

Universal Waste Bulk Packaging Guideline

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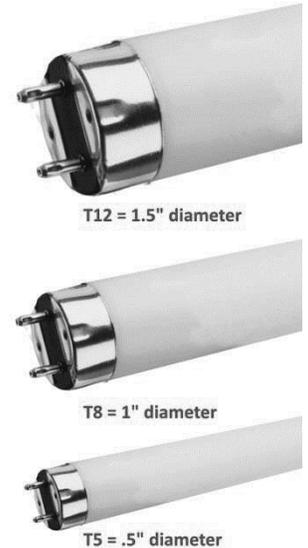
Straight Fluorescent Lamp Packaging Guideline

The procedures outlined in this document must be used to store and prepare “Universal Waste” fluorescent lamps for proper recycling. Questions regarding this document should be directed to customer service, toll-free at 1-800-556-5267. All precautions should be taken to eliminate breakage of lamps. Extra charges may result from excessive breakage.

General Packaging Guidelines for Straight Fluorescent Lamps

1. Lamps should be packaged in containers that protect the lamps during the storage and transport. Acceptable containers include: cardboard boxes, fiber drums, or the original manufacturer cardboard boxes. Boxes that are designed to transport lamps may also include a poly liner. Veolia can provide containers for fluorescent lamps, contact customer service toll free at 1-800-556-5267 for more information.
2. Place lamps carefully into the container as to avoid breakage.
3. Egg crate type inserts are not required, but boxes and drums should be filled to prevent excess movement of lamps during transport, leaving no void space.
4. Box ends must be secured with tape. Three-inch PVC tape is recommended. **VEOLIA WILL NOT ACCEPT CONTAINERS FOR SHIPMENT THAT HAVE LAMPS EXPOSED OR PROTRUDING FROM THE PACKAGING.**
5. **DO NOT tape lamps together.**
6. **DO NOT** place items other than fluorescent lamps into containers.
7. Any shipment greater than 10 boxes should be palletized, four foot boxes on a four foot pallet, eight foot boxes on an eight foot pallet. (Any overhang will result in breakage and will not be accepted). Pickups that exceed 10 boxes and are not palletized may be subject to additional charges.
8. Boxes must be placed on a pallet by evenly stacking boxes in layers. **DO NOT EXCEED 48” IN HEIGHT.**
9. Once they have been placed on a pallet, the boxes must be secured with shrink or stretch wrap. (Remember to wrap the pallet as well, to minimize shifting in transit).
10. Please remember that when reusing boxes after a retrofit, switching from T12 to T8 boxes will result in a diameter differential, T12 bulbs are 50% wider than T8 bulbs.
11. Lamp Inventories should be taped to the outside of the lamps boxes. Alternatively the boxes can be marked with the lamp type and count.

Types of Straight Fluorescent Lamps



Labeling as Universal Waste

All packages used for containing fluorescent lamps must have a label that states “**Universal Waste Lamps**” or a similar statement as authorized by state regulation.

Storage of Lamps

Universal waste lamps must not be stored in excess of one year. To demonstrate the storage time, mark all containers with an “**Accumulation Start Date**” (the beginning date the lamps were stored for disposal). All lamps should be stored in a manner that prevents breakage and should be stored indoors, protected against the elements. Wet packages are subject to additional handling fees. The universal waste rule requires boxes containing universal waste lamps to be kept closed unless adding or removing lamps.

Breakage

If lamp breakage should occur, broken glass and lamp constituents may be subject to additional regulation. Call Veolia toll-free at 1-800-556-5267 for assistance with shipping crushed or broken lamps. If broken prior to packaging, lamps should be placed into plastic or steel drums. Breakage during transport is possible, therefore taping of box ends with tape is recommended. If box contains a liner make certain liner is sealed well before transport.

Lamp Inventories

Customers are encouraged to tape lamp inventories to the end of each box. An inspection will be made at Veolia of all containers to verify lamp type and count received. Each container of fluorescent lamps will be billed for the full amount of lamps as received on the shipment.



Other Suggestions:

- Whenever possible store lamps in an area accessible to the vehicle which will be picking them up.
- Minimize the number of people managing the lamps to only those that are properly trained. Collecting mercury-containing fluorescent lamps for disposal requires care to minimize breakage and an awareness of possible exposure to mercury and broken glass hazards.
- Take an in-house inventory of lamps while loading and maintain a record-keeping system for spent lamps.

Available Veolia Lamp Containers

Containers can be provided by Veolia. Please contact customer service toll-free at 1-800-556-5267 for additional details. Additional packaging may be available.

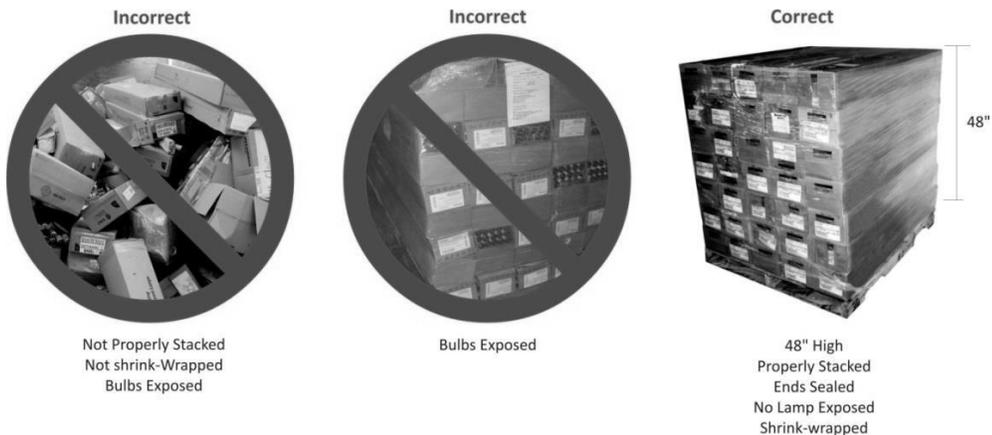
SKU	Type	Dimensions	Capacity
Supply-280	Corrugated Box	8.5x8.5x48	30 T12 or 72 T8 4ft straight lamps or 10 T12 or 20 T8 u-tubes
Supply -262	Corrugated Box	40x48x50	800 T12 or 1600 T8 straight lamps or 360 400w HIDS or 312 T12 or 480 T8 u-tubes
Supply -281	Corrugated Box	8x8x96	25 T12 or 57 T8 8ft straight lamps
Supply -282	Corrugated Box	22x22x24	46 T12 or 81 T8 u-tubes or 60 400w HIDS or Misc CFLs
Supply-036	Fiber Drum*	16.25 x 48	85 4' T12 lamps or 170 4' T8 lamps
Supply-001	Fiber Drum*	20.75 x 48	140 4' T12 lamps or 280 4' T8 lamps
Supply-258	Flexible Waste Drum*	17.5x17.5x27	250 lbs. of waste materials
Supply-006	Steel Drum*	55 gal – 34.50 x 24	600 lbs of broken or crushed lamps

* UN/DOT approved

How to Palletize Lamps

Palletizing lamps correctly ensures not only compliance with DOT regulations regarding shipping fluorescent lamps, but also decreases costs by optimizing truck load capacity. Pallets should be used to store lamps and aid truck loading with the availability of a fork lift and loading dock. Both lamp cartons and drums may be loaded on pallets into the truck and, if necessary, hand loaded from pallets to maximize truck capacity. 4 foot lamp boxes should be stacked in layers, in the same direction to minimize pallet sizes and maximize truck capacity. The boxes should not exceed 48" in height. 8 foot lamp boxes should be stacked parallel with the eight foot pallet All pallets of lamp cartons should be stretch-wrapped to the pallet.

Examples of Properly and Improperly Packaged Lamps





Specialty Lamp Packaging Guidelines (HID Lamps, Compact Fluorescent Lamps, and U-Tubes)

The procedures outlined in this document must be used to store and prepare “Universal Waste” specialty lamps for proper recycling. Questions regarding this document should be directed to customer service, toll-free at 1-800-556-5267. All precautions should be taken to eliminate breakage of lamps. Extra charges may result from excessive breakage.

General Packaging Guidelines for Specialty Lamps

1. Specialty lamps may be packaged in the strong outer packages. Strong outer packages are containers that are sturdy, durable, and constructed so that it will retain its contents under normal conditions of transportation. This includes original manufacturer boxes, other cardboard boxes, or fiber, plastic or steel pails and drums.
2. Sort all specialty lamps by type. **DO NOT MIX** specialty lamps.
3. Place specialty lamps in a strong outer package in a manner to prevent breakage. Where possible, avoid glass to glass pressure point. Examples include placing HID lamps into the cardboard sleeves used to ship the replacement lamps or wrapping the lamps.
4. Any shipment greater than 10 boxes or pails should be palletized, Pickups that exceed 10 containers that are not palletized may be subject to additional charges. Containers must be placed on a pallet by evenly stacking in layers. **DO NOT EXCEED 48” IN HEIGHT.**
5. Once they have been placed on a pallet, the containers must be secured with shrink or stretch wrap. (Remember to wrap the pallet as well, to minimize shifting in transit).
6. Fiber and steel drums may be palletized for shipment.

Labeling as Universal Waste

All packages used for containing specialty lamps must have a label that states “**Universal Waste Lamps**” or a similar statement as authorized by state regulation.

Storage of Lamps

Universal waste lamps must not be stored in excess of one year. To demonstrate the storage time, mark all containers with an “**Accumulation Start Date**” (the beginning date the lamps were stored for disposal). All lamps should be stored in a manner that prevents breakage and should be stored indoors, protected against the elements. Wet packages are subject to additional handling fees. The universal waste rule requires boxes containing universal waste lamps to be kept closed unless adding or removing lamps.

Breakage

If lamp breakage should occur, broken glass and lamp constituents may be subject to additional regulation. Call Veolia toll-free at 1-800-556-5267 for assistance with shipping crushed or broken lamps. If broken prior to packaging, lamps should be placed into plastic or steel drums. Breakage during transport is possible, therefore taping of box ends with tape is recommended. If box contains a liner make certain liner is sealed well before transport.

Lamp Inventories

Customers are encouraged to tape lamp inventories to the end of each box. An inspection will be made at Veolia of all containers to verify lamp type and count received. Each container of specialty lamps will be billed for the full amount of lamps as received on the shipment.

Other Suggestions:

- Whenever possible store lamps in an area accessible to the vehicle which will be picking them up.
- Minimize the number of people managing the lamps to only those that are properly trained. Collecting specialty lamps for disposal requires care to minimize breakage and an awareness of possible exposure to mercury and broken glass hazards.
- Take an in-house inventory of lamps while loading and maintain a record-keeping system for spent lamps.
- Sort all specialty lamps by type. **DO NOT MIX** specialty lamps.

Types of Specialty Lamps



Spiral Compacts



Plug-In Compacts



High-Intensity Discharge



U-tubes



Available Veolia Specialty Lamp Containers

Containers can be provided by Veolia. Please contact customer service toll-free at 1-800-556-5267 for additional details. Additional packaging may be available.

SKU	Type	Dimensions	Capacity
Supply-005	U-Tube Box	Varies by Region	Varies by Region
Supply-006	Steel Drum*	55 gal – 34 ½" x 24"	600 lbs of Lamps
Supply-011	Cubic Yard Box*	36"x36"x36"	1100 lbs
Supply-094	Cubic Yard Box	36"x36"x36"	1100 lbs

* UN/DOT approved

How to Palletize Lamps

Palletizing lamps correctly ensures not only compliance with DOT regulations regarding shipping fluorescent lamps, but also decreases costs by optimizing truck load capacity. Pallets should be used to store lamps and aid truck loading with the availability of a fork lift and loading dock. Both lamp cartons and drums may be loaded on pallets into the truck and, if necessary, hand loaded from pallets to maximize truck capacity. Boxes should be stacked in layers, in the same direction to minimize pallet sizes. The boxes should not exceed 48" in height. All pallets of lamp cartons should be stretch-wrapped to the pallet.



Lamp Ballast Packaging Guidelines

The procedures outlined in this document must be used to store and prepare lamp ballast for proper recycling. The packaging, labeling and marking requirements will be dependent on the type of ballast contained within the package. For additional information on lamp ballasts, see the Ballast Appendix. Questions regarding this document should be directed to customer service, toll-free at 1-800-556-5267. All precautions should be taken to eliminate leaking ballast. Extra charges will apply to all containers received with leaking ballast.

General Packaging Guidelines for Lamp Ballast

1. PCB containing lamp ballast must be packaged in DOT specification containers, such as a 55-gallon steel drum or a 5-gallon pail and it is recommended that all other lamp ballast also be packaged in specification containers.
2. By law, DOT specification containers must not exceed the rated capacity of the container. A standard 55 gallon drum is rated for a gross weight of 550 lb. while other drums may be rated for as much as 800 pounds. Therefore, the number of ballast per drum should not exceed:
 - a. 200 4' ballast,
 - b. 94 8' slim line ballast,
 - c. 68 8' HO ballast, or
 - d. Equivalent combination of ballast types.

A good approximation to follow is to only fill 55g drums of ballasts 2/3 full in order to avoid exceeding the DOT weight limit of the container.

3. A typical 5 gallon pail will be rated for approximately 66 pounds. Therefore, the quantity of ballast per pail should not exceed:
 - a. 16 4' ballast,
 - b. 8 8' slim line ballast,
 - c. 6 8' HO ballast, or
 - d. Equivalent combination of ballast types.
4. Drums must be labeled pursuant to applicable U.S. DOT and EPA regulations. Labels can be provided by Veolia.
5. Veolia ships empty steel drums with a cover, gasket, bolt-ring closure. Once filled, the cover, with gasket, should be secured to the drum by securing the bolt-ring closure. Closure instructions are provided for all DOT specification containers supplied by Veolia. Veolia reserves the right to refuse pickup of material that is improperly packaged or is offered in damaged packaging. A callout fee will be assessed and the pickup will be re-scheduled once the material is re-packaged by the customer.
6. Information needed to arrange the pickup of ballast include the physical location of the ballast (On a loading dock?), whether or not the truck will need a lift-gate, whether or not a drum hand-cart will be needed and pickup hours.

Labeling:

The labels required for each container of lamp ballast will be dependent on the type of ballast within the container. While in storage prior to shipment, the containers should be marked with, generator name, generator address and a description of the contents of the container. Depending on the state in which you are located additional markings and labels may be required for PCB lamp ballast. For transport the containers must also be marked and labeled according to DOT regulations. The Ballast Appendix contains additional information on marking and labeling.

Types of Ballast



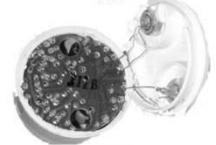
Magnetic



Electronic



HID



CFL



Electronic Waste Packaging Guidelines

The procedures outlined in this document must be used to store and prepare electronic waste for recycling. Questions regarding this document should be directed to customer service, toll-free at 1-800-556-5267. All precautions should be taken to eliminate leaking ballast. Monitors/CRTs contain leaded glass and care should be taken not to break or crush the glass in order to minimize lead exposure. Veolia recommends the following packaging guidelines.

General Packaging Guidelines for Electronic Waste:

- Carefully put individual monitors/CRTs, or other electronics in cardboard boxes and place on a pallet. Do not stack pallet higher than four feet (4"). When the pallet is full, secure by shrink wrapping the boxes to the pallet; OR:
- Carefully place monitors/CRTs, or other electronics into a cubic yard box (e.g. "Gaylord") and tightly pack in an orderly fashion; OR:
- If monitors/CRTs or other electronics are similar in size, pack evenly on a pallet and separate each layer with a piece of cardboard. Do not stack pallet higher than four feet (4"). Secure units to the pallet by shrink-wrap.



Monitors



PC and Components

Labeling:

Electronic wastes and/or CRTs are classified as universal waste in certain states and must be labeled accordingly. In other states, the electronic waste will be classified as an exempt recyclable material and should be labeled to identify the contents of the container as a best management practice.

Broken CRTs are also subject to additional labeling. In most states, broken monitors must be marked as:

- "Used cathode ray tube(s)-contains leaded glass" or
- "Leaded glass from televisions or computers." and
- "Do not mix with other glass materials."

Storage of Electronic Waste:

Electronic waste and CRTs are subject to speculative accumulation limits. As such, all electronic waste and CRTs should be recycled within a year of being determined to be a waste. To demonstrate the storage time, mark all containers with an "Accumulation Start Date" (the beginning date the electronics or CRTs were stored for disposal). All electronic waste should be stored indoors, protected against the elements. Wet packages are subject to additional handling fees.



Equipment

Breakage:

Broken monitors are subject to additional regulation and may be considered hazardous waste in your state. Prior to shipping, contact customer service toll-free at 1-800-556-5267 for further assistance.

Available Veolia Electronics Containers:

Containers can be provided by Veolia. Please contact customer service toll-free at 1-800-556-5267 for additional details. Additional packaging may be available.

SKU	Type	Dimensions	Capacity
Supply-011	Cubic Yard Box*	36"x36"x36"	1100 lbs
Supply-021	FlexPak Box*	36"x36"x36"	1100 lbs
Supply-094	Cubic Yard Box	36"x36"x36"	1100 lbs

* UN/DOT approved

How to Palletize Electronics Waste:

Palletizing electronic waste correctly decreases costs by optimizing truck load capacity. Pallets should be used to electronic waste and aid truck loading with the availability of a fork lift and loading dock. One cubic yard box can be placed on a pallet at a time. If stacking like monitors, pack evenly on a pallet and separate each layer with a piece of cardboard. Do not stack pallet higher than four feet (4"). Secure units to the pallet by using sufficient shrink-wrap not only to secure the material to the pallet but to prevent the load from shifting or collapsing during transport.



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, any potential hazards will 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.

All 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 All Batteries Regardless of Type or Size

- Only chemically compatible battery types should be packed in the same package. Do not mix acidic batteries with alkaline batteries.
- 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 and those batteries that fall under the exception for 9-volts or less as described below do not require additional short circuit protection.
- All methods employed to protect from short circuit 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.

Exception for Spent Batteries of the Type "Batteries, Dry, Sealed, n.o.s." With a Marked rating of 9-volts or Less

In accordance with 49 CFR 172.102, Special Provision 130, used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as "Batteries, dry, sealed, n.o.s." and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type "Batteries, dry, sealed, n.o.s." with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.



Health and Safety Considerations

Many batteries contain toxic and/or corrosive materials. While intact, these 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 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 the most common battery types currently available. If you have a specialty battery that is not identified in the following guidelines please contact your customer service representative for specific packaging requirements (i.e. special use batteries, thermal batteries, etc.).

The battery specific packaging information contained in this document is strictly to be used as guidance when packaging batteries. 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 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 a 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

Multiple (chemically compatible) batteries may be packed together in a single outer packaging in accordance with the following requirements:



- 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.
- Wet cell batteries must be placed in an upright position and secured from movement within the outer container.
- 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.

BATTERIES LOADED ONTO A PALLET

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 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 assure 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.
- Batteries secured to a pallet in accordance with 49 CFR §173.159(d)(1) are considered to be a single non-bulk package even if the completed package weighs more than 400 kg (882 pounds). Therefore, marking and labeling should be in accordance with the non-bulk packaging requirements found under 49 CFR, Subpart D – Marking and Subpart E – Labeling.

BATTERIES AS PART OF A POWER SUPPLY SYSTEM

Office UPS Units

Office UPS units (Uninterruptible Power Supplies), containing non-spillable lead acid batteries, are designed to be serviced by non-qualified personnel and have safety measures incorporated into their design. This may include protecting terminals from short circuit within the unit or encasing the batteries in a non-conductive housing that will be removed and replaced as a unit. These safety features will allow for office UPS units to be transported “as is” with the batteries in place.

Industrial Battery Power Supplies

Industrial battery power supplies are intended to only be serviced by qualified personnel and as such, do not include the same types of safety features found in office UPS units. These units will often have more batteries for a higher voltage and the batteries will often be much larger. All shipments of industrial battery power supplies must meet the following requirements:

1. Battery Power Supplies must be safely de-energized prior to shipment.
2. Batteries must be removed from the racking system and packaged in accordance with Veolia policy.
3. Palletized materials must be evaluated to assure that the pallet can safely support the weight of the load.

Since these units will typically require a qualified electrician to remove them from service, it is recommended that the electrician disconnects the batteries at the same time. Under no circumstances should industrial battery power supplies be transported with the batteries in place and electrically connected.



Alkaline Batteries, Dry-Cell



Typical Uses: Flashlights, cameras, portable radios, audio players, and toys.

Composition: Alkaline batteries have a zinc anode and a manganese dioxide cathode. The electrolyte used in an alkaline battery is a paste of either potassium hydroxide or sodium hydroxide. Each of these components, along with conductors and separators are then assembled into or contained within a hermetically sealed unit. Typical household size alkaline battery is a 1.5 volt (AA, AAA, C, D).

US DOT Description:

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A (NONE)
Identification Number	N/A
Packing Group	N/A

US DOT Packaging Requirements: 49 CFR §172.102 Special Provision 130

All dry cell batteries other than those excepted below must be prepared and packaged in a manner to prevent:

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

Batteries must be packaged in strong outer packagings or, if large enough, firmly secured to pallets capable of withstanding the shocks normally incident to transportation.

Exception for Spent Batteries of the Type “Batteries, Dry, Sealed, n.o.s.” with a Marked Rating of 9-Volts or Less

Used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as “Batteries, dry, sealed, n.o.s.” and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type “Batteries, dry, sealed, n.o.s.” with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

NOTE: Multiple 1.5-volt alkaline batteries interconnected or grouped in series are not included in this exception and must continue to be packaged in accordance with SP130 (terminals must be protected against damage and short circuits).

US EPA Regulations: Since this class of battery does not fail the TCLP nor does it contain any free liquids, it is not classified as a hazardous waste as defined by the US EPA and as such, is not subject to the universal waste requirements. Individual states may adopt more stringent regulations than the federal regulations; therefore, alkaline batteries may be classified as a universal waste in some states.



Lead Acid Batteries, Wet-Cell



Typical Uses: Automotive, marine, industrial applications.

Composition: Lead acid batteries have a lead anode and a lead dioxide cathode. The electrolyte is an aqueous solution of sulfuric acid. The battery cell contains 60 to 75 percent lead and lead oxide, by weight, and the electrolyte contains between 28 and 51 percent sulfuric acid, by weight.

US DOT Description:

Proper Shipping Name	Batteries, wet, filled with acid
Hazard Class	8
Identification Number	UN2794

US DOT Packaging Requirements: 49 CFR §173.159

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

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

Batteries must be packaged in USDOT authorized packagings which include:

Non-Bulk Containers:

- Specification packages listed in 49 CFR §173.159(c). The most common of these containers are the 4G fiberboard box, the 1G fiberboard drum and the 1H2 poly drum. Metal drums are not authorized for shipping wet cell batteries,
- To prohibit battery movement within drums or boxes, the use of folded cardboard, “honeycomb” cardboard or other bulky packing materials should be utilized. The use of vermiculite, floor dry or other granular absorbents is not recommended and may be subject to additional charges.
- Batteries must be shipped in an upright configuration and must be secured within the package to prevent the battery from reorienting in transport.
- **1H2 poly drums larger than 5 gallons should not be used for the transport of lead acid batteries.** As an alternative, multiple, larger-sized batteries should be secured to pallets for transport or packaged in lined 1G fiberboard drums.

Palletized Batteries:

- When secured to a pallet for transport, non-conductive strapping must be used. **Metal banding is not permissible due to the potential risk of short circuiting.** When using non-conductive banding to secure batteries to pallets, precautions should be taken to assure any metal clips used to connect the banding straps do not come in contact with exposed battery terminals.
- Firmly secured to skids or pallets capable of withstanding the shocks normally incident to transportation. The pallet must not exceed a height of 1.5 times the width of the pallet and must be capable of withstanding a superimposed weight of 2 times the weight of the pallet. The battery terminals must not be relied upon to support any of the superimposed weight and must not short out if a conductive material is placed in direct contact with them,

US EPA Regulations:

Rules specific to the recycling of lead acid batteries are contained in 40 CFR part 266 Subpart G. As an alternative to this section, generators of lead acid batteries may choose to manage their lead acid batteries in accordance with the universal waste standards. When managed as a universal waste, each battery or each package containing batteries must be marked with the words “Universal Waste Batteries,” “Waste Batteries,” or “Used Batteries.” Broken or damaged batteries that no longer



qualify for either the recycling exemption or the universal waste exemption must be managed as a hazardous waste. The RCRA waste codes D002 and D008 apply when the batteries or containers hold liquid electrolyte. The RCRA waste code D008 only applies to batteries or containers that have no liquids within them.

Broken Batteries:

Broken lead acid batteries and clean up materials may be described on the shipping paper using the Batteries, wet containing acid proper shipping. When shipped on a hazardous waste manifest with US EPA waste codes this shipping name must be preceded by word "Waste".

Damaged lead acid batteries that are no longer capable of retaining electrolyte must be packaged as described in 49 CFR §173.159(k). 49 CFR §173.159(k) provides several packaging alternatives for damaged lead acid batteries:

- Drain the battery of fluid to eliminate the potential for leakage during transportation.
- Individually pack the battery in a leak proof intermediate package (poly bag sufficient to contain the battery and prevent punctures of the bag) with sufficient compatible absorbent material capable of absorbing the release of any electrolyte and place the intermediate packaging in a leakproof outer packaging (poly drum 1H2).
- Pack the battery in a salvage packaging, or
- When packaged with other batteries or materials (e.g., on pallets or non-skid rails) and secured to prevent movement during transport, pack the battery in leakproof packaging to prevent leakage of battery fluid from the packaging under conditions normally incident to transportation

Please note that many neutralizing agents used in the cleanup of broken batteries contain carbonate compounds and will generate carbon dioxide when reacting with electrolyte. When this reaction occurs in a vapor tight container the pressure can build to a point that poses a hazard to personnel handling the container. Packaging methods to separate these carbonate compounds from additional acid electrolyte must be used to reduce the potential for incidents in transport.



Lead Acid Batteries, Non-Spillable (Valve Regulated Lead Acid)



Typical Uses: Camcorders, computers, portable radios, lawn equipment, portable industrial equipment, marine applications

Composition: Like wet cell lead acid batteries, non-spillable or Valve Regulated Lead Acid (VRLA) batteries also have a lead anode, a lead dioxide cathode, and an aqueous sulfuric acid electrolyte. However, because of the way in which non-spillable batteries are manufactured, the electrolyte will not spill out of the battery. Although somewhat of a misnomer, these batteries are often referred to as sealed lead acid batteries. There are two primary categories of non-spillable batteries:

1. Absorbed glass mat (AGM) batteries, these batteries contain a liquid electrolyte that is absorbed into a glass mat sandwiched between the electrodes.
2. Gel cell batteries, these are batteries which have a chemical added to the electrolyte which causes it to form a gel which will not spill from the battery.

Non-spillable batteries authorized to be shipped under the below listed shipping name and packaging standards must be clearly marked “NONSPILLABLE” or “NONSPILLABLE BATTERY” by the manufacturer.

US DOT Description:

Proper Shipping Name	Batteries, wet, non-spillable
Hazard Class	8
Identification Number	UN2800

US DOT Packaging Requirements: 49 CFR §173.159a

Non-spillable lead acid batteries are exempted from the packaging requirements of 49 CFR §173.159 when prepared and packaged in accordance with 49 CFR §173.159a. For non-spillable batteries packaged under 49 CFR §173.159a, the batteries must be packaged in strong outer packages and must be prepared in a manner to prevent:

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

The batteries and outer packaging must be plainly and durable marked “NONSPILLABLE” or “NONSPILLABLE BATTERY”.

Additional Packaging Requirements:

1. **1H2 poly drums larger than 5 gallons should not be used for the transport of lead acid batteries.** As an alternative, larger quantities of small non-spillable batteries should be packaged in lined 1G fiberboard drums.
2. Larger batteries, comparable to an automotive battery should be packaged following the packaging requirements of 49 CFR §173.159. (See the ‘Lead Acid, Wet Cell’ guidelines for packaging requirements of 49 CFR §173.159)
3. Batteries must be shipped in an upright configuration and must be packaged to prevent the battery from reorienting in transport.
4. To secure batteries within drums or boxes, the use of folded cardboard, “honeycomb” cardboard or other bulky packing materials should be utilized. The use of vermiculite, floor dry or other granular absorbents is not recommended and may be subject to additional charges.



US EPA Regulations: Rules specific to the recycling of lead acid batteries are contained in 40 CFR part 266 Subpart G. As an alternative to this section, generators of lead acid batteries may choose to manage their lead acid batteries in accordance with the universal waste standards. When managed as a universal waste, each battery or each package containing batteries must be marked with the words “Universal Waste Batteries,” “Waste Batteries,” or “Used Batteries.”

Broken or damaged batteries that no longer qualify for either the recycling exemption or the universal waste exemption must be managed as a hazardous waste. The RCRA waste codes D002 and D008 apply when the batteries or containers hold liquid electrolyte. The RCRA waste code D008 applies only to batteries or containers that have no liquids within them.

Broken Batteries:

Broken lead acid batteries and clean up materials may be described on the shipping paper using the Batteries, wet containing acid proper shipping. When shipped on a hazardous waste manifest with US EPA waste codes this shipping name must be preceded by word “Waste”.

Damaged lead acid batteries that are no longer capable of retaining electrolyte must be packaged as described in 49 CFR §173.159(k). 49 CFR §173.159(k) provides several packaging alternatives for damaged lead acid batteries:

- Drain the battery of fluid to eliminate the potential for leakage during transportation.
- Individually pack the battery in a leak proof intermediate package (poly bag sufficient to contain the battery and prevent punctures of the bag) with sufficient compatible absorbent material capable of absorbing the release of any electrolyte and place the intermediate packaging in a leak-proof outer packaging (poly drum 1H2).
- Pack the battery in a salvage packaging, or
- When packaged with other batteries or materials (e.g., on pallets or non-skid rails) and secured to prevent movement during transport, pack the battery in leak-proof packaging to prevent leakage of battery fluid from the packaging under conditions normally incident to transportation

Please note that many neutralizing agents used in the cleanup of broken batteries contain carbonate compounds and will generate carbon dioxide when reacting with electrolyte. When this reaction occurs in a vapor tight container the pressure can build to a point that poses a hazard to personnel handling the container. Packaging methods to separate these carbonate compounds from additional acid electrolyte must be used to reduce the potential for incidents in transport.



Lithium Metal Batteries (See separate listing for Lithium Ion Batteries)



Typical Uses: Cameras, calculators, watches, small electronics etc.

Composition: These 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:

Proper Shipping Name	Lithium metal batteries	Lithium metal batteries contained in equipment	Lithium metal batteries packed with equipment
Hazard Class	9	9	9
Identification Number	UN3090	UN3091	UN3091

US DOT Packaging Requirements: 49 CFR §173.185

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

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

Due to the high 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.

Lithium batteries and cells transported for recycling or disposal by motor vehicle only:

- Packaged in non-bulk strong outer packagings, 49 CFR §173.185(d)

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- Strong outer packages must meet general packaging requirements of 49 §§173.24 and 173.24a
- Not subject to testing and recordkeeping requirements of 49 CFR §173.185(a).
- Lithium batteries shipped by vessel must be in UN specification packaging (PG II) per 173.185(b)(3).

Damaged, Defective or Recalled Cells or Batteries – 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 individual, non-metallic inner packaging 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; and
- 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.
- As an additional Veolia requirement all packages, whether packed in accordance with the CFR or the special permit requirements, containing damaged/defective lithium batteries must be equipped with a venting device. The package must be opened to relieve any pressure build-up prior to transportation and vented periodically while in storage.
- DOT-SP 16532 authorizes more than one damaged/defective battery per outer packaging. Refer to the special permit for specific packaging requirements. As an additional Veolia safety measure, all packages prepared in accordance with the special permit must be equipped with a venting device (see above).

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 so as to prevent accidental operation during transport; and
- Any spare lithium cells or batteries packed with the equipment must be packaged in accordance with paragraph (b)(3) of this section or in accordance with paragraph (d) when shipped for disposal or recycling. The requirements for paragraph (d) are described above. When a package containing lithium batteries in equipment and spare lithium batteries the package must be described as “Lithium metal batteries packed with equipment” (Special Provision 181).

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

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

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 Part 273. All containers of universal waste batteries must be marked with the words “Universal Waste Batteries,” “Waste Batteries,” or “Used Batteries.”



Lithium Ion Batteries

(See separate listing for Lithium Metal 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, ethylene carbonate. Lithium ion batteries include lithium ion polymer batteries.

US DOT Description:

Proper Shipping Name	Lithium ion batteries	Lithium ion batteries contained in equipment	Lithium ion batteries packed with equipment
Hazard Class	9	9	9
Identification Number	UN3480	UN3481	UN3481

US DOT Packaging Requirements: 49 CFR §173.185

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

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

Lithium batteries and cells transported for recycling or disposal by motor vehicle only:

- Packaged in non-bulk strong outer packagings, 49 CFR §173.185(d)
- Strong outer packages must meet the general packaging requirements of 49 §§173.24 and 173.24a
- Not subject to testing and recordkeeping requirements of 49 CFR §173.185(a).
- Lithium batteries shipped by vessel must be in UN specification packaging (PG II) per 173.185(b)(3).

Damaged, Defective or Recalled Cells or Batteries – 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 individual, non-metallic inner packaging 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; and
- 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.
- As an additional Veolia requirement all packages, whether packed in accordance with the CFR or the special permit requirements, containing damaged/defective lithium batteries must be equipped with a venting device. The package must be opened to relieve any pressure build-up prior to 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.
- DOT-SP 16532 authorizes more than one damaged/defective battery per outer packaging. Refer to the special permit for specific packaging requirements. As an additional Veolia safety measure, all packages prepared in accordance with the special permit must be equipped with a venting device (see above).

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

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

Wet Lithium Ion Batteries – Batteries are forbidden from being shipped while submerged in water or oil. Once these batteries have been wet, they should be considered to be damaged/defective and must be managed in accordance with Veolia’s RCG policy entitled, RCG Procedure - Lithium Ion Cells and Batteries That Have Been Wetted or Submerged in Water or Mineral Oil - Handling, Packaging and Transportation

Thin Film Lithium Ion Batteries – Lithium ion batteries with “thin film” outer membranes must be handled with care. Any damage or tearing of the thin membrane has an extremely high risk of resulting in a fire.

Intact thin film lithium ion batteries must be managed as damaged lithium ion batteries following 49 CFR 173.185(f) or DOT-SP 16532 and including the additional Veolia venting requirement as a precaution.

Damaged thin film lithium ion batteries (including tears that may occur while packaging) must be submerged in water or mineral oil to prevent or stop reactions. These submerged batteries must then be handled as Wet Lithium Ion Batteries (shown above) following the RCG "Lithium Ion Cells and Batteries That Have Been Wetted or Submerged in Water or Mineral Oil - Handling, Packaging and Transportation" procedure, which requires removing the batteries from the water (or mineral oil), observing the batteries for 7 days while they dry out and then packaging them following 49 CFR 173.185(f) or DOT-SP 16532 with the additional Veolia venting requirement.

Sodium-Ion (NIB) Batteries or Cells - Sodium-ion battery (also called NIB) is a type of rechargeable battery analogous to the lithium-ion battery, but using sodium ions (Na⁺) as the charge carriers. Packaging requirements for Sodium-ion batteries/cells are found in 49 CFR §173.189, and the DOT shipping name for Sodium-Ion Batteries is UN3292 “Batteries, containing sodium” class 4.3 (or UN3292 “Cells, containing sodium” class 4.3 for Sodium-Ion cells).

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 Part 273. All containers of universal waste batteries must be marked with the words “Universal Waste Batteries,” “Waste Batteries,” or “Used Batteries.”



Magnesium Batteries



TYPICAL USES: Flashlights, cameras, portable radios, audio players, and toys.

COMPOSITION: Magnesium batteries have a magnesium anode, manganese dioxide cathode, and an electrolyte of a paste containing magnesium bromide or magnesium perchlorate with a chromate inhibitor to prevent corrosion to the magnesium anode. Each of these components, along with conductors and separators are then typically assembled into or contained within a hermetically sealed unit. If the battery is not a hermetically sealed unit, the battery should be considered a specialty battery and the following information is not applicable. For assistance in determining the proper packaging for these specialty batteries please contact customer service.

US DOT DESCRIPTION:

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A (NONE)
Identification Number	N/A

US DOT PACKAGING REQUIREMENTS: 49 CFR §172.102 Special Provision 130
All dry cell batteries must be prepared and packaged in a manner to prevent:

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

Batteries must be packaged in strong outer packagings or, if large enough, firmly secured to pallets capable of withstanding the shocks normally incident to transportation.

EXCEPTION FOR SPENT BATTERIES OF THE TYPE “BATTERIES, DRY, SEALED, N.O.S.” WITH A MARKED RATING OF 9-VOLTS OR LESS

In accordance with 49 CFR 172.102, Special Provision 130, used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as “Batteries, dry, sealed, n.o.s.” and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type “Batteries, dry, sealed, n.o.s.” with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

US EPA REGULATIONS: Based on the original composition and charge state of the battery, these batteries may fail the TCLP for chromium. As such magnesium 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.”



Mercury Batteries



TYPICAL USES: Hearing aids, pacemakers, camera, calculators, watches, etc.

COMPOSITION: Mercury batteries have a zinc anode and a mercuric oxide cathode. The electrolyte used in a mercury battery is a paste of either potassium hydroxide or sodium hydroxide. Each mercury cell contains a total of 20 to 50 percent mercury by weight. Each of these components, along with conductors and separators are then assembled into or contained within a hermetically sealed unit.

US DOT DESCRIPTION:

Packages containing less than 3 pounds of mercury batteries

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A
Identification Number	N/A

US DOT PACKAGING REQUIREMENTS: 49 CFR §172.102 Special Provision 130

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

- A dangerous evolution of heat,
- Short circuits, and
- Damage to terminals

Batteries must be packaged in strong outer packagings.

Packages which contain greater than 3 pounds of mercury batteries meet the US DOT definition of a hazardous substance and must be prepared for transport in accordance with the US DOT regulations using the proper shipping name “RQ Environmentally hazardous substance solid, n.o.s. (Mercury)”.

EXCEPTION FOR SPENT BATTERIES OF THE TYPE “BATTERIES, DRY, SEALED, N.O.S.” WITH A MARKED RATING OF 9-VOLTS OR LESS

Used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as “Batteries, dry, sealed, n.o.s.” and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type “Batteries, dry, sealed, n.o.s.” with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

US EPA REGULATIONS: Mercury batteries typically fail the TCLP for mercury. As such, all mercury 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.”

When not shipped as universal waste, the RCRA Waste code D009 (mercury) would need to be included on the manifest.



Nickel Cadmium Batteries, Wet-Cell



Typical Uses: Industrial applications, back up batteries and computers

Composition: Nickel cadmium (NiCd) batteries have a cadmium anode and a nickel oxyhydroxide cathode. The electrolyte within a wet cell NiCd battery is an aqueous solution of potassium hydroxide.

US DOT Description:

Proper Shipping Name	Batteries, wet, filled with alkali
Hazard Class	8
Identification Number	UN2795

US DOT Packaging Requirements: 49 CFR §173.159

All wet cell NiCd batteries must be prepared and packaged in a manner to prevent:

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

Batteries must be packaged in US DOT authorized packagings which include:

1. Specification packages listed in §173.159(c). The most common of these containers are the 4G fiberboard box and the 1H2 poly drum. Metal drums are not authorized for shipping wet cell batteries,
2. Firmly secured to skids or pallets capable of withstanding the shocks normally incident to transportation. The pallet must not exceed a height of 1.5 times the width of the pallet and must be capable of withstanding a superimposed weight of 2 times the weight of the pallet. The battery terminals must not be relied upon to support any of the superimposed weight and must not short out if a conductive material is placed in direct contact with them,
3. In accordance with one of the other packaging alternatives not specifically listed above.

US EPA Regulations: Wet cell NiCd batteries contain a liquid electrolyte which exhibits the characteristic of corrosivity and when tested will fail the TCLP for cadmium. As such, wet cell NiCd 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.”

When not shipped as a universal waste, the RCRA Waste code D002 (Corrosivity) and D006 (cadmium) would need to be included on the manifest.



Nickel Cadmium Batteries, Dry-Cell



Typical Uses: Cameras, rechargeable appliances such as portable power tools, hand held vacuums, etc.

Composition: Dry cell nickel cadmium (NiCd) batteries have a cadmium anode and nickel oxyhydroxide cathode. The electrolyte used in a dry cell NiCd battery is a paste of potassium hydroxide. Each of these components, along with conductors and separators are then assembled into or contained within a hermetically sealed unit.

US DOT Description:

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A
Identification Number	N/A

US DOT Packaging Requirements: 49 CFR §172.102 Special Provision 130

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

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

Batteries must be packaged in strong outer packagings or, if large enough, firmly secured to pallets capable of withstanding the shocks normally incident to transportation.

Exception for Spent Batteries of the Type "Batteries, Dry, Sealed, n.o.s." with a Marked Rating of 9-Volts or Less

Used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as "Batteries, dry, sealed, n.o.s." and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type "Batteries, dry, sealed, n.o.s." with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

SPECIAL REQUIREMENTS FOR "UN3208, Batteries dry containing potassium hydroxide solid, 8, III"

USDOT regulations contain Special provision 237 for the shipping name "Batteries, dry, containing potassium hydroxide solid, electric storage". SP 237 states that the batteries must be prepared and packaged in accordance with the requirements of 173.159(a), (b), and (c) and that for transportation by aircraft, the provisions of 173.159(b)(2). On January 7, 2013 (HM-215L) USDOT modified SP 237 by clarifying the applicability of the provision. Specifically language was added to state that the entry for "Batteries, dry, containing potassium hydroxide solid, electric storage" may only be used for the transport of non-activated batteries that contain dry potassium hydroxide and that are intended to be activated prior to use by the addition of an appropriate amount of water to the individual cells. Therefore, spent or used dry cell Ni-Cad batteries that don't meet these specifications described above should be assigned the proper shipping name "Batteries, dry, sealed, n.o.s. (Nickel Cadmium Batteries)".

US EPA Regulations: Dry cell NiCd batteries typically will fail the TCLP for cadmium. As such, dry cell NiCd 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.” When not shipped as a universal waste, the RCRA Waste code D006 (cadmium) would need to be included on the manifest.



Nickel Metal Hydride Batteries



Typical Uses: Cameras, rechargeable appliances such as portable power tools, hand held vacuums, etc.

Composition: Nickel metal hydride (NiMH) batteries have a hydrogen-absorbing metal alloy anode and a nickel oxyhydroxide cathode. The electrolyte in a NiMH battery is typically a potassium hydroxide paste. Each of these components, along with conductors and separators are then assembled into or contained within a hermetically sealed unit.

US DOT Description:

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A
Identification Number	N/A

US DOT Packaging Requirements: 49 CFR §172.102 Special Provision 130 for highway shipments
For vessel shipments nickel metal hydride batteries are subject to additional requirements (see Special Provision 340)

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

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

Batteries must be packaged in strong outer packagings or, if large enough, firmly secured to pallets capable of withstanding the shocks normally incident to transportation.

Exception for Spent Batteries of the Type “Batteries, Dry, Sealed, n.o.s.” with a Marked Rating of 9-Volts or Less
Used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as “Batteries, dry, sealed, n.o.s.” and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type “Batteries, dry, sealed, n.o.s.” with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

US EPA Regulations: Since this class of battery does not fail the TCLP nor does it contain any free liquids, it is not classified as a hazardous waste as defined by the US EPA and as such, is not subject to the universal waste requirements. Individual states may adopt more stringent regulations than the federal regulations; therefore, NiMH batteries may be classified as a universal waste in some states.



Silver Oxide Batteries



Typical Uses: Hearing aids, watches, cameras, calculators

Composition: Silver oxide batteries have a zinc anode and a silver oxide cathode. The electrolyte used in a silver oxide battery is a potassium hydroxide or sodium hydroxide paste. Each of these components, along with conductors and separators are then assembled into or contained within a hermetically sealed unit. In addition to the above materials, many of the older silver oxide batteries contained a significant amount of mercury. Batteries containing both silver and mercury should be managed as mercury batteries. The below listed information is for non-mercury containing silver oxide batteries.

US DOT Description:

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A
Identification Number	N/A

US DOT Packaging Requirements: 49 CFR §172.102 Special Provision 130
All dry cell batteries must be prepared and packaged in a manner to prevent:

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

Batteries must be packaged in strong outer packagings or, if large enough, firmly secured to pallets capable of withstanding the shocks normally incident to transportation.

Exception for Spent Batteries of the Type “Batteries, Dry, Sealed, n.o.s.” with a Marked Rating of 9-Volts or Less

Used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as “Batteries, dry, sealed, n.o.s.” and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type “Batteries, dry, sealed, n.o.s.” with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

US EPA Regulations: Silver oxide batteries typically will fail the TCLP for silver and older silver oxide batteries will typically fail the TCLP for silver and mercury. As such, silver oxide 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.”

When not shipped as a universal waste, the RCRA Waste code D011 (silver) would need to be included on the manifest.



Carbon Zinc Batteries



Typical Uses: Flashlights, toys, etc.

Composition: Carbon zinc batteries, often referred to as Heavy Duty Batteries, have a zinc anode and a cathode that contains a mixture of manganese dioxide, carbon and electrolyte. The batteries also contain a carbon electrode that serves as a cathode current collector. The electrolyte is an aqueous solution of ammonium chloride and zinc chloride or a solution of zinc chloride. The electrolyte is mixed the other components of the battery to form a paste. Each of these components, along with conductors and separators are then assembled into or contained within a hermetically sealed unit.

US DOT Description:

Proper Shipping Name	Batteries, dry, sealed, n.o.s.
Hazard Class	N/A (NONE)
Identification Number	N/A

US DOT Packaging Requirements: 49 CFR §172.102 Special Provision 130
All dry cell batteries must be prepared and packaged in a manner to prevent:

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

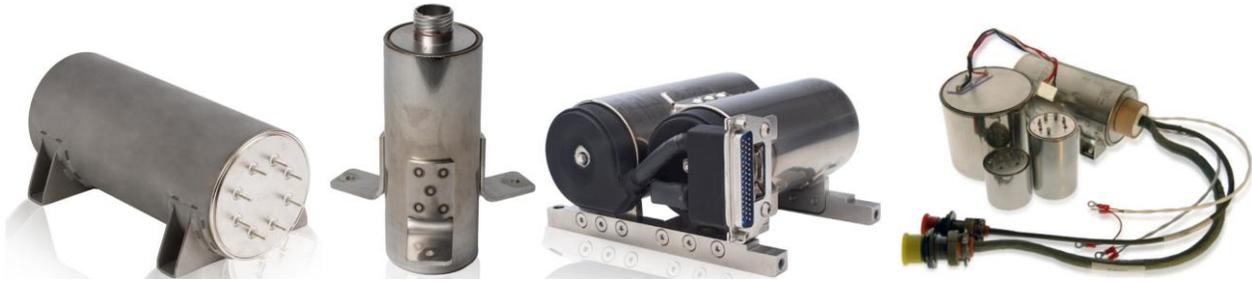
Batteries must be packaged in strong outer packaging or, if large enough, firmly secured to pallets capable of withstanding the shocks normally incident to transportation.

Exception for Spent Batteries of the Type “Batteries, Dry, Sealed, n.o.s.” with a Marked Rating of 9-Volts or Less
Used or spent dry, sealed batteries of both non-rechargeable and rechargeable designs, described as “Batteries, dry, sealed, n.o.s.” and are not specifically covered by another proper shipping name, with a marked rating up to 9-volts are not likely to generate a dangerous quantity of heat, short circuit, or create sparks in transportation. Therefore, used or spent batteries of the type “Batteries, dry, sealed, n.o.s.” with a marked rating of 9-volts or less that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to the regulation and do not require terminal protection or protection against short circuiting. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package.

US EPA Regulations: Since this class of battery does not fail the TCLP nor does it contain any free liquids, it is not classified as a hazardous waste as defined by the US EPA and as such, is not subject to the universal waste requirements. Individual states may adopt more stringent regulations than the federal regulations; therefore, carbon zinc batteries may be classified as a universal waste in some states.



Thermal Batteries



Typical Uses: Ground vehicles, launch vehicles, marine applications, oil and gas drilling and satellites

Composition: Thermal batteries are known by different names: molten salt batteries, or liquid sodium batteries.

Thermal batteries contain: lithium anodes, iron disulfide cathodes, fused eutectic solid mixture of inorganic salts as the electrolyte, and a pyrotechnic blend of iron powder and potassium perchlorate (heat powder) as the heat source. The key to the long life of thermal batteries is that the electrolyte is a mixture of solid sodium or lithium salt that becomes liquid when heated. Thermal batteries are activated by an electronic squib or mechanical striker which activates a primer, which in turn ignites the pyrotechnic and melts the salt electrolyte.

Thermal batteries can provide several output voltages from one battery and are compatible with either steady load conditions or pulsed applications. A thermal battery is totally inert and non-reactive until activated. Because most external environments have little or no effect on the inactivated battery, it can be stored for 20+ years. The battery can be activated at any time without preparation, and will begin supplying power almost immediately. After activation, the battery quickly reaches peak voltage, which declines gradually during the rest of its active life. Once activated, the battery functions until a critical active material is exhausted or until the battery cools below the electrolyte's melting point. Thermal batteries remain inert during storage and are typically hermetically sealed so they can withstand environmental stresses. They are designed to handle extreme temperatures (either high or low, and have a range of more than 100C), vibration, mechanical shock, vacuum, very high or low pressures, EMI, and acceleration. Thermal batteries have a relatively short activated life, can develop high surface temperatures, can have non-linear output voltages, and are one time use batteries. Thermal batteries work through a chemical reaction of the solid lithium salt mixture. The battery has many cells in series that each has an anode, cathode, electrolyte, and igniter. The igniter sets off pyrotechnic reactions in each cell which increases the temperature to the melting point of the electrolyte. The molten electrolyte is highly conductive which allows current to flow between the anode and cathode of each cell. Thermal batteries are designed to be in storage for 20+ years then be used at full capacity. The electrolyte is stored as a solid salt, but still can react with the anode and cathode materials over the expected storage time. The chemical reaction can reduce the power capacity of the battery, as well as damage the anode or cathode.

US DOT Description:

Proper Shipping Name	Varies depending on the composition of the thermal battery and the USDOT EX Letter
Hazard Class	Varies (1.4S, 5.1, 4.1, 9, etc.)
Identification Number	Varies

Note: Thermal batteries are typically classified as non-explosive but some do require a USDOT EX letter.

Some thermal batteries contain asbestos! Other hazardous components include chromium, lithium, or thermal battery powder.

Caution When Handling: If the battery is designed to be activated by an electrical pulse then the possibility exists for the battery to be activated by any stray electrical pulse, such as static electricity. To prevent accidental activation, some thermal batteries are shipped with the squib contacts shorted together with copper wire. If such a wire is not present during storage, a single strand copper of 20 gauge or larger should be connected between the squib contacts to prevent accidental activation.

When the battery is installed in the next assembly or system, the squib shorting wire should be removed. Note that when the



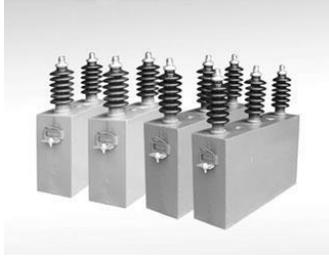
shorting wire is removed, the battery will be subject to ignition by stray electrical signals or static electricity and great care should be used to prevent such signals from contacting the squib terminals. Thermal batteries should not be allowed to contact bare skin either during or immediately after activation. Following performance requirements, the battery should be allowed to cool down in ambient conditions for four to six hours or until the outer case has reached room temperature. Personnel handling the battery immediately after activation should wear protective clothing as required by OSHA for handling high temperature substances. At a minimum, high temperature rated insulated gloves, a full-face shield, and protective coveralls are recommended. If the surface of the battery container is distorted, dented, or punctured before activation, the battery must NOT be activated. The squib terminals should be shorted together and the battery should be disposed of as required by local, state, and federal EPA regulations.

Inspection/Deactivation: Inspect thermal batteries to determine if they have been activated already or if they are still active. If deactivation is required, follow manufacturer specific procedures since the method varies with different battery types.

US EPA Regulations: The RCRA Waste codes to be included on the manifest for Thermal Batteries can vary based on the chemical composition. Many self-contained thermal batteries carry no RCRA codes, but others are D001 (flammable solids). Thermal batteries containing chromium would be D001 (oxidizer) and D007 (chromium). Other thermal batteries containing lithium or releasing hydrogen sulfide gas would be D003 (water reactive/H₂S gas former).



Capacitor Packaging Guidelines Large Capacitors



Composition: A capacitor is a passive two-terminal electrical component used to store energy in an electric field. The forms of capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric (insulator). Most large capacitors consist of metal foils separated by a thin layer of insulating film. Prior to 1979, capacitors contained PCB oil as a dielectric fluid.

Hazards: Capacitors may retain a charge long after power is removed from a circuit; this charge can cause dangerous or even potentially fatal shocks or damage connected equipment.

US DOT Description:

PCB Containing Capacitors

Proper Shipping Name	Polychlorinated Biphenyls, liquid
Hazard Class	9
Identification Number	UN2315
Packing Group	III*

* When transported by highway or rail, PCBs are reclassified as Packing Group III in accordance with Special Provision 140

Non-PCB Containing Capacitors

Proper Shipping Name	Non-DOT regulated
Hazard Class	N/A (None)
Identification Number	N/A
Packing Group	N/A

US DOT Packaging Requirements:

49 CFR 173.21 Forbidden Materials

(c) Electrical devices, such as batteries and battery-powered devices, which are likely to create sparks or generate a dangerous evolution of heat, unless packaged in a manner which precludes such an occurrence.

Although this section of the regulations references batteries, capacitors do have the potential to store sufficient quantities to pose a hazard in transport. As such, large capacitors (>10 lb. each) must be transported as follows.

- PCB containing capacitors must be packaged in DOT specification containers unless specification packagings are impractical. If specification packaging are impractical, non-specification packaging may be used or the item itself may be considered the packaging provided it meets the general packaging requirements of the hazardous material regulations. When the capacitors themselves are the package, the capacitors must be secured to pallets adequate to support the weight of the capacitors.
- Capacitors must be transported in a discharged state.
- Each large capacitor must be shunted or grounded. This is accomplished by using a conductor to connect the terminals or connecting the terminals to a ground.

US EPA Regulations: As noted above capacitors manufactured prior to 1979 contain PCBs and must be managed in accordance with the TSCA regulations. Each PCB article must be marked with the M_L marker. PCB articles transported for disposal must be accompanied by hazardous waste manifest that includes the serial number of the article or container number if it is a PCB article container and the out of service date for the article. If multiple articles or article containers are listed on the same manifest, a continuation page must be included with the manifest noting the serial/container numbers and out of service dates.



Small Oil Filled Film Capacitors



Composition: are the most commonly available of all types of capacitors, consisting of a relatively large family of capacitors with the difference being in their dielectric properties. Oil filled film type capacitors are available in capacitance ranges from as small as 5pF to as large as 100uF depending upon the actual type of capacitor and its voltage rating. Film capacitors also come in an assortment of shapes and case styles. Prior to 1979, capacitors contained PCB oil as a dielectric fluid.

Hazards: Capacitors may retain a charge long after power is removed from a circuit; this charge can cause dangerous or even potentially fatal shocks or damage connected equipment.

US DOT Description:

PCB Containing Capacitors

Proper Shipping Name	Polychlorinated Biphenyls, liquid
Hazard Class	9
Identification Number	UN2315
Packing Group	III*

* When transported by highway or rail, PCBs are reclassified as Packing Group III in accordance with Special Provision 140

Non-PCB Containing Capacitors

Proper Shipping Name	Non-DOT regulated
Hazard Class	N/A (None)
Identification Number	N/A
Packing Group	N/A

US DOT Packaging Requirements:

Capacitor manufactured prior to 1979 may contain PCBs in a concentrated form. As such, a container of capacitors may exceed the reportable quantity (1 pound) and be regulated as a hazardous material when transported by highway. When transported by air or water,

PCB containing small capacitors must be packaged in DOT specification containers rated for packing group III when transported by highway or rail.

US EPA Regulations: As noted above capacitors manufactured prior to 1979 contain PCBs and must be managed in accordance with the TSCA storage, manifesting and disposal regulations. However, in accordance with 40 CFR 761.60(b)(2) small capacitors that are generated for disposal by any person other than a manufacturer of small capacitors are exempt from the disposal and manifesting requirements of 40 CFR 761. Small capacitors are defined as those capacitors that contain less than 3 pounds of dielectric fluid. As a general rule any capacitor that is less than nine pounds gross weight will meet this definition. Although exempt from EPA regulation, these capacitors may be subject to state hazardous waste rules.



Battery Appendix

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

§172.102, SPECIAL PROVISION 130

"Batteries, dry, sealed, n.o.s.," commonly referred to as dry batteries, are hermetically sealed and generally utilize metals (other than lead) and/or carbon as electrodes. These batteries are typically used for portable power applications. The rechargeable (and some non-rechargeable) types have gelled alkaline electrolytes (rather than acidic) making it difficult for them to generate hydrogen or oxygen when overcharged and therefore, differentiating them from non-spillable batteries. Dry batteries specifically covered by another entry in the §172.101 Table must be transported in accordance with the requirements applicable to that entry. For example, nickel-metal hydride batteries transported by vessel in certain quantities are covered by another entry (see Batteries, nickel-metal hydride, UN3496). Dry batteries not specifically covered by another entry in the §172.101 Table are covered by this entry (i.e., Batteries, dry, sealed, n.o.s.) and are not subject to requirements of this subchapter except for the following:

- a) Incident reporting. For transportation by aircraft, a telephone report in accordance with §171.15(a) is required if a fire, violent rupture, explosion or dangerous evolution of heat (i.e., an amount of heat sufficient to be dangerous to packaging or personal safety to include charring of packaging, melting of packaging, scorching of packaging, or other evidence) occurs as a direct result of a dry battery. For all modes of transportation, a written report submitted, retained, and updated in accordance with §171.16 is required if a fire, violent rupture, explosion or dangerous evolution of heat occurs as a direct result of a dry battery or battery-powered device.
- b) Preparation for transport. Batteries and battery-powered device(s) containing batteries must be prepared and packaged for transport in a manner to prevent:
 - 1) A dangerous evolution of heat;
 - 2) Short circuits, including but not limited to the following methods:
 - i. Packaging each battery or each battery-powered device when practicable, in fully enclosed inner packagings made of non-conductive material;
 - ii. Separating or packaging batteries in a manner to prevent contact with other batteries, devices or conductive materials (e.g., metal) in the packagings; or
 - iii. Ensuring exposed terminals or connectors are protected with non-conductive caps, non-conductive tape, or by other appropriate means; and
 - 3) Damage to terminals. If not impact resistant, the outer packaging should not be used as the sole means of protecting the battery terminals from damage or short circuiting. Batteries must be securely cushioned and packed to prevent shifting which could loosen terminal caps or reorient the terminals to produce short circuits. Batteries contained in devices must be securely installed. Terminal protection methods include but are not limited to the following:
 - i. Securely attaching covers of sufficient strength to protect the terminals;
 - ii. Packaging the battery in a rigid plastic packaging; or
 - iii. Constructing the battery with terminals that are recessed or otherwise protected so that the terminals will not be subjected to damage if the package is dropped.
- c) Additional air transport requirements. For a battery whose voltage (electrical potential) exceeds 9 volts-
 - 1) When contained in a device, the device must be packaged in a manner that prevents unintentional activation or must have an independent means of preventing unintentional activation (e.g., packaging restricts access to activation switch, switch caps or locks, recessed switches, trigger locks, temperature sensitive circuit breakers, etc.); and
 - 2) An indication of compliance with this special provision must be provided by marking each package with the words "not restricted" or by including the words "not restricted" on a transport document such as an air waybill accompanying the shipment.
- d) Used or spent battery exception. Used or spent dry batteries of both non-rechargeable and rechargeable designs, with a marked rating up to 9-volt that are combined in the same package and transported by highway or rail for recycling, reconditioning, or disposal are not subject to this special provision or any other requirement of the HMR. Note that batteries utilizing different chemistries (i.e., those battery chemistries specifically covered by another entry in the §172.101 Table) as well as dry batteries with a marked rating greater than 9-volt may not be combined with used or spent batteries in the same package. Note also that this exception does not apply to batteries that have been reconditioned for reuse.

§172.102, SPECIAL PROVISION 181

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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.

§172.102, SPECIAL PROVISION 237

“Batteries, dry, containing potassium hydroxide solid, *electric storage*” must be prepared and packaged in accordance with the requirements of § 173.159(a) and (c). For transportation by aircraft, the provisions of § 173.159(b)(2) apply. This entry may only be used for the transport of non-activated batteries that contain dry potassium hydroxide and that are intended to be activated prior to use by the addition of an appropriate amount of water to the individual cells.

§172.102, SPECIAL PROVISION 340

This entry applies only to the vessel transportation of nickel-metal hydride batteries as cargo. Nickel-metal hydride button cells or nickel-metal hydride cells or batteries packed with or contained in battery-powered devices transported by vessel are not subject to the requirements of this special provision. See “Batteries, dry, sealed, n.o.s.” in the §172.101 Hazardous Materials Table (HMT) of this part for transportation requirements for nickel-metal hydride batteries transported by other modes and for nickel-metal hydride button cells or nickel-metal hydride cells or batteries packed with or contained in battery-powered devices transported by vessel. Nickel-metal hydride batteries subject to this special provision are subject only to the following requirements: (1) The batteries must be prepared and packaged for transport in a manner to prevent a dangerous evolution of heat, short circuits, and damage to terminals; and are subject to the incident reporting in accordance with §171.16 of this subchapter if a fire, violent rupture, explosion or dangerous evolution of heat (i.e., an amount of heat sufficient to be dangerous to packaging or personal safety to include charring of packaging, melting of packaging, scorching of packaging, or other evidence) occurs as a direct result of a nickel metal hydride battery; and (2) when loaded in a cargo transport unit in a total quantity of 100 kg gross mass or more, the shipping paper requirements of Subpart C of this part, the manifest requirements of §176.30 of this subchapter, and the vessel stowage requirements assigned to this entry in Column (10) of the §172.101 Hazardous Materials Table.

§172.102, SPECIAL PROVISION 422

When labelling is required, the label to be used must be the label shown in § 172.447. Labels conforming to requirements in place on December 31, 2016 may continue to be used until December 31, 2018. When a placard is displayed, the placard must be the placard shown in § 172.560.

§172.447 LITHIUM BATTERY label



§173.21(c) Forbidden materials and packages

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(c) Electrical devices, such as batteries and battery-powered devices, which are likely to create sparks or generate a dangerous evolution of heat, unless packaged in a manner which precludes such an occurrence.

§173.159 Batteries, wet

- a) Electric storage batteries, containing electrolyte acid or alkaline corrosive battery fluid (wet batteries), may not be packed with other materials except as provided in paragraphs (g) and (h) of this section and in §§173.220 and 173.222; and any battery or battery-powered device must be prepared and packaged for transport in a manner to prevent:
 - 1) A dangerous evolution of heat (i.e. , an amount of heat sufficient to be dangerous to packaging or personal safety to include charring of packaging, melting of packaging, scorching of packaging, or other evidence);
 - 2) Short circuits, including, but not limited to:
 - i. Packaging each battery or each battery-powered device when practicable, in fully enclosed inner packagings made of non-conductive material;
 - ii. 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; or
 - iii. Ensuring exposed terminals are protected with non-conductive caps, non-conductive tape, or by other appropriate means; and
 - 3) Damage to terminals. If not impact resistant, the outer packaging must not be used as the sole means of protecting the battery terminals from damage or short circuiting. Batteries must be securely cushioned and packed to prevent shifting which could loosen terminal caps or reorient the terminals. Batteries contained in devices must be securely installed. Terminal protection methods include but are not limited to:
 - i. Securely attaching covers of sufficient strength to protect the terminals;
 - ii. Packaging the battery in a rigid plastic packaging; or
 - iii. Constructing the battery with terminals that are recessed or otherwise protected so that the terminals will not be subjected to damage if the package is dropped.

§173.159a Exceptions for non-spillable batteries

- a) Exceptions for hazardous materials shipments in the following paragraphs are permitted only if this section is referenced for the specific hazardous material in the §172.101 table or in a packaging section in this part.
- b) Non-spillable batteries offered for transportation or transported in accordance with this section are subject to the incident reporting requirements. For transportation by aircraft, a telephone report in accordance with §171.15(a) is required if a fire, violent rupture, explosion or dangerous evolution of heat (i.e., an amount of heat sufficient to be dangerous to packaging or personal safety to include charring of packaging, melting of packaging, scorching of packaging, or other evidence) occurs as a direct result of a non-spillable battery. For all modes of transportation, a written report in accordance with §171.16(a) is required if a fire, violent rupture, explosion or dangerous evolution of heat occurs as a direct result of a non-spillable battery.
- c) Non-spillable batteries are excepted from the packaging requirements of §173.159 under the following conditions:
 - 1) Non-spillable batteries must be securely packed in strong outer packagings and meet the requirements of §173.159(a). A non-spillable battery which is an integral part of and necessary for the operation of mechanical or electronic equipment must be securely fastened in the battery holder on the equipment;
 - 2) The battery and outer packaging must be plainly and durably marked "NON-SPILLABLE" or "NON-SPILLABLE BATTERY." The requirement to mark the outer package does not apply when the battery is installed in a piece of equipment that is transported unpackaged.
- d) Non-spillable batteries are excepted from all other requirements of this subchapter when offered for transportation and transported in accordance with paragraph (c) of this section and the following:
 - 1) At a temperature of 55 °C (131 °F), the battery must not contain any unabsorbed free-flowing liquid, and must be designed so that electrolyte will not flow from a ruptured or cracked case; and
 - 2) For transport by aircraft, when contained in a battery-powered device, equipment or vehicle must be prepared and packaged for transport in a manner to prevent unintentional activation in conformance with §173.159(b)(2) of this Subpart.

§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 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
 - (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."

(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.



(ii) For transportation by highway, rail or vessel, the provisions in 49 CFR 173.185(c)(3) (revised as of October 1, 2016) for marking packages, including the exceptions from marking, may continue to be used until December 31, 2018. For transportation by aircraft, the provisions for the lithium battery handling marking in 49 CFR 173.185(c)(3)(ii) (revised as of October 1, 2016) may continue to be used until December 31, 2018.

(4) Air transportation.

(i) For transportation by aircraft, lithium cells and batteries may not exceed the limits in the following table. The limits on the maximum number of batteries and maximum net quantity of batteries in the following table may not be combined in the same package:

Contents	Lithium metal cells and/or batteries with a lithium content not more than 0.3 g	Lithium metal cells with a lithium content more than 0.3 g but not more than 1g	Lithium metal batteries with a lithium content more than 0.3 g but not more than 2 g	Lithium ion cells and/or batteries with a Watt-hour rating not more than 2.7 Wh	Lithium ion cells with a Watt-hour rating more than 2.7 Wh but not more than 20 Wh	Lithium ion batteries with a Watt-hour rating more than 2.7 Wh but not more than 100 Wh
Maximum number of cells/batteries per package	No Limit	8 cells	2 batteries	No Limit	8 cells	2 batteries.
Maximum net quantity (mass) per package	2.5 kg	n/a	n/a	2.5 kg	n/a	n/a.

(ii) When packages required to bear the lithium battery mark in paragraph (c)(3)(i) are placed in an overpack, the lithium battery mark must either be clearly visible through the overpack, or the handling mark must also be affixed on the outside of the overpack, and the overpack must be marked with the word "OVERPACK."

(iii) Each shipment with packages required to bear the handling marking must include an indication on the air waybill of compliance with this paragraph (c)(4) (or the applicable ICAO Packing Instruction), when an air waybill is used.

(iv) For lithium batteries packed with, or contained in equipment, the number of batteries in each package is limited to the minimum number required to power the piece of equipment, plus two spares, and the total net quantity (mass) of the lithium cells or batteries in the completed package must not exceed 5 kg.

(v) Each person who prepares a package for transport containing lithium cells or batteries, including cells or batteries packed with, or contained in equipment in accordance with the conditions and limitations in this paragraph, must receive adequate instruction on these conditions and limitations, commensurate with their responsibilities.

(vi) A package that exceeds the number or quantity (mass) limits in the table shown in (c)(4) is subject to all applicable requirements of this subchapter, except that a package containing no more than 2.5 kg lithium metal



cells or batteries or 10 kg lithium ion cells or batteries is not subject to the UN performance packaging requirements in paragraphs (b)(3)(ii) of this section when the package displays both the lithium battery handling marking and the Class 9 label. This paragraph does not apply to batteries or cells packed with or contained in equipment.

(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)."

(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.

Key Definitions:

Anode - The electrode where oxidation occurs in an electrochemical cell. It is the negative electrode on a battery.

Battery - A device consisting of one or more electrically connected electrochemical cells which is designed to receive, store, and deliver electric energy.

Cathode - The electrode where reduction occurs in an electrochemical cell. It is the positive electrode on a battery.

Cell - A system consisting of an anode, cathode, and an electrolyte, plus such connections (electrical and mechanical) as may be needed to allow the cell to deliver or receive electrical energy.

Electrolyte - A chemical compound (salt, acid, or base) that dissociates into electrically charged ions when dissolved in a solvent. The resulting electrolyte (or electrolytic) solution is an ionic conductor of electricity.

Hermetically sealed - A device or unit that is sealed and for practical purposes is considered airtight.

Primary cells and batteries - Non-rechargeable cells and batteries.

Secondary cells and batteries - Rechargeable cells and batteries.



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 

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. Exempted 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	<p>UN3090, Lithium metal batteries OR UN3091, Lithium metal batteries contained in equipment OR UN3091, Lithium metal batteries packed with equipment AND</p>

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 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 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>



			 AND <div style="border: 1px solid black; padding: 5px; text-align: center;"> Damaged/Defective Lithium Metal Battery </div>
<p>DOT-SP 16532</p> <p>(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;"> Damaged/Defective Lithium Ion Batteries </div> <p>OR</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Damaged/Defective Lithium Metal Batteries </div> <p>AND</p> 

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.

Effective 5/11/20 – 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
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Button Cell Batteries Installed in Equipment (including circuit boards)	N/A	No Limit	No Markings Required
Lithium Ion (For highway or rail shipments only)	≤60 Wh per cell or ≤300 Wh per battery	≤30 kg (66 lbs)	 AND 
Lithium Ion (For all modes except air)	≤20 Wh per cell or ≤100 Wh per battery	≤30 kg (66 lbs)	 OR  AND 
Lithium Ion Packed With or Contained in Equipment (For highway or rail shipments only)	≤60 Wh per cell or ≤300 Wh per battery	No Limit (>5 kg net weight)	 AND 
Lithium Ion Packed With or Contained in Equipment (For highway or rail shipments only)	≤60 Wh per cell or ≤300 Wh per battery	≤5 kg net weight	



<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>BLBY LABEL PASTER® 2002 021 000 www.blby.com</p> <p>AND</p> 
<p>Lithium Ion Contained in Equipment (Not applicable to Packed With Equip.) (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 (Not applicable to Packed With Equip.) (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>
<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> 
<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 (Not applicable to Packed With Equip.) (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 (Not applicable to Packed With Equip.) (For highway or rail shipments only)</p>	<p>≤5 grams per cell or ≤25 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>



Ballast Appendix

Federal Regulations

TSCA stands for the “Toxic Substance Control Act”

Please note the following general information regarding lamp ballasts and the TSCA regulations:

- Lamp ballasts are devices that control the flow of electricity to fluorescent and HID lamps.
- Ballasts contain a capacitor, and a transformer. Older lamp ballasts also contain an asphalt potting compound. The potting compound is the material that holds the components of the ballast in place and provides insulation for the electrical components.
- The capacitors within the ballasts contain less than 3 pounds of dielectric fluid and are defined as small capacitors by EPA and are exempt from TSCA regulation regardless of PCB content.
- Any ballast that is leaking PCB dielectric fluid is subject to TSCA regulation.
- Ballasts manufactured before July 2, 1979 contain PCBs in the capacitor and may contain PCBs in the asphalt potting compound.
- If the manufacture date is unknown and the ballast is not marked “No PCBs”, the ballast should be assumed to have been manufactured prior to July 2, 1979.
- Ballasts that contain greater than 50 ppm PCBs in the potting compound are regulated by TSCA.
- The generator must determine if their ballasts are TSCA regulated, either through generator knowledge or testing.
- In order to reduce long-term environmental liability and preserve natural resources, all ballasts should be recycled or destroyed at a TSCA permitted incineration facility. Improper disposal, and release of PCB’s into the environment, may result in the generator of the waste being financially responsible for clean-up under the Superfund rules.

Please note the following guidelines for generators:

TSCA regulated PCB Ballast:

- Must transport on a Hazardous Waste manifest. If the generator stores ballasts for greater than 30 they must have and use a generator EPA ID number.
- Each container must have a unique identification number (per drum) assigned by the generator and an out-of-service date (the date the first ballast in the drum was removed from service).
- Must be stored and transported in a DOT approved container. DOT approved containers will be marked with a UN specification marking.
- Each container must be marked with the TSCA PCB marker/M_L label.
- If stored for greater than 30 days, each container must be stored in a designated PCB storage area. The requirements for a PCB storage area are attached.
- TSCA regulated PCBs must be destroyed within one year of the out-of-service date. To ensure compliance, PCBs should always be shipped less than 9 months after the out-of-service date.
- Weights must be recorded and reported in kilograms.
- Must be described on the manifest using the shipping name of “Polychlorinated biphenyls, solid, 9, UN 3432, PGIII”.

Non TSCA regulated PCB Ballast:

- Transported on a Bill of Lading, rather than a Hazardous Waste Manifest (no EPA ID number required of generator), and may be transported by a common carrier
- No unique drum number, serial number, or out of service date required
- No secondary containment necessary
- No storage time limitation
- Must use proper DOT shipping containers and shipping name referenced above.

Non PCB Ballasts:

- Ballasts manufactured after July 2, 1979 may be assumed to be non-PCB
- Not TSCA or RCRA regulated
- Transported on a Bill of Lading, rather than a Hazardous Waste Manifest (no EPA ID number required of generator), and may be transported by a common carrier

State Regulations



The following states regulate PCB containing materials under their hazardous waste regulations.

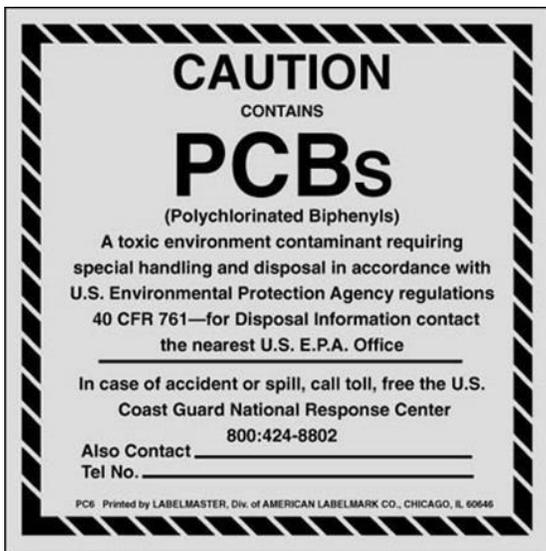
State	Waste Code	State	Waste Code
California	261	Minnesota ⁵	MN03
Connecticut ⁴	CR01	New York (500+ ppm) ³	B005
Maine ¹	M002	New York (50-499 ppm) ³	B004
Maryland (500+ ppm)	M001	Rhode Island	R007
Massachusetts	MA02	Vermont ¹	VT01
Massachusetts ²	MA99	Washington	W001

1. These states have included fluorescent lamp ballasts under their Universal Waste Rules and these waste codes only apply to leaking ballasts.
2. This waste code applies to all ballasts managed under the Massachusetts guidance.
3. These waste codes do not apply to PCB small capacitors, therefore, PCB lamp ballast are exempt from regulation.
4. Waste code applies to manifested shipments.
5. Minnesota regulations contain provisions which allow minimal quantities of hazardous waste to be excluded from the manifesting requirements.

Notes:

1. Regardless of type, all fluorescent lighting ballasts received by Veolia are properly treated and decontaminated at fully licensed facilities. See chart below.
2. Because the **small capacitors** within the ballasts are considered to be **exempt from TSCA regulation**, some generators consider the entire ballast to be exempt from TSCA regulation. This determination should technically be made by testing the ballasts or through generator knowledge of the ballasts. Others tend to be more conservative and consider the ballasts to be **TSCA regulated** because of the potential for PCB's in the potting compound. However, keep in mind the above mentioned guidelines **MUST** be followed in this situation, and Veolia can assist in providing proper labeling and shipping documentation.

Sample TSCA PCB Marker/M_L Label





PCB Storage Area Requirements

- Adequate roof and walls to prevent rain water from reaching the stored PCBs and PCB Items;
- An adequate floor that has continuous curbing with a minimum 6 inch high curb. The floor and curbing must provide a containment volume equal to at least two times the internal volume of the largest PCB Article or PCB Container or 25 percent of the total internal volume of all PCB Articles or PCB Containers stored there, whichever is greater. PCB/radioactive wastes are not required to be stored in an area with a minimum 6 inch high curbing. However, the floor and curbing must still provide a containment volume equal to at least two times the internal volume of the largest PCB Container or 25 percent of the total internal volume of all PCB Containers stored there, whichever is greater.
- No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area;
- Floors and curbing constructed of Portland cement, concrete, or a continuous, smooth, non-porous surface as defined at §761.3, which prevents or minimizes penetration of PCBs.
- Not located at a site that is below the 100-year flood water elevation.
- Marked as required in subpart C §761.40(a)(10) (marked with the PCB M_L label).
- No item of movable equipment that is used for handling PCBs and PCB Items in the storage units and that comes in direct contact with PCBs shall be removed from the storage unit area unless it has been decontaminated as specified in §761.79.
- All PCB Items in storage shall be checked for leaks at least once every 30 days. Any leaking PCB Items and their contents shall be transferred immediately to properly marked non-leaking containers. Any spilled or leaked materials shall be immediately cleaned up and the materials and residues containing PCBs shall be disposed of in accordance with §761.61. Records of inspections, maintenance, cleanup and disposal must be maintained in accordance with §761.180(a) and (b).
- Any container used for the storage of liquid or non-liquid PCB waste shall be in accordance with the requirements set forth in the DOT Hazardous Materials Regulations (HMR) at 49 CFR parts 171 through 180. PCB waste not subject to the HMR (i.e., PCB wastes at concentrations of <20 ppm or <1 pound of PCBs regardless of concentration) must be packaged in accordance with Packaging Group III, unless other hazards associated with the PCB waste cause it to require packaging in accordance with Packaging Groups I or II. For purposes of describing PCB waste not subject to DOT's HMR on a manifest, one may use the term "Non-DOT Regulated PCBs."

PCB Items shall be dated on the item when they are removed from service for disposal. The storage shall be managed so that the PCB Items can be located by this date.



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Resourcing the world

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