

ELECTRIC VEHICLE (EV) – Safety Hazards Associated with Working On or Around the Battery

A checklist has been developed to support employers with identifying hazards associated with working on or around EV batteries in the workplace, with legislative references and recommended controls. The legislation listed below should not be considered exhaustive, and other legislative requirements may apply. The recommended controls may not be required in all workplaces and are intended as a starting point to address the identified hazards.

Hazard	Hazard Details	Applicable?	Legal and Other Requirements	Suggested Program Elements and Controls	Additional Controls Implemented by the Workplace
High Force	Depending on vehicle size and class, lithium-ion batteries can weigh between 300-600 kg.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(c), (2)(a)(d)(h) (employer responsibilities) ▪ Reg. 851 s.45(a) (material handling), 51 (lifting devices) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> MSD Prevention Program <input type="checkbox"/> Lifting device training (crane, lift truck, pump cart) <input type="checkbox"/> Certified lifting device (crane, lift truck, pump cart) <input type="checkbox"/> Pre-use inspection of lifting devices <input type="checkbox"/> Equipment marked with max-rated load <input type="checkbox"/> SOP (standard operating procedure)	
Electrocution-Low voltage system	EV has low and high voltage systems. Some examples of how electrocution can occur include direct contact with battery terminals (two points), contact with damaged or exposed parts of the battery system, touching components before energy has been dissipated (can retain charge after vehicle is turned off), bridging of circuits with tools touching cables or connectors.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d), 25(2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.42 (LOTO), s.42.1 (live work), s.43 (electrical tools), 79 (PPE training), 81 (eye protection), 84 (skin protection) ▪ CSA Z460.20 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> Lock Out Tag Out (LOTO) written procedure <input type="checkbox"/> LOTO training (theory and equipment specific) <input type="checkbox"/> Only use electrically rated tools (inspected prior to use) <input type="checkbox"/> PPE and training on how to inspect PPE prior to use	

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Crush Hazard	Potential for battery to crush worker(s) while lifting/lowering battery or moving around workplace.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(c), (2)(a)(d)(h) (employer responsibilities) ▪ Reg. 851 s.45 (material handling) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Lifting device training (crane, lift truck, pump cart) <input type="checkbox"/> Certified lifting device (crane, lift truck, pump cart) <input type="checkbox"/> Pre-use inspection of lifting devices <input type="checkbox"/> Equipment marked with max-rated load	
Electrocution-High Voltage	EV has low and high voltage systems. The high voltage system can exceed 700 Volts. In some cases, work must be completed on the high voltage system. When disconnecting the high voltage system there is also a risk of electrocution in an EV.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.42 (LOTO), 42.1 (live work), 43 (electrical tools), 79 (PPE training), 81 (eye protection), 84 (skin protection) ▪ CSA Z460.20 	<input type="checkbox"/> Hazard communicated to employees (including restricting access to the work area for unauthorized personnel) <input type="checkbox"/> LOTO written procedure <input type="checkbox"/> LOTO training (theory and equipment specific) <input type="checkbox"/> Electrical safety training <input type="checkbox"/> SOP (standard operating procedures) <input type="checkbox"/> PPE and electrically rated tools (both inspected prior to use) <input type="checkbox"/> FR-rated clothing <input type="checkbox"/> Gloves dielectrically tested <input type="checkbox"/> PPE training on the care, inspection and use	

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Arc Flash	Arc flash may occur when working on or near the high voltage electrical system and there is a short circuit, when the battery is being serviced and connections are made or broken under load, a fault or damage to components can also be a source.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.42 (LOTO), 43 (electrical tools), 79 (PPE training), 81 (eye protection), 84 (skin protection) 	<input type="checkbox"/> Hazard communicated to employees (including restricting access to the work area for unauthorized personnel) <input type="checkbox"/> Arc flash awareness training <input type="checkbox"/> SOP (standard operating procedures) <input type="checkbox"/> FR rated clothing <input type="checkbox"/> PPE training on the care, inspection and use	
Thermal runaway-fire explosion	This is a self-sustaining reaction in which the cell heats up rapidly and can ignite or explode. An electric short causes current to pass through the positive and negative end of the battery causing the battery to heat up and damage the internal components. Once the internal components are damaged, the reaction will increase and potentially spread to other cells.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(2)(a) (d)(h) (employer responsibilities), 42 (Training on physical agents) ▪ Reg 851 s.130 (Physical Agents) ▪ Reg. 213/07: Fire Code 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> Fire safety plan <input type="checkbox"/> Emergency response procedures <input type="checkbox"/> Fire drills <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> PPE training on the care, inspection and use	

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Electrical	Electrical Short to chassis - It is possible for an EV to develop a short to the chassis, either due to a manufacturing defect or damage. This could result in the body of the vehicle being energized and causing the potential for electrocution. There would be no visual indication of this hazard.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d), 25(2)(a) (d)(h) (employer responsibilities) ▪ Reg. 851 s. 42 (LOTO), 42.1 (live work), 43 (electrical tools) ▪ CSA Z460.20 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> LOTO written procedure <input type="checkbox"/> LOTO training (theory and equipment specific) <input type="checkbox"/> PPE training on the care, inspection and use <input type="checkbox"/> Electrical safety training <input type="checkbox"/> PPE and electrically rated tools (both inspected prior to use) <input type="checkbox"/> Care, inspection and use of voltmeters <input type="checkbox"/> Gloves dielectrically tested	
Electrical	Contact with/damaged High Voltage cables or battery while moving an EV with a forklift or other mechanical material handling device.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d) (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.43 (electrical tools), 45 (material handling), 51 (lifting device), 53 (travelling crane), 54 (mobile equipment) ▪ Reg. 851 s.42 (LOTO) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> Lift truck training <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Lift equipment training <input type="checkbox"/> Lifting devices certified <input type="checkbox"/> Pre-use inspection of lifting devices <input type="checkbox"/> Equipment marked with max rated load	

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Electrical	Risk of damage to the battery if welding connections are made close to the battery.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(1)(a) (b)(c)(d), 25(2)(a) (d)(h) (employer responsibilities) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Welding training <input type="checkbox"/> Welding equipment inspected	
Unintended movement/starting	Potential for vehicle to start unexpectedly if proximity key is left in the vehicle or a potential short circuit has occurred.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities), 26 (1)(k) (written instructions) ▪ Reg 851 s.57 (immobilized vehicle), 76 (blocking) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Wheels chocked when working on the vehicle	
Identification of Hybrid/BEV	Some Hybrid/BEV may not be identified as having a high voltage system, resulting in unexpected contact with high voltage system.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(2)(a) (d)(h) (employer responsibilities) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> Pre-work inspection of vehicle prior to start of work <input type="checkbox"/> SOP on pre-inspection of vehicles	
Vehicle Modifications	Deliberate or inadvertent changes to the battery management system, or battery, can cause unexpected changes to the battery operation including design, operation and safety.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(2)(a) (d)(h) (employer responsibilities) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> Pre-work inspection of vehicle prior to start of work <input type="checkbox"/> SOP on pre-inspection of vehicles	

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Chemical exposure	Lithium-ion batteries contain electrolytes that can be made up of various chemicals. Risk of exposure is minimal when the battery is in good repair or intact. When the battery is damaged, potential exposure to the electrolytes can occur. Exposure to these chemicals can be associated with toxicity or corrosiveness. Accidental exposure can lead to chemical burns as well as respiratory issues.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.79 (PPE training), 81 (eye protection), 84 (skin protection), 124 (eye washes/shower), s.130 (Chemical exposure training), s.126 (safe removal of material), 127 (ventilation) ▪ Reg 860 (WHMIS) ▪ Reg 833 (Bio/Chemical Agents) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> WHMIS program <input type="checkbox"/> WHMIS training, including workplace chemical specific training <input type="checkbox"/> Available SDS and proper labelling <input type="checkbox"/> Transportation of dangerous goods training <input type="checkbox"/> Eyewash/deluge shower <input type="checkbox"/> Eyewash/deluge shower inspection <input type="checkbox"/> PPE and training provided on its care, inspection and use <input type="checkbox"/> Training on emergency measures and procedures <input type="checkbox"/> SOP (Standard Operating Procedure) <input type="checkbox"/> Proper chemical cleanup and spill training <input type="checkbox"/> Spill cleanup material available	

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Flammable	Damaged or defective batteries can pose a fire hazard during handling/ transportation or storage. Additionally, individual cells/ modules may be packaged in combustible materials such as cardboard, that allow for damage during transportation, and make it difficult to identify damage.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.123 (Fire extinguishers) ▪ Reg. 213/07: Fire Code ▪ Reg 860 (WHMIS) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire extinguisher inspections <input type="checkbox"/> Fire alarm <input type="checkbox"/> Fire alarm testing <input type="checkbox"/> Emergency response procedures <input type="checkbox"/> Proper PPE training on its care, inspection and use <input type="checkbox"/> SOP (standard operating procedure)	
Flammable chemicals	Fire hazard if flammable chemicals contact electricity or arc, including gloves contaminated with oils.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.79 (PPE training), 81 (eye protection), 84 (skin protection), 130 (Chemical exposure) ▪ Reg 213 (Fire Code) ▪ Reg 860 (WHMIS) ▪ Reg 833 (Bio/ Chemical Agents) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> WHMIS program <input type="checkbox"/> WHMIS training including workplace chemical specific training <input type="checkbox"/> SDS and labels as required <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire extinguisher inspections <input type="checkbox"/> Emergency response plans <input type="checkbox"/> Fire alarm <input type="checkbox"/> Fire alarm testing <input type="checkbox"/> Proper disposal containers for contaminated materials/ gloves	

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Chemical exposure- Hydrofluoric acid (HF)	When a Li-ion battery is damaged, overcharged, or exposed to elevated temperatures, the chemicals inside can break down into other hazardous compounds. The LiPF6 within the battery can produce hydrofluoric acid (HF) if it is exposed to high heat. The addition of water may decrease the temperature at which this reaction occurs. HF is a highly corrosive and toxic substance that can cause severe burns upon contact and can be lethal if inhaled.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.79 (PPE training), 81 (eye protection), 84 (skin protection), 124 (eye washes/shower), s.130 (Chemical exposure) ▪ Reg. 860 (WHMIS) ▪ Reg. 833(Bio/ Chemical Agents) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> WHMIS program <input type="checkbox"/> WHMIS training including workplace chemical specific training <input type="checkbox"/> SDS sheets and labels as required <input type="checkbox"/> First aid kits and first aid training as required <input type="checkbox"/> Eyewash/deluge shower <input type="checkbox"/> Eyewash/deluge shower inspection <input type="checkbox"/> Proper PPE and PPE training on the care, inspection and use	
Thermal Runaway biproducts	The chemical reactions during thermal runaway can produce gases like carbon dioxide, carbon monoxide, hydrogen, and hydrocarbons. Depending on the location of the battery storage (inside) and the size of the battery the presence of these gases can be toxic.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OSHA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg 851 s.130 (Chemical Agents) 	<input type="checkbox"/> Hazard communicated to employees <input type="checkbox"/> CO detector/four gas monitor <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Respirators and fit testing as required <input type="checkbox"/> Proper PPE and PPE training on the care, inspection and use	

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Improper Battery System Coolant	If battery system coolant is replaced with improper coolant it may result in an increased risk of thermal runaway if the system develops a leak	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg. 851 s.130 (Chemical exposure) ▪ Reg. 860 (WHMIS) 	<input type="checkbox"/> Hazard Communicated to Employees <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Proper PPE and PPE training on the care, inspection and use	
Flammable Chemicals in AC	Some AC refrigerants contain flammable oils, which if used in a high voltage BEV AC System could result in a fire	<input type="checkbox"/> Yes <input type="checkbox"/> No	<ul style="list-style-type: none"> ▪ OHSA s.25(1)(a) (b)(c)(d), (2)(a) (d)(h) (employer responsibilities) ▪ Reg. 860 (WHMIS) ▪ Reg. 851 s.130 (Chemical exposure) 	<input type="checkbox"/> Hazard Communicated to Employees <input type="checkbox"/> SOP (standard operating procedure) <input type="checkbox"/> Proper PPE and PPE training on the care, inspection and use <input type="checkbox"/> WHMIS Program <input type="checkbox"/> WHMIS Training including workplace chemical specific training <input type="checkbox"/> SDS sheets and labels as required	

*The legislative list is not exhaustive, and other legislative requirements may apply.

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