



*Alliance for Batteries Technology, Training and Skills*

*2019-2023*

## **Mechanical Engineer**



Co-funded by the  
Erasmus+ Programme  
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## Mechanical Engineer in Battery Industry

A battery mechanical engineer is responsible for designing, developing, and testing mechanical systems for batteries. They work with a team of engineers and scientists to create efficient and cost-effective energy storage solutions for electric vehicles, consumer electronics, and other applications. They are responsible for the mechanical design of the battery system, which includes the housing, packaging, cooling systems, and other mechanical components.

They need to have a strong understanding of mechanical engineering, materials science, and manufacturing processes, as well as experience with thermal management systems, safety protocols and regulations. They also need to be familiar with simulation and modeling tools to predict the performance of the battery systems under different conditions. They need to be able to work closely with other engineers and stakeholders to ensure that the mechanical design of the battery system meets the requirements of the application and is compatible with the rest of the system. They also need to be familiar with the regulations and standards related to battery mechanical systems and safety. They may also be responsible for the testing and validation of the mechanical systems, and for troubleshooting and resolving issues that arise during the development or production phases.

### ESCO Occupations - [ESCO - Occupations - European Commission \(europa.eu\)](https://ec.europa.eu/esco/)

ID	NAME	Concept URI
2151.1	electrical engineer	<a href="http://data.europa.eu/esco/occupation/86ca306c-ab99-420a-9e2a-aa73c5c4de22">http://data.europa.eu/esco/occupation/86ca306c-ab99-420a-9e2a-aa73c5c4de22</a>
2149.2.4	design engineer	<a href="http://data.europa.eu/esco/occupation/6fc8f605-98b9-4218-b5e2-91c4c9c55c4d">http://data.europa.eu/esco/occupation/6fc8f605-98b9-4218-b5e2-91c4c9c55c4d</a>
2144.1	mechanical engineer	<a href="http://data.europa.eu/esco/occupation/579254cf-6d69-4889-9000-9c79dc568644">http://data.europa.eu/esco/occupation/579254cf-6d69-4889-9000-9c79dc568644</a>

### Context

**Minimum EQF**

6/7/8

<b>Value Chain</b>	Raw Materials and Processing Components and Cells Manufacturing Modules and Packs Battery Integration Operation, Repair, and Maintenance Second Life Recycling
<b>Departments</b>	Production and Maintenance Quality RnD
<b>Specialisations</b>	Other job roles that are more specialised but based on this Mechanical Supervisor Mechanical Cell Design Engineer Mechanical Design Engineer Cell Mechanical Engineer Cell Module Mechanical Engineer Mechanical Battery Design Engineer Powertrain Mechanical Systems Design Engineer Battery Mechanical Engineer EV General - Mechanical Engineer Battery Mechanical Engineer - Aviation Electro-mechanical Engineer Mechanical Engineer Electro-mechanical Engineer

### Cross-sectoral Specific Competence

Name	Type (S/K)	Description/Context	Level	ESCO
Models/Modelling/Diagrams/Schematics	S	<ul style="list-style-type: none"> <li>- Evaluate, design and improve electro-mechanical systems &amp; components by applying knowledge of electrical and mechanical engineering principles</li> <li>- Develop manufacturing processes by designing and modifying equipment for fabricating, building, assembling, and installing components for heavy equipment</li> <li>- Develop complex mechanical and/or electro-mechanical mechanisms including designs, drawings, performance predictions and verification requirements</li> <li>- Create prototypes and support the</li> </ul>	Expert	develop models



		<p>development of manufacturing processes and automation</p> <ul style="list-style-type: none"> <li>- Develop and review mechanical drawings and models with computer aided tools</li> <li>- Modeling and design of mechanical systems and components</li> <li>- Develop mechanical designs for battery cells</li> </ul>		identify process improvement
Process Improvement	S	<ul style="list-style-type: none"> <li>- Develop designs which meet customer-specific functional and performance requirements, while maximizing subassembly design re-use and tool re-use</li> <li>- Lead and support continuous improvements for existing products</li> <li>- Contribute to overall profitability related to component design and test yield improvements on new and existing products</li> <li>- Optimize pack designs for power/energy density (weight and volume) as well as cost</li> <li>- Implement processes for efficient on-going project management, including feedback of lessons learned, continuous improvement, and reuse of specifications and designs</li> </ul>	Expert	
Analysis Methods	K	<ul style="list-style-type: none"> <li>- Drive failure analyses and design of experiments (DOEs)</li> <li>- Statistical data analysis for electrode &amp; cell quality</li> <li>- Perform NVH, mechanical shock, and durability analysis</li> <li>- Drive and lead internal and external design reviews within the mechanical and structural analysis area</li> <li>- Generate innovative designs including detailed written specifications, drawings and tolerance analyses</li> <li>- Utilize engineering principles to create test plans, identify root causes for field or test failures and implement fixes</li> <li>- Develop mechanical designs for battery cell utilizing 3D CAD and supported by analysis</li> <li>- Mechanical design analysis including thermal, structural, design for assembly, and design for test</li> </ul>	Expert	



Develop/Ensure Conformity to Specifications	S	<ul style="list-style-type: none"> <li>- Communicates multi-functionally on design directions and requirements</li> <li>- Assist with early requirements definition; translate customer requirements into detailed hardware requirements</li> <li>- Facilitate communication and clarification of technical requirements between customers and internal stakeholders</li> <li>- Assist in the development of comprehensive design verification and validation</li> </ul>	Expert	ensure conformity to specifications
Analyse Test Data	S	<ul style="list-style-type: none"> <li>- Plan, organize, direct and follow up on project related testing activities</li> <li>- Determine required tolerances using GD&amp;T</li> <li>- Drives failure analyses and design of experiments (DOEs) to reach design solutions and corrective actions</li> </ul>	Expert	analyse test data
(Automated) Product Testing	S	<ul style="list-style-type: none"> <li>- Conduct specification, design and testing</li> <li>- Define and execute design validation and characterization from prototype bring-up to product testing</li> <li>- Troubleshoot electrical systems, perform root cause analyses &amp; find solutions</li> <li>- Drive failure analyses and design of experiments (DOEs) to reach design solutions and corrective actions</li> <li>- Define component level requirements, participate in DFMEAs, create and oversee test and validation plans</li> <li>- Mechanical design analysis including thermal, structural, design for assembly, and design for test</li> </ul>	Expert	perform product testing
CAD	S	<ul style="list-style-type: none"> <li>- Experienced in 3D CAD systems (NX or Solidworks) and electrical design software (Zuken E3 or Solidworks Electrical)</li> <li>- Use CAD software and create CAD models</li> <li>- Develop mechanical designs for battery cell utilizing 3D CAD</li> </ul>	Expert	use CAD software
Product Design	S	<ul style="list-style-type: none"> <li>- Develop cell requirements and specifications with system product development</li> <li>- Create prototypes and support the development of manufacturing processes and</li> </ul>	Expert	develop product design



		<p>automation</p> <ul style="list-style-type: none"> <li>- Brainstorm design concept and execute design concepts in all phases of a development cycle</li> <li>- Define and execute design validation and characterization from prototype bring-up to product testing</li> <li>- Investigate new cathode development to improve performance for next generation cell product</li> <li>- Design, development, and validation of cathode components, assemblies, specifications and the full suite of APQP Process</li> </ul>		
Requirements engineering	S	<ul style="list-style-type: none"> <li>- Develops cell requirements and specifications</li> <li>- Communicates multi-functionally on design directions and requirements</li> <li>- Facilitate communication and clarification of technical requirements between customers and internal stakeholders</li> </ul>	Practitioner	conform with production requirements
Prototype Development	S	<ul style="list-style-type: none"> <li>- Create prototypes and support the development of manufacturing processes and automation</li> <li>- Modeling and design of mechanical systems and components</li> <li>- Assist in engineering prototype builds and component fabrication</li> </ul>	Expert	design prototypes
Thermal Analysis / Management	S	<ul style="list-style-type: none"> <li>- Mechanical design analysis including thermal, structural, design for assembly, and design for test</li> <li>- Develop application-specific battery packs including internal and external structures, housings, subassemblies, harnessing and retention, thermal management features, interfaces, and environmental compatibility features</li> <li>- Characterize cell thermal behaviour and modelling</li> <li>- Integration of necessary components and features to meet thermal runaway requirements</li> <li>- Understanding of lithium ion battery thermal</li> </ul>	Expert	use thermal analysis

		runaway prevention		develop new products
Product Development	S	<ul style="list-style-type: none"> <li>- Develop cell requirements and specifications with system product development</li> <li>- Brainstorm and execute design concepts in all phases of a development cycle</li> <li>- Lead product development and production troubleshooting efforts</li> <li>- Coordinate activities during product development</li> </ul>	Expert	
Safety Procedures	K	<ul style="list-style-type: none"> <li>- Familiarity with safety testing standards such as UN 38.3, SAE 2464, RTCA DO-311, RTCA DO-160</li> <li>- Ensure that designs and documentation of components and systems meet specified technical customer demands, product safety, legislative requirements and internal demands</li> </ul>	Practitioner	safety engineering

### Sector Specific Competence

Name	Type (S/K)	Description/Context	Level	ESCO
Battery Design	K	<ul style="list-style-type: none"> <li>- Design, development, and validation of cathode components, assemblies, specifications and the full suite of APQP Process</li> <li>- Specification, design and testing</li> <li>- Modeling and design of mechanical systems and components</li> <li>- Mechanical design analysis</li> <li>- Design batteries, solar hardware, EV chargers and energy management products for the home environment.</li> <li>- Brainstorm design concepts and execute design concepts in all phases of a development cycle</li> <li>- Generate innovative designs, including detailed written specifications, drawings and tolerance analyses.</li> <li>- Defines and executes design validation and characterization from prototype bring-up to product testing.</li> <li>- Develops designs and processes with external vendors</li> <li>- Conducts design reviews</li> </ul>	Expert	industrial design
Battery System	K	<ul style="list-style-type: none"> <li>- Understanding the battery system to be able to design, develop and execute products to meet the requirements</li> </ul>	Expert	

## Soft Competence

Name	Type (S/K)	Description/Context	Level	ESCO
Communication	K	<ul style="list-style-type: none"> <li>- Facilitate communication and clarification of technical requirements between customers and other stakeholders</li> <li>- Communicate multi-functionally on design directions and requirements</li> <li>- Communicates status effectively throughout the management structure</li> <li>- Recruit and train personnel</li> <li>- Drive cross functional collaboration between stakeholders</li> <li>- Plan, organize, direct and follow up on project related testing activities</li> </ul>	Practitioner	communication
Teamwork	K	<ul style="list-style-type: none"> <li>- Work in an international and multicultural environment</li> <li>- Together with the team, develop and maintain a safe work environment</li> <li>- Lead a team by allocating work, training and recruiting new employees etc.</li> <li>- Generate innovative designs with multi-functional teams</li> </ul>	Practitioner	teamwork principles

## General Transversal Competence

Name	Type (S/K)	Description/Context	Level	ESCO
Documentation	S	<ul style="list-style-type: none"> <li>- Ability to read and analyze schematics and electrical engineering drawings</li> <li>- Experience preparing manufacturing drawings to ANSI Y14.5M drawing standards using GD&amp;T for manufacturing and repeatability</li> <li>- Develop and review mechanical drawings and models</li> <li>- Communicate multi-functionally on design directions and requirements</li> <li>- Use technical documentation in processes</li> </ul>	Expert	use technical documentation; observe documents
Computer Literacy / Office	S	<ul style="list-style-type: none"> <li>- Proficient in the use of MS Excel, Word, Powerpoint and database software</li> </ul>	Practitioner	have computer literacy
Customers/ Stakeholders	S	<ul style="list-style-type: none"> <li>- Work as a member of an integrated team to examine, discuss, and develop solutions to difficult/complex issues with both internal and external stakeholders (customers, suppliers, internal management, etc.)</li> </ul>	Practitioner	communicate with customers



		<ul style="list-style-type: none"> <li>- Facilitate communication and clarification of technical requirements between customers and internal stakeholders</li> <li>- Ensure that designs and documentation of components and systems meet specified technical customer demands, product safety, legislative requirements and internal demands</li> </ul>		
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### Academic Competence (can be taken from University programme)

Name	Type (S/K)	Description/Context	Level	ESCO
Mechanical Engineering	K	<ul style="list-style-type: none"> <li>- Understanding of mechanical engineering to develop and review mechanical drawings and models</li> <li>- Developing li-ion battery cells</li> <li>- Designing products from a mechanical perspective and understanding its challenges.</li> </ul>	Expert	mechanical engineering
Material Science	K	<ul style="list-style-type: none"> <li>- Cathode materials development and evaluation for high performance cell</li> <li>- Electrode optimization including density, porosity, conductive additives and binder</li> </ul>	Expert	materials science
RnD	S	<ul style="list-style-type: none"> <li>- Research and benchmark competitive technologies</li> <li>- Develops cell requirements and specifications with system product development</li> <li>- Generates innovative designs</li> <li>- Defines and executes design validation and characterization from prototype bring-up to product testing.</li> <li>- Develops designs and processes</li> </ul>	Expert	manage research and development projects