

Lithium Battery Packaging Guidelines

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LITHIUM BATTERY PACKAGING GUIDELINES

Veolia ES Technical Solutions, LLC (Veolia) has developed these guidelines for packaging batteries in an effort to provide its customers with instructions on how to safely package and ship batteries for recycling or disposal*. By following these proper packaging methods, potential hazards may be minimized while the batteries are accumulated at the generator's location as well as during transportation to a recycling or disposal facility.

Historically, there were several incidents reported where a fire occurred as a result of small batteries being improperly packed in a drum. Veolia's goal is to assure that all batteries it manages are properly packaged and therefore the risk of such an incident occurring is minimized.

Lithium cells and batteries pose potential hazards during transportation, therefore it is imperative that all batteries comply with the proper US Department of Transportation (USDOT) packaging requirements that are referenced in this document. These guidelines were specifically developed to Address the shipment of batteries by highway, rail and cargo vessel. Additional requirements may apply to air shipments.

General Guidelines Applicable to Lithium Cells and Batteries Regardless of Type or Size

- Lithium-ion and lithium-metal batteries should not be packed together in the same outer package.
- USDOT requires that all batteries be packaged in a manner to prevent short-circuiting and damage to the terminals. Acceptable methods for short circuit prevention and terminal protection are described in the next section of this document.
- Note that batteries with recessed terminals in which damage to the terminals or short circuits would not occur do not require additional short circuit protection.
- All methods employed to protect from short circuits and to protect the terminals of the batteries must be adequate to withstand conditions normally incident to transportation. This includes the effects of shifting and vibration caused during transportation and subsequent handling!
- All batteries should be stored in a cool, dry environment.
- Leaking batteries must be individually packaged and may require shipment as an EPA hazardous waste.
- Incident reporting in accordance with §171.16 is required for ALL incidents involving shipments of batteries or battery-powered devices including fire, violent rupture, explosion, or a dangerous evolution of heat. This requirement applies to all battery shipments, including batteries that are excepted from the HMR requirements.

Health and Safety Considerations

Intact lithium batteries do not pose a health or safety hazard during use. However, if a battery becomes damaged there is a potential for exposure to these hazardous materials. If a battery becomes damaged or

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begins to leak consult a Safety Data Sheet from the manufacturer of the battery to obtain applicable health and safety data.

Battery Specific Information

The following pages contain specific packaging requirements for lithium-ion and lithium-metal cells and batteries.

By following these proper packaging methods, potential hazards may be minimized while the batteries are accumulated at the generator's location as well as during transportation to a recycling or disposal facility. Per USDOT regulation and agency guidance documents, any electrical device, even one not otherwise subject to the HMR (either by specific exception from the HMR, or because the device and its power source contains no material meeting the definition of a hazardous material), is forbidden from being offered for transportation, or transported, if the device is likely to create sparks or a dangerous evolution of heat, unless packaged in a manner that precludes such an occurrence.

For some batteries the packaging guidelines contained within this document may be more stringent than the USDOT packaging requirements. If circumstances dictate the use of a packaging method that is authorized by the USDOT but not listed in this document is required, authorization must be obtained from the Veolia Corporate Transportation Department.

Exceptions to these packaging procedures must be approved by Veolia Branch and Corporate EHS&T management. Packaging policy exceptions will only be approved when it can be shown that (1) the alternative packaging scenario complies with USDOT requirements, and (2) the packaging required by company policy is not feasible or practical to use given the unique characteristics of the batteries or the customer project.

The document will be amended as additional information regarding battery packaging is available.

PREVENT SHORT CIRCUITS AND PROTECT BATTERY TERMINALS



All batteries with exposed terminals must be packaged in a manner to prevent short-circuiting and with adequate protection of the battery terminals.

To prevent short-circuiting the USDOT has identified the following methods as acceptable methods of short-circuit protection:

1. Packaging each battery or each battery-powered device when practicable, in fully enclosed inner packagings made of non-conductive material.
2. Reattach the manufacturer's original terminal caps/covers and further secure the covers in place with tape if loose or seem likely to fall off during transportation/handling.
3. Separating or packaging batteries and battery-powered devices in a manner to prevent contact with other batteries, devices or conductive materials (e.g., metal) in the packagings.
4. Ensuring exposed terminals are protected with non-conductive caps, non-conductive tape, or by other appropriate means. Proper insulation includes taping the terminals of the batteries or packaging in

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individual clear plastic bags. Clear tape is required for small batteries so that battery identification is still possible. The tape or protective covering must be of sufficient durability and secured in a manner that it remains intact and abrasion-free during transportation/handling. Other forms of insulation may also be used provided they do not obscure the battery identification markings.

To prevent damage to terminals the USDOT has identified the following methods as acceptable methods for protecting battery terminals:

1. Securely attaching covers of sufficient strength to protect the terminals.
2. Packaging the battery in rigid plastic packaging.
3. Constructing the battery with terminals that are recessed.
4. Cushioning and packaging the batteries to prevent shifting which could loosen terminal caps or reorient the terminals.

BATTERIES PACKED IN OUTER CONTAINERS

- Batteries with different DOT shipping names should not be combined in the same outer packaging unless authorized by the US DOT under specific packaging instructions or an exclusion from the regulations.
- Batteries must be packaged in a manner that meets or exceeds the battery-specific packaging requirements specified within this document and all applicable regulations.
- The outer container must be constructed of a material that is non-conductive and compatible with the battery chemistry.
- The total weight of the outer packaging must not exceed the weight rating tested for the container.

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LITHIUM-ION CELLS / BATTERIES



Typical Uses:

Cameras, computers, phones, power tools, etc. Come in various sizes including AAA, AA and button cell. Lithium-ion batteries are often contained in non-standard sizes and shape battery packs used for special applications. Button cells with codes beginning in LIR are lithium-ion.

Composition:

Rechargeable secondary cells utilize lithium ions that are intercalated into graphite, lithium metal oxides and/or lithium salts. Common metal oxides and salts include lithium cobalt oxide, lithium manganese oxide and lithium iron phosphate. Metallic lithium is not used as either the anode or cathode in a lithium-ion battery. The electrolyte in a lithium-ion battery is typically an organic solvent. Organic solvents may include one or more of the following: propylene carbonate, dioxolane, dimethoxyethane or ethylene carbonate. Lithium-ion batteries include lithium-ion polymer batteries.

USDOT Description:

Type	Hazard Class	UN #
Lithium Ion Batteries	9	UN3480
Lithium Ion Batteries Contained in Equipment	9	UN3481
Lithium Ion Batteries Packed with Equipment	9	UN3481

US DOT Packaging Requirements: 49 CFR §173.185

All lithium-ion batteries must be prepared and packaged in a manner to prevent:

1. A dangerous evolution of heat,
2. Short circuits, and
3. Damage to the terminals

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Due to the degree of hazard presented by lithium-ion batteries, additional packaging restrictions are necessary to ensure the safety of the general public as well as Veolia employees and facilities. These include applying short-circuit protection to ALL battery terminals and restricting the methods of short-circuit protection to packaging lithium-ion batteries individually in clear plastic bags or packages or using clear tape over the terminals. This includes lithium-ion batteries with recessed terminals and terminals contained within plugs attached to the battery.

US DOT Marking and Labeling Requirements:

Refer to the [MARKING REQUIREMENTS FOR PACKAGINGS CONTAINING LITHIUM BATTERIES](#) section of the guidelines for marking and labeling requirements for lithium battery packagings.

US EPA Regulations:

All lithium batteries should be managed as a universal waste in accordance with 40 CFR Part 273. All containers of universal waste batteries must be marked with the words "Universal Waste Batteries," "Waste Batteries," or "Used Batteries."

LITHIUM-ION CELLS / BATTERIES TRANSPORTED FOR RECYCLING OR DISPOSAL

- Not subject to testing and recordkeeping requirements of 49 CFR §173.185(a).
- Limited to transportation by motor vehicle only.
- Cells/batteries must be protected against short circuits and damage to terminals.
- Packaged in non-bulk strong outer packaging, 49 CFR §173.185(d)
- Non-bulk strong outer packages must meet general packaging requirements of 49 §§173.24 and 173.24a
- Lithium batteries shipped by vessel must be in UN specification packaging (PG II) per 173.185(b)(3).
- Excepted from 49 CFR, Part 172, Subparts C through H when the lithium cell or battery meets the size, packaging, and hazard communication conditions in paragraph 173.185(c)(1)-(3) for [small-sized lithium cells/batteries](#).

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DAMAGED, DEFECTIVE OR RECALLED (DDR) LITHIUM-ION CELLS OR BATTERIES

One Cell / Battery Per Single Outer Package

According to §173.185(f), lithium cells or batteries that have been damaged or identified as defective and have the potential of producing a dangerous evolution of heat, fire, or short circuit may be transported by highway, rail or vessel only, and must be packaged as follows:

- Each cell or battery must be placed in an individual, sealable, plastic inner packaging (e.g. ziplock bag, plastic liner) that completely encloses the cell or battery;
- The inner packaging must be surrounded by cushioning material that is non-combustible, non-conductive, and absorbent; and
- Each inner packaging must be individually placed in one of the following UN specification packagings meeting the Packing Group I level:
 - Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), or solid plastic (4H2) box; Metal (1A2, 1B2, 1N2), plywood (1D), or plastic (1H2) drum
- The outer package must be marked with an indication that the package contains a “Damaged/defective lithium-ion battery”
- As an additional Veolia safety measure, all packages containing damaged/defective lithium cells/batteries must be equipped with a venting device. The package must be opened to relieve any pressure build-up before transportation and vented periodically while in storage.
Exception: Small lithium-ion batteries may be packed in a 5 gallon pail without the use of a venting device as long as the total weight of the batteries (applies to the entire battery, not only the lithium content) does not exceed 0.5 lbs.

Multiple DDR Batteries Per Single Outer Package (DOT-SP 16532)

- DOT-SP 16532 authorizes more than one damaged/defective cell or battery per outer packaging.
- Refer to the special permit for specific packaging requirements.
- As an additional Veolia safety measure, all packages containing damaged/defective lithium cells/batteries and prepared following the special permit must be equipped with a venting device (see above). The package must be opened to relieve any pressure build-up before transportation and vented periodically while in storage.

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LARGE SIZE LITHIUM-ION CELLS / BATTERIES

Lithium cells or batteries that weigh 12 kg (26.5 pounds) or more and have a strong, impact-resistant outer casing, may be packed in strong outer packagings; in protective enclosures (for example, in fully enclosed or wooden slatted crates); or on pallets or other handling devices, instead of packages meeting the UN performance packaging requirements in §173.185 (b)(3)(ii) and (b)(3)(iii).

When loading large batteries onto a pallet for transportation the following requirements must be followed:

- Batteries must be stacked on the pallet with the terminals protected from short-circuits with non-conductive caps, tape or other insulating material and facing away from touching the terminals of other batteries.
- Layers of batteries with top-facing terminals should be stacked in a manner that will protect the terminals from damage or breakage. Heavy batteries should always be placed on the lowest level to prevent crushing. Layers should be separated by waffle board or sheets of cardboard for stabilization and to help prevent short circuits.
- Batteries must be secured against movement or shifting on the pallet by nailing wooden cleats to the pallet. Plastic banding or shrink wrap of sufficient strength should be wrapped around the completed pallet to secure the batteries in place. Banding must not be in a position in which it will come in contact with the battery terminals. When using non-conductive banding to secure batteries to pallets, precautions should be taken to ensure any metal clips used to connect the banding straps do not come in contact with exposed battery terminals.
- Pallets must be of good integrity with no broken or loose boards and must be sturdy and durable enough to handle the weight of the battery load.
- Cells and batteries must be secured to prevent inadvertent shifting, and the terminals may not support the weight of other superimposed elements.

SMALL-SIZED LITHIUM-ION CELLS / BATTERIES - EXCEPTION

Relief from certain DOT requirements can be found in 49 CFR §173.185(c) for certain small lithium-ion cells and batteries.

Size Limits:

- The Watt-hour (Wh) rating may not exceed 60 Wh for a lithium-ion cell or 300 Wh for a lithium-ion battery (*highway and rail shipments*)

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- The Watt-hour (Wh) rating may not exceed 20 Wh for a lithium-ion cell or 100 Wh for a lithium-ion battery (*vessel shipments*)
- Except when lithium cells or batteries are packed with, or contained in, equipment, each package must not exceed 30 kg (66 pounds) gross weight.

Packaging:

- Small lithium cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- Strong rigid outer packaging (Non-UN specification container)
- Each package of lithium cells or batteries, or the completed package when packed with equipment, must be capable of withstanding a 1.2-meter drop test, in any orientation, without damage to the cells or batteries contained in the package, without shifting of the contents that would allow battery-to-battery (or cell-to-cell) contact, and without the release of the contents of the package.

Marking:

- *For Highway or Rail Shipments* - The outside package must be marked "LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL." Consult the regulations for size requirements. Must be visible or affixed to the outside of an overpack.
- *For Vessel Shipments* - The outside package must be marked "LITHIUM ION BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT". Consult the regulations for size requirements. Must be visible or affixed to the outside of an overpack.
- Each package must display the lithium battery mark except when a package contains only button cell batteries contained in equipment (including circuit boards), or when a consignment contains two packages or fewer where each package contains not more than four lithium cells or two lithium batteries contained in equipment. See 173.185(c)(3) for mark requirements.
- When packages are placed in an overpack, the lithium battery mark shall either be clearly visible through the overpack or be reproduced on the outside of the overpack, and the overpack shall be marked with the word "OVERPACK." The lettering of the "OVERPACK" mark shall be at least 12 mm (0.47 inches) high.

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LITHIUM BUTTON CELL BATTERIES CONTAINED IN EQUIPMENT

According to 173.185(c), lithium button cell batteries installed in equipment (including circuit boards) are excluded from the hazard communication and specification packaging requirements. No DOT marking/labels are required.

WET LITHIUM-ION BATTERIES / CELLS

Batteries are forbidden from being shipped while submerged in water or oil. Once the batteries have been wet, they should be considered to be damaged/defective and must be managed in accordance with Veolia's policy entitled, [Wetted or Submerged Lithium Ion Cells and Batteries](#).

THIN FILM / POUCH LITHIUM-ION CELLS / BATTERIES

Lithium-ion cells or batteries with thin film outer membranes or in pouches are fragile and must be handled with care. Any damage or tearing of the thin membrane/pouch has an extremely high risk of resulting in fire or explosion.

Intact Thin Film / Pouch Batteries

Intact thin film/pouch lithium-ion cells or batteries must be managed as damaged lithium-ion batteries following 49 CFR 173.185(f), DOT-SP 16532 or other equivalent USDOT special permit.

- Each cell or battery must be placed in an individual, sealable, plastic inner packaging (e.g. ziplock bag, plastic liner) that completely encloses the cell or battery;
- Multiple inner packages are authorized under DOT-SP 16532
- As an additional Veolia safety measure, the outer container for intact thin film/pouch lithium-ion batteries, whether packed in accordance with 49 CFR 173.185(f) or a USDOT special permit, must be a UN specification package rated to the PG I level. The outside package must be a 5 gallon or smaller poly container with a twist off lid. Vents are not required. Outside containers must not exceed 35 pounds. *Note: 5 gallons is the smallest size package authorized under DOT-SP 16532. 2.5 gallon poly pails with twist off lids are authorized under 49 CFR 173.185(f).
- The inner packaging must be surrounded by Veolia's DefendPak™ thermal suppressant media. The thermal suppressant media must be in a quantity enough to fill the outer package to less than one inch from the top of the container;

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- The outer package must only contain thin film (pouch) lithium-ion batteries. No other types of lithium-ion batteries can be packed in the same outer container.

Damaged Thin Film / Pouch Batteries

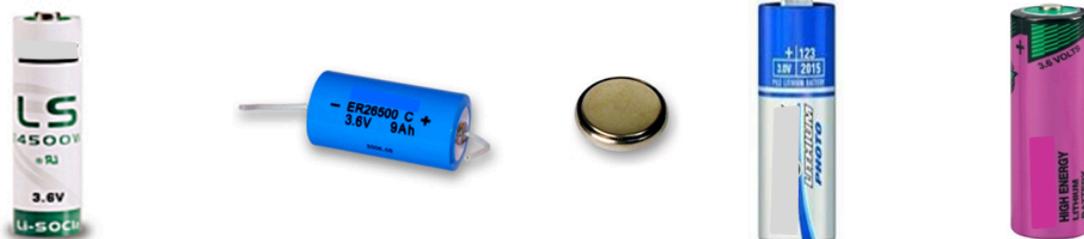
As a Veolia safety measure, damaged thin film/pouch lithium-ion cells or batteries (including tears that occur while packaging) are limited to one cell/battery per outer package and must be packaged in accordance with 49 CFR 173.185(f). DOT-SP 16532 should not be used for the shipment of DDR thin film/pouch lithium-ion cells or batteries.

- Each cell or battery must be placed in an individual, sealable, plastic inner packaging (e.g. ziplock bag, plastic liner) that completely encloses the cell or battery;
- The inner packaging must be surrounded by Veolia's DefendPak™ thermal suppressant media. The thermal suppressant media must be in a quantity enough to fill the outer package to less than one inch from the top of the container;
- As an additional Veolia safety measure, the outer container for DDR thin film/pouch lithium-ion batteries must be a UN specification package rated to the PG I level. The outside package must be a 5 gallon or smaller poly container with a twist off lid. Vents are not required. Outside containers must not exceed 35 pounds.
- The outer package must be marked with an indication that the package contains a "Damaged/defective lithium-ion battery"
- The outer package must only contain thin film (pouch) lithium-ion batteries. No other types of lithium-ion batteries can be packed in the same outer container.

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LITHIUM METAL CELLS / BATTERIES



Typical Uses:

Cameras, calculators, watches, small electronics etc.

Composition:

Lithium metal cells and batteries are constructed with metallic lithium. The metallic lithium in a non-rechargeable primary lithium battery is a combustible alkali metal that self-ignites at 352°F, and when exposed to water or seawater reacts exothermically and releases hydrogen. Lithium metal batteries include lithium alloy batteries.

The table below lists several of the most common types of lithium batteries:

Anode	Cathode	Electrolyte
Lithium	Manganese Dioxide	Lithium perchlorate in an organic solvent*
Lithium	Iron Sulfide	Organic solvent*
Lithium	Thionyl Chloride	Lithium tetrachloroaluminate in thionyl chloride
Lithium	Sulfur Dioxide	Lithium bromide in sulfur dioxide and acetonitrile

*Organic solvents may include one or more of the following: propylene carbonate, dioxolane, dimethoxyethane, ethylene carbonate

US DOT Description:

Type	Hazard Class	UN #
Lithium Metal Batteries	9	UN3090
Lithium Metal Batteries Contained in Equipment	9	UN3091

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Lithium Metal Batteries Packed with Equipment	9	UN3091
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US DOT Packaging Requirements: 49 CFR §173.185

All lithium batteries must be prepared and packaged in a manner to prevent:

4. A dangerous evolution of heat,
5. Short circuits, and
6. Damage to the terminals

Due to the degree of hazard presented by lithium batteries, additional packaging restrictions are necessary to ensure the safety of the general public as well as Veolia employees and facilities. These include applying short-circuit protection to ALL battery terminals and restricting the methods of short-circuit protection to packaging lithium batteries individually in clear plastic bags or packages or using clear tape over the terminals. This includes lithium batteries with recessed terminals and terminals contained within plugs attached to the battery.

US DOT Marking and Labeling Requirements:

Refer to the [MARKING REQUIREMENTS FOR PACKAGINGS CONTAINING LITHIUM BATTERIES](#) section of the guidelines for marking and labeling requirements for lithium battery packagings.

US EPA Regulations:

Lithium metal is a water-reactive metal. As such lithium batteries should be managed as a universal waste in accordance with 40 CFR 273. All containers of universal waste batteries must be marked with the words: "Universal Waste Batteries", "Waste Batteries", or "Used Batteries".

LITHIUM METAL CELLS / BATTERIES TRANSPORTED FOR RECYCLING OR DISPOSAL
<ul style="list-style-type: none">• Not subject to testing and recordkeeping requirements of 49 CFR §173.185(a).• Limited to transportation by motor vehicle only.• Cells/batteries must be protected against short circuits and damage to terminals.• Packaged in non-bulk strong outer packaging, 49 CFR §173.185(d).• Non-bulk strong outer packages must meet general packaging requirements of 49 §§173.24 and 173.24a.• Lithium batteries shipped by vessel must be in UN specification packaging (PG II) per

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§173.185(b)(3).

- Excepted from 49 CFR, Part 172, Subparts C through H when the lithium cell or battery meets the size, packaging, and hazard communication conditions in paragraph §173.185(c)(1)-(3) for smaller size lithium cells/batteries.

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DAMAGED, DEFECTIVE OR RECALLED (DDR) LITHIUM METAL CELLS OR BATTERIES

One Cell / Battery Per Single Outer Package

According to §173.185(f), lithium cells or batteries that have been damaged or identified as defective and have the potential of producing a dangerous evolution of heat, fire, or short circuit may be transported by highway, rail or vessel only, and must be packaged as follows:

- Each cell or battery must be placed in an individual, sealable, plastic inner packaging (e.g. ziplock bag, plastic liner) that completely encloses the cell or battery:
- The inner packaging must be surrounded by cushioning material that is non-combustible, non-conductive, and absorbent, and
- Each inner packaging must be individually placed in one of the following UN specification packagings meeting the Packing Group I level:
 - Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), or solid plastic (4H2) box; Metal (1A2, 1B2, 1N2), plywood (1D), or plastic (1H2) drum.
- The outer package must be marked with an indication that the package contains a “Damaged/defective lithium metal battery”.
- As an additional Veolia safety measure, all packages containing damaged/defective lithium cells/batteries must be equipped with a venting device. The package must be opened to relieve any pressure build-up before transportation and vented periodically while in storage.
Exception: Small lithium metal batteries may be packed in a 5-gallon pail without the use of a venting device as long as the total weight of the batteries (applies to the entire battery, not only the lithium content) does not exceed 0.5 lbs.

Multiple DDR Batteries Per Single Outer Package (DOT-SP 16532)

- DOT-SP 16532 authorizes more than one damaged/defective cell or battery per outer packaging.
- Refer to the special permit for specific packaging requirements.
- As an additional Veolia safety measure, all packages containing damaged/defective lithium cells/batteries and prepared following the special permit must be equipped with a venting device (see above). The package must be opened to relieve any pressure build-up before transportation and vented periodically while in storage.

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LARGE SIZE LITHIUM METAL CELLS / BATTERIES

Lithium cells or batteries that weigh 12 kg (26.5 pounds) or more and have a strong, impact-resistant outer casing, may be packed in strong outer packagings; in protective enclosures (for example, in fully enclosed or wooden slatted crates); or on pallets or other handling devices, instead of packages meeting the UN performance packaging requirements in §173.185(b)(3)(ii) and (b)(3)(iii).

When loading batteries onto a pallet for transportation the following requirements must be followed:

- Batteries must be stacked on the pallet with the terminals protected from short-circuits with non-conductive caps, tape or other insulating material and facing away from touching the terminals of other batteries.
- Layers of batteries with top-facing terminals should be stacked in a manner that will protect the terminals from damage or breakage. Heavy batteries should always be placed on the lowest level to prevent crushing. Layers should be separated by waffle board or sheets of cardboard for stabilization and to help prevent short circuits.
- Batteries must be secured against movement or shifting on the pallet by nailing wooden cleats to the pallet. Plastic banding or shrink wrap of sufficient strength should be wrapped around the completed pallet to secure the batteries in place. Banding must not be in a position in which it will come in contact with the battery terminals. When using non-conductive banding to secure batteries to pallets, precautions should be taken to ensure any metal clips used to connect the banding straps do not come in contact with exposed battery terminals.
- Pallets must be of good integrity with no broken or loose boards and must be sturdy and durable enough to handle the weight of the battery load.
- Cells and batteries must be secured to prevent inadvertent shifting, and the terminals may not support the weight of other superimposed elements.

SMALL-SIZED LITHIUM METAL CELLS / BATTERIES - EXCEPTION

Relief from certain DOT requirements can be found in 49 CFR §173.185(c) for certain small lithium metal cells and batteries.

- Special hazard communication and marking requirements will need to be met.
- Each package must be rigid unless the cell or battery is contained in equipment and is afforded equivalent protection by the equipment in which it is contained.

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- Each package of lithium cells or batteries, or the completed package when packed with equipment must be capable of withstanding a 1.2 meter drop test.

Size Limits:

- The lithium content may not exceed 1 g for a lithium metal cell or 2 g for a lithium metal battery. (*Vessel shipments*)
- The lithium content may be increased to 5 g for a lithium metal cell or 25 g for a lithium metal battery. (*Highway and rail shipments only*)
- Except when the lithium cells or batteries are packed with, or contained in, equipment, each package must not exceed 30 kg (66 pounds) gross weight.

Packaging:

- Inner packaging must completely enclose the cell/battery.
- Strong rigid outer packaging (Non-UN specification container)
- Each package of lithium cells or batteries, or the completed package when packed with equipment, must be capable of withstanding a 1.2-meter drop test, in any orientation, without damage to the cells or batteries contained in the package, without shifting of the contents that would allow battery-to-battery (or cell-to-cell) contact, and without the release of the contents of the package.

Marking:

- *For Highway or Rail Shipments* - The outside package must be marked "LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL." Consult the regulations for size requirements. Must be visible or affixed to the outside of an overpack.
- *For Vessel Shipments* - The outside package must be marked "LITHIUM METAL BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT". Consult the regulations for size requirements. Must be visible or affixed to the outside of an overpack.
- Each package must display the lithium battery mark except when a package contains only button cell batteries contained in equipment (including circuit boards), or when a consignment contains two packages or fewer where each package contains not more than four lithium cells or two lithium batteries contained in equipment. See 173.185(c)(3) for mark requirements.
- When packages are placed in an overpack, the lithium battery mark shall either be clearly visible through the overpack or be reproduced on the outside of the overpack, and the overpack

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shall be marked with the word "OVERPACK". The lettering of the "OVERPACK" mark shall be at least 12 mm (0.47 inches) high.

LITHIUM BATTERIES CONTAINED IN EQUIPMENT

According to §173.185(b)(4), lithium cells or batteries contained in equipment must be packaged as follows:

- The outer packaging, when used, must be constructed of suitable material of adequate strength and design in relation to the capacity and intended use of the packaging, unless the lithium cells or batteries are afforded equivalent protection by the equipment in which they are contained;
- Equipment must be secured against movement within the outer packaging and be packed to prevent accidental operation during transport; and
- Any spare lithium cells or batteries packed with the equipment must be packaged in accordance with paragraph §173.185(b)(3) or (d) when shipped for disposal or recycling.
- When a package contains lithium batteries in equipment and spare lithium batteries the package must be described as "Lithium metal batteries packed with equipment" (Special Provision 181).

LITHIUM BUTTON CELL BATTERIES CONTAINED IN EQUIPMENT

According to §173.185(c), lithium button cell batteries installed in equipment (including circuit boards) are excluded from the hazard communication and specification packaging requirements. No DOT markings/labels are required.

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MARKING REQUIREMENTS FOR PACKAGINGS CONTAINING LITHIUM BATTERIES

FULLY REGULATED BATTERIES

Subject to marking, labeling and shipping papers. Cell or battery size limits do not apply. Specific UN specification packagings are required. Lithium batteries that weigh 12 kg (26.5 pounds or more and have a strong, impact-resistant outer casing may be packed in strong outer packages or shipped on pallets. See §173.185(a) & (b) for full details regarding packaging requirements.

Battery Type	Lithium Content Watt-hour Rating	Container Size	Markings Required
Lithium Ion	No Restriction	See §173.185(b) for approved UN packaging types	UN3480, Lithium-ion batteries OR UN3481, Lithium-ion batteries contained in equipment OR UN3481, Lithium-ion batteries packed with equipment AND 
Lithium Metal	No Restriction	See §173.185(b) for approved UN packaging types	UN3090, Lithium metal batteries OR UN3091, Lithium metal batteries contained in equipment OR UN3091, Lithium metal batteries packed with equipment AND 

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LITHIUM CELLS OR BATTERIES SHIPPED FOR DISPOSAL OR RECYCLING

§173.185(d) Applicable to highway shipments only.

Must be transported to a permitted storage facility or disposal site for the purposes of disposal or recycling. Excepted from UN specification packaging requirements and battery testing/recordkeeping by the manufacturer. When these shipments meet the applicable size, packaging and hazard communication conditions for “smaller” cells and batteries in 173.185(c), they may be marked in accordance with the smaller lithium battery provisions.

Battery Type	Lithium Content Watt-hour Rating	Container Size	Markings Required
Lithium Ion	No Limit	No Limit	UN3480, Lithium-ion batteries OR UN3481, Lithium-ion batteries contained in equipment OR UN3481, Lithium-ion batteries packed with equipment AND 
Lithium Metal	No Limit	No Limit	UN3090, Lithium metal batteries OR UN3091, Lithium metal batteries contained in equipment OR UN3091, Lithium metal batteries packed with equipment AND 

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DAMAGED, DEFECTIVE OR RECALLED CELLS OR BATTERIES			
§173.185(f) Applicable to highway, rail and vessel shipments only.			
Battery Type	Lithium Content Watt-hour Rating	Container Size	Markings Required
Lithium Ion	No Limit	<p><i>Only one battery per outer packaging is allowed.</i></p> <p><i>The battery must be placed in a non-metallic inner packaging that completely encompasses the cell or battery.</i></p> <p><i>See §173.185(f) for specific packaging requirements.</i></p>	<p>UN3480, Lithium-ion batteries OR UN3481, Lithium-ion batteries contained in equipment OR UN3481, Lithium-ion batteries packed with equipment AND</p>  <p>AND</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>Damaged/Defective Lithium Ion Battery</p> </div>
Lithium Metal	No Limit	<p>Only one battery per outer packaging is allowed.</p> <p>See §173.185(f) for specific packaging requirements.</p>	<p>UN3090, Lithium metal batteries OR UN3091, Lithium metal batteries contained in equipment OR UN3091, Lithium metal batteries packed with equipment AND</p>  <p>AND</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>Damaged/Defective Lithium Metal Battery</p> </div>

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<p>DOT-SP 16532 (For highway or rail shipments only)</p>	<p><u>Lithium Metal</u> ≤5 g per cell or ≤ 25 g per battery</p> <p><u>Lithium Ion</u> ≤60 Wh per cell or 300 Wh per battery</p>	<p>Authorizes multiple cells/batteries per outer packaging.</p> <p>See SP for specific packaging requirements.</p>	<p>UN3480, Lithium-ion batteries OR UN3090, Lithium metal batteries AND</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>Damaged/Defective Lithium Ion Batteries</p> </div> <p>OR</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>Damaged/Defective Lithium Metal Batteries</p> </div> <p>AND</p> 
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EXCEPTIONS FOR SMALLER CELLS OR BATTERIES

Excepted from shipping papers, marking, labeling, placarding, emergency response information, training and UN specification packaging requirements. Subject to size limitations. Special hazard communication requirements apply. The completed package must not exceed 66 pounds for batteries or cells that are not packed with or contained in equipment. Applicable to all modes of transportation (highway, rail, cargo vessel and air). Additional restrictions applicable to shipments by air are not included in this document. It is against Veolia's policy to offer lithium cells/batteries for transportation by air. See §173.185(c) for full requirements.

The lithium battery mark must either: (1) be clearly visible through the overpack; or (2) the lithium battery mark must also be affixed on the outside of the overpack, and the overpack must be marked with the work "OVERPACK" in lettering at least 12 mm (0.47 inches) high.

Note: When a package contains button cell batteries installed in equipment (including circuit boards) OR when a package contains no more than four small lithium cells or two small lithium batteries contained in equipment when there are no more than two packages in a consignment, the Lithium Battery Mark is not required. The Lithium Battery Forbidden For Transport Aboard Aircraft / Vessel mark must be applied unless the shipment is also limited to ≤4 cells or ≤2 batteries and there are less than 2 packages containing batteries in the entire shipment.

Battery Type	Lithium Content Watt-hour Rating	Container Size	Markings Required
Button Cell Batteries Installed in Equipment (including circuit boards)	N/A	No Limit	No Markings Required

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<p>Lithium-Ion (For highway or rail shipments only)</p>	<p>≤60 Wh per cell or ≤300 Wh per battery</p>	<p>≤30 kg (66 lbs)</p>	<p>LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL</p> <p>AND</p> 
<p>Lithium-Ion (For all modes except air)</p>	<p>≤20 Wh per cell or ≤100 Wh per battery</p>	<p>≤30 kg (66 lbs)</p>	<p>LITHIUM ION BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT</p> <p><small>UL94V-0 LABEL FACTORY # 0000 001 0000 www.lithiumbattery.com</small></p> <p>OR</p>  <p>AND</p> 
<p>Lithium-Ion Packed With or Contained in Equipment (For highway or rail shipments only)</p>	<p>≤60 Wh per cell or ≤300 Wh per battery</p>	<p>No Limit (>5 kg net weight)</p>	<p>LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL</p> <p>AND</p> 

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<p>Lithium-Ion Packed With or Contained in Equipment (For highway or rail shipments only)</p>	<p>≤60 Wh per cell or ≤300 Wh per battery</p>	<p>≤5 kg net weight</p>	
<p>Lithium-Ion Packed With or Contained in Equipment (For shipments by cargo vessel)</p>	<p>≤20 Wh per cell or ≤100 Wh per battery</p>	<p>≤5 kg net weight</p>	
<p>Lithium-Ion Packed With or Contained in Equipment (When shipping by cargo vessel)</p>	<p>≤20 Wh per cell or ≤100 Wh per battery</p>	<p>>5 kg net weight</p>	<p>LITHIUM ION BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT</p> <p>SLB34 LABEL PRACTICE® (800) 631-6888 www.infomaster.com</p> <p>AND</p> 
<p>Lithium-Ion Contained in Equipment <i>(Not applicable to Packed With Equip.)</i> (For all modes except air)</p>	<p>≤20 Wh per cell or ≤100 Wh per battery</p>	<p>≤4 cells or ≤2 batteries AND ≤2 packages per shipment AND Total lithium content in the package does not exceed 5 kg net weight</p>	<p>No Markings Required</p>
<p>Lithium-Ion Contained in Equipment <i>(Not applicable to Packed With Equip.)</i> (For highway or rail shipments only)</p>	<p>≤60 Wh per cell or ≤300 Wh per battery</p>	<p>≤4 cells or ≤2 batteries AND ≤2 packages per shipment AND Total lithium content in the package does not exceed 5 kg net weight</p>	<p>No Markings Required</p>

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<p>Lithium Metal (For highway or rail shipments only)</p>	<p>≤5 grams per cell or ≤25 grams per battery</p>	<p>≤30 kg (66 lbs)</p>	<p>LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL</p> <p>AND</p> 
<p>Lithium Metal Packed With or Contained in Equipment (For highway or rail shipments only)</p>	<p>≤5 grams per cell or ≤25 grams per battery</p>	<p>≤5 kg net weight</p>	
<p>Lithium Metal Packed With or Contained in Equipment (For highway or rail shipments only)</p>	<p>≤5 grams per cell or ≤25 grams per battery</p>	<p>No Limit (>5 kg net weight)</p>	<p>LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL</p> <p>AND</p> 
<p>Lithium Metal (For all modes except air)</p>	<p>≤1 gram per cell or ≤2 grams per battery</p>	<p>≤30 kg (66 lbs)</p>	<p>LITHIUM METAL BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT</p> <p>OR</p>  <p>AND</p>

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<p>Lithium Metal Packed With or Contained in Equipment (For all modes except air)</p>	<p>≤1 gram per cell or ≤2 grams per battery</p>	<p>No Limit (>5 kg net weight)</p>	<p>LITHIUM METAL BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT</p> <p>OR</p>  <p>AND</p> 
<p>Lithium Metal Packed With or Contained in Equipment (For all modes except air)</p>	<p>≤1 gram per cell or ≤2 grams per battery</p>	<p>≤5 kg net weight</p>	
<p>Lithium Metal Contained in Equipment <i>(Not applicable to Packed With Equip.)</i> (For all modes)</p>	<p>≤1 gram per cell or ≤2 grams per battery</p>	<p>≤4 cells or ≤2 batteries AND ≤2 packages per shipment AND Total lithium content in the package does not exceed 5 kg net weight</p>	<p>No Markings Required</p>
<p>Lithium Metal Contained in Equipment <i>(Not applicable to Packed With</i></p>	<p>≤5 grams per cell or ≤25 grams per</p>	<p>≤4 cells or ≤2 batteries AND ≤2 packages per</p>	<p>No Markings Required</p>

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<i>Equip.)</i> (For highway or rail shipments only)	battery	shipment AND Total lithium content in the package does not exceed 5 kg net weight	
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REGULATORY APPENDIX

The following contains excerpts from the US DOT regulations. 49 CFR Part 171-173, that are referend in the guidance document. For a complete version of the hazardous materials regulations consult the Code of Federal Regulations.

§172.102, SPECIAL PROVISION 181

When a package contains a combination of lithium batteries contained in equipment and lithium batteries packed with equipment, the following requirements apply:

- a. The shipper must ensure that all applicable requirements of § 173.185 of this subchapter are met. The total mass of lithium batteries contained in any package must not exceed the quantity limits in columns (9A) and (9B) for passenger aircraft or cargo aircraft, as applicable;
- b. Except as provided in § 173.185(c)(3) of this subchapter, the package must be marked "UN 3091 Lithium metal batteries packed with equipment", or "UN 3481 Lithium ion batteries packed with equipment," as appropriate. If a package contains both lithium metal batteries and lithium ion batteries packed with and contained in equipment, the package must be marked as required for both battery types. However, button cell batteries installed in equipment (including circuit boards) need not be considered; and
- c. The shipping paper must indicate "UN 3091 Lithium metal batteries packed with equipment" or "UN 3481 Lithium ion batteries packed with equipment," as appropriate. If a package contains both lithium metal batteries and lithium ion batteries packed with and contained in equipment, then the shipping paper must indicate both "UN 3091 Lithium metal batteries packed with equipment" and "UN 3481 Lithium ion batteries packed with equipment."

NOTE: Due to the restrictions of the Veolia field tracking system all batteries must be sorted as only one shipping name can be assigned to a single line item on the manifest.

§172.102, SPECIAL PROVISION 182

Equipment containing only lithium batteries must be classified as either UN 3091 or UN 3481.

§172.447 LITHIUM BATTERY label



§173.185 Lithium cells and batteries

As used in this section, lithium cell(s) or battery(ies) includes both lithium metal and lithium-ion chemistries. Equipment means the device or apparatus for which the lithium cells or batteries will provide electrical power for its operation. Consignment means one or more packages of hazardous materials accepted by an operator from one shipper at one time and at one address, receipted for in one lot and moving to one consignee at one destination address.

(a) Classification.

- (1) Each lithium cell or battery must be of the type proven to meet the criteria in part III, sub-section 38.3 of the UN Manual of Tests and Criteria (IBR; see §171.7 of this subchapter). Lithium cells and

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batteries are subject to these tests regardless of whether the cells used to construct the battery are of a tested type.

(i) Cells and batteries manufactured according to a type meeting the requirements of sub-section 38.3 of the UN Manual of Tests and Criteria, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, unless otherwise provided in this subchapter.

(ii) Cell and battery types only meeting the requirements of the UN Manual of Tests and Criteria, Revision 3, are no longer valid. However, cells and batteries manufactured in conformity with such types before July 2003 may continue to be transported if all other applicable requirements are fulfilled.

(2) Each person who manufactures lithium cells or batteries must create a record of satisfactory completion of the testing required by this paragraph prior to offering the lithium cell or battery for transport and must:

(i) Maintain this record for as long as that design is offered for transportation and for one year thereafter; and

(ii) Make this record available to an authorized representative of the Federal, state or local government upon request.

(3) Except for cells or batteries meeting the requirements of paragraph (c) of this section, each lithium cell or battery must:

(i) Incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport;

(ii) Be equipped with means of preventing external short circuits; and

(iii) Be equipped with a means of preventing dangerous reverse current flow (e.g., diodes or fuses) if a battery contains cells, or a series of cells that are connected in parallel.

(b) Packaging.

(1) Each package offered for transportation containing lithium cells or batteries, including lithium cells or batteries packed with, or contained in, equipment, must meet all applicable requirements of subpart B of this part.

(2) Lithium cells or batteries, including lithium cells or batteries packed with, or contained in, equipment, must be packaged in a manner to prevent:

(i) Short circuits;

(ii) Movement within the outer package; and

(iii) Accidental activation of the equipment.

(3) For packages containing lithium cells or batteries offered for transportation:

(i) The lithium cells or batteries must be placed in non-metallic inner packagings that completely enclose the cells or batteries, and separate the cells or batteries from contact with equipment, other devices, or conductive materials (e.g., metal) in the packaging.

(ii) The inner packagings containing lithium cells or batteries must be placed in one of the following packagings meeting the requirements of part 178, subparts L and M, of this subchapter at the Packing Group II level:

(A) Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), fiberboard (4G), or solid plastic (4H1, 4H2) box;

(B) Metal (1A2, 1B2, 1N2), plywood (1D), fiber (1G), or plastic (1H2) drum;

(C) Metal (3A2, 3B2) or plastic (3H2) jerrican.

(iii) When packed with equipment, lithium cells or batteries must:

(A) Be placed in inner packagings that completely enclose the cell or battery, then placed in an outer packaging. The completed package for the cells or batteries must meet the Packing Group II performance requirements as specified in paragraph (b)(3)(ii) of this section; or

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- (B) Be placed in inner packagings that completely enclose the cell or battery, then placed with equipment in a package that meets the Packing Group II performance requirements as specified in paragraph (b)(3)(ii) of this section.
- (4) When lithium cells or batteries are contained in equipment:
- (i) The outer packaging, when used, must be constructed of suitable material of adequate strength and design in relation to the capacity and intended use of the packaging, unless the lithium cells or batteries are afforded equivalent protection by the equipment in which they are contained;
 - (ii) Equipment must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during transport; and
 - (iii) Any spare lithium cells or batteries packed with the equipment must be packaged in accordance with paragraph (b)(3) of this section.
- (5) Lithium batteries that weigh 12 kg (26.5 pounds) or more and have a strong, impact-resistant outer casing and assemblies of such batteries, may be packed in strong outer packagings; in protective enclosures (for example, in fully enclosed or wooden slatted crates); or on pallets or other handling devices, instead of packages meeting the UN performance packaging requirements in paragraphs (b)(3)(ii) and (b)(3)(iii) of this section. Batteries or battery assemblies must be secured to prevent inadvertent movement, and the terminals may not support the weight of other superimposed elements. Batteries or battery assemblies packaged in accordance with this paragraph are not permitted for transportation by passenger-carrying aircraft, and may be transported by cargo aircraft only if approved by the Associate Administrator.
- (6) Except for transportation by aircraft, the following rigid large packagings are authorized for a single battery, including for a battery contained in equipment, meeting provisions in paragraphs (b)(1) and (2) of this section and the requirements of part 178, subparts P and Q, of this subchapter at the Packing Group II level:
- (i) Metal (50A, 50B, 50N);
 - (ii) Rigid plastic (50H);
 - (iii) Wooden (50C, 50D, 50F);
 - (iv) Rigid fiberboard (50G).

(c) Exceptions for smaller cells or batteries. Other than as specifically stated below, a package containing lithium cells or batteries, or lithium cells or batteries packed with, or contained in, equipment, that meets the conditions of this paragraph is excepted from the requirements in subparts C through H of part 172 of this subchapter and the UN performance packaging requirements in paragraphs (b)(3)(ii) and (iii) of this section under the following conditions and limitations.

(1) Size limits.

- (i) The Watt-hour (Wh) rating may not exceed 20 Wh for a lithium ion cell or 100 Wh for a lithium ion battery. After December 31, 2015, each lithium ion battery subject to this provision must be marked with the Watt-hour rating on the outside case.
- (ii) The lithium content may not exceed 1 g for a lithium metal cell or 2 g for a lithium metal battery.
- (iii) Except when lithium metal cells or batteries are packed with or contained in equipment in quantities not exceeding 5 kg net weight, the outer package that contains lithium metal cells or batteries must be marked: "PRIMARY LITHIUM BATTERIES-FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES-FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT", or labeled with a "CARGO AIRCRAFT ONLY" label specified in §172.448 of this subchapter.
- (iv) For transportation by highway or rail only, the lithium content of the cell and battery may be increased to 5 g for a lithium metal cell or 25 g for a lithium metal battery and 60 Wh for a lithium ion cell or 300 Wh for a lithium ion battery provided the outer package is marked: "LITHIUM BATTERIES-FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL."

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(v) The marking specified in paragraphs (c)(1)(iii) and (iv) of this section must have a background of contrasting color, and the letters in the marking must be:

(A) At least 6 mm (0.25 inch) in height on packages having a gross weight of 30 kg (66 pounds) or less, except that smaller font may be used as necessary when package dimensions so require.

(B) At least 12 mm (0.5 inch) in height on packages having a gross weight of more than 30 kg (66 pounds).

(vi) Except when lithium cells or batteries are packed with, or contained in, equipment, each package must not exceed 30 kg (66 pounds) gross weight.

(2) Packaging. Each package must be rigid unless the cell or battery is contained in equipment and is afforded equivalent protection by the equipment in which it is contained. Except when lithium cells or batteries are contained in equipment, each package of lithium cells or batteries, or the completed package when packed with equipment must be capable of withstanding a 1.2 meter drop test, in any orientation, without damage to the cells or batteries contained in the package, without shifting of the contents that would allow battery-to-battery (or cell-to-cell) contact, and without release of the contents of the package.

(3) Hazard communication. Each package must display the lithium battery mark except when a package contains button cell batteries installed in equipment (including circuit boards), or no more than four lithium cells or two lithium batteries contained in equipment, where there are not more than two packages in the consignment.

(i) The mark must indicate the UN number, 'UN3090' for lithium metal cells or batteries or 'UN 3480' for lithium-ion cells or batteries. Where the lithium cells or batteries are contained in, or packed with, equipment, the UN number 'UN3091' or 'UN 3481' as appropriate must be indicated. Where a package contains lithium cells or batteries assigned to different UN numbers, all applicable UN numbers must be indicated on one or more marks. The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.

(A) The mark must be in the form of a rectangle with hatched edging. The mark must be not less than 120 mm (4.7 inches) wide by 110 mm (4.3 inches) high and the minimum width of the hatching must be 5 mm (0.2 inches) except markings of 105 mm (4.1 inches) wide by 74 mm (2.9 inches) high may be used on a package containing lithium batteries when the package is too small for the larger mark;

(B) The symbols and letters must be black on white or suitable contrasting background and the hatching must be red;

(C) The "*" must be replaced by the appropriate UN number(s) and the "***" must be replaced by a telephone number for additional information; and

(D) Where dimensions are not specified, all features shall be in approximate proportion to those shown.



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(ii) The lithium battery mark, in conformance with the requirement of this paragraph, in effect on May 9, 2024, may continue to be used until December 31, 2026.

(iii) When the packages are placed in an overpack, the lithium battery mark shall either be clearly visible through the overpack or be reproduced on the outside of the overpack, and the overpack shall be marked with the "OVERPACK". The lettering of the "OVERPACK" mark shall be at least 12 mm (0.47 inches high).

(d) Lithium cells or batteries shipped for disposal or recycling. A lithium cell or battery, including a lithium cell or battery contained in equipment, that is transported by motor vehicle to a permitted storage facility or disposal site, or for purposes of recycling, is excepted from the testing and record-keeping requirements of paragraph (a) and the specification packaging requirements of paragraph (b)(3) of this section, when packed in a strong outer packaging conforming to the requirements of §§173.24 and 173.24a. A lithium cell or battery that meets the size, packaging, and hazard communication conditions in paragraph (c)(1)-(3) of this section is excepted from subparts C through H of part 172 of this subchapter.

(e) Low production runs and prototypes. Low production runs (i.e., annual production runs consisting of not more than 100 lithium cells or batteries), or prototype lithium cells or batteries, including equipment transported for purposes of testing, are excepted from the testing and record-keeping requirements of paragraph (a) of this section, provided:

(1) Except as provided in paragraph (e)(4) of this section, each cell or battery is individually packed in a non-metallic inner packaging, inside an outer packaging, and is surrounded by cushioning material that is noncombustible and non-conductive or contained in equipment. Equipment must be constructed or packaged in a manner as to prevent accidental operation during transport;

(2) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the cells or batteries within the package that may lead to damage and a dangerous condition during transport. Cushioning material that is non-combustible and nonconductive may be used to meet this requirement;

(3) The lithium cells or batteries are packed in inner packagings or contained in equipment. The inner packaging or equipment is placed in one of the following outer packagings that meet the requirements of part 178, subparts L and M, of this subchapter at the Packing Group I level. Cells and batteries, including equipment of different sizes, shapes or masses must be placed into an outer packaging of a tested design type listed in this section provided the total gross mass of the package does not exceed the gross mass for which the design type has been tested. A cell or battery with a net mass of more than 30 kg is limited to one cell or battery per outer packaging;

(i) Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), or solid plastic (4H2) box; (ii) Metal (1A2, 1B2, 1N2), plywood (1D), or plastic (1H2) drum.

(4) Lithium batteries, including lithium batteries contained in equipment, that weigh 12 kg (26.5 pounds) or more and have a strong, impact-resistant outer casing or assemblies of such batteries, may be packed in strong outer packagings, in protective enclosures (for example, in fully enclosed or wooden slatted crates), or on pallets or other handling devices, instead of packages meeting the UN performance packaging requirements in paragraphs (b)(3)(ii) and (iii) of this section. The battery or battery assembly must be secured to prevent inadvertent movement, and the terminals may not support the weight of other superimposed elements;

(5) Irrespective of the limit specified in column (9B) of the § 172.101 Hazardous Materials Table, the battery or battery assembly prepared for transport in accordance with this paragraph may have a mass exceeding 35 kg gross weight when transported by cargo aircraft;

(6) Batteries or battery assemblies packaged in accordance with this paragraph are not permitted for transportation by passenger-carrying aircraft, and may be transported by cargo aircraft only if approved by the Associate Administrator prior to transportation; and

(7) Shipping papers must include the following notation "Transport in accordance with § 173.185(e)."

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(f) Damaged, defective, or recalled cells or batteries. Lithium cells or batteries, that have been damaged or identified by the manufacturer as being defective for safety reasons, that have the potential of producing a dangerous evolution of heat, fire, or short circuit (e.g., those being returned to the manufacturer for safety reasons) may be transported by highway, rail or vessel only, and must be packaged as follows:

- (1) Each cell or battery must be placed in individual, non-metallic inner packaging that completely encloses the cell or battery;
- (2) The inner packaging must be surrounded by cushioning material that is non-combustible, non-conductive, and absorbent; and
- (3) Each inner packaging must be individually placed in one of the following packagings meeting the applicable requirements of part 178, subparts L, M, P and Q of this subchapter at the Packing Group I level:
 - (i) Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), or solid plastic (4H2) box;
 - (ii) Metal (1A2, 1B2, 1N2), plywood (1D), or plastic (1H2) drum; or
 - (iii) For a single battery or for a single battery contained in equipment, the following rigid large packagings are authorized:
 - (A) Metal (50A, 50B, 50N);
 - (B) Rigid plastic (50H);
 - (C) Plywood (50D); and
- (4) The outer package must be marked with an indication that the package contains a "Damaged/defective lithium-ion battery" and/or "Damaged/defective lithium metal battery" as appropriate. The marking required by this paragraph (f)(4) must be in characters at least 12 mm (0.47 inches) high.

(g) Approval. A lithium cell or battery that does not conform to the provisions of this subchapter may be transported only under conditions approved by the Associate Administrator.

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