Detroit Engineered products (DEP), is an engineering services, product development, software development, consulting and talent acquisition company. Since its inception in 1998 in Troy, USA, DEP is now a global company with footprints in Europe, China, Korea, Japan, and India. DEP uses the accelerated and transformed product development process, accomplished by utilizing our proprietary platform, DEP MeshWorks, which rapidly reduces the development time of products for all segments. The MeshWorks platform delivers tool sets that accelerate virtual validation activities associated with powertrain development across all stages for both conventional and electric powertrain.

Battery testing and standards play a crucial role in ensuring the safety, reliability, and performance of batteries in the automotive industry. Through comprehensive testing, battery manufacturers and automotive OEMs can evaluate various parameters such as capacity, cycle life, performance, and safety aspects of the batteries. Testing protocols based on industry standards, such as UL, IEC, and SAE, provide a framework for conducting rigorous tests and validating compliance with specific requirements. These standards help establish consistent quality benchmarks and ensure that batteries meet the necessary safety and performance criteria. By adhering to testing standards, the automotive industry can confidently integrate batteries into electric and hybrid vehicles, providing reliable and efficient energy storage solutions.

DEP (Detroit Engineered Products) is a leading provider of battery management systems (BMS) that adhere to industry norms and deliver exceptional efficiency. With a deep understanding of automotive engineering and advanced technology, DEP designs and develops BMS solutions that meet and exceed industry standards. By employing robust algorithms, advanced control strategies, and sophisticated hardware, DEP BMS ensures optimal battery performance, cell balancing, and thermal management. DEP's BMS solutions are meticulously designed to maximize energy efficiency, enhance battery longevity, and maintain strict safety standards. With a focus on innovation and quality, DEP is dedicated to delivering BMS solutions that enable efficient and reliable battery management in automotive applications.

DEP

Smarter solutions. Realized.

BATTERY TESTING STANDARDS

Battery testing standards in the automotive industry ensure the performance, safety, and reliability of batteries used in electric vehicles (EVs) and hybrid electric vehicles (HEVs). These standards encompass a comprehensive evaluation of battery performance, including capacity, energy efficiency, cycle life, safety features, and environmental impact. By establishing standardized testing procedures, manufacturers are able to compare and benchmark different battery technologies, facilitating informed decisions regarding battery selection and design. This promotes the development of high-quality batteries that meet industry standards and enables the advancement of electric and hybrid vehicle technologies.

Battery Chemistries	Energy Density (Wh/kg)	Comments
Nickel-Cadmium	38.9	Inexpensive, but severely harmful to environment.
Lead Acid	38.9	Inexpensive, with moderate energy density, mostly used as automobile battery.
NiMH (Nickel Metal Hydride)	100.0	Low cost, very heavy, Conventional NiMH, has high energy density and high rate of self-discharge. Primarily used in **hybrid electric vehicles.**
Lithium Ion	127.8	Very expensive, high-energy density, low rate of self-discharge. Mostly used in laptop, cellphones.
Lithium Cobalt Oxide ($LiCoO_2$)	200.0	High Specific energy, relatively short lifespan.
Lithium Iron Phosphate (LFP)	88.9	Good electrochemical performance with low resistance. Used by **Tesla, GM**, recently adopted by MG ZS EV, for the Indian market.
Lithium Manganese Oxide	100.0	High thermal stability and enhanced safety. Can discharge at currents of 20-30A with moderate heat buildup.

Ensuring Automotive Advancement: The Vital Role of Battery Testing Standards in Electric and Hybrid Vehicles

Importance of battery testing standards in the automotive industry
Ensure the safety, reliability, and performance of EVs and HEVs
Evaluate various aspects of battery systems:

- Capacity
- Efficiency
- Cycle life
- Thermal management
- Safety features

SAE	J2288, J2464,J1798, J2929
IEC	62133-(1-2), 6195-(1-2), 61960-3, 62281, 60086-4
UL	1642,1973,2054,2271,2580

Society of Automotive Engineers
SAE-J2288- Life cycle Testing of Electric Vehicle Battery Modules
SAE-J2464- Electric and Hybrid Vehicle Rechargeable Energy Storage System (RESS) safety
SAE-J1798- Recommended Practice for Performance Rating of Electric Vehicle Battery Modules.
SAE-J2929- Safety standard for Electric and Hybrid Vehicle Propulsion systems, using Lithium based rechargeable cells.
ISO 12405-3/ ISO 12405-1 Electrically propelled Road Vehicles-Test specification for Lithium-Ion traction battery packs and systems.
Korea KMVSS18-3- Korean safety standards, for the battery traction of a vehicle.
India AIS-048- Automotive Industry standard, for the safety requirement of traction batteries in battery-operated vehicles.
China QC/T 743- This specifies the standards for the lithium-ion batteries used in Electric vehicles.
UN ECE R100- This regulation specifies all tests that must be carried out on the Lithium batteries installed on the Four-wheel electric road vehicles for transport of people or goods.
UN/DOT 38.3 Testing –The prescribed test procedures helps ensure the safety of lithium-ion or lithium metal batteries during shipping.
International Electrochemical Commission standards
IEC-62133-(1*)(2*)-Safety Requirement(Portable application) for Secondary Sealed Cells and Batteries containing alkaline cells, using (Part-**1*Nickel systems) (Part-2*- Lithium systems**).
IEC-61951-(1*)(2*)- Secondary Sealed Cells and Batteries for portable applications, containing alkaline or other non-acid electrolytes, using (Part-**1*Nickel-Cadmium) (Part-2*-Nickel Metal Hydride).**
IEC-61960-3- Secondary Lithium cells and batteries for portable applications- Part-3:Prismatic and Cylindrical lithium Cells.
IEC-62281- Safety of Primary and Secondary cells during transportation.
IEC-60086-4- Safety of Primary cells-based Lithium batteries.
IEC-62660-2- Safety standards for Secondary cells-based Lithium-ion Cells, for the propulsion of the Electric Road vehicles.: Reliability and abuse testing. **Underwriters Laboratories standards.**
UL 1642- Test requirements for a Round Bar Crush test for Lithium soft-case punch cells.
UL 1973- Defines a set of construction parameters, for Li, and other battery chemistries.
UL 2054- Nickel Cells or lithium packs
UL 2271- Designs for batteries used in Light Electric Vehicle (LEV), such as battery pack assembly, cell selection, thermal management and overcharge protection.
UL 2580- This standard assesses the ability of electrical energy storage equipment to safely withstand simulated abuse conditions

Battery performance testing methods

- Cell, module, and pack cycling
- Charge/discharge cycle durability
- Drive cycle testing
- Pulse power testing
- Shock and vibration
- Thermal cycling
- Altitude simulation
- Ingress protection
- Controller area network, communication, and control
- Free fall testing
- Charge retention/overcharge testing
- Low/high-temperature testing
- Testing for polarity and short-circuit testing
- Thermal abuse test

		International standards (SAE)/IEC					EU	USA		KOREA	India	China
	Test	SAE J2464	SAE J2929	ISO 12405-1 (2)	ISO 12405-3	IEC 62660-2 (3)	UN/ECE-R100.02	UL 2580	UN/DOT 38.3 Testing [T1-T8]	KMVSS 18-3	AIS-048	QC/T 743
Year →		(2009)	(2013)	(2012)	(2014)	(2011) (2016)	(2013)	(2013)	(2016)	(2009)	(2009)	(2006)
Mechanical	Mechanical Shock	CMP	CMPV	P	P	C	CMPV	CMP	CM		M	
	Drop	P	P					CP	C	P		C
	Penetration	CMP									CM	CP
	Immersion	MP	P		P			MP		P		
	Crush/crash	CMP	PV		PV	C	CMPV	CMP	C			CP
	Rollover	MP	P					P			M	
	Vibration		CMP	P	P	C	CMP	CMP	CMP		M	P
Electrical	External short circuit	CMP	P	P	P	C	C MP	CMP	CMP	P	CMP	CP
	Internal short circuit					C						
	Overcharge/ Over-discharge	CMP	P	P	P	C	CMPV	CMP	C	P	CMP	CP
Environmental	Thermal stability	C				C		C	CM	P		CP
	Thermal shock and cycling	CMP	CMP	P	P	C	C MP	CMP				
	Overheat	MP	P				CMPV					
	Extreme cold											
	Temperature Fire	MP	P		PV		CMPV	CMP	C	P		
Chemical	Emissions	CMP	P					CMP				
	Flammability	CMP	P					CMP				

Abbreviations:- **C**-Cell, **M**-Module, **P**-Pack, **V**-Vehicle

Email us: email@depusa.com | Visit our Website: www.depusa.com
USA: MI (HQ) : Detroit Engineered Products, 850 East Long Lake Road, Troy, MI 48085, USA. I Phone: +1-248-269 7130
INDIA : DEP India Pvt. Ltd., #2/86, 7th Avenue, Ashok Nagar, Chennai – 600 083, India I Phone: +91 44 42141453
BANGALORE : DEP India Pvt. Ltd., 4th Floor, Gamma Block, Sigma Soft Tech Park , HAL – Whitefield Main Rd , Bangalore 560066