



# TROJAN<sup>®</sup> GC2 48V LITHIUM-ION BATTERY USER'S GUIDE



# CONGRATULATIONS

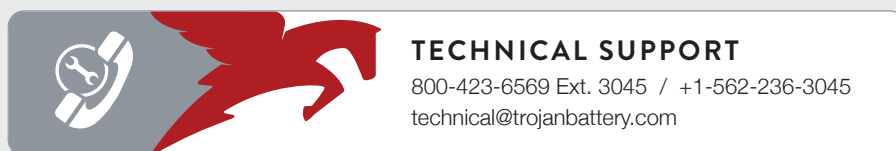
on your purchase from Trojan Battery Company, LLC (“Trojan”), manufacturers of the world’s most trusted batteries. GC2 Lithium-Ion batteries are engineered for safety and performance—delivering faster charge times and longer distances with virtually zero required maintenance. It’s the next innovation in battery power backed by 100 years of expertise. We’re proud to continue our tradition of delivering clean, long-lasting and reliable batteries to power your world.

TROJAN BATTERY  
COMPANY WITH  
QUALITY SYSTEM  
CERTIFIED BY DNV  
= ISO 9001:2015 =

# THIS USER'S GUIDE

was created by Trojan's application engineers and contains vital information regarding proper care and maintenance of your new battery. Please read through this User's Guide carefully and completely before using your battery. It will help you achieve optimum performance and long life from your new investment. If you have any questions concerning safety precautions or for any assistance in installing or using the battery in your system, contact Trojan's technical support engineers at one of the following numbers, or send us an email through our website at [www.trojanbattery.com/tech-support/](http://www.trojanbattery.com/tech-support/).

[www.trojanbattery.com](http://www.trojanbattery.com)



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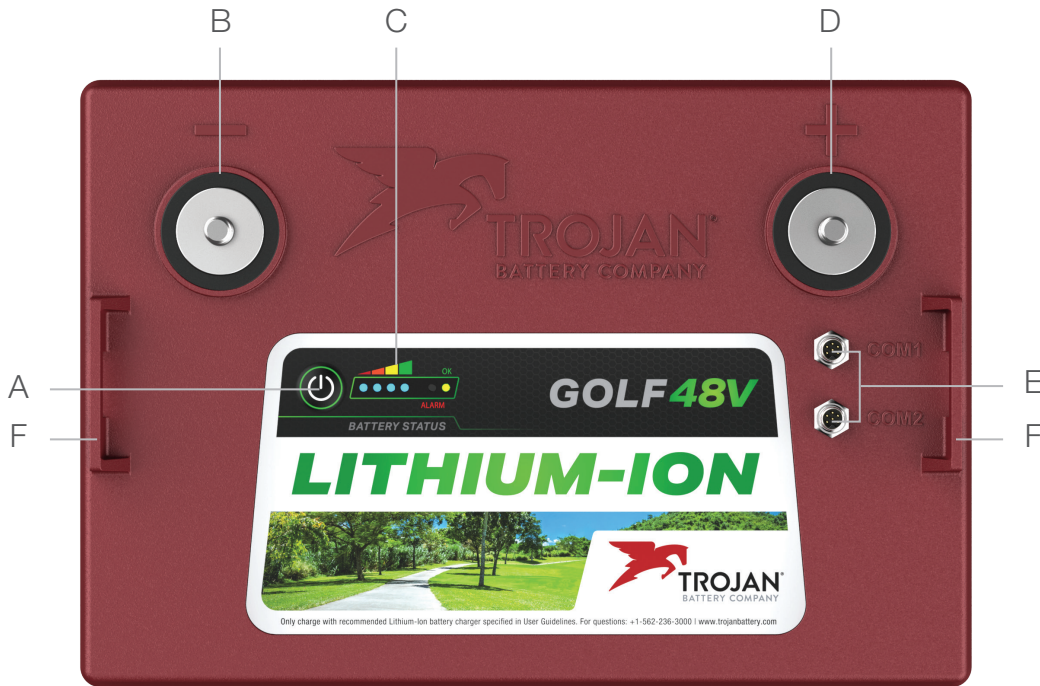
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# 1 YOUR TROJAN LITHIUM-ION BATTERY

The TR GC2-48-G battery is a deep-cycle lithium-ion battery specifically designed for use in golf carts and similar personal transportation vehicles with 48V battery packs. Key attributes of the battery include:

- ▶ Case size: BCI Group GC2
- ▶ Nominal Voltage: 51.2V
- ▶ Capacity\*: 30Ah
- ▶ Terminal configuration: M8-1.25 threaded studs
- ▶ Communication Port: CAN Bus SAE J1939



- A. Status Button
- B. Negative Terminal (M8 size)
- C. Battery Status Indicators (SOC)
- D. Positive Terminal (M8 size)
- E. Communications Port I/II
- F. Lifting Brackets

\*Temperature, load, state of charge, and battery age can affect battery performance and capacity.

## 2 SAFETY

ALWAYS	NEVER
Always wear proper personal protective equipment (PPE) (eye protection and gloves).	Never wear jewelry or other metal objects when working on or around batteries.
Always use insulated tools when working on batteries.	Never place objects on top of batteries.
Always check connections for proper torque.	Never attempt to charge a battery when the temperature is below 32°F (0°C) or above 113°F (45°C).
Always keep sparks and flames away from batteries. This includes sources of static electricity.	Never store batteries below 30% State of Charge.
Always use short cables of appropriate size to minimize voltage drop.	Never exceed maximum charging currents for the battery's temperature.
Always make sure charger is set as recommended.	Never dispose of batteries as household waste. Use recycling channels in accordance with local, state and federal regulations.
Always charge batteries before installing.	Never connect or disconnect terminals from batteries without first disconnecting loads.
Always make sure chargers are off or disconnected while working on batteries.	Never attempt to open the battery case.
Always add additional TR GC2-48-G batteries in parallel.	Never use pressure washers to clean the battery or immerse the battery in water.
Always use battery lifting strap.	Never short-circuit the battery terminals.
Always review product warning labels and Trojan® GC2 48V Lithium-Ion User's Guide.	Never physically damage the battery (this includes, without limitation): Puncturing, dropping, crushing, burning, penetrating, shaking, hammering, and misconnecting terminals.
Always install batteries while powered off.	Never lift by the battery terminals.
	Never over-charge or over-discharge the battery.
	Never attempt to connect TR GC2-48-G batteries in series.



**WARNING! RISK OF FIRE, EXPLOSION OR BURNS. DO NOT DISASSEMBLE, HEAT ABOVE 140°F (60°C) OR INCINERATE.**



**THE MOST EFFECTIVE FIRE EXTINGUISHER TYPES FOR TROJAN LITHIUM-ION BATTERIES ARE CO<sub>2</sub> OR WATER. SEE SAFETY INSTRUCTIONS.**



### **DANGER!**

UNLIKE LEAD-ACID BATTERIES, LITHIUM-ION BATTERIES, INCLUDING THE TROJAN® GC2 48V LITHIUM-ION BATTERY, WILL DISCONNECT FROM THE HOST SYSTEM UNDER A VARIETY OF CONDITIONS IN ORDER TO AVOID INTERNAL DAMAGE ("AUTOMATIC DISCONNECTION"). FOR A FULL LIST OF CONDITIONS PLEASE SEE SECTION 10.3: "PROTECTION LIMITS: AUTOMATIC DISCONNECTION". WHEN AUTOMATIC DISCONNECTION OCCURS IN EQUIPMENT POWERED BY GC2 BATTERIES, ALL POWER WILL BE LOST. IN EQUIPMENT WITH ESSENTIAL SYSTEMS THAT RELY ON BATTERY POWER (FOR EXAMPLE, LOW-SPEED VEHICLES WITH ELECTRONIC BRAKING SYSTEMS) (EACH AN "AFFECTED APPLICATION"), AN ABRUPT INTERRUPTION OF POWER CAN CAUSE UNDESIRABLE, UNEXPECTED AND POTENTIALLY DANGEROUS EQUIPMENT BEHAVIOR, INCLUDING BUT NOT LIMITED TO BRAKING LOSS OR SUDDEN BRAKING. USERS AND INSTALLERS OF THE GC2 MUST UNDERSTAND THE CONSEQUENCES OF AUTOMATIC DISCONNECTION. WHEN THE GC2 BATTERY IS USED IN AN AFFECTED APPLICATION, THE USER AND/OR INSTALLER OF THE GC2 BATTERY ("USER AND/OR INSTALLER") ASSUMES ALL RISK AND LIABILITY FOR ANY DAMAGES, INJURIES TO PERSONS OR PROPERTY (INCLUDING BUT NOT LIMITED TO DEATH), OR ACCIDENTS ARISING OUT OF OR RELATED TO SUCH USE OR INSTALLATION. USERS AND/OR INSTALLERS MUST FAMILIARIZE THEMSELVES WITH THE CONDITIONS CAUSING AUTOMATIC DISCONNECTION AS DESCRIBED IN THIS USER GUIDE, SECTION 10.3, "PROTECTION LIMITS: AUTOMATIC DISCONNECTION". USERS AND/OR INSTALLERS SHOULD CONSULT THE MANUFACTURER OF ANY AFFECTED APPLICATION FOR RISK MITIGATION OPTIONS RELATED TO THE AUTOMATIC DISCONNECTION BY EXCEEDING THE PROTECTION LIMITS OF THE BATTERY, WHICH MAY INCLUDE BUT NOT BE LIMITED TO HIGH VOLTAGE, LOW VOLTAGE, HIGH CURRENT, EXTERNAL SHORT CIRCUIT, HIGH TEMPERATURES, LOW TEMPERATURES, SELF DIAGNOSTICS, AND/OR AFTER MARKET MOTOR CONTROLLERS.



## DANGER!

LITHIUM-ION BATTERIES, INCLUDING THE TROJAN® GC2 48V LITHIUM-ION BATTERY, WEIGH SUBSTANTIALLY LESS THAN LEAD-ACID BATTERIES OF COMPARABLE CAPACITY. MANY TYPES OF EQUIPMENT ARE DESIGNED TO UTILIZE THE WEIGHT OF LEAD-ACID BATTERIES TO ACHIEVE THE MANUFACTURER'S INTENDED WEIGHT DISTRIBUTION. IF GC2 BATTERIES ARE INSTALLED AS REPLACEMENT BATTERIES IN EQUIPMENT DESIGNED TO USE LEAD-ACID BATTERIES AS BALLAST, THE WEIGHT DISTRIBUTION OF THE EQUIPMENT COULD BE IMPACTED. THE USER AND/OR INSTALLER OF THE GC2 BATTERY IN SUCH EQUIPMENT MUST UNDERSTAND THE CONSEQUENCES OF MODIFIED WEIGHT DISTRIBUTION AND ENSURE THAT STABILITY REMAINS WITHIN A SAFE RANGE FOR THE INTENDED USE. THE PROPER INSTALLATION OF GC2 BATTERIES MAY REQUIRE ADDITIONAL BALLAST WEIGHTS OR OTHER ADJUSTMENTS OR EQUIPMENT MODIFICATIONS TO ENSURE STABILITY AND SAFE WEIGHT DISTRIBUTION. THE IMPROPER INSTALLATION AND/OR USE OF GC2 BATTERIES COULD COMPROMISE THE WEIGHT BALANCE AND PHYSICAL STABILITY OF THE EQUIPMENT LEADING TO UNSAFE CONDITIONS. THE USER AND/OR INSTALLER OF THE GC2 BATTERY IN SUCH EQUIPMENT ASSUMES ALL RISK AND LIABILITY FOR ANY DAMAGES, INJURIES TO PERSONS OR PROPERTY (INCLUDING BUT NOT LIMITED TO DEATH), OR ACCIDENTS ARISING OUT OF OR RELATED TO DEGRADED STABILITY RESULTING FROM IMPROPER INSTALLATION AND/OR USE OF THE GC2 BATTERY.

## 3 EQUIPMENT NEEDED

Before installation or maintenance of your batteries, have the following equipment available:

- ▶ Proper personal protective equipment (eye protection and gloves)
- ▶ Battery charger
- ▶ 13mm socket
- ▶ Insulated tools
- ▶ Voltmeter (optional)
- ▶ Cables

The TR GC2-48V-G weighs 37 lbs. Use of a battery lifting strap to aid installation is recommended. Lifting strap must be designed and rated for lifting batteries and able to securely engage integrated lifting brackets.

## 4 BATTERY INSTALLATION

The Lithium-ion battery voltage is 48V for use in 48V vehicles only. Connect batteries in parallel electrically when installing more than one battery in your vehicle. Be sure to follow the instructions for parallel installation.

Installing multiple batteries in parallel (See Section 4.5: “Connecting Batteries in Banks”) increases the driving range and may be required to match the power requirements of the motor controller in your vehicle.

**DO NOT CONNECT BATTERIES IN A SERIES.** Series connection may pose danger to user and/or installer and cause damage to the battery. The installer should verify every battery is off before performing the installation procedure. See Section 4.10: “Battery Start-Up.” For operation and use, turn the battery back ON using the status button on each battery.

### 4.1 INSPECTION AND 12V ACCESSORIES

Check for visible damage including cracks, dents, deformation and other visible abnormalities.

The tops of the batteries and terminal connections should be clean, free of dirt and corrosion, and dry.

If any problems are detected with the batteries, contact Trojan technical support or your battery distributor.

If damage occurred in transit, contact your freight carrier.

## 4.1 INSPECTION AND 12V ACCESSORIES (CONTINUED)

To prevent damage to 12V accessories in the cart, first verify the voltage requirement of accessories like lights or others items in the vehicle. Then, if needed, the installer can use a voltage reducer to reduce the 48V battery voltage to 12V or as required. To ensure you install your batteries properly and safely, please use the following guidelines.

## 4.2 TERMINALS AND TORQUE VALUES

Both the positive and negative terminals of the battery are M8-1.25 x 18mm threaded studs. Ensure that the nuts are tightened to the **proper dry torque of 80-90 in•lbs (9-10Nm)**. OVER-TIGHTENING TERMINAL CONNECTIONS CAN CAUSE TERMINAL BREAKAGE, AND LOOSE CONNECTIONS CAN RESULT IN TERMINAL MELTDOWN OR FIRE.

## 4.3 CORRECT HARDWARE INSTALLATION

If using flat or lock washers, it is very important to ensure the battery cable lug is contacting the top surface of the terminal, and the washer is placed on top of the lug. DO NOT PLACE A WASHER BETWEEN THE BATTERY TERMINAL AND THE LUG, AS THIS WILL CREATE HIGH RESISTANCE AND CAUSE EXCESSIVE HEATING OF THE CONNECTION, WHICH CAN RESULT IN FIRE. If assistance is needed in determining the appropriate hardware configuration, contact Trojan Battery technical support.

## 4.4 CABLE SIZE

Battery cables should be sized to handle the expected load and be of sufficient length and flexibility to avoid applying undesirable mechanical loads on the battery terminals. Refer to Table 1 for the maximum amperage based on the cable/wire gauge size.



**WARNING! SHOCK HAZARD – DO NOT TOUCH UN-INSULATED BATTERY, CABLES, OR TERMINALS. ALL TOOLS SHOULD BE ADEQUATELY INSULATED TO AVOID THE POSSIBILITY OF SHORTING CONNECTIONS. DO NOT LAY TOOLS ON THE TOP OF THE BATTERY.**

**TABLE 1**

CABLE/WIRE GAUGE SIZE, AWG (mm <sup>2</sup> )	AMPACITY (Amps)
14 (2.08)	20
12 (3.31)	25
10 (5.26)	35
8 (8.36)	50
6 (13.3)	65
4 (21.1)	85
2 (33.6)	115
1 (42.4)	130
1/0 (53.5)	150
2/0 (67.4)	175

Table values are from NEC Table 310.15(B)16 for copper cables rated at 167°F (75°C), operating at an ambient temperature of no more than 86°F (30°C). Lengths in excess of 6 feet (1829mm) may require heavier gauge wire to avoid unacceptable voltage drop. In parallel battery banks, it is preferable for all cables to be the same length.

For more information refer to the National Electrical Code for correct cable/wire size, which can be located at [www.nfpa.org](http://www.nfpa.org).



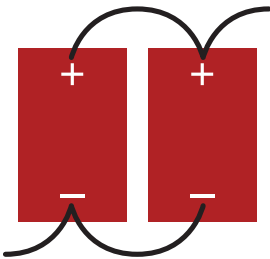
## 4.5 CONNECTING BATTERIES IN BANKS

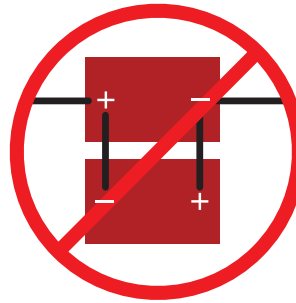
You can increase the cart driving range and battery power capability by connecting multiple batteries together in parallel electrically as shown in Table 2.



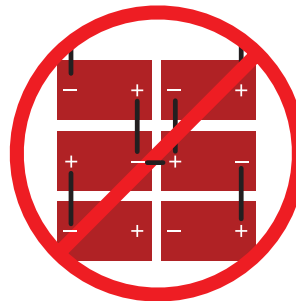
**WARNING! SHOCK HAZARD; RISK OF FIRE – THE TR GC2-48-G IS INTENDED FOR USE IN 48VDC APPLICATIONS ONLY. ATTEMPTING TO USE THIS BATTERY IN HIGHER VOLTAGE SYSTEMS OR CONNECTING IN SERIES MAY BYPASS INTERNAL BATTERY SAFETY FEATURES AND CREATE A HAZARDOUS SITUATION. PERSONAL PROTECTIVE EQUIPMENT RECOMMENDED IN THIS USER GUIDE MAY BE INADEQUATE IF BATTERY IS MISUSED IN THIS WAY. REFER TO NFPA 70E OR LOCAL ELECTRICAL SAFETY GUIDELINES FOR ADDITIONAL INFORMATION RELATED TO PERSONAL PROTECTIVE EQUIPMENT AND SAFETY PROTOCOLS.**

**TABLE 2**

PARALLEL CONNECTION
To increase capacity, connect batteries in parallel. This will not increase the system voltage.
Two 51.2V batteries rated at 30Ah connected in parallel

System Voltage: 51.2V System Capacity: 30Ah + 30Ah = 60Ah
<b>CALL TECH SUPPORT FOR ADDITIONAL CONFIGURATIONS</b>



**WARNING! SHOCK HAZARD; RISK OF FIRE – DO NOT INSTALL BATTERIES IN REVERSE POLARITY. THIS MAY PERMANENTLY DAMAGE THE BATTERY**



**WARNING! SHOCK HAZARD; RISK OF FIRE – DO NOT INSTALL BATTERIES IN SERIES. THIS MAY PERMANENTLY DAMAGE THE BATTERY**

## 4.6 VENTILATION

Trojan® GC2 48V Lithium-Ion batteries do not release gas during normal use. There are no specific ventilation requirements for TR GC2-48-G installations, although sufficient airflow should be provided to prevent excessive heat build-up.

## 4.7 BATTERY ORIENTATION

Batteries should be installed only in a **vertical orientation with the terminals on top.**

## 4.8 BATTERY ENVIRONMENT

Batteries should be stored and installed in a clean, cool and dry place, keeping water, oil and dirt away from the batteries. If any of these materials are allowed to accumulate on the batteries, tracking and current leakage can occur, resulting in self-discharge and possible short-circuits. Battery chargers should also be installed in well-ventilated, clean areas that are easily accessible. Relative humidity should be <90%.

## 4.9 TEMPERATURE

The operating temperature range for discharging TR GC2-48-G batteries is -4°F to 140°F (-20°C to 60°C). Charging batteries below 32°F (0°C) is prohibited, and charging currents must be reduced below 68°F (20°C). See the product datasheet for more information on charging current constraints.

Attempting to charge the battery at temperatures below 32°F (0°C) will cause the battery to disconnect from the charger and enter an under-temperature alarm, charging will be disabled while the alarm is active. Refer to Section 10.1: “Charging” for charging current limitations.

Note that battery life diminishes as temperature increases, while capacity diminishes as temperature decreases.

It is important to minimize temperature variations between the batteries. Therefore, avoid restricting airflow by tightly packing batteries together. The batteries should have a minimum of 0.50” (12.7mm) of space between them to allow for adequate airflow.

## 4.10 BATTERY START-UP

Your battery may be shipped at 50% state of charge or lower. Prior to installation, follow the instructions in Section 6.2: “Initial Charging.”

Perform the following steps to turn the battery on:

Verify that the battery is either completely disconnected or correctly connected to the equipment it will be powering.

- ▶ Be sure that you are able to see the LEDs, then **press and hold** the status button.
- ▶ The LEDs will successively turn on from left to right until they are all on.
- ▶ **Once all LEDs are on, wait another 2 seconds, then release the status button.**
- ▶ The battery will perform a self test for about 10 seconds and turn on. Press and release the status button to verify the green LED is on and the battery is ready to be used.

## 4.10 BATTERY START-UP (CONTINUED)

Perform the following steps to turn the battery off and place it in storage mode:

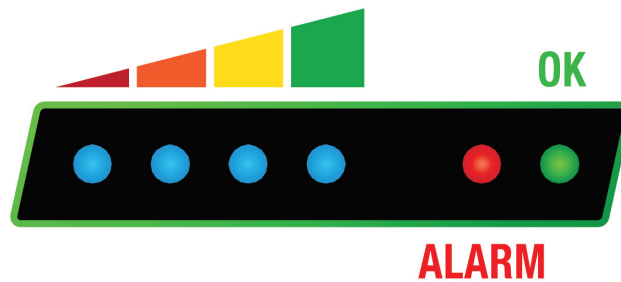
- ▶ Press and hold the status button.
- ▶ All LEDs will turn on, then successively turn off, starting with the green LED.
- ▶ Once all LEDs are off, wait another 2 seconds, then release the status button.

If the battery has been intentionally turned off for shipping or because of a shutoff condition, you can restart it by the above steps. However, if a condition that causes a shutoff has not been corrected, the battery will shut off again.

See Section 10.3: “Protection Limits: Automatic Safety Shutdown,” for specific explanations of shutdown causes.

## 4.11 INDICATOR LEDS

The Trojan® GC2 48V Lithium-Ion battery features a status push button and indicator LEDs on the top of the case as illustrated below. After the status button is momentarily pressed, the indicator LEDs will operate as follows:



LED COLOR	DEFINITION
Blue	Each blue LED represents 25% State of Charge (SOC) as shown in the legend. During charging, they will flash the SOC once each second.
Red	Active alarm (battery disabled)
Green	Battery OK

The light will display this color pattern while the button is pressed.

When the battery is charging, the blue LEDs will blink to indicate charging and the increasing state of charge percentage. When the charging stops, all the LEDs turn off.

## 4.12 CAN BUS

The battery includes a Controller Area Network (CAN) bus communications interface. The two circular M8 DIN connectors are on the top of the battery to enable one battery to connect to another battery using CAN bus cables in a simple daisy chain wiring scheme.

For normal battery operation, the CAN bus feature is not required. The battery operates and protects autonomously; it does not require any CAN bus communication or external devices such as external controllers, or other CAN bus-connected batteries to function. Keep the two black caps installed on the two M8 connectors to protect them from the environment when not used.

Trojan's field service can retrieve the battery usage history and view status over the CAN bus interface to help resolve issues or questions.

A certified field service technician can update the battery firmware over the CAN bus to add features or enhancements.

The CAN bus interface is galvanically isolated from the internal battery voltages. Therefore, an external power source is required to turn on and power the field side of the isolated CAN bus. Contact Trojan's technical support engineers if you have any questions about the CAN bus interface and its use. [See Section 8: "Maximizing the Performance of Your Battery"](#) for technical support information.

# 5. PREVENTATIVE MAINTENANCE

## 5.1 INSPECTION

- ▶ Power off battery before inspection.
- ▶ Examine the outside appearance of the battery. The tops of the batteries and terminal connections should be clean, dry and free of corrosion.
- ▶ Check battery cables and connections. Replace any damaged cables and tighten any loose connections. [Refer to Section 4.2: "Terminals and Torque Values."](#)

## 5.2 CLEANING

Check the battery for cleanliness at regular intervals and keep terminals and connectors free of corrosion. Terminal corrosion may adversely affect the performance of the battery and present a safety hazard.

- ▶ Power off battery before cleaning.
- ▶ Disconnect the battery from the charging source and the load.
- ▶ Clean the top of the battery, terminals and connections with a damp cloth or non-metallic brush. If the battery is extremely soiled, a household cleaner may be used.
- ▶ Dry with a clean cloth.
- ▶ Keep the area around batteries clean and dry.

# 6. CHARGING

## 6.1 BACKGROUND

Trojan® GC2 48V Lithium-Ion batteries may be used in applications where lead-acid batteries have previously been utilized. Best charging results are obtained by using an appropriate Trojan-recommended charger and charging profile (algorithm). Refer to documentation on your specific charger for more information.

## 6.2 INITIAL CHARGING

Unless your dealer has charged your battery prior to delivery, it will be received at partial state of charge. If your system uses more than one battery, follow the steps below:

1. Prior to installation, turn each battery on, then measure and record each battery's voltage.
2. If all voltages are within 0.5 volts of each other, turn them off, proceed with the installation, then follow the normal charging procedure.
3. If the voltages differ by more than 0.5 volts, each battery should be individually charged, then the installation can proceed.

## 6.3 BALANCING

One function of lithium-ion batteries is to maintain balance between each group of cells within the battery. This allows the battery to deliver full capacity without any cells experiencing an over or under-voltage condition.

Balancing is performed when a parallel group of cells reaches a specified threshold voltage corresponding to nearly 100% state of charge (SOC). At that point, the highest-charged cells “bleed down” a small amount to enable the remaining groups of cells to “catch up.”

## 6.4 INITIAL CHARGING CYCLES

In systems using more than one (1) battery, new batteries will be slightly unbalanced when they are unpacked and initially installed. Interruption of individual battery charging current and charge cycling may occur during the first charging cycle and is considered normal. Allow some extra time during first charging cycle to allow the batteries to come into balance.

## 6.5 CHARGING PROFILES

The recommended charging approach is to use an I-E charging profile with a voltage setting of 55.2 to 57.6 VDC. Use of a compatible charging profile is highly recommended to obtain a fully-charged and balanced battery pack. Other AGM or GEL charging algorithms may be used with varying degrees of success, depending upon the charger's specific settings.

55.2 VDC

### Recommended Charger Range

57.6 VDC

Chargers which charge at lower voltages will not harm the battery, but will not provide a full charge to maximum capacity. This may affect range and usable lifespan of the battery.

Chargers which charge at higher voltages will not harm the battery, but may not provide a full charge because the battery will shut off as soon as the voltage gets too high. Charger cycling may result.

## 6.6 CHARGING AT TEMPERATURES BELOW 68°F (20°C)

Maximum charging currents must be reduced at temperatures below 68°F (20°C). Measures need to be taken to ensure that charging currents do not exceed the values shown on the product datasheet. As mentioned previously, charging is prohibited below 32°F (0°C).

## 6.7 CHARGING PROCEDURE

- ▶ Verify that the battery is correctly hooked up to the charger with the positive wire on the positive (+) terminal and the negative wire on the negative (–) terminal.
- ▶ Ensure the charger is set to run the appropriate profile.
- ▶ If the charger will not run until it detects battery voltage, be sure that the batteries are turned on.
- ▶ Start charging, following the charger manufacturer’s instructions.
- ▶ After the charge has completed, the charger may be shut off and disconnected, or if it remains in a “maintenance mode” at less than 55.2 VDC, it can remain connected to the battery indefinitely.

## 6.8 OTHER CHARGING INFORMATION

- ▶ **Chargers which utilize an automatic desulfation or equalization mode are not recommended.**
- ▶ **While the battery is being charged, the blue LEDs will flash the current state of charge once each second.** See Section 4.11: “Indicator LEDs,” for interpretation of LED information.
- ▶ *If a battery shuts off due to low state of charge, it should be recharged as soon as possible. Failure to do so may render the battery permanently unusable.*
- ▶ *Depending upon the initial state of charge and the size of the load, even small parasitic loads such as motor controllers and on-board chargers can fully discharge batteries in as little as a few days. For instance, a 25mA load amounts to 0.6Ah discharge per day. Be sure to understand the parasitic loads in your application and set an appropriate charging interval. If the batteries will not be used for extended periods of time, turn them off.*
- ▶ *It is not recommended to use power outlets controlled by switches, peak shaving controllers or that rely solely on non-continuous power sources such as solar or wind generation to charge batteries. Interruption of the charge cycle may prevent the battery from reaching full state of charge or prolong charging times.*

## 7. STORAGE AND SHIPPING

A fully charged TR GC2-48-G can be safely stored in climate controlled conditions for up to one year (12 months) while in sleep mode. It is recommended that the battery state of charge is checked every 4-6 months. Temperatures exceeding 77°F (25°C) will cause the battery to self-discharge faster and will require more frequent checks. Never put the battery into prolonged storage if the state of charge is below 30%.

The following tips will help ensure that your batteries emerge from storage in good condition:

- ▶ Prior to long-term storage of the battery, fully charge the battery. Storing a discharged battery can result in permanent damage or decreased run time.
- ▶ Store in a cool and dry location, protected from the elements.
- ▶ Place the **battery in storage mode** to eliminate potential parasitic loads that may discharge the battery.

Perform the following steps to turn the battery off and place it in storage mode:

- ▶ Press and hold the status button for the entire sequence below.
- ▶ All LEDs will turn on, then successively turn off, starting with the green LED.
- ▶ Once all LEDs are off, release the status button after 2 more seconds.
- ▶ When batteries are taken out of storage they should be given an initial charge prior to use as outlined in Section 6.



**IF YOU SHIP THIS BATTERY, YOU MUST COMPLY WITH STATE, FEDERAL AND INTERNATIONAL LAWS, RULES, REGULATIONS AND REQUIREMENTS REGARDING LITHIUM BATTERIES. YOU MUST UTILIZE A QUALIFIED SHIPPING AGENT PROPERLY CERTIFIED FOR HAZARDOUS MATERIALS (“HAZMAT”) SHIPMENTS.**



## 8. MAXIMIZING THE PERFORMANCE OF YOUR BATTERY

- ▶ Follow all the procedures in this User’s Guide for proper installation, maintenance and storage.
- ▶ If you have any questions or concerns about battery care, please contact Trojan’s technical support engineers at 800-423-6569 Ext. 3045 or +1-562-236-3045 before a problem develops.

## 9. WHAT TO EXPECT FROM YOUR TROJAN LITHIUM-ION BATTERY

- ▶ Your Trojan® GC2 48V Lithium-Ion battery will deliver rated capacity when it is new. No “break-in” period is required.
- ▶ When operating batteries at low temperatures, they will deliver less than the rated capacity.
- ▶ When operating batteries at high temperatures, battery life will be reduced.
- ▶ The life of a battery is difficult to predict and will vary by application, frequency of usage and load characteristics.

# 10. ELECTRICAL SPECIFICATIONS

## 10.1 CHARGING

The charging and discharging current limits in the tables below are for one battery. Installing and electrically connecting batteries in parallel increases the current limits. For example, two batteries connected in parallel effectively doubles the current values in the tables below. Adding more batteries increases the driving range, current, and power capability.

CHARGING INFORMATION	
Recommended Charging Voltage	55.2 to 57.6V
Recommended Float Voltage	55.2V
Charge Voltage Cutoff	58.4V
Peak Charge Current (max.)	75A for 0.5 seconds
Charge Current (max. Continuous) @ Temperature	
< 32°F (0°C)	0A
32°F to 50°F (0°C - 10°C)	10A
50°F to 68°F (10°C - 20°C)	17A
68°F to 113°F (20°C - 45°C)	34A
> 113°F (45°C)	0A

## 10.2 DISCHARGING

DISCHARGING INFORMATION	
Discharge Current (max. continuous)	30A
Discharge Current (time < 30 seconds)	100A
Discharge Current (time < 2 seconds)	155A
Discharge Current (time < 0.2 seconds)	175A

## 10.3 PROTECTION LIMITS: AUTOMATIC DISCONNECTION

As outlined in the following table, Trojan® GC2 48V Lithium-Ion batteries will automatically shut down under excessive use conditions in order to prevent damage to the battery and connected equipment. This will generally result in total loss of power to equipment.

Systems must be implemented and precautions must be taken to ensure that sudden loss of power does not result in hazardous system behavior.





**AS NOTED IN SECTION 2: “SAFETY,” THE SYSTEM INSTALLER/USER ASSUMES ALL RESPONSIBILITY AND LIABILITY FOR ANY DAMAGES THAT MAY OCCUR DUE TO SUDDEN LOSS OF POWER.**

PROTECTIVE SHUTOFF AND RESTART CONDITIONS			
	SHUTOFF	RESTART	OTHER RESTART CONDITIONS
Over Voltage	Any cell voltage > 3.74V Battery voltage > 59.9V	All cell voltages < 3.64V Battery voltage < 58.2V	Load attached and discharging
Low Voltage	Any cell voltage < 2.53V Battery voltage < 40.5V	All cell voltages > 2.63V Battery voltage > 42.1V	Charger attached and charging
Short circuit current	660A instantaneously	No automatic restart	Push and hold the status button to clear red LED
Over Temperature Discharge	140°F (60°C)	131°F (55°C)	
Over Temperature Charge	113°F (45°C)	104°F (40°C)	
Under Temperature Discharge	-4°F (-20°C)	14°F (-10°C)	
Under Temperature Charge	32°F (0°C)	41°F (5°C)	
Automatic Sleep/ Storage Mode	No use for 30 days or 5 days if the battery state of charge is lower than 24%	No automatic restart	Push and hold the status button to manually wakeup the battery

## 11. BATTERY RECYCLING

Trojan® GC2 48V Lithium-Ion batteries are recyclable and should not be disposed of as household or landfill waste. If you need assistance in recycling your battery, contact your dealer or Trojan's technical support engineers as outlined at the front of this manual.

## 12. BATTERY ABBREVIATIONS

A	Ampere	M6/M8	6mm/8mm terminal
Ah	Ampere-hour	SOC	State of Charge
AWG	American Wire Gauge	T	Temperature
°C	Degrees Celsius	V	Volt
DOD	Depth of Discharge	VDC	Volts DC
°F	Degrees Fahrenheit		





# TROJAN BATTERY COMPANY

would like to thank you for selecting our battery. With close to 100 years of experience, Trojan Battery is the world's most trusted name in deep-cycle battery technology backed by our outstanding technical support. We look forward to serving your battery needs.



**TECHNICAL SUPPORT**  
800-423-6569 Ext. 3045 / +1-562-236-3045  
technical@trojanbattery.com



**Do not mix with lead-acid batteries when recycling**

FAILURE TO ABIDE BY THE CARE AND MAINTENANCE REQUIREMENTS OUTLINED HEREIN MAY RESULT IN VOIDING THE WARRANTY, AS APPLICABLE.

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