

BATTERY SAFETY AND RECYCLING: BIOMEDICAL ENGINEERING

1. Purpose

- 1.1.1** The purpose of this document is to provide instructions to ensure Battery Safety for our staff and reduce the fire risk at our sites.
- 1.1.2** The purpose of this document is also to guide proper disposal and recycling of batteries to reduce the environmental impact medical devices have and avoid disposing of batteries in our landfills.

The goal of battery recycling is to reduce the number of batteries disposed in municipal solid waste landfills. Batteries are potentially hazardous if disposed of in the garbage, where they can cause fires and release harmful chemicals into our environment. Additionally, Health Organizations encourage battery recycling to minimize the contamination of the natural environment by the addition of heavy metals and other toxic chemicals from batteries.

Batteries should not be disposed as regular garbage. Instead, they should be sorted and stored in designated areas until sufficient quantities are collected for pick-up. Collection boxes are available at all Lower Mainland sites through a national program with Call2Recycle.

Defective, Damaged or Recalled (DDR) Lithium-based batteries pose a major safety and fire risk. DDR Lithium-based batteries need to be handled differently and cannot be collected, stored, and/or shipped in regular battery recycling containers.

2. Definitions

Acronym or Word	Definition
Collection Box	The Call2Recycle cardboard boxes used to collect recyclable batteries that are not Defective, Damaged or Recalled Lithium-based batteries.
DDR Batteries	<p>Defective, Damaged or Recalled batteries</p> <ul style="list-style-type: none"> Defective batteries: may not appear damaged – usually, a notification has been distributed advising there was a defect Damaged batteries: usually have visible or other damage – dents, swelling, hot, smell, smoking, etc. Recalled batteries: like defective batteries, may not appear damaged and have an alert or recall advisory from the vendor or ECRI <p>If an alert or recall has been sent out on a lot or model number, even if the batteries appear to be undamaged, they need to be treated as a DDR battery for safe disposal.</p>
DDR Recycling Kit	The Call2Recycle approved transport kit for DDR Lithium-based batteries (see Appendix A)
Lithium-based Batteries	Include Lithium (Primary – Single-use), Lithium-Ion, and Lithium-Polymer batteries.
Primary Batteries	<p>Include:</p> <ul style="list-style-type: none"> Alkaline: AA, AAA, 6V, 9V, C, D, button (coin) cell Lithium Primary (single-use)

Battery Safety and Recycling

SOP # ABCD-14-16-40010

Rechargeable Batteries	<p>Include:</p> <ul style="list-style-type: none"> • Nickel Cadmium (Ni-Cd) • Lithium-Ion (Li-Ion) • Lithium-Polymer (Li-Po) • Nickel Metal Hydride (Ni-MH) • Small Sealed Lead Acid (SSLA/Pb) • Nickel Zinc (Ni-Zn)
Single-Use Batteries	Same as Primary Batteries (see above)

3. Scope

3.1 Battery recycling instructions are laid out in the SOP in three (3) sections:

- Defective, Damaged or Recalled (DDR) batteries
- Recycling Rechargeable and Primary (Single-Use) Batteries with Call2Recycle (only BC vendor)
- Recycling Lead-Acid Batteries (over 5 kg) with Capital Salvage (other vendors available)

3.2 Batteries Included:

3.2.1 Batteries included in Call2Recycle Program:

- Rechargeable Batteries
- Primary (Single Use) Batteries

3.2.2 Batteries included in Capital Salvage Program:

- Lead-Acid Batteries more than 5 kg

3.3 Batteries Excluded from the recycling program:

- Lithium batteries weighing more than 5 kg
- Lithium-Ion rechargeable batteries over 300 watt-hours
- Lithium primary (single-use) batteries with over 25 grams of lithium content

4. Procedure Defective, Damaged or Recalled (DDR) batteries

4.1 Non-Lithium-based Defective, Damaged or Recalled (DDR) batteries are not a high fire risk and can be recycled in regular Call2Recycle Collection boxes.

4.2 Defective, Damaged or Recalled (DDR) Lithium-based batteries are a major fire risk.

Lithium-based batteries with signs of damage such as swelling, smoking, leaking, or overheating are a fire and safety hazard. These damaged batteries, including defective or recalled lithium-based batteries, need to be put in a cool, dry area in non-flammable absorbent material (sand or cat litter) immediately. **Do NOT** place Lithium-based DDR batteries in regular Call2Recycle Collection boxes.

Battery Safety and Recycling

SOP # ABCD-14-16-40010



Do NOT place damaged Lithium Ion or Lithium primary batteries in a collection box. Immediately put them in an absorbent, non-flammable material (sand or cat litter) in a cool, dry area.

4.3 Removal of Damaged Lithium-based Batteries from Devices

Removing and disposing of a swollen or damaged battery can be dangerous but leaving such a battery in the device can have serious consequences.

- a) Read all warnings carefully and proceed with caution. All batteries are hazardous waste and must be disposed of properly.
- b) If your device is extremely hot or smelling, **do NOT** attempt to remove the battery. Power the device down, place it in a well-ventilated area, and wait for the symptoms to dissipate before attempting to remove the battery.
- c) If you suspect your battery is swollen, **do NOT** charge the device.
- d) **Protect yourself.** Work in a well-ventilated area to help diffuse fumes. Wear eye protection (ideally, full goggles) and gloves to help safely remove a damaged battery.
- e) Prepare a fireproof container (see 4.5 Proper Disposal of DDR Lithium-based Batteries below) to contain any batteries that may begin to combust or leak.
- f) Work on a non-flammable surface. **Under no circumstances should water be used** (battery chemicals may react with water and cause a fire).
- g) Once the above precautions have been taken, you can start removing the battery. For the most part, you can follow your device's battery replacement guide. Take extra care to avoid damaging the battery during removal. If the battery is glued in place, it is recommended to start the removal process with a solvent like high-concentration isopropyl alcohol or acetone. Keep in mind that acetone may cause damage to plastic parts.
- h) **Only use plastic tools and avoid anything sharp enough to puncture the battery wrapping.** Puncturing the battery can lead to dangerous fires and the release of gases that may harm your health. If at any point the smell increases, the device begins to heat up, or any smoke appears, place the device outside or in a fireproof container and wait for the symptoms to dissipate before reattempting to remove the battery.
- i) **Do NOT** transport damaged batteries or devices with damaged batteries in your vehicle or with a regular courier.

Battery Safety and Recycling

SOP # ABCD-14-16-40010

4.4 Battery Fire

DDR Lithium-based batteries have the potential to catch fire and release irritating vapours or toxic fumes.

If a Lithium-based battery overheats, hisses, or bulges, immediately move the device away from flammable materials and place it in a well-ventilated area on a non-combustible surface. If possible, remove the battery and place it outdoors to burn out or in non-flammable material like sand or cat litter (see 4.5 Proper Disposal of DDR Lithium-based Batteries below). Simply disconnecting the battery from the charge **will not** stop the reaction.

According to the National Fire Protection Association (NFPA), fires have five classifications (Classes A, B, C, D, and K, see table below).

- Lithium-Ion and Lithium-Polymer battery fires can vary but are generally classified as Class B fires. A type ABC or BC fire extinguisher is effective against these type of fires. Lithium battery fires are also classified as a Class B, and a type D fire extinguisher can be used **only for Lithium battery fires**. **Do NOT** use a type D fire extinguisher for Lithium-Ion and Lithium-Polymer battery fires.

The table below describes the five fire classifications:

Class	Description
A	Fires in <u>ordinary combustible materials</u> , such as wood, cloth, paper, rubber, and many plastics.
B	Fires in <u>flammable liquids</u> , combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and <u>flammable gases</u> .
C	Fires that involve energized <u>electrical equipment</u>
D	Fires in combustible <u>metals</u> , such as magnesium, titanium, zirconium, sodium, lithium, and potassium.
K	Fires in cooking appliances that involve <u>combustible cooking media</u> (vegetable or animal oils and fats).

4.5 Proper Disposal of DDR Lithium-based Batteries

- If you are able to safely remove the DDR batteries safely from the devices, safely store the DDR batteries until you can package them in the DDR Recycling Kit for disposal. Follow these steps for **safe storage at your site**:
 - 1) Line a bucket with a plastic bag.
 - 2) Partially fill the bucket with sand or cat litter.
 - 3) Place each battery in a separate sealed zip-lock type bag and seal the bag.
 - 4) Place each bag in the bucket (multiple batteries can be placed in the bucket within reason).
 - 5) Cover the battery bags with sand or cat litter.
 - 6) Contact Call2Recycle to order a DDR Kit by email customerservice@call2recycle.ca

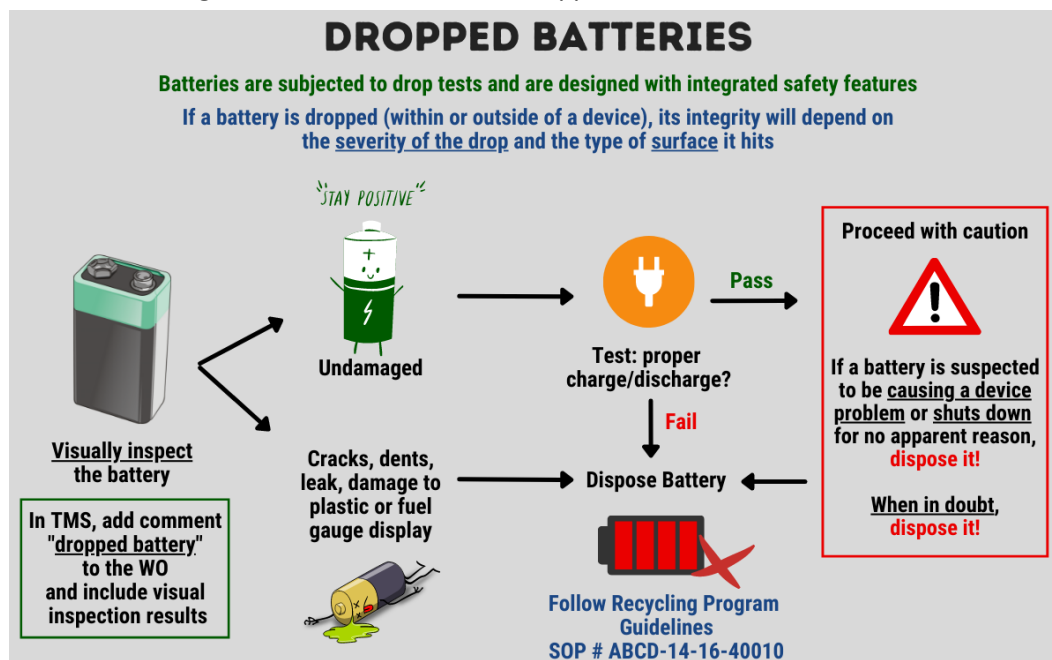
Battery Safety and Recycling

SOP # ABCD-14-16-40010

- 7) Provide them with your **site Account Number** from the LMBME Employee Resources SharePoint site.
 - 8) Provide them with **your contact info** and clearly state in the email the DDR kit should be addressed **to you** in the Biomed department.
 - 9) Provide the size of kit you require (1- or 5-gallon) based on the size and number of batteries you need to dispose of (multiple batteries can go in each kit). Customer Service can assist you with making this decision if you have questions (call **1.888.224.9764**).
 - 10) Once the DDR Recycling Kit arrives, move the battery bags into the DDR Recycling Kit and follow the detailed instructions on the DDR Guideline (**Appendix A**).
 - 11) Call Call2Recycle to schedule a pick-up of the DDR Recycling Kit **1.888.224.9764**.
- b) If you are **NOT** able to safely remove the battery from the device or if the battery has damaged the device, speak to your supervisor/manager or possibly the vendor to determine if the device needs to be retired.
 - c) Recalled and Defective batteries may *appear* undamaged. If there is a recall advisory on a battery, the battery must go in a DDR Recycling Kit for safe disposal.

4.6 Dropped Batteries and Devices

Batteries and devices have been drop-tested to meet industry safety standards. However, they can still be damaged upon being dropped. Any battery or device that is dropped requires a visual inspection and assessment. Follow the guidelines below to assess dropped batteries:



5. Procedure for Rechargeable and Primary (Single-Use) Battery Recycling

5.1 Recycling Rechargeable and Primary (Single-Use) Batteries with Call2Recycle

5.1.1 Accepted batteries:

**Call2Recycle accepts rechargeable batteries
each weighing less than 5kg**

Accepted Rechargeable Batteries



Nickel Cadmium (Ni-Cd)



Lithium Ion (Li-Ion)



Nickel Metal Hydride (Ni-MH)



Small Sealed Lead Acid (SSLA/Pb)



Nickel Zinc (Ni-Zn)

Accepted Primary (Single-Use) Batteries



Alkaline: AA, AAA, 6V,
9V, C, D, button cells



Lithium Primary

5.1.2 Call2Recycle will not accept these batteries:

- Batteries weighing more than 5 kg
- Wet cell batteries (composed of a liquid), such as car or boat batteries
- Lithium-Ion rechargeable batteries over 300 watt-hours
- Lithium primary (single-use) batteries with over 25 grams of lithium content
- Any batteries that do not fit in a Call2Recycle collection box

Battery Safety and Recycling

SOP # ABCD-14-16-40010

5.1.3 Battery Preparation and Handling

- a) Many batteries hold a residual charge even when they appear dead and/or completely discharged. When these batteries come into contact with other batteries or metal, a spark or heat can occur. Unprotected battery terminals can be dangerous. **For additional safety, the new versions of the Call2Recycle collections boxes now come lined with a fire-safe padding. This padding is NOT a substitute for bagging, it is an additional precaution.**





Transport Canada requires terminal protection in the form of bagging or taping for Lithium-based, Small Sealed Lead Acid, Button/Coin Cell, and Alkaline (over 12v) batteries (see diagram below).

When in doubt of the battery type, Call2Recycle recommends batteries be individually bagged or taped.

Minimum Terminal Protection Guidelines

SHIPPING IN CALL2RECYCLE BOXES

Below are the minimum requirements for preparing household batteries for shipment. When in doubt of the battery type, Call2Recycle® recommends the battery be individually bagged or taped.

BATTERY TYPE / CHEMISTRY	TERMINAL PROTECTION REQUIRED?	
 <p>Rechargeable Batteries Lithium Ion (Li-Ion) Small Sealed Lead Acid (SSLA/Pb)</p> <p>Primary Batteries Lithium Alkaline (over 12v) Button/Coin Cell</p>	<p>YES</p> <p>Terminal Protection IS REQUIRED</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Charge Up Safety!™ call2recycle.ca/safety</p> <p> Avoid the spark! Battery terminals that touch metal surfaces or other batteries can spark, causing a fire or explosion.</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; font-weight: bold;">Protect terminals before shipping How to Bag or Tape a Battery!</p> <div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>Place the battery into a clear plastic bag.</p> <ul style="list-style-type: none"> • Call2Recycle-provided bags • Produce bags • Newspaper bags • Ziploc® bags <p>! Clear bags only</p> </div> <div style="width: 45%;"> <p>If no bags are available, tape the positive (+) terminal with a non-conductive tape.</p> <ul style="list-style-type: none"> • Clear packing tape • Electrical tape • Duct tape <p>! No masking tape No Scotch® tape No painter's tape Do not cover chemistry label</p> </div> </div>  <p style="text-align: right;">(drop in the box)</p> </div>
 <p>Rechargeable Batteries Nickel Cadmium (Ni-Cd) Nickel Metal Hydride (Ni-MH) Nickel Zinc (Ni-Zn)</p> <p>Primary Batteries Alkaline (under 12v) Carbon Zinc</p>	<p>NO</p> <p>Terminal Protection NOT REQUIRED (drop in the box)</p>	

This material has been prepared solely for use at Fraser Health (FH), Providence Health Care (PHC), Provincial Health Services Authority (PHSA) and Vancouver Coastal Health (VCH). FH, PHC, PHSA and VCH accept no responsibility for use of this material by any person or organization not associated with FH, PHC, PHSA and VCH. A printed copy of this document may not reflect the current electronic version.

Battery Safety and Recycling

SOP # ABCD-14-16-40010

- b) Call2Recycle battery boxes come with clear sealable bags. If you run out of bags provided by Call2Recycle, below are a few other options for bags or you can tape the terminal of the batteries:



BEST OPTION
Clear bags provided by
Call2Recycle



Clear Ziploc® bags



Clear produce bags
(should be tied to seal)



Clear newspaper bags
(should be tied to seal)

You can use these types of tape (clear preferred):



Clear packing tape



Duct tape



Non-conductive
electrical tape

Only tape the terminals, DO NOT cover the entire battery or the chemistry type on battery label.

For Lithium Primary - AA, AAA, C & D batteries

Tape the positive (+) terminal (the one with the bump).



Other battery types

Tape the charging terminals.



Battery Safety and Recycling

SOP # ABCD-14-16-40010

c) For Button Batteries you can make a 'Ravioli'

1. Lay down a piece of CLEAR packing tape, sticky side up.
2. Place the button batteries on the tape *with space between each battery*.
3. Cover with a second layer of CLEAR tape.

CLEAR packing tape helps the sorter identify the battery type quickly.



d) Do NOT use any of the following to protect battery terminals:



Colored bags



Grocery bags



Paper bags



Paraffin or other dipping products



Painter's tape



Masking tape



Scotch tape

e) Lithium-based rechargeable and primary (single-use) batteries:

Lithium-based rechargeable and primary batteries are the most popular battery today

They are found in cellphones and other electronics.

They come in many shapes and sizes, are hard to identify and are very hazardous.



Always bag or tape **each** one!



Battery Safety and Recycling

SOP # ABCD-14-16-40010

f) Collection Boxes (Call2Recycle)

- All Lower Mainland (LM) sites have an account set up with Call2Recycle. Collection Departments vary across the LM. Instructions on storing and preparing the box for shipment are only applicable to sites where Biomed manages the account. Some sites might have accounts managed by FMO or Housekeeping. Site account codes, details, and contacts are available on the LMBME Employee Resources SharePoint site.

Call2Recycle accepts batteries returned in:

- Call2Recycle boxes
- Those pre-approved by Call2Recycle



Boxes must be stored in a cool, dry place and should be checked frequently.



g) Preparing a collection box for shipping

- 12) Visually inspect and remove all non-battery items from the collection box:

No paper! No plastic! No metal! No containers!



No paper



No metals, such as screws or paper clips



No extra items, such as light bulbs or other recyclables



No extra Call2Recycle plastic bags



No containers



- 13) **Do NOT** add padding to the box

- 14) Seal the box

- Release the header tabs and side flaps

This material has been prepared solely for use at Fraser Health (FH), Providence Health Care (PHC), Provincial Health Services Authority (PHSA) and Vancouver Coastal Health (VCH). FH, PHC, PHSA and VCH accept no responsibility for use of this material by any person or organization not associated with FH, PHC, PHSA and VCH. A printed copy of this document may not reflect the current electronic version.

Battery Safety and Recycling

SOP # ABCD-14-16-40010

- Remove backing from inside adhesive strips
 - Fold down while inserting side flaps
 - Cross tape the outside in a tic-tac-toe design
- 15) Ensure label is legible and **not** damaged
- 16) **Do NOT** add warning labels
- 17) **Do NOT** cover the text on the back of the box. The Canada/US Department of Transportation requires the text to be visible
- 18) Call the shipping company (likely Purolator, see label on the box) and provide them with the details on the box label to schedule a pick-up
- 19) A replacement collection box will be shipped to your site a few weeks after Call2Recycle process your return
- 20) If you need additional boxes or assistance, contact customer service at 1.888.224.9764. Alternatively, email customerservice@call2recycle.ca

6. Procedure for Lead-Acid Battery (Over 5 kg) Recycling

6.1 Recycling Lead-Acid Batteries (over 5 kg)





6.1.1 A vendor option for recycling Lead-Acid Batteries is Capital Salvage. They will pick up from any LM site. If your site already uses another vendor, or has a Facilities or Housekeeping process, continue with that process.

6.1.2 Lead Acid batteries can be picked up by Capital Salvage.

- The batteries should be on pallets, either single or double stacked and shrink-wrapped if possible.
- Store the used batteries until a full pallet is collected and contact Capital Salvage to schedule a pick up by phone 604-253-8481 or email recycle@capitalsalvage.ca.

7. Reference Documents

Site Posters and guidance documents:

Call2Recycle DDR Guideline	Call2Recycle Best Practices Safety Training	Dropped Batteries and Devices	Minimum Terminal Protection Guidelines
 DDR Guideline.pdf	 BestPracticesSafetyTraining_CanadaEng.pdf	 Dropped batteries (11 × 8.5 in print).pc	 Battery Protection Guide.pdf

- www.call2recycle.ca

Battery Safety and Recycling

SOP # ABCD-14-16-40010

- capitalsalvage.ca

Effective Date:	31-JAN-2022			
First Released:	31-JAN-2022			
Last Revised:				
Last Reviewed:				
Approved By:	LMBME Engineers and Directors			
Owners:	LMBME Directors			
Revision History:	Version	Date	Description/ Key Changes	Revised By
	1.0	31-JAN-2022	First Version	QI Leader

This material has been prepared solely for use at Fraser Health (FH), Providence Health Care (PHC), Provincial Health Services Authority (PHSA) and Vancouver Coastal Health (VCH). FH, PHC, PHSA and VCH accept no responsibility for use of this material by any person or organization not associated with FH, PHC, PHSA and VCH. A printed copy of this document may not reflect the current electronic version.

Battery Safety and Recycling

SOP # ABCD-14-16-40010

APPENDIX A DEFECTIVE, DAMAGED AND RECALLED (DDR) GUIDELINE



LARGE DAMAGED, DEFECTIVE OR RECALLED (DDR) LITHIUM BATTERY RECYCLING KIT

(08-8400HAZ-C2R, CLS379, UN 1A2/X9.3/S)


Leading the charge for recycling.™

Contents List



Overpack Box x1



Metal Drum x1



Metal Lid x1



Locking Ring Clamp x1



Bag of CellBlockEX x1



Drum Liner x1



Zip Bags x15



Strip of Tape x1



Zip Tie x1



Instructions x1

UNPACK & PREPARE

Step 1: Unpack the overpack box



Carefully open the battery return kit and contents. This box will be used to return your battery.

Step 2: Install liner & pour base layer



Place provided liner into drum and pour in at least a 1/2-inch deep bed of provided CellBlockEX.

Step 3: Bag battery or device



Bag and seal into the provided bag.

Step 4: Place bagged items into can/liner



Bury the bagged battery or device into CellBlockEX, making sure the item is **completely surrounded**.

Step 5: Fill drum



Pour the remaining CellBlockEX into drum/liner up to the drum rim. Discard any excess CellBlockEX.

SEAL & SHIP

Step 6: Seal bag



Pinch and twist the open end of the bag and secure with provided zip tie.

Step 7: Seal drum



IMPORTANT:
SEE BACK FOR
SPECIAL INSTRUCTIONS

Step 8: Pack box



Place sealed drum into overpack box and seal with provided tape.

Step 9: Secure & ship



Drop at your assigned carrier's local store* or call for pick-up.
*Designated on return label.

! One battery or device per bag.

! Use zip-style baggies for any additional batteries or devices.

! Total combined battery weight must not exceed 5 kgs (11 lbs.).

! Packages containing damaged or defective lithium batteries are forbidden from air transport.



For questions or assistance, contact customer service at 1.888.224.9764 or customerservice@call2recycle.ca

The performance certification of this package requires that it be filled, assembled, and used in full accordance with the instructions herein. The use of substitute components or packing methods, or failure to follow the supplied instructions may result in a package that is not compliant with this certification. Instructions valid

until revoked or superseded. This temporary certificate for transporting damaged, defective, or recalled lithium batteries is offered through the Call2Recycle® program, temporary certificate TU 0660. A copy of this temporary certificate is maintained at www.call2recycle.ca/certifications.



LARGE DDR KIT: PROPER DRUM SEALING GUIDELINES

(08-8400HAZ-C2R, CLS379, UN 1A2/X9.3/S)

Required items



Metal Drum x1



Metal Lid x1



Locking Ring Clamp x1

Step 1: Position lid



Place the metal lid onto the drum's rim with the black side facing up. Press down along the edge of the lid to ensure proper alignment.

Step 2: Open ring clamp



Before placing the ring clamp, it must be completely open revealing a gap in the ring beneath the leverlock as shown.

Step 3: Orient ring clamp



Orient the ring clamp so that the 'UP' arrows on the leverlock are pointing up.

Step 4: Place ring clamp



With the locking ring fully open, place it (arrow up) around the lip of the lid and release the leverlock from its fully open position.

Step 5: Lock ring clamp



Ensure that the locking ring is touching the entire edge of the lid and close the lever lock by pulling the lever to the closed position.

Step 6: Inspect



Inspect to ensure that the lid is evenly seated inside the ring clamp with no gaps, the lock is engaged and the ring is oriented properly.

**For questions or assistance, contact customer service at
 1.888.224.9764 or customerservice@call2recycle.ca**