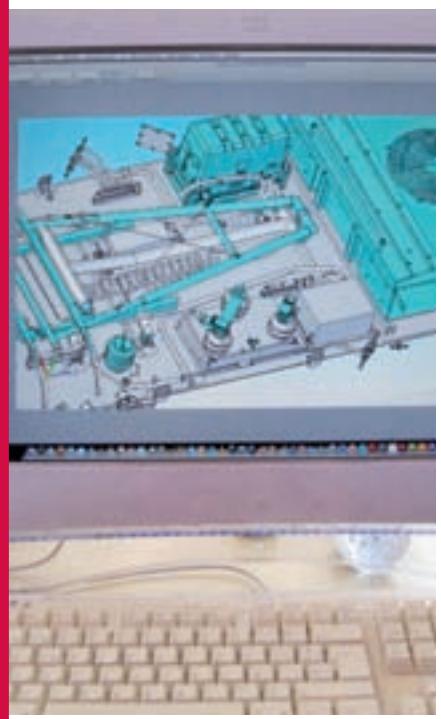


Traction systems

index

Ingeteam

UT 3500

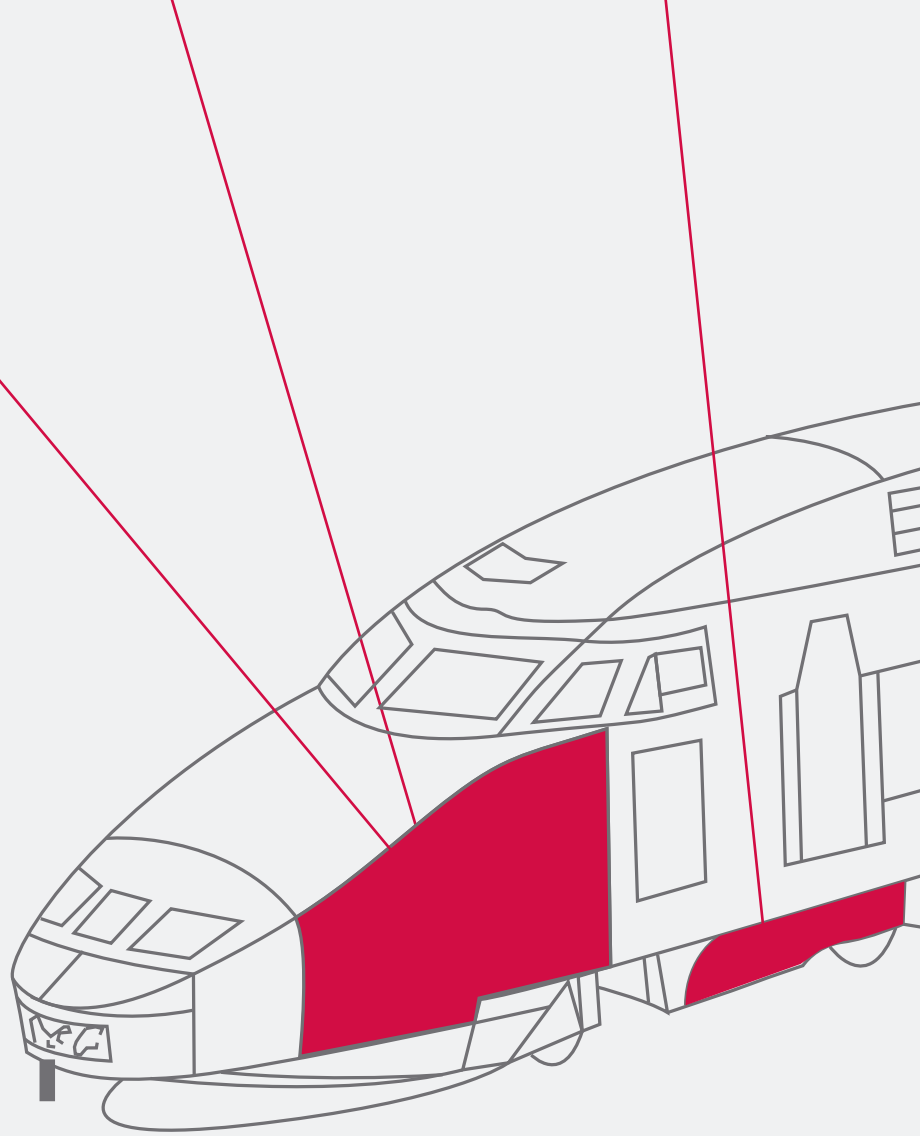
UT 200

Bilbao Tram

Vehicle control unit (VCU)

Human-machine interface (HMI)

Traction motor



TRAVCA 250

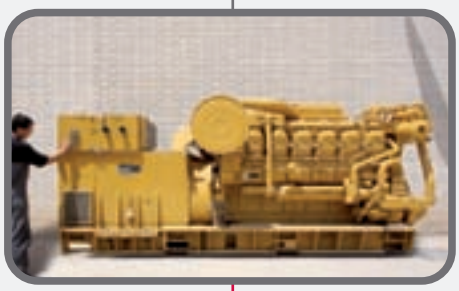
ED 74

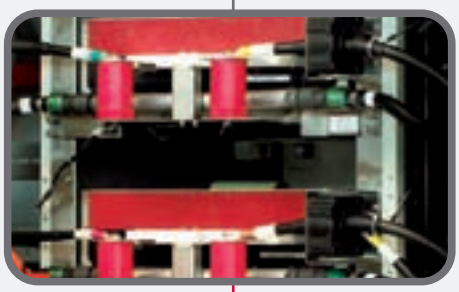
TD 2000

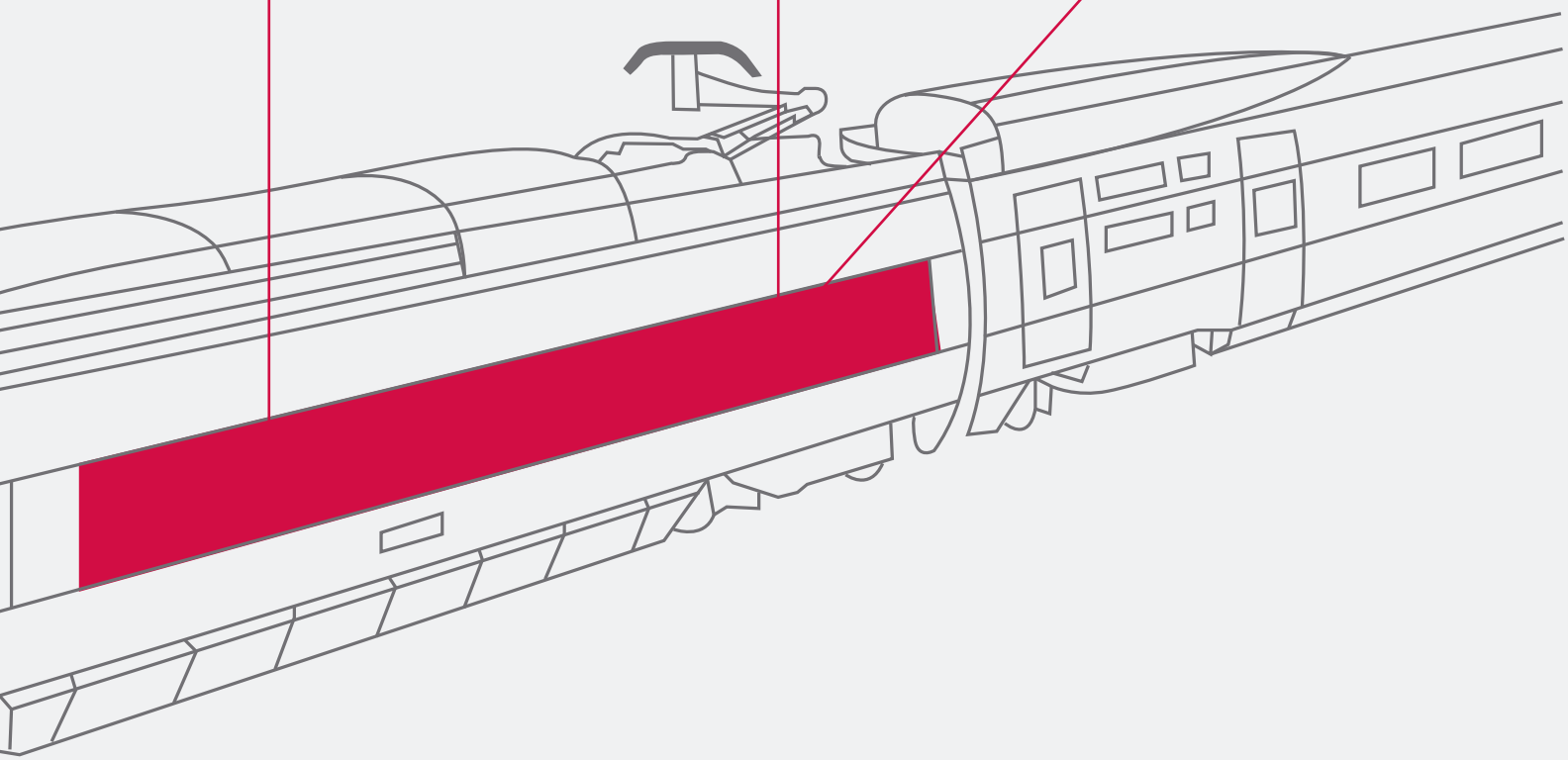
Engine generator group

Traction converter

Auxiliary converter



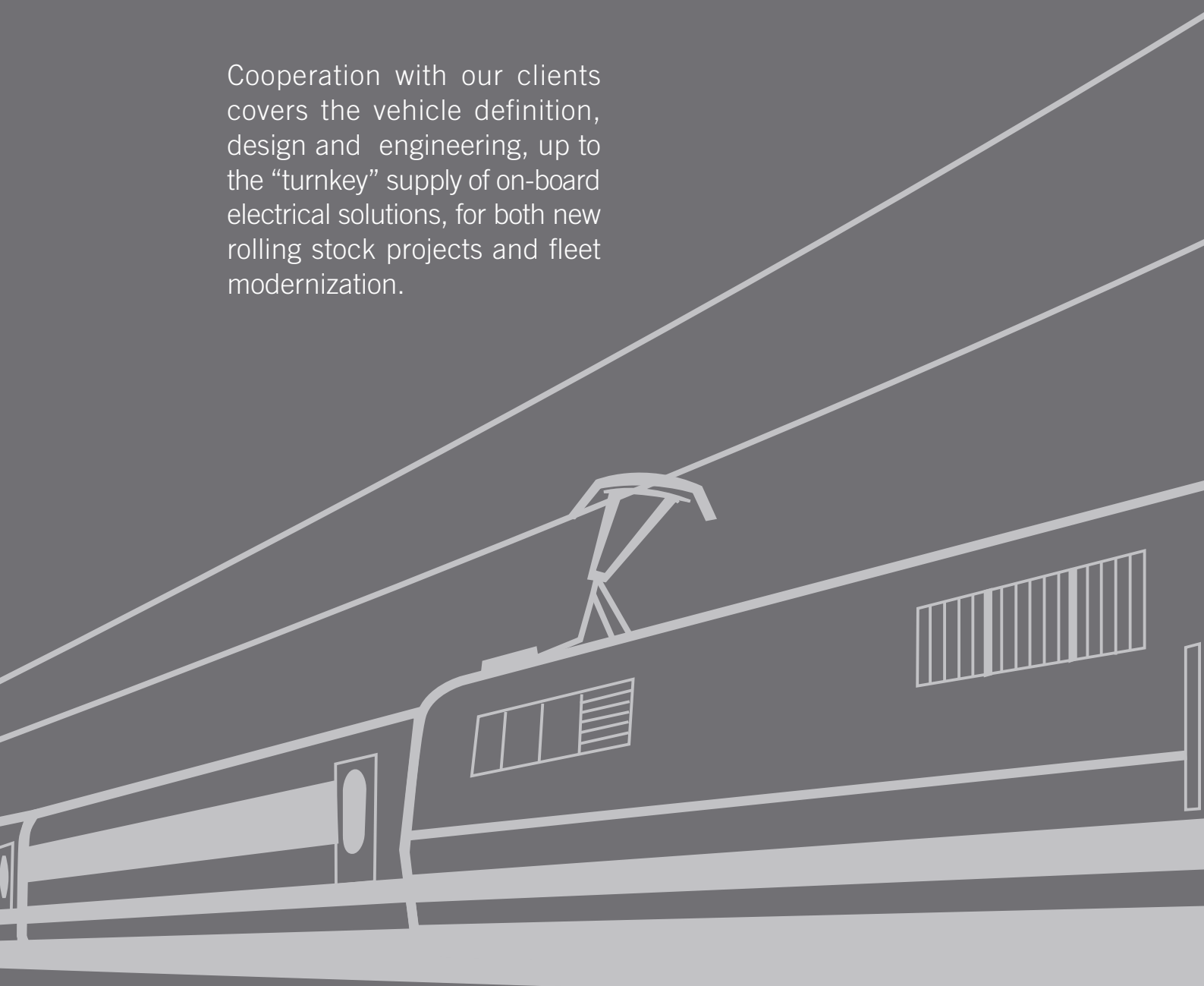




Ingeteam Traction designs and supplies complete traction, control and auxiliary systems for trams, EMUs, locomotives and high-speed trains, based on in-house technological developments in the field of control and power electronics, with the goal of maximizing the availability and performance of trains, as well as the offer of comfort and safety.

Cooperation with our clients covers the vehicle definition, design and engineering, up to the "turnkey" supply of on-board electrical solutions, for both new rolling stock projects and fleet modernization.

Our capabilities and experience in the railway sector allows us to offer advanced solutions that contribute towards significant improvements to railway operation, focusing especially on operating costs, reliability, availability, maintenance and energy consumption.



Philosophy

Our priorities in tackling projects are:

Proximity to the client

The key for the success of all projects is joint collaboration with our clients, from the definition phase of the project, during commissioning and the subsequent assistance phase of each project.

Flexibility

As an equipment designer and manufacturer, we provide customised solutions suitable to meet each of our clients' individual needs, by developing and supplying the optimal solution for each project.

Minimizing operating costs

Since we are conscious of the challenges railway operators face to optimize the life cycle cost (LCC) of rolling stock, we pay special attention to:

Maximizing energy performance: our solutions seek to optimize the efficiency of the system by reducing consumption and by incorporating energy recovery systems.

Reliability and availability: our systems are known for maximizing the rates of reliability and availability of rolling stock, thanks to our analysis based on the AMFE model, advanced simulation tools and finally an exhaustive final testing process.

Low maintenance cost: in the design phase, we take into consideration maintenance activities, in such a way that our systems incorporate advanced diagnosis tools and a high degree of modularity and standardization so that these activities can be carried out at the lowest cost and the greatest efficiency possible.

Experience

Since it was founded in 1972, our group has been known for the development and supply of innovative solutions in the field of electrical engineering. The technological effort of the divisions, their knowledge and experience are applied to the development of solutions directed at energy control through the application of electrical power systems and the automation, control and supervision of processes in different spheres of activity.

Ingeteam Traction's presence in carrying out projects in the railway sector is backed by our mastery when it comes to combining extensive experience in the development and supply of electronic power and control equipment with our knowledge of rolling stock engineering and railway operations. The traction systems developed by Ingeteam Traction have been successfully applied in the most demanding railway environments, both electrical traction and diesel-electric, as well as conventional and high-speed rolling stock.

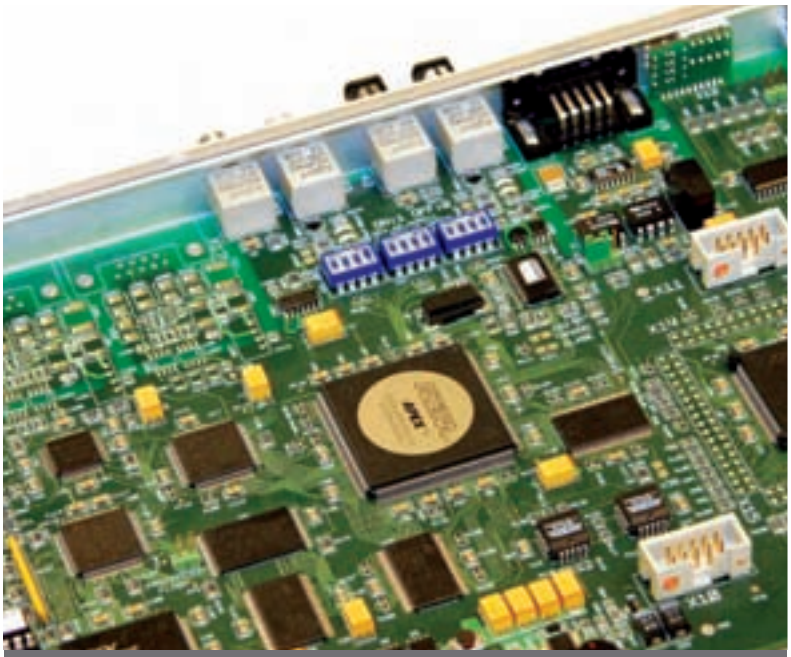
R&D

Our strategy is based on continued investment in research and development in the electro-technical field, focused on power and control systems, as well as the use of exclusive technologies and in the application of in-house processes. To that end, we have a qualified team working in modern labs and testing facilities with the most advanced simulation tools available on the market.

In the field of power electronics, systems have been developed that incorporate the latest technology in semiconductors applied to a wide range of voltages and power levels, put to the test in the most demanding environments within the energy, iron and steel, marine and railway fields. In this context, we work in close collaboration with the design teams of the main manufacturers of power semiconductors, incorporating the latest state-of-the-art developments in IGBTs or more recently in IGCTs or IEGTs.

In the field of control systems, the R&D activity found its first success with the first automation units developed in 1982. Expansion in R&D activities has led to the development of the current distributed systems that have been incorporated in some of the most advanced projects in the railway market.

Quality



The excellence of our products and services is our reason for existance, as well as the goal behind all our production processes and the tasks that our collaborators carry out. In keeping with this policy, we apply error analysis and continual improvement processes to our management, placing special emphasis on critical components. To this end, we demand the highest levels of quality from our approved providers and cooperate with them to incorporate the most advanced and reliable components in our products.

Our management system is recognised by ISO 9001 and 14001 certifications. Our processes are aligned with the agents and results of the EFQM excellence model. Likewise, our organization is seriously committed to the requirements imposed by IRIS standards.

Service

We consider that proximity and adaptation to the client's needs is fundamental to the success of each project. For this purpose, we maintain a relevant geographic presence and make our organizational structure flexible.

Our effort to strengthen collaborative relationships and maintain the trust of our clients brings us to adapt project management and our procedures to each client's specific needs and to maintain an organization that offers a service that is close at hand.

One main feature of our business model is offering competitive advantages for the products and projects, and our commitment is to satisfy the needs of our clients, meeting their expectations.

Ingeteam Traction's Offer

Supply of the traction system

At Ingeteam Traction, we design and manufacture comprehensive traction systems using in-house technology and know-how to offer a very high energy performance, maximum reliability and reduced maintenance costs, adapted to our clients' requirements and their needs to minimize the life cycle costs (LCC) of rolling stock.

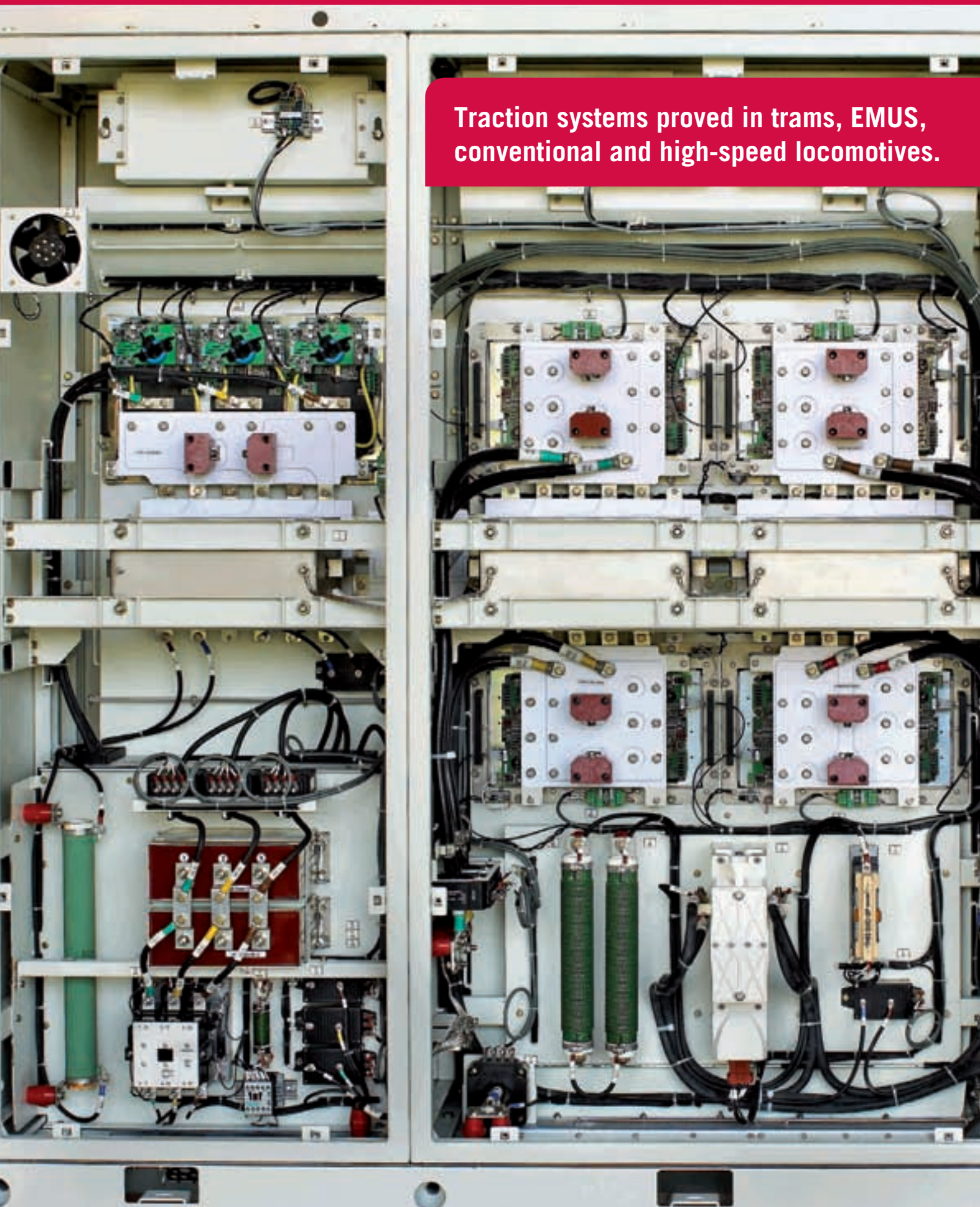
Our traction systems, including traction converters, electrical machines and auxiliary elements, cover a whole range of catenary voltages (750 Vdc, 1,500 Vdc, 3,000 Vdc, 15 kVac, 25 kVac) and power levels, for light tramcars, metros, EMUs, rail tractor units and high speed locomotives.

In the development and manufacture of our traction converters, we apply the latest advances in the field of power semiconductors, and we pay special attention to modularity along with a high degree of standardization; these are the key aspects that allow us to offer high rates of reliability and reduced maintenance costs.

In this field, we maintain a policy of close collaboration and preferential agreements with the main suppliers of power semiconductors and other critical components, for the purpose of incorporating state-of-the-art components into our products and ensuring the supply chain of these products.

Ingeteam Traction's industrial activity also includes design and manufacture of electric generators for diesel-electric solutions and traction motors adapted to the individual requirements of each project. 200-class insulations are applied in all of these in order to minimize weight and size in both open and closed solutions, self-ventilated or forced cooling solutions.

Finally, in cooperation with our suppliers' design departments, we specify and integrate auxiliary elements for the traction system like pantographs or transformers.



Traction systems proved in trams, EMUS, conventional and high-speed locomotives.

Ingeteam Traction's Offer

Auxiliary power supply systems

IngeteamTraction designs and manufactures auxiliary power supply systems for rolling stock that are light and compact for the entire range of catenary voltages, with the possibility of being integrated into the traction converter.

From the initial design phase of these systems, we take into account that it is fundamental to obtain the best energy performance, a modular construction and minimize life cycle costs.

Its main characteristics are:

- Solutions for all kind of catenary systems: continous voltage catenary of 750 Vdc, 1,500 Vdc or 3,000 Vdc networks, as well as 1,000 Vac or 1,500 Vac 16 2/3 Hz or 2500Vac 50 Hz for AC catenary systems.
- Easy maintenance, thanks to modular design of equipments and advanced systems.
- Equipment for different power ranges.
- Communication with control system via TCN, CAN, RS-485, and other communication buses.
- The power circuit switching devices are state-of-the-art IGBTs, specific for traction.
- The cooling of the auxiliary converter is carried out by natural, forced-air ventilation or water, depending on the output power and the client's preferences.

Our offer includes battery chargers based on resonant or high-frequency circuits to minimize the space required and weight, and to be integrated with the auxiliary converter itself.

Reliability, modularity and availability

Ingeteam Traction's Offer

Vehicle control

Ingeteam Traction's experience in the development and manufacture of control solutions, for application in different sectors, makes it a leader in the design and manufacture of vehicle control systems and human-machine interfaces. These are based on in-house control electronics platforms that allow for programming in open languages in accordance with IEC Standard 1131-3.

These systems are conceived for use in distributed configurations, minimizing the wiring, and may be connected both by means of TCN protocol (MVB or WTB) in accordance with IEC 61.375-1 and other bus protocols.

The conception of the vehicle control electronics (VCU) is carried out fulfilling the requirements demanded by railway standards and covers all needs for control, monitoring and communications of any kind of rolling stock, from LRVs, EMUs, conventional and high-speed locomotives.

Among said needs, the following stand out:

- Control of train propulsion and braking.
- Control of auxiliary converters and battery chargers.
- Monitoring and driver-assistance systems.
- Management of the trains' on-board systems and their communication with a ground station.
- Maintenance diagnosis and assistance system.

Finally, we integrate the signalling systems required for vehicle operation (ERTMS or others), as well as the communication elements (GSM-R or others) so as to provide a comprehensive control system for the vehicle.

Design and development of comprehensive control systems

Ingeteam Traction's Offer

Comprehensive on-board electrical system engineering

Our vocation is to work side by side with our clients throughout the various phases of the project. From the initial phase we contribute with our experience in the analysis of a system's performance, and starting with the original system in the case of renovations, right up to the final phase, to offer optimal solutions in terms of both performance and cost.

In this process, all the necessary simulations are carried out to guarantee the proper power specification of the traction system in keeping with the track profiles, the aerodynamics of the vehicles and acceleration requirements.

Likewise, we execute the specifications for all the on-board electrical components, traction system, control, auxiliary power supply, communications, signalling, security and comfort, integrating said systems in the engineering of the train.

Our engineers then proceed to program the various control systems of the vehicle, its commissioning and subsequent approval, thus supplying a “turnkey” project.

Maintenance

As part of a comprehensive offering, our commitment is to guarantee the best service during operation.

We provide highly qualified and experienced teams and the necessary means for the maintenance of the electrical systems installed aboard, to ensure that the specified ratios of reliability and availability are complied with.

Our extensive offer of services and systems maintenance is supported by our mastery in developing and executing complex projects, and in the qualifications of our technical teams.

Electric and diesel-electric traction

Comprehensive solutions for new rolling stock

Within our collaboration with clients, both rolling stock manufacturers and operators, our capacities allow us to offer a comprehensive traction and control system for new rolling stock. From specifications and engineering, the integration of the different elements offered by Ingeteam Traction and the remaining subsystems necessary for rolling stock operation, we work side by side with our clients in obtaining the corresponding approval certificates and cooperating in maintenance.

Our participation includes the following:

Design of the optimal configuration

Our engineers collaborate in the specification of equipment and systems so they meet all the dynamic requirements of rolling stock.

Calculation of energy consumption

Our experience in the field of power electronics applied to energy, enables us to design and supply systems that minimize energy consumption.

Maximum safety

The engineering considers the necessary criteria to minimize the risk of accidents, both during operation and in maintenance stops, by means of the corresponding security measures, such as interlocking and redundant systems.

Maximum reliability and improvement of maintenance conditions

Our systems are designed keeping the ease of maintenance in mind. We also offer a modern diagnostic system that allows for incidents to be located quickly. These factors, along with low energy consumption, allow our solutions to reduce the life cycle cost (LCC) of the project.

Interoperability criteria

The design and engineering of our equipment is carried out keeping in mind the interoperability criteria that allow for the use of the vehicle by different operators.

Interior comfort through multimedia technologies

As part of the engineering of the rolling stock, we integrate the most modern multimedia systems to provide the maximum quality in interior equipment and offer the greatest comfort to passengers.

Minimization of energy consumption and maintenance costs

Modernization of rolling stock

Ingeteam Traction offers operators the possibility of renovating the electrical traction and control system of the rolling stock, obtaining the advantages contributed by our modern traction systems, but with a lesser investment and a reduced project execution time.

The high costs of maintenance and operation of a fleet of vehicles, as well as insufficient dynamic performance, frequently oblige the operator to make investment decisions on the modernization of the equipment.

Our modernization proposals are especially suitable when the mechanical components of the fleet are in good condition and only require conditioning or cleanup, and however, direct current traction systems often show reliability problems which considerably reduce the dynamical performance.

The advantages obtained in this type of project are:

Greater availability

The new alternate-current traction systems offer greater reliability than the traditional direct-current systems. This, along with the lower number of necessary electromechanical elements, allows for greater fleet availability, improving the returns on the investment in rolling stock.

Lower maintenance costs

Alternate-current systems, especially asynchronous ones, require less maintenance since they present no problems with brushes, collectors, camshafts, contactors and electromechanical parts in general. This situation, along with a lower cost for replacement parts for the alternate-current systems, allows the fleet maintenance costs to be significantly reduced.

Lower energy consumption

The possibility of returning energy to the catenary wire via regenerative electrical braking means important savings in operational costs, taking into account the evolution of energy costs.

Greater comfort

The precision in traction control offered by the new traction systems contribute to jerk control, leading to improved comfort for the passenger. This advantage therefore contributes to offer a perception of improvement of the service on the part of the user.

Improvement of dynamic performance.

The dynamic performance of rolling stock improves thanks to the remodelling of the traction system, facilitating the use of rolling stock on lines with greater demands or the reduction of operational times, given that the new alternate-current systems allow for greater performance in the same space.

Extending the useful life of rolling stock.

With the renovation of the traction system the useful life of the rolling stock is extended for the purpose of optimizing the existing fleet.

Reduction of life cycle cost (LCC)
Improved disponibility

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