to send orders to the line, these buttons can be operated with the HMI out of service.

The pushbuttons functions are detailed below:

- Run: Sends the Run order to the line. When the user presses the run pushbutton and the line has the conditions to start, it makes the engine line run. The speed is defined via the Configuration screen in the HMI. The run function is memorized in the PLC, if an incident requires a line stop, the line is stopped during the incidence, when it is solved, the line returns to the run mode, is not necessary to press the run pushbutton.

- Stop: Sends the stop order to the line. When the user presses the stop pushbutton, the line changes to stop mode. If the button is pressed while the line is stopped by an incidence, when the incidence is reestablished, he line doesn't return to run mode.
- Reset: Reset the safety modules. The safety modules are connected to the safety beam devices and emergency stop pushbuttons, the function of the safety modules is to disconnect the power of the engines and variable speed drives.
- Restore: Restore the system and returns to the situation before of an incidence. This pushbutton doesn't reset the safety modules.

5.2.3.2. Operation of the system

Below are described the steps to follow for controlling the basic functions of the system.

Acknowledgment of Alarms

When the operator solves the incidence, the alarm turns red in the alarm list. Pressing the Restore button, at the control cabinet door, the line returns to the operative state before the incidence.

Alarm list

The alarms of the system are listed below, near his possible solution:

Alarm text	*Reason*	*Solution*
STOP Station X	The emergency pushbutton of the X station is pressed	See “Emergency Stop”
Security Module	Any of the emergency pushbuttons is pressed or the safety beam devices are active	See “Emergency Stop”
Drive Faulted	The Drive is faulted usually by a communication link error at the PLC-Variable speed drive	Check wiring, EOL resistors and addresses of the devices.
E-CHECK Alarm	The check box is at the end of the track	Place the check-box in a safe position, when it arrives at the end of the track. It makes the limit switch act and stops the line to prevent damage to the cockpits and wiring.
Chain Alarm	The detector has been given a chain failure, it is possible that the chain is broken	Check the conveyor and the detector.
Fault for not taking cockpit	The detector has been given a cockpit failure	Check the cockpit and the detector.
Fault in Weightless	The Weightless has been given a failure	Check the Weightless.
Clever STOP Station *X*	The Clever system displays X station failure	Check the station.

Table 5.1: Alarms and its possible solution

Startup procedure

To startup the conveyor, the user has to follow the below steps

1. Check system alarms

   Check in the HMI that there aren't active alarms. If any alarm is active, the alarms screen shows blue colored alarm. The conveyor doesn’t run while alarms are active (See “Acknowledge of alarms”).

2. Send Run order, pressing on the run pushbutton.

   The run pushbutton is located below the HMI screen, at the control cabinet door.

3. Check that the speed displayed in HMI corresponds to the desired speed.

   The speed will be changed in the configuration screen.

Line Stop

To stop the line in a controlled way, complete the following steps:

- With conveyor running, push the stop button situated below the HMI screen. The line is stopped and remains available for run, waiting the operator push the run button.
- With conveyor stopped, push the stop button situated below the HMI screen. The line is stopped by an incidence and the PLC lose the run memorized mode, when the incidence which generated the line stop is solved, the line remains in stop and available for run, waiting the operator to push the run button.

Emergency stop

At the installation, there are emergency pushbuttons.

When an emergency pushbutton is pressed, the power voltage of the control cabinet is shut down, this action generates an immediate stop of the system.

The emergency pushbuttons, are connected to a safety module, this module manages the power of the control cabinet and the PLC Connection.

After restoring the operation, the line restarts without giving a running order, if the user wants the line not to start up, he must press the Stop button.

To restore the operation, after pressing an emergency pushbutton, complete the following steps:

1. Check and correct the incidence that generated the emergency stop.

   Before restoring the system, user has to check that the incidence that generated the emergency stop is corrected.

2. Restore the emergency pushbutton.

   When an emergency pushbutton is pressed, the spindle is mechanically locked, to restore it, has to rotate a quarter turn and an internal mechanism (spring-like), place it in position.

3. Restore the safety module.

   Push the restore Pushbutton situated at door of the control cabinet. An alarm is activated in the alarm list of the HMI.

4. Failure Reset.

   Push the Reset button situated at door of the control cabinet. Alarms are initialized and the conveyor starts running. If the stop button is pressed during the time the line is in stop, the conveyor continues stopped.

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ISO 9001
ISO 14001
OHSAS 18001
BUREAU VERITAS
Certification

C. ECONOMIC OFFER

SICE

ASSEMBLY LINE-NEWARK FOR THE MODEL 3, TESLA

CONTENTS INDEX

1. MEASUREMENTS

1.1. STRUCTURE

The function of the main structure of the assembly line, is to support and secure the drive systems of the trolley, light fixtures, air distribution, assembly tooling and test electrical systems.

It is subcontracted to PERMAR, for this reason there is only one price.

SUMMARY	QUANTITY
Ud. Structure for 18 points assembly line (31.000 mm long, 7.300 mm width and 2.900/3.200 mm tall) 3 mm width sigmas, drillings on the columns and tray on "C" for the transporting guides and cables	1,00

1.2. DRAGGING SYSTEM

Dragging systems allows moving trolleys all around the circuit. The components of the systems are: guide or rail, chain and caterpillar.

Caterpillar is a gear motor with frequency variable.

SUMMARY	QUANTITY
Ud. Group of straight dragging model Caterpillar (D47 C150)	1,00
Ml. Universal articulated chain MOD. D47 C150	58,50
Ml. Rail D47 C150	58,50
Ud. Horizontal curves 90º R-2000	4,00

SUMMARY	QUANTITY
PA. Clamping flanges	1,00
Ud. Double straight tensor	2,00
PA. Nuts, bolts and other elements to close the circuit	1,00
Ud. Elements for the dragging system	18,00
H. Chain and guide mounting supervision	1,00

1.3. LINE COMPONENTS

It corresponds to the elements which compose the assembly line. Like the plate rolling and accessories that the line needs.

SUMMARY	QUANTITY
Ud. 2000x1000x3 mm steel sheet for the floor	28,00
Ml. 25 mm diameter double tube for the tool holder	56,00
Ud. Double tray for clamping on columns	14,00
Ud. Brackets for PC's screen	14,00

SUMMARY	QUANTITY
Ud. Brackets for Power Focus	14,00
Ud. Elements for the tool holder	14,00
Ud. Guide wheels for the elements of the tool holders and E-Check	14,00

1.4. E-CHECK, LINEAR SYSTEM

The E-Check is the system that owns the company, for the operator to know which components needs each cockpit.

SUMMARY	QUANTITY
Ud. Support for E-check	1,50
Ml. 25 mm diameter double tube for the E-check circuit	20,00
Ml. Electro guided Vahle, bracket and connections included	10,00

1.5. ELECTRIC SYSTEM

The electric system is composed of the electrical cabinet (which belongs to an assembly line) responsible for checking the operation of different elements which composed it. It is also composed by the safety elements, as the pushbuttons and detectors.

SUMMARY	QUANTITY
Ud.1.800 x 1.200 x 400 mm Control panel (Cabinet, protections, PLC, screen, frequency inverters and security modules included)	1,00
Ud. UL 508 A control panel certification	1,00
Ud. Line's stop push button	14,00
Ud. Emergency stop push button (signaling beacon included)	14,00
Ud. Bar detector for controlling field devices	3,00

1.6. SOFTWARE

Here it is included the software which belongs to SICE, for controlling the line. That is, the software of the HMI and the elements to control the line.

This software is explained on the control section in the project report.

SUMMARY	QUANTITY
H. Software adaptation of the line according to the installation's characteristics	150,00

1.7. ENGINEERING

It is included the hours needed to design the project.

SUMMARY	QUANTITY
H. Design engineering of gondolas, E-check, plans and documentation	180,00
H. Electric design engineering, plan generating and documentation	150,00

1.8. ACCOMODATION, EATING EXPENSES AND TRIPS

As the project is in California, but it is designed in Spain. Workers of SICE have to travel to California to supervise the project.

It was agreed that SAS would take over the expenses of the trips to California.

SUMMARY	QUANTITY
P.A. Trips Spain-California and trips on Spain	5,00
P.A. Accommodation at Newark	80,00
P.A. Eating expenses	80,00
P.A. Rental car during the supervision of the assembly	1,00

1.9. ASSEMBLY TROLLEY

The assembly trolley is an element used to carry the different pieces, which hold the cockpit, while these is assembled along the line.

This trolley is designed and adapted for any cockpit manufactured in the line and allows the movement and rotation of the cockpit for making easier the assembly of the its different components.

SUMMARY	QUANTITY
Ud. Trolley manufactured according customer specifications	18,00
Ud. Fixing System CCB	18,00

2. PRICE LIST

2.1. STRUCTURE

SUMMARY	UNIT PRICE
Ud. Structure for 18 points assembly line (31.000 mm long, 7.300 mm width and 2.900/3.200 mm tall) 3 mm width sigmas, drillings on the columns and tray on "C" for the transporting guides and cables	54.450,97 € FIFTY-FOUR THOUSAND FOUR HUNDRED AND FIFTY EUROS WITH NINETY-SEVEN CENTS

2.2. DRAGGING SYSTEM

SUMMARY	UNIT PRICE
Ud. Group of straight dragging model Caterpillar (D47 C150)	10.353,16 € TEN THOUSAND THREE HUNDRED AND FIFTY-THREE EUROS WITH SIXTEEN CENTS
Ml. Universal articulated chain MOD. D47 C150	112,02 € ONE HUNDRED AND TWELVE EUROS AND 2 CENTS
Ml. Rail D47 C150	105,94 € ONE HUNDRED AND FIVE EUROS AND NINETY-FOUR CENTS
Ud. Horizontal curves 90º R-2000	863,76 € EIGHT HUNDRED AND SIXTY-THREE EUROS AND SEVENTY-SIX CENTS
PA. Clamping flanges	3.122,60 € THREE THOUSAND ONE HUNDRED AND TWENTY-TWO EUROS AND SIXTY CENTS
Ud. Double straight tensor	564,58 € FIVE HUNDRED AND SIXTY-FOUR EUROS AND FIFTY-EIGHT CENTS

SUMMARY	UNIT PRICE
PA. Nuts, bolts and other elements to close the circuit	1.880,81 € ONE THOUSAND EIGHT HUNDRED AND EIGHTY EUROS AND EIGHTY-ONE CENTS
Ud. Elements for the dragging system	193,85 € ONE HUNDRED AND NINETY-THREE EUROS AND EIGHTY-FIVE CENTS
H. Chain and guide mounting supervision	8.823,53 € EIGHT THOUSAND EIGHT HUNDRED AND TWENTY-THREE EUROS AND FIFTY-THREE CENTS

2.3. LINE COMPONENTS

SUMMARY	UNIT PRICE
Ud. 2000x1000x3 mm steel sheet for the floor	342,26 € THREE HUNDRED AND FORTY-TWO EUROS AND TWENTY-SIX CENTS
Ml. 25 mm diameter double tube for the tool holder	131,20 € ONE HUNDRED AND THIRTY-ONE EUROS AND TWENTY CENTS
Ud. Double tray for clamping on columns	71,91 € SEVENTY-ONE EUROS AND NINETY-ONE CENTS
Ud. Brackets for PC's screen	203,12 € TWO HUNDRED AND THREE EUROS AND TWELVE CENTS
Ud. Brackets for Power Focus	144,80 € ONE HUNDRED AND FORTY-FOUR EUROS AND EIGHTY CENTS
Ud. Elements for the tool holder	74,83 € SEVENTY-FOUR EUROS AND EIGHTY-THREE CENTS

SUMMARY	UNIT PRICE
Ud. Guide wheels for the elements of the tool holders and E-Check	58,31 € FIFTY-EIGHT EUROS AND THIRTY-ONE CENTS

2.4. E-CHECK. LINEAR SYSTEM

SUMMARY	UNIT PRICE
Ud. Support for E-check	3.242,44 € THREE THOUSAND TWO HUNDRED AND FORTY-TWO EUROS AND FORTY-FOUR CENTS
Ml. 25 mm diameter double tube for the E-check circuit	123,37 € ONE HUNDRED AND TWENTY-THREE EUROS AND THIRTY-SEVEN CENTS
Ml. Electro guided Vahle, bracket and connections included	323,66 € THREE HUNDRED AND TWENTY-THREE EUROS AND SIXTY-SIX CENTS

2.5. ELECTRIC SYSTEM

SUMMARY	UNIT PRICE
Ud.1.800 x 1.200 x 400 mm Control panel (Cabinet, protections, PLC, screen, frequency inverters and security modules included)	20.818,86 € TWENTY THOUSAND EIGHT HUNDRED AND EIGHTEEN EUROS AND EIGHTY-SIX CENTS
Ud. UL 508 A control panel certification	11.570,33 € ELEVEN THOUSAND FIVE HUNDRED AND SEVENTY EUROS AND THIRTY-THREE CENTS

SUMMARY	UNIT PRICE
Ud. Line's stop push button	177,65 € ONE HUNDRED AND SEVENTY-SEVEN EUROS AND SIXTY-FIVE CENTS
Ud. Emergency stop push button (signaling beacon included)	391,37 € THREE HUNDRED AND NINETY-ONE EUROS AND THIRTY-SEVEN CENTS
Ud. Bar detector for controlling field devices	192,84 € ONE HUNDRED AND NINETY-TWO EUROS AND EIGHTY-FOUR CENTS

2.6. SOFTWARE

SUMMARY	UNIT PRICE
H. Software adaptation of the line according to the installation's characteristics	59,59 € FIFTY-NINE EUROS AND FIFTY-NINE CENTS

2.7. ENGINEERING

SUMMARY	UNIT PRICE
H. Design engineering of gondolas, E-check, plans and documentation	52,23 € FIFTY-TWO EUROS AND TWENTY-THREE CENTS
H. Electric design engineering, plan generating and documentation	52,23 € FIFTY-TWO EUROS AND TWENTY-THREE CENTS

2.8. ACCOMMODATION, EATING EXPENSES AND TRIPS

SUMMARY	UNIT PRICE
P.A. Trips Spain-California and trips on Spain	1.609,21 € ONE THOUSAND SIX HUNDRED AND NINE EUROS AND TWENTY-ONE CENTS
P.A. Accommodation at Newark	336,47 € THREE HUNDRED AND THIRTY-SIX EUROS AND FORTY-SEVEN CENTS
P.A. Eating expenses	190,18 € ONE HUNDRED AND NINETY EUROS AND EIGHTEEN CENTS
P.A. Rental car during the supervision of the assembly	3.072,12 € THREE THOUSAND AND SEVENTY-TWO EUROS AND TWELVE CENTS

2.9. ASSEMBLY TROLLEY

SUMMARY	UNIT PRICE
Ud. Trolley manufactured according customer specifications	3.138,95 € THREE THOUSAND ONE HUNDRED AND THIRTY-EIGHT EUROS AND NINETY-FIVE CENTS
Ud. Fixing System CCB	1.122,12 € ONE THOUSAND ONE HUNDRED AND TWENTY-TWO EUROS AND TWELVE CENTS

3. BREAKDOWN- PRICE LIST

3.1. STRUCTURE

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
Ud. Structure for 18 points assembly line (31.000 mm long, 7.300 mm width and 2.900/3.200 mm tall) 3 mm width sigmas, drillings on the columns and tray on "C" for the transporting guides and cables		
Material unit price	45.780,90 €	
Workforce unit price	8.670,08 €	
		54.450,97 €

FIFTY-FOUR THOUSAND FOUR HUNDRED AND FIFTY EUROS WITH NINETY-SEVEN CENTS

3.2. DRAGGING SYSTEM

SUMMARY	WHITHOUT BREAKDOWN
Ud. Group of straight dragging model Caterpillar (D47 C150)	**10.353,16 €**

TEN THOUSAND THREE HUNDRED AND FIFTY-THREE EUROS WITH SIXTEEN CENTS

Ml. Universal articulated chain MOD. D47 C150 **112,02 €**

ONE HUNDRED AND TWELVE EUROS AND 2 CENTS

Ml. Rail D47 C150 **105,94 €**

ONE HUNDRED AND FIVE EUROS AND NINETY-FOUR CENTS

Ud. Horizontal curves 90º R-2000 **863,76 €**

EIGHT HUNDRED AND SIXTY-THREE EUROS AND SEVENTY-SIX CENTS

PA. Clamping flanges **3.122,60 €**

THREE THOUSAND ONE HUNDRED AND TWENTY-TWO EUROS AND SIXTY CENTS

Ud. Double straight tensor **564,58 €**

FIVE HUNDRED AND SIXTY-FOUR EUROS AND FIFTY-EIGHT CENTS

PA. Nuts, bolts and other elements to close the circuit **1.880,81 €**

ONE THOUSAND EIGHT HUNDRED AND EIGHTY EUROS AND EIGHTY-ONE CENTS

Ud. Elements for the dragging system **193,85 €**

ONE HUNDRED AND NINETY-THREE EUROS AND EIGHTY-FIVE CENTS

H. Chain and guide mounting supervision **8.823,53 €**

EIGHT THOUSAND EIGHT HUNDRED AND TWENTY-THREE EUROS AND FIFTY-THREE CENTS

3.3. LINE COMPONENTS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
Ud. 2000x1000x3 mm steel sheet for the floor		
Material unit price	283,22 €	
Workforce unit price	59,04 €	
		342,26 €

The total quantity ascends to: THREE HUNDRED AND FORTY-TWO EUROS AND TWENTY-SIX CENTS

Ml. 25 mm diameter double tube for the tool holder		
Material unit price	102,05 €	
Workforce unit price	29,16 €	
		131,20 €

The total quantity ascends to: ONE HUNDRED AND THIRTY-ONE EUROS AND TWENTY CENTS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE

Ud. Double tray for clamping on columns

Material unit price	42,76 €
Workforce unit price	29,16 €
	71,91 €

The total quantity ascends to: SEVENTY-ONE EUROS AND NINETY-ONE CENTS

Ud. Brackets for PC's screen

Material unit price	173,96 €
Workforce unit price	29,16 €
	203,12 €

The total quantity ascends to: TWO HUNDRED AND THREE EUROS AND TWELVE CENTS

Ud. Brackets for Power Focus

Material unit price	115,65 €
Workforce unit price	29,16 €
	144,80 €

The total quantity ascends to: ONE HUNDRED AND FORTY-FOUR EUROS AND EIGHTY CENTS

Ud. Elements for the tool holder

Material unit price	52,96 €
Workforce unit price	21,87 €
	74,83 €

The total quantity ascends to: SEVENTY-FOUR EUROS AND EIGHTY-THREE CENTS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE

Ud. Guide wheels for the elements of the tool holders and E-Check

Material unit price	29,16 €
Workforce unit price	29,16 €
	58,31 €

The total quantity ascends to: FIFTY-EIGHT EUROS AND THIRTY-ONE CENTS

3.4. E-CHECK. LINEAR SYSTEM

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE

Ud. Support for E-check

Material unit price	3.242,44 €
Workforce unit price	0,00 €
	3.242,44 €

The total quantity ascends to: THREE THOUSAND TWO HUNDRED AND FORTY-TWO EUROS AND FORTY-FOUR CENTS

Ml. 25 mm diameter double tube for the E-check circuit

Material unit price	94,34 €
Workforce unit price	29,03 €
	123,37 €

The total quantity ascends to: ONE HUNDRED AND TWENTY-THREE EUROS AND THIRTY-SEVEN CENTS

Ml. Electro guided Vahle, bracket and connections included

Material unit price	245,29 €
Workforce unit price	78,38 €
	323,66 €

The total quantity ascends to: THREE HUNDRED AND TWENTY-THREE EUROS AND SIXTY-SIX CENTS

3.5. ELECTRIC SYSTEM

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE

Ud.1.800 x 1.200 x 400 mm Control panel (Cabinet, protections, PLC, screen, frequency inverters and security modules included)

Material unit price	15.520,01 €
Workforce unit price	5.298,84 €
	20.818,86 €

The total quantity ascends to: TWENTY THOUSAND EIGHT HUNDRED AND EIGHTEEN EUROS AND EIGHTY-SIX CENTS

Ud. UL 508 A control panel certification

Material unit price	11.570,33 €
Workforce unit price	0,00 €
	11.570,33 €

The total quantity ascends to: ELEVEN THOUSAND FIVE HUNDRED AND SEVENTY EUROS AND THIRTY-THREE CENTS

Ud. Line's stop push button

Material unit price	73,81 €
Workforce unit price	103,84 €
	177,65 €

The total quantity ascends to: ONE HUNDRED AND SEVENTY-SEVEN EUROS AND SIXTY-FIVE CENTS

Ud. Emergency stop push button (signaling beacon included)

Material unit price	287,54 €
Workforce unit price	103,84 €
	391,37 €

The total quantity ascends to: THREE HUNDRED AND NINETY-ONE EUROS AND THIRTY-SEVEN CENTS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
Ud. Bar detector for controlling field devices		
Material unit price	89,00 €	
Workforce unit price	103,84 €	
		192,84 €

The total quantity ascends to: ONE HUNDRED AND NINETY-TWO EUROS AND EIGHTY-FOUR CENTS

3.6. SOFTWARE

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
H. Software adaptation of the line according to the installation's characteristics		
Material unit price	0,00 €	
Workforce unit price	59,59 €	
		59,59 €

The total quantity ascends to: FIFTY-NINE EUROS AND FIFTY-NINE CENTS

3.7. ENGINEERING

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
H. Design engineering of gondolas, E-check, plans and documentation		
Material unit price	0,00 €	
Workforce unit price	52,23 €	
		52,23 €

The total quantity ascends to: FIFTY-TWO EUROS AND TWENTY-THREE CENTS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE

H. Electric design engineering, plan generating and documentation

Material unit price	0,00 €
Workforce unit price	52,23 €
	52,23 €

The total quantity ascends to: FIFTY-TWO EUROS AND TWENTY-THREE CENTS

3.8. ACCOMMODATION, EATING EXPENSES AND TRIPS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE

P.A. Trips Spain-California and trips on Spain

Material unit price	1.609,21 €
Workforce unit price	0,00 €
	1.609,21 €

The total quantity ascends to: ONE THOUSAND SIX HUNDRED AND NINE EUROS AND TWENTY-ONE CENTS

P.A. Accommodation at Newark

Material unit price	336,47 €
Workforce unit price	0,00 €
	336,47 €

The total quantity ascends to: THREE HUNDRED AND THIRTY-SIX EUROS AND FORTY-SEVEN CENTS

P.A. Eating expenses

Material unit price	190,18 €
Workforce unit price	0,00 €
	190,18 €

The total quantity ascends to: ONE HUNDRED AND NINETY EUROS AND EIGHTEEN CENTS

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
P.A. Rental car during the supervision of the assembly		
Material unit price	3.072,12 €	
Workforce unit price	0,00 €	
		3.072,12 €

The total quantity ascends to: THREE THOUSAND AND SEVENTY-TWO EUROS AND TWELVE CENTS

3.9. ASSEMBLY TROLLEY

SUMMARY	UNIT PRICE	TOTAL UNIT PRICE
Ud. Trolley manufactured according customer specifications		
Material unit price	2.977,37 €	
Workforce unit price	161,59 €	
		3.138,95 €

The total quantity ascends to: THREE THOUSAND ONE HUNDRED AND THIRTY-EIGHT EUROS AND NINETY-FIVE CENTS

Ud. Fixing System CCB		
Material unit price	1.122,12 €	
Workforce unit price	0,00 €	
		1.122,12 €

The total quantity ascends to: ONE THOUSAND ONE HUNDRED AND TWENTY-TWO EUROS AND TWELVE CENTS

4. ECONOMIC OFFER

4.1. STRUCTURE

SUMMARY	QUANTITY	UNIT PRICE	PRICE
Ud. Structure for 18 points assembly line (31.000 mm long, 7.300 mm width and 2.900/3.200 mm tall) 3 mm width sigmas, drillings on the columns and tray on "C" for the transporting guides and cables	1,00 €	54.450,97 €	**54.450,97 €**

TOTAL 1: 54.450,97 €

4.2. DRAGGING SYSTEM

SUMMARY	QUANTITY	UNIT PRICE	PRICE
Ud. Group of straight dragging model Caterpillar (D47 C150)	1,00	10.353,16 €	**10.353,16 €**
Ml. Universal articulated chain MOD. D47 C150	58,50	112,02 €	**6.552,91 €**
Ml. Rail D47 C150	58,50	105,94 €	**6.197,72 €**
Ud. Horizontal curves 90º R-2000	4,00	863,76 €	**3.455,06 €**
PA. Clamping flanges	1,00	3.122,60 €	**3.122,60 €**
Ud. Double straight tensor	2,00	564,58 €	**1.129,16 €**
PA. Nuts, bolts and other elements to close the circuit	1,00	1.880,81 €	**1.880,81 €**

SUMMARY	QUANTITY	UNIT PRICE	PRICE
Ud. Elements for the dragging system	18,00	193,85 €	**3.489,29 €**
H. Chain and guide mounting supervision	1,00	8.823,53 €	**8.823,53 €**

TOTAL 2: 45.004,25 €

4.3. LINE COMPONENTS

SUMMARY	QUANTITY	UNIT PRICE	PRICE
Ud. 2000x1000x3 mm steel sheet for the floor	28,00	342,26 €	**9.583,35 €**
Ml. 25 mm diameter double tube for the tool holder	56,00	131,20 €	**7.347,31 €**
Ud. Double tray for clamping on columns	14,00	71,91 €	**1.006,79 €**
Ud. Brackets for PC's screen	14,00	203,12 €	**2.843,61 €**
Ud. Brackets for Power Focus	14,00	144,80 €	**2.027,25 €**
Ud. Elements for the tool holder	14,00	74,83 €	**1.047,60 €**
Ud. Guide wheels for the elements of the tool holders and E-Check	14,00	58,31 €	**816,37 €**

TOTAL 3: 24.672,28 €

4.4. E-CHECK. LINEAR SYSTEM

SUMMARY	QUANTITY	UNIT PRICE	PRICE
Ud. Support for E-check	1,50	3.242,44 €	**4.863,66 €**
Ml. 25 mm diameter double tube for the E-check circuit	20,00	123,37 €	**2.467,39 €**
Ml. Electro guided Vahle, bracket and connections included	10,00	323,66 €	**3.236,64 €**

TOTAL 4: 10.567,69 €

4.5. ELECTRIC SYSTEM

SUMMARY	QUANTITY	UNIT PRICE	PRICE
Ud.1.800 x 1.200 x 400 mm Control panel (Cabinet, protections, PLC, screen, frequency inverters and security modules included)	1,00	20.818,86 €	**20.818,86 €**
Ud. UL 508 A control panel certification	1,00	11.570,33 €	**11.570,33 €**
Ud. Line's stop push button	14,00	177,65 €	**2.487,09 €**
Ud. Emergency stop push button (signaling beacon included)	14,00	391,37 €	**5.479,23 €**
Ud. Bar detector for controlling field devices	3,00	192,84 €	**578,52 €**

TOTAL 5: 40.934,03 €

4.6. SOFTWARE

SUMMARY	QUANTITY	UNIT PRICE	PRICE
H. Software adaptation of the line according to the installation's characteristics	150,00	59,59 €	**8.938,62 €**

TOTAL 6: 8.938,62 €

4.7. ENGINEERING

SUMARY	QUANTITY	UNIT PRICE	PRICE
H. Design engineering of gondolas, E-check, plans and documentation	180,00	52,23 €	**9.401,66 €**
H. Electric design engineering, plan generating and documentation	150,00	52,23 €	**7.834,72 €**

TOTAL 7: 17.236,38 €

4.8. ACCOMMODATION, EATING EXPENSES AND TRIPS

SUMARY	QUANTITY	UNIT PRICE	PRICE
P.A. Trips Spain-California and trips on Spain	5,00	1.609,21 €	**8.046,04 €**
P.A. Accommodation at Newark	80,00	336,47 €	**26.917,65 €**
P.A. Eating expenses	80,00	190,18 €	**15.214,32 €**
P.A. Rental car during the supervision of the assembly	1,00	3.072,12 €	**3.072,12 €**

TOTAL 8: 53.250,13 €

4.9. ASSEMBLY TROLLEY

SUMARY	QUANTITY	UNIT PRICE	PRICE
Ud. Trolley manufactured according customer specifications	18,00	3.138,95 €	**56.501,13 €**
Ud. Fixing System CCB	18,00	1.122,12 €	**20.198,21 €**

TOTAL 9: 76.699,34 €

5. REQUIREMENTS AND CONCLUSIONS

The offer is EXW. EXW is a technical international term which means, that the material is in the supplier's office or factory, and the client has to deal with the transport to the destination, pay the insurance, pay the customs…

The economic offer is in euros due to the offer is EXW.

Payment method and conditions:

- All invoices will be payed within 30 days.
- 30% of the contract value on acceptance of contract.
- 40% of the contract value after assembly line has been loaded in Spain.
- 20% of the contract value after installation has been finished.
- 10% of the contract value after final acceptance and 14 days testing.

The transport of the materials will be provided by SAS, a space will be reserved for the tools. Energy (electricity, water, air, etc..), Internet access and lifts are provided by SAS too.

The download of the material will be with SAS's means.

It has been estimated 30 days for the assembly of both lines. If the time required to finish is longer, for any reasons external to SICE, the additional time will be invoiced and the price will be 500 € per day and person.

Total quantity of the project, which includes a 7% discount:

ECONOMIC OFFER	
TOTAL PER UNIT	331.753,69 €
DISCOUNT, 7%	23.222,76 €
TOTAL PER UNIT	308.530,93 €
ASSEMBLY LINES	2
TOTAL (without taxes, EUROS)	**617.061,86 €**

The total price of the project is 617.061,86 €.

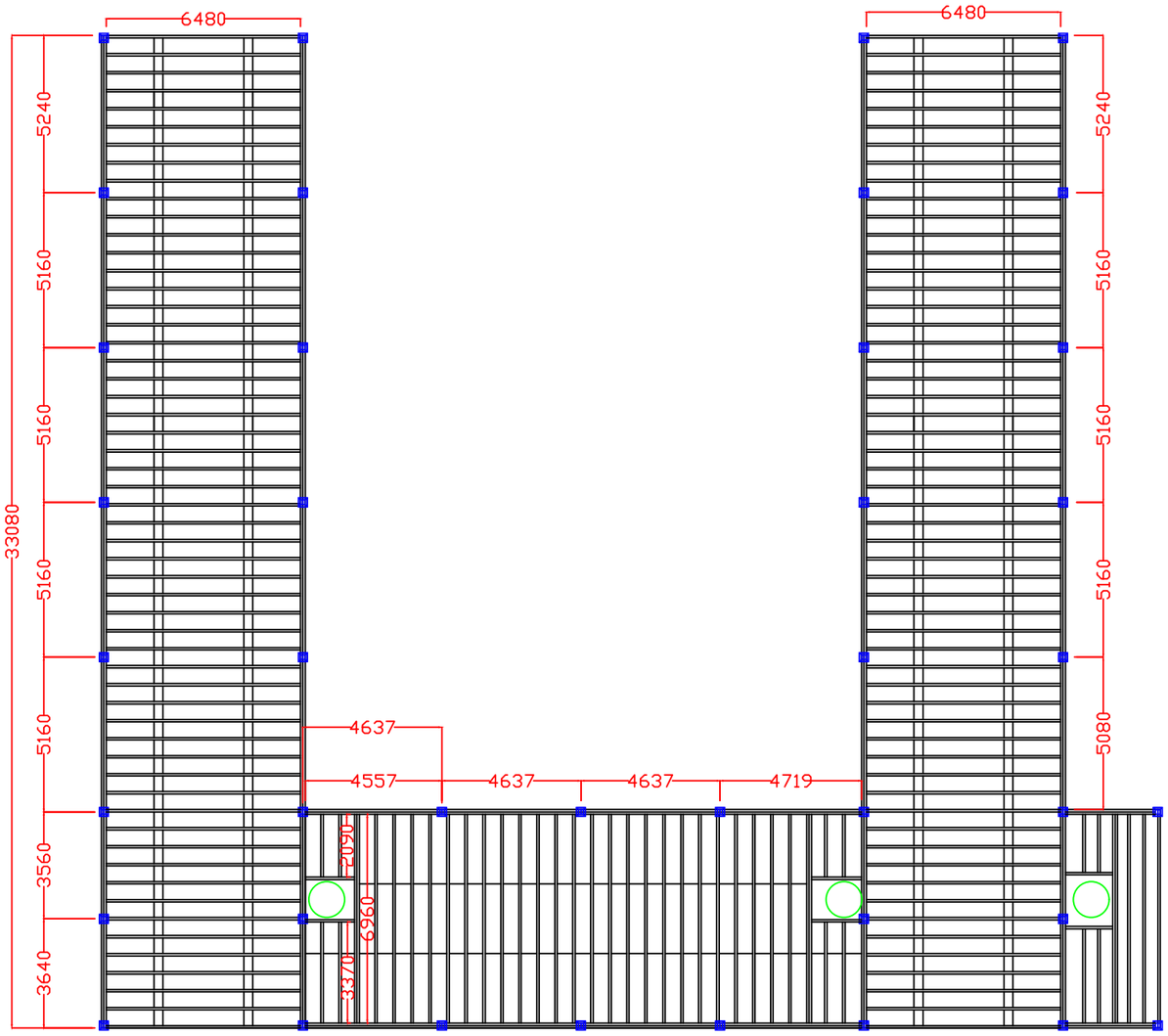
ISO 9001
ISO 14001
OHSAS 18001
BUREAU VERITAS
Certification

D. DRAWINGS

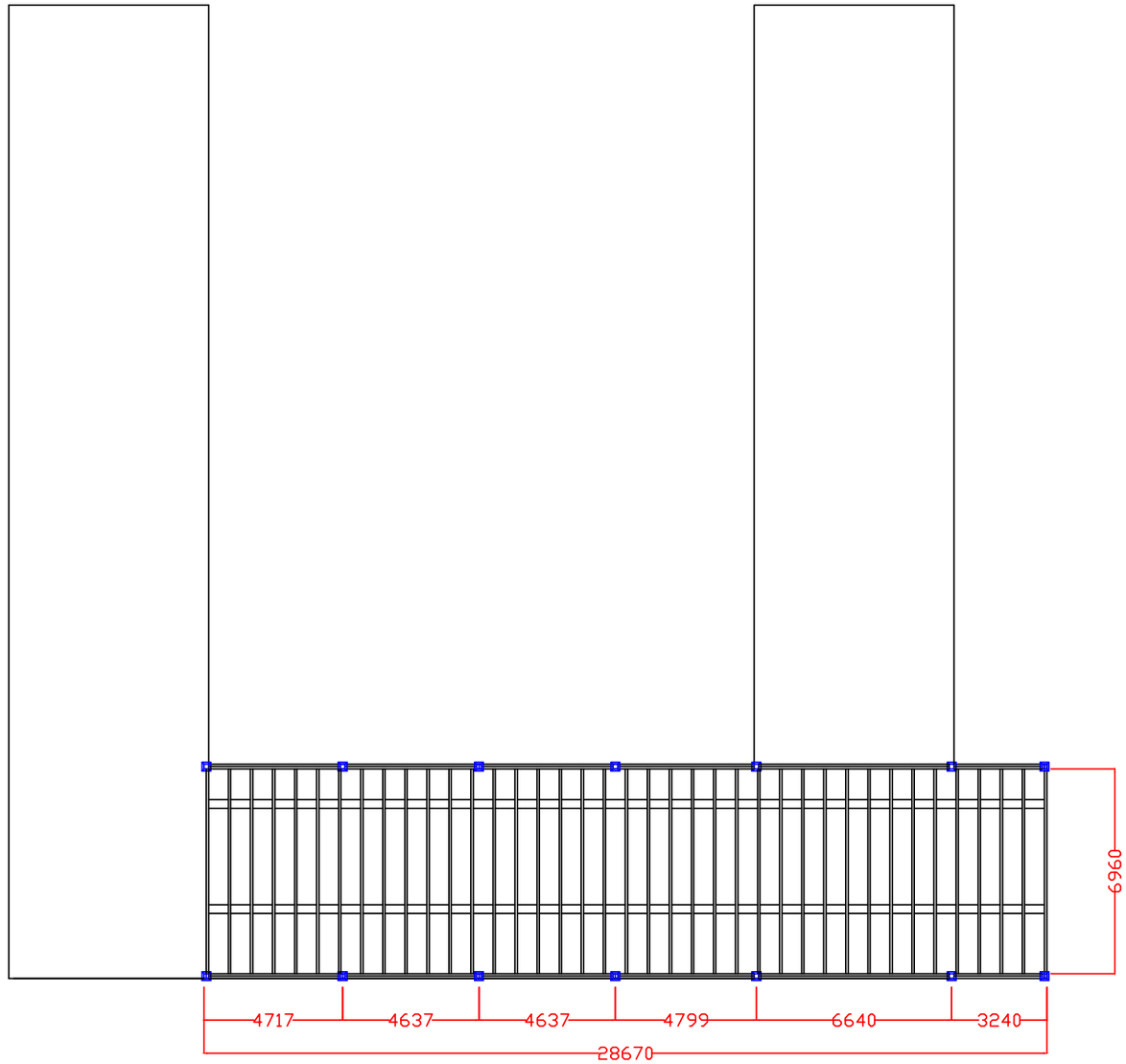
ASSEMBLY LINE-NEWARK FOR THE MODEL 3, TESLA

CONTENTS INDEX

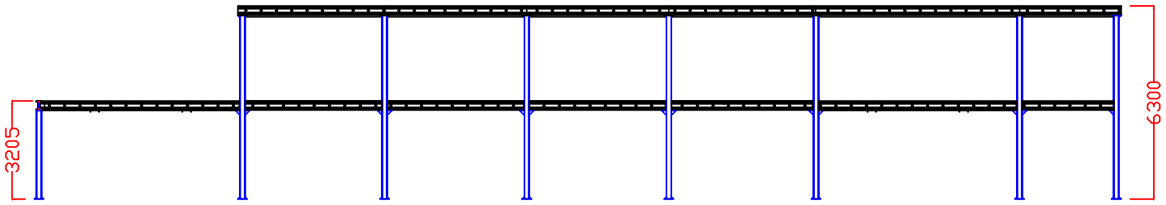
1. STRUCTURE

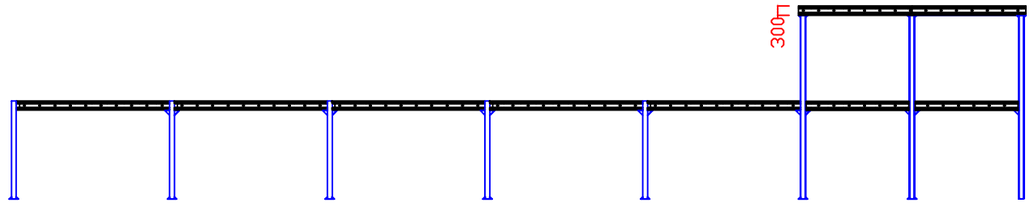


DESIGNED BY: **Carmelo**	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Structure's lower plan view**	SCALE: *1:200*	Nº DRAWING: *1*

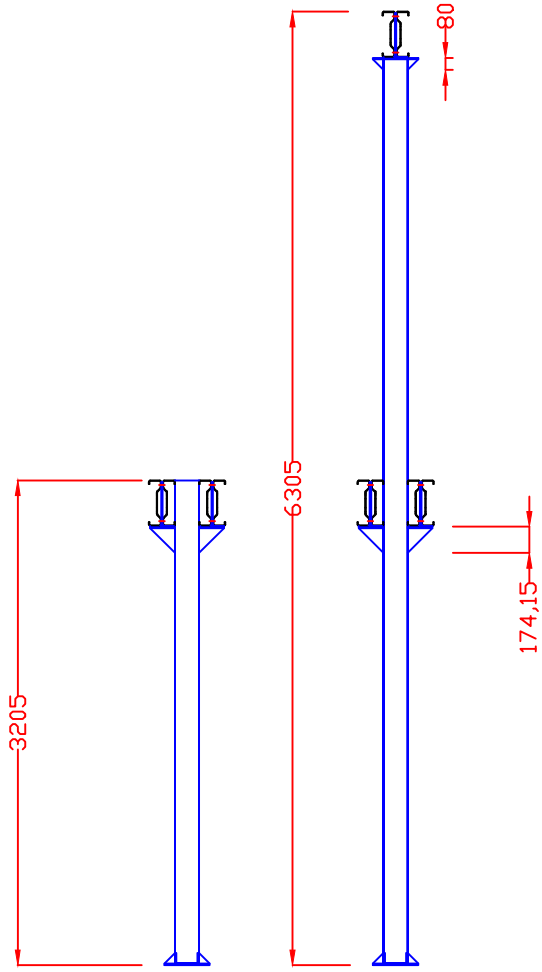


DESIGNED BY: **Carmelo**	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Structure's upper plan view**	SCALE: *1:200*	Nº DRAWING: *2*

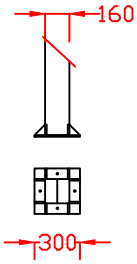




DESIGNED BY: **Carmelo**	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Structure's side view**	SCALE: *1:200*	Nº DRAWING: *3*



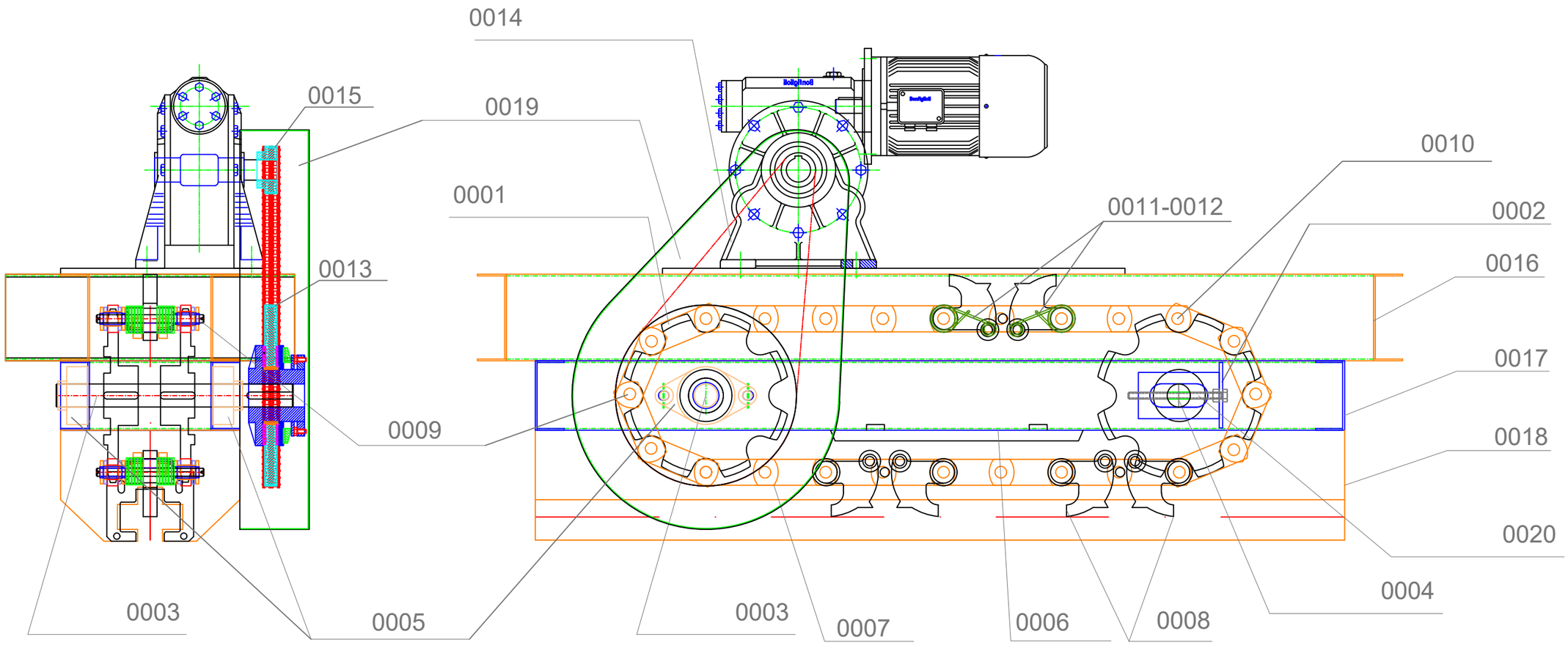
COLUMN'S VIEW WITH THE SYSTEM
FOR ATTACHING TO THE SIGMA BEAMS



UPPER VIEW OF THE
COLUMN'S PROTECTIONS

DESIGNED BY: **Carmelo**	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Columns view**	SCALE: *1:50*	Nº DRAWING: *4*

2. DRAGGING SYSTEM



NUMBER	NAME	UDS.
0020	TENSIONING SCREW	2
0019	TRANSMISSION PROTECTION	1
0018	GROUP GUIDES	1
0017	BOTTOM CHASSIS	1
0016	TOP CHASSIS	1
0015	TRASMISSION PINION	1
0014	TRANSMISSION CHAIN	1
0013	CROWN	1
0012	LEFT SPRING	12
0011	RIGHT SPRING	12
0010	CHAIN SHAFT	18
0009	ROLLER SHAFT	12
0008	NAIL	12
0007	GROUP CHAIN	2
0006	SKID	1
0005	BEARING BRACKET	2
0004	TENSIONING SHAFT	1
0003	DRIVE SHAFT	1
0002	TENSIONING WHEEL	2
0001	DRIVE WHEEL	2

DESIGNED BY: SICE

CUSTOMER: SAS Automotive Systems

FINAL CUSTOMER:

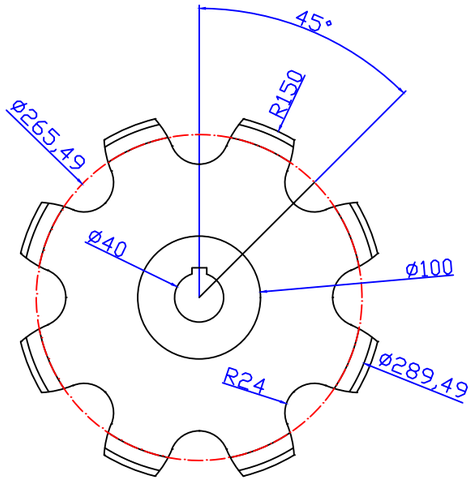
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**

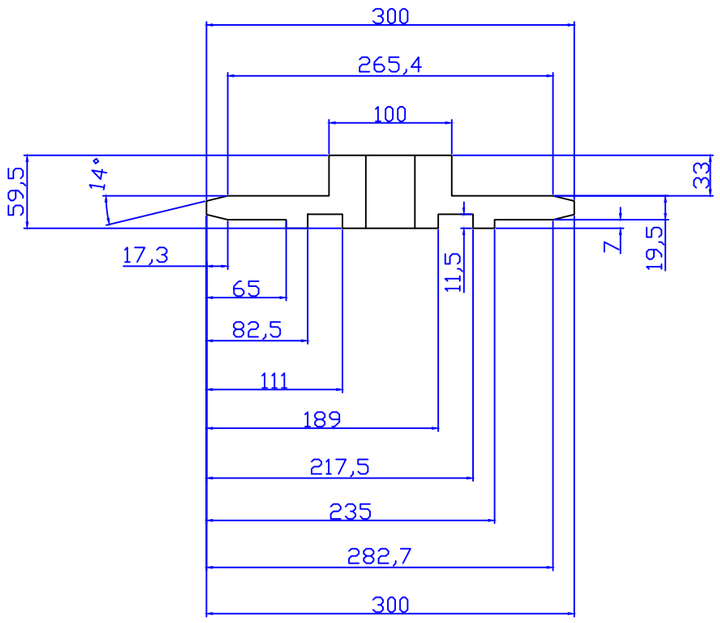
DRAWING: **Dragging system, Explosion drawing**

SCALE: *1:10*

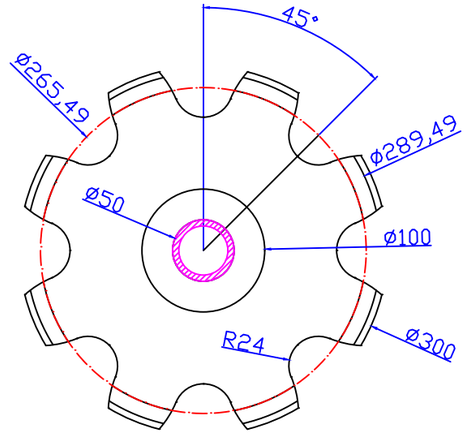
Nº DRAWING: *1*

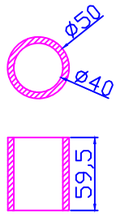
Drive wheel

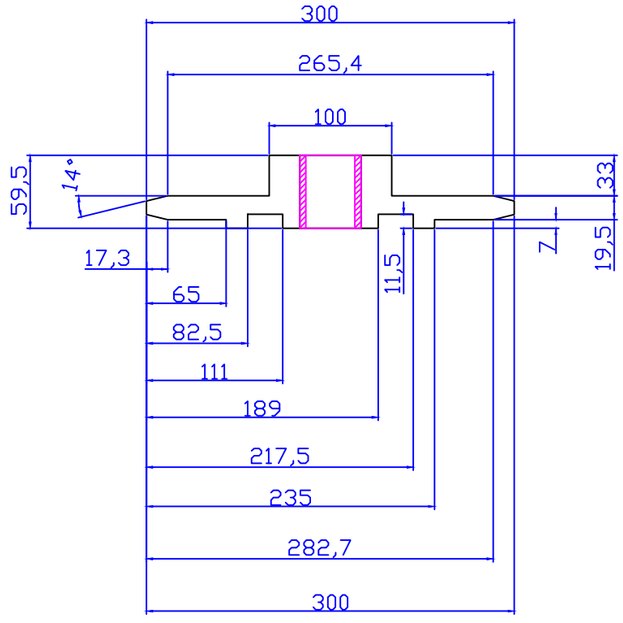




Tensioning wheel

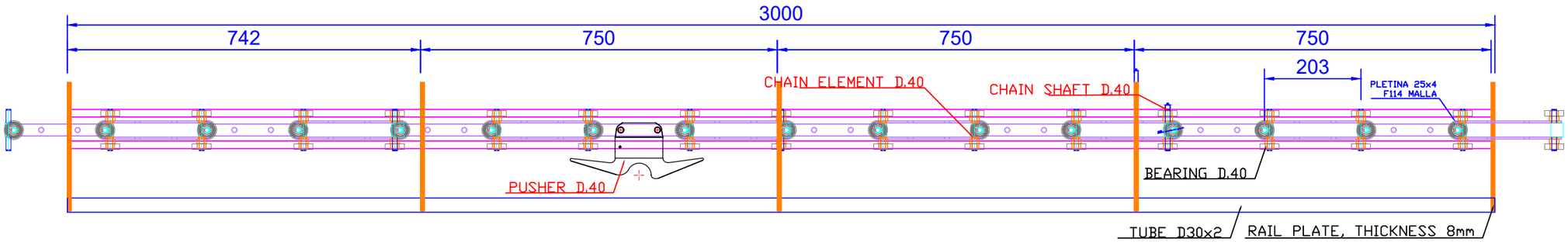




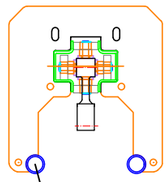


DESIGNED BY:	CUSTOMER:	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		
DRAWING: **Drive and tensioning wheels**	SCALE: *1:5*	Nº DRAWING: *2*

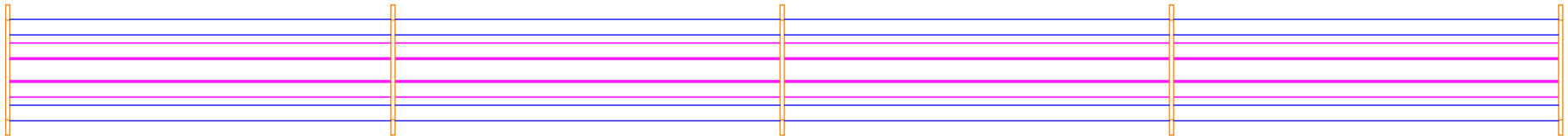
FRONT VIEW



SIDE VIEW

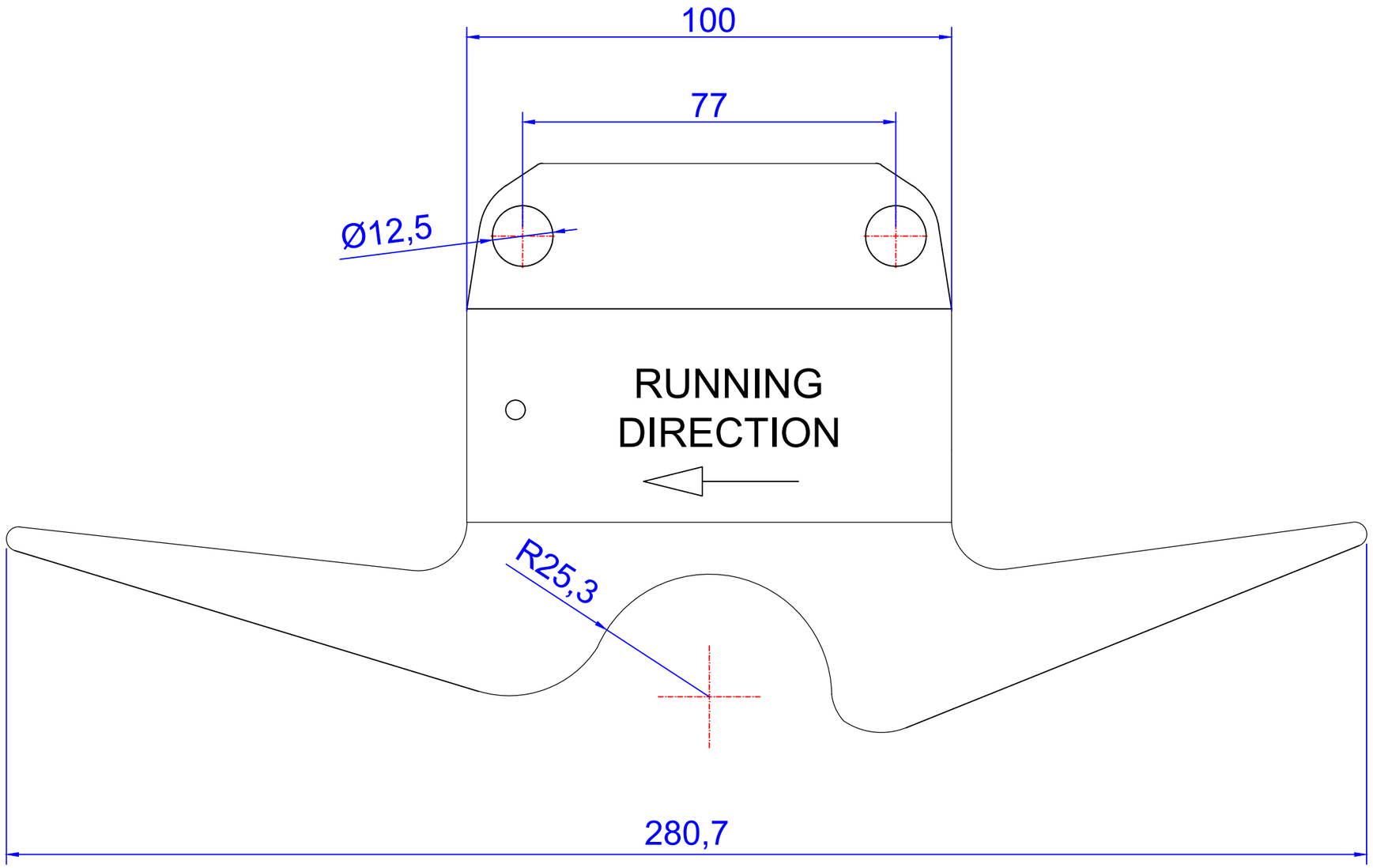


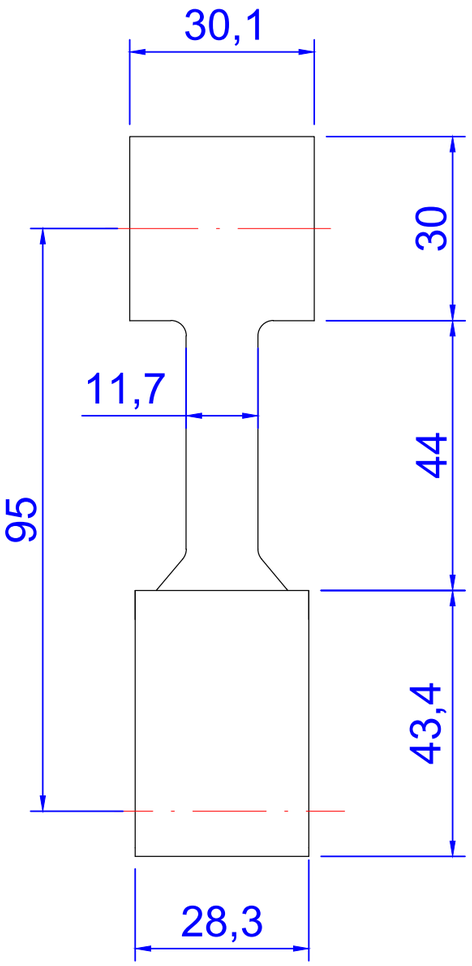
Tube Ø30
thickness 2,5mm



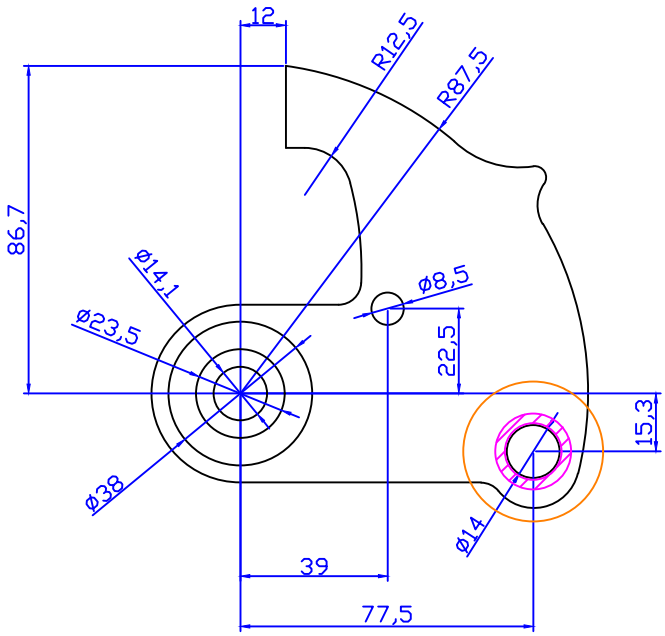
PLAN VIEW

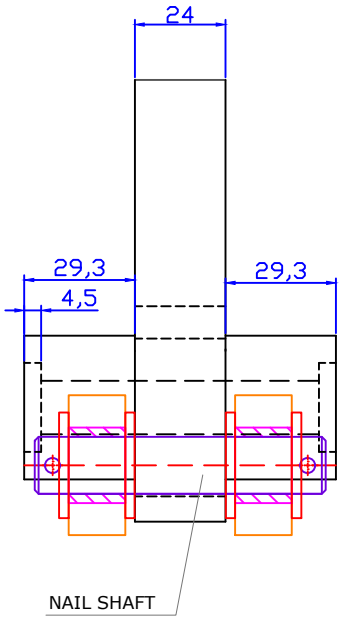
DESIGNED BY: SICE	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		
DRAWING: **Chain and rail**	SCALE: *1:10*	Nº DRAWING: *3*

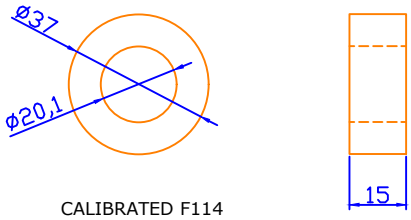




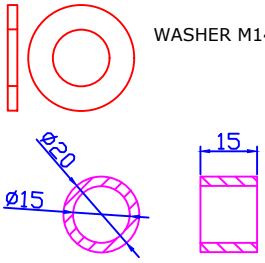
DESIGNED BY: SICE	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		
DRAWING: **Pusher**	SCALE: *1:1*	Nº DRAWING: *4*







CALIBRATED F114



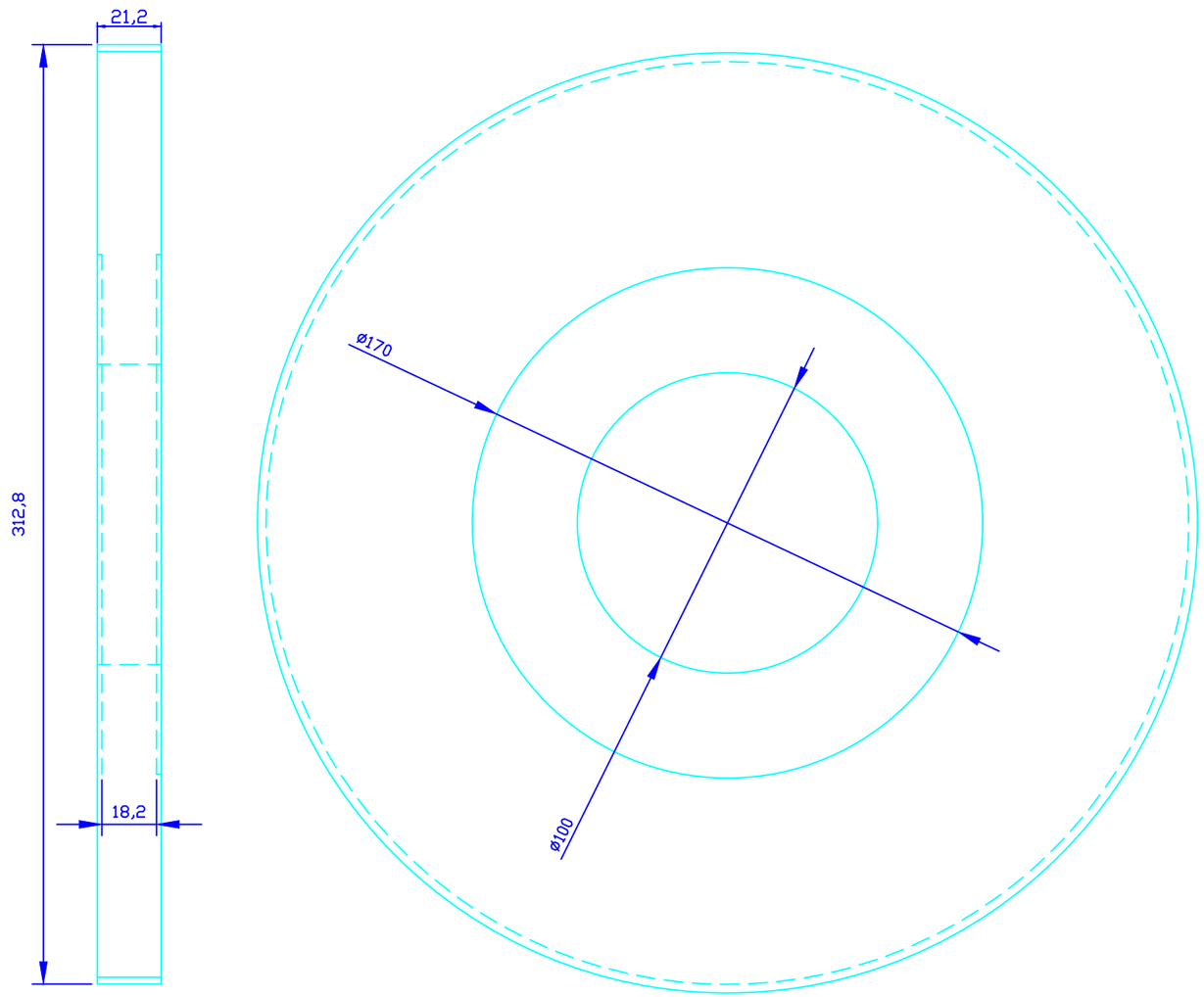
AUTOLUBRICATED BRONCE SLEEVE

DESIGNED BY:	CUSTOMER:	FINAL CUSTOMER:

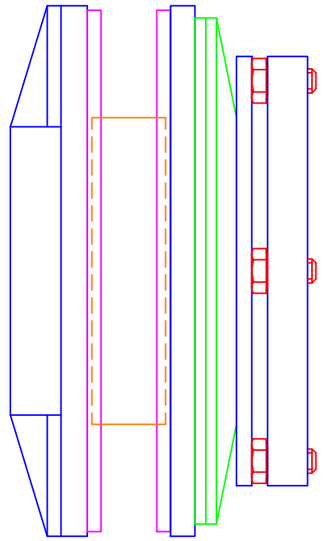
PROJECT:

Cockpit Assembly Line for the Model 3, TESLA

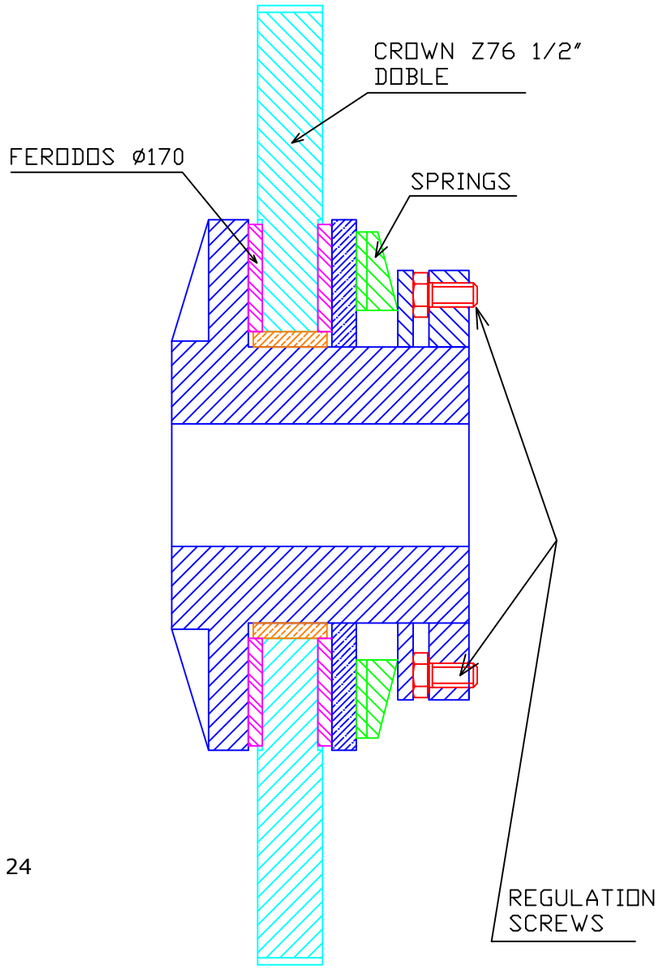
DRAWING:	SCALE:	Nº DRAWING:
Nail	*1:2*	*5*



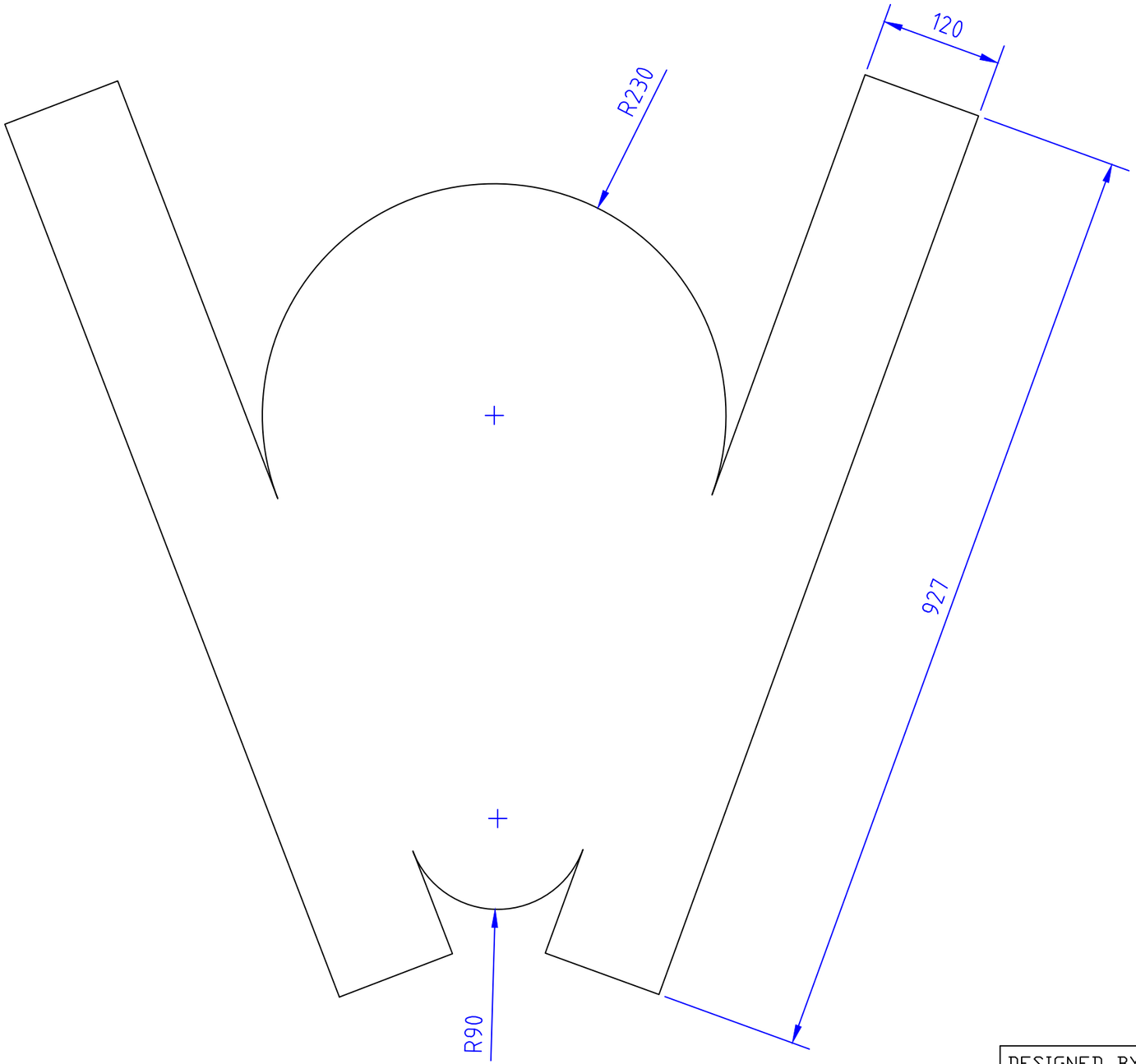
DOUBLE CROWN Z76 ½"
MECANIZED FOR LIMITER OF Ø170

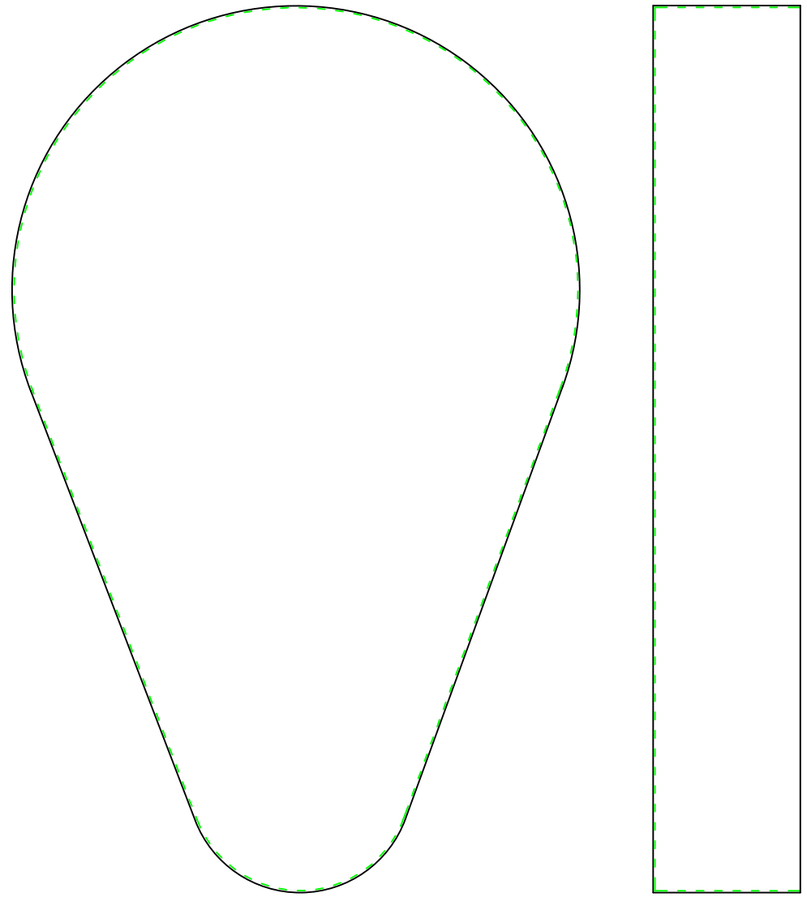


TORQUE LIMITER LP-170-R2. SLEEVE OF 24



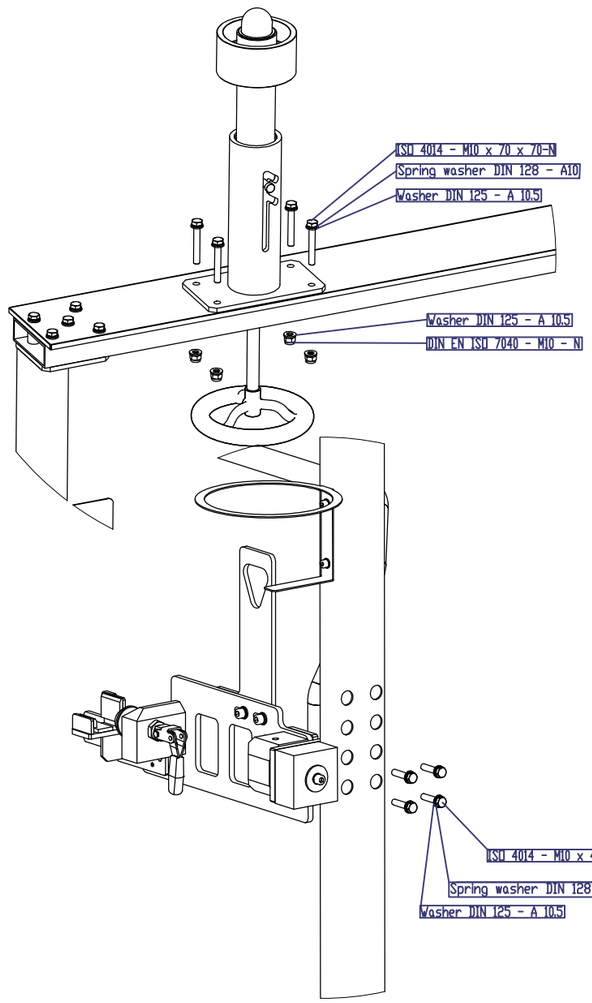
DESIGNED BY: SICE	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		
DRAWING: **Transmission crown**	SCALE: *1:2*	Nº DRAWING: *6*

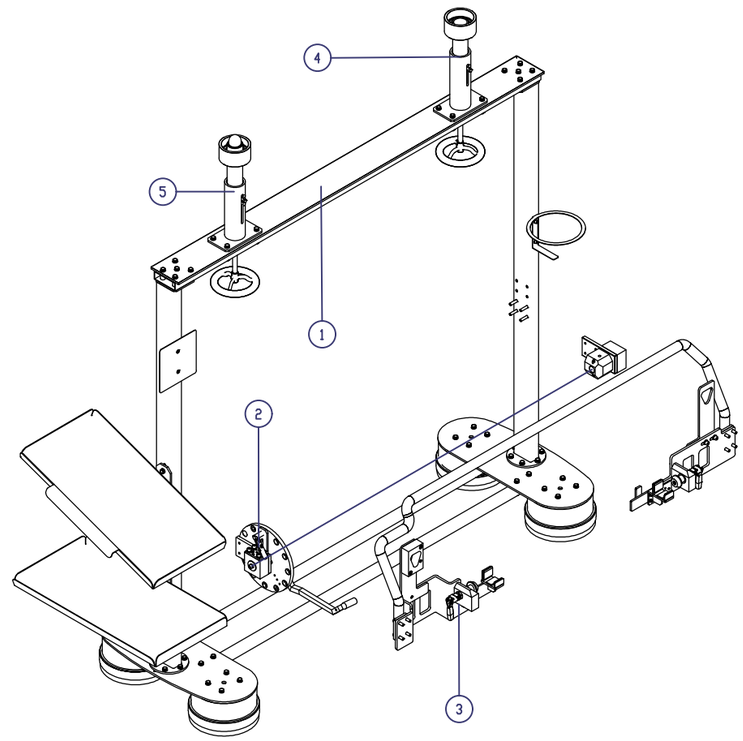




DESIGNED BY: SICE	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		
DRAWING: **Transmission protection**	SCALE: *1:5*	Nº DRAWING: *7*

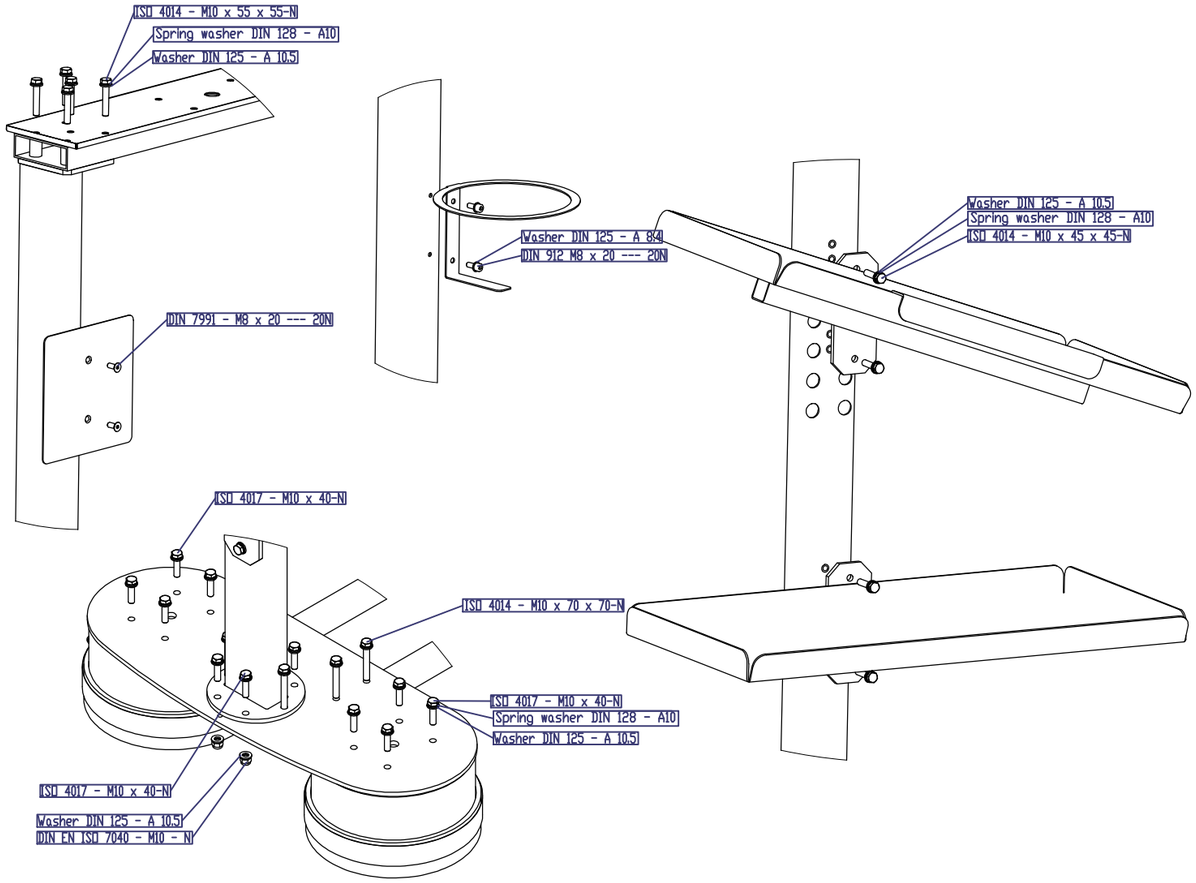
3. TROLLEY





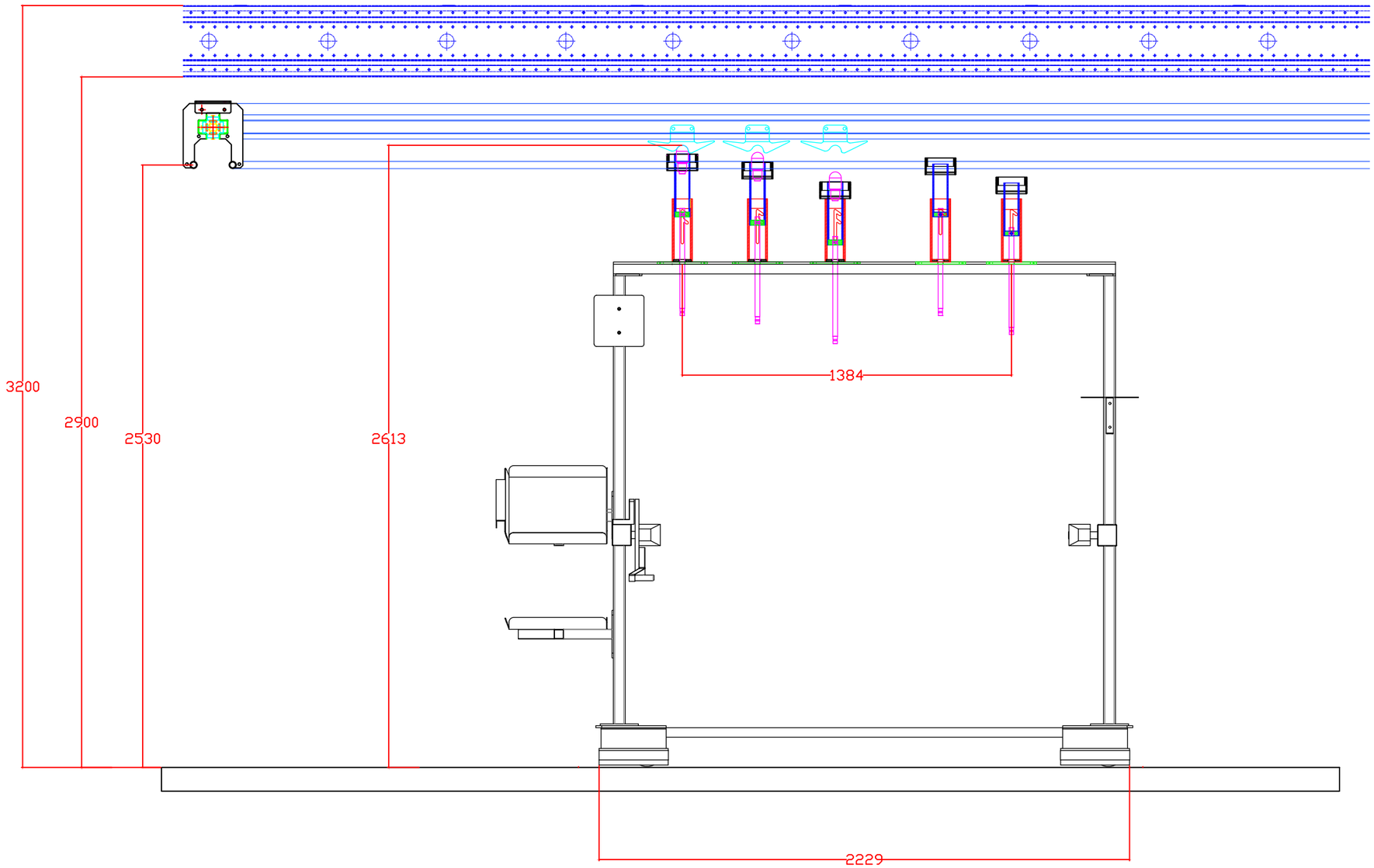
ITEM NO.	NAME	QTY.
1	ASSY TROLLEY FRAME	1
2	ROTATION SYSTEM	1
3	ASSY CLAMPING	1
4	TROLLEY GUIDE	1
5	ASSY PULLING DEVICE	1
6	ISO 4014 - M10 x 70 x 70-N	8
7	ISO 4014 - M10 x 45 x 45-N	8
8	Washer DIN 125 - A 10.5	24
9	Spring washer DIN 128 - A10	24
10	DIN EN ISO 7040 - M10 - N	8

DESIGNED BY: **Carmelo**	CUSTOMER: SAS	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Main view of the trolley**	SCALE: *1:50*	Nº DRAWING: *1*

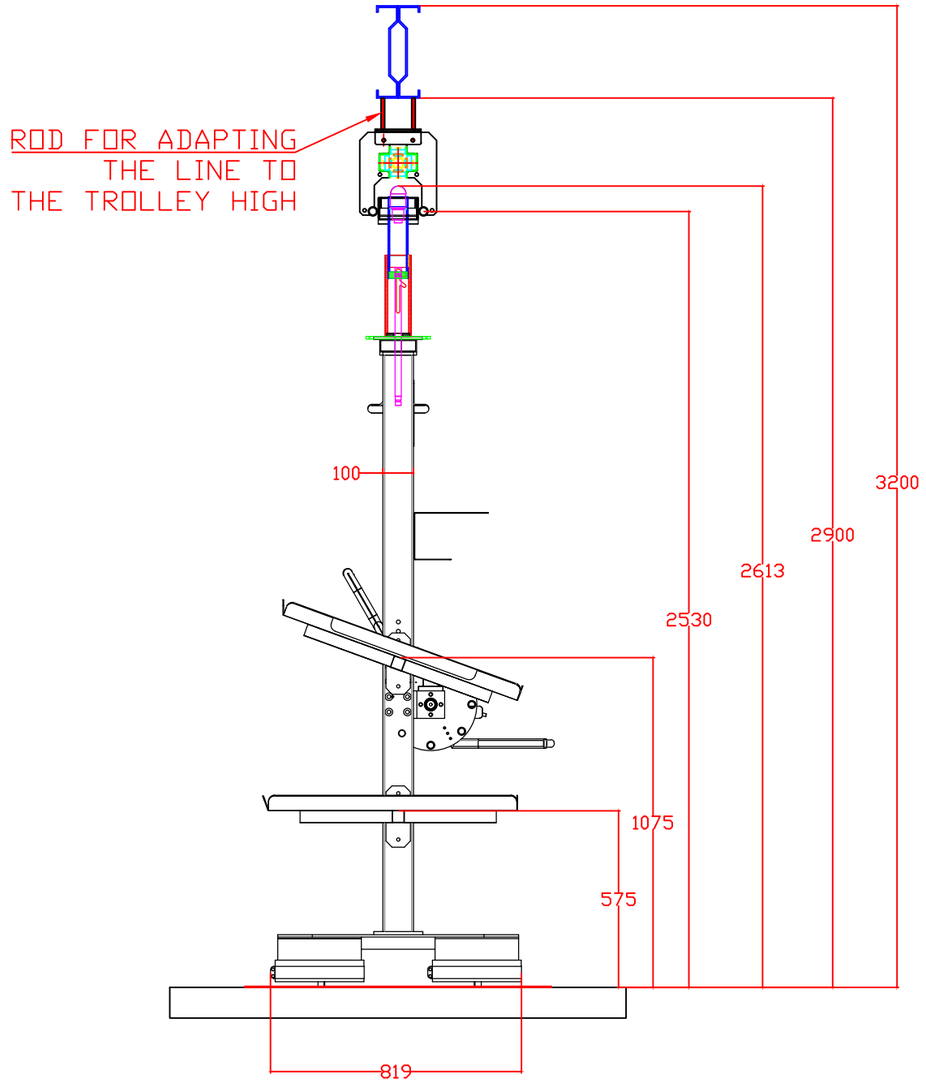


ITEM NO.	NAME	QTY.
1	BUCKET BRACKET	1
2	SHEET BRACKET	1
3	SIDE FRAME R	1
4	SIDE FRAME L	1
5	BASE PLATE	2
6	BOTTOM FRAME	1
7	TOP BEAM FRAME	1
8	TRAY FRAME	2
9	LOWER FLANGE PLATE	1
10	UPPER FLANGE PLATE	1
11	LOWER TRAY	1
12	DROPPING OIL TRAY	1
13	UPPER TRAY	1
14	WHEELS PROTECTION BELT	4
15	ASSY WHEELS PROTECTION	4
16	SCREW REINFORCED	10
17	RUBBER WHEELS COVER	4
18	RUEDA TENTE 3470UAR125P63_red_STEP-2.14b	4
19	Washer DIN 125 - A 10.5	86
20	Washer DIN 125 - A 8.4	2
21	Spring washer DIN 128 - A10	86
22	ISO 4014 - M10 x 55 x 55-N	10
23	ISO 4014 - M10 x 45 x 45-N	4
24	ISO 4014 - M10 x 80 x 80-N	4
25	ISO 4014 - M10 x 70 x 70-N	8
26	DIN EN ISO 7040 - M10 - N	36
27	DIN EN ISO 7040 - M8 - N	8
28	ISO 7045 - M8 x 16 - Z --- 16N	8
29	DIN 7991 - M8 x 20 --- 20N	2
30	ISO 4017 - M10 x 40-N	24
31	DIN 912 M8 x 20 --- 20N	2

DESIGNED BY: **Carmelo**	CUSTOMER: SAS	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Main view of the trolley frame**	SCALE: *1:50*	Nº DRAWING: *2*



DESIGNED BY: **Carmelo**	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Front view of Trolley in the line**	SCALE: *1:20*	Nº DRAWING: *3*



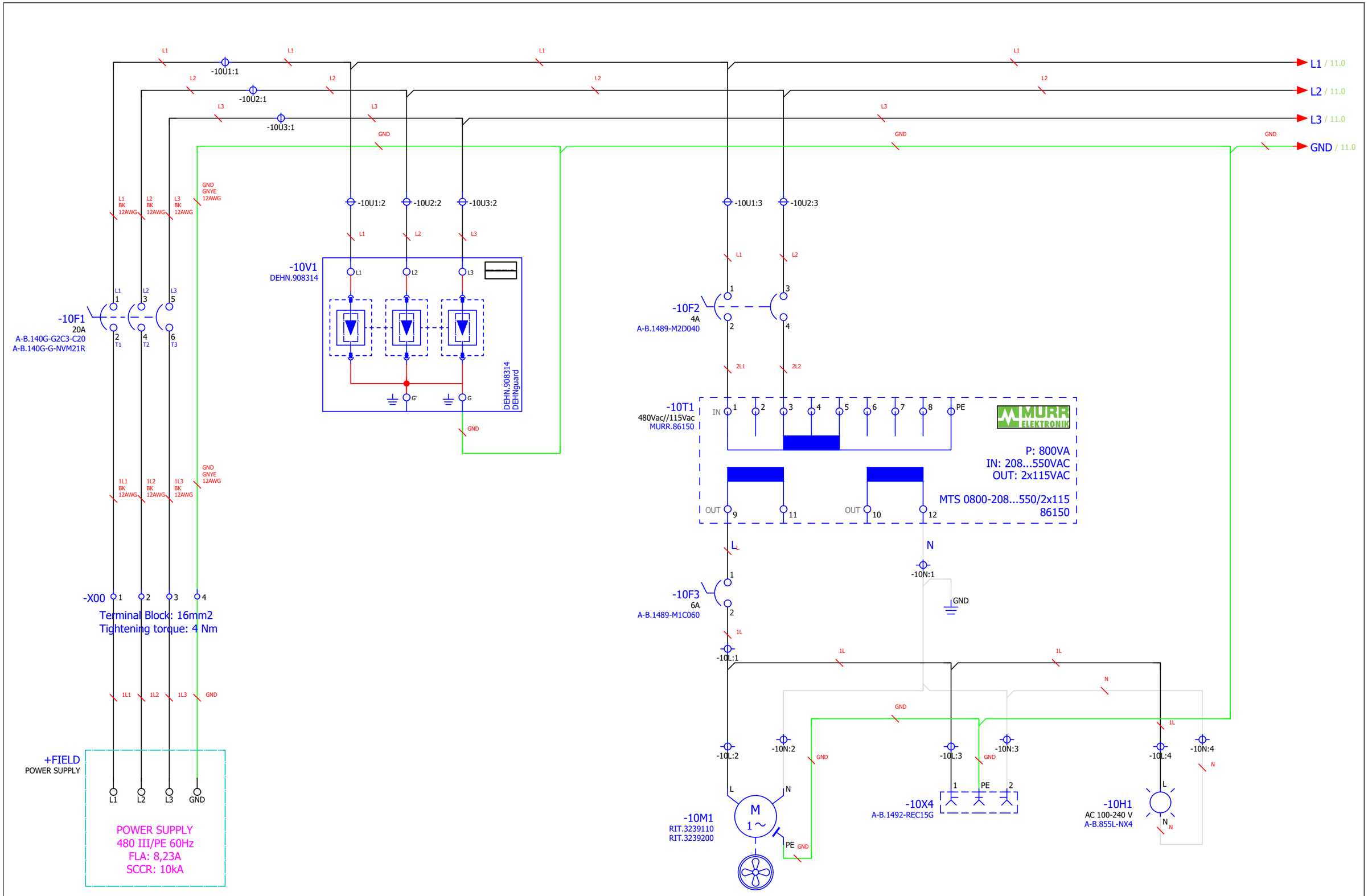
DESIGNED BY: **Carmelo**	CUSTOMER: SAS Automotive Systems	FINAL CUSTOMER:
PROJECT: **Cockpit Assembly Line for the Model 3, TESLA**		SICE
DRAWING: **Side view of Trolley in the line**	SCALE: *1:20*	Nº DRAWING: *4*

4. ELECTRIC INSTALLATION

SICE
Pol. Ind. Mutilva Baja, C/ I, 10
C.P.31192 Mutilva Baja, Navarra (España)
Telf: +34 948 29 00 41

www.sice.com

Company / Client:	SAS Automotive, TESLA Inc.
Project description:	NEWARK - 2 x INDUSTRIAL CONTROL PANEL UL508A
Design number:	OT-3220
Project Name:	COCKPIT ASSEMBLY LINE IN NEWARK
Created	11/06/17
Inspected	26/07/17



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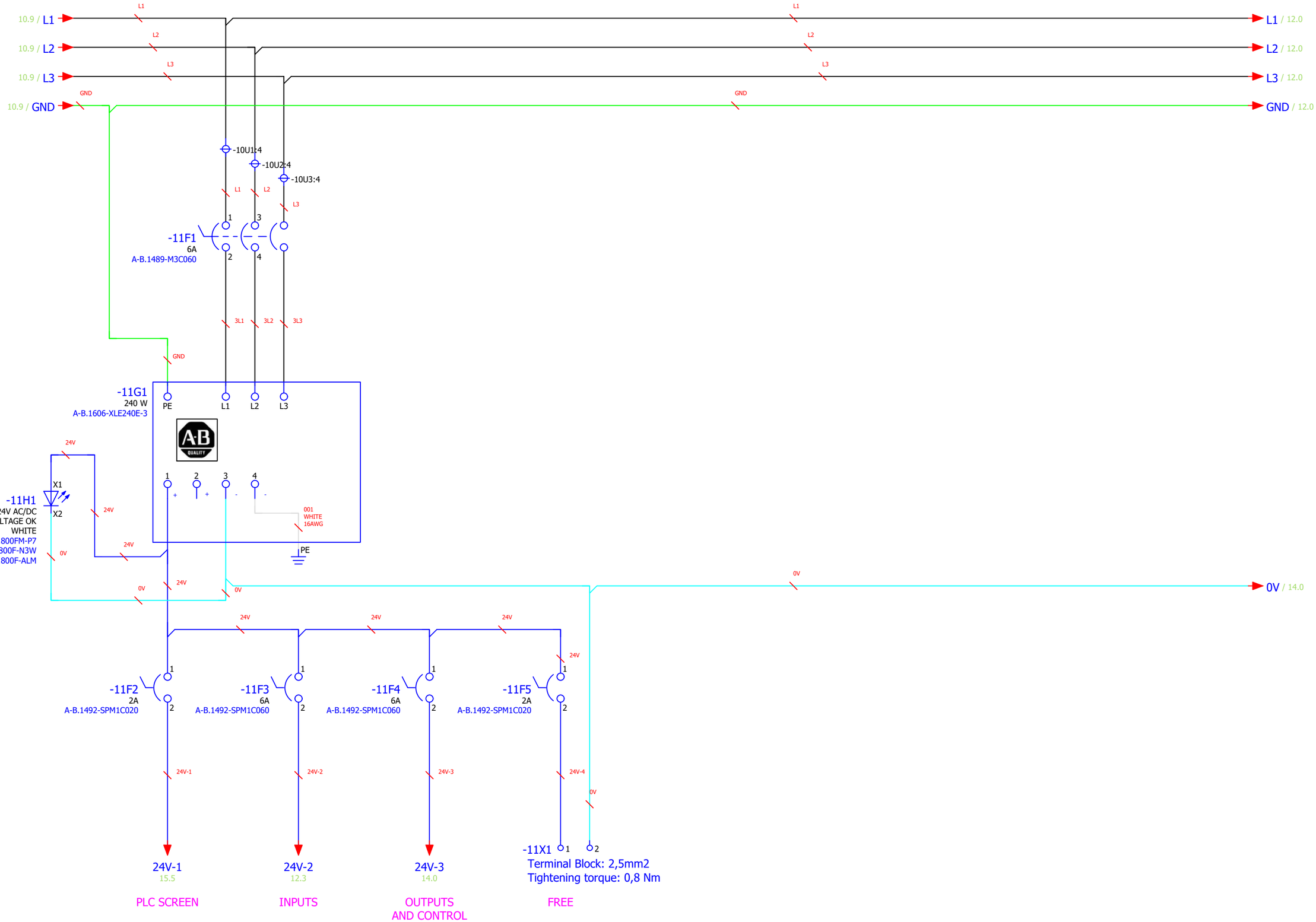
Carmelo Fernández	Maite Aparicio	COCKPIT ASSEMBLY LINE IN NEWARK	POWER CIRCUIT	www.sice.com		TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 11 Page: 10



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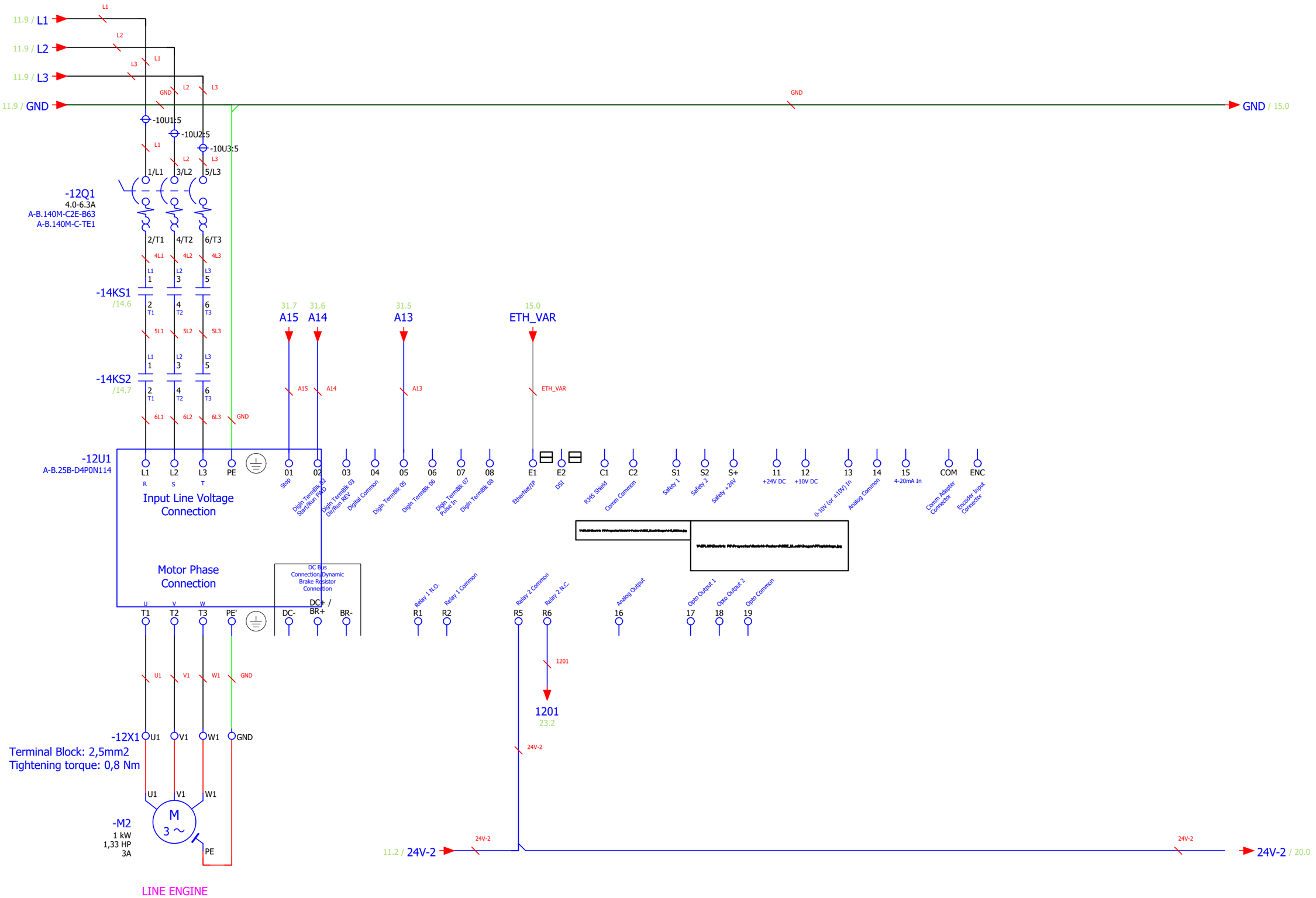
Carmelo Fernández	Maite Aparicio	COCKPIT ASSEMBLY LINE IN NEWARK	POWER SUPPLY	www.sice.com		TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 12 Page: 11



Revised by	Designed by	Project name	Page Name:		Customer:	Customer:	
Carmelo Fernández	Maite Aparicio	COCKPIT ASSEMBLY LINE IN NEWARK	SPEED DRIVER	www.sice.com	SAS Automotive Systems	TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 14 Page: 12

11.3 / 24V-3

24V-3

24V-3 / 15.0

009

-14XS1 1

010

3

-14S1 E

/30.5

PULS.RESET

BLUE

A-B.800FM-LF6

A-B.800F-ALM

A-B.800F-X10

A-B.800F-N3W

4

011

-14XS1 2

+FIELD

-SE1

STOP EMERGENCY

1 11 2 12

-14XS1 3 4

002 005

-14S00

STOP EMERGENCY

A-B.800FM-MT44

A-B.800F-15YS112

A-B.800F-X01

A-B.800F-ALM

1 11 2 12

003 006

-14KS0

A-B.440R-N23126

S12 S21

S11 S52 S22 S34

004 004 008 013

HASTA 16 SETAS EN CAMPO.....

-SE16

STOP EMERGENCY

1 11 2 12

-14XS1 5 6

-14KS1 61 62

.6

014

-14KS2 61 62

.7

009

009

009

A1 13 23 33 41

SECURITY RELAY 440R-N23126

A2 14 24 34 42

015

016

016

016

A1

-14KS1

24V, 9A

A-B.100S-C09EJ23C

A2

A1

-14KS2

24V, 9A

A-B.100S-C09EJ23C

A2

11.9 / 0V

0V

0V / 15.0

100S-C09EJ23C

1	2	/12.1	
3	4	/12.1	
5	6	/12.1	
13	14	/20.8	
53	54		
61	62	.4	
71	72		
81	82		

100S-C09EJ23C

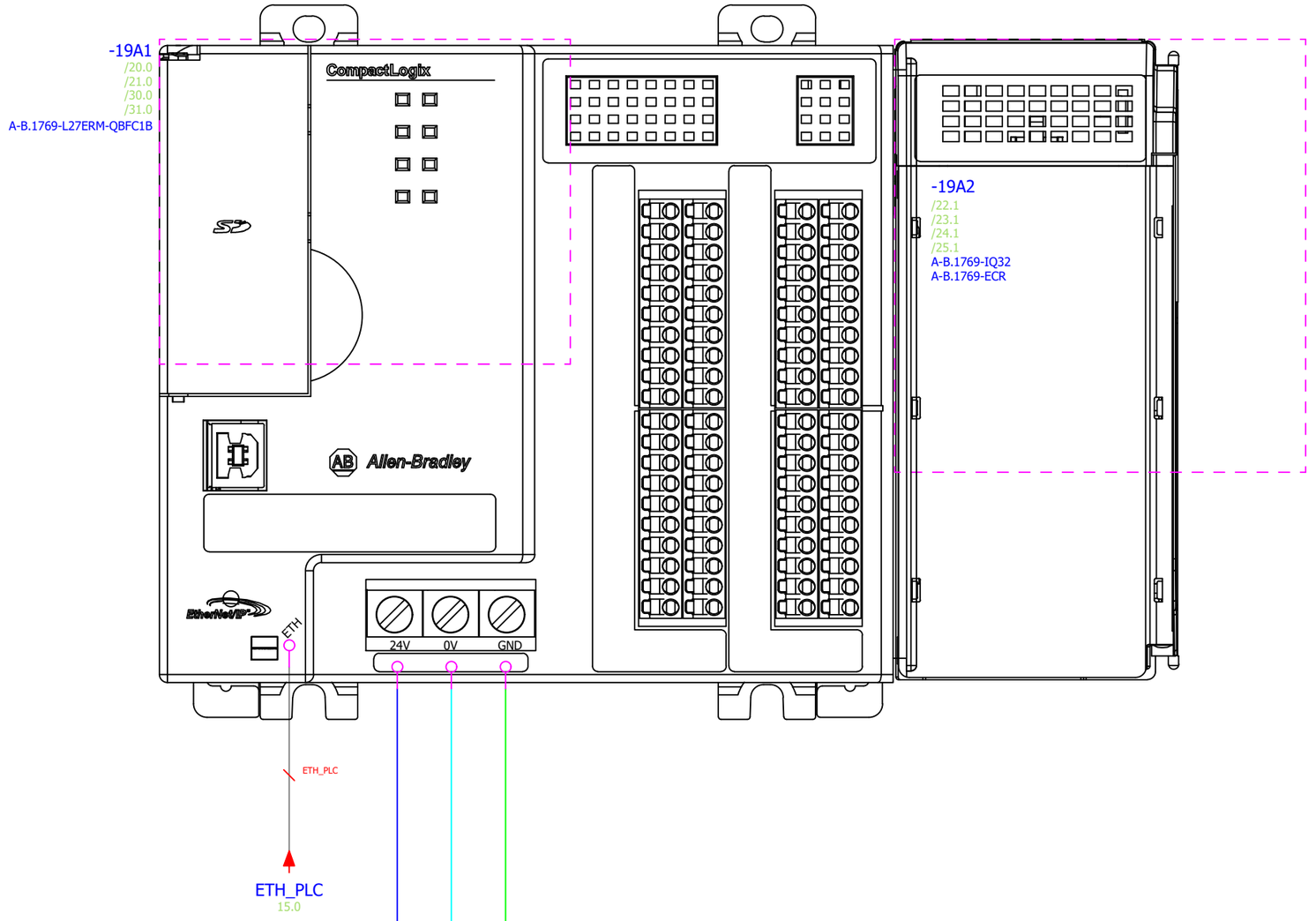
1	2	/12.1	
3	4	/12.1	
5	6	/12.1	
13	14	/20.8	
53	54		
61	62	.4	
71	72		
81	82		

Revised by	Designed by	Project name	Page Name:		Customer:	Customer:
Carmelo Fernández	Maite Aparicio	COCKPIT ASSEMBLY LINE IN NEWARK	SAFETY	www.sice.com	SAS Automotive Systems	TESLA, Inc.

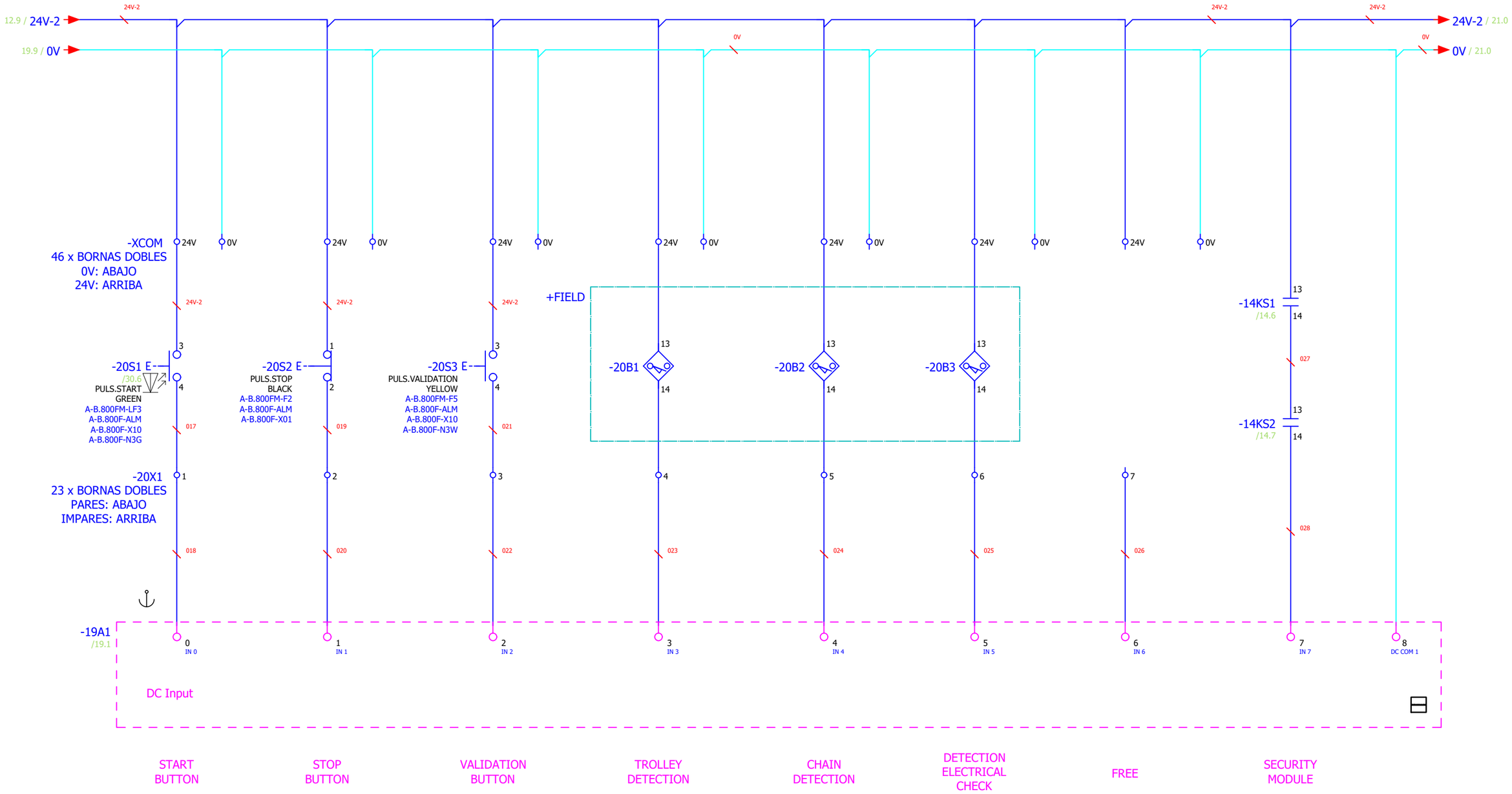
Location: =	
Cabinet: +	OT-3220
Next page:	15
Page:	14

14.9 / 24V-3
14.9 / 0V
12.9 / GND
24V-3
0V
GND
24V-3 / 19.0
0V / 19.0
GND / 19.0
11.1
24V-1
-15U1
Switch
A-B.1783-US5T
1 GND
2 DC +
3 DC -
4 GND
5 AC (L)
6 AC (N)
Allen-Bradley
Stratix 2000 Switch,
Unmanaged, 5-port Switch
Copper port 1
Copper port 2
Copper port 3
Copper port 4
Copper port 5
-15U2
Screen
A-B.2711P-T10C21D8S
1 GND
2 CC +
3 CC -
Allen-Bradley
PanelView Plus
PE
ETH
ETH_VAR
ETH_PLC
ETH_HMI
A-B.1585J-M8UBJM-2
ETH_VAR
2 m
12.3 / ETH_VAR
A-B.1585J-M4TBJM-2
ETH_PLC
2 m
19.1 / ETH_PLC
A-B.1585J-M4TBJM-2
ETH_HMI
2 m

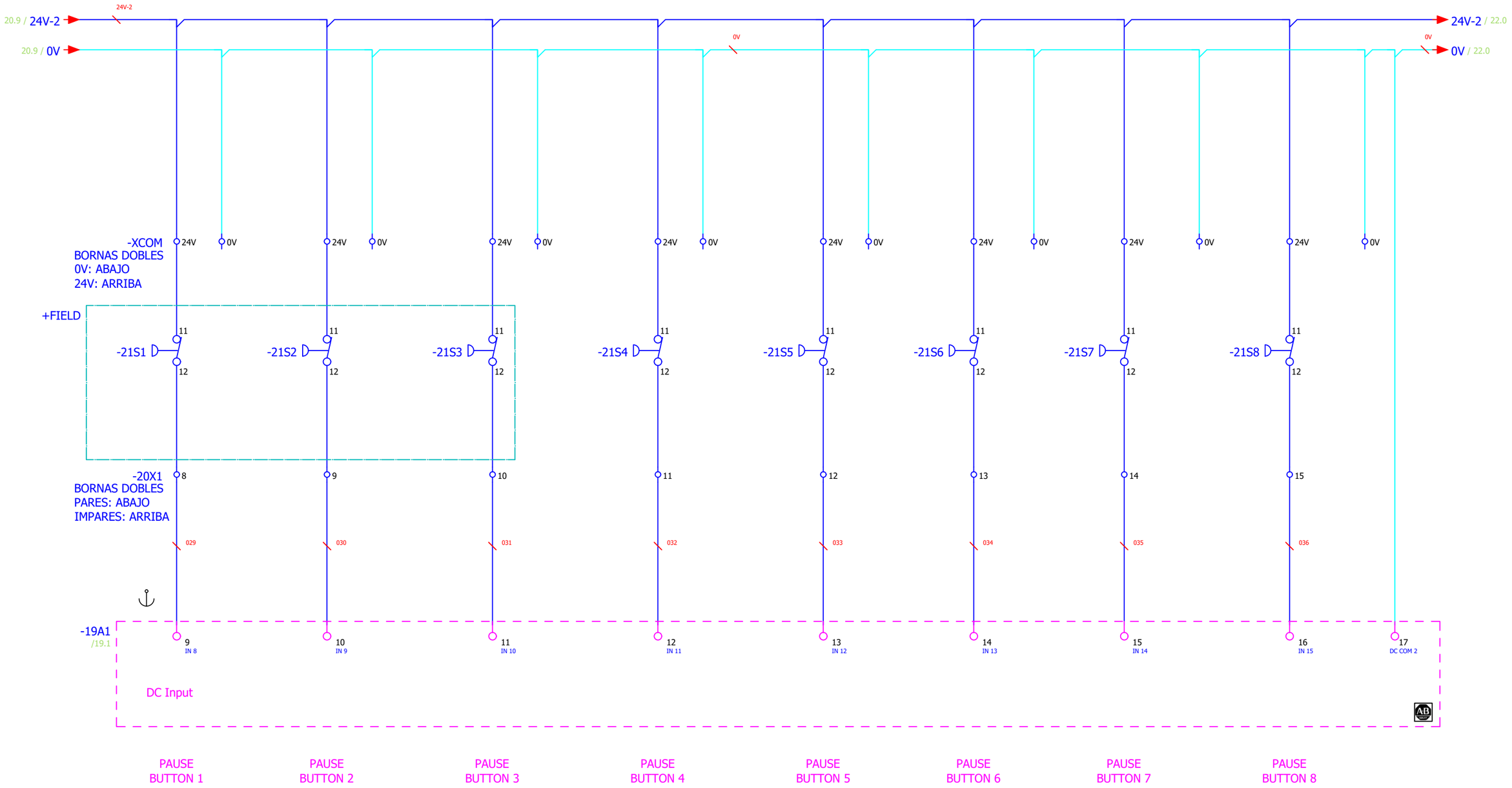
Revised by Carmelo Fernández	Designed by Maite Aparicio	Project name COCKPIT ASSEMBLY LINE IN NEWARK	Page Name: SWITCH-SCREEN	www.sice.com	Customer: SAS Automotive Systems	Customer: TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 19 Page: 15



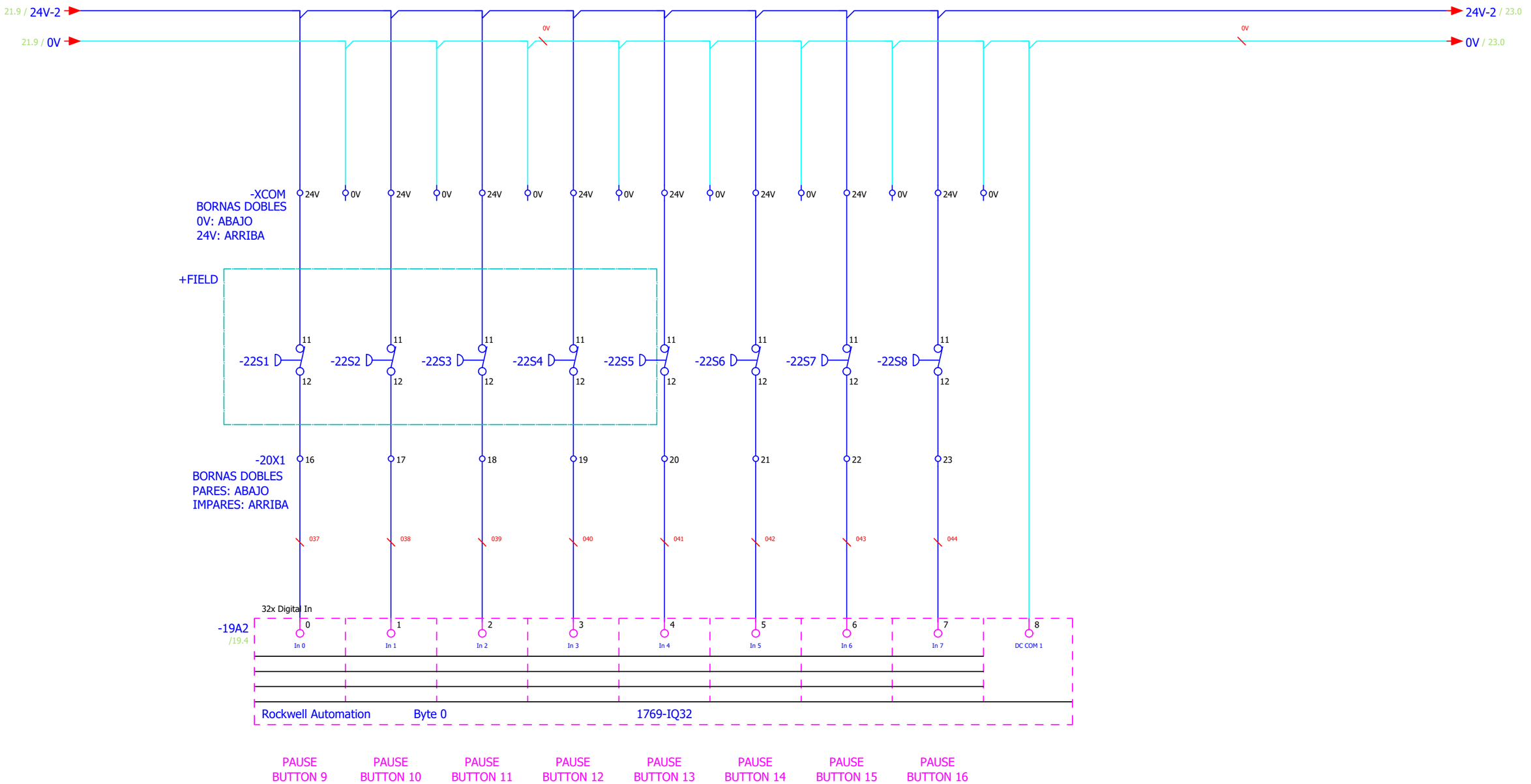
Revised by Carmelo Fernández	Designed by Maite Aparicio	Project name COCKPIT ASSEMBLY LINE IN NEWARK	Page Name: PLC	www.sice.com	Customer: SAS Automotive Systems	Customer: TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 20 Page: 19



Revised by	Designed by	Project name	Page Name:		Customer:	Customer:	
Carmelo Fernández	Maite Aparicio	COCKPIT ASSEMBLY LINE IN NEWARK	DIGITAL INPUTS	www.sice.com	SAS Automotive Systems	TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 21 Page: 20



Revised by: Carmelo Fernández	Designed by: Maite Aparicio	Project name: COCKPIT ASSEMBLY LINE IN NEWARK	Page Name: DIGITAL INPUTS	www.sice.com	Customer: SAS Automotive Systems	Customer: TESLA, Inc.	Location: = / Cabinet: + OT-3220 / Next page: 22 / Page: 21



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Carmelo Fernández	Maite Aparicio	COCKPIT ASSEMBLY LINE IN NEWARK	DIGITAL INPUTS	www.sice.com		TESLA, Inc.	Location: = Cabinet: + OT-3220 Next page: 23 Page: 22

22.9 / 24V-2

22.9 / 0V

24V-2 / 24.0

0V / 24.0

0V

0V

-XCOM

24V 0V 24V 0V 24V 0V 24V 0V 24V 0V 24V 0V 24V 0V

BORNAS DOBLES
0V: ABAJO
24V: ARRIBA

12.3
1201

1201

-20X1

24 25 26 27 28 29 30

BORNAS DOBLES
PARES: ABAJO
IMPARES: ARRIBA

045 046 047 048 049 050 051

32x Digital In

-19A2
/19.4

9 10 11 12 13 14 15 16 17

In 9 In 8 In 11 In 10 In 13 In 12 In 15 In 14 DC COM 2

Rockwell Automation Byte 1 1769-IQ32

FREQUENCY SPEED DRIVER ALARM

FREE FREE FREE FREE FREE FREE FREE

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22.9 / 24V-2

22.9 / 0V

24V-2 / 24.0

0V / 24.0

0V

0V

-XCOM

24V 0V 24V 0V 24V 0V 24V 0V 24V 0V 24V 0V 24V 0V

BORNAS DOBLES
0V: ABAJO
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12.3
1201

1201

-20X1

24 25 26 27 28 29 30

BORNAS DOBLES
PARES: ABAJO
IMPARES: ARRIBA

045 046 047 048 049 050 051

32x Digital In

-19A2
/19.4

9 10 11 12 13 14 15 16 17

In 9 In 8 In 11 In 10 In 13 In 12 In 15 In 14 DC COM 2

Rockwell Automation Byte 1 1769-IQ32

FREQUENCY SPEED DRIVER ALARM

FREE FREE FREE FREE FREE FREE FREE

Revised by: Carmelo Fernández	Designed by: Maite Aparicio	Project name: COCKPIT ASSEMBLY LINE IN NEWARK	Page Name: DIGITAL INPUTS	www.sice.com	Customer: SAS Automotive Systems	Customer: TESLA, Inc.

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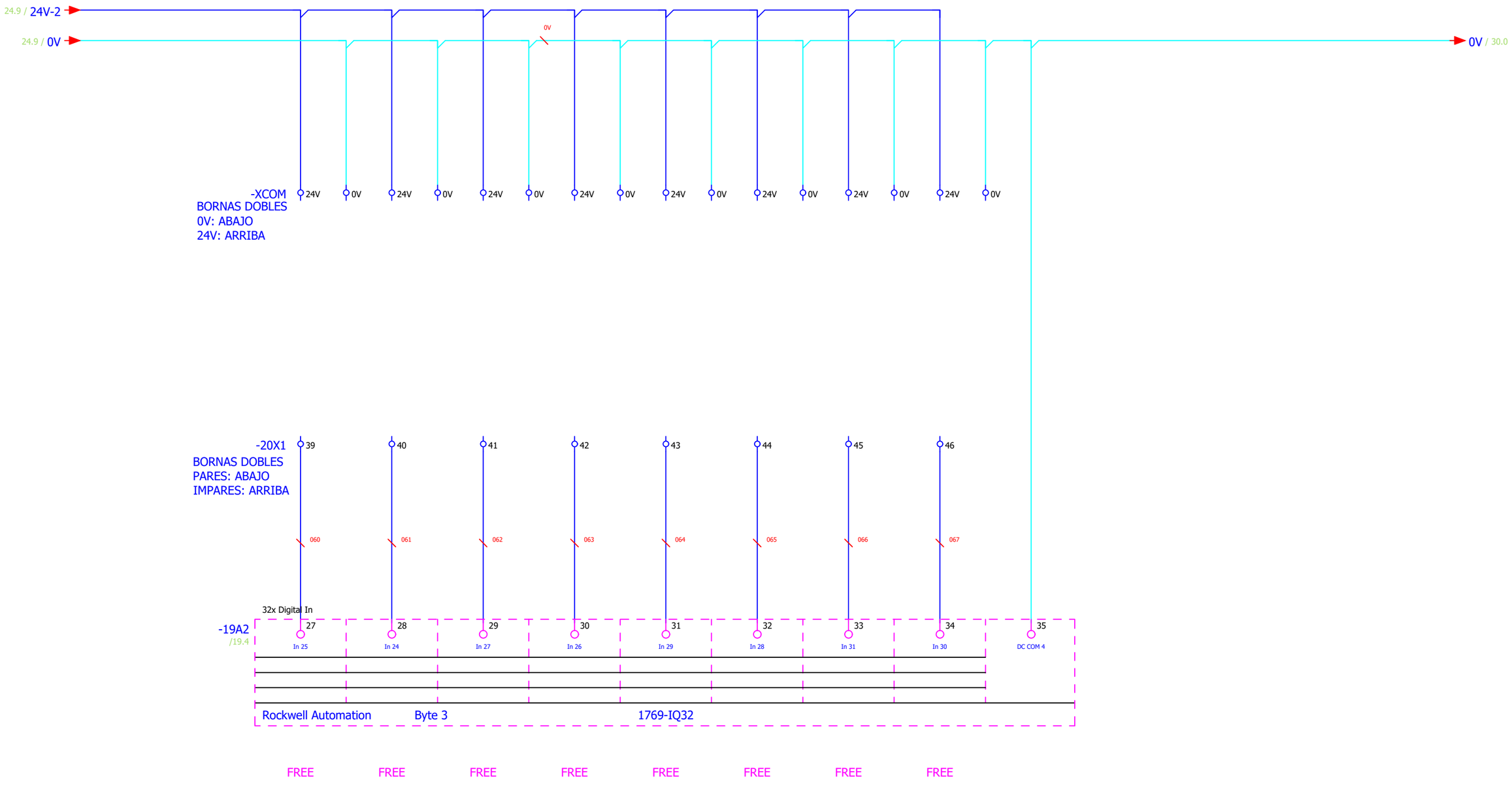

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-19A1
/19.1

DC Output

+V DC 0 | OUT 0 1 | OUT 1 2 | OUT 2 3 | OUT 3 4 | OUT 4 5 | OUT 5 6 | OUT 6 7 | OUT 7 8 | COM 0V

24V-3

24V-3

068 | 069 | 070 | 071 | 072 | 073

-30XH1
24VDC
BALIZA
A-B.855T-BPM10C
A-B.855T-B24TL3
A-B.855T-B24TL4
A-B.855T-B24TL5
A-B.855T-B24SA1

-30H1 GREEN LIGHT x1 x2
-30H2 YELLOW LIGHT x1 x2
-30H3 RED LIGHT x1 x2
-30H4 BUZZER x1 x2

0V | 0V | 0V

-14S1 /14.4 24V AC/DC BLUE X1 X2
-20S1 /20.1 24V AC/DC GREEN X1 X2

0V | 0V

19.9 / 24V-3 → 24V-3 / 31.0

25.9 / 0V → 0V / 31.0

GREEN LIGHT | YELLOW LIGHT | RED LIGHT | BUZZER | RESET BUTTON LED BLUE | START BUTTON LED GREEN | FREE

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-19A1
/19.1

DC Output

+V DC	OUT 8	OUT 9	OUT 10	OUT 11	OUT 12	OUT 13	OUT 14	OUT 15	COM
24V	9	10	11	12	13	14	15	16	0V

A13 → A13 12.3

A14 → A14 12.2

A15 → A15 12.2

24V-3

0V

30.9 / 24V-3

30.9 / 0V

RESET	RESET	RESET	RESET	SPEED DRIVER FAILURE RESET	SPEED DRIVER START	SPEED DRIVER STOP	RESET

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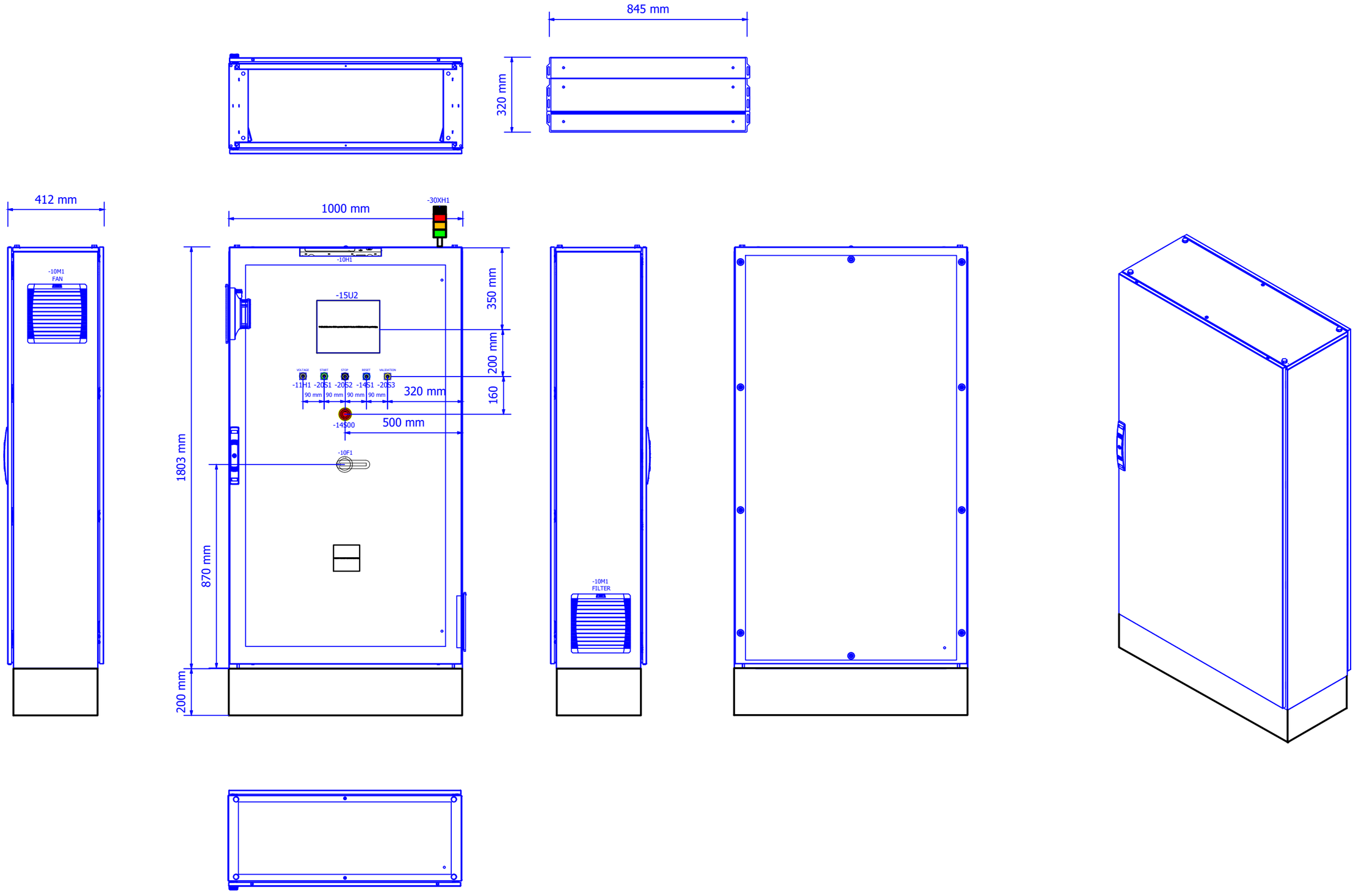

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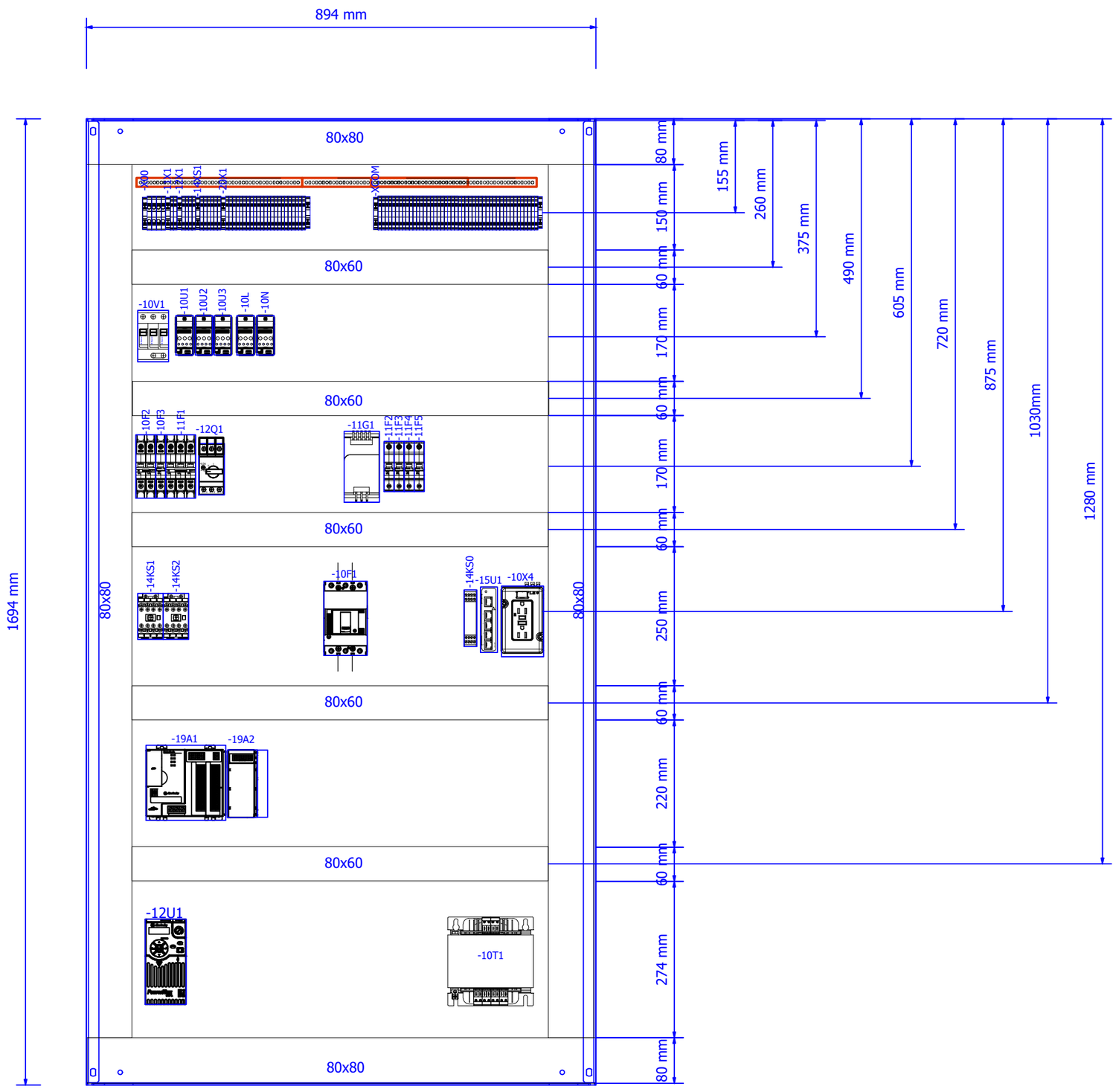

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Lista de artículos

F01_001

Identificador de medios de explotación	Cantidad	Designación	Número de tipo	Proveedor	Número de artículo
	1				RIT.8601000
	1				RIT.8601040
	1				RIT.8084500
	1				RIT.8184235
	1				RIT.7072200
-19A1	1	Controlador CompactLogix / con Ethernet dual / Capacidad DLR	1769-L27ERM-QBFC1B	A-B	A-B.1769-L27ERM-QBFC1B
-19A2	1	CompactLogix Digital módulo de entrada	1769	A-B	A-B.1769-IQ32
-19A2	1	TERMINADOR FINAL DERECHO PARA COMPACTBUS	1769-ECR	AB	A-B.1769-ECR
-10F1	1	G frame interruptor de circuito de caj	140G	A-B	A-B.140G-G2C3-C20
-10F1	1	Rotary Operadores de profundidad variables con manija de operación interna NFPA 79	140G	A-B	A-B.140G-G-NVM21R
-10F2	1	Interruptor en miniatura	1489	A-B	A-B.1489-M2D040
-10F3	1	Interruptor en miniatura	1489	A-B	A-B.1489-M1C060
-11F1	1	Interruptor en miniatura	1489	A-B	A-B.1489-M3C060
-11F2	1	Interruptor en miniatura	1492	A-B	A-B.1492-SPM1C020
-11F3	1	Interruptor en miniatura	1492	A-B	A-B.1492-SPM1C060
-11F4	1	Interruptor en miniatura	1492	A-B	A-B.1492-SPM1C060
-11F5	1	Interruptor en miniatura	1492	A-B	A-B.1492-SPM1C020
-11G1	1	Fuentes de alimentación conmutada	1606	A-B	A-B.1606-XLE240E-3
-10H1	1				A-B.855L-NX4
-11H1	1	Operador de luz piloto	800F	A-B	A-B.800FM-P7
-11H1	1	Módulo LED integrado	800F	A-B	A-B.800F-N3W
-11H1	1	Enclavamiento de montaje metálico	800F	A-B	A-B.800F-ALM
-14KS0	1	Relé de seguridad Guardmaster - MSR127RP/TP	440R-N23126	A-B	A-B.440R-N23126
-14KS1	1	IEC Contactor de seguridad	100S-C09EJ23C	A-B	A-B.100S-C09EJ23C
-14KS2	1	IEC Contactor de seguridad	100S-C09EJ23C	A-B	A-B.100S-C09EJ23C
-10L	1	UD 80 A	569010	ERI	ERI.569010
-10M1	1				RIT.3239110
-10M1	1				RIT.3239200
-10N	1	UD 80 A	569010	ERI	ERI.569010
-12Q1	1	Interruptor automático de proteccion de motor	140M	A-B	A-B.140M-C2E-B63
-12Q1	1	Spacing Adapter	140M	A-B	A-B.140M-C-TE1
-14S00	1	Desbloqueo por rotación, 40mm	800F	A-B	A-B.800FM-MT44
-14S00	1	Placa de inscripción, 60 mm redonda, agujero de montaje de 30.5 mm	800F	A-B	A-B.800F-15YS112
-14S00	2	Bloque de contactos	800F	A-B	A-B.800F-X01
-14S00	1	Enclavamiento de montaje metálico	800F	A-B	A-B.800F-ALM
-14S1	1	Pulsador Iluminado	800F	A-B	A-B.800FM-LF6
-14S1	1	Enclavamiento de montaje metálico	800F	A-B	A-B.800F-ALM
-14S1	1	Bloque de contactos	800F	A-B	A-B.800F-X10
-14S1	1	Módulo LED integrado	800F	A-B	A-B.800F-N3W
-20S1	1	Pulsador Iluminado	800F	A-B	A-B.800FM-LF3
-20S1	1	Enclavamiento de montaje metálico	800F	A-B	A-B.800F-ALM
-20S1	1	Bloque de contactos	800F	A-B	A-B.800F-X10
-20S1	1	Módulo LED integrado	800F	A-B	A-B.800F-N3G
-20S2	1	Pulsador	800F	A-B	A-B.800FM-F2
-20S2	1	Enclavamiento de montaje metálico	800F	A-B	A-B.800F-ALM
-20S2	1	Bloque de contactos	800F	A-B	A-B.800F-X01
-20S3	1	Pulsador	800F	A-B	A-B.800FM-F5
-20S3	1	Enclavamiento de montaje metálico	800F	A-B	A-B.800F-ALM
-20S3	1	Bloque de contactos	800F	A-B	A-B.800F-X10
-20S3	1	Módulo LED integrado	800F	A-B	A-B.800F-N3W
-10T1	1	MST Single phase control and isolation transformer	MTS 0800-208...550/2x115	MURR	MURR.86150
-10U1	1	UD 80 A	569010	ERI	ERI.569010
-10U2	1	UD 80 A	569010	ERI	ERI.569010
-10U3	1	UD 80 A	569010	ERI	ERI.569010
-12U1	1	PowerFlex525	PF525	A-B	A-B.25B-D4P0N114
-15U1	1	Conmutador Ethernet Industrial	1783	A-B	A-B.1783-US5T

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Lista de artículos

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Identificador de medios de explotación	Cantidad	Designación	Número de tipo	Proveedor	Número de artículo
-15U2	1	PanelView Plus 7 Standard Terminal, Touch Screen, 10.4 inches, TFT Color, Single Ethernet, 24V DC	2711P-T10C21D8S	A-B	A-B.2711P-T10C21D8S
-10V1	1	DEHNguard® modular for North America DG MU 3PY 480 3W+G	DEHN.908314	DEHN	DEHN.908314
-X00	3	alimentación estándar a través de los bloques de terminales	1492-J16	A-B	A-B.1492-J16
-X00	1	Ancla Final	1492-EAJ35	A-B	A-B.1492-EAJ35
-X00	1	Barrera Final	1492-EBJ16	A-B	A-B.1492-EBJ16
-X00	1	Bloques de conexión a tierra	1492-JG16	A-B	A-B.1492-JG16
-10X4	1	Ground Fault Circuit Interrupter (GFCI), 15 A	1492-REC15G	A-B	A-B.1492-REC15G
-11X1	2	alimentación estándar a través de los bloques de terminales	1492-J3	A-B	A-B.1492-J3
-11X1	1	Ancla Final	1492-EAJ35	A-B	A-B.1492-EAJ35
-11X1	1	Barrera Final	1492-EBJ3	A-B	A-B.1492-EBJ3
-12X1	3	Borne conexión tornillo 2,5mm²	1492-J3	AB	AB.1492-J3
-12X1	1	Ancla Final	1492-EAJ35	A-B	A-B.1492-EAJ35
-12X1	1	Borne conexión tornillo 2,5mm² de tierra	1492-JG3		AB.1492-JG3
-20X1	23	abrazadera del resorte-bloques de conexión de terminales	1492-LD3	A-B	A-B.1492-LD3
-20X1	2	Ancla Final	1492-EAJ35	A-B	A-B.1492-EAJ35
-20X1	1	Barrera Final	1492-EBLD3		A-B.1492-EBLD3
-XCOM	46	abrazadera del resorte-bloques de conexión de terminales	1492-LD3	A-B	A-B.1492-LD3
-XCOM	1	Barrera Final	1492-EBLD3		A-B.1492-EBLD3
-XCOM	2	Ancla Final	1492-EAJ35	A-B	A-B.1492-EAJ35
-30XH1	1	Base de montaje para columnas luminosas, envolvente color negro	855T	A-B	A-B.855T-BPM10C
-30XH1	1	Módulo de Luz Control Tower™, 70mm, envolvente color negro	855T	A-B	A-B.855T-B24TL3
-30XH1	1	Módulo de Luz Control Tower™, 70mm, envolvente color negro	855T	A-B	A-B.855T-B24TL4
-30XH1	1	Módulo de Luz Control Tower™, 70mm, envolvente color negro	855T	A-B	A-B.855T-B24TL5
-30XH1	1	Módulo de sonido estilo transductor, envolvente color negro, 70mm	855T	A-B	A-B.855T-B24SA1
-14XS1	6	abrazadera del resorte-bloques de conexión de terminales	1492-L3	A-B	A-B.1492-L3
-14XS1	1	Barrera Final	1492-EBL3	A-B	A-B.1492-EBL3

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E. ANNXES

SICE

ASSEMBLY LINE-NEWARK FOR THE MODEL 3, TESLA

Stratix 2000 Ethernet Unmanaged Switches— Series A

Cat. No.	Total Ports	RJ45 Ports[1]	Combo Ports[1]	SFP Ports[1]
1783-US4T1F/A	5	4 FE	—	1 FE multimode preinstalled fiber SFP module
1783-US4T1H/A	5	4 FE	—	1 FE singlemode preinstalled fiber SFP module
1783-US5T/A	5	5 FE	—	—
1783-US5TG/A	5	5 GE	—	—
1783-US6T2F/A	8	6 FE	—	2 FE multimode preinstalled fiber SFP modules
1783-US6T2H/A	8	6 FE	—	2 FE singlemode preinstalled fiber SFP modules
1783-US6TG2CG/A	8	6 GE	2 GE[2]	—
1783-US7T1F/A	8	7 FE	—	1 FE multimode preinstalled fiber SFP module
1783-US7T1H/A	8	7 FE	—	1 FE singlemode preinstalled fiber SFP module
1783-US8T/A	8	8 FE	—	—
1783-US14T2S/A	16	14 FE	—	2 FE[2]
1783-US16T/A	16	16 FE	—	—

(1) FE = Fast Ethernet; GE = Gigabit Ethernet.
(2) SFP modules must be ordered separately.

The following table lists Stratix 2000 series A switches and their series B replacements. For specifications of series B switches, see page 3.

Table 5 - Stratix 2000 Series Change

Series A Cat. No.	Series B Replacement Cat. No.	Change[1]
1783-US4T1F/A	1783-US4T1F/B	Same catalog number and configuration
1783-US4T1H/A	1783-US4T1H/B	Same catalog number and configuration
1783-US5T/A	1783-US5T/B	Same catalog number and configuration
1783-US5TG/A	1783-US5TG/B	Same catalog number and configuration
1783-US6T2F/A	1783-US6T2F/B	Same catalog number and configuration
1783-US6T2H/A	1783-US6T2H/B	Same catalog number and configuration
1783-US7T1F/A	1783-US7T1F/B	Same catalog number and configuration
1783-US7T1H/A	1783-US7T1H/B	Same catalog number and configuration
1783-US8T/A	1783-US8T/B	Same catalog number and configuration
1783-US16T/A	1783-US16T/B	Same catalog number and configuration
1783-US14T2S/A	1783-US16T2S/B	New catalog number Replaced 2 GE combo ports with 2 GE copper ports on series B replacement Added 2 GE SFP slots to series B replacement
1783-US6TG2CG/A	1783-US8TG2GX/B	New catalog number Added 2 FE copper ports to series B replacement

(1) FE = Fast Ethernet; GE = Gigabit Ethernet.

Table 6 - Technical Specifications - Stratix 2000 Switches, Series A

Attribute	1783-US4T1F/A 1783-US4T1H/A	1783-US5TG/A	1783-US6T2F/A 1783-US6T2H/A	1783-US7T1F/A 1783-US7T1H/A	1783-US6TG2CG/A	1783-US14T2S/A	1783-US16T/A	1783-US5T/A	1783-US8T/A
Inrush current, max	0.11 A	0.25 A	0.86 A	1.06 A	0.66 A	4.34 A	4.72 A	0.11 A	1.47 A
Power input	24V (18...60V DC, 18...30V AC 50/60 Hz), Class 2/SELV								
Current rating	230.5 mA	432.1 mA	442.3 mA		1242.7 mA	663.2 mA	555.5 mA	250 mA	361 mA
Power dissipation, max	2.841 W	5.491 W	5.927 W		13.643 W	7.991 W	6.72 W	2 W @ 24V AC/DC	4.04 W @ 24V AC/DC
Isolation voltage	30V (continuous), basic insulation type, power to network channels No isolation between individual network channels Type tested at 500V AC for 60 s								
Wire size, Ethernet connection(1)	RJ45 connector according to IEC 60603-7, 2-pair or 4-pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702 rated 82 °C (180 °F) min							RJ45 connector according to IEC 60603-7, 2-pair or 4-pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702	
Wire size, DC power connection	0.82…2.5 mm^2 (18…14 AWG) twisted-pair copper wire suitable for 82 °C (180 °F) above surrounding ambient temperature outside the enclosure							0.75…2.5 mm^2 (18…14 AWG) twisted-pair copper wire suitable for 30 °C (86 °F) above surrounding ambient temperature outside the enclosure	
Wire size, ground connection	2.5 mm^2 (14 AWG) copper wire suitable for 82 °C (180 °F) above surrounding ambient temperature outside the enclosure, with a suitable ring terminal							2.5 mm^2 (14 AWG) copper wire suitable for 30 °C (86 °F) above surrounding ambient temperature outside the enclosure, with a suitable ring terminal	
Screw torque, ground terminal, max	1.82 N•m (16 in•lb)								
Screw torque, power terminals	0.4…0.5 N•m (3.5…4.4 in•lb)								
Wiring category(2)	1 - on power ports 2 - on communication ports								
Enclosure type rating	None (open-style)								
North American temp code	T4							T5	
IEC temp code	T4							T5	
MAC addresses, max supported	1 K	1K	8 K		8 K	8 K	8 K	1K	8 K
SFP modules(3)	Preinstalled	No SFP slots	Preinstalled	Preinstalled	Ordered separately: 1783-SFP1GSX 1783-SFP1GLX 1783-SFP1GEXE 1783-SFP1GZX	Ordered separately: 1783-SFP100FX 1783-SFP100LX 1783-SFP100EXC 1783-SFP100ZXC	No SFP slots	No SFP slots	No SFP slots

(1) See page 71 for recommended products.
(2) Use this conductor category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.
(3) For specifications of preinstalled SFP modules, see Table 7. For specifications of SFP modules ordered separately, see Table 54.

Table 7 - Preinstalled SFP Module Specifications - Stratix 2000 Switches

Attribute	Multimode (100Base-FX)	Singlemode (100Base-LX)
Central wavelength (nm)	1310	1310
Transmission distance (km)	2	20
Applicable distance (km)	0…2	0…20

Table 7 - Preinstalled SFP Module Specifications - Stratix 2000 Switches

Attribute	Multimode (100Base-FX)	Singlemode (100Base-LX)
Luminous power, min (db)	-19	-10
Luminous power, max (db)	-10	-5
Receiving sensitivity (dBm)	-31	-34
Overload luminous power	-3	-3

Table 8 - Environmental Specifications - Stratix 2000 Switches, Series A

Attribute	1783-US4T1F/A, 1783-US4T1H/A, 1784-US5TG/A, 1783-US6T2F/A, 1783-US6T2H/A, 1783-US6TG2CG/A, 1783-US7T1F/A, 1783-US7T1H/A, 1783-US14T2S/A, 1783-US16T/A	1783-US5T/A	1783-US8T/A
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-40…+70 °C (-40…+158 °F)	0…+60 °C (32…+140 °F)	
Temperature, surrounding air, max	70 °C (158 °F)	60 °C (140 °F)	
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold) IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat) IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)		
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing		
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…150 Hz		2 g @ 10…500 Hz
Operating shock IEC 60068-2-27 (Test Ea, Unpackaged Shock)	15 g		
Nonoperating shock IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g		
Emissions CISPR11 (IEC 61000-6-4)	Class A		
ESD immunity IEC 61000-4-2	8 kV contact discharges 15 kV air discharges		6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz		
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on power ports ±3 kV at 5 kHz on communication ports		
Surge transient immunity IEC 61000-4-5	±2 kV line-line (DM) and ±4 kV line-earth (CM) on DC power ports ±2 kV line-earth (CM) on communication port		
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz		
Magnetic field immunity IEC 61000-4-8	30 A/m long duration and 300 A/m short duration at 50 Hz		
Magnetic pulse immunity IEC 61000-4-9	—		30 A/m pulse
Environmental rating	IP20		

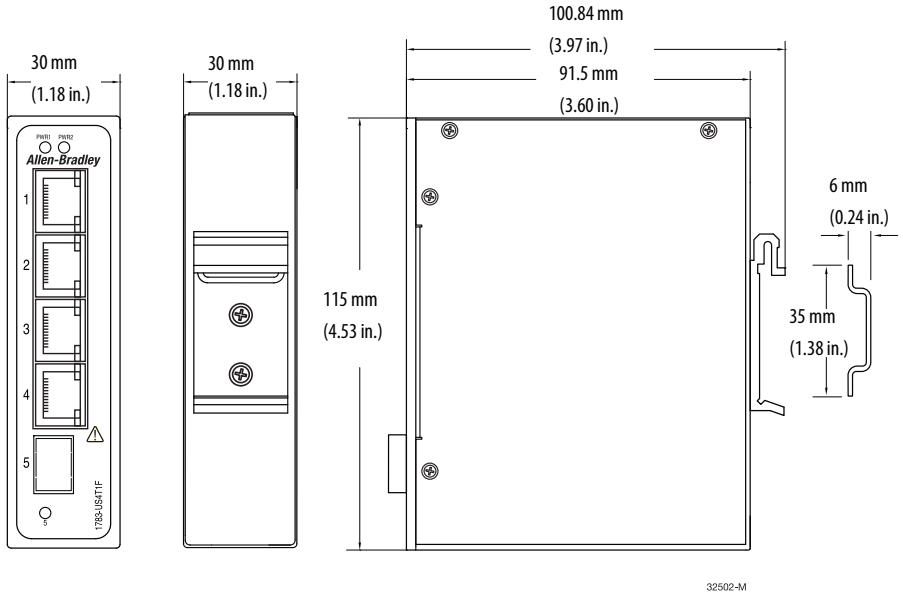
Table 9 - Certifications- Stratix 2000 Switches, Series A

Certifications (when product is marked)(1)	1783-US4T1F/A, 1783-US4T1H/A, 1784-US5TG/A, 1783-US6T2F/A, 1783-US6T2H/A, 1783-US6TG2CG/A, 1783-US7T1F/A, 1783-US7T1H/A, 1783-US14T2S/A, 1783-US16T/A	1783-US5T/A, 1783-US8T/A
c-UL-us	UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2011/65/EU RoHS, compliant with: EN 50581; Technical Documentation	
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6.4; Industrial Emissions	
Ex	European Union 94/9/EC ATEX Directive, compliant with: EN 60079-15; Potentially Explosive Atmospheres, Protection “n” EN 60079-0; General Requirements II 3 G Ex nA IIC T4 Gc X	European Union 94/9/EC ATEX Directive, compliant with: EN 60079-15; Potentially Explosive Atmospheres, Protection “n” EN 60079-0; General Requirements II 3 G Ex nA IIC T5 Gc
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3	

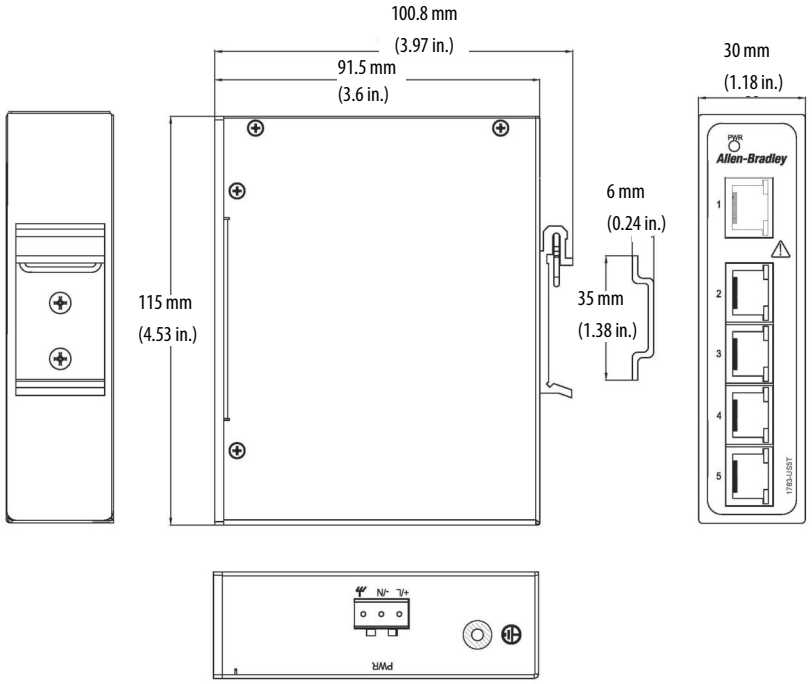
(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Dimensions—Stratix 2000 Switches, Series A

1783-US4T1F/A, 1783-US4T1H/A,1783-US5TG/A Switch Dimensions



1783-US5T/A Switch Dimensions



Product datasheet
Characteristics

NSYSM181040P
Spacial SM compact enclosure with mounting plate - 1800x1000x400 mm

Main

Range	Spacial
Product name	Spacial SM
Product or component type	Compact enclosure
Device application	Multi-purpose
Installation accessory type	Floor-standing
Device composition	1 body 1 cable gland plate 1 door 1 mounting plate 1 locking system with handle for door 4 mounting plate bracket
Removable parts	Door fixed by screws for hinge Mounting plate bracket fixed by screws Mounting plate fixed by screws for mounting plate bracket
Enclosure nominal height	1800 mm
Enclosure nominal width	1000 mm
Enclosure nominal depth	400 mm

Complementary

Number of doors	1 on front
Door opening	Reversible 120 °
Door type	Plain
Lock type	4 points lock, handle with 5 mm double bar insert
Body type	Single piece body with welded rear panel Front part forming a rigid frame with welded corners
Mounting plate description	Plain
Type of gland plate	Standard
Cable entry	1 entry
Material	Galvanised steel for mounting plate Sheet steel for body Sheet steel for door Zamak for hinge
Surface finish	Epoxy-polyester powder
Colour	Enclosure : grey RAL 7035 Handle : black RAL 9005
Accessibility for operation	Front

Environment

standards	IEC 62208
product certifications	BV DNV UL
IP degree of protection	IP55 conforming to IEC 60529
IK degree of protection	IK10 conforming to IEC 62262

Offer Sustainability

Sustainable offer status	Green Premium product
RoHS (date code: YYWW)	Compliant - since 0940 - Schneider Electric declaration of conformity

REACh	Reference not containing SVHC above the threshold
Product environmental profile	Available
Product end of life instructions	Need no specific recycling operations

Contractual warranty

Warranty period	18 months

CompactLogix™ 5370 L2 Programmable Automation Controllers

1769L24ER-QB1B, -L24ER-QBFC1B, -L27ERM-QBFC1B

Features and Benefits

The CompactLogix 5370 L2 controllers deliver scalable, affordable control in a space-saving form factor. From small stand-alone equipment to higher performance applications, these controllers are ideal for assembly machines, hoisting systems, process skids, indexing tables, and packaging.

Machine builders and end users can take advantage of the cost-saving features of these controllers:

- Support for Integrated Motion on EtherNet/IP
- Support for Device Level Ring (DLR) network topologies
- Built-in energy storage eliminates the need for lithium batteries
- Support reuse of existing 1769 I/O
- Removable 1GB secure digital (SD) card improves data integrity
- Memory options up to 1MB
- Higher resolution analog capability supports thermocouple and RTD inputs
- Support for Kinematics eliminates the need for additional robot controllers and software
- Open socket capability allows support for Modbus TCP as well as devices such as printers, barcode readers and servers

Build a better machine with with CompactLogix 5370 L2 Programmable Automation Controllers.

Expanding on the scalability of the Logix family of controllers, the CompactLogix 5370 L2 programmable automation controllers (PAC) are designed to meet the growing need for a higher performance controller in a compact and affordable package. Offering a 40% reduction in required panel space and the same capabilities as the CompactLogix 5370 L3, the L2 controllers truly enable you to build a high performance, more cost-effective machine.

As part of the Integrated Architecture system, the CompactLogix 5370 L2 controllers use the same programming software, network protocol, and information capabilities as all Logix controllers, providing a common development environment for all control disciplines.

Integrated Motion on EtherNet/IP

The CompactLogix 5370 L2 controllers provides a strong motion solution for customers looking for performance and cost competitiveness.

- Supports up to 4 axes of integrated motion
- Together with the Kinetix 350, offers cost-effective, scalable motion solution

Network Capabilities

With dual Ethernet ports and an integrated Ethernet switch, these controllers now support Device Level Ring (DLR) network topologies, simplifying integration of components in your control system and reducing system cost:

- Provides resiliency from loss of one network connection
- Allows replacement of devices one at a time without stopping production
- Reduces the number of Ethernet switches in the control system

CompactLogix 5370 L2 Controller Product Specifications

	1769-L24ER-QB1B	1769-L24ER-QBFC1B	1769-L27ERM-QBFC1B
User memory	750 KB	750 KB	1 MB
Controller tasks	32	32	32
Programs per task	100	100	100
Integrated Motion	--	--	4 axis CIP motion position loop axis
Package Size	115mm wide x 118mm high x 105mm deep	140mm wide x 118mm high x 105mm deep	
Certifications	cULH (Class I Division 2), KCC / UL (UL 508), ULH (Class I & II, Division 2 and Class III, Divisions 1 & 2) / ATEX, CE, C-Tick, GOST-R, Marine		
Local Expansion Modules	4	4	4
Embedded I/O	16 digital inputs 16 digital outputs	16 digital inputs / 16 digital outputs, 4 universal analog input, 2 analog output, 4 channels HSC	
Local Expansion I/O Points	128	128	128
Communication Module Additions	DeviceNet with 1769-SDN or 3rd party		
Flash Memory Card	Industrially rated and certified Secure Digital (SD) memory card (1 and 2 GB options); all controllers shipped with 1 GB card		
Servo Drives (Position Loop CIP)	--	--	4
Ethernet I/O IP nodes	8	8	16
Virtual axes	100	100	100
Feedback only, torque, velocity, Vhz (max CIP motion drives)	--	--	16
Axes/ms	--	--	2
Kinematics support	--	--	yes
Software / Firmware	RSLogix 5000 V20 and RSLinx Classic V2.59 Firmware v20.1x or later		

www.rockwellautomation.com

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Publication 1769-PP011D-EN-E – July 2013
Supersedes Publication 1769-PP011C-EN-E – January 2013

1769-IQ32

Compact 24V DC sink/source input module

1769-IQ32

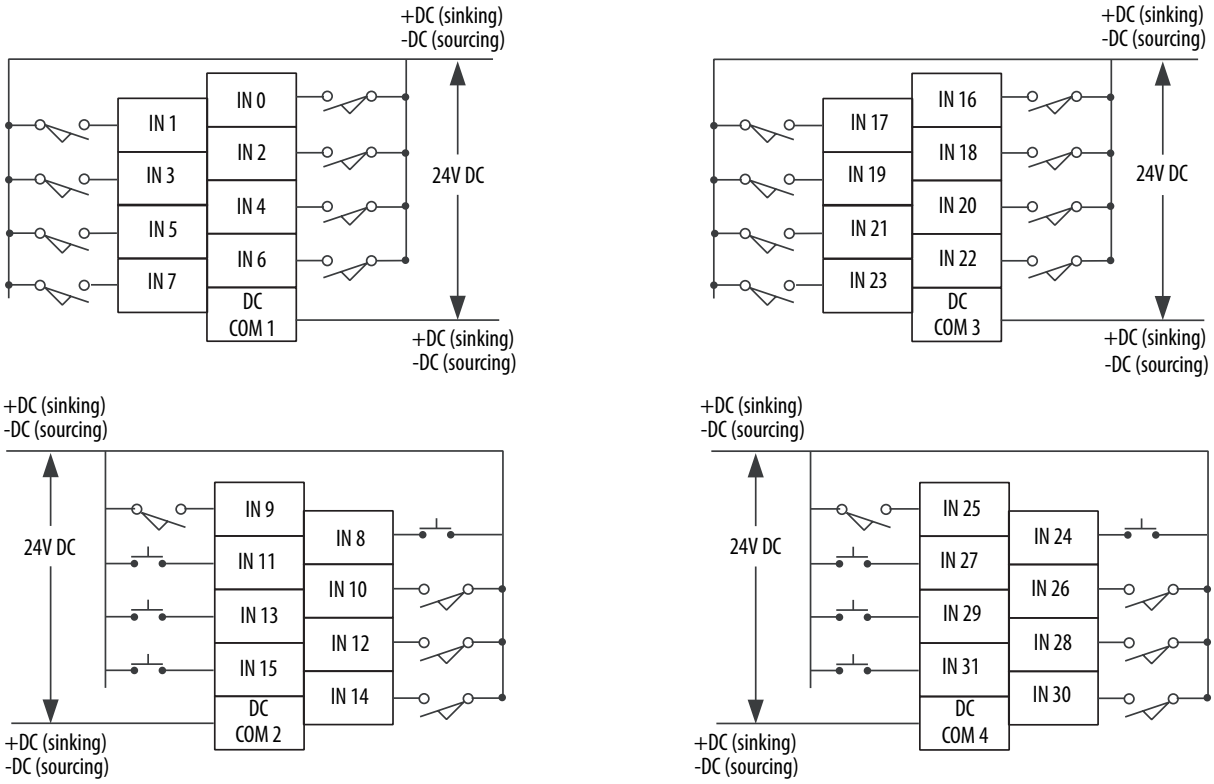


Table 39 - Technical Specifications - 1769-IQ32

Attribute	1769-IQ32
Inputs	32 (8 points/group)
Voltage category	24V DC sink/source
Operating voltage range	10…30V DC @ 30 °C (86 °F) 10…26.4V DC @ 60 °C (140 °F)
Input delay, on	8 ms
Input delay, off	8 ms
Current draw @ 5.1V	170 mA
Heat dissipation, max	4.6 W
Off-state voltage, max	5V DC
Off-state current, max	1.5 mA
On-state voltage, min	10V DC
On-state current, min	2 mA
Inrush current, max	250 mA
Input impedance, nominal	5.2 kΩ @ 24V DC 6.1 kΩ @ 30V DC
Isolation voltage	Verified by one of the following dielectric tests: 1200V AC for 1 s or 1697V DC for 1 s, input point to bus and group to group 75V DC working voltage (IEC Class 2 reinforced insulation)
Weight, approx	440 g (0.97 lb)

Table 39 - Technical Specifications - 1769-IQ32

Attribute	1769-IQ32
Dimensions (HxWxD), approx	118 x 52.5 x 87 mm (4.65 x 2.07 x 3.43 in.) Height with mounting tabs 138 mm (5.43 in.)
Slot width	1.5
Module location	DIN rail or panel mount
Power supply	1769-PA2, 1769-PB2, 1769-PA4, 1769-PB4
Power supply distance rating	8 modules
Terminal screw torque	0.68 N●m (6 lb●in)
Retaining screw torque	0.46 N●m (4.1 lb●in)
Wire size	(22…14 AWG) solid (22…16 AWG) stranded
Wire type	Cu-90 °C (194 °F)
IEC input compatibility	Type 1+
Replacement terminal block	1769-RTBN18 (1 per kit)
Replacement door label	1769-RL1 (2 per kit)
Replacement door	1769-RD (2 per kit)
Vendor ID code	1
Product type code	7
Product code	68
Enclosure type rating	None (open-style)

Table 40 - Certifications - 1769-IQ32

Certification[1]	1769-IQ32
c-UL	C-UL certified (under CSA C22.2 No. 142) UL 508 listed Class I, Division 2 Group A,B,C,D Hazardous Locations (UL 1604, C-UL under CSA C22.2 No. 213)
CE	CE compliant for all applicable directives
C-Tick	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Enclosure

(1) When marked. See the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declarations of Conformity, Certificates, and other certification details.

Allen-Bradley

PanelView Plus 7 Standard Terminals

Catalog Numbers 2711P-T4W21D8S, 2711P-T4W22D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S-B, 2711P-T6C21D8S, 2711P-T6C22D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S-B, 2711P-T7C21D8S, 2711P-T7C22D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S-B, 2711P-T9W21D8S, 2711P-T9W22D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S-B, 2711P-T10C21D8S, 2711P-T10C22D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S-B, 2711P-T12W21D8S, 2711P-T12W22D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S-B, 2711P-T15C21D8S, 2711P-T15C22D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S-B

Summary of Changes

Topic	Page
In the Technical Specifications table, corrected the measurements (in inches) in the Cutout dimensions line for the 9 in. terminals.	5

The PanelView™ Plus 7 Standard terminals are operator interface devices. They monitor and control devices that are attached to ControlLogix® 5570 and CompactLogix™ 5370 controllers on an EtherNet/IP network. Animated graphic and text displays provide operators a view into the operating state of a machine or process. Operators interact with the control system by using touch screen input.

The PanelView Plus 7 Standard terminals include these features:

- Terminal functionality permits connection to 1 controller, up to 25 screens, and up to 200 alarms.
- FactoryTalk® View Machine Edition software provides a familiar environment for creating HMI applications.
- Windows CE operating system with desktop access for configuration and third-party applications.
- Ethernet communication that supports linear and star network topology.
- PDF viewer to access PDF files that are stored on the terminal.

- More screen options including 4-in., 6-in., 7-in., 9-in., 10-in., 12-in., and 15-in. terminals.
- Widescreen on three sizes, 4-in., 9-in., and 12-in. terminals.
- Greater screen resolution.
- Terminals are available with an Allen-Bradley brand marking, or with no marking for customers who want to put their own brand label on the terminal.
- Certifications including Class I, Div. 2; Class II, Div. 2; Class III; and ATEX and INMETRO Zones 2 and 22.

Environmental Specifications

Table 1 - Environmental Specifications - 2711P-T4W21D8S, 2711P-T4W22D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S-B, 2711P-T6C21D8S, 2711P-T6C22D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S-B, 2711P-T7C21D8S, 2711P-T7C22D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S-B, 2711P-T9W21D8S, 2711P-T9W22D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S-B, 2711P-T10C21D8S, 2711P-T10C22D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S-B, 2711P-T12W21D8S, 2711P-T12W22D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S-B, 2711P-T15C21D8S, 2711P-T15C22D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S-B[1]

Attribute	Value
Temperature, operating	0…55 °C (32…131 °F)
Temperature, nonoperating	-25…+70 °C (-13…+158 °F)
Relative humidity	5…95% without condensation
Heat dissipation	4 in., 15 W = 51 BTU 6 in., 15 W = 51 BTU 7 in., 15 W = 51 BTU 9 in., 20 W = 68 BTU 10 in., 20 W= 68 BTU 12 in., 30 W= 102 BTU 15 in., 30 W= 102 BTU
Altitude, operating	2000 M
Vibration 4.3-in., 5.7-in., 6.5-in., 9.0-in., 10.4-in., 12.1-in., and 15-in.	 0.012 pk-pk, 10…57 Hz 2g peak at 57…500 Hz
Shock, operating	15 g at 11 ms
Shock, nonoperating	30 g at 11 ms
Enclosure ratings	NEMA and UL Type 12, 13, 4X (indoor use only), also rated IP54 or IP66 as Classified by UL

(1) Catalog numbers with a -B extension denote terminals that do not include the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

Certifications

Table 2 Certifications - 2711P-T4W21D8S, 2711P-T4W22D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S-B, 2711P-T6C21D8S, 2711P-T6C22D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S-B, 2711P-T7C21D8S, 2711P-T7C22D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S-B, 2711P-T9W21D8S, 2711P-T9W22D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S-B, 2711P-T10C21D8S, 2711P-T10C22D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S-B, 2711P-T12W21D8S, 2711P-T12W22D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S-B, 2711P-T15C21D8S, 2711P-T15C22D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S-B(1)

Certification(2)	Value
cULus	cULus Listed Industrial Control Equipment for use in Hazardous Locations (E10314) per standards ANSI / ISA 12.12.01 and CSA C22.2 No. 213. rated: • Class I, Division 2, Groups A, B, C and D • Class II, Division 2, Groups F and G • Class III Enclosure type ratings per UL50 and CSA C22.2 No. 94.2-07. Enclosure ingress protection classified by UL per IEC 60529
ATEX	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-0:2009; EN 60079-11:2012; EN 60079-15:2010; and EN 60079-31:2009 • II 3 GD • Ex ic nA IIC T4 Gc • Ex tc IIIC T135 °C (275 °F) Dc IP66 • Tamb = 0 °C to +55 °C (32 °F to +131 °F) • DEMKO 14 ATEX 1302X
INMETRO	ABNT NBR IEC 60079-0:2008+Errata 1:2011; ABNT NBR IEC 60079-11:2009; ABNT NBR IEC 60079-15:2012; ABNT NBR IEC 60079-31:2011 Ex ic nA IIC T4 Gc Ex tc IIIC T135 °C (275 °F) Dc IP66 Tamb = 0 °C to +55 °C (32 °F to +131 °F) UL-BR 14.0716X
CE (EMC)	European Union 2004/108/EC EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers
CE (LVD)	European Union 2006/95/EC Low Voltage Directive, compliant with: • EN 61131-2; Programmable Controllers
RCM	Australian Radio Communications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
EAC	Certificate of compliance
RoHS	China RoHS, Turkey RoHS, European RoHS
KCC	Certificate of compliance

(1) Catalog numbers with a -B extension denote terminals that do not include the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

(2) When marked. See the Product Certification link on http://www.ab.com for declarations of conformity, certificates, and other certification details.

Technical Specifications

Table 3 - PanelView Plus 7 Standard 4-in and 6-in Terminals

Attribute	4-in. Touch 2711P-T4W21D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S, 2711P-T4W22D8S-B	6-in. Touch 2711P-T6C21D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S, 2711P-T6C22D8S-B
Operator input	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD
Display size, diagonal	4.3 in. widescreen	5.7 in.
Viewing area	95 x 54 mm	115 x 86 mm
Display resolution	480 x 272 WQVGA, 18-bit color graphics	640 x 480 VGA, 18-bit color graphics
Aspect ratio	16:9	4:3
Brightness, typical	300 nits	
Backlight life	50,000 h life, min. at 40° C to half-brightness. Backlight is not replaceable	
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams	
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell (Allen-Bradley part number 2711P-RY2032)	
Memory		
System	512 MB RAM and 512 MB storage	
User	80 MB nonvolatile storage for applications	
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)	
USB ports		
Host	One USB 2.0 high-speed host port (type A) support removal flash drives for storage	
Device	One high-speed 1.0 device port (type B) supports connection to host computer	
Ethernet port		
Cat. Nos. with 21	One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support	
Cat. Nos. with 22	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology	
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support	
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later	
Electrical		
Input voltage, DC	24V DC nom (18…30V DC), nonisolated DC power supply	
Power consumption, DC	35 W max (1.46A at 24V DC)	
Power supply	DIN-rail power supply, AC-to-DC, 85…265V AC, 47…63 Hz Replacement: Allen-Bradley part number 2711P-RSACDIN	
Mechanical		
Weight, approx	0.44 kg (0.97 lb)	0.70 kg (1.53 lb)
Dimensions, HxWxD, approx.	110 x 135 x 56.5 mm (4.33 x 5.31 x 2.22 in.)	152 x 176 x 56.5 mm (5.98 x 6.93 x 2.22 in.)
Cutout dimensions, HxW, approx.	92 x 117 mm (3.62 in. x 4.61 in.)	123 x 156 mm (4.84 x 6.14 in.)

Table 4 - PanelView Plus 7 Standard 7-in., 9-in., and 10-in. Terminals

Attribute	7-in. Touch 2711P-T7C21D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S, 2711P-T7C22D8S-B	9-in. Touch 2711P-T9W21D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S, 2711P-T9W22D8S-B	10-in. Touch 2711P-T10C21D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S, 2711P-T10C22D8S-B
Operator input	Touch	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD	Color TFT LCD
Display size, diagonal	6.5 in.	9 in. widescreen	10.4 in.
Viewing area	132 x 99 mm	196 x 118 mm	211 x 158 mm
Display resolution	640 x 480 VGA, 18-bit color graphics	800 x 480 WVGA, 18-bit color graphics	800 x 600 SVGA, 18-bit color graphics
Aspect ratio	4:3	5:3	4:3
Brightness, typical	300 nits		
Backlight life	50,000 hr life, min at 40° C (104 °F) to half-brightness. Backlight is not replaceable.		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: ±2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell (Allen-Bradley part number 2711P-RY2032)		
Memory System User	 512 MB RAM and 512 MB storage 80 MB nonvolatile storage for applications		
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)		
USB ports Host Device	 One USB 2.0 high-speed host port (type A) support removal flash drives for storage One high-speed 1.0 device port (type B) supports connection to host computer		
Ethernet port Cat. Nos. with 21 Cat. Nos. with 22	 One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology		
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support		
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later		
Electrical			
Input voltage, DC	24V DC nom (18…30V DC), nonisolated DC power supply		
Power consumption, DC	50 W max (2.1A at 24V DC)		
Power supply	DIN-rail power supply, AC-to-DC, 85…265V AC, 47…63 Hz Replacement: Allen-Bradley part number 2711P-RSACDIN		
Mechanical			
Weight, approx	0.85 kg (1.86 lb)	1.29 kg (2.84 lb)	1.82 kg (4.0 lb)
Dimensions, HxWxD, approx	170 x 212 x 56.5 mm (6.69 x 8.35 x 2.22 in.)	190 x 280 x 56.5 mm (7.48 x 11.02 x 2.22 in.)	252 x 297 x 56.5 mm (9.92 x 11.69 x 2.22 in.)
Cutout dimensions, HxW, approx.	142 x 184 mm (5.59 x 7.24 in.)	162 x 252 mm (6.38 x 9.92 in.)	224 x 269 mm (8.82 x 10.59 in.)

Table 5 - PanelView Plus 7 Standard 12-in. and 15-in. Terminals

Attribute	12-in. Touch 2711P-T12W21D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S, 2711P-T12W22D8S-B	15-in. Touch 2711P-T15C21D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S, 2711P-T15C22D8S-B
Operator Input	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD
Display size, diagonal	12.1 in. widescreen	15-in.
Viewing area	261 x 163 mm	304 x 228 mm
Display resolution	1280 x 800 WXGA, 18-bit color graphics	1024 x 768 XGA, 18-bit color graphics
Aspect ratio	5:3	4:3
Brightness, typical	300 nits	
Backlight life	50,000 h life, min. at 40° C to half-brightness. Backlight is not replaceable	
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams	
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell	
Memory		
System	512 MB RAM and 512 MB storage	
User	80 MB nonvolatile storage for applications	
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)	
USB ports		
Host	One USB 2.0 high-speed host port (type A) support removal flash drives for storage	
Device	One high-speed 1.0 device port (type B) supports connection to host computer	
Ethernet port		
Cat. Nos. with 21	One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support	
Cat. Nos. with 22	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology	
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support	
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later	
Electrical		
Input voltage, DC	24V DC nom (18…30V DC), nonisolated DC power supply	
Power consumption, DC	50 W max (2.1A at 24V DC)	
Power supply	DIN-rail power supply, AC-to-DC, 85…265V AC, 47…63 Hz Replacement: Allen-Bradley part number 2711P-RSACDIN	
Mechanical		
Weight, approx.	1.95 kg (4.29 lb)	3.07 kg (6.75 lb)
Dimensions, HxWxD, approx.	240 x 340 x 56.5 mm (9.65 x 13.39 x 2.22 in.)	318 x 381 x 56.5mm (12.52 x 15.00 x 2.22 in.)
Cutout dimensions, HxW, approx.	218 x 312 mm (8.58 x 12.28 in.)	290 x 353 mm (11.42 x 13.90 in.)

Product Dimensions

The table provides product dimensions. The 5.7-in. and 10.4-in. touch-screen terminals are shown for illustrative purposes. All other terminal sizes look similar. For information on proper mounting clamp installation, refer to the PanelView Plus 7 Standard Terminals User Manual, publication 2711P-UM007.

Figure 1 - Series A and Series B Terminals, Front View

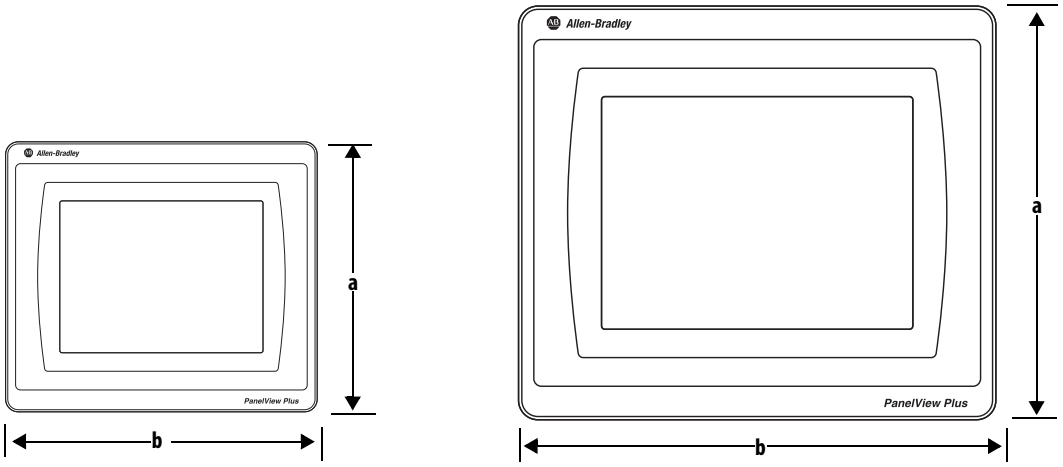


Figure 2 - Series A and Series B Terminals with Single Ethernet Port, Bottom View

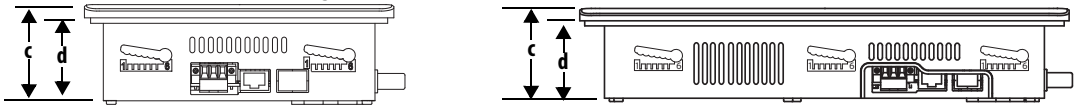


Figure 3 - Series B Terminals with Dual Ethernet Ports, Bottom View

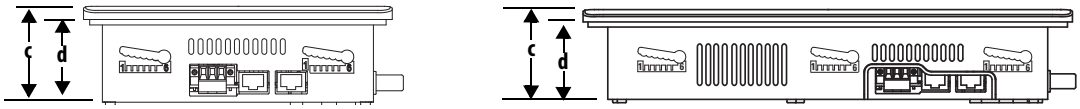
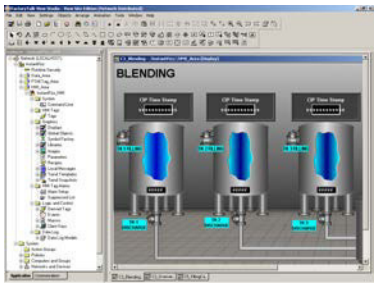


Table 6 - PanelView Plus 7 Standard Dimensions

Terminal Size	Input Type	Height (a) mm (in.)	Width (b) mm (in.)	Overall Depth (c) mm (in.)	Mounted Depth (d) mm (in.)
4.3 in.	Touch	110 (4.33)	135 (5.31)	56.5 (2.22)	50.14 (1.97)
5.7 in.	Touch	152 (5.98)	176 (6.93)	56.5 (2.22)	50.14 (1.97)
6.5 in.	Touch	170 (6.69)	212 (8.35)	56.5 (2.22)	50.14 (1.97)
9 in.	Touch	190 (7.48)	280 (11.02)	56.5 (2.22)	50.14 (1.97)
10.4 in.	Touch	252 (9.92)	297 (11.69)	56.5 (2.22)	50.14 (1.97)
12.1 in.	Touch	240 (9.65)	340 (13.39)	56.5 (2.22)	50.14 (1.97)
15 in.	Touch	318 (12.52)	381 (15.00)	56.5 (2.22)	50.14 (1.97)

TIP When mounted in a panel, the front of the bezel extends less than 6.36 mm (0.25 in.) from the front of the panel.

HMI Software



All PanelView Plus 7 terminals are configured with FactoryTalk View Studio software and have an integrated runtime system called FactoryTalk View Machine Edition Station.

Machine Edition Station runs projects developed with FactoryTalk View Studio software and is included on all PanelView Plus 7 terminals.

Two versions of FactoryTalk View Studio software support application development for PanelView Plus 7 terminals.

Cat. No.(1)	Description
9701-VWSTMENE	FactoryTalk View Studio for Machine Edition software - Configuration software for developing and testing machine level human machine interface (HMI) applications. Includes RSLinx® Enterprise and KEPServer Enterprise software.
9701-VWSTENE	FactoryTalk View Studio software - Configuration software for developing and testing machine level and supervisory level human machine interface (HMI) applications.

(1) Order localized versions of the software by replacing EN in the catalog number with DE for German, FR for French, JP for Japanese, or ZH for Chinese.

You can import PanelView Standard/PanelBuilder™32 and PanelView *e* applications into FactoryTalk View Studio software as Machine Edition applications by using the Machine Edition Import Wizard. The Import Wizard steps you through a few options such as scaling to a new screen resolution size, and then converts objects, text, tags, and communication configurations to ones that are available in Machine Edition.

FactoryTalk ViewPoint software, an add-on to FactoryTalk View Studio software, allows plant managers, production supervisors, system integrators, and other key stakeholders to view and control real-time plant floor operations remotely from a web browser. FactoryTalk ViewPoint enabled displays are fully scalable and animated in the browser. The remote user can also view displays that are not the active display of the terminal.

Each PanelView Plus 7 terminal contains one license supporting a single client connection to the terminal. No additional software is required.

For a complete list of available HMI software, visit http://www.rockwellautomation.com/rockwellsoftware.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
PanelView Plus 7 Standard Terminals User Manual, publication 2711P-UM007	Provides details on how to install, configure, and operate the PanelView Plus 7 Standard terminals.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 2711P-TD008F-EN-P - February 2016
Supersedes Publication 2711P-TD008E-EN-P - December 2015

stay connected

MST 1-PHASE CONTROL AND ISOLATION TRANSFORMER

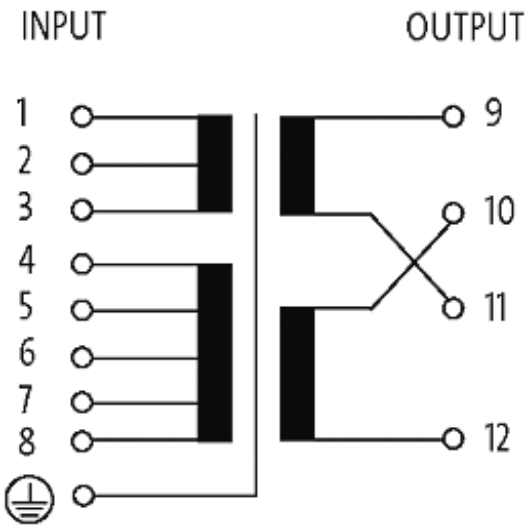
P: 800VA IN: 208...550VAC OUT: 2x115VAC

Single-phase - Control and Isolation Transformers
800 VA
Isolation class T 40/B

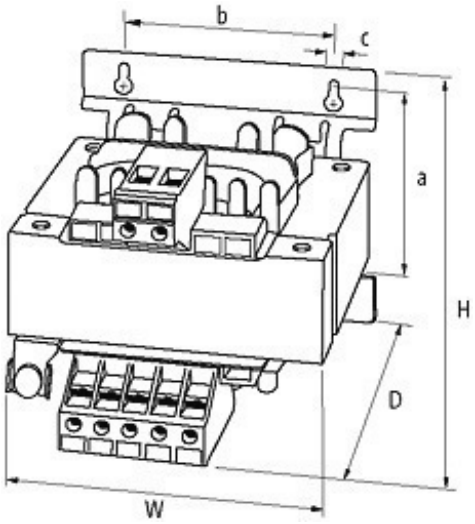
Other voltages on request.

Link to Product

Illustration



MURR ELEKTRONIK
stay connected



Product may differ from Image

Approvals

Input

Input voltage	208, 230, 380, 400, 420, 440, 460, 480, 500, 525, 550 V AC
Input current	4.2 A (208 V AC); 1.61 A (550 V AC)
Inrush current	96 A (208 V AC); 36 A (550 V AC)
Short-circuit current	123 A (208 V AC); 47 A (550 V AC)
Frequency	50...60 Hz

General data

Standards	EN 61558-1, EN 61558-2-4, EN 62041 category 0
Test isolation voltage	4 kV (prim./sec.)
Mounting method	Key-hole mounting
Dimensions H × W × D	156×150×150 mm
Fixing centers a × b × c	134×122×7 mm
Drill hole Ø	7×11 mm
Temperature range	-20...+40 °C (storage temperature -20...+80 °C)

Output

Output voltage	1 × 230, 1 × 115, 2 × 115 V AC
Output rating	800 VA

Commercial data

country of origin	CZ
customs tariff number	85043180
EAN	4048879078733
eClass	27031302

minimum order quantity	1

Allen-Bradley

Switched Mode Power Supply Specifications

Bulletin Numbers 1606-XL, -XLE, -XLP, -XLS

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Quick Guide

Bulletin 1606 ♠ Power Supply Quick Guide

	15...40 W	50 W	60 W	72...80 W	90...100 W	120 W	180 W	240 W	480 W	720 W	960 W
5...5.5V	XLP15A XLP25A	—	—	—	—	—	—	—	—	—	—
10...12V	XLP30B	—	—	—	—	—	—	—	—	—	—
12...15V 1-Ph	XLP15B	XLP50B	XLP60BQ XLP60BQT	—	XLP90B	—	XL180B	—	—	—	—
12...15 V 3-Ph	—	—	—	—	XLE96B	—	—	—	—	—	—
(+/-)12 and 15V	XLP36C	—	—	—	—	—	—	—	—	—	—
24...28V 1-Ph	XLP15E XLP30E XLP30EQ	XLP50E XLP50EZ	XL60D XLP60EQ XLP60EQT	XLS80E XLE80E XLP72E	XLP95E XLP100E	XLS120E XLS120EA XLE120E XLE120EC XLE120EE XLE120EN	—	XLS240E XLS240EC XLE240E XLE240EP XLE240EE XLE240EN	XLS480E XLS480EA XLS480EC XLS480EE	—	XLS960EE
24...28V 2-Ph/3-Ph	—	—	—	—	XLP90E-2 XLP100E-2	XLE120E-2	—	XL240E-3C XLE240E-3	XLS480E-3 XLS480E-3C	XL720E-3	XLE960DX-3N XLS960E-3
36...43V	—	—	—	—	—	—	—	—	XLS480G-3	—	—
48...56V 1-Ph	—	XLP50F	—	—	XLP100F	—	—	XLE240F	XLS480F	—	XLS960FE
48...56V 3-Ph	—	—	—	—	—	—	—	XLE240F-3	XLS480F-3	—	XLE960MX-3N XLS960F-3
24V Redundant	—	—	XL60DR	—	—	XL120DR	—	XL240DR	—	—	—
DeviceNet	—	—	—	XLEDNET3	XLSDNET4	—	—	XLSDNET8	—	—	—

♠ Example: For a 24...28 Volt, 3-Phase, 120 Watt power supply, the **Cat. No.** would be **1606-XL120E-3**.

Special Applications

Bulletin Number	NEC Class 2	ABS/GL Marine	Hazardeous Location Rating, Class 1 Div 2	ODVA Requirements	Conformal Coating	ATEX
1606-XLE	XLE80E	All XLE Power Supplies	All XLE Power Supplies	XLEDNET3	XLE120EC	—
1606-XLP	XLP15A XLP15B XLP15E XLP25A XLP30B XLP30E XLP36C XLP50B XLP50E XLP50EZ XLP50F XLP72E XLP90B XLP90E-2 XLP95E	XLP15A XLP15B XLP15E XLP25A XLP30E XLP36C XLP50E XLP50EZ XLP72E XLP90B XLP100E XLP100F XLPRED	XLP15A XLP15B XLP15E XLP25A XLP30B XLP30E XLP50B XLP50E XLP50EZ XLP72E XLP90B XLP95E XLP100E XLPRED	—	—	—
1606-XLS	XLSDNET4	ALL XLS Power Supplies	All XLS Power Supplies★	XLSDNET4 XLSDNET8	XLS240EC XLS480E-C XLS480E-3C	XLS120EA XLS240EA XLS480EA

★ Cat. No. 1606-XLS240K does not have Hazardeous Location Rating.

Bulletin 1606-XLS

	1606-XLS80E	1606-XLS120E 1606-XLS120EA&	1606-XLS180B	1606-XLS240E 1606-XLS240EA& 1606-XLS240EC♠
Output Volts/Watts	24…28V/80 W	24…28V/120 W	12...15V/180 W	24…28V/240 W
Input Voltage (47...63 Hz)	100…240V AC, 110...150V DC	100…240V AC, 110...300V DC	100…240V AC, 110...150V DC	100…240V AC, 110...150V DC
Operational Range	85…276V AC, 88…188V DC	85…264V AC, 88…360V DC	85…264V AC, 88…188V DC	85…276V AC, 88…188V DC
Hold-up Time	27…174 ms	33…59 ms	32 ms	27 ms
Rated Input Current	1.4 A (100V AC), 0.82 A (240V AC)	1.4 A (100V AC), 0.65 A (240V AC)	1.65 A (120V AC), 0.93 A (230V AC)	2.8 A (100V AC), 1.2 A (240V AC)
Efficiency	typ. 90.0%	typ. 92.7%	typ. 91.5%	typ. 91.8%
Output Voltage	24…28V	24…28V	12...15V	24…28V
Rated Output Current	3.4 A (@ 24V) 3.0 A (@ 28V)	5 A (@ 24V) 4.5 A (@ 28V)	15 A	10 A (@ 24V) 9 A (@ 28V)
ReservePower (typ. 4 s)	5.4 A (@ 24V) 5.0 A (@ 28V)	7.5 A (@ 24V) 6.7 A (@ 28V)	22.5 (@12V)	15 A (@ 24V) 13.5 A (@ 28V)
Ripple/Noise	<100 mV_{PP}	<50 mV_{PP}	<50 mV_{PP}	<50 mV_{PP}
Operating Temperature Range (T_{amb})	-25...+70 °C >60 °C with derating			
Non-Operating Temperature Range	-40...+85 °C			
MTBFΔ	>650 000 hours	>831 000 hours	>577 000 hours	>581 000 hours
Dimensions (W x H x D)	32 x 124 x 102 mm	40 x 124 x 117 mm	60 x 124 x 117 mm	60 x 124 x 117 mm
Weight	420 g	620 g	900 g	900 g
Certifications/Standards ★	1, 2, 3, 5, 6, 7, 9			1, 2, 3, 5, 6, 7, 8, 9
Special Features	Active PFC; Class 1 Div. 2; Semi F47, 9) ABS/GL/RINA (Marine)			

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 8) ATEX, 9) GL/ABS
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C, 8) ATEX
& Indicates ATEX rating
♠ Indicates conformal coating

	1606-XLS480E 1606-XLS480EA& 1606-XLS480EC♠	1606-XLS480E-3 1606-XLS480E-3C♠	1606-XLS480F	1606-XLS480F-3	1606-XLS480G	1606-XLS480G-3
Output Volts/Watts	24…28V/480 W	24…28V/480 W	48...56V/480 W	48...56V/480 W	36...42V/480 W	36...42V/480 W
Input Voltage (47...63 Hz)	100…240V AC /110...150V DC	380…480V AC, 600V DC	100…240V AC, 110...300V DC	380…480V AC, 600V DC	100…240V AC, 110...300V DC	380…480V AC, 600V DC
Operational Range	85…276V AC, 88…188V DC	323…552V AC, 450…780V DC	85…276V AC, 88…375V DC	323…552V AC, 450…780V DC	85…276V AC, 88…375V DC	323…552V AC, 450…780V DC
Hold-up Time	32…51 ms	19 ms	32...51 ms	22 ms	32...51 ms	22 ms
Rated Input Current	4.6 A (100V AC), 2.5 A (240V AC)	0.9 A (380V AC), 0.65 A (480V AC)	4.6 A (100V AC), 2.5 A (240V AC)	0.79 A (380V AC), 0.65 A (480V AC)	4.6 A (100V AC), 2.5 A (240V AC)	0.79 A (380V AC), 0.65 A (480V AC)
Efficiency	typ. 92.4%	typ. 94.8%	typ. 92.4%	typ. 95.4 %	typ. 92.4%	typ. 94.8%
Output Voltage	24…28V	24…28V	24…28V	48...55V	36...42V	36...42V
Rated Output Current	20 A (@ 24V) 17 A (@ 28V)	20 A (@ 24V) 17.5 A (@ 28V)	20 A (@ 24V) 17 A (@ 28V)	10 A (@ 48V)	13 A (@ 36V)	13.3 A (@ 36V)
ReservePower (typ. 4 s)	30 A (@ 24V) 26 A (@ 28V)	30 A (@ 24V) 26 A (@ 28V)	30 A (@ 24V)	15 A (@ 48V)	20 A (@ 42V)	20 A (@ 42V)
Ripple/Noise	<100 mV_{PP}	<100 mV_{PP}	<100 mV_{PP}	<100 mV_{PP}	<100 mV_{PP}	<100 mV_{PP}
Operating Temperature Range (T_{amb})	-25...+70 °C >60 °C with derating					
Non-Operating Temperature Range	-25...+70 °C >60 °C with derating					
MTBFΔ	>469 000 hours	>690 000 hours	>469 000 hours	>690 000 hours	> 407 000 hours	> 690 000 hours
Dimensions (W x H x D)	84 x 124 x 127 mm	65 x 124 x 127 mm	84 x 124 x 127 mm	65 x 124 x 127 mm	82 x 124 x127 mm	65 x 124 x127 mm
Weight	1200 g	870 g	1200 g	870 g	1200 g	870 g
Certifications/Standards ★	1, 2, 3, 5, 6, 7, 8, 9	1, 2, 3, 5, 6, 7, 9				
Special Features	ABS/GL/RINA (Marine)					

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 8) ATEX, 9) ABS/GL/RINA (Marine)
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C
& Indicates ATEX rating
♠ Indicates conformal coating

Bulletin 1606-XLS

	1606-XLS960EE	1606-XLS960E-3	1606-XLS960F-3
Output Volts/Watts	24…28V/960 W	24…28V/960 W	24…28V/960 W
Input Voltage (47...63 Hz)	200...240V AC	380...480 V AC	200...240V AC
Operational Range	170...264V AC	380....480V AC	170...264V AC
Hold-up Time	32 ms	20 ms	20 ms
Rated Input Current	4.6 A	1.65 A	1.65 A
Efficiency	typ. 94.6%	typ. 95.2%	typ. 95.4%
Output Voltage	24...28V	24...28V	48...54V
Rated Output Current	40 A (@ 24V) 34 A (@ 28V)	40 A (@ 24V) 34.3 A (@ 28V)	20 A (@ 48V) 17.8 A (@ 54V)
ReservePower (typ. 4 s)	60 A (@ 24V) 51 A (@ 28V)	60 A (@ 24V) 51 A (@ 28V)	30 A (@ 48V) 26.7 A (@ 54V)
Ripple/Noise	<100 mV_{PP}	<100 mV_{PP}	<100 mV_{PP}
Operating Temperature Range (T_{amb})	-25 °C...+70 °C		
Non-Operating Temperature Range	-40 °C...+85 °C		
Dimensions (W x H x D)	125 x 124 x 127 mm	110 x 124 x 127 mm	125 x 124 x 127 mm
Weight	1800 g	1500 g	1800 g
Certifications/Standards ★	1, 2, 3, 4, 5, 6, 7, 9		
Special Features	Class 1, DIv. 2, ABS/GL/RINA (Marine)		

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9) ABS/GL/RINA (Marine)
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606-XLE

	1606-XLE80E	1606-XLE120E 1606-XLE120EC♠	1606-XLE120EE	1606-XLE120EN	1606-XLE240E	1606-XLE240EE	1606-XLE240EN	1606-XLE240EP	1606-XLE240F
Output Volts/ Watts	24V...28V/ 80 W	24V...28V/ 120 W	24V...28V/ 120 W	24V...28V/ 120 W	24V...28V/ 240 W	24V...28V/ 240 W	24V...28V/ 240 W	24V...28V/ 240 W	48V...52V/ 240 W
Input Voltage (47...63 Hz)	100...120/ 200...240V AC, 110...150V DC	100...120/ 200...240V AC	200...240V AC	100...120V AC	100...120/ 200...240V AC	200...240V AC	100...120V AC	100...120/200...240V AC	
Operational Range	90...132/ 180...264V AC, 88...188V DC	90...132V AC	180...264V AC	90...132V AC	90...132/ 180...264V AC	180...264V AC	90...132V AC	90...132/180...264V AC	
Hold-up Time	>60 ms (120V) >244 ms (240V)	>80 ms (120V) >78 ms (240V)	>80 ms (120V)	>78 ms (240V)	>46 ms (120V) >42 ms (240V)	>45 ms (240V)	>46 ms (120V)	>46ms (120V) >42ms (240V)	>46ms (120V) >42ms (240V)
Rated Input Current	1.24 A (100V AC) 0.68 A (240V AC)	2.6 A (100V AC) 1.3 A (240V AC)	2.6 A	1.4 A	5 A (100V AC) 2.5 A (240V AC)	2.7 A	5 A	<5.0 A (115V)/<2.3 A (230V)	<1.3 A (115V)/<0.7 A (230V)
Efficiency	typ. 90%	typ. 90%	typ. 90%	typ. 90.2%	typ. 91%	typ. 91.6 %	typ. 90.8 %	typ. 91%	typ. 92%
Output Voltage	24...28V								48...52V
Rated Output Current	3.3 A @ 24V 2.9 A @ 28V	5 A @ 24V 4.3 A @ 28V	5 A @ 24V	5 A @ 24V	10 A @ 24V 8.6 A @ 28V	10 A @ 24V	10 A @ 24V	10 A	5 A @ 48V 4.6 A @ 52V
Ripple/Noise	<50 mV_{PP}								
Operating Temperature Range (T_{amb})	-25...+70 °C, >60 °C with derating								
Non-Operating Temperature Range	-40...+85 °C								
MTBF∆	>700 000 hours								
Dimensions (W x H x D)	32 x 124 x 102 mm	32 x 124 x 117 mm			60 x 124 x 117 mm				
Weight	430 g	500 g	500 g	500 g	700 g	700 g	700 g	800 g	700 g
Certifications/Standards ★	1, 2, 3, 4, 5, 6, 7, 9								
Special Features	NEC Class 2	—							

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9) ABS/GL/RINA (Marine)

∆ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C.

♠ Indicates conformal coating.

Bulletin 1606-XLE

	1606-XLE96B-2	1606-XLE120E-2	1606-XLE240E-3	1606-XLE240F-3	1606-XLE960DX-3N	1606-XLE960MX-3N
Output Volts/ Watts	12V...15V/ 96 W	24V...28V/ 120 W	24V...28V/ 240 W	48V...52V/ 240 W	24V...28V/ 960 W	48V...52V/ 960 W
Input Voltage (47...63 Hz) [V AC]	380...480	380...480	380...480	380...480	480	480
Operational Range [V AC]	380...480	380...480	380...480	380...480	408...552	408...552
Hold-up Time	33 ms (400) 58 ms (480)	27 ms (400) 48 ms (480)	34 ms (400) 54 ms (480)	34 ms (400) 54 ms (480)	3 ms (19V)	3 ms (41V)
Rated Input Current						
Efficiency	87	90	92	92	95	96
Output Voltage	12...15	24...28	24...28	48...56	24	48
Rated Output Current	8 (12) 6.4 (15)	5 (24) 4.3 (28)	10 (24) 8.6 (28)	5 (48) 4.3 (56)	40	20
Ripple/Noise	<50 mV_{PP}					
Operating Temperature Range (T_{amb})	-25...+70 °C, >60 °C with derating					
Non-Operating Temperature Range	-40...+85 °C					
MTBF∆	>700 000 hours					
Dimensions (W x H x D)	40 x 124 x 117 mm				96 x 124 x 157 mm	
Weight	500 g		750 g		1400 g	
Certifications/Standards ★	1, 2, 3, 4, 5, 6, 7, 9					
Special Features	NEC Class 2	—				

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9) ABS/GL/RINA (Marine)

∆ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C.

♠ Indicates conformal coating.

Bulletin 1606-XLP

	1606-XLP15A	1606-XLP15B	1606-XLP15E	1606-XLP25A
Output Volts/Watts	5...5.5V/15 W	12...15V/15 W	24...28V/15 W	5...5.5V/25 W
Input Voltage (47...63 Hz)	100...240V AC wide range; 85...370V DC			
Operational Range	85...264V AC			
Hold-up Time	>168 ms (230V AC) >45 ms (100V AC)	>191 ms (230V AC) >46 ms (100V AC)	>196 ms (230V AC) >47 ms (100V AC)	>170 ms (230V AC) >19 ms (100V AC)
Rated Input Current	<0.28 A (100V AC) <0.17 A (196V AC)			<0.5 A (100V AC) <0.35 A (196V AC)
Efficiency	typ. >77%	typ. >83%	typ. >88%	typ. >80%
Output Voltage	5...5.5V 5.1V preset	12...15V	24...28V	5...5.5V 5.1V preset
Rated Output Current	3 A	1.0...1.3 A	0.54...0.63 A	5 A (at 5.1V), 4.5 A (at 5.5V)
Ripple/Noise	<50 mV_{pp}	<75 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}
Operating Temperature Range (T_{amb})	-10...+70 °C, >60 °C: 0.4 W/K derating			-10...+70 °C >60 °C: 0.5 W/K derating
Non-Operating Temperature Range	-40...+85 °C			
MTBFΔ	2 686 000 hours	3 811 000 hours	4 369 000 hours	600 000 hours
Dimensions (W x H x D)	22.5 x 75 x 91 mm			45 x 75 x 91 mm
Weight	130 g			240 g
Certifications/Standards ★	1, 2, 4, 5, 7, 9			
Special Features	NEC Class 2 power supply; ABS/GL/RINA (Marine); Class 1 Div. 2			

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9) ABS/GL/RINA (Marine)
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

	1606-XLP30B	1606-XLP30E	1606-XLP30EQ	1606-XLP36C	1606-XLP50B
Output Volts/Watts	10...12V/30 W	24...28V/30 W	24...28V/30 W	±12V/±15V/36 W	12...15V/50 W
Input Voltage (47...63 Hz)	100...240V AC wide range; 85...375V DC				
Operational Range	85...264V AC				
Hold-up Time	>170 ms (230V AC) >18 ms (100V AC)	>190 ms (230V AC) >19 ms (100V AC)	>141 ms (230V AC) >31 ms (100V AC)	>180 ms (230V AC) >18 ms (100V AC)	>170 ms (230V AC) >17 ms (100V AC)
Rated Input Current	<0.6 A (100V AC) <0.25 A (240V AC)	<0.6 A (100V AC) <0.35 A (196V AC)	<0.54 A (100V AC) <0.3 A (230V AC)	<0.65 A (AC 100V AC) <0.4 A (AC 196V AC)	<1.0 A (100V AC) <0.6 A (196V AC)
Efficiency	typ. 84%	typ. 87.5%	typ. 88.5%	typ. 86%	typ. 90%
Output Voltage	10...12V 12V preset (with jumper), 10...12V adjustable (without jumper)	24...28V 24.5V preset	24...28V	±12V (without jumper), ±15V (with jumper) ±15V preset	12...15V 15V preset (with jumper) 12...15V adjustable (without jumper)
Rated Output Current	3 A (@ 10V), 2.5 A (@ 12V)	1.3 A (@ 24.5V), 1 A (@ 28V)	1.3 A (@ 24V), 1 A (@ 28V)	0...2.8 A (@ +12V), 0...1.4 A (@ -12V) 0...2.4 A (@ +15V), 0...1.4 A @ (-15V)	4.2 A (@ 12V), 3.4 A (@ 15V)
Ripple/Noise	<10 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}	<100mV_{pp}
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C: 0.6 W/K derating	-10...+70 °C >60 °C: 0.5 W/K derating	-10...+70 °C >60 °C: 0.8 W/K derating	-10...+70 °C > 60 °C: 1 W/K derating	-10...+70 °C >60 °C: 1 W/K derating
Non-Operating Temperature Range	-10...+70 °C >60 °C: 0.6 W/K derating	-10...+70 °C >60 °C: 0.5 W/K derating	-10...+70 °C >60 °C: 0.5 W/K derating	-10...+70 °C > 60 °C: 1 W/K derating	-10...+70 °C >60 °C: 1 W/K derating
MTBFΔ	appr. 650 000 hours		2 123 000 hours	600 000 hours	appr. 600 000 hours
Dimensions (W x H x D)	45 x 75 x 91 mm	45 x 75 x 91 mm	22.5 x 75 x 91 mm	45 x 75 x 91 mm	45 x 75 x 91 mm
Weight	250 g	230 g	140 g	240 g	260 g
Certifications/Standards ★	1, 2, 4, 5, 7, 9				
Special Features	NEC Class 2 power supply; Class 1 Div. 2, ABS/GL/RINA (Marine)	NEC Class 2 power supply; Class 1 Div. 2; Semi F47, ABS/GL/RINA (Marine)	NEC Class 2 power supply; Class 1 Div. 2; Semi F47, ABS/GL/RINA (Marine)	Output voltage adjustable: DC ±12V without jumper or DC ±15V with jumper; NEC Class 2 power supply; Class 1 Div. 2; ABS/GL/RINA (Marine)	Output voltage adjustable: DC 12...15V without jumper or DC 15V with jumper; NEC Class 2 power supply; Class 1 Div. 2 ABS/GL/RINA (Marine)

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9) ABS/GL/RINA (Marine)
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606-XLP

	1606-XLP50E	1606-XLP50EZ	1606-XLP50F	1606-XLP60EQ	1606-XLP60EQT
Output Volts/Watts	24...28V/50 W		48...56V/50 W	24...28V/60 W	
Input Voltage (47...63 Hz)	100...240V AC wide range; 85...375V DC				
Operational Range	85...264V AC				
Hold-up Time	>171 ms (230V AC) >17 ms (100V AC)		>170 ms (230V AC) >17 ms (100V AC)	>107 ms (230V AC) >24 ms (120V AC)	
Rated Input Current	<1.0 A (100V AC) <0.6 A (196V AC)				
Efficiency	typ. 88.5%		typ. 90%	typ. 88%	
Output Voltage	24...28V 24.5V preset		48...56V 48V preset	24...28V	
Rated Output Current	2.1 A (@ 24.5V), 1.8 A (@ 28V)		1.05 A (@ 48V), 0.9 A (@ 56V)	2.5 A (@ 24V), 2.1 A (@ 28V)	
Ripple/Noise	<50 mV_{pp}		<200 mV_{pp}	<50 mV_{pp}	
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C: 1 W/K derating				-40...+70 °C >60 °C: 1 W/K derating
Non-Operating Temperature Range	-40...+85 °C				
MTBFΔ	appr. 600 000 hours			> 1 292 000 h	
Dimensions (W x H x D)	45 x 75 x 91 mm				
Weight	240 g			250 g	
Certifications/Standards ★	1, 2, 3, 4, 5, 6, 9			1, 2, 3, 4, 5, 6	
Special Features	NEC Class 2 power supply; ABS/GL/RINA (Marine); Class 1 Div. 2; Semi F47	Removeable Terminations; NEC Class 2 power supply; ABS/GL/RINA (Marine); Class 1 Div. 2	NEC Class 2 power supply; ABS/GL/RINA (Marine)	NEC Class 2 power supply	

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9)ABS/GL/RINA (Marine)
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

	1606-XLP60BQ	1606-XLP60BQT	1606-XLP72E	1606-XLP90B	1606-XLP90E-2
Output Volts/Watts	12...15V/54 W	12...15V/54 W	24...28V/72 W	12...15V/90 W	24...28V/90 W
Input Voltage (47...63 Hz)	100...240V	100...240V	100...120/220...240V AC manual select; 220...375V DC	100...120/220...240V AC; 220...375V DC	2Ø, 380...480V AC
Operational Range	85...264V AC	85...264V AC	85...132/184...264V AC		323..552V AC
Hold-up Time	>113 ms (230V AC) >25 ms (120V AC)	>113 ms (230V AC) >25 ms (120V AC)	>40 ms (230V AC) >25 ms (100V AC)	>40 ms (230V AC) >20 ms (196V AC, 100V AC)	>52 ms (400V) >93 ms (480V)
Rated Input Current	<0.91 A (110V AC) <0.54 A (230V AC)	<0.97 A (110V AC) <0.61 A (230V AC)	<1.6 A (100V AC) <0.8 A (220V AC)	<1.9 A	<0.42 A (400V) <0.36 A (480V)
Efficiency	typ. 87.2 %	typ. 87.6 %	typ. 89%	typ. 88.5%	typ. 89%
Output Voltage	12...15V	12...15V	24...28V 24.5V preset (at 2.9 A)	12...15V Preset at 12V	24...28V Preset at 24.5V
Rated Output Current	4.5 A (@ 12V), 3.6 A (@ 15V)	4.5 A (@ 12V), 3.6 A (@ 15V)	3 A (@ 24V), 2.6 A (@ 28V)	7.5 A (@ 12V), 6 A (@ 15V)	3.75 A (@ 24V), 3.2 A (@ 28V)
Ripple/Noise	<50 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}
Operating Temperature Range (T_{amb})	-10...+70 °C 60...70 °C: 1.4 W/°C derating	-40...+70 °C 60...70 °C: 1.4 W/°C derating	-10...+70 °C >60 °C: 1.5 W/K derating	-10...+70 °C >60 °C: 1 W/K derating	-10...+70 °C >60 °C: 2 W/K derating
Non-Operating Temperature Range	-40...+85 °C				
MTBFΔ	—	—	appr. 600 000 hours	appr. 500 000 hours	appr. 500 000 hours
Dimensions (W x H x D)	45 x 75 x 91 mm	45 x 75 x 91 mm	45 x 75 x 91 mm	73 x 75 x 103 mm	73 x 75 x 103 mm
Weight	250 g	250 g	260 g	360 g	360 g
Certifications/Standards ★	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6, 9	1, 2, 3, 4, 5, 6, 7, 9	1, 2, 3, 4, 5, 6, 7, 9
Special Features	NEC Class 2 power supply	NEC Class 2 power supply Operation down to -40 °C	NEC Class 2 power supply; ABS/GL/RINA (Marine); Class 1 Div. 2	NEC Class 2 power supply; ABS/GL/RINA (Marine); Class 1 Div. 2	NEC Class 2 power supply; ABS/GL/RINA (Marine)

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1, 9)ABS/GL/RINA (Marine)
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606-XLP

	1606-XLP95E	1606-XLP100E	1606-XLP100F	1606-XLP100E-2
Output Volts/Watts	24...28V/95 W	24...28V/100 W	48...56V/100 W	24...28V/100 W
Input Voltage (47...63 Hz)	100...120/220...240V AC auto select; 220...375V DC			2Ø, 380...480V AC
Operational Range	85...132/184...264V AC			323..552V AC
Hold-up Time	>40 ms (230V AC) >20 ms (100V AC)			>48 ms (400V) >85 ms (480V)
Rated Input Current	<2.0 A (100V AC) <0.95 A (220V AC)	<2.1 A (100V AC) <1.0 A (220V AC)		<0.46 A (400V) <0.40 A (480V)
Efficiency	typ. 90%		typ. 91%	typ. 89%
Output Voltage	24...28V 24.5V preset		48...56V 48V preset	24...28V Preset at 24.5V
Rated Output Current	3.9 A (@ 24.5V), 3.2 A (@ 28V)	4.2 A (@ 24.5V), 3.6 A (@ 28V)	2.1 A (@ 48V), 1.8 A (@ 56V)	4.2 A (@ 24V), 3.6 A (@ 28V)
Power Boost	—	—	—	—
Ripple/Noise	<50 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}	<50 mV_{pp}
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C: 2 W/K derating			
Non-Operating Temperature Range	-40...+85 °C			
MTBFΔ	appr. 500 000 hours			
Dimensions (W x H x D)	73 x 75 x 103 mm			
Weight	360 g			
Certifications/Standards★	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 5, 6, 9	1, 2, 3, 5, 6, 9	
Special Features	NEC Class 2 power supply; Class 1 Div. 2	Single/parallel operation (inclined characteristic) select on front panel; ABS/GL/RINA (Marine); Class 1 Div. 2; Semi F47	Single/parallel operation (inclined characteristic) select on front panel; ABS/GL/RINA (Marine)	

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Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

1606-XL Single Phase Specifications

						
	1606-XL60D	**1606-XL180B**	**1606-XL480EP**	**1606-XL480EPT**	**1606-XL480GP**	**1606-XL480F**
Output Volts/Watts	24V/60 W	12...15V/180 W	24...28V/480 W		36...43V/480 W	48...56V/480 W
Input Voltage (47...63 Hz)	100...120/200...240V AC manual select; 160...375V DC	100...120/220...240V AC 240...375V DC	100...120/200...240V AC			
Operational Range	85...132/176...264V AC	85...132/176...264V AC	85...132/184...264V AC			
Hold-up Time	>20 ms (196V AC)	>81 ms (230V AC) >84 ms (120V AC) >45 ms (100V AC)	30 ms (120/230V AC)		>27 ms (230V AC)	30 ms (230V AC)
Rated Input Current	<1.3 A (115V)/<0.7A (230V)	<5A (115V)/<2.3 A (230V)	10 A (115V)/5 A (230V)			
Efficiency	typ. 87.5%	typ. >87%	typ. 90.5%		typ. 92%	typ. 93%
Output Voltage	24V	12...15V Preset at 12V	24...28V Front panel potentiometer		36...43V Front panel potentiometer	48...56V Front panel potentiometer
Rated Output Current	2.5 A	15 A (@ 12V), 12 A (@ 15V)	20 A (@ 24V), 18 A (@ 28V)		13.3 A (@ 36V), 11.2 A (@ 43V)	10 A (@ 48V), 8.6 A (@ 56V)
Power Boost	—	18 A	25 A (22 A)		16.6 A (14 A)	12.5 A (10.7 A)
Ripple/Noise	<25 mV_{pp}	<50 mV_{pp}	< 20 mV_{pp} (single operation) <40 mV_{pp} (parallel operation)		<30 mV_{pp} (single operation) <80 mV_{pp} (parallel operation)	<40 mV_{pp} (single operation) <80 mV_{pp} (parallel operation)
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C with derating	0...70 °C >60 °C with derating	0...+70 °C >60 °C with derating			
Non-Operating Temperature Range	-40...+85 °C	0...70 °C >60 °C with derating	-40...+85 °C			
MTBF♣	740 000 hours	<425 000 hours	519 000 hours			
Dimensions (W x H x D)	49 x 124 x 102 mm	120 x 124 x 102 mm	220 x 124 x 102 mm			
Weight	460 g	980 g	2500 g			1800 g
Certifications/Standards✶	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6, 7			1, 2, 3, 4, 5, 6
Special Features	NEC Class 2 power supply; Semi F47	—	PFC choke; Overload behavior selectable; (hiccup/continuous current); ‡	PFC choke; ‡	Selectable single/parallel operation (inclined characteristic); PFC choke; ‡	‡

✶ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1
‡ Low inrush current
♣ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

1606-XL Three Phase Specifications

						
	1606-XL120E-3	**1606-XL240E-3 and 1606-XL240E-3C⌘**	**1606-XL480F-3H**	**1606-XL720E-3**	**1606-XL960E-3**	**1606-XL960E-3S♣**
Output Volts/Watts	24...28V/120 W	24...28V/240 W	48...56V/480 W	24...28V/720 W	24...28V/960 W	
Input Voltage (47...63 Hz)	3Ø, 400...500V AC wide range; 450...820V DC	3Ø, 400...500V AC wide range; 450...820V DC	3Ø, 400V AC; 450...700V DC	3Ø, 400...500V AC wide range; 450...820V DC	3Ø, 400...500V AC wide range	
Operational Range	340...576V AC		340...479V AC	340...576V AC		
Hold-up Time	>16 ms (3Ø 400V AC) >10 ms (2Ø 400V AC)	>24 ms (3Ø 400V AC) >20 ms (2Ø 400V AC)	>11 ms	>10 ms (3Ø 400V AC)	>15 ms (3Ø 400V AC)	
Rated Input Current	3 x 0.5 A	3 x 0.8/0.7 A @ 400/500V	3 x 1.5 A	3 x 2.0 A	3 x 3.0 A	
Efficiency	typ. 89%	typ. 92%	typ. 92%	typ. 92.5%	typ. 92.5%	
Output Voltage	24...28V 24.5V preset	24...28V 24.5V preset	48...56V 48.1V preset	24...28V front panel potentiometer	24...28V front panel potentiometer	
Rated Output Current	5 A (@ 24V), 4.3 A (@ 28V)	10 A (@ 24V) 8.6 A (@ 28V)	10 A (@ 48V), 9 A (@ 56V)	30 A (@ 24V), 26 A (@ 28V)	40 A (@ 24V), 35 A (@ 28V)	
Power Boost	6 A	12 A (up to 288 W)	12.5 A	33 A	45 A	
Ripple/Noise	<25 mV_{PP}	<30 mV_{PP}	<50 mV_{PP}	<20 mV_{PP} (single operation) <40 mV_{PP} (parallel operation)	<50 mV_{PP}	
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C with derating	0...+70 °C >60 °C with derating	0...+70 °C >60 °C with derating			
Non-Operating Temperature Range	-40...+85 °C		-40...+85 °C			
MTBF♣	410 000 hours	543 000 hours (3Ø), 525 000 hours (2Ø)	310 000 hours	425 000 h @ 400V AC, 360 000 h @ 480V AC	305 000 hours	268 000 hours
Dimensions (W x H x D)	73 x 124 x 117 mm	89 x 124 x 117 mm	220 x 124 x 102 mm	240 x 124 x 112 mm	275 x 124 x 117 mm	
Weight	730 g	980 g	1800 g	2000 g	3300 g	
Certifications/Standards✶	1, 2, 3, 4, 5, 6, 7					
Special Features	PFC choke	Overload behavior selectable (FUSE Mode/continuous current); 2-phase operation admissible, Single/parallel operation (inclined characteristic); PFC choke; ‡	Single/parallel operation (inclined characteristic) selectable (jumper); PFC choke; ‡	PFC choke; ‡	Single/parallel operation (inclined characteristic) selectable (jumper); passive load sharing; PFC choke; ‡	Parallel operation through active current sharing; Output signals (Power-Fail, Shut-Down, internal current measurement, overtemperature warning); PFC choke; ‡♣

✶ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1
‡ Low inrush current
♣ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C
⌘ Because this catalog number ends with "**C**", it indicates the device has conformal coating.

"DC Ok" Output

Function: Indicating whether the unit is operating properly. Output can directly energize a relay or a control light.
Signaling: Output signal is at a "high" level (24V, current source) in normal operation (no overload, overheating, short circuit). When the output signal switches to "low" level (no power at output), Vout remains for 5 ms (nominal) at nominal load.
Connection (signal common): Connection is made with respect to the "Signal GND" terminal (signal output).
Important: Do not connect to the power output (terminals + and -).

Permissible load: resistance - min. 300 Ω, e.g. 24V relay, control lights (LEDs need no series resistance), Evaluation logic.
For 5V signal: In order to receive a 5V signal: switch a 5V Zener diode (0.5 W) and 1 kΩ resistance in parallel between this output and the "Signal GND" terminal.

"Thermal Alarm" Output

Function: Output gives warning shortly before and while overtemperature state occurs. Output can directly control a relay or a control light.
Signaling: Output signal is at a "high" level (24V, current source) in normal operation (no overtemperature). At overtemperature, the output switches to "low". Only when the temperature in the unit increases further will the unit reduce its output current (power output).
Connection and permissible load: same as for "DC ok" output.

"Current Monitor" Output

Function: Measuring the output current (power output). Output signal is proportional to the output current of the unit.
Connection: Made with respect to the "Signal GND" terminal (signal output).
Important: Do not connect to the power output (terminals + and -).
Signaling:
Voltage measuring: Voltage at signal output is 1V per 10 A output current (Ri(voltmeter) > 100 k ohm)
Current measurement: Current at signal output is 1 mA per 10 A output current (Ri(ammeter) < 100 W)

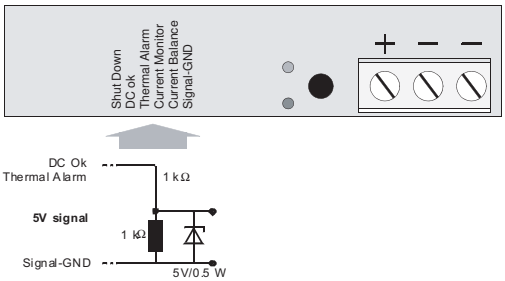
"Current Balance" In-/Output

Function: Using these terminals, parallel operating units ensure an equal load sharing (active balancing). Balancing also works reliably with decoupling diodes at the power output (redundancy).

Connection: Connect together "Current Balance" outputs of all units involved.
Important: Signal common here is the - terminal of the power output, not the "Signal GND". Do not connect the "Signal GND" terminals to each other!

"Signal GND" Terminal

Function: Grounding terminal for all signal terminals (not for "Current Balance").
Connection instructions: Do not connect this terminal with terminals + or - of the unit (not even over a load: risk of overload). Do not connect this terminal with terminals of other units (not even with the "Signal GND" terminal of another unit).
Permissible load: Maximum current load: 0.3 A. Terminal is fused internally with a self-healing fuse (polyswitch).



Bulletin 1606 Special Modules

	1606-XLDC40A	1606-XLDC92D	1606-XLSDNET4	1606-XLSDNET8	1606-XLEDNET3
Output Volts/Watts	24V/40 W	24V/92 W	24V/91 W	24V/192 W	24V...28V/80 W
Input Voltage (47...63 Hz)	18...36V DC	24V DC	100…240V AC; 110...300V DC	AC 100…240V DC 110...300V	100...120V AC/200...240 V AC
Operational Range	16...40V DC	14...32.4V DC	85…264V AC 88…360V DC	85…276 V AC 88…375 V DC	90...132V AC/180...264V AC
Hold-up Time	18...36V DC	18...36V DC	43 ms (120V AC) 77 ms (240V AC)	38 ms (120V AC) 41 ms (240V AC)	>60 ms (120V) >244 ms (240V)
Rated Input Current	<2.9 A	<5.5 A	1.1 A (100V AC) 0.5 A (240V AC)	2.3 A (100V AC) 1.0 A (240V AC)	1.24 A (100V AC) 0.68 A (240V AC)
Efficiency	typ. 82%	typ. 90.3%	typ. 92.4%	typ. 92.7%	typ. 90%
Output Voltage	5.1V	24V	24V	24V	24...28V
Rated Output Current	8 A	3.8 A	3.8 A	8 A	3.3 A @ 24V 2.9 A @ 28V
Ripple/Noise	<50 mV_{PP}	<50 mV_{PP}	< 50 mV_{pp}	< 50 mV_{pp}	<50 mV_{PP}
Operating Temperature Range (T_{amb})	0...+70 °C >60 °C with derating	-25...+70 °C >60 °C with derating	-25...+70 °C >60 °C with derating	-25...+70 °C >60 °C with derating	-25...+70 °C, >60 °C with derating
Non-Operating Temperature Range	-25...+85 °C	-40...+85 °C	-40...+85 °C	-25...+70 °C >60 °C with derating	-40...+85 °C
MTBFΔ	> 510 000 hours	-	>581 000 hours	>831 000 hours	>700 000 hours
Dimensions (W x H x D)	49 x 124 x 102 mm	32 x 124 x 102 mm	40 x 124 x 117 mm	60 x 124 x 117 mm	32 x 124 x 102 mm
Weight	470 g	410 g	620 g	900 g	430 g
Certifications/Standards ★	1, 2, 3, 5, 6, 7		1, 2, 3, 5, 6, 7	1, 2, 3, 5, 6, 7	1, 2, 3, 4, 5, 6, 7
Special Features	—		NEC Class 2 power supply; Active PFC; ODVA Approved; Class 1 Div. 2; Semi F47	Active PFC; ODVA Approved; Class 1 Div. 2; Semi F47	NEC Class 2 power supply; ODVA Approved; Class 1 Div. 2; Semi F47

★ 1) = CE, 2) = UL 508 (cULus LISTED), 3) = UL 1950 (cURus), 4) = CSA C22.2, No. 60950, 5) Safety standards = IEC/EN 60950, EN 50178, 6) EMC standards = EN 55011 (Class B), EN 55022 (Class B), EN 61000-6-2, 7) EMC standards = EN 61000-3-2 (A14), EN 50081-1
Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606 Redundant Power Supplies

	N+1 Redundancy	N+1 Redundancy	N+1 Redundancy
	1606-XL60DR	1606-XL120DR	1606-XL240DR
Output Volts/Watts	24V/60 W	24V/120 W	24V/240 W
Input Voltage (47...63 Hz)	100...120V/200...240V AC manual select; 160...375V DC	100...120/200...240V AC manual select; 210...375V DC	AC 100...120/200...240V manual select; DC 240...375V
Operational Range	—	85...132/176...264V AC	85...132/176...264 V AC
Hold-up Time	>20 ms (AC 196V)	>37 ms (AC 196V)	>25 ms (AC 196V)
Rated Input Current	<1.3 A (115V)/<0.7 A (230V)	<2.6 A (115V)/<1.4 A (230V)	<6 A (115V)/<2.8 A (230V)
Efficiency	typ. 86.5%	typ. 89%	typ. 89%
Output Voltage	24V	24V	24V
Rated Output Current	2.5 A	5 A	10 A
Power Boost	—	6 A	12 A
Ripple/Noise	<30 mV_{PP}	<30 mV_{PP}	<30 mV_{PP}
Operating Temperature Range (T_{amb})	-10...+70 °C >60 °C with derating	-10...+70 °C >60 °C with derating	0...+70 °C >60 °C with derating
Non-Operating Temperature Range	-10 °C...+70 °C >60 °C with derating	-40...+85 °C	-40...+85 °C
MTBF∆	700 000 hours	480.000 hours	390.000 hours
Dimensions (W x H x D)	49 x 124 x 102 mm	64 x 124 x 102 mm	120 x 124 x 102 mm
Weight	470 g	620 g	980 g
Certifications/Standards ★	1, 2, 3, 5, 6	1, 2, 3, 5, 6, 7	1, 2, 3, 5, 6
Special Features	RDY relay contact; N+1 redundancy; plug connectors; NEC Class 2 power supply	RDY relay contact; N+1 redundancy; plug connectors	RDY relay contact; N+1 redundancy; plug connectors

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∆ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606 Redundancy Module

	N+1 Redundancy	N+1 Redundancy	N+1 Redundancy	N+1 Redundancy		N+1 Redundancy	N+1 Redundancy
	1606-XLRED20-30	1606-XLRED40	1606-XLPRED	1606-XLSRED	1606-XLERED	1606-XLSRED40	1606-XLSRED80
Output Volts/Watts	30 A Dual redundancy module	40 A Single redundancy module	8 A Dual redundancy	10 A Dual redundancy		20 A Dual redundancy	40 A Dual redundancy
Input Voltage (47...63 Hz)	DC 24V (max. 35V)		DC 10...60V	DC 10...60V		24...28 V DC	24...28 V DC
Operational Range	18...36 V DC		10...60V DC	10...60V DC		24...28 V DC	24...28 V DC
Rated Input Current	20...30 A (max. 35 A)	0...40 A (max. 50 A)	Single input: 8 A max. Dual input: 16 A max. total	Single input: 10 A max. Dual input: 20 A max. total		Single input: 20 A max. Dual input: 40 A max. total	Single input: 40 A max. Dual input: 80 A max. total
Output Voltage	Vin -0.5V typ.	Vin -0.6V typ.	Vin -0.9V typ.	Vin -0.9V typ.		Vin -2.15V typ.	Vin -2.7V typ.
Rated Output Current	20...30 A (max. 35 A)	0...40 A (max. 50 A)	0...10 A	0...20 A		0...40 A	0...80 A
Operating Temperature Range (T_{amb})	-10 °C...+70 °C		-40 °C...+70 °C >60 °C with derating	-25 °C...+70 °C >60 °C with derating		-25 °C...+70 °C >60 °C with derating	-25 °C...+70 °C >60 °C with derating
Dimensions (W x H x D)	48 x 124 x 102 mm	48 x 124 x 117 mm	45 x 75 x 91 mm	32 x 124 x 102 mm	32 x 124 x 117 mm	36 x 124 x 127 mm	46 x 124 x 127 mm
Weight	625 g	646 g	136 g	290 g	350 g	340 g	440 g
Certifications/Standards ★	1, 2, 3, 6		1, 2, 3, 6	1, 2, 3, 6		1, 2, 3, 6	1, 2, 3, 6
Special Features	Dual redundancy module for 2x35 A; N+1 redundancy	Single redundancy module for 2.5-50 A; N+1 redundancy	Redundancy for DC 10...60V applications; ABS/GL/RINA (Marine); Class 1 Div. 2	Redundancy for DC 10...60V applications; Class 1 Div. 2	Redundancy for DC 10...60V applications; Class 1 Div. 2; DC OK	Redundancy for DC 24...28V applications; Class 1 Div. 2	Redundancy for DC 24...28V applications; Class 1 Div. 2

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∆ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606-XLS UPS

	UPS	UPS	UPS	UPS
	1606-XLS240-UPS	1606-XLS240-UPSC	1606-XLS240-UPSD	1606-XLS240-UPSE
Output Volts/Watts	22.5V...30V/240 W	22.25V/240 W	22.25V and 12V/240 W	
Input Voltage (47...63 Hz)	24V DC (22.5...30V DC)	24V DC (22.5...30V DC)	24V DC (22.5...30V DC)	
Rated Input Current Voltage stand-by mode/charging mode	typ. 0.12 A/ max. 1.3 A	typ. 0.12 A/ max. 1.3 A	—	typ. 0.12 A/ max. 1.3 A
Operational Range	22.5...30V DC	22.5...30V DC	22.5...30V DC	22.5...30V DC
Hold-up Time	battery dependent			
Output Voltage	22.4V	22.25V	22.25V	22.25V
Rated Output Current	10 A	10 A	10 A	10 A
Power Boost	15 A	15 A	15 A	15 A
Operating Temperature Range (T_{amb})	-25...+60 °C	-25...+40 °C		
Non-Operating Temperature Range	-40...+85 °C	-20...+50 °C		
MTBFΔ	886 000 hours	886 000 hours	788 000 hours	886 000 hours
Dimensions (W x H x D)	49 x 124 x 117	123 x 124 x 119	49 x 124 x 117	49 x 124 x 117
Weight	530 g	2850 g	650 g	545 g
Certifications/Standards ★	1, 2, 3, 5, 6			
Special Features	Inhibit replacement battery buffering			

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Δ MTBF determined by Siemens norm SN 29500 at full load current and 40 °C

Bulletin 1606-XLSBUFFER

	Buffer Module	Buffer Module
	1606-XLSBUFFER 24	1606-XLSBUFFER 48
Output Volts	22.5V DC	45V DC
Input Current	80 mA typ. 600 mA max.	40 mA typ. 500 mA max.
Hold-up Time	200 ms @ 20 A	100 ms @ 20 A
Output Voltage	Vin -1V: 22.5V fixed	Vin -2V: 45V fixed
Rated Output Current	20 A	20 A
Operating Temperature Range (T_{amb})	-25...+70 °C	
Non-Operating Temperature Range	-40...+85 °C	
Dimensions (W x H x D)	64 x 124 x 102 mm	64 x 124 x 102 mm
Weight	740 g	740 g
Certifications/Standards ★	1, 2, 3, 5, 6	
Special Features	Selectable buffered voltage; §	

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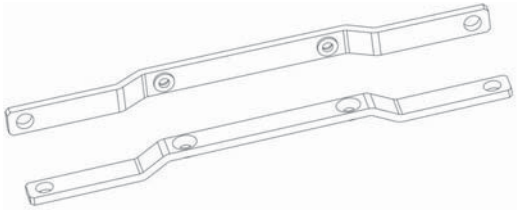
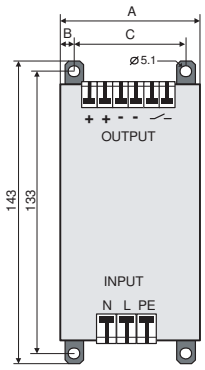
§ Low inrush current

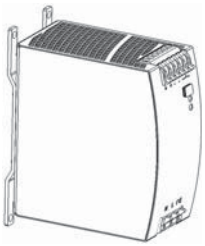
Approximate Dimensions - Accessories

Approximate dimensions are shown in millimeters (in.) unless otherwise indicated. Dimensions are not to be used for manufacturing purposes.

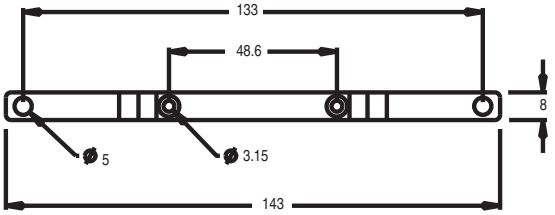
Cat. No. 1606-XLB, Back of Panel Mounting Bracket
For use with Bulletin 1606-XLE and -XLS Power Supplies below 20 A.



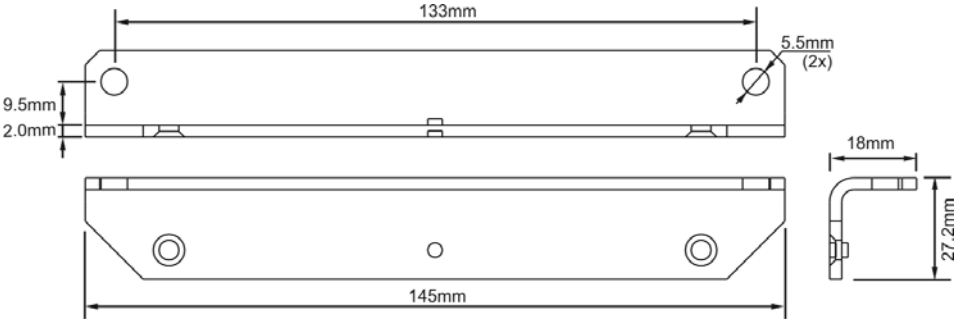




mm	A	B	C
1606-XLS80E	32	4.8	22.5
1606-XLS120E	40	5.3	29.5
1606-XLS240E	60	5.8	48.5
1606-XLS480E-3	65	6.3	40
1606-XLSRED	32	4.8	22.5



Cat. No. 1606-XLC, Back of Panel Mounting Bracket
For use with Bulletin 1606-XLE and -XLS Power Supplies 20 A and above.

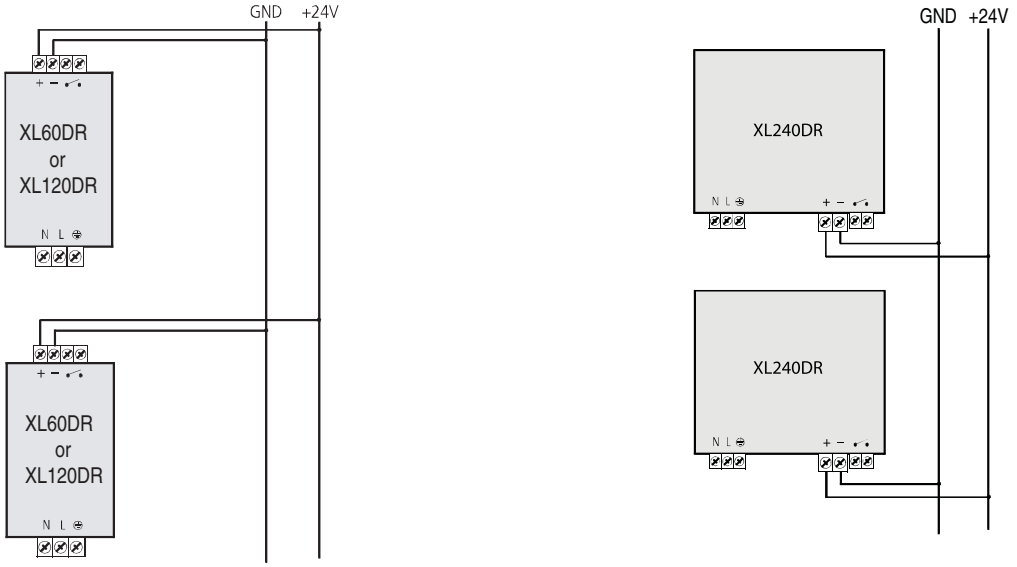


Application Information

1606-XL Redundancy Capabilities

The 1606-XL family has two cost effective methods for providing redundancy to applications that are critical and can not risk failure.

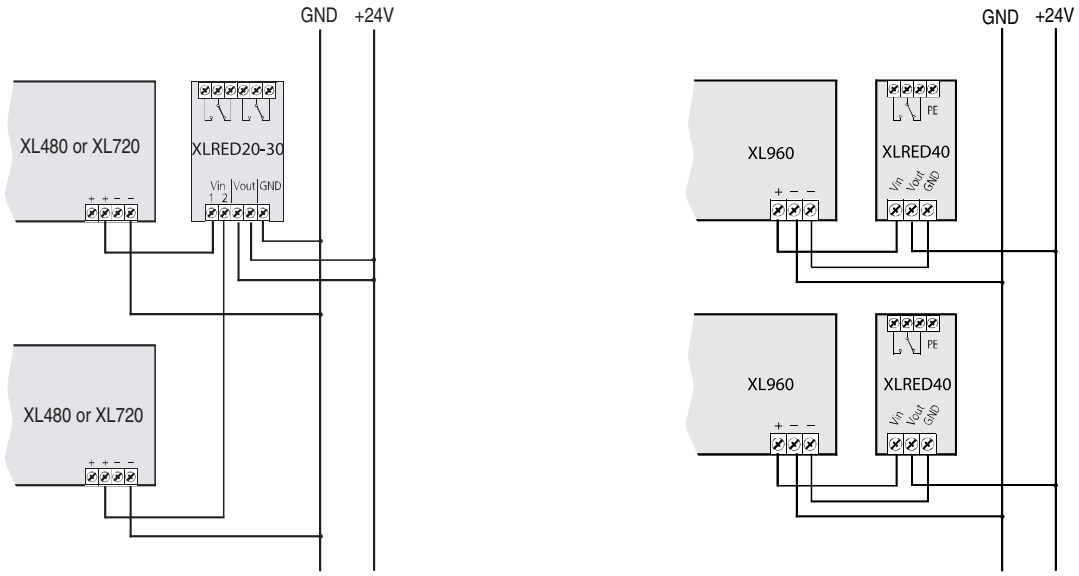
1606-XL60DR, XL120DR and XL240DR Redundant Power Supplies



The 1606-XL60DR, XL120DR and XL240DR are enhanced versions of the standard power supplies.

- Each device has internal diodes which provide isolation against DC bus problems corrupting working supplies.
- Provides "DC OK" output relay to allow remote monitoring of DC power status.
- Utilizes pluggable terminals for easy installation.

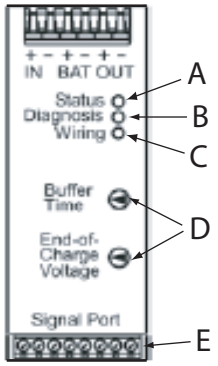
1606-XLRED20-30 and 1606-XLRED40 Redundancy Modules



Extensive Diagnostic & Monitoring Functions

Protective Features:

- Wrong battery voltage (24V instead of 12V)
- Wrong battery polarity
- Too high ambient temperature
- Output overload or output short-circuit
- Deep discharge (battery) protection
- Wrong polarity on input terminals
- Over-voltage protection (malfunctioning of the internal regulation loops)



A - Status LED (green):

- Ready: Battery is charged > 85%, no wiring failure is recognized, input voltage is sufficient and inhibit signal is not active.
- Charging: Battery is charging and battery capacity is below 85%.
- Buffering: Unit is in buffer mode.

B - Diagnosis LED (yellow):

- Overload: Output has switched off, due to long overload in buffer mode or due to high temperatures.
- Replace battery: Indicates a battery which failed the battery quality test (SCH test). Battery should be replaced soon.
- Buffer time expired: Output has switched off due to settings of buffer time. The signal will be stored and displayed for 15 minutes.
- Inhibit active: Indicates that buffering is disabled due to an active inhibit signal.

C - Check wiring LED (red):

- Check wiring between DC UPS and battery, as well as the battery itself. Also indicates when input voltage is not in range.

D - Adjustor:

- Buffer time limiter: User accessible switch which limits the maximum buffer time in a buffer event, to save battery capacity.
- End-of-charge voltage: User accessible potentiometer which sets the end-of-charge voltage. Adjust the potentiometer according to the expected battery temperature.

E - Signal contacts:

Ready (contact 1-2):

Contact is closed when battery is charged more than 85%, no wiring failure is recognized, input voltage is sufficient, and inhibit signal is not active.

Buffering (contact 3-4):

Contact is closed when unit is buffering.

Replace battery (contact 5-6):

Contact is closed when input voltage is sufficient and battery quality test (SCH test) indicates a negative result, three times in a row.

Inhibit input (contact 7&8):

The inhibit input disables buffering. In normal mode, a static signal is required. In buffer mode, a pulse with a minimum length of 250 ms is required to stop buffering. The inhibit is stored and can be reset by cycling the input voltage.

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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