WA Technology

E-Ray 12 Volt Lithium Ion Battery (revised 6/2025)

- ***When is a Charger Required? (My GUESS, Should be OK for ~4+ weeks)***
- ***Type of Charger Needed? (This Revised Doc Shows Why, IMO: Use Only the GM C8 Chargers sold from 2020 that are for Li-Ion & Lead Acid Batteries. Check Charger Instructions to Verify. NOT on Charger.)***

When Does E-Ray Lithium-Ion Battery Need Charging?

The first 2024 MY (Model Year) Owner's Manual was released in July 2023 had two confusing statements. One said if the EV battery was low, it needed to be plugged into a charger! Crazy, there is no plug/charger, NO WAY to do that!

The other stated if the car was "stored" for over a week either disconnect battery negative cable and E-Ray Controller Area Connecting Network (CAN) signal connecters or plug in a Maintenance Charger! Why after a week when Lithium-Ion batteries can be stored a longer time then Lead Acid batteries? Were the CAN connectors draining the battery? In the Jay Leno E-Ray video with Tadge Juechter (*Executive Chief Corvette Engineer at the time*) agreed with Jay that Lithium Ion 12-volt batteries can go longer than Lead Acid without a charger. When my E-Ray was delivered February 2024, the paper Owner's Manual had the *"after 1 week storage use charger statement."* Could not get a formal answer so contacted Tadge Juechter. (*The following Pic shows his email response*.)

Owner's Manual, Page 268: 12-volt Lithium-ion Battery(E-Ray)

When the vehicle is going to be stored for longer than one week a battery maintainer package can be used to keep the battery charged when the vehicle is not in use.

Not what Tadge Juechter said in the Jay Leno E-Ray video so when my E-Ray arrived February 28 contacted him! He wrote:

Hi Jerry,
Our Owner's Manuals are very conservatively written. E-Ray can stand for several weeks easily without a tender. Longer than that, I would put the tender on it. Li batteries are actually better than lead-acid for sit-time. I never bother disconnecting the terminal. Congrats on getting such an early VIN!
Tadge Juechter

GM corrected what were misstatements in all MY 2024 Owner's Manuals in the MY 2025 Owner's Manual (see Pic Below.) *No foolish mention of charging the EV battery* with an external device. AND *for Li-Ion 12 volt battery it now states "need a charger if stored for a long time!" No mention of "how long."*

2024 Owner's Manual

268 Vehicle Care

12-volt Lithium-ion Battery (E-Ray)

When the vehicle is going to be stored for longer than one week, the 12-volt lithium-ion battery negative and Controller Area Network (CAN) signal connectors should be disconnected to preserve the life of the 12-volt lithium-ion battery. Ensure the signal connector is facing downwards and shielded from direct water exposure to prevent corrosion while disconnected. A battery maintainer package can be used to keep the battery charged when the vehicle is not in use.

2025 Owner's Manual

280 Vehicle Care

12-Volt Lithium-Ion Battery (E-Ray)

Use the Battery Voltage info tile to determine if your battery is low and needs to be charged. See *Instrument Cluster* ⇨ *81* under the "Info Tiles" section for more information.

GM recommends charging your 12-volt lithium-ion battery when storing your vehicle for long periods of time. See "Vehicle Storage" later on in this section.

From Page 282 Storage

When storing the vehicle on a long-term basis:

- Attach a compatible battery tender or trickle charger to the 12-volt lithium-ion battery.
- Keep the remote key more than 3 m (10 ft) away from the vehicle.

The 2025 Owner's Manual eliminated the reference to "stored over a week." Also searched and no mention of "Controller Area Network (CAN) or removing the cables (wherever they were!) LOL

Issue Resolved! ***Well, no time suggested but "Long" not the previous "Week!"***

Considering: ***1) Tadge's Statement; 2) Since we do not know the E-Ray Parasitic Current Draw: My Best GUESS is install a Charger before sitting ~4 Weeks.***

Next Issue: *Type of Charger Needed:*

GM Specifies and Sells the Same CTEK Sourced Maintenance Charger for All C8s. MY 2025 GM Charger Instructions State, for Li-Ion and Lead Acid Batteries.

I bought the GM MY 2025 Charger, part # 85530676 from GM Parts Source ShopChevyParts.com for $127 + shipping (MSRP = $175.) ***Details of my tests follow in a Pic/Caption Format. You can scan and read what is important to you.***

BTW, I bought the GM Spec'd Li-Ion/Lead Acid charger when I decided to use my 10-year-old CTEK (*seldom used*) charger when the 2nd Schumacher charger in 23 years being used on my Street Rod 24/7 failed. Initially thought it might work for the E-Ray IF the Li-Ion battery got below 13 volts. Recent GM Doc clearly says NOT!

Fastened, the charger to the wall and routed the wires thru a split hollow tube that is ~5 feet high so I can duck under when needed!

Can A Conventional Lead Acid Battery Be Used?

My first thoughts were perhaps, as some Li-Ion battery manufacturers indicate they can work but will not charge to as high a voltage. BUT "New" GM Info, says NOPE! See GM Tech Link in Appendix, TIP page 17, repeated below:

TIP: Older unapproved battery maintainers may not provide current as the 12V LiB is normally sitting at 13.3V, and older chargers will not output any current when the voltage appears to be at a fully charged level. As a result, the 12V LiB will drain and the contactors will open during programming when an older legacy battery maintainer is connected.

Note all GM Maintenance Chargers sold from 2020 for C8s are for Li-ion & Lead Acid batteries, as they are labeled in the Instructions BUT NOT on the Charger.

I drive my E-Ray at least several times a week and usually a 50/60-mile round trip to town. The alternator has more than enough time to charge to the level GM defines as Maximum. I typically measure 13.3 volts about 85 to 90% capacity. If the car sits for ~4 days the dash gauge reads fully charged 13.3 Volts in ~5 miles.

My E-Ray Li-Ion Battery Charging History:

- **My E-Ray was built February 7th, 2024**
- **Sat on QC Hold with ~100 others (*GM's QA Method To Check For Possible Manufacturing issues that might require modified tooling or additional operator training at some assembly stations etc.)***
- **Left BG on February 27**
- **At My Dealer Late February 28**

So, the battery was sitting for a minimum 20 days after install in BG and sometime before it was installed in the E-Ray. Thought I should use a charger when I got it home. It wasn't clear if my old equivalent to GM CTEK built charger would work. I bought that ~10 year old, Model 3300 CTEK charger in 2013 for my C7. Plugged into my E-Ray after measuring the battery voltage at 13.28 volts. It indicated Fully Charged in seconds. Tried one other time with the same result. I and some others who have posted on Forums *INCORRECTLY* thought the old Vette chargers might work. Since the E-Ray alternator charges the Li-Ion 12-volt battery to 13.3 volts when I plugged my 2014 CTEK Charger, similar to what GM sold that year, it instantly showed filly charge. Yep since 100% charger on a Lead Acid battery is ~12.9 volts, logical. MISTAKENLY thought IF the Li-Ion battery dropped to ~12.9 volts it would start charging. BUT as the TechLink Tip says, *"Nope, battery internal contactors will OPEN when the old charger is connected."*

Apparently from having driven my E-Ray home ~50 miles from the dealer the E-Ray alternator had fully charged the Li-Ion battery to the voltage/capacity GM desired! The LT2 alternator charges the battery to ~13.3 Volts,. That is above the voltage that would cause my Model 3300 lead acid battery charger, seeing 13.3 volts when it was connected and lit the fully charged LED.

Should A CTEK (or Other Brand) Dedicated Lithium-Ion Battery Charger Be Used?

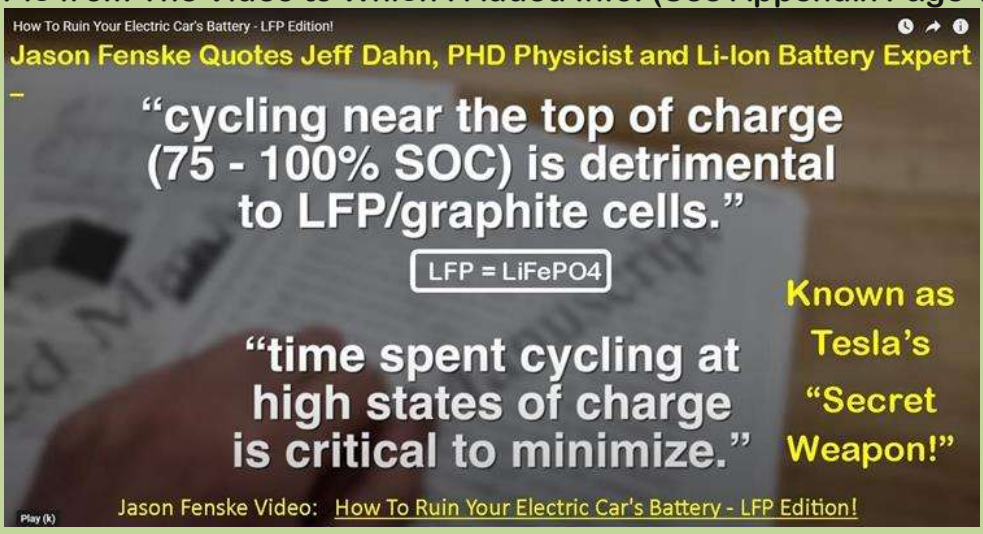
This was posted on a forum as received from CTEK to the question:
Lithium-ion is a general term used for many types of lithium batteries including Li-FePO4, Li-Fe, Li-iron and LFP type batteries our Lithium Charger, will work fine on your ERay 12V lithium battery. It has 8 Step Cycles

1 STEP- ACCEPT Tests if the battery can accept charge. This step prevents charging from proceeding on a defective battery.
2 STEP -BULK Charging with maximum current until about 90% battery capacity.
3 STEP -ABSORPTION Charging with declining current up to 95% battery capacity.
4 STEP -ANALYZE Tests if the battery can hold charge. Batteries that cannot hold charge may need to be replaced.
5 STEP -COMPLETION Final charge with reduced current up to approximately 98% battery capacity.
6 STEP -MAXIMIZATION Final charge with maximum voltage up to 100% battery capacity. (My Note: Does GM want the battery charged to this higher voltage? Also, will the Li-Ion Battery Management Control, BMC, allow the battery to be charged at the higher level?)
7 STEP -FLOAT Maintaining the battery voltage at maximum level by providing a constant voltage charge.
8 STEP -PULSE Maintaining the battery at 95–100% capacity. The charger monitors the battery voltage and gives a pulse when necessary to keep the battery fully charged.

CTEK Added*: Another option is our client-branded Corvette charger that is both 12V lead-acid and lithium compatible (Lithium-ion (Li-FePO4, Li-Fe, Li-iron, LFP type). For more information on the GM Corvette charger please contact your local dealership*

There is some additional Technical Information that Cautions charging to 100% other than perhaps once a month! It is discussed in detail in a video by Jason Fenske (Engineering Explained.) An expert in mechanical car issues and ICEs, Jason is gaining an understanding of EV's and the technical questions centered around their batteries. He notes he has read many tech papers on the subject.

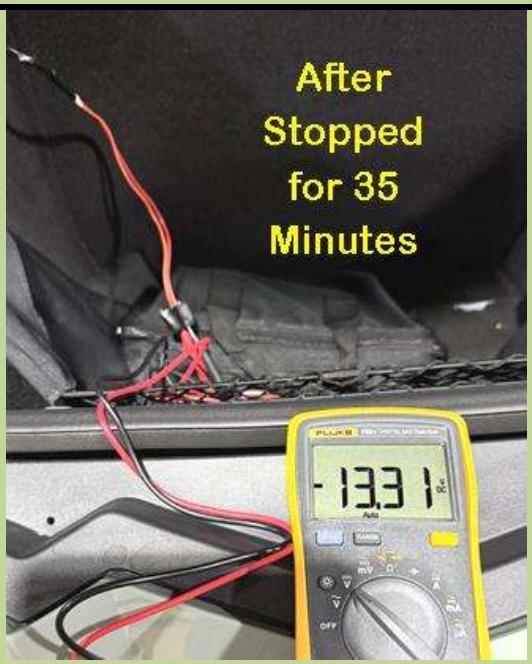
This is one of his several Video's, this one related to LiFePO4 batteries:
https://www.youtube.com/watch?v=w1zKfIQUQ-s&t=1s
This is a Pic from The Video to Which I Added Info: (See Appendix Page 14)



PIC/Caption Test Info

Before I installed the GM Spec'd and Sold E-Ray *(and all C8*) Charger, I made a battery voltage measurement. *(Read same voltage as when I brought my E-Ray home ~50 miles from the Dealer*.) **I had just finished a ~50-mile roundtrip drive to town. The LT2 alternator charges the battery when engine is running.**

For fun, checked after I stopped before ~2 minutes as there is a higher parasitic current draw until the *"battery saver circuits"* fully activate. The Frunk light goes off in less than 10 minutes but some other circuits may still be active up to ~20/30 minutes. Note the Frunk light is lite in this Pic.



Waited 35 minutes for Battery Saver Circuits to lower parasitic current draw to its lowest level. Not sure what that level is for the E-Ray but Andybump measured >10 milliamps after ~15 minutes for his C8. That is very low, equivalent to a 0.12-Watt Bulb!

So, with whatever parasitic current was flowing at 2 minute, it caused the battery voltage to be 0.03 volts lower that with the lowest parasitic current draw at 35 minutes. Therefore, the base starting voltage would be ~13.3 *IF the charger was installed at that time.*

But after 1 hr 15 minutes Charger had not lit the 100% charge LED and I did not have the time to wait.

Was out of town for a week and prior to leaving, as mentioned above, had no time to wait for the max charge LED light. So, when I returned home I 1st measured the battery voltage. It was 13.27 Volts. So, in that week, battery voltage reduced from ~13.31 to 13.27. Therefore, the battery voltage dropped 0.04 volts.

I then plugged in the Charger.

Note: Instructions state Li-Ion & Lead Acid batteries on Cover and in Tech Specs. BUT NOT on Charger! Too many languages with other "stuff!"

After installing the GM MY 2025 charger, within seconds it showed what the instructions say is 80% charged LED. Looking at the capacity versus voltage table for LiFePO4 battery in the appendix. The measured 13.27 volts is about 80% capacity.

But as some Internet info suggests, charge significantly slows when past 80%. It took ~4 hrs to reach what the instructions label 100% charge LED.

About 30 minutes after the charger reached 100% and was removed the parasitic current draw at a low level. The Battery Voltage was 13.36. That is significantly below the ~14.4 volts some Li-Ion batteries can be charged. The Capacity versus Voltage table in the appendix shows it could be called ~99% but that is before the voltage/capacity curve takes a sharp turn upward. It shows max voltage at 100% capacity can be 14.4 volts.

An internet discussion re measuring Li-Ion battery voltages states, quoting:

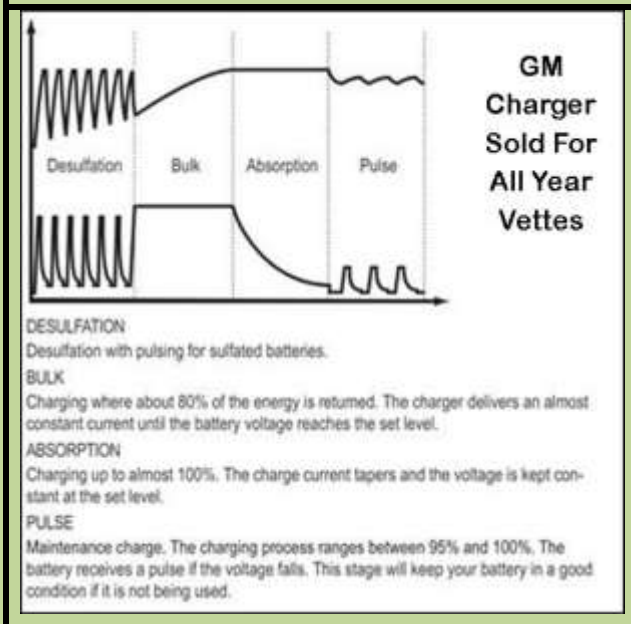
"Voltage: ***The higher the battery voltage, the fuller the battery is. In order to get accurate results, you must keep the battery at rest for at least four hours before measuring. Some manufacturers even recommend around 24 hours of rest."***

So, after 24 hours from being charged to 100% with the GM Spec'd Charger it shows13.3 volts. That is the same voltage where the LT2 alternator charges the battery! Using the table in the appendix that is ~90% capacity.

What About Using and Older Model CTEK Charger? New GM Info, See page 17 states Nope:

GM Doc TIP: Older unapproved battery maintainers would not provide current as the fully charged 12V LiB is normally sitting at 13.3V, and older chargers will not output any current when the voltage appears to be at a fully charged level. As a result, the 12V LiB will drain and the contactors will open during programming when an older legacy battery maintainer connected.

Note: I thought (*as did others*) when the Li-Ion battery got to ~13 volts the old charge would work! GM Says NOT-- ***The Internal Contactors Will Open if battery volts are low!***



Another Concern: Li-Ion chargers should NOT HAVE a Desulphation cycle. Found, CTEK method of operation prevents Desulphation cycle being used (full details in appendix.)

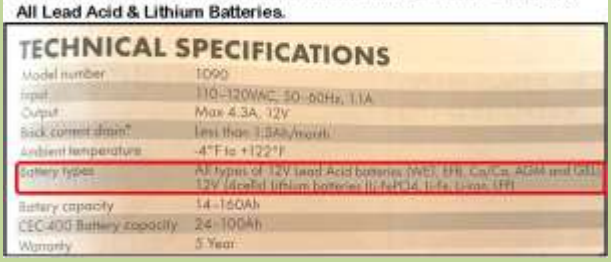
- ***CTEK Desulphation is accomplished if needed by sensing if the lead acid battery is sulfated by measuring the internal resistance.***
- ***A sulphated lead acid battery has a high internal resistance;***
- ***A Li-ion battery has low resistance***
- ***The Desulphation Cycle is bypassed if not need.***

No Diagram of C8 Charger Cycles. Too Many Languages, no room! So Asked Google about Desulfation Cycle

Google AI Said: "*Yes, the C8 battery charger, designed for both lithium-ion and lead-acid batteries, typically includes a Desulfating cycle for lead-acid batteries. This feature helps to remove sulfation, a process where sulfate crystals can build up on the battery plates, hindering the battery's ability to store and release energy.***"**

No assurance that Google AI is right! BUT combined with what CTEK says how their Chargers evaluate (above) when to use the Desulfation Cycle, it probably does. But doesn't activate when connected to a Li-Ion battery.

Forum Member Andybump's 2021 Corvette Charger ALSO States For: All Lead Acid & Lithium Batteries.



The highlighted area states All Types of Lead Acid and Lithium Batteries. As AndyBump notes even though there was no E-Ray in 2021. GM knew it was coming and specified that requirement to CTEK!

In addition, Member Andybump's 2021 Corvette Logo Charger states it is for Li-Ion and Lead Acid batteries.

My 2013 CTEK Model 3300 equivalent to the Corvette Logo charger states it's for Lead Acid batteries. Because my E-Ray battery was at the alternator set 13.3 volts it showed Green Charged enough in seconds. GM states IF the Li-Ion battery voltage is TOO LOW (*no value given)* when an older CTEK Lead Acid only battery charger is connected the internal Li-Ion connectors would open and could not be charged!

Bottom Line: Is an Older GM CTEK Charger Acceptable? NO!

In latest Li-Ion Doc r.e. E-Ray Battery says NO. Thought my older 2013 Model 3300 CTEK charger could be satisfactory. *NOT*, See page 17.

It appears if battery gets to around 13 volts where I thought an old charger might work, it will open the internal contactors and it will not be able to charge! All Li-Ion batteries have such contactors and Battery Management Control to "protect" the battery.

CTEK 56-926
Lithium with 12 volt
Plug for Frunk
Receptacle

QUESTIONABLE IMO

Is the CTEK (Or Other) Dedicated Li-Ion Charger Acceptable to Use?

No guidance from GM who may just say we don't test all chargers.

It may OK even if it charges to 14.0 volts, although long use at that higher voltage may reduce battery life. That is an issue for Hybrid and EV batteries but the 12 volt battery is relatively low cost to replace in the E-Ray compared to an EV battery even if the life is reduced.

BUT WHY TAKE A CHANCE? GM CHARGER DESIGNED WITH BATTERY MANUFACTURER, WORKS JUST FINE!

SIDEBAR

Another Issue For Those Who Hae Not Accessed The Battery:

How To Remove The Plastic Frunk Covers

I removed the three plastic covers on my 2020 C8 a number of times. But when looking for any information printed on the E-Ray Lithium Ion battery, such as is it a LiFePO4 type, I removed the Frunk Plastic covers.

When putting the rear panel back, one of the two Yellow Plastic fasteners that hold the front of the rear, panel came out of its holding slot. It fell into an opening down to the bottom and may still be sitting on an aero panel. I tried braking hard to see if I could have, by inertia, it moved and fall thru a side opening. No luck. So bought a new one.

The following is a pic sequence of removing the Frunk Plastic Covers. With "Cautions" and how to assure you won't lose a Yellow Plastic Panel Fastener!

The Frunk has 3 Plastic Covers that must be removed to access the battery as well as the Lift Reservoir. The two side plastic covers must be removed 1st. Then the rear panel covering the battery, lift reservoir fill cap etc. can be removed.

With my 2020 C8 was able to remove the plastic covers with my hands, which IMO was saver. But for the E-Ray, need plastic Trim Tools to leverage the clips that hold the sides off.

You must be careful and ONLY leverage in the correct direction.

Note in Pic is the purchased yellow plastic clip that fell out of its holder and may still be sitting on a lower aero panel! LOL

The key point in removing the side panels is they DO NOT clip to the bottom. They must move toward the center of the car, as noted with arrows. The metal clips are tight. Best to start in the front and using two trim tools work backward.

Be careful as you move back as there is a thin section, don't break!

One clip is behind the hood hinge. You can remove it with your fingers.

The thin sections of the sides will bend but be careful when removing, don't break.

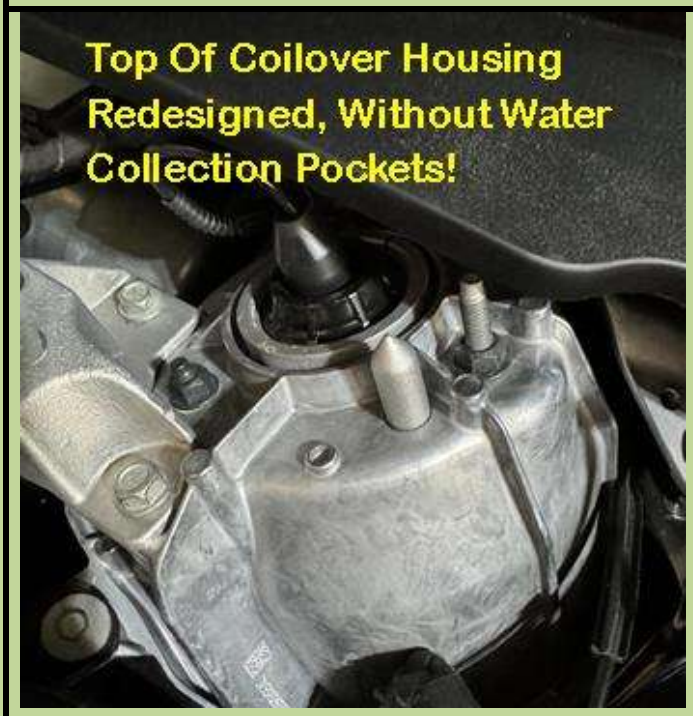
When reinstalling, start from the front and note the upper part fits under the sheet metal. Can pull up and pull into the fender with your fingers.

This is the underside of the rear panel. As noted, there are two yellow plastic fasteners that hold the front in hole in a lower panel. These clips are pulled out first. Best done using your fingers under the rear panel front sides.

This is the Lithium Battery. All I found were GM numbers. Perhaps some info is under the metal battery holder but did not bother to remove it.

When reinstalling the rear panel, insert the rear clips first. Have to hold it at a ~45-degree angle to slip it under the metal lip.

After the rear clips are in their respective slots BEFORE to press down the front two side where the Yellow Clips are located, BE SURE THE POINTED TIPS are in the holes where they fit. Once both tips are in, press down to fasten.



Of side interest. My 2020 C8 had pockets that could hold water around the upper coilover bolts that could cause rust. I installed aftermarket "Tower Covers."
The E-Ray design is different. There are no pockets and any water that enters from the windshield wiper area will just drain below.

Bottom Line

IMO safest to use what GM has defined, no doubt with the Li-Ion battery manufacturer, that is also compatible with the Battery Management Control (BMC.) Like all Li-Ion batteries it has A BMC that controls things like charging rates, Min and Max voltages, balancing cells etc. Some are part of the car, There are no visible BMC controls visible on the battery as some that are sold where you can adjust charging parameters. With the E-Ray Li-Ion battery and GM sold charger those parameters are fixed.

APPENDIX

Lithium-Ion Battery info:

LiFe04 Voltage to SOC at rest

SOC; State of Charge

Voltage	Capacity
14.4V	100%
13.6V	100%
13.4V	99%
13.3V	90%
13.2V	70%
13.1V	40%
13.0V	30%
12.9V	20%
12.8V	17%
12.5V	14%
12.0v	9%
10.0v	0%

This is a Chart Showing lithium battery capacity versus voltage. It is a very flat curve except at the high and low extremes. So, the typical voltage reading I have made showing from 13.2 to 13.3 volts means the battery was between 70 to 90% charged.

Since it is such a flat voltage/capacity curve, judging capacity by voltage measurement is not the best method but gives an indication. It also has significant implications if charging with a CTEK designed for lead acid batteries like my ~10-year-old Model 3300 and probably older GM chargers designed for lead acid batteries. They typically charge to about 12.9 volts. Although that would be sufficient to start the car and the alternator could charge to the battery, GM Doc page 17 says NOPE, Contactors would open!

Other Internet Info RE Li-Ion Batteries

These are the questions I asked and Google answered:

My Question: When does a CTEK Charger start the Desulphation Cycle?
Google Answer: *Desulfation is accomplished at the very first stage of charging if it is needed with a CTEK charger. If it is not needed it bypasses this stage of charging. It senses if the battery is sulfated by measuring the internal resistance of the battery."*

My Question: Does a sulfated battery have a high internal resistance?
Google Answer: *Yes, a sulfated lead acid battery has a high internal resistance; when a lead acid battery becomes sulfated, the sulfate crystals that form on the plates create a non-conductive barrier, significantly increasing the battery's internal resistance and hindering its ability to deliver current effectively.*

My Question: Does a Li-Ion Have the same internal resistance as a lead acid battery
Google Answer: No, a lithium-ion battery typically has a significantly lower internal resistance compared to a lead-acid battery; meaning a Li-ion battery offers less resistance to current flow, allowing for faster charging and discharge rates with less energy loss as heat.

Bottom Line: **We don't know why GM may NOT WANT that higher Li-Ion battery charger voltage. Perhaps it is a reason I searched and found it provides for better battery life. In addition Li-Ion battery manufacturers who are NOT PUSHING their own chargers state similar to this Quote:**

NOTE:** This generic Li-Ion charger statement shows they can charge from 14.4 to 14.8 volts. The GM Tech Link re the E-Ray battery states: **TIP: The 12 V LiB may be damaged if charged to more than 14.5 volts. This is some additional info from that GM TechLink:

The 12V lithium-ion battery is charged by the K1 14V Power Module while the vehicle is operating in the EV modes (Stealth and Shuttle modes). Once the vehicle exits an EV mode and the engine is powering the vehicle, the generator (LT2 alternator) takes over 12V LiB charging.

The 12V LiB has an internal set of contactors that will open if voltage, current or temperature reach a critical state. Contactor self-tests run every time the vehicle is powered down and, once the self-tests begin, are completed within 5 seconds. It may be possible to hear the contactors opening and closing. The battery communicates via CAN to the K9 Body Control Module (BCM) to provide status and DTCs.

The TechLink also notes it has circuits to protect the battery:

***Voltage** – In an over-voltage condition, the relay will open in any cell that exceeds 4.0 volts, which can be expected when the battery is charged above 15 volts. The relay will close once voltage is below 15 volts.*

***Under Voltage** – In an under-voltage condition, the relay will open if any cell drops below 2.5 volts, which may occur when the battery is discharged below 11 volts. The relay can be closed under normal conditions by charging the battery using the EL-52800 E-XTEQ Diagnostic Charge Battery Station (DCBS) or an approved charger in power supply mode.*

***Severe Discharge** – If the battery is severely discharged — any cell drops to 1.5 volts — it will set a critical low voltage and end of life fault and the relay will not close again*

***Over Current** – If there is an over-current condition, such as an external short circuit, the relay will open if current exceeds 2,000 amps. The relay can be closed under normal conditions by charging the battery using an approved charger in power supply mode.*

***Over Temperature** – The relay will open if there is an over-temperature condition where the internal temperature exceeds 185°F (85°C). The relay will close once the temperature drops below 176°F (80°C).*

Here are some Internet comments about charging a Li Ion car battery to 80 to 85% versus 100%

> Charging a lithium-ion (Li-ion) car battery to 80–85% instead of 100% can help - improve the battery's long-term health and efficiency:

> Battery degradation: Charging a Li-ion battery to 100% regularly can cause it to degrade faster. This is because the high voltage needed to maintain a full charge can stress the battery's chemistry.

> Charging rates: Charging rates slow down significantly after 80%.

>Battery efficiency: Li-ion batteries are most efficient when operating between 20–80%.

>While it's safe to charge to 100% when needed, like for a long journey, it's best to avoid doing so regularly.

The Above General Statements are Supported by Extensive Testing Summarized by Jason Fenske in This Video:

https://www.youtube.com/watch?v=w1zKfIQUQ-s&t=1s

For EVs it suggested charging to 100% about once/month. That recalibrates the method used to define and display capacity or battery miles left to drive. Important for HEV's and very important for EVs. As noted, the flat volts versus battery capacity curve makes defining an accurate battery capacity with voltage measurement difficult . Jason says to get accurate values, they count elections coming in from charging and out .

However, over time that measurement becomes inaccurate. Assume they are measuring and counting amps in and out. So, it needs to be recalibrated and the high voltage at the curve end clearly defines 100%. But for the same amount of battery energy storage, it takes more energy and is harder on the battery to say charge from 75 to 100% than from say 0 to 25%. Same amount of energy storage but it requires more effort. Jason equates that to filling an empty parking lot from 0 to 25% where there are many open spaces compared to 75 to 100% where it takes effort to find empty spaces.

Frankly my interest is more for our PHEV BMW SUV and to some degree the E-Ray EV battery than the 12 Volt Li-Ion battery. But thought some might be interested. Yep, will have to switch from a gearhead to one filled with electrons! LOL

This is a GM Tech Link with Li-Ion Checking Details and Info

About the Corvette E-Ray 12-Volt Lithium-Ion Battery

April 30, 2024 Updated October 3, 2024 – By: Lane Rezek and Brett Holsworth

The 2024 Corvette E-Ray uses two lithium-ion batteries — one for high-voltage functions with the front electric axle and one for low-voltage operations that replaces the traditional lead-acid 12V battery. (Fig. 8)

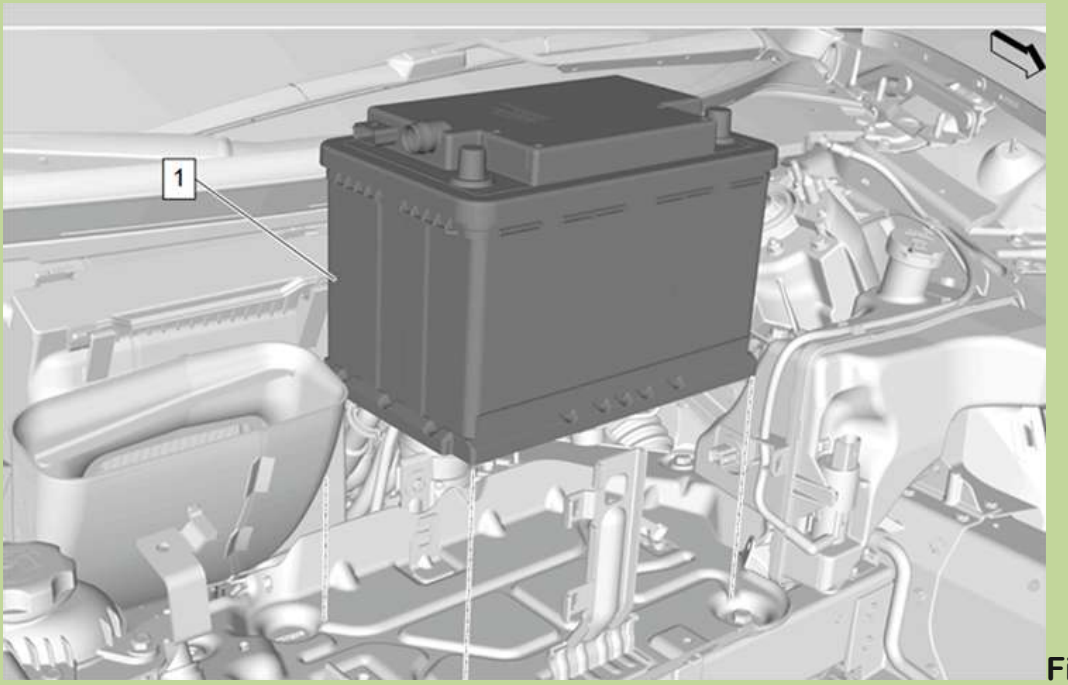


Fig. 8

While other Corvette models have 12V flooded lead-acid batteries, the 12V lithium-ion battery in the E-Ray, also known as the 12V LiB, enables the 6.2L V8 (RPO LT2) to perform a flying start when exiting Stealth mode while driving.

The 12V lithium-ion battery is charged by the K1 14V Power Module while the vehicle is operating in the EV modes (Stealth and Shuttle modes). Once the vehicle exits an EV mode and the engine is powering the vehicle, the generator takes over 12V LiB charging. (Note: I inserted Pic of 300 V DC to 12 V DC converter.)

Battery Contactors

The 12V LiB has an internal set of contactors that will open if voltage, current or temperature reach a critical state. The voltage curve is not the same as a lead-acid (PbA) 12V battery.

Contactor self-tests run every time the vehicle is powered down and, once the self-tests begin, are completed within 5 seconds. It may be possible to hear the contactors opening and closing. The battery communicates via CAN to the K9 Body Control Module (BCM) to provide status and DTCs. 12V battery voltage is displayed on the instrument cluster. (Fig. 9) GDS2 can be used to read scan tool information directly from the 12V LiB under the K244 Battery Management Control Module.

Fig. 9

Over Voltage – In an over-voltage condition, the relay will open in any cell that exceeds 4.0 volts, which can be expected when the battery is charged above 15 volts. The relay will close once voltage is below 15 volts.

Under Voltage – In an under-voltage condition, the relay will open if any cell drops below 2.5 volts, which may occur when the battery is discharged below 11 volts. The relay can be closed under normal conditions by charging the battery using the EL-52800 E-XTEQ Diagnostic Charge Battery Station (DCBS) or an approved charger in power supply mode.

Severe Discharge – If the battery is severely discharged — any cell drops to 1.5 volts — it will set a critical low voltage and end of life fault and the relay will not close again.

Over Current – If there is an over-current condition, such as an external short circuit, the relay will open if current exceeds 2,000 amps. The relay can be closed under normal conditions by charging the battery using an approved charger in power supply mode.

Over Temperature – The relay will open if there is an over-temperature condition where the internal temperature exceeds 185°F (85°C). The relay will close once the temperature drops below 176°F (80°C).

The lithium-ion battery will not decay like a lead-acid battery. The battery health will fall off sharply; it will never provide a slow crank. The contactors inside the battery provide protection to the battery and, if the battery fails, it may be due to the contactors not allowing power to the posts, resulting in the battery to appear to be completely dead.

The 12V LiB also has an internal control module (K244 Battery Management Control Module), which can be programmed with SPS and has data available to view in GDS2. The K244 Battery Management Control Module should not be confused with the K16 Battery Energy Control Module, which is strictly for the high-voltage battery.

SPS Programming

Stable battery voltage is critical during programming. Any fluctuation, spiking, over voltage or loss of voltage will interrupt programming. Install an approved battery maintainer or power supply that provides a steady and stable voltage to support the 12V system during SPS programming events.

TIP: Older unapproved battery maintainers may not provide current as the 12V LiB is normally sitting at 13.3V, and older chargers will not output any current when the voltage appears to be at a fully charged level. As a result, the 12V LiB will drain and the contactors will open during programming when an older legacy battery maintainer is connected.

The following tools are approved to provide a steady power supply while performing programming on the E-Ray. Older tools or unapproved tools, which may not keep current flow at a proper level during programming, should NOT be used.

MTRMSP0702GM – Midtronics MSP-070 Power Supply Charger with 2-Meter Charge Cable

MTRMSP0703GM – Midtronics MSP-070 Power Supply Charger with 3-Meter Charge Cable

MTRMSP0705GM – Midtronics MSP-070 Power Supply Charger with 5-Meter Charge Cable

XTQEZ0179B – E-XTEQ 512EVO Battery Charger/Maintainer

XTQEZ0179BX2 – E-XTEQ 512EVO Battery Charger/Maintainer (Quantity: 2)

XTQEZ0179BX3 – E-XTEQ 512EVO Battery Charger/Maintainer (Quantity: 3)

XTQEXBC1012-001-G – E-XTEQ BC1012 12V/100A Diagnostic Charger/Maintainer

XTQEXBC1012-001-GX2 – E-XTEQ BC1012 12V/100A Diagnostic Charger/Maintainer (Quantity: 2)

ESS6100 – Associated Equipment 100A Reflash Power Supply Charger

IBC6008MSK – Associated Equipment 70A Intellamatic Smart Charger/Analyzer

IBC6008 – Associated Equipment 70A Intellamatic Smart Battery Charger with Power Supply

ESS6008MSK – Associated Equipment 70A Intellamatic Smart Wheel Charger

ESS6008 – Associated Equipment 70A Charger with Power Supply

Battery Testing and Charging

Currently, GM does not offer an external testing method for the 12V lithium-ion battery. Do not use the EL-52800 E-XTEQ Diagnostic Charge Battery Station (DCBS) or EL-50313 Midtronics GR8 Battery Tester/Charger to perform a load test. However, these tools may be used to charge the 12V LiB. Be sure to use the proper settings on both tools to charge the 12V LiB.

Use the scan tool — Battery Management Control Module – Battery State of Charge to determine the battery's state of charge.

TIP: The 12 V LiB may be damaged if charged to more than 14.5 volts.

When using the DCBS, select “Charging,” “manual battery selection”, and then “Lithium” when setting up the charger. If the contactors are open, the tool will automatically detect no power and ask for confirmation. Once confirmed, the DCBS will energize the battery to close the contactors.

Refer to Bulletin #23-NA-055 for additional information and FAQs regarding using the DCBS.

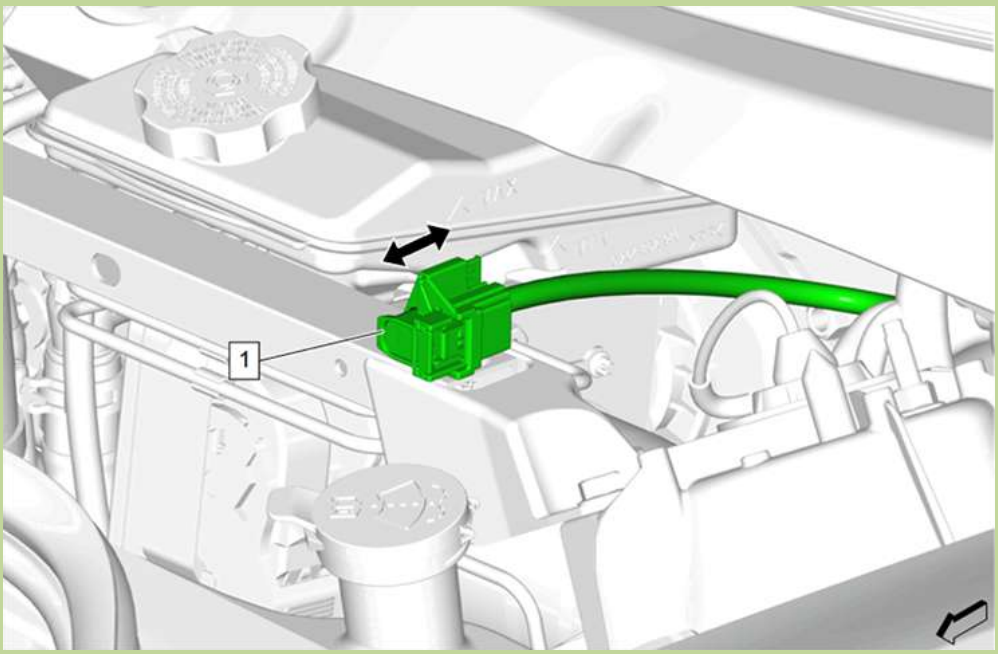
When using the GR8, select “Charging,” “PDI”, and “In Vehicle” when setting up the charger. If the contactors are open, select “power supply mode,” set the max voltage to 14.5V and allow the battery to charge for several minutes before going to a normal charge mode.

Battery Replacement

If the 12V lithium-ion battery requires replacement, the vehicle will set DTCs in accordance with emissions regulations. The DTCs should be recorded on the warranty claim.

TIP: Since the 12V LiB is connected to the high-voltage system, the High-Voltage Service Lockout (HVSL) must be engaged before disconnecting the battery negative cable when replacing the battery. (Fig. 10) Engage the HVSL by lifting the red Connector Position Assurance tab and then, while depressing the connector tab, pull apart the connector halves until the indicator tab wording changes from ON to OFF. Place a tie strap or a high-voltage disable padlock through the exposed HVSL hole to prevent improper re-engagement.

Fig 10



The 12V LiB should be ordered as a regular service part through EPIC, but there will be a unique return process to be announced soon. Do not send a faulty 12V LiB to your local 12-volt battery recycler, as it is considered hazardous material and must not be mixed with other 12V batteries.

The 12V lithium-ion battery will have two new unique labor codes for warranty. If the traditional labor code for 12V batteries is submitted, the claim will be rejected. The new codes, as of April 1, 2024, are 4041430 – Battery Module Replacement and 404143E – Battery Module Replacement – Emissions. These codes do not require a printed test slip since an external test is not possible.

The appropriate Service Information diagnostics should be followed if an emissions-related fault is the cause of a battery failure. When the 12V LiB reaches its end of life, it will be indicated by the end-of-life parameter in GDS2 as set by the K244 Battery Management Control Module. The Driver Information Center message "Service Charging System Vehicle May Stall" will be displayed in the vehicle without any DTCs set.

Do not replace a 12V LiB with a lead-acid battery in a customer-pay scenario, as a number of vehicle conditions may occur with the missing control module.

There Is Even More!

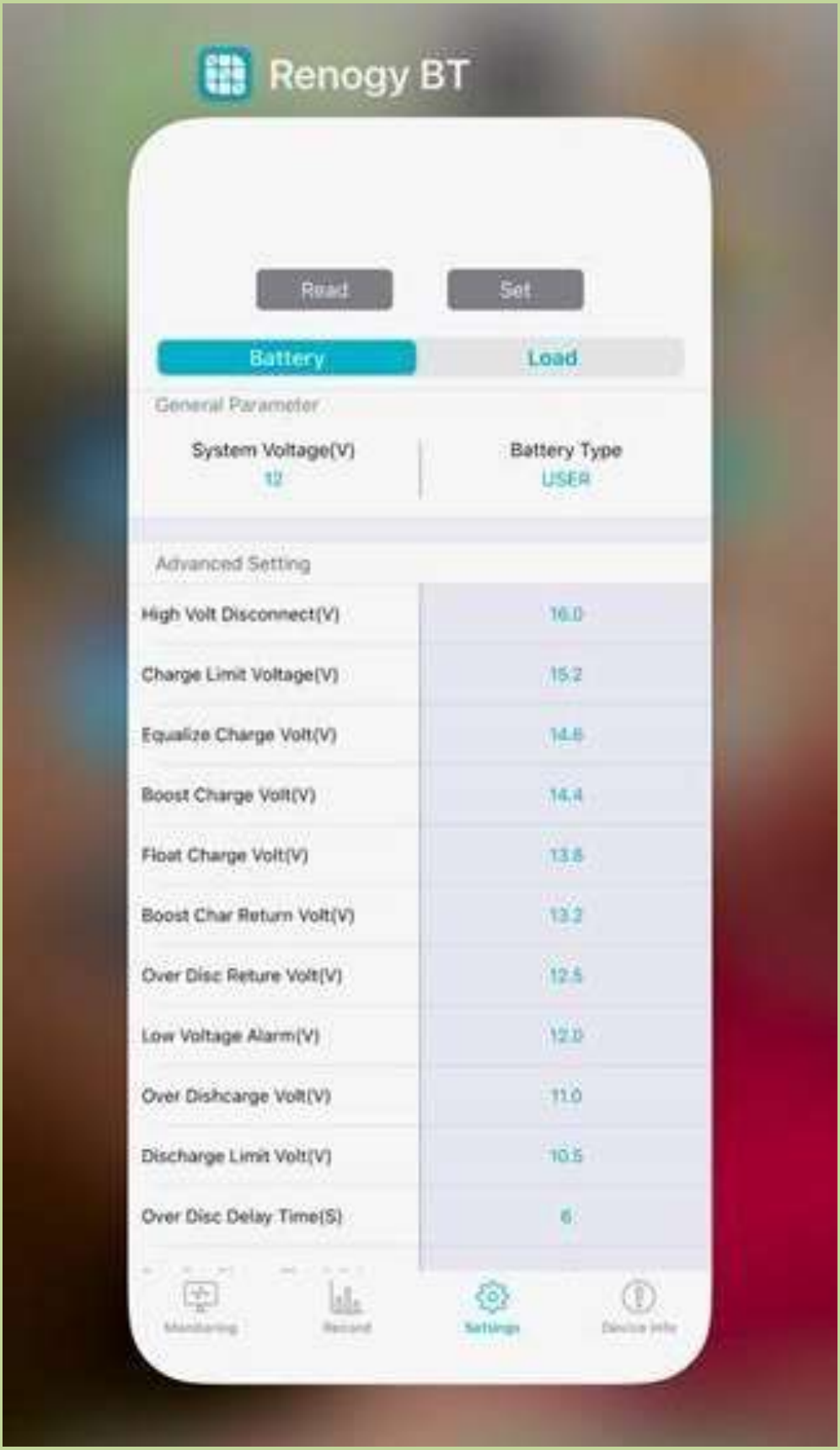
The following is more info than even I can explain fully but reinforces IMO why it's SMART to use the battery charger GM sells for the E-Ray. Yep, been selling the same one that charges both Li-Ion and Lead Acid batteries since 2020 when the C8 came out! Yep, that was before the E-Ray was OUT!

As seen above that charger only charges to ~13.3 volts the same voltage as the Alternator. WHY not higher like 14+ volts some Li-Ion batteries can be charged. That would be 100% capacity where 13.3 volts is about 85 to 90% capacity. Why is that like the Lead Acid Battery being charged to only 80% which the clearly say is to save gasoline energy? Or is it to extend the Li-Ion battery Life. GM does not say.

What happened if you use a charger that can go to 14 volts? GM does not say and we don't know. But the following may help understand why I think it's SMART to use the GM sold Maintenance Charger:

Li-Ion car batteries are not new. I have a friend who has an RV with several Li-Ion batteries he uses when parked. He charges them with the vehicles Alternator as well as solar cells on the roof. He has done a lot of investigating on Li-Ion Battery design and charging. He uses high end Valance Li-Ion batteries and can set many charging and operating parameters with his phone.

This is a Pic he sent with typical values:



Note he can set the:

- High Voltage Disconnect Voltage
- Discharge Limit Voltage
- Charge Limit Voltage
- Low Voltage Alarm etc.
- And many other charging/discharging parameters

As he explained it is all dependent on the specific Li-Ion battery design as to what value range is acceptable. In the E-Ray all these paraments are defined by the E-Ray software or whatever BMS is in the Battery. It's NOT accessible for us to set. It reinforces why IMO best to use what GM sells for the maintenance charger and with the battery manufacturer (*whoever it is not visible on the battery*.)

Another Tech Item I Only Have Internet Sourced Knowledge:

A few internet sources state you require 100% Charge of a Li-Ion Battery to Balance the induvial Li-Ion Cells.

I believe the Ford conflicting statements in that regard, summarized in the Jason Fenske in his video state it best! Summary page 14. This is Video:

https://www.youtube.com/watch?v=w1zKfIQUQ-s&t=1s

For EV's there may be some logic because of the very flat battery voltage/ capacity curve until about 13.5 volts when the curve is steep to 14+ volts where the battery is at a known 100% capacity. Fror the expected mileage they display, their algorithm is based on monitoring current in and out , which can be off over time. So an occasional charge to a know 100% allows resetting parameters to a known capacity. BUT Ford clearly states best for battery life and energy use to charge in the 20 to 80% range,

This is What Google Says to the Question:

"Does a 12 Volt Li-Ion Car Battery need to be charged to 100% for Cell Balancing?

"No, it's not necessary to charge a 12V Li-ion car battery to 100% capacity for cell balancing. Balancing is primarily done by the battery management system (BMS) within the battery pack itself, and it typically starts balancing when the cells reach a certain voltage, usually around 3.4V per cell."

Google Adds Why:

The BMS monitors individual cell voltages and uses methods like **bleed resistors** or other techniques to equalize the charge across the cells. This process happens during charging and discharging, not solely at the end of a charge cycle

The BMS usually begins balancing when cells are at a relatively high voltage, typically below 3.4V per cell. This means the balancing process starts before the battery reaches 100% capacity.

In fact, Lithium-ion batteries generally perform best and last longer if they are not fully charged to the maximum capacity all the time

AN ADDITIONAL POINT:

I am well aware that Google AI, now in its development stage, can give wrong answers. BUT rather than just my speculation I asked a question from my research, I thought could occur :

MY Question: Is it possible a dedicated Li-ion charger could cause the Corvette E-Ray 12 volt Li-Ion battery to open the internal contacts:

Google AI Answer:
Yes, it's possible that a dedicated Li-ion charger could cause the Corvette E-Ray 12-volt Li-ion battery to open its internal contactors under certain circumstances, but it's important to understand the specifics.

Google Adds, Here's Why:

- Internal Protection Mechanisms: The E-Ray's 12V Li-ion battery has internal contactors and a Battery Management Control Module (BCM) that act as a protection system. This system is designed to open the contactors to protect the battery under various conditions, including:
- Over-voltage: If a cell exceeds 4.0 volts
- Severe Discharge: If any cell drops to 1.5 volts.

Wrong Charger: If you use a dedicated Li-ion charger not designed for the E-Ray's specific battery chemistry and voltage requirements, it could potentially exceed the safe voltage or current limits, triggering the protection system and opening the contactors.
Incompatible Charging Algorithms: Different types of lithium-ion batteries have different charging profiles (Constant Current/Constant Voltage or CC/CV). Using a charger with an incompatible algorithm can lead to improper charging, potentially causing damage or safety issues, and triggering the protection system.

In Summary:
Using a dedicated Li-Ion charger specifically designed for the Corvette E-Ray 12V Li-ion battery is the safest approach. Chevrolet offers a genuine accessory battery tender/charger designed for this purpose. Using a charger that is not compatible or does not have lithium-specific settings could potentially lead to overcharging or other issues that would activate the internal protection system and open the contactors. This would cause the battery to appear completely dead.
Note Google AI could be wrong and don't know what an incorrect dedicated Li-Ion charger might cause issues. BUT IMO WHY TAKE A CHANCE!

YOUR CAR YOUR CHOICE, BUT APPEARS TO ME BEST TO USE WHAT GM AND THE LI-ION BATTERY MANUFACTURER DEFINE AND PROGRAM THE REQUIRED IN The BCM.

What if the battery gets TOO LOW opening the internal contactors?

The Charger Instructions state this prevents the Charger from detecting there is a battery connected. The Charger needs to open the UVP (Under Voltage Protection.) Pressing the large RED Rest Button for 10 seconds opens the UVP. Once open the charger automatically starts the charging cycle.

CAUTION: *A member who had a CTEK dedicated Li-Ion charger with the same wording had what appeared to be a dead battery. He tried pressing the Reset as suggested. Even tried Rest with a GM C8 charger. It did not allow charging. His Chevy dealer brought a Battery Jump Starter that allowed the car to start.*

From 2024 Owner's Manual, E-Ray Jump Start Box Procedure

GM States use approved Jump Box BUT no has list of what they are!
Appears they are saying use the Jump Box so battery accepts a C8 charger!

1. Set the jump start box to OFF.
2. Connect the red (+) cable to the lithium-ion battery positive (+) tab.
3. Connect the black (–) cable to the lithium-ion battery negative (–) post.
4. Once the jump start box has been connected, set the jump start box to ON. After the jump start box is powered on, ensure the instrument cluster lights up before starting the vehicle.
5. After the instrument cluster lights up, ***use a GM approved battery charger to fully charge the battery.***

WA Technology

"60" E-Ray, C8 Z51, 2017 Grand Sport & 2014 Z51 Stingray Mods or Info Available As PDFs:

60 PDFs discuss improvements or info about a E-Ray, C8, 2017 Grand Sport, 2014 Z51 Stingray function and/or esthetics. Some are minor and others, like installing "Low Dust Brake Pads" on C8 & C7s, have detailed information.

Below are the PDF's available. Click Blue PDF link or copy and paste the PDF link (Blue type) into your browser. Or email me at *TechSupport@NetWelding.com* **and state the title desired, shown in Yellow:**

E-Ray PDI & Info ***Details of My E-Ray PDI*** **http://netwelding.com/E-Ray_PDI.pdf**	
E-Ray 1st Mod ***Details of My E-Ray Cross Brace*** **http://netwelding.com/E-Ray_Mod_1.pdf**	
E-Ray Need Lift? ***Yep, How I Scraped My Front Aero Panel*** **http://netwelding.com/E-Ray_Lift.pdf**	
E-Ray PPF Bottom Of Rocker Panels ***Small Amount of PPF Added To Rocker Panels*** **http://netwelding.com/E-Ray_PPF.pdf**	
E-Ray Tire Slide & Rear Mesh ***Safe way to remove and install wheels*** **http://netwelding.com/E-Ray_Tire_Slide.pdf**	
E-Ray 12 Volt Battery **http://netwelding.com/E-Ray_12_Volt.pdf**	
C8 & E-Ray Brakes ***C8 Brakes Are Anemic Compared to Other MEs*** **http://netwelding.com/C8_Big_Brakes.pdf**	

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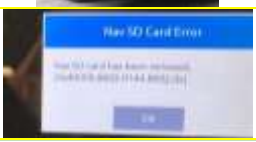
C8 & E-Ray PDR SD Card Selection ***Things to Consider When Buying SD Card*** **http://netwelding.com/PDR_SD_Card.pdf**	
E-Ray, C8, C7 eLSD vs Positraction ***eLSD is a Modern Dif; Positraction is from 1960s*** **http://netwelding.com/eLSD _VS_Posi.pdf**	
E-Ray, C8 FWD Hybrid ***WFWD Hybrid Provides More Power & MPG*** **http://netwelding.com/C8_FWD_Hybrid.pdf**	
C8 Edge Red Engine Cover ***Engine Cover Matches Valve Cover*** **http://netwelding.com/Engine_Cover.pdf**	
C8 Engine Compartment Lights ***Multicolor Lights Remote operated*** **http://netwelding.com/Engine_Lights.pdf**	
C8 Side Skirts & Splitter ***Install C7 Carbon side skirts & splitter on C8*** **http://netwelding.com/Side_Skirts.pdf**	
C8 Z51, GS/C7 Z51 Ceramic Brake Pads ***Performance Vettes have dusty brakes. These help!*** **http://netwelding.com/Ceramic_Pads.pdf**	
C8 Low Restriction Air Intake ***Low Restriction Air Filter Why & How To*** **http://netwelding.com/C8_Air_Intake.pdf**	
C8 & C7 Splitter & C8 Condenser Mesh ***Mesh Protects AC Condenser & Splitter Install*** **http://netwelding.com/CF_Splitter.pdf**	
C8 NAV SD Card Removed Error ***Error When SD Card and Reader Are Fine*** **http://netwelding.com/NAV_SD_Card.pdf**	
C8/GS/C7 Splash Guards ***GM splash guards. ACS Best Front Guards for GS.*** ***http://netwelding.com/Splash_Guard.pdf***	
Jacking a E-Ray/C8/GS/C7 Vette ***Safely jacking either front only or back & front*** ***http://netwelding.com/Jacking_A_C7.pdf***	
E-Ray, C8 & C7 Plates & Frame; **Must Meet South Carolina Law** **http://netwelding.com/License_Plate_Frame.pdf**	
Change C8/GS/C7 Oil ***WHY change your own oil and C7 Lifting Methods*** **http://netwelding.com/Changing_Oil.pdf**	

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E-Ray/C8/GS/C7 Mirror Proximity Alarm
Limit switch alarm warns when close to door frame
http://netwelding.com/Mirror_Proximity_Alarm.pdf

Jacking Pads for E-Ray/C8/GS/C7
Manual says Jacking Pads 2 1/2-inch max OD..
http://netwelding.com/Jacking_pads.pdf

E-Ray/C8/GS/C7 Radar Power
For C7 tapped rear fuse panel. For GS tapped mirror
http://netwelding.com/Radar_Detector_Power.pdf

E-Ray, C8 & C7 Wheel Chatter/Hop
Why sharp, low speed turns with cold tires causes the front tires to chatter/hop.
http://netwelding.com/Wheel_Chatter.pdf

E-Ray/C8/GS/C7 Wheel Locks
Wheel locks, help protect your expensive wheels.
http://netwelding.com/Wheel_Locks.pdf

Deer Whistle Installed on E-Ray/C8/GS/C7
Do they work? Plus Install Info
http://netwelding.com/Deer_Whistle.pdf

C8 & C7 Splitter Protector
Scrape Armor Protection for Splitter
http://netwelding.com/Splitter_Protectors.pdf

E-Ray, C8 & C7 Cargo Area
Rear cargo area storage device and rear protector
http://netwelding.com/Rear_Cargo_Area.pdf

C8 Front Coilover Tower Covers
Prevent water from filling Cast aluminum cavities
http://netwelding.com/Tower_Covers.pdf

C8.R Info & GS Rear Diffuser (Fits Any C7)
Rear Carbon Flash Composite Diffuser
http://netwelding.com/Rear_Diffuser.pdf

GS/C7 Belt Rattle
Passenger seat belt rattles against the seat back.
http://netwelding.com/Eliminate_Rattle.pdf

Aluminum C8 & C7 Chassis and Repair
The C7 aluminum chassis. Includes weld repair info.
http://netwelding.com/Aluminum_Chassis.pdf

Manage GS/C7 Spilled Gas & Door Lock
Protect when filling gas. Preventing door lock failure.
http://netwelding.com/Manage_Spilled_Gas.pdf

GS/C7 License Plate Light
LED license plate light & cargo area bulbs
http://netwelding.com/License_Plate_Light.pdf

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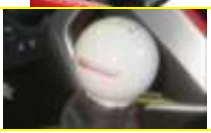
E-Ray/GS/C7 Door Panel Protector ***Black plastic protector prevents scuffing of door*** **http://netwelding.com/Door_Panel_Protector.pdf**	
GS/C7 Improved Cup Holder ***A solution to the cup holder spilling*** **http://netwelding.com/Improved_cup_Holder.pdf**	
C7 Carbon Fiber Grille Bar ***Install genuine carbon fiber grille bar overlay*** ***http://netwelding.com/CF_Grille_Bar.pdf***	
GS/C7 Blind Spot Mirror ***Smaller rear and side windows cause C7 blind spots.*** **http://netwelding.com/Blind_Spot.pdf**	
GS/C7 Skid Pad Protector ***After the air dam, the aluminum "skid pad" hits*** **http://netwelding.com/Skid_Pad_Protector.pdf**	
GS/C7 OnStar Lights ***Rear view mirror OnStar LED's, at a quick glance, look like a police car flashing light! This is a fix.*** **http://netwelding.com/OnStar_Lights.pdf**	
GS/C7 Skip Shift Eliminator ***Skip Shift Eliminator install*** **http://netwelding.com/Skip_shift_Eliminator.pdf**	
GS/C7 Catch Can & Clean Oil Separator ***What is Coking and how to reduce the potential*** **http://netwelding.com/Catch_Can.pdf**	
GS MGW Flat Stick Shifter ***The MGW shifter shortens throw and is more precise*** **http://netwelding.com/MGW_Shifter.pdf**	
GS/C7 Round Shift Knob ***A round shift knob shortens throw on OEM shifter*** **http://netwelding.com/Shift_Knob.pdf**	
GS/C7 Stingray Sill Plate ***Stingray sill plate replaces original.*** **http://netwelding.com/Sill_Plate.pdf**	
GS/C7 Nylon Bra ***Nylon Bra Stops Bugs. Fits with Stage 3 Winglets*** **http://netwelding.com/Nylon_Bra.pdf**	
GS/C7 Clutch Fluid Change ***Clutch fluid after 3000 miles gets dirty*** **http://netwelding.com/Clutch_Fluid.pdf**	
GS/C7 Cold Air Intake ***Low Restriction Air Filter & Duct*** **http://netwelding.com/Cold_Air_Intake.pdf**	

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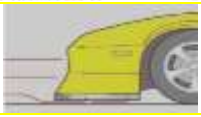
GS/C7 Soler Modified Throttle Body ***For Improved Throttle Response*** **http://netwelding.com/Soler_Mod_TB.pdf**	
GS Splitter Stage 3 Winglet ***Stage 3 Winglets Integrate with Spats*** **http://netwelding.com/Stage_3_Winglets.pdf**	
C7 Removing GM Plastic Film ***How To Remove The Rocker Panel Film*** **http://netwelding.com/Rocker_Panel_Film.pdf**	
GS 2LT to 2.5 LT ***Red Upper Dash Pad Like 3LT*** **http://netwelding.com/Red_Dash_Pad.pdf**	
Jake Emblem/Decals for GS ***Jake Symbols Support GS Racing Image*** **http://netwelding.com/Jake_Emblems.pdf**	
Rusty GS/C7 Muffler ***Why the C7 muffler rusts way to turn matte black.*** **http://netwelding.com/Muffler_Rust.pdf**	
GS Engine Compartment Mods ***Cosmetic Additions in Engine Compartment*** **http://netwelding.com/Engine_Compartment.pdf**	
Boomy Bass Solution ***Use Presets to Adjust Bass etc. Tone/Balance*** **http://netwelding.com/Boomy_Bass**	
GS/C7 Air Dam, Functions ***Why Missing from Z51, Some GS & Z06*** **http://netwelding.com/Air_Dam.pdf**	
Rusty GS/C7 Muffler ***Why the C7 muffler rusts way to turn matte black.*** **http://netwelding.com/Muffler_Rust.pdf**	
Engineering a ProStreet Rod ***How Our '34 ProStreet Rod Was Designed and Built*** **http://netwelding.com/Engineering%20Street%20Rod%203-08.pdf**	
Motorsports Welding Article ***Wrote Article on NHRA and NASCAR Chassis Design*** **http://netwelding.com/Motorsports_Welding_2018.pdf**	
Write Flyer Build: Fun Winter Project **http://netwelding.com/Wright_Brothers_First_Airplane.pdf**	
Chris Craft Build: Fun Winter Project **http://netwelding.com/Building_Dumas_Chris_Craft_Boat_Model.pdf**	

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