

40 Years of Excellence





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Welcome to PEC

40 Years of Excellence



Starting from the initial projects in the nineties with Duracell and Samsung, PEC became a seasoned player in the test and manufacturing equipment industry for advanced, Lithium-Ion batteries. Our experience and the, at our customers sites installed cell finishing capacity for over one million cells daily, makes us one of the most accustomed suppliers worldwide.

But performance is more important than experience or size; our test equipment excels in functionality and accuracy, while our innovative cell finishing solutions deliver the best performing cell against the lowest TCO. Maximum simplification, full digitalization, automation and modularity, combined with the lowest possible energy consumption and minimum greenhouse gas emissions, are the cornerstones of our equipment.

Long-time continuing investments in R&D and innovation pay off. Over the last 40 years, PEC transformed its solutions from system integration, over products to a standard, worldwide supported technology and patent portfolio.

Most of you, using prime brand in ear headsets, already experienced a better battery performance from cells manufactured with PEC equipment. With nearly all German, leading US, and several Asian automobile manufacturers as PEC customers, our key role in the electrification and decarbonization is clear. High-end customers clearly appreciate our high caliber products and services.

Also, Central Banks trust us with their valuables, and fully rely on PEC for their daily cash issuing transactions.

An excellent financial performance makes PEC sustainable for its employees, customers, share and stakeholders as a leading and very unique non-Asian technology company in its industry.

For almost 40 years the PEC logo has been a guarantee for excellence in everything we do; something we are very proud of and grateful to all of you that joined and will continue to join us during the next legs of our exciting and challenging journey.

Thank You.

Raf Goossens

CEO



40 Years of Excellence in Automation and Testing

For its global customer base, PEC delivers Turn-Key Systems and Expertise in Energy Storage and Cash Operations. 40 years focus to R&D and functional know-how have turned PEC into a technological and market leader in both industries.

PEC develops, delivers and installs turnkey test and manufacturing systems, including management software to leverage the capabilities of its automated solutions in an industry 4.0 world.

The following applications are our key competence and have been implemented with customers worldwide.

Turn Key Systems for Cell Manufacturing and Testing:

- Turn key test labs for cells and modules
- Turn Key automated Cell Finishing Lines including electrolyte filling, soaking, pre-charge, formation, degassing, final sealing, end-of-line testing, sorting, packing...
- Inline Cell Testing Equipment

Cash Automation for Central and Commercial Banks:

- Automated vaults
- Automated Cash operations (receiving, pre - and post processing)
- Automated Retail Order Picking systems
- Automated filling of ATM cassettes
- End-to-end Cash Management Systems

Industry 4.0 Software

The brain behind all these systems is PEC's Manufacturing and Logistics Execution System, MWare.

Equipment only works when there is functionality to support and automate the configuration, execution and reporting of the automated processes. The architecture is 100% compliant with Industry 4.0, the industry architecture for future proof automation.

All PEC equipment have intelligent front-ends, automatically connecting to the MWare system for system configurations, process variables, process plans, validation, statistical analysis, and even the necessary preventive and predictive maintenance.

MWare consists of 3 standard packages:

- MWare LifeTest provides the required functionality for Lab and Test Automation
- MWare Cell Finishing includes the manufacturing, logistics, quality, process control, maintenance and reporting functionalities for a manual or automated Cell Finishing Line
- MWare Cash Management supports the cash operations of a cash center, including a Web Portal, providing process automation between Central Banks, Commercial Banks, CIT's and Retailers.

Our Story

Founded in 1984, PEC is now headquartered in Budapest, Hungary, with manufacturing, R&D, and project management groups in Belgium, Germany, Hungary, the United States, China and Japan.

Innovation

At PEC, we believe innovation means more than just developing products and solutions. We're working with our clients to create new processes, to help them successfully step up volumes, quality and performance.

Although we will continue our search for automating manufacturing, testing and logistics processes by exploring and inventing new technologies, we're also creating an environment where our employees can bring innovation to bear on every aspect of their jobs.

And we are setting our sights beyond the borders of our industries by exploring new ways of working with an ecosystem of technology suppliers, business partners, universities and institutes. This innovation sets us and our customers apart from competition.

Technology

Our commitment to these global markets and PEC's continued R&D efforts, have resulted in technological leadership and significant growth in all major economical regions.

Our company is staffed world-wide with highly educated experts that combine functional knowhow in Energy Storage and Cash with all required technological domains of our solutions: Robotics, Material Handling, Power Electronics, Embedded Controls, Software Development, Safety and IT Security.

This multidisciplinary skill matrix allows PEC to deliver 100% of the solutions by in-house experts. It is the core of PEC's technological leadership, creating substantial competitive advantages for our customers, in terms of quality, reliability and operational cost.

Project and Support Services

PECs' skilled, knowledgeable project managers, application engineers and installation teams can help you successfully integrate, automate, implement and run our technology, maximize the value of your investment, and address your critical business needs.

Services include Consulting, Engineering, Project Management and Turn-Key Projects.

With our devoted team members and genuine 24/7 support, PEC can truly help you optimize your organizational performance and maximize your business success.

Manufacturing and Supply Chain

PEC has established a global manufacturing and supply chain group. This group is responsible for the on-time sourcing, manufacturing, quality assurance and delivery of our products and solutions.

The PEC supply chain group delivers the equipment from 5 manufacturing plants. 2 plants in Asia (Huzhou, China and Penang, Malaysia) are producing the mechanical sub-assemblies. The plants in Tatabánya, Hungary, and Coconut Creek, Florida, are taking care of the final assembly before shipment to customers in Europe and the Americas. The Belgian plant is supplying the specific technology for electrolyte filling, degassing and final sealing.

Our approach has given PEC the advantage of shortened delivery times to our global customer base, as well as an important price competitiveness.





Turn Key Cell Finishing Lines

Turn Key Cell Finishing Lines

PEC covers all cell manufacturing technologies from electrolyte filling to final testing and sorting. This manufacturing stage is referred to as Cell Finishing.

Cell Finishing

The last stage of cell manufacturing is known as Cell Finishing. It covers all manufacturing technologies **from electrolyte filling to final sealing, testing and sorting** of the cell.

The cell is activated during this stage and will be undergoing a series of processes and test operations before the cell can be safely and reliably used in a battery pack or module.

Cell filling, soaking, pre-charging, roll pressing, formation, degassing, final sealing, ageing and grading are all integrated in a single turn-key Cell Finishing Line, using standard PEC equipment, including automated storage and retrieval systems and PECs well-known electronics for cycling and testing cells.

The Automated Cell Finishing Lines are designed for **modular expansion** and most important for **fully automatic operation**.

PEC believes that automation during all stages of production is essential in achieving **consistent quality** and throughput at a **competitive manufacturing costs**.

The design and implementation of the equipment is done with a clear focus to the **Total Cost of Ownership (TCO)**. The equipment provides:

- **The best energy efficiency, reducing the running costs and heat load on the cells**
- **The highest availability and yield, immediately contributing to the bottom line**

- **The best process homogeneity, resulting in a better cell performance**
- **The best safety, reducing the operational risks of a cell manufacturing plant**
- **The only modular expandable solution, aligning CAPEX with required capacity**

It is the only way for cell and battery suppliers to move away from the early stages of prototype and pilot production, and establish a reliable high volume supply chain for a HEV, PHEV or EV car assembly plant.

PEC offers different equipment configurations for the most common cell types, including small and large **cylindrical cells (coin cells, 21700, 46XXX...), pouch cells and large prismatic cells**.

The complete system is managed by PEC's Manufacturing Execution System, that controls the material handling equipment, guarantees individual cell trace-ability, and presents management with accurate manufacturing and quality reports.

The operator tasks are limited to supervising these 24/7 running systems. This guarantees a **cost-effective** operation in all geographies.



Turn Key Test Labs for Cells and Modules



Excellence in Automated Cell and Module Testing

Thanks to PEC's LifeTest Software, running a test lab is very easy. All results are in a single place and can be validated and analysed automatically.

PEC supplies the energy storage industry with complete **turn-key test labs**. These systems include standard PEC test equipment for cells and modules, in combination with climate chambers, reliable cell contacting and safety.

PEC has always been at the forefront of the large-format cell architectures and has a clear focus to **high power, high accuracy and high speed test systems**.

PEC's equipment is water cooled. It does not pollute the lab with a heat-load or noise, and as a minimum it doubles the MTBF compared to air-cooled systems.

We find many OEMs and tier 1 automotive suppliers, as well as leading cell and battery manufacturers, aerospace and defense players and universities amongst our clients.

Also independent testing and certification labs are key customers for PEC, as these companies require the highest accuracy in combination with flexibility for their various customer projects.

Testing Equipment

PEC supplies the following equipment and software:

- Test equipment for evaluation and inspection of cells and modules
- Quality Assurance equipment for cells and modules
- Laboratory Automation and Test Management System for battery testing labs

The power requirements are tuned to the customers need, and range from cell to module voltages, and from a few micro-Amps to thousands of Amps.

Test Lab Automation

The battery test lab is controlled by the MWare LifeTest system. LifeTest controls the test plans and operator progress, guarantees individual test sample traceability, and presents management with accurate reports.

The system includes Quality Assurance functionality for automatic validation and drill-down analysis of the test results.

LifeTest provides an open interface to integrate test results from any test system. This way the complete test lab can be controlled by a single software and user interface.





Cash Center Automatic

Excellence in Cash Center Automation

Automation, Enforcement and Traceability are key requirements for Cash Center automation.

Central Banks around the world are dealing with increasing cash volumes in storage, processing and distribution. At the same time Central Banks need to guarantee the quality and volume of cash in circulation in a cost effective way.

For this reason Central Banks are replacing and combining their smaller regional branches and central cash centers by larger, **more automated and better secured facilities**. Automation, enforcement and traceability are key requirements for these cash centers.

Zero-Touch Implementation model

Eliminates almost every manual interaction from receiving over processing and payout. It is also helps in the further standardization of all logistic processes between the Central Bank, the commercial banks, the CIT companies and retailers.

PEC Cash Management System

Supports this standardization and its Web Portal platform facilitates the IT integration between the different parties, improving overall efficiency and reliability of the complete cash cycle.

During every step of the process, the MWare Cash Management System will organize, control and enforce the correct and timely execution of that step.

MWare combines all control functions in one solution, including:

- **Custody Management:** Full traceability on cash holdings per room, per team..., using individual traceable cash packs in each cash center operation.
- **Inventory Management:** Organization and control of all cash movements inside the cash center.

- **Operations Control:** Full control over all automated and manual operations in the cash center.

This way MWare forms the ideal solution for managing your cash center.

Our offering is based on more than 35 years of experience. It includes Cash Containers, Standardized Cash Packs, Vault Automation, Automated Pre and Post Processing, Automated Receiving and Payout, and a Cash Management System to control the entire operations of the automated facility.

PEC can operate as Turn-Key contractor or as Project Manager, coordinating and managing the different material handling and equipment suppliers

PEC also offers consulting services to the Cash Industry in order to develop and implement this automated cash cycle.

During the initial steps of the project, our experienced consultants will help you analyzing and defining the boundaries of the project.

Based on the process data and the project scope our consultants will design a functional layout, supporting your current and expected volumes.

During this step, our consultants will also deliver realistic budgetary information for making clear decisions on the next stages of the project.

PEC will convert the functional design into general and detailed layouts of the equipment and machinery. PEC will collect all detailed technical and functional specifications in a specification document that can be used for contracting.

The PEC Cash Management System will guarantee a smooth operation, integration and control of the different automated systems within the cash center.



A photograph of a modern office hallway with a grid overlay. The hallway is long and brightly lit, with a polished floor that reflects the overhead lights. The walls are white, and there are glass partitions on the left side. In the distance, a dark area, possibly a reception desk or a set of stairs, is visible. A white grid pattern is overlaid on the entire image, with a few diagonal lines crossing it. The text "Project and Support Services" is written in a large, black, sans-serif font at the bottom of the image.

Project and Support Services

Excellence in Service and Support

Turn-Key Projects, Project Methodology, Service and Support.

Turn-Key Projects

PEC helps you realize and implement the project as a Turn-Key solution including:

- The required know-how and experience in high volume cell production and testing
- All required equipment for the complete Cell Finishing Line or Automated Cash Center
- Automated Material Handling including ASRS systems, conveyors, AGV's, robotics...
- Complete Management Software
- An experienced project management team that will guide you all the way to a successful go-live of the system

Project Methodology

For a successful realization of your project a solid project methodology, combined with real project experience is crucial. PEC's project organization is based on in-house project teams, each holding their own specific expertise such as Cell Manufacturing, Testing, Cash Management, Automation and Logistics, and each led by experienced Project Managers.

The Contract Manager leads and coordinates these project teams and is also the main contact with the client. Regular and well-structured communication between PEC and the client, as well as within the PEC organization, is key.

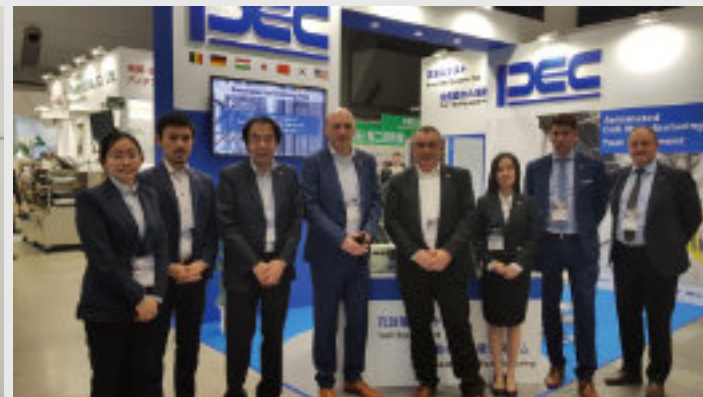
Our experience goes beyond the specific product knowledge required for the project. All our senior project managers have worked for many years at PEC and have built up a profound industry knowledge in the industries we serve.

This guarantees a project implementation with a clear focus on functionality and efficiency improvements while guaranteeing security, safety and traceability in each step of the project.

Service and Support

PEC offers standard Service Level Agreements (SLA) including preventive and corrective maintenance services including spare parts. As part of these SLA's PEC also offers a wide range of services to support your daily operations:

- Consulting and engineering services
- Training services for local maintenance staff, IT departments, supervisors and operators
- Upgrade services of PEC's software applications. In the continuous effort to increase functionality, PEC offers quarterly releases of its software to customers with a SLA.



References Energy Storage

ABB	GS YUASA	SCANIA
AKASOL	HOFER POWERTRAIN	SGS
ALELION	HUSQVARNA	SHANGHAI INSTITUTE OF SPACE POWER SOURCES
ATL	HYUNDAI MOBIS	SONY
AUDI	IFE	TATUNG UNIVERSITY
BAE SYSTEMS	IK4 - CIDETEC	SINTEF
BAIC - BJEV	INTERTEK	SKELETON
BERNER FACHHOCHSCHULE	IOXUS	SUN YAT-SEN UNIVERSITY
BMW GROUP	ITALDESIGN	SOUTH WEST RESEARCH INSTITUTE
BOSCH	JACOBS	TSE
BUREAU VERITAS	JAPAN TOBACCO INTERNATIONAL	TUBITAK
BYEXPERT	JOHNSON CONTROLS - CLARIOS	TUV RHEINLAND
CEA	JTEKT	TUV SUD
CELLFORCE GROUP	KIWA	UEP
CETC	KREISEL	ULTRALIFE
CHALMERS UNIVERSITY	LECLANCHE	UNIVERSITY OF KANSAS
CITIC (MGL)	LILIUM	UNIVERSIDAD DE OVIEDO
DAIMLER TRUCK	MEET INSTITUTE	UNIVERSITÉ DE PICARDIE
DNV-GL	METU	UC BERKELEY
DONG FENG	MURATA	UNIVERSITY OF STUTTGART
DURACELL	NASA	VARTA CONSUMER
EAGLEPICHER TECHNOLOGIES	NATRON ENERGY	VARTA MICRO BATTERIES
EDAG	NAVSEA	VITO
ENGIE	NEXTERA ENERGY	VRIJE UNIVERSITEIT BRUSSEL
ENERGIZER	NIPPON CHEMICON	VOLKSWAGEN
ENERGYVILLE	NISSAN MOTORS	VOLVO
EOS	NY BEST	VTT
EVA FAHRZEUGTECHNIK	PANASONIC	YIGITAKU
EXIDE	PELLENC	...AND MANY OTHERS
FFI	PORSCHE	
FLANDERS MAKE	QINETIQ	
FLEX-N-GATE	RAYOVAC	
FRAUNHOFER	RIMAC	
GEELY	RISE	
GLABAT	SABS	
GM	SAFT	
GRILLO	SAMSUNG	

References in Cash Automation

PEC has completed many consulting and implementation projects in the Cash Industry. We are proudly serving:

- Bulgarian National Bank
- Central Bank of the Republic of Azerbaijan
- Central Bank of Hungary
- Central Bank of Iraq
- Dutch National Bank
- Saudi Arabian Monetary Authority
- State Oil Fund of Azerbaijan



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