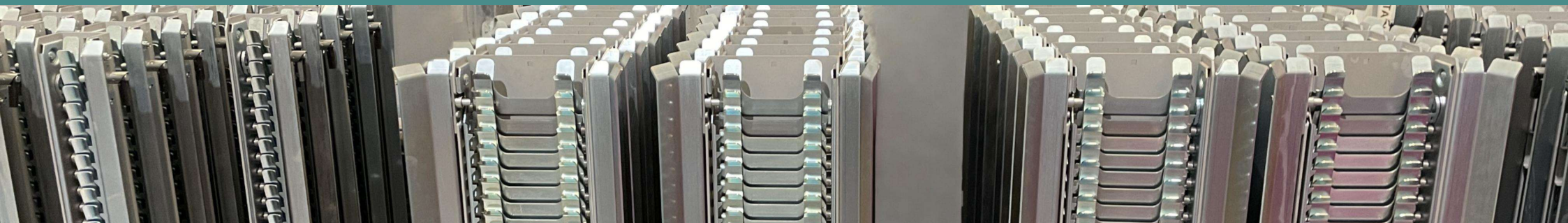




Ferrinox Automotive a. s.

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Proprietary technology and technical continuity since 2003



For further technical and commercial information

a.violante@ferrinoxautomotive.com

Technical Continuity and Professional Identity since 2003



Since 2003, a single technical leadership has guided the development of Stacking Columns, contributing to the completion of more than 1,200 projects for major European automotive manufacturers.

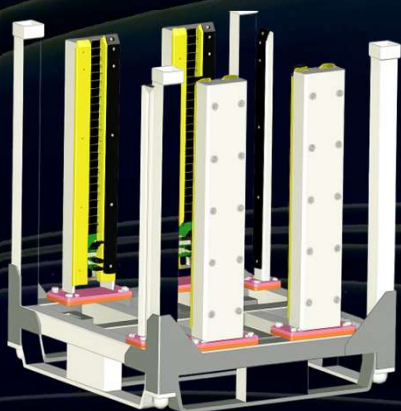
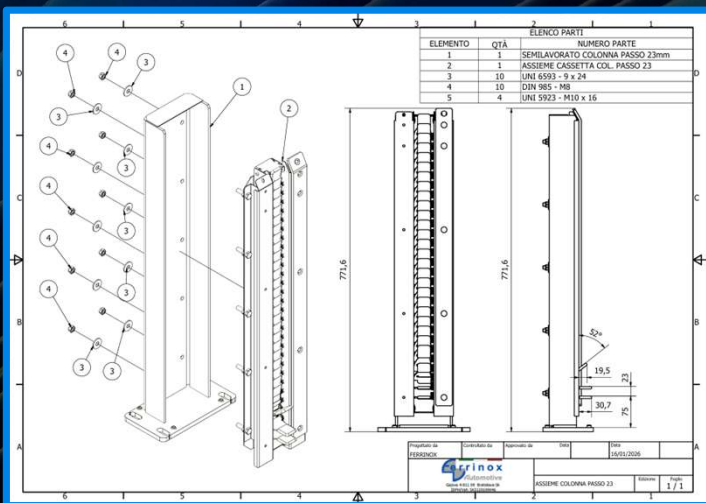


Ferrinox Automotive a.s. continues this continuity with the same proprietary know-how, the same methodology and the same attention to quality that have made the original technology a well-established benchmark in the sector.



Technical continuity is ensured by the same engineering leadership which, since 2003, has developed and refined automatic stacking solutions, guaranteeing design consistency, high reliability and the continuous evolution of proprietary technologies.

Focus and Service



Activities: We work on an ongoing basis with integrated-system suppliers, manufacturers of containers equipped with automatic columns, and industrial automation companies.



Engineering Delegate In addition to the full technical development of the container equipped with columns and related systems — from the initial analysis through design, prototyping and final validation.



Advanced Technical Services

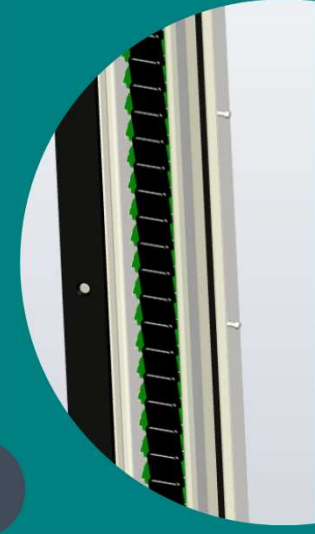
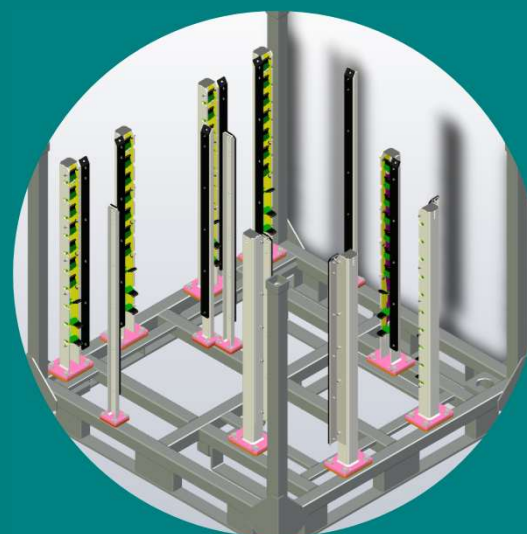
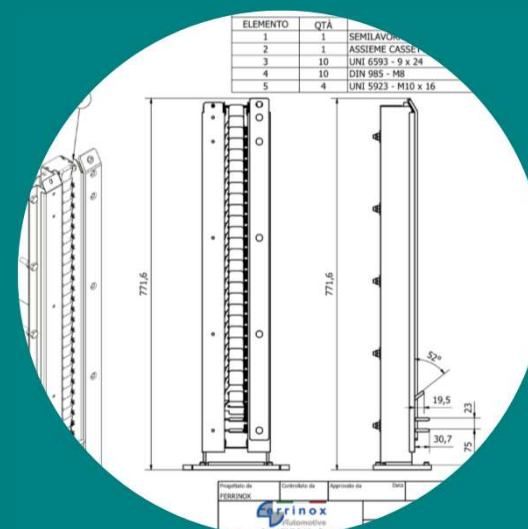
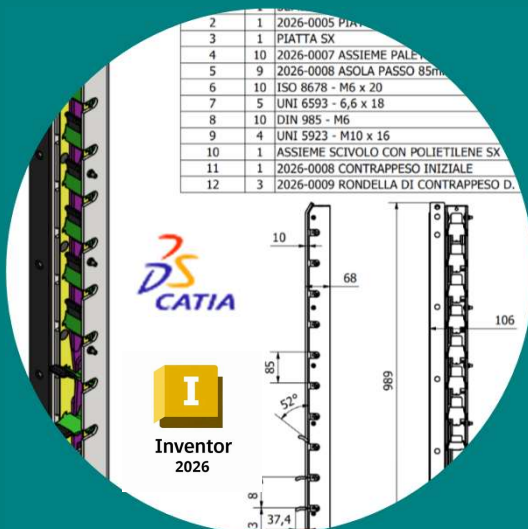
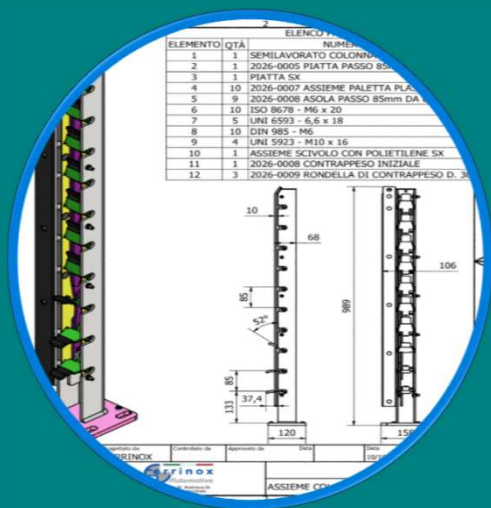
- Technical and functional validation of stacking systems
- Reverse engineering of existing components and solutions
- Optimisation of columns and containers already in service
- Technical audits on third-party columns



Ferrinox Automotive a.s. operates in full compliance with the confidentiality of the technical and commercial information provided by its clients.

Design

- The know-how acquired over the years has enabled and continues to enable the development and integration of Stacking Pillars into multiple automatic stacking and handling systems, adapting them to all configurations and materials used in vehicle-production environments.

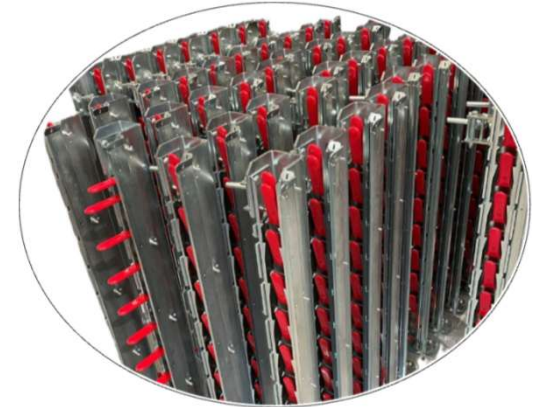
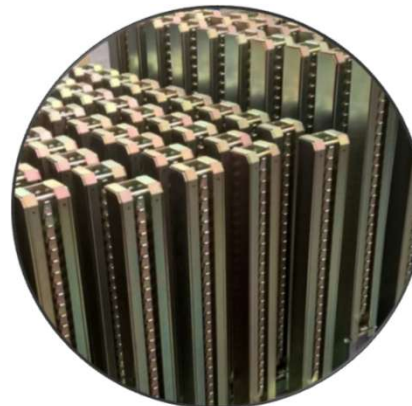
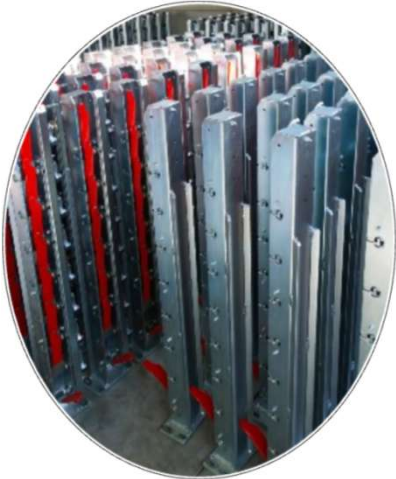
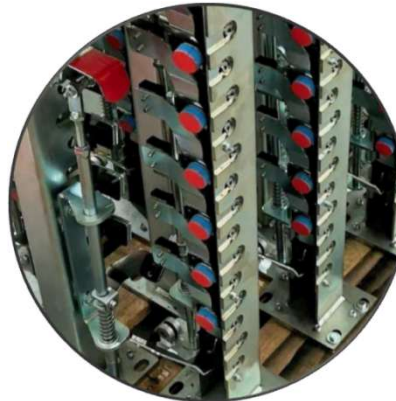




**Technology
and know-how**



The original patent and
the know-how acquired
over the years enable us
to develop solutions
without limits.

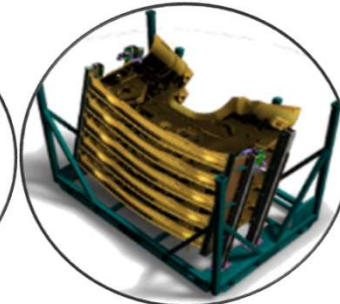
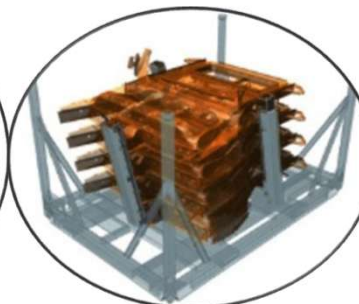
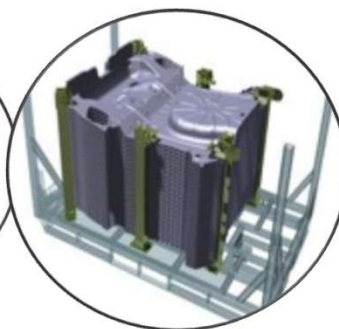


Applications for automotive racks

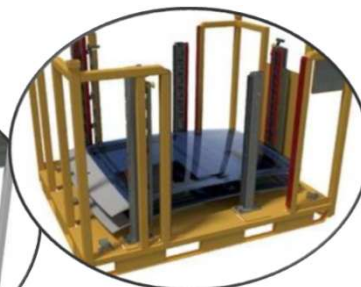
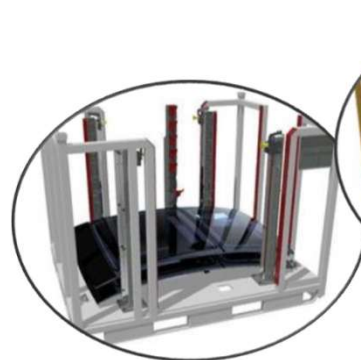
Horizontal System



Vertical System



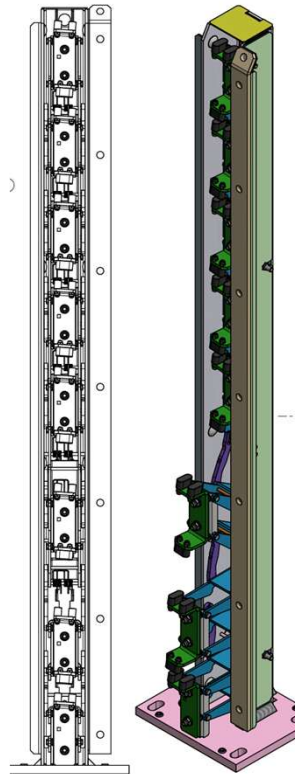
Glass Roof
System



With a pitch starting at
10 mm

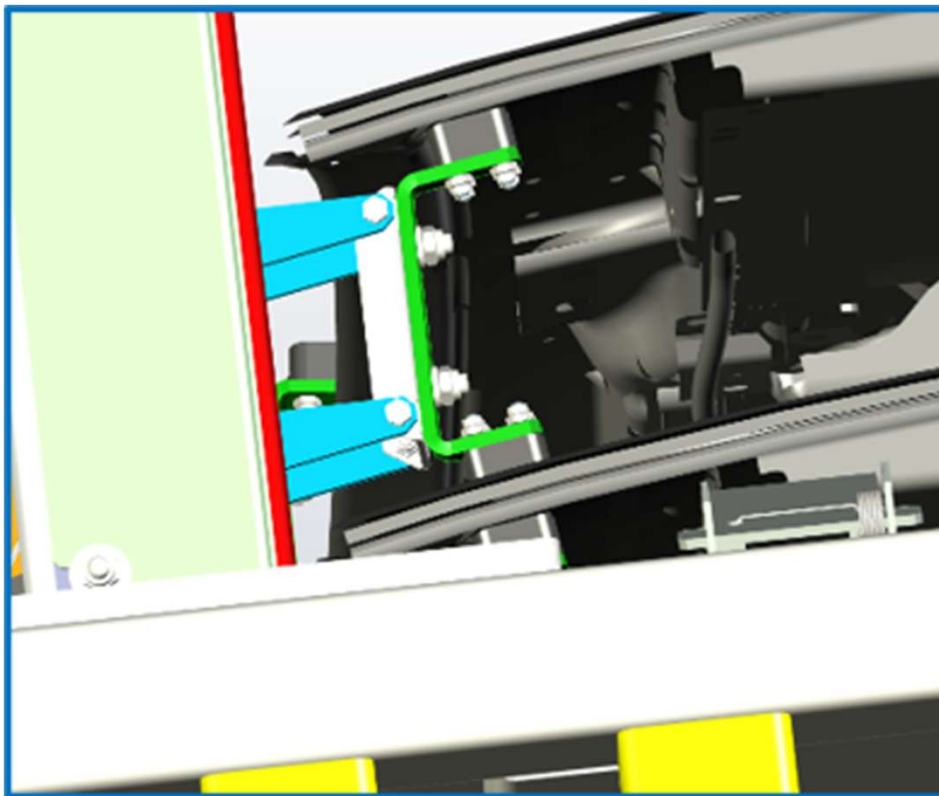
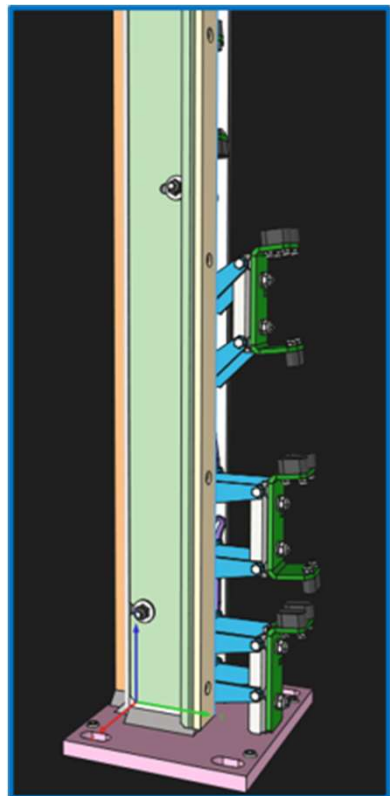
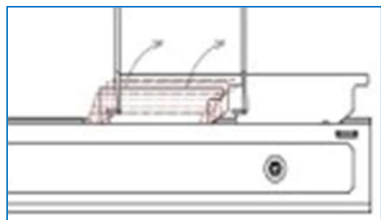


Multi-Link – System Stacking Columns for Panoramic Glass Roof



Multi – Link –System - Columns for Panoramic Glass Roof

- Technology validated by more than 10 years of applications in the Automotive and industrial sectors



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
25 June 2015 (25.06.2015)

(10) International Publication Number
WO 2015/092537 A1

(51) International Patent Classification:
B65G 1/14 (2006.01)

(21) International Application Number:
PCT/IB2014/002887

(22) International Filing Date:
15 December 2014 (15.12.2014)

(25) Filing Language: English
(26) Publication Language: English

(30) Priority Data:
MI2013A002111 17 December 2013 (17.12.2013) IT

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,

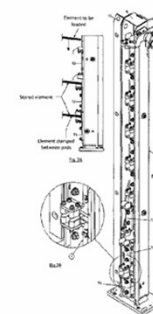
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KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
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TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
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DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— of inventorship (Rule 4.17(iv))

Published:
— with international search report (Art. 21(3))
— with amended claims (Art. 19(1))

(54) Title: AUTOMATIC STACKING COLUMN FOR STORING AND TRANSPORTING ELEMENTS



(57) Abstract: An automatic column (21) for storage and transportation of elements is disclosed, more particularly elements to be assembled in production lines of the automotive industry. The column comprises a set of loading blocks (3) for the elements to be handled, wherein each loading block, when one element is placed on it, causes the overlying block to be lowered in preparation to receive a subsequent element, at the same time clamping the loaded element between vibration dampening pads (31).

Stacking column with self-locking fingers
technology for panoramic glass roofs.

Multi – Link –System - Columns for Panoramic Glass Roof

• TECHNICAL

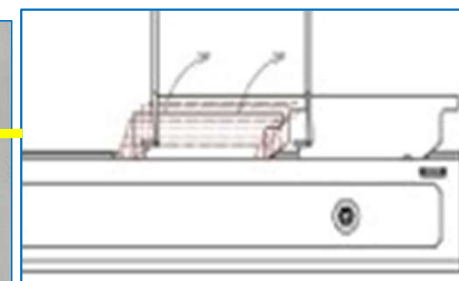
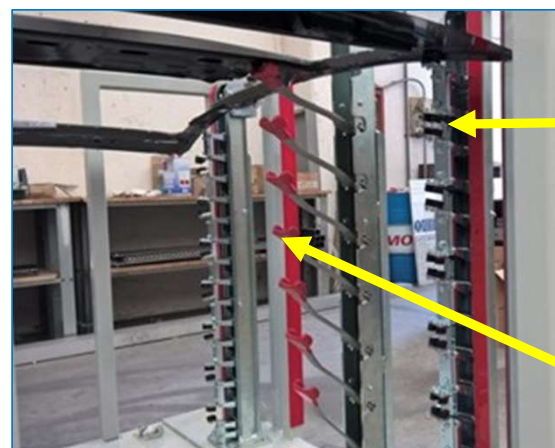
The supports provide lateral and longitudinal restraint, preventing translation and rotation of the roof module during handling and transport. The system is designed to ensure component retention up to 1.0 g of horizontal acceleration, a value consistent with the expected operating conditions for road transport, forklifts, and AGVs.

- The maximum mass considered for the roof module is 30 kg. Accelerations exceeding 1.0 g—caused by impacts, collisions, or extreme manoeuvres—fall outside the scope of this design. Under such exceptional conditions, the roof module may shift by a few millimetres from its nominal position.

• TECHNICAL

The number of supports is defined according to the mass of the roof module, in order to keep the load on each individual retention point at approximately 50 N under 1.0 g of horizontal acceleration. Up to 10 kg, 2 diagonal supports are used; between 10 kg and 20 kg, 4 supports; between 20 kg and 30 kg, 6 supports; above 30 kg, 8 supports.

- This configuration ensures a balanced distribution of forces and the correct anti-translation and anti-rotation function of the roof module during handling and transport.



- Optional containment support for heavy loads

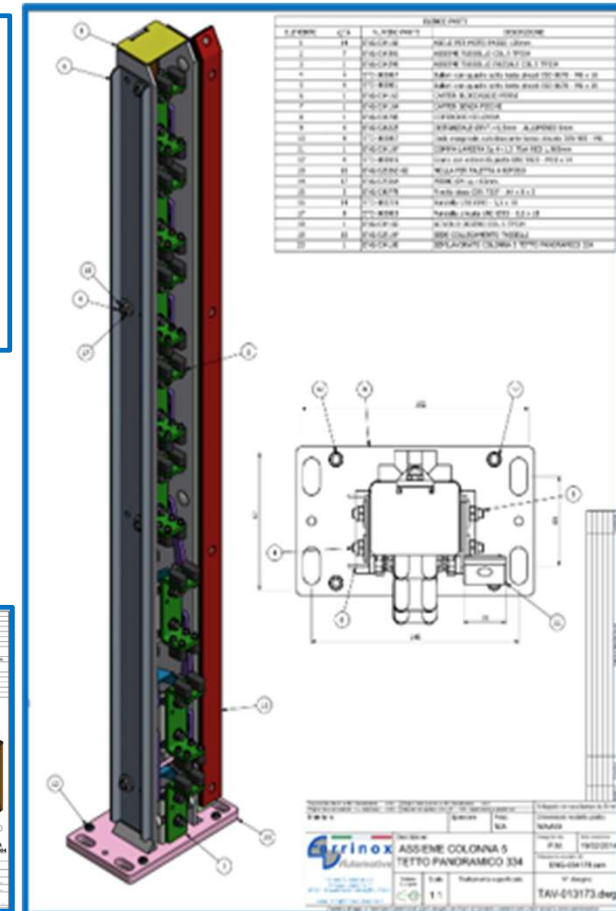
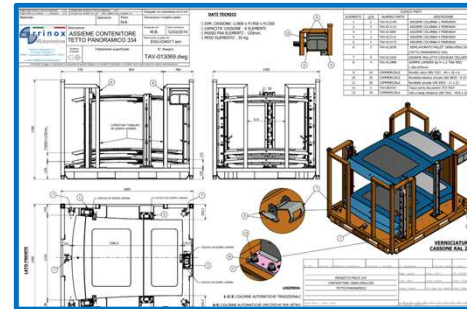
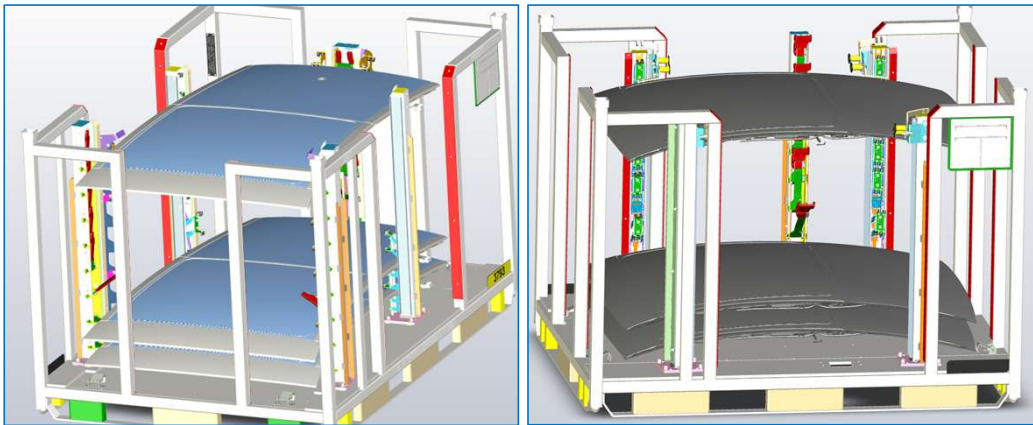
Multi – Link –System - Columns for Panoramic Glass Roof

- **The adopted technology**

Validated across multiple applications, it ensures a roof-locking system with high structural stability and zero relative slippage, even during handling and positioning operations. This performance is achieved thanks to a constraint featuring a high friction coefficient and low sensitivity to micro-slippage phenomena.

Moreover, compared to traditional columns, the system offers optimized overall dimensions and lower total mass, while fully maintaining the required stiffness, load-bearing capacity, and operational safety under the expected service conditions.

- **Reduced** overall weight and dimensions, combined with high internal kinematic stiffness.
- **Reinforceable** structure for heavy loads

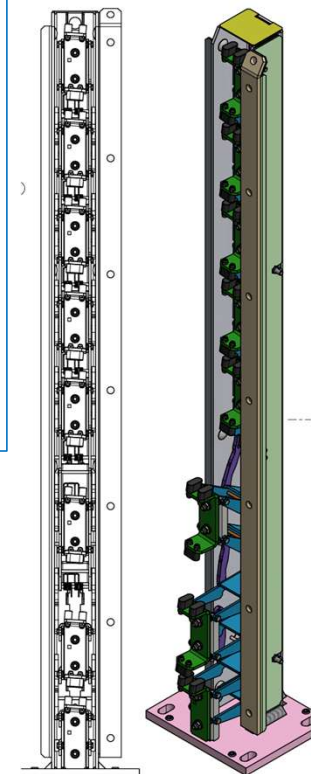


Multi – Link –System - Columns for Panoramic Glass Roof

- Support sizing rule based on weight
To keep the load per support at approximately ≈ 50 N under 1 g,

up to 10 kg $\rightarrow$ 2 supports (diagonally arranged)
>10 kg and ≤ 20 kg $\rightarrow$ 4 supports
>20 kg and ≤ 30 kg $\rightarrow$ 6 supports
>30 kg $\rightarrow$ 8 supports
- This progression keeps the load per support constant, regardless of the module's weight.

- Assuming a maximum roof-module mass of 30 kg and a design horizontal acceleration of 1.0 g (9.81 m/s^2), the resulting inertial force is 294 N.
- Distribution across 6 supports yields a load of approximately 49 N per support. For masses above 30 kg, 8 supports are used, keeping the load per point within values compatible with the mechanical capacity of the system.



<i>Panoramic roof weight</i>	<i>Fingers required for each roof</i>	<i>Total force at 1 g (N)</i>	<i>Support force (N)</i>
10 kg	2 and 2 classic fingers	98 N	49 N
20 kg	4	196 N	49 N
30 kg	6	294 N	49 N
35 kg	8	343 N	43 N

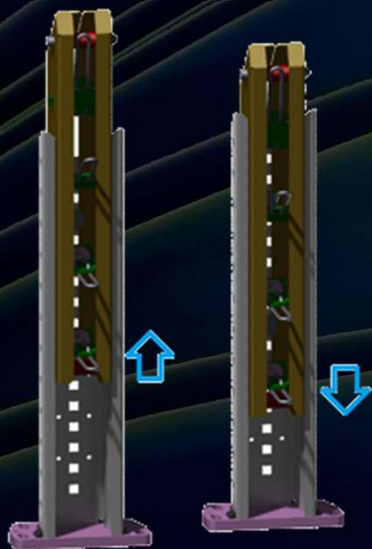


Low -cost -Automation

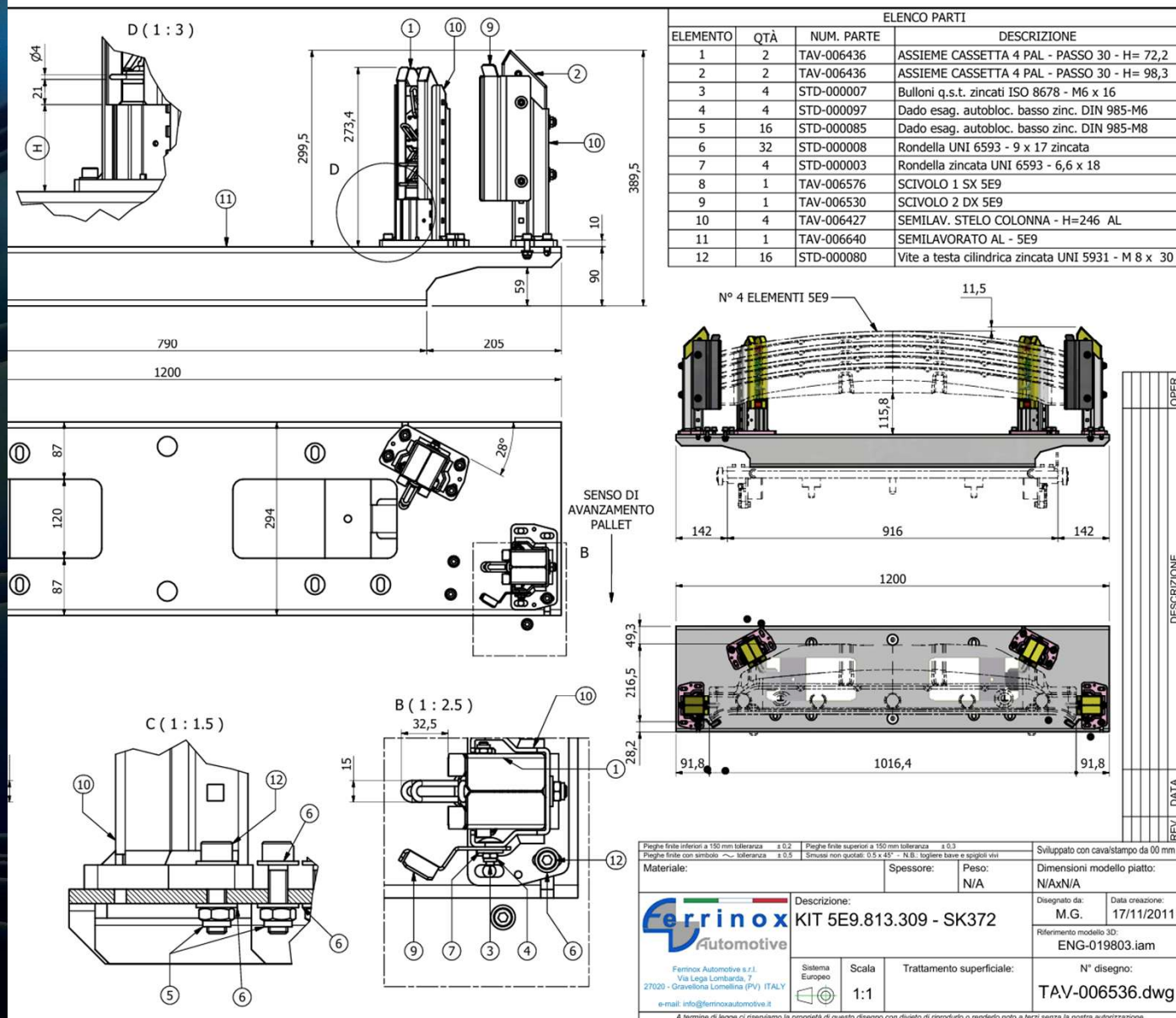


L.C.A. (Low Cost Automation)

S.A.C. (Standard Adjustable Column)

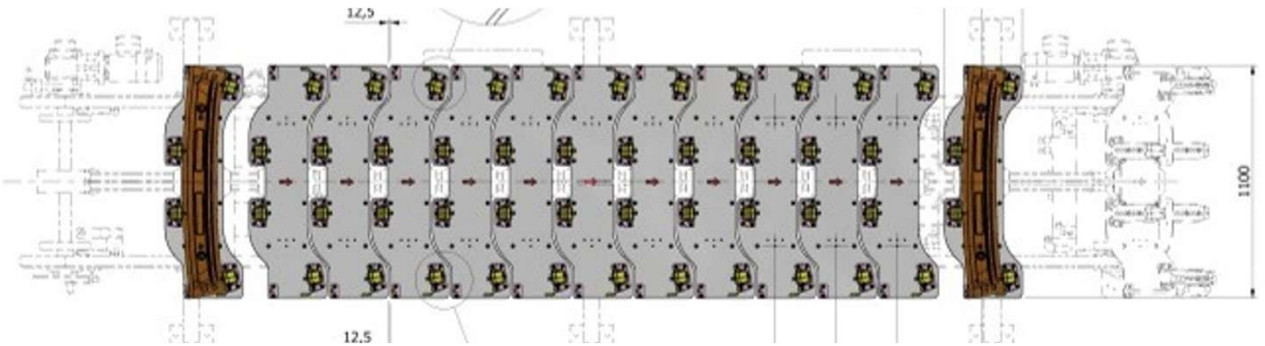
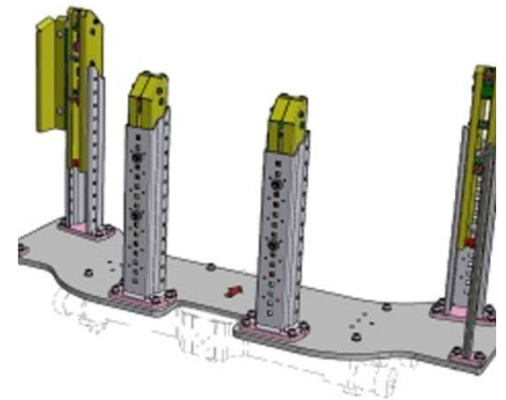
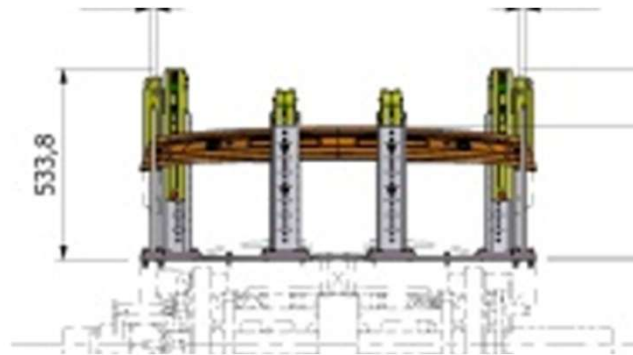
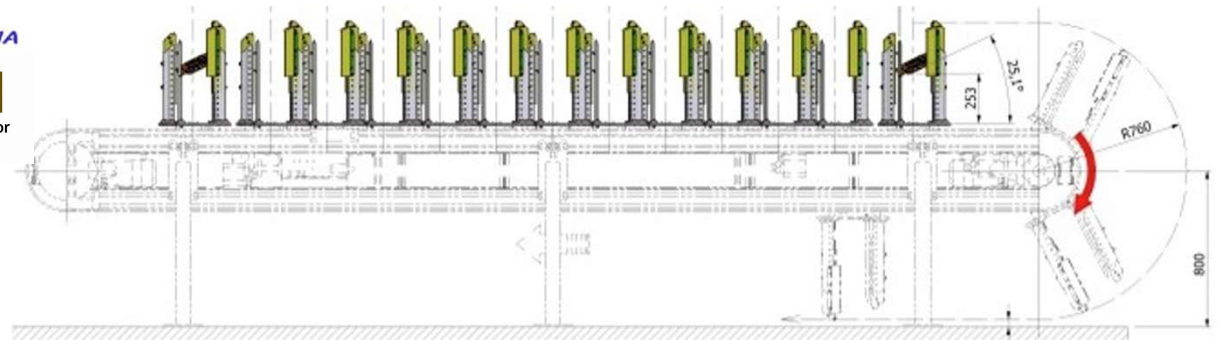
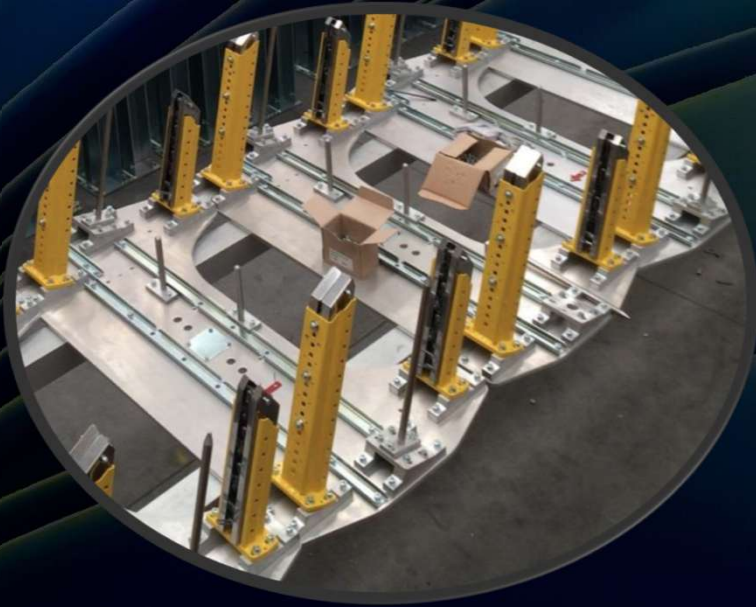


Ultralight column to optimize
the overall system weight



L.C.A. (Low Cost Automation)

S.A.C. (Standard Adjustable Column)



L.C.A. (Low Cost Automation)

S.A.C. (Standard Adjustable Column)

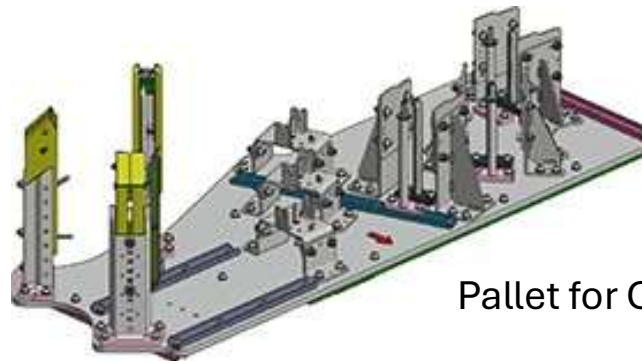
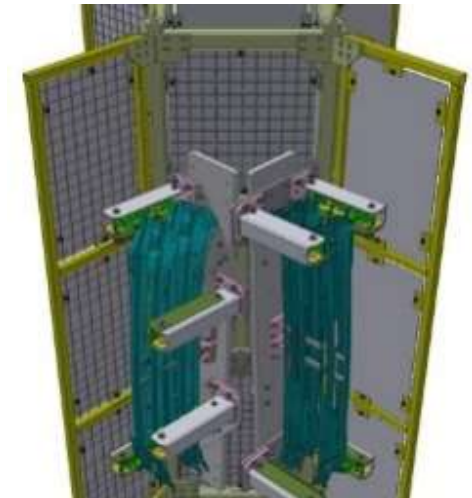


Ultralight column to optimize
the overall system weight

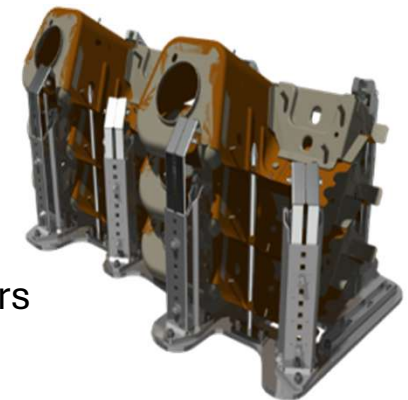
Trolley



Horizontal Turntable



Pallet for Conveyors



L.C.A. (Low Cost Automation)

S.A.C. (Standard Adjustable Column)



Millimetre-precise adjustment allows for optimisation of the robotic process and guarantees high adaptability to the components to be picked.

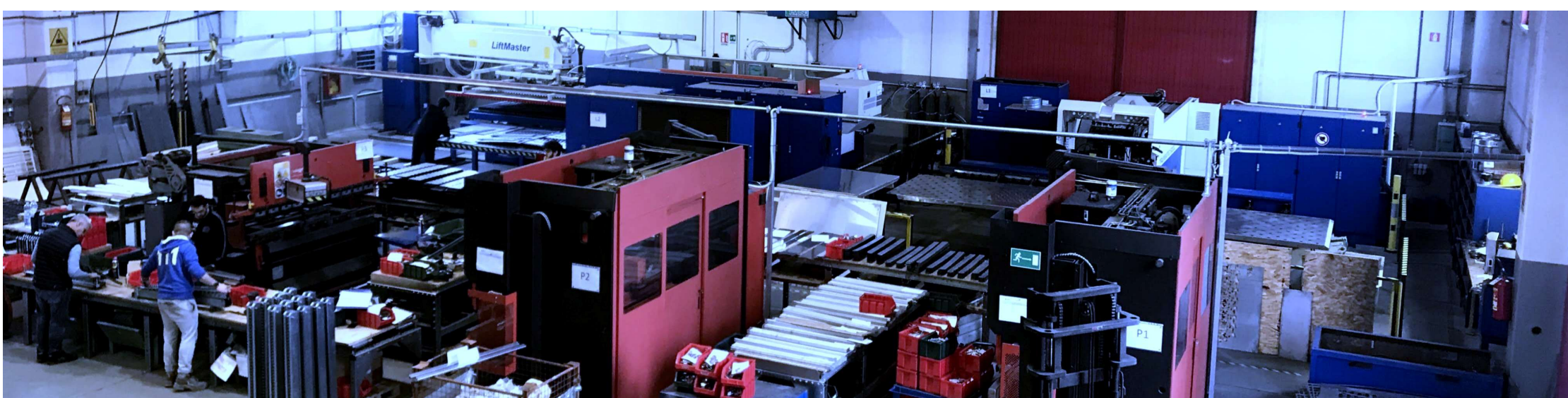
Standard systems in stock

Series 350				
Technical features		SAC 40 /350	SAC 50/350	SAC 60/350
* Max. number of positions / Capacity	Q.ty	6	5	4
Step - mm	mm	40	50	60
Initial position: 50 mm, incrementally adjustable	mm	50	50	50
minimum overall height	mm	350	350	350
maximum adjustable height	mm	600	600	600
* Specify the required number of position				
3D formats will be provided upon request				
Other customized formats available				

Series 450				
Technical features		SAC 40 /450	SAC 50/450	SAC 60/450
* Max. number of positions / Capacity	Q.ty	8	7	6
Step - mm	mm	40	50	60
Initial position: 50 mm, incrementally adjustable	mm	50	50	50
minimum overall height	mm	450	450	450
maximum adjustable height	mm	750	750	750
* Specify the required number of positions				
3D formats will be provided upon request				
Other customized formats available				



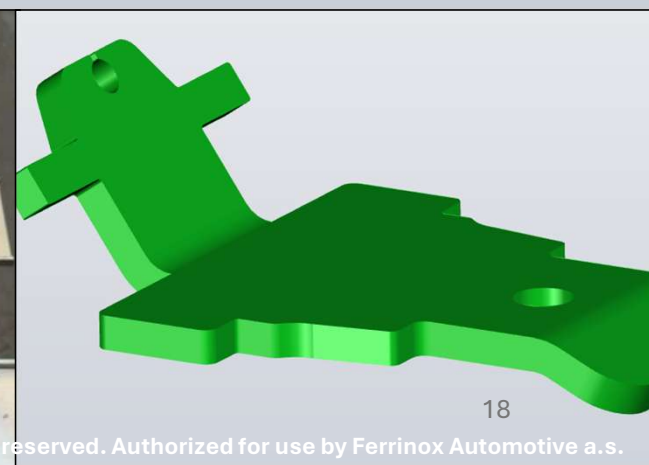
Proprietary technology and know-how – Since 2003



Technology and Guarantee

- **The proprietary technical originality** of the system lies in the **hourglass-shaped hole architecture**, the **one-piece latch**, and the **rectangular rotation pin**. This design solution allows the latch to position itself both in the lower and upper dead points, ensuring enhanced ergonomics, operational precision, and absolute long-term reliability. The system is a consolidated technical benchmark in the sector.
- **ZERO MAINTENANCE** The design approach adopted for each individual solution, combined with equipment featuring centesimal tolerances, ensures consistent performance throughout the entire production life cycle of the vehicle, without maintenance.

Hourglass Architecture: the original patented technology



- From 2003 to today, the technical direction carried out by Mr. Violante has remained consistent, ensuring methodological continuity and ongoing professional development. The engineering solutions developed over the years have been applied for many years in various European production environments, contributing to consolidated industrial processes.



The origin of the technical solutions

presented traces back to the first patent developed by Mr. Alberto Violante within the sole proprietorship Ferrinox, which formed the foundation for the subsequent path of innovation.



The technologies and technical contents presented are original works of the author and are used by Ferrinox Automotive a.s. within the scope of its industrial and commercial activities.



Stacking Columns

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Thank you for your attention