SPB

Sealed Performance Batteries

The Professionals In Energy Storage

Presented By: Ryan Hammond – SPB Director

SPB
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INVICTA LITHIUM BATTERIES

ACDelco

Energizer

BMPRO

EMS S

FORGE GOLF CART SERIES

ZEAL

SPECTRUM ENERGY STORAGE SOLUTIONS

POWER PS SONIC
TRUSTED AUTOMOTIVE BATTERIES

POWER PS SONIC
TRUSTED BATTERY SOLUTIONS

SUPER PS SPORT

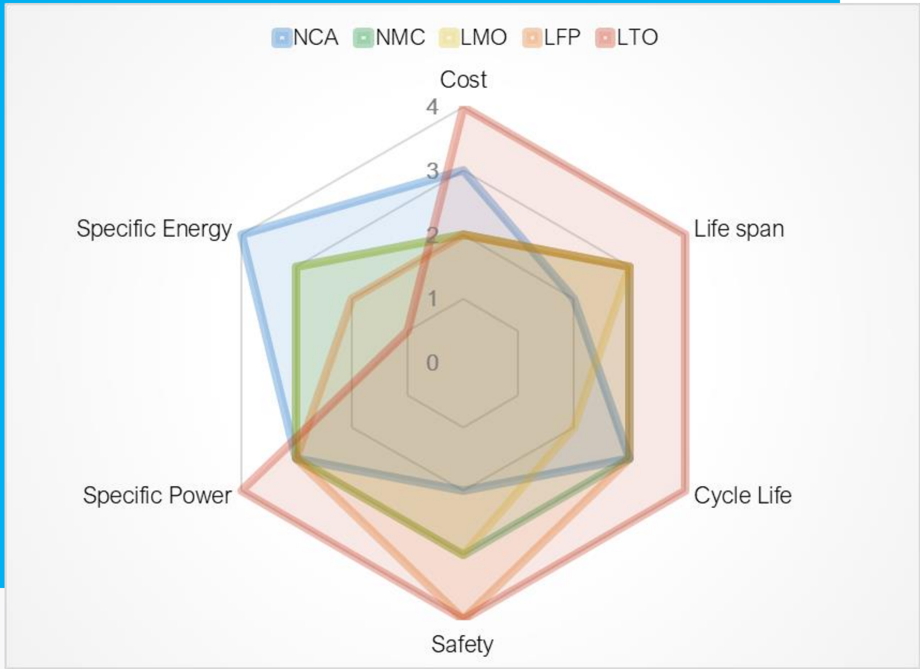
GARO

evesco
ELECTRIC VEHICLE ENERGY STORAGE COMPANY

Different Lithium Ion Chemistries

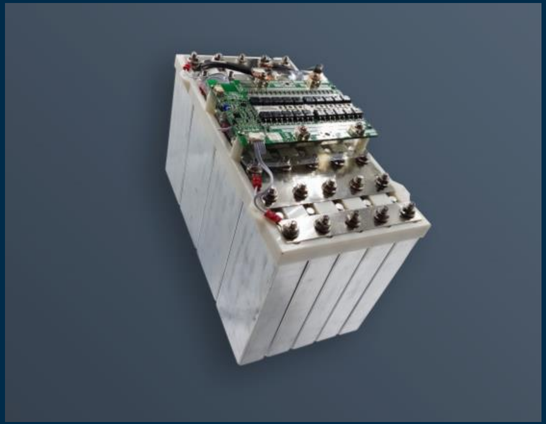
There are a number of Lithium Ion chemistries which come under the "Lithium Ion" umbrella

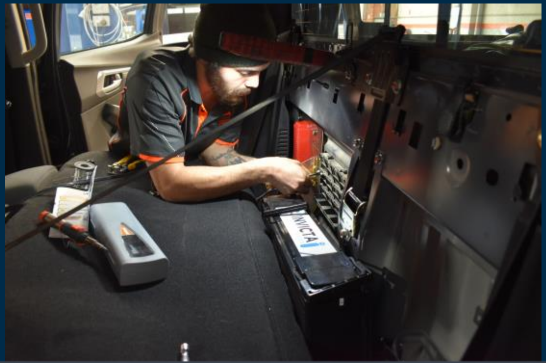
- Nickel Cobalt Aluminium (NCA)
- Nickel Manganese Cobalt (NMC)
- Lithium Titanate (LTO)
- Lithium Iron Phosphate (LiFePO4)
- Lithium Manganese Oxide (LMO)
- Lithium Cobalt Oxide (LCO)



Why Lithium Iron Phosphate (LiFePO4) for SLA replacement?

- Similar voltage to Sealed Lead acid (SLA) (3.2V per cell = 12.8V)
- Good all round performance making it flexible for many applications
- Safe form of Lithium Ion when considering temperature and abuse such as overcharge/discharge, short circuit and penetration
- High thermal runaway point
- Environmentally friendly, phosphate is not hazardous and so is friendly both to the environment and health.
- Slow capacity loss - meaning they can sit for longer without requiring re-fresh charge.
- High cycle life
- Cost effective





Different LiFePO4 Cell Types

Prismatic Cells (SNL Series)

- Mechanically stable
- Space efficient
- Larger capacity
- Smaller number of cells per battery
- Higher cost to manufacture
- Deep cycle applications

Pouch Cells

- Lightweight
- Cost effective
- More susceptible to high humidity
- Not as mechanically stable
- Swelling of pouches need to be considered in battery design.
- High-rate discharge applications

Cylindrical Cells

- Higher specific energy (designed for EV)
- Good mechanical stability
- Low cost to manufacture
- High redundancy in larger packs
- Inefficient use of space
- Due to higher numbers of cells BMS can be more complex
- EV Ap

Battery Management System (BMS/PCM)

Lithium Ion batteries require a BMS for safety and to protect the cells from damage. The BMS protect the batteries from a number of potentially damaging and unsafe scenarios such as

- Over / under temperature
- Over charge/discharge – voltage
- Overcurrent
- Short circuit

- The BMS is configurable and so the protection parameters across the above do vary between suppliers
- A BMS is <u>not a charge controller</u>, the correct charger is still required to charge these batteries correctly

LiFePO4 vs AGM

- **Less than half the weight of SLA**
  - Good for controlling your total GVM
- **Flat discharge curve**
  - Holds terminal voltage for longer during discharge
  - Efficient use of available capacity
- **Greater number of cycles**
  - Lower total cost of ownership
  - Longer life expectancy longer
- **Greater use of available capacity** – up to 100%
- **Reduced charge time**
  - Can be charged at higher rates
  - Back to 100% quicker and less driving or Solar charge time
- **Longer shelf life**
  - Twice that of Sealed lead acid battery

Certification - IEC62619 vs IEC62133

Portable vs Industrial

Test items			Test unit	
Category	**Test**		**Cell** (see Note 1)	**Battery system** (see Note 2)
Product safety test (safety of cell and battery system)	7.2.1 External short-circuit test		R	-
	7.2.2 Impact test		R (see Note 3)	-
	7.2.3 Drop test		R	R
	7.2.4 Thermal abuse test		R	-
	7.2.5 Overcharge test		R (see Note 4)	-
	7.2.6 Forced discharge test		R	-
	7.3 Consideration of internal short circuit (select one from the two options)	7.3.2 Internal short-circuit test	R*	-
		7.3.3 Propagation test	-	R
Functional safety test (safety of battery system)	8.2.2 Overcharge control of voltage		-	R
	8.2.3 Overcharge control of current		-	R
	8.2.4 Overheating control		-	R

"R" = required (minimum of 1)

"R*" = required. As for the sample number, refer to IEC 62133:2012, 8.3.9.

"-" = unnecessary or not applicable

NOTE 1 The manufacturer can use "cell block(s)" instead of "cell(s)" at any test that specifies "cell(s)" as the test unit in this document. The manufacturer clearly declares the test unit for each test.

NOTE 2 If a battery system is divided into smaller units, the unit can be tested as representative of the battery system. The manufacturer can add functions which are present in the final battery system to the tested unit. The manufacturer clearly declares the tested unit.

NOTE 3 Cylindrical cell or cell block: 1 direction, prismatic cell or cell block: 2 directions.

NOTE 4 The test is performed with those battery systems that are provided with only a single control or protection for charging voltage control.

Test		Cell [a, d]	Battery
7.2.1	Continuous charge	5	–
7.2.2	Case stress	–	3
7.3.1	External short-circuit	5 per temperature	–
7.3.2	External short-circuit	–	5
7.3.3	Free fall	3	3
7.3.4	Thermal abuse	5 per temperature	–
7.3.5	Crush	5 per temperature	–
7.3.6	Overcharge	–	5
7.3.7	Forced discharge	5	–
7.3.8	Mechanical – 7.3.8.1 Vibration – 7.3.8.2 Mechanical shock	–	 3 3
7.3.9	Forced internal short [b, c]	5 per temperature	–
D.2	Measurement of the internal AC resistance for coin cells	3	–

[a] Excludes coin cells with an internal resistance greater than 3 Ω.

[b] Country specific test: only required for listed countries.

[c] Not applicable to coin and lithium ion polymer cells.

[d] For tests requiring charge procedure of 7.1.2 (procedure 2): 5 cells per temperature are tested

UN38 - Overview

Section 38 - Classification Procedures, test methods and criteria relating to Class 9.

Section 38.3 – Lithium metal and Lithium Ion Batteries

- T1-T5 (Same Samples, Tested in Order, All Types)

    T1: Altitude Simulation

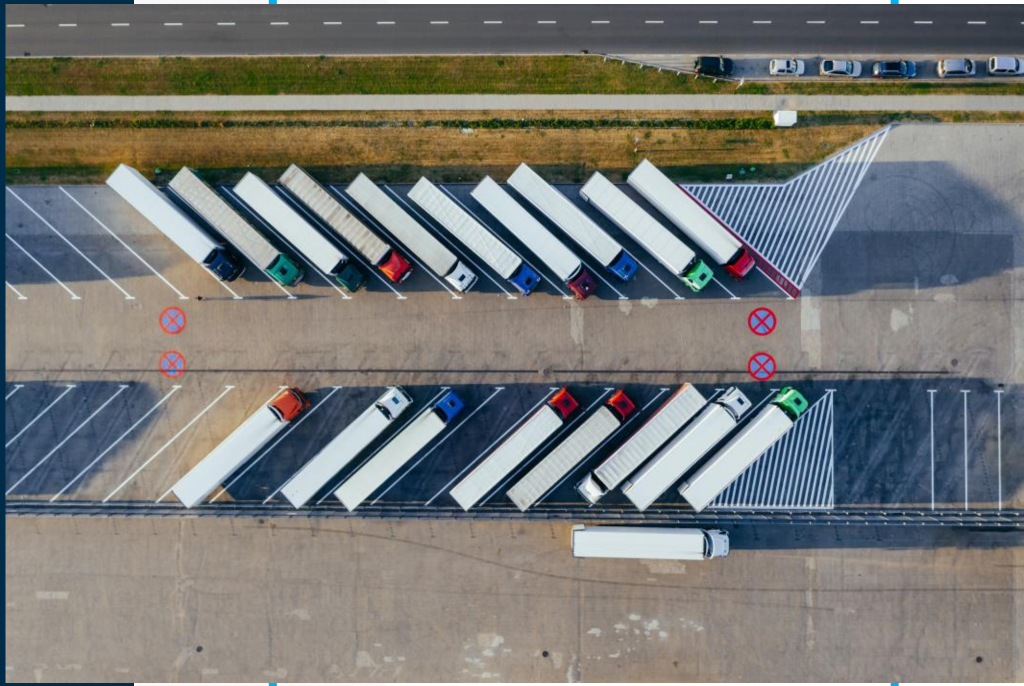
    T2: Thermal Test

    T3: Vibration

    T4: Shock

    T5: External Short Circuit

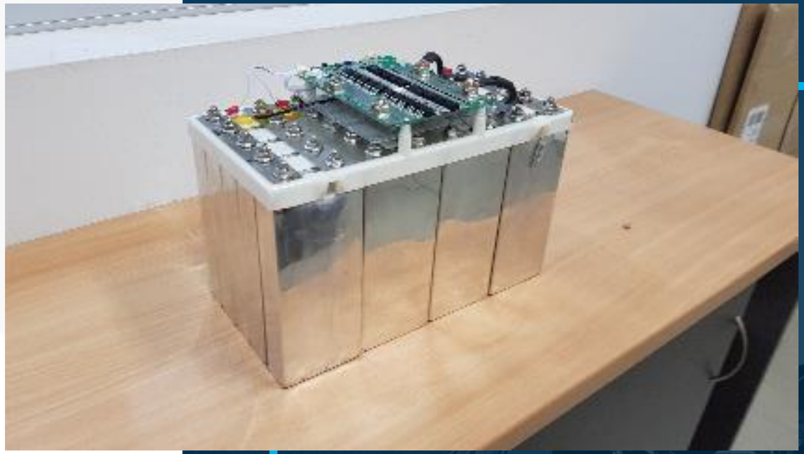
- T6: Impact/Crush (Primary and Secondary Cells Only)
- T7: Overcharge (Secondary Batteries Only)
- T8: Forced Discharge (Primary and Secondary Cells Only)
- No leakage, venting, disassembling, rupture and no fire



Not All Lithium Are Created Equal

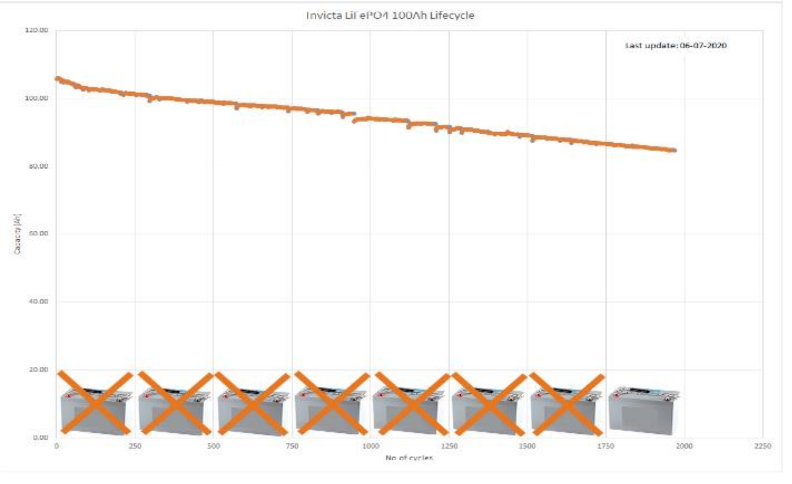
Its What's Inside that Counts

- Construction
  - Mechanically strong aluminium prismatic cells
  - Cell connection bolted plates for added
  - Strength – no welding
  - Further strength frame around all cells
  - Strongly secured, offset BMS mounting
- Cell Quality
  - "A" grade Cells, specifically designed for your applications (not just Evs)



What To Look For

- Certification
  - IEC62619 @ battery level
  - Independent cycle life testing
  - RCM
  - UN38.3
- Warranty
  - At least 5 years



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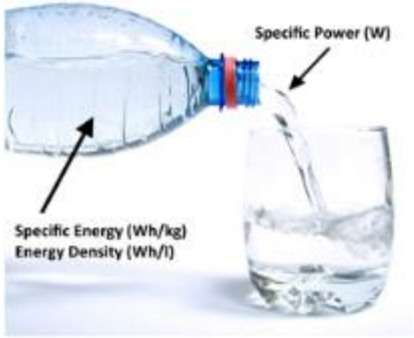
Battery / Inverter Matching

Power & Energy & Capacity

- Power (Watts) = 12.8V (Volts) x 100A *(max cont. discharge) = 1280W*
- Energy (Wh) = 12.8 (Power) x 125Ah (Time/*Capacity) = 1600Wh*

AC Output	Continuous power	2000W
	Surge power	4000W
	Max Constant Power Start	2400W for 10 seconds
	Output Wave form	Pure Sine Wave(THD<3%)
	Output Frdquency	50Hz±3Hz
	Voltage	240VAC
DC Input	DC Input Voltage	12VDC
	Voltage Range	10V-15V
	Low Voltage Alarm	10.5V±0.5V
	Low Voltage Shut down	10V±0.5V
	Over Voltage Shut down	15V±0.5V

Nominal Voltage	12.8v
Nominal Capacity (25ºC, 0.33C)	100Ah
Terminal	M8
Length (mm)	551 ± 2mm
Width (mm)	109 ± 2mm
Height (mm)	239 ± 2mm
Weight	12.4kg
Max Charge Voltage	14.6 ± 0.1V
Standby	13.8 ± 0.1V
Cut off Voltage	10V
Max. Discharge Current	100A
Max. Pulse Discharge Current (3 Sec)	250A
Max. Charge Current	60A
Recommended Current Charge	≤ 50A



Battery / Inverter Matching

Power

- It's important to use a specification sheet to find the right inverter size
- Max Discharge x Nominal Voltage (200BT)
- 180A x 12.8V = 2304W
  - (2000W inverter OK. / 3000W inverter NOT ok)

- Tip** Inverter inrush can be up to 5 x max power rating depending on brand

AC Output	Continuous power	2000W
	Surge power	4000W
	Max Constant Power Start	2400W for 10 seconds
	Output Wave form	Pure Sine Wave(THD<3%)
	Output Frdquency	50Hz±3Hz
	Voltage	240VAC

SNL12V200BT

Nominal Voltage	12.8v
Nominal Capacity (25ºC, 0.33C)	200Ah
Terminal	M8
Length (mm)	483 ± 2mm
Width (mm)	170 ± 2mm
Height (mm)	241 ± 2mm
Weight	24.2kg
Max Charge Voltage	14.6 ± 0.1V
Standby	13.8 ± 0.1V
Cut off Voltage	10V
Max. Discharge Current	180A
Max. Pulse Discharge Current (3 Sec)	450A
Max. Charge Current	150A
Recommended Current Charge	≤ 100A

SNLFT12V100BT

Nominal Voltage	12.8v
Nominal Capacity (25ºC, 0.33C)	100Ah
Terminal	M8
Length (mm)	551 ± 2mm
Width (mm)	109 ± 2mm
Height (mm)	239 ± 2mm
Weight	12.4kg
Max Charge Voltage	14.6 ± 0.1V
Standby	13.8 ± 0.1V
Cut off Voltage	10V
Max. Discharge Current	100A
Max. Pulse Discharge Current (3 Sec)	250A
Max. Charge Current	60A
Recommended Current Charge	≤ 50A

Battery/Application Matching

Capacity-Runtime

- How long can the battery provide power for (capacity).
- This calculation is based on the load of your system and how long you want it to run = Capacity/load = 1280 / 684 = 1.8 days runtime (without charge)
- Extended runtime (60%+) from LiFePO4 due to
  - Greater DoD (100%)
  - Flat discharge curve
  - Reduced weight

Appliance (12V)	Amps (Ah)	Runtime (Hr)	Watts Used/pDay (Ah x V x Hr)
Lights	1	8	96
Fridge	5	7	420
Laptop Charging	2	7	168
Total			684
Battery (12.8V)	100	1.8 Days	1280
Total Remaining			596

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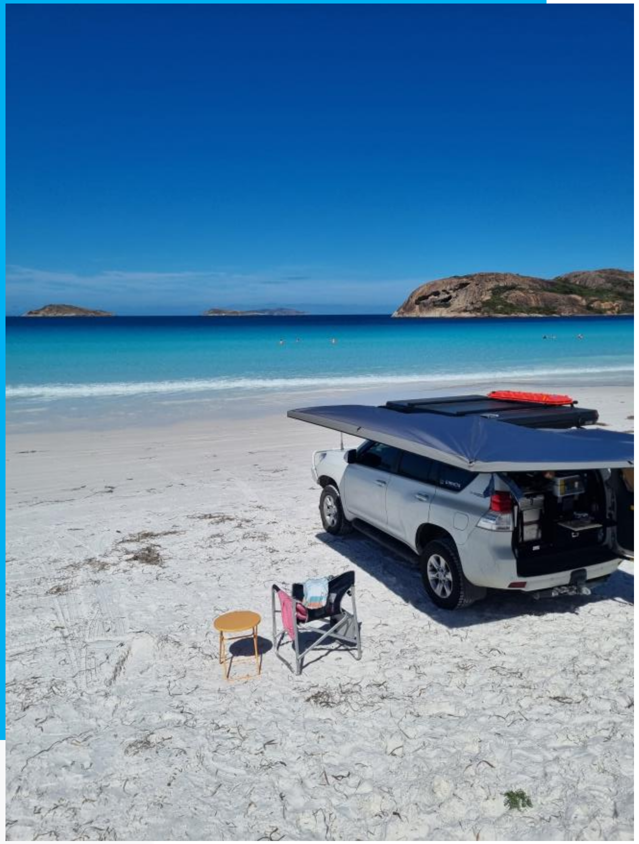
Battery/Application Matching

Capacity-Runtime

- Power vs Capacity (Energy)
- Now what if you add a coffee machine?
    - Total Existing Load 684W/day
    - *Coffee Pod Machine 365W/day (1450W, only takes 3mins)*
    - New Total 1049W/day

    - So still 100Ah (1280Wh) battery is still O.K capacity wise with over 1-day runtime
    - However – 1450W @ 12.8V = 113A for 3 mins.
    - Including other loads – this MAY be too much power for a 100Ah battery with 100A max



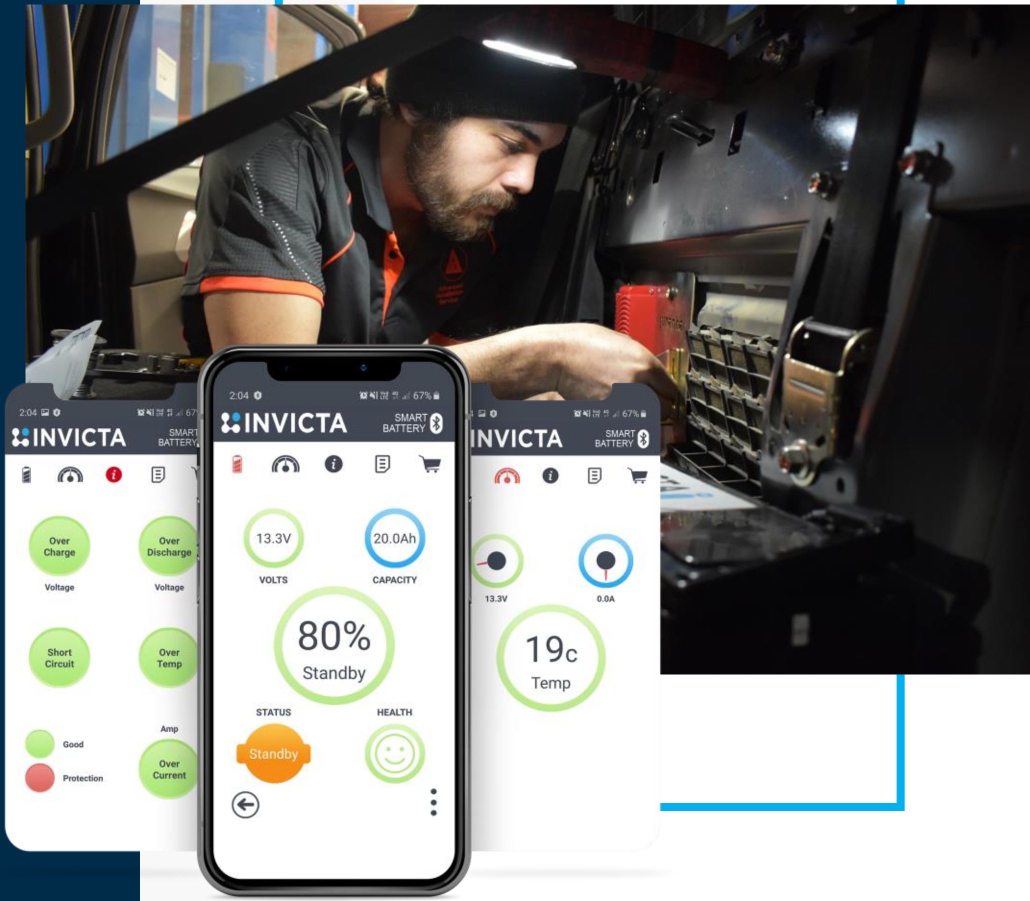
Quick Battery Troubleshoot

It's Not Always The Battery's Fault

- 9/10 Cases we see, the battery is not faulty
- Check the Bluetooth – are there any protections in place?
- Remove the battery from the system to eliminate system problems
- Is the correct charger being used (14.5V +/- 0.1V) with Lithium profile
- Use a charger with a lithium profile and wake-up function
- Do a complete discharge and charge while checking the Bluetooth
- If you're still unsure – give us a call

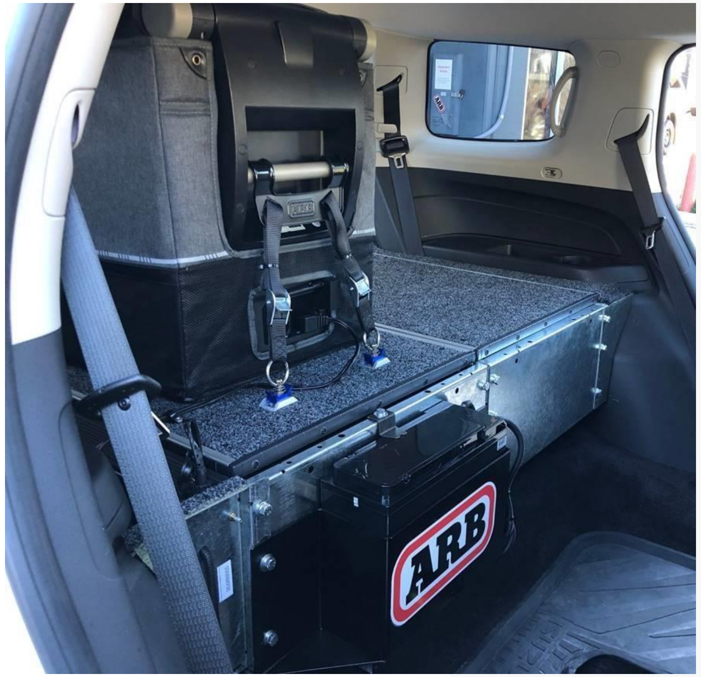
Common System Problems We See

- Inverter is too big or failed
- DC-DC charger has failed or installed incorrectly
- Incorrect charger being used
- Short circuit in the system
- Expected vs actual run time – the difference between a fridge with an average 1Ah current and 3Ah current is 48hrs runtime



Lithium (LiFePO4)

Dual Battery Systems



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