

Backhaul Manual



Packaging Guidelines & Best Practices

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Packaging Guidelines & Best Practices

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Electronic Waste

Inventory Estimates

The following are rough average weights and estimates that can be used for planning purposes:

Material	Avg. Weights	Estimated Quantity per Pallet	Estimated Pallet Weights
CRT Monitors	35 lbs	18 CRT Monitors (9 per layer)	CRT Pallet: 500-600 lbs
CRT TV	65 lbs	8 TVs per pallet (4 per layer)	TV Pallet: 400-500 lbs
LCD Monitors	13 lbs	30-40 LCDs per Pallet	LCD Pallet: 300-500 lbs
Computer Towers (CPUs)	23 lbs	40 CPUs per pallet	CPU Pallet: 700-800 lbs
Mixed/Misc. Electronics	<i>Varies</i>	<i>Varies</i>	Mixed Electronics: 500-600 lbs

Personal Protective Equipment (PPE)

Suggested PPE for the consolidation and packaging of electronic waste includes the following items:

- o Gloves
- o Eye protection/Safety Glasses

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing electronic waste for backhaul includes the following items:

- o Sturdy Pallets
- o Stretch Wrap (80 gauge or similar)
- o Miscellaneous Boxes (For containing small items that would otherwise fall through a pallet, as needed)
- o Miscellaneous Tools that may be of use (Wire cutters, Screwdrivers, Hammer, Sockets, etc.)

Spill Cleanup/Emergency Response

In general, electronic waste does not pose a significant spill threat or potential emergency situation.

- o Broom/Brush
- o Buckets with lids
- o Dust Mask

General Packaging Guidelines

The following general packaging guidelines and notes apply to packaging and shipping electronic waste for recycling:

- o If possible, package like materials on the same pallet. This should help achieve the best value for the material.
- o Choose pallets that are not split, broken, or otherwise significantly damaged. Pallets should be able to support the full load of the packaged material.
- o Materials on pallets should be wrapped tightly with stretch wrap. Material should not shift, spill, or collapse while being transported.

More detailed packaging guidelines are provided in the *Electronic Waste – Packaging Guidance* section.

Labeling

There are no labeling requirements for electronic waste. Be sure to check with transporters and vendors to see if there are any labeling requirements specific to them.

Shipping

If possible, staged materials should be kept dry prior to shipment. Individual boxes or full pallets of material may be shipped via plane, truck, or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

Smaller Shipments

Small shipments of electronics do not have to be palletized. Electronics just need to be packaged in cardboard boxes.



Boxes of electronics sent in from rural communities

Please do not send miscellaneous office equipment, or other non-electronic items such as binders, notebooks, towels, etc.

Be sure to contact your recycling vendor to determine what materials are acceptable for electronic recycling.

Palletizing Miscellaneous Electronics

Many times what may seem like a lot of material can actually be consolidated into a small area. This is the advantage of packaging miscellaneous electronics on pallets.



Place heavy and flat items on the pallet first. This will build a strong, stable foundation. Build up the pallet of material. A good stopping point is when the material is between waist and chest height.

80-gauge stretchwrap works well for wrapping electronics. To tightly wrap the pallet, pull the stretchwrap tight as you go around the corners. When finished wrapping, give the material a push to check how tightly bound it is. Continue wrapping if needed.



Finishing off a pallet by tightly securing it with stretchwrap

Palletizing Computer Monitors

Begin placing computer monitors on a pallet. Start with one on each corner and one in the middle, all positioned facedown. Try to use the monitors with the flattest faces and backs for the first layer.

Next, place monitors face up between face down monitors. The curves in the monitors should allow them to fit together snugly (see below).



Monitors will normally fit together nicely when using the face up/face down pattern



Start the second layer, placing the monitors the same way as the first layer. Next, use stretchwrap to secure the load. 80-gauge stretchwrap works well for wrapping monitors. To tightly wrap the pallet, pull the stretchwrap tight as you go around the corners. When finished wrapping, give the stack a push to check how tightly bound it is. Continue wrapping, as needed.

Palletizing Other Similar Electronics

If a large quantity of electronics has been collected, then it may be possible to palletize computer towers, televisions, and printer separately. Packing materials separately may help reduce recycling fees.



Computer Towers



Televisions



Printers

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Fluorescent Lamps

Inventory Estimates

The following are rough average weights and estimates that can be used for planning purposes:

Lamp Length	Boxes	Drums	Gaylord/Pallet Box
4-ft Lamps	Appx Weight: 35 lbs Appx Qty: T12 – 64 lamps T8 – 120 lamps	Appx Weight: 65 lbs Appx Qty: T12 – 120 lamps T8 – 240 lamps	Appx Weight: 600 lbs Appx Qty: T12 – 800 lamps T8 – 1200 lamps
8-ft Lamps	Appx Weight: 30 lbs Appx Qty: T12 – 25 lamps T8 – 50 lamps	Appx Weight: 60 lbs Appx Qty: T12 – 60 lamps T8 – 120 lamps	Not Applicable

Personal Protective Equipment (PPE)

Suggested PPE for the consolidation and packaging of fluorescent lamps includes the following items:

- o Gloves (if possible, cut resistant gloves)
- o Eye Protection/Safety Glasses
- o Long sleeves

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing fluorescent lamps for backhaul includes the following items:

- o Sturdy Lamp Boxes (if possible, utilize the original lamp boxes)
- o Fiber Drums, if appropriate
- o Gaylord/Pallet Boxes, if appropriate
- o Packaging Tape
- o Stretch wrap (80 gauge or similar) if shipping multiple boxes on a pallet
- o Labels

Spill Cleanup/Emergency Response

Exposure to mercury vapor is the main risk when fluorescent lamps break. If a fluorescent lamp breaks, the EPA recommends the following steps prior to cleaning up the material:

- o Have everyone leave the immediate area
- o Allow the area to ventilate for 5-10 minutes
- o Detailed Cleanup guidelines are provided here: www.epa.gov/cfl/cleaning-broken-cfl

Materials for cleaning up fluorescent lamps include the following

- o Broom/Brush & Heavy plastic bag (for containing spill cleanup matter)
- o DOT approved 5-gallon bucket with lid

Broken lamp material safety should be contained in a sealed bucket may be labeled as “*Accidentally Broken Fluorescent Lamps.*”

General Packaging Guidance

The following general packaging guidelines and notes apply to packaging and shipping fluorescent lamps for recycling:

- o Lamps can be contained in boxes, drums, or in some cases, pallet boxes.
- o Lamp containers must be structurally sound
- o Lamps must be fully contained within a container (no open tops, holes, gaps, etc...Lamps must not be exposed in any manner).
- o Containers must be completely sealed; if lamps break within the container, no material should be able to “leak” out.
- o Lamps boxes may be stacked on pallets and secured using stretch wrap.

More detailed packaging guidelines are provided in the *Fluorescent Lamps – Packaging Guidance* section.

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Fluorescent Lamps

Labeling

The following labels should be used for staging and shipping fluorescent lamps to be recycled.

- Universal Waste Label
- Optional – “Fragile” Label
- Optional – “Glass” Label

Shipping

Lamp containers ***must*** be kept dry prior to shipment. Further, ensure the following prior to shipping:

- All containers are appropriately labeled
- Ensure lamps are completely contained
 - Ends should be sealed (ex: with packaging tape)
 - Any holes, gaps, loose seams must be sealed (ex: with packaging tape)
 - If the box/package breaks, material should not be capable of leaking from the package
- Do not stack items on top of lamp boxes, drums, or pallets.

Individual boxes and full pallets can be shipped via plane, truck or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

1) Be sure to use gloves and safety glasses when handling fluorescent lights.



Using gloves and safety glasses



Marked used fluorescent tube

2) If available, use the original box for packing fluorescent lamps. When a new bulb is taken out, put the expired bulb in its place. Mark the old bulb to indicate it no longer works.

3) Contact your vendor if no boxes are available in your community. Carefully place the expired fluorescent lamps in the light boxes. Be careful not to over-fill the boxes, BUT also make sure boxes are shipped full.



Full box of used fluorescent tubes ready to be closed and labeled



Taped box lid

4) Tape both ends of the boxes to seal them securely. Carefully tape all seams of the boxes and tape the corners so that if lamp breakage occurs, toxic components will stay in the box.

5) Contact your shipper concerning proper labeling. Boxes should include “Universal Waste” labels indicating they are Used Fluorescent Lamps and the start accumulation date.



An example of labeling

Lamp boxes can be shipped individually or multiple boxes may be shipped on pallets. Ensure pallets containing boxes of lamps are stretch wrapped securely to pallets. Additionally, lamp drums (fiber and plastic) can be utilized, in lieu of boxes, to contain large volumes of lamps.



Wrapped Pallet of 4-ft Lamps



Wrapped Pallet of 4-ft Drums

Additional Lamp Packaging Notes

When collecting and packaging fluorescent lamps for shipment, consider the following:

- ***Do not* tape groups of lamps together** – Taping lamps together increases the chance of breakage, increases the risk of cuts to lamp recycling personnel, and increases the chance of damaging lamp recycling equipment.
- **All Lamp containers must be closed, structurally sound, and compatible with its contents** – Lack evidence of leakage, spillage, or damage that could cause leakage under reasonable foreseeable conditions
- **Minimize the risk of lamp breakage** – Accumulate lamps in packages/containers that are structurally sound and adequate to prevent leakage
- **Keep lamp containers dry** – Universal waste lamps must be stored within containers that are staged in a manner that prevents the containers from being exposed to the elements (i.e. indoors, shed, connex, etc.).
- **Accidentally broken lamps can be managed as Universal Waste** – Place accidentally broken lamps in a plastic bag and seal. Then place the bag in a bucket or drum and seal. Buckets or drums containing accidentally broken lamps must be labeled “*Accidentally Broken Fluorescent Lamps*”.
- **Intentionally crushed lamps must be managed as Hazardous Waste** – Any intentionally crushed lamps cannot be shipped/transported as Universal Waste.



Mercury Bearing Devices

Inventory Estimates

Mercury containing devices can vary in size. Typically, actual components containing the mercury are relatively small (switches, relays, ampules). Mercury has been used in a wide variety of equipment. Examples of mercury containing devices includes the following:

- Thermometers
- Thermostats
- Navigation equipment (ex: aircraft and vessel autopilot systems)
- Equipment designed to measure pressure (ex: barometers, manometers, etc.)
- Tilt switches (ex: chest freezers, vehicle hood and trunk lights)
- Telecommunication equipment (mercury wetted relays on circuit boards.)
- Gas fired appliances (ex: stoves, water heaters)

Personal Protective Equipment (PPE)

Suggested PPE for the consolidation and packaging mercury containing devices includes the following items:

- Gloves (ex: cut resistant gloves)
- Eye protection (ex: protective glasses).

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing mercury containing devices for backhaul includes the following items:

- Plastic Bags
- DOT approved sealable bucket with a lid
- Labels

Spill Cleanup/Emergency Response

Exposure to mercury vapor is the main risk when mercury is released. The following materials are recommended to manage mercury spills:

- Nitrile Gloves
- Mercury Spill Kit
- Plastic Bags
- DOT approved sealable bucket with a lid

If possible, ventilate the area where the spill occurred after cleanup. Use mercury indicator powder (it be included in the spill kit) to determine if mercury is still present.

General Packaging Guidance

The following general packaging guidelines and notes apply to packaging and shipping mercury bearing devices for recycling:

- Contain mercury bearing devices in a DOT approved plastic container with a lid that seals
- Contain individual devices in plastic bags
- Carefully lay bagged devices in the plastic container; pack in a manner that minimizes the chance of breakage
- Keep the lid on the plastic container sealed whenever the container is not being actively filled.

More detailed packaging instructions can be found in the *Mercury Bearing Devices – Packaging Guidance* section



Mercury Bearing Devices

Labeling

The following labels should be used for staging and shipping mercury containing devices to be recycled.

- Universal Waste Label
- #8 Corrosive Label
- #6 Poison Label

Shipping

Keep containers dry prior to shipment. Further, ensure the following prior to shipping:

- Declare as Hazmat
- All containers are appropriately labeled
- Ship materials upright
- #8 Corrosive placards will be needed for the shipping container

Contained mercury bearing devices can be shipped via plane, truck or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

Mercury Bearing Devices Packaging Guidance

Manufactured articles that contain mercury (mercury bearing devices) should be handled with extreme care. If mishandled, switches, relays, and ampules that contain the mercury may break. Mercury, when released, can contaminate the environment and poses a risk to human health.



Examples of Mercury Bearing Devices

Mercury is extremely corrosive when it comes in contact with certain metals, especially aluminum. To protect people, equipment, and the environment from mercury releases, mercury bearing devices should be packaged in completely sealed containers (preferably plastic containers).

The following provides guidance for packaging and containing multiple mercury bearing devices:

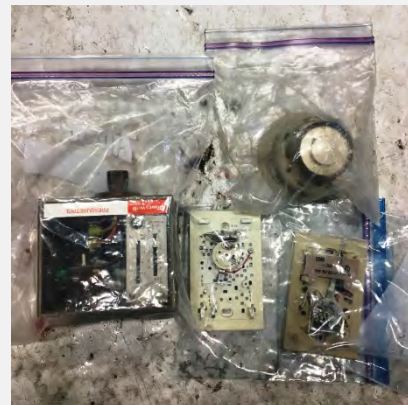
- 1) Use a sturdy, plastic, leak-proof container (such as a screw-top bucket with a lid) for consolidating mercury bearing devices.



- 2) Line the container with a plastic bag.



- 3) Enclose mercury bearing devices into plastic bags.



4) Gently pack the mercury bearing devices into the lined container.



5) Close up the liner.



6) Seal the lid and label appropriately.



Labels used for packaging *Manufactured Articles Containing Mercury* (i.e. mercury bearing devices).



Universal Waste Label



Primary Hazard Class
#8 Corrosive



Subsidiary Hazard Class
#6 Poison



Household Batteries

Inventory Estimates

The following are rough average weights and estimates that can be used for planning purposes:

- 1-Gallon Container – 15 lbs
- 5-Gallon Bucket – 80 lbs

Note: Lithium/Lithium Ion/Lithium Polymer containers are limited to a gross weight not exceeding than 66 lbs (Combination of batteries and packaging materials)

Personal Protective Equipment (PPE)

Suggested PPE for the sorting, consolidation, and packaging of household batteries includes the following items:

- Gloves
- Eye protection

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing household batteries for backhaul includes the following items:

- Containers that are closeable, structurally sound, compatible with the contents of the battery, and lacks evidence of leakage, spillage, or damage.
- UN rated (packing group II or higher) buckets with lids, when required.
- Insulating material (ex: packaging tape, electrical tape)
- Appropriate Markings & Labels

Spill Cleanup/Emergency Response

The potential for fire and explosion is the main risk when managing batteries; Lithium, Lithium-Ion, and Lithium Polymer batteries pose the greatest threat of fire/explosion. When handling batteries the following materials will assist with cleanup and emergency response.

- Nitrile gloves
- Chemical resistant gloves
- Absorbent (ex: vermiculite, kitty litter, absorbent powder)
- Broom/Brush & Heavy plastic bag (for containing spill cleanup matter)
- Bucket or other container with a sealable lid;
- Fire Extinguisher

General Packaging Guidelines

The following general packaging guidelines and notes apply to packaging and shipping electronic waste for recycling:

- The following batteries must be insulated to prevent short circuits (leading to fires/explosions)
 - All batteries greater than 9-volts
 - All Ni-MH batteries, if shipped by barge/vessel
 - All "Lantern" style batteries
 - All batteries containing lithium (Lithium, Lithium-Ion, Lithium Polymer, etc.)
 - Any battery with an "unknown" chemistry
- Batteries should be fully contained in a DOT approved shipping container with a sealing lid.
- Avoid storing batteries in a manner that could allow water to mix with the batteries



Household Batteries

Labeling

The following labels should be used for staging and shipping batteries to be recycled.

- Universal Waste (Lead Acid, Ni-Cad, Lithium, Lithium-Ion, Lithium Polymer)
- Corrosive #8 (Lead Acid, Ni-Cad)
- Miscellaneous #9 (NiMH)
- Miscellaneous #9 Lithium Batteries (Lithium, Lithium-Ion, Lithium Polymer)
- UN 3090 (Lithium Primary)
- UN 3480 (Lithium-Ion, Lithium Polymer)
- "Danger – do not ship on passenger aircraft/Cargo Air Craft only" (Lithium-Ion, Lithium Polymer)

Shipping

Further, ensure the following prior to shipping:

- All battery terminals are insulated to prevent fires or short circuits.
- Follow all applicable Hazardous Materials Regulations
- Ship materials in appropriate containers that are marked, labeled, closed, secure, & upright.
- When needed, block/brace into place to ensure containers don't shift during transport.
- Placards shipping connexes, when applicable
- Ensure all Lithium, Lithium-Ion, and Lithium Polymer battery containers' gross weight do not exceed 66 pounds
- Remember all Lithium, Lithium-Ion, and Lithium Polymer batteries cannot be shipped on passenger aircraft.

Battery containers can be shipped via plane, truck or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

Chemistry: Alkaline

Identification Information:

- Alkaline Batteries look like “typical” household batteries that are commonly used in everyday devices.
- In general, Alkaline Batteries are not rechargeable (but rechargeable Alkaline do exist).
- Carbon-Zinc batteries can be easily confused with Alkaline Batteries.
- Alkaline Batteries also exist in button cell form.

Labels:



Note: This is not a DOT label.

Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
NO	NO*	NO

Detailed Shipping Description:

Batteries, dry, sealed n.o.s. (Alkaline Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- If shipping by air or barge, insulate terminals all battery terminals.
- In general, do not mix with Lithium, Lithium Ion, Nickel Metal Hydride, and Nickel Cadmium batteries.

** Alkaline Batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.*

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Carbon-Zinc Batteries

Packaging Guidance

Chemistry: Carbon-Zinc (also Zinc-Chloride)

Identification Information:

- Carbon-Zinc look like “typical” household batteries that are commonly used in everyday devices (similar applications as Alkaline Batteries).
- Alkaline Batteries can be easily confused with Carbon-Zinc Batteries.
- Carbon-Zinc Batteries are often labelled “Heavy Duty”, “Extra Heavy Duty”, and “Super Heavy Duty.”
- Carbon-Zinc Batteries are not rechargeable.

Labels:



Note: This is not a DOT label.

Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
NO	NO*	NO

Detailed Shipping Description:

Batteries, dry, sealed n.o.s. (Carbon-Zinc Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- If shipping by air or barge, insulate terminals all battery terminals.
- In general, do not mix with Lithium, Lithium Ion, Nickel Metal Hydride, and Nickel Cadmium batteries.

* Carbon-Zinc Batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

Nickel Cadmium (Ni-Cad) Batteries

Packaging Guidance

Chemistry: Nickel Cadmium (Ni-Cad) dry cells

Identification Information:

- Nickel Cadmium Batteries occur in multiple forms:
 - Some look like “Typical” household batteries;
 - They are found in Power Packs (ex: power tools, cordless phones).
- Nickel Cadmium Batteries can be easily confused with Nickel Metal Hydride (NiMH) Batteries.
- Nickel Cadmium Batteries are rechargeable.
- The base voltage (of a single cell) for a Ni-Cad Battery is 1.2 Volts.
- Nickel Cadmium Batteries also exist in button cell form (rarely).
- Wet Nickel Cadmium Batteries (similar to Lead Acid Batteries) also exist – See *Wet Battery Packaging Guidance* section

Labels:



Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
YES	NO*	NO**

Detailed Shipping Description:

Batteries, dry, sealed n.o.s. (Nickel Cadmium Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- If shipping by air or barge, insulate terminals all battery terminals.
- In general, do not mix with Lithium, Lithium Ion, or Nickel Metal Hydride, and Alkaline batteries.

* Dry cell Ni-Cad Batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

** Universal Waste Regulations require containers are closeable, structurally sound, compatible with the contents of the battery, and must lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions.

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Nickel Metal Hydride (NiMH) Batteries

Packaging Guidance

Chemistry: Nickel Metal Hydride (NiMH)

Identification Information:

- Nickel Metal Hydride Batteries occur in multiple forms:
 - Some look like “Typical” household batteries;
 - They are found in Power Packs (ex: power tools, cordless phones).
- Nickel Metal Hydride Batteries can be easily confused with Nickel Cadmium (Ni-Cad) Batteries.
- Nickel Metal Hydride Batteries are rechargeable.
- The base voltage (of a single cell) for a NiMH Battery is 1.2 Volts.
- Nickel Metal Hydride Batteries also exist in button cell form (rarely).

Labels:



Note: This is not a DOT label.



When shipped by Barge/Vessel

Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
NO	Vessel – YES Other Modes of Transport – NO*	NO**

Detailed Shipping Description:

Barge/Vessel Shipments – UN3496, Batteries, Dry, Nickel-Metal Hydride, 9

All Other Modes of Shipment – Batteries, dry, sealed, n.o.s. (Nickel Metal Hydride Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- Insulate **ALL** terminals (regardless of size and shape); and
- Do not mix with Lithium, Lithium Ion, Nickel Cadmium, and Alkaline batteries.

* NiMH Batteries, when shipped in any mode other than vessel/barge, are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

** When shipped by vessel/barge, 49 CFR 172.102 Special Provision 130, states NiMH batteries must be prepared and packaged for transport in a manner to prevent a dangerous evolution of heat, short circuits, and damage to terminals

Lithium Ion & Lithium Polymer Batteries

Packaging Guidance

Chemistry: Lithium Ion (Li-Ion) & Lithium Polymer (Li-Poly) Batteries

Identification Information:

- Li-Ion and Li-Poly batteries are all rechargeable batteries.
- Li-Ion and Li-Poly batteries will generally have a label indicating it is a rechargeable lithium battery.

Suggested Packaging:



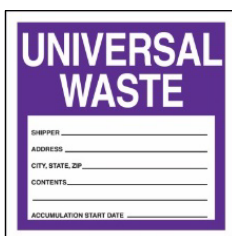
Screw-top plastic bucket – Not to exceed 66 lbs

Insulate All Terminals:

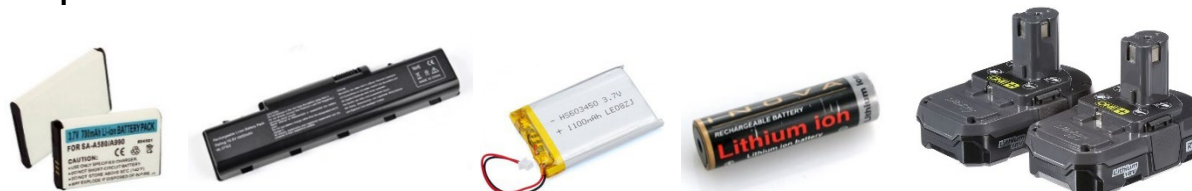


- Terminals can be insulated using tape.
- Avoid excessive taping and ensure labels can be read.

Required Marks & Labels (requirements vary depending on battery size and shipping mode*):



Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
YES	YES*	YES*

Detailed Shipping Description:

UN3480, Lithium Ion Batteries, 9

Special Handling Instruction:

- *Handle carefully* – Damaged and short-circuited Li-Ion batteries can cause intense fires/explosions.
- Insulate terminals on all Li-Ion and Li-Poly batteries without recessed terminals.
- Contain in a UN Rated (level II packaging or greater) screw-top plastic bucket – Not to exceed 66 lbs.
- Do not mix with other battery chemistries.

* Marking, labelling, and packaging requirements for Li-Ion batteries vary depending on size and mode of transportation. Please refer to 49 CFR 173.185 for specific instructions for your shipping situation.

Lithium (Primary) Batteries

Packaging Guidance

Chemistry: Lithium Metal (Li) Batteries

Identification Information:

- Lithium batteries are non-rechargeable batteries found in high-energy household items (ex: cameras), but also in commercial equipment such as medical devices.
- Lithium batteries can be very similar to common household batteries (double check labels).

Suggested Packaging:



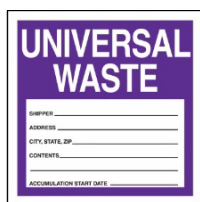
Screw-top plastic bucket – Not to exceed 66 lbs

Insulate All Terminals:



- Terminals can be insulated using tape.
- Avoid excessive taping and ensure labels can be read.

Required Marks & Labels (requirements vary depending on battery size and shipping mode*):



Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
YES	YES*	YES*

Detailed Shipping Description:

UN3090, Lithium Metal Batteries, 9

Special Handling Instruction:

- *Handle carefully* – Damaged and short-circuited Lithium batteries can cause intense fires/explosions.
- Insulate terminals on all Lithium Batteries.
- Contain in a UN Rated (level II packaging or greater) screw-top plastic bucket – Not to exceed 66 lbs.
- Do not mix with other battery chemistries.

* Marking, labelling, and packaging requirements for Lithium batteries vary depending on size and mode of transportation. Please refer to 49 CFR 173.185 for specific instructions for your shipping situation.

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Wet Batteries (Lead Acid & Ni-Cad)

Inventory Estimates

The following are rough average weights and estimates that can be used for planning purposes:

Battery Type	Weight
ATV & UPS Batteries	5 – 20 lbs
Car and Truck batteries	40 lbs
Deep Cycle Marine and Solar Batteries	80 – 120 lbs
Pallet of Wet Batteries	2,500 – 3,200 lbs (800 – 1,200 lbs per layer)
Tote of Wet Batteries	1,600 – 2,000 lbs (800 – 1,000 lbs per layer)

Note: Wet batteries shipped in totes by air under special permit number SP 12283 are limited to a gross weight of 1,800 lbs (combination of batteries and packaging materials).

Personal Protective Equipment (PPE)

Suggested PPE for the sorting, consolidation, and packaging of wet batteries includes the following items:

- Gloves (ex: chemical resistant gloves)
- Eye protection (ex: protective goggles).
- Long sleeves
- Heavy pants
- Steel/composite toed boots

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing wet batteries for backhaul includes the following items:

- Sturdy pallet
- Material to separate & insulate battery layers (Cardboard, Waffle board, etc.)
- Stretch wrap (80 gauge or similar)
- Banding
- Non-leaking fish tote with a lid, if needed
- Labels

Spill Cleanup/Emergency Response

The potential for fire/explosion and the risk of leaking electrolyte are the main risk when managing wet batteries; Battery terminals should be insulated and to reduce the threat of fire/explosion. Batteries should be handled, stacked, and staged in a responsible manner to limit the risk of spilling electrolyte.

When handling batteries the following materials will assist with emergency response and spill cleanup:

- Nitrile Gloves
- Heavy/Thick Plastic Bags
- Chemical Resistant gloves
- Absorbent (ex: vermiculite, kitty litter, absorbent powder)
- Electrolyte neutralizer (ex: Baking powder for Acid, Vinegar for Alkali)
- Broom/Brush & Heavy plastic bag (for containing spill cleanup matter)
- Fire Extinguisher

General Packaging Guidance

The following general packaging guidelines and notes apply to packaging and shipping wet batteries for recycling:

- Packaging Wet Batteries on Pallets
 - Choose pallets that are not split, broken, or otherwise significantly damaged. Pallets should be able to support the full load of the packaged batteries.



Wet Batteries (Lead Acid & Ni-Cad)

- Materials on pallets should be wrapped tightly with stretch wrap and secured with banding. Material should not shift, spill, or collapse while being transported.
- Do not stack more than 3 layers of batteries.
- Ensure each layer (including the top layer) has a significant amount of insulating material separating the layers of batteries.
 - Insulating layers should prevent accidental short circuit (leading to fires/explosions)
 - Insulating layers should protect against battery terminals on lower layers from puncturing the bottom of batteries stacked on top of them.
 - Insulation on the top layer should be thick enough to ensure banding material does not come in contact with any battery terminals.
- Packaging Wet Batteries in Totes
 - Typically, totes can hold 2 layers of batteries.
 - Ensure each layer (including the top layer) has a significant amount of insulating material separating the layers of batteries.
 - Insulating layers should prevent accidental short circuit (leading to fires/explosions)
 - Insulating layers should protect against battery terminals on lower layers from puncturing the bottom of batteries stacked on top of them.
 - Ensure the lid can fully cover the tote and securely band the lid shut when finished packaging

More detailed packaging guidelines are provided in the *Wet Battery – Packaging Guidance* sections (for packaging on pallets and totes, respectively)

Labeling

The following labels should be used for staging and shipping wet batteries to be recycled.

- Labeling for transport by barge or road
 - Universal Waste Label
 - Corrosive #8
- Labeling for transport by air (Batteries packed in a tote utilizing SP 12283)
 - Universal Waste Label
 - Corrosive #8
 - Up arrows
 - “Danger – Do not ship on passenger aircraft” or similar
 - Special Permit – Full document attached to the container

Shipping

If possible, keep pallets and totes dry prior to shipment. Further, ensure the following prior to shipping:

- All battery containers are appropriately labeled
- Declare batteries as Hazmat
- Ship materials upright
- Do not stack battery pallets/totes on top of any other pallets of material.
- Block/brace battery pallets/totes into place to ensure materials don't shift during transport
- #8 Corrosive placards will be needed for the shipping container
- Remember, wet batteries shipped in totes by air under special permit number SP 12283 are limited to a gross weight of 1,800 lbs.

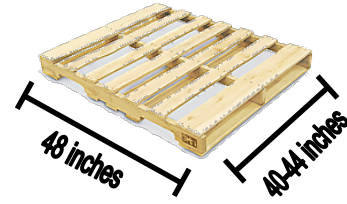
Battery containers can be shipped via plane, truck or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

Wet Batteries (Lead Acid & Ni-Cad)

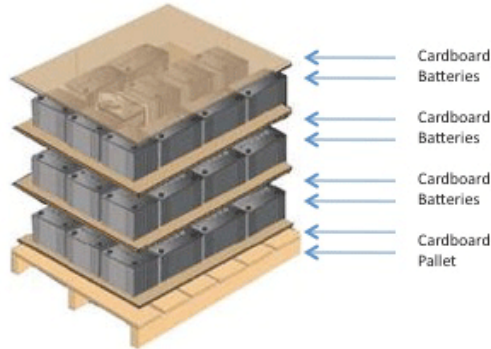
Packaging Guidance – Pallets

Important Pallet and Packaging Specifications:

1. Maximum pallet sizes: 40" x 48" or 44" x 48"



2. Maximum layers per pallet: 3 – roughly 24 batteries/layer = 72 batteries for 3 layers.



Wet batteries must have a layer cardboard separating each level.
This includes a layer of cardboard on the bottom and the top of the load.

3. Typical Pallet Weight (for 3 layers): *Between 2800 and 3300 lbs – Pallets are not to exceed 3300 lbs.*
4. Only lead-acid batteries may be packaged: *No mixing in other batteries or recyclables.*
5. Pallet must be built with a minimum of **3** bottom boards and durable enough to handle the weight of the batteries.

This pallet has 3 bottom boards



Instructions for Stacking Wet Batteries on a Pallet

1. Select a sturdy pallet with no broken or missing boards. Be sure there are no nails sticking out, which could puncture the batteries or pose a safety hazard.



An example of a typical wood pallet

2. Place a layer of cardboard on the pallet to create a flat work surface and help prevent batteries from sliding off of the pallet.

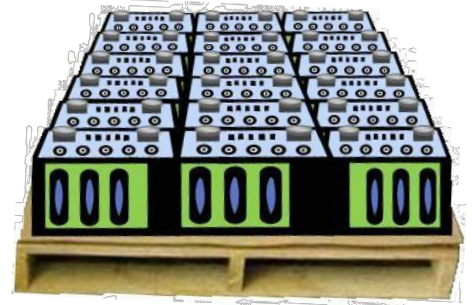


A pallet with a layer of cardboard

Wet Batteries (Lead Acid & Ni-Cad)

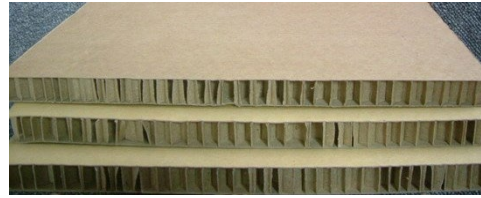
Packaging Guidance – Pallets

3. Make the first layer of batteries as level and as close together as possible.
 - If some of the batteries are shorter, they should be placed in the center of the layer.
 - Batteries that are relatively taller should be saved and placed on the top layer (if stacking more than 1 layer).
 - Ensure no batteries are hanging over the edge of the cardboard/pallet.



Single layer of batteries

4. Place cardboard (multiple sheets if necessary) between each layer of batteries.
 - It is best to use the thick honeycomb cardboard (if available).



Examples of honeycomb cardboard

- Alternatively, multiple layers of typical cardboard can also be used.



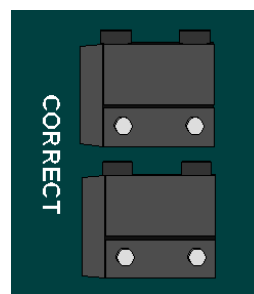
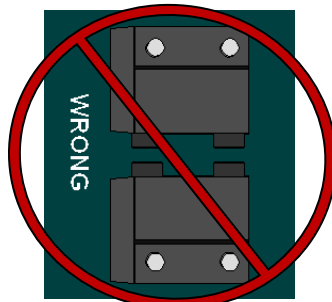
Examples of layers of typical cardboard

- Enough layers of cardboard must be applied to achieve the following:
 - Prevent the possibility of short circuits; and
 - Prevent the terminals from puncturing the underside of the batteries in the layer above.



2 layers of batteries with honeycomb cardboard separating the two layers

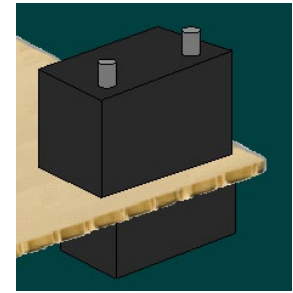
Note #1: Side terminal batteries must be stacked so the posts are facing away from each other and not facing towards the outside of the pallet. Side terminals must never touch (below displays overhead views of “Side Terminal Batteries”).



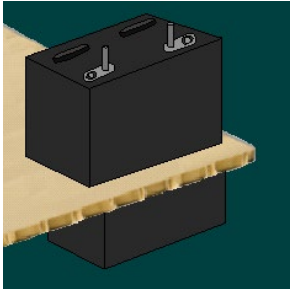
Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Pallets

Note #2: Top posts must be positioned toward the outside of the pallet so the layer above it leans toward the center. Make sure that no batteries are overhanging the cardboard.



Example: The top battery has the terminals positioned toward the outside of the pallet.



Note #3: Stud post batteries (such as Marine Batteries) should be on the top layer. If this is not possible, you will need extra layers of cardboard between the layers of batteries to prevent punctures. This is also important when stacking three layers high.

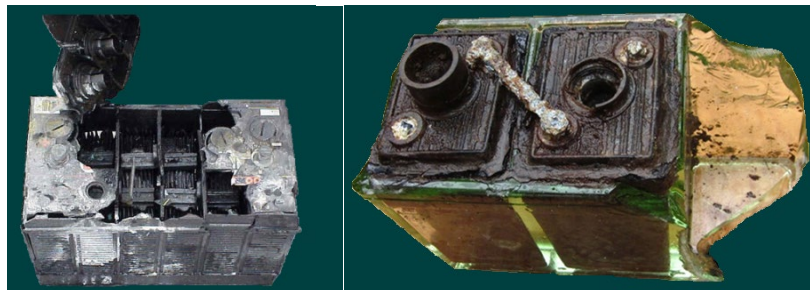
Example: The top “stud post” battery has its terminals positioned toward the outside of the pallet, and would need extra layers of cardboard to prevent puncturing the next layer of batteries.

- A maximum of 3 layers of batteries may be placed on a pallet. When stacking is complete, place cardboard on top of the final layer of batteries.



3 layers of batteries with a layer of cardboard on top.

- Any battery that has been damaged and has the potential to leak must first be placed in a container capable of holding its contents.



Examples of damaged lead acid batteries

- Damaged batteries that are not visibly leaking electrolyte should be put in heavyweight polyethylene plastic bags (minimum: 6 mil), properly sealed with plastic tie, and placed in the middle of the top layer.
- Damaged batteries that have the potential to leak must be placed in a container that is capable of holding its contents (i.e. will not leak fluid) such as a DOT approved 5- gallon bucket.



An example of a DOT approved 5-gallon container

Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Pallets

Instructions for Wrapping Pallet

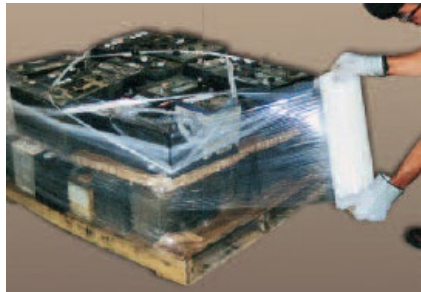
All batteries should be secured to the pallet with stretch wrap. An 80 gauge (or stronger) stretch wrap is recommended. Stretch wrap works best if it is pulled tight before stretching it around the corners.

1. Start with the stretch wrap turned sideways to create a “rope-effect”. Wrap around the top layer twice.*
2. Using the rope-effect, wrap the top layer twice* more, each time crossing over the top to form an “X-pattern.” This should pull the batteries towards the center, preventing batteries from falling off of the pallet.



Creating a “rope-effect” with stretch wrap

3. Holding the stretch wrap open, wrap around the bottom layer twice*, being sure to catch the edges of the pallet.



Holding the stretch wrap open



3 layers of batteries wrapped up

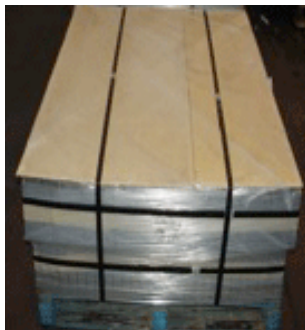
4. After placing a layer of cardboard on top of the batteries, wrap around the top layer at least twice* and tear-off the stretch wrap at the last corner.



Fully wrapped pallet of batteries

****Note:*** After wrapping twice (during each step) judge the load; wrap as many times as necessary to stabilize the load.

5. To further secure the load, band the material to the pallet.

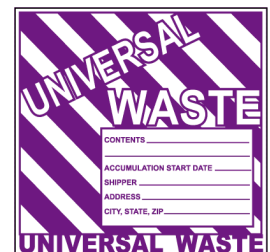


A wrapped and banded pallet of lead acid batteries (3 levels)

6. Finally, ensure the pallet is properly labeled. At minimum, the pallet should include a #8 Corrosive and a Universal Waste Label. Check with your transporter to see if any additional labeling is required.



Ex: #8 Corrosive Label



Ex: Universal Waste Label



Battery Labeling Matrix










TYPE	PROPER SHIPPING NAME	UNIVERSAL WASTE?	HAZARDOUS MATERIAL?
ALKALINE	BATTERIES, DRY, SEALED, N.O.S (ALKALINE)	NO	NO*
NICKEL METAL HYDRIDE	<i>Vessel/Barge Shipment:</i> UN3496, BATTERIES, DRY, NICKEL METAL HYDRIDE, 9	NO	YES
NICKEL METAL HYDRIDE	<i>Truck/Air/Rail Shipment:</i> BATTERIES, DRY, SEALED, N.O.S (NICKEL METAL HYDRIDE)	NO	NO*
NI-CAD (Dry)	BATTERIES, DRY, SEALED, N.O.S (NICKEL CADMIUM)	YES	NO*
NI-CAD (Wet)	UN2795, BATTERIES, WET, FILLED WITH ALKALI, 8 (NICKEL CADMIUM)	YES	YES
LEAD ACID (Wet)	UN2794, BATTERIES, WET, FILLED WITH ACID, 8 (LEAD ACID)	YES	YES
LITHIUM	<i>Small Battery Exemption (Truck or Vessel – Limited to 30 kg or 66 lbs):</i> UN3090, LITHIUM METAL BATTERIES, 9	YES	NO**
LITHIUM	<i>Small Battery Exemption (Air – Limited to 2.5 kg or 5.5 lbs):</i> UN3090, LITHIUM METAL BATTERIES, 9	YES	YES
LITHIUM	<i>Fully Regulated (Limited to 35 kg or 77 lbs on Cargo Aircraft):</i> UN3090, LITHIUM METAL BATTERIES, 9	YES	YES
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Truck or Vessel – Limited to 30 kg or 66 lbs):</i> UN3480, LITHIUM ION BATTERIES, 9	YES	NO**
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Air – Limited to 10 kg or 22 lbs):</i> UN3480, LITHIUM ION BATTERIES, 9	YES	YES
LITHIUM ION (including Li-Poly)	<i>Fully Regulated (Limited to 35 kg or 77 lbs on Cargo Aircraft):</i> UN3480, LITHIUM ION BATTERIES, 9	YES	YES

* These batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

** Marking, labelling, and packaging requirements for Lithium batteries vary depending on size and mode of transportation. Please refer to 49 CFR 173.185 for specific instructions for your shipping situation.





















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Battery Labeling Matrix

TYPE	PROPER SHIPPING NAME	LABELS	ADDITIONAL LABELS	ADDITIONAL LABELS
ALKALINE	BATTERIES, DRY, SEALED, N.O.S (ALKALINE)		---	---
NICKEL METAL HYDRIDE	<i>Vessel/Barge Shipment:</i> UN3496, BATTERIES, DRY, NICKEL METAL HYDRIDE, 9			---
NICKEL METAL HYDRIDE	<i>Truck/Air/Rail Shipment:</i> BATTERIES, DRY, SEALED, N.O.S (NICKEL METAL HYDRIDE)		---	---
NI-CAD (Dry)	BATTERIES, DRY, SEALED, N.O.S (NICKEL CADMIUM)		---	---
NI-CAD (Wet)	UN2795, BATTERIES, WET, FILLED WITH ALKALI, 8 (NICKEL CADMIUM)			---
LEAD ACID (Wet)	UN2794, BATTERIES, WET, FILLED WITH ACID, 8 (LEAD ACID)			---

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Battery Labeling Matrix

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LITHIUM	<i>Small Battery Exemption (Air):</i> UN3090, LITHIUM METAL BATTERIES, 9			 
LITHIUM	<i>Fully Regulated:</i> UN3090, LITHIUM METAL BATTERIES, 9			<i>If shipping by air</i> 
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Truck or Vessel):</i> UN3480, LITHIUM ION BATTERIES, 9			
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Air):</i> UN3480, LITHIUM ION BATTERIES, 9			 
LITHIUM ION (including Li-Poly)	<i>Fully Regulated:</i> UN3480, LITHIUM METAL BATTERIES, 9			<i>If shipping by air</i> 

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