

## 12 VDC

### BATTERIES

#### TYPES:

1. LIQUID LEAD – consists of a plastic container with cells molded into it. Each cell will feature a grid of lead plates along with an electrolyte based on sulphuric acid.
2. AGM (Absorbed Glass Mat) – are just like flooded batteries, except the electrolyte is being held in the glass mats, as opposed to freely flooding the plates. Very thin glass fibers are woven into a mat to increase the surface area enough to hold sufficient electrolyte on the cells for their lifetime.
3. Gel Cell – has gelified electrolyte.

### BATTERY BANKS

**Parallel battery wiring is where two or more batteries are hooked together in parallel (i.e. both/all positive battery terminals are wired together, and both/all negative battery terminals are wired together. This results in a battery voltage which is the same as that of the individual batteries (typically 12V in most cars). The reason for doing this is to boost battery capacity- two identical batteries wired in parallel give twice the electrical storage capacity of one battery. No increase in voltage is obtained with parallel wiring.**

**Series wiring is where two or more batteries are hooked together in series (i.e. positive terminal of the first battery is hooked to the negative terminal of the second battery). The resulting voltage is the sum of the individual battery voltages - if two 6V batteries are hooked together, the resulting voltage will be 12V. No increase of storage capacity is obtained with series wiring.**

Read more: [http://wiki.answers.com/Q/What\\_is\\_parallel\\_car\\_battery\\_wiring#ixzz1DU8i8icg](http://wiki.answers.com/Q/What_is_parallel_car_battery_wiring#ixzz1DU8i8icg)

**In situations where multiple batteries are connected in series, parallel or series/parallel, replacement batteries should be the same size, type and manufacturer (if possible). Age and usage level should be the same as the companion batteries.**

# What are the most common causes of premature battery failures?

- A. Deep discharges
- B. Misapplication
- C. Using an undersized battery overcharging
- D. Loss of electrolyte due to heat or
- E. Corrosion
- F. Freezing (any fully-charged vehicle battery will not freeze until the temperature is -75 degrees F. Frozen batteries are not warrantable.)
- G. Failure to charge a battery during a period of 6 months or more

## BATTERY MAINTENANCE

This is a VERY important issue and is often overlooked by many RV technicians and/or owners.

1. Batteries should be cleaned with a baking soda and water solution. (Couple of tablespoons to a pint of water)
2. Cable connections need to be cleaned and tightened. (Many battery and/or voltage problems are often caused by dirty and loose connections).
3. Serviceable batteries need to have their fluid levels checked. (Use only distilled water. Make sure to not overfill. This may result in acid overflow, and cause customers to think that their batteries are overcharging)

**NOTE:** To prevent corrosion, coat connections with high temperature grease. Most people do not know that just the gases from the battery that condensate on metal parts cause most corrosion.

As batteries age their maintenance requirements change. This means longer charging time and/or higher finish rate (higher amperage at the end of the charge). Usually older batteries need to be watered more often. And, their capacity decreases.

Inactivity can be extremely harmful to all lead acid batteries.

## **Battery Safety and Handling Guidelines**

Whenever you're handling or working with a lead-acid battery, consult your vehicle and battery owners' manual for instructions and safety precautions.

Lead-acid batteries contain hydrogen-oxygen gases that can be explosive and sulfuric acid that can cause severe burns.

To help avoid risk of danger and injury, observe these precautions when handling or working with a lead-acid battery:

- **Wear ANSI\*** approved safety glasses or goggles and a face shield.
- **Wear proper clothing** to protect your face, hands and body.
- **Make sure work area is well-ventilated.**
- **Never lean over battery while boosting, testing or charging.**
- **Cigarettes, flames or sparks could cause a battery to explode. Keep all ignition sources away from the battery.**
- **Always shield eyes and face from battery.**
- **Do not charge or use booster cables or adjust post connections without proper instructions and training.**
- **KEEP VENT CAPS TIGHT AND LEVEL.**
- **In event of accident, flush with water and call a physician immediately.**
- **KEEP OUT OF REACH OF CHILDREN.**

\*ANSI – American National Standards Institute

## **State of Charge**

### **Here are no-load typical voltages vs. state of charge**

(Figured at 10.5 volts = fully discharged, and 77 degrees F). Voltages are for a 12 volt battery system. VPC is the volts per individual cell - if you measure more than a .2 volt difference between each cell, you need to equalize, or your batteries are going bad, or they may be sulfated. These voltages are for batteries that have been at rest for 3 hours or more. Batteries that are being charged will be higher - the voltages while under charge will not tell you anything, you have to let the battery sit for a while. For longest life, batteries should stay in the green zone. Occasional dips into the yellow are not harmful, but continual discharges to those levels will shorten battery life considerably. It is important to

realize that ***voltage measurements are only approximate***. The best determination is to measure the specific gravity, but in many batteries this is difficult or impossible. Note the large voltage drop in the last 10%.

State of Charge	12 Volt battery	Volts per Cell
100%	12.7	2.12
90%	12.5	2.08
80%	12.42	2.07
70%	12.32	2.05
60%	12.20	2.03
50%	12.06	2.01
40%	11.9	1.98
30%	11.75	1.96
20%	11.58	1.93
10%	11.31	1.89
0	10.5	1.75

### Why 10.5 Volts?

Throughout this FAQ, we have stated that a battery is considered dead at 10.5 volts. The answer is related to the internal chemistry of batteries - at around 10.5 volts, the specific gravity of the acid in the battery gets so low that there is very little left that can do. In a dead battery, the specific gravity can fall below 1.1. Some actual testing was done recently on a battery by one of our solar forum posters, and these are his results:

*I just tested a 225 ahr deep cycle battery that is in good working order.  
I put a load on it 30a for 4 hrs it dropped its voltage to 11.2  
I then let it cool down for 2 hrs*

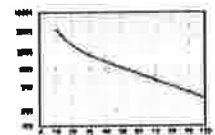
*then put the load back on again in 1hr 42 mins it dropped to 10.3v  
35 mins under 30a load 9.1v (273w)  
10 mins later max output current 11.6a 8.5v (98.6w)  
5 mins later max output current 5.2 amps 7.9v (41w)  
3 mins later 7.6v and 2.3a (17.5w)*

*This shows after it gets below 10.3 v you only have 35 mins of anything  
useful available from the battery.  
battery is now dead and most likely will not fully recover*

## Cycles vs. Life

A battery "cycle" is one complete discharge and recharge cycle. It is usually considered to be discharging from 100% to 20%, and then back to 100%. However, there are often ratings for other depth of discharge cycles. The most common ones are 10%, 20%, and 50%. You have to be careful when looking at ratings that list how many cycles a battery is rated for unless it also states how far down it is being discharged. For example, one of the widely advertised telephone type (float service) batteries have been advertised as having a 20-year life. If you look at the fine print, it has that rating only at 5% DOD - it is much less when used in an application where they are cycled deeper on a regular basis. Those same batteries are rated at less than 5 years if cycled to 50%. For example, most golf cart batteries are rated for about 550 cycles to 50% discharge - which equates to about 2 years.

Battery life is directly related to how **deep** the battery is cycled each time. If a battery is discharged to 50% every day, it will last about twice as long as if it is cycled to 80% DOD. If cycled only 10% DOD, it will last about 5 times as long as one cycled to 50%. Obviously, there are some practical limitations on this - you don't usually want to have a 5 ton pile of batteries sitting there just to reduce the DOD. The most practical number to use is 50% DOD on a regular basis. This does NOT mean you cannot go to 80% once in a



while. It's just that when designing a system when you have some idea of the loads, you should figure on an **average** DOD of around 50% for the best storage vs cost factor. Also, there is an upper limit - a battery that is continually cycled 5% or less will usually not last as long as one cycled down 10%. This happens because at very shallow cycles, the Lead Dioxide tends to build up in clumps on the the positive plates rather in an even film. The graph above shows how lifespan is affected by depth of discharge. The chart is for a Concorde Lifeline battery, but all lead-acid batteries will be similar in the shape of the curve, although the number of cycles will vary.

### Lifespan of Batteries

**The lifespan of a deep cycle battery will vary considerably with how it is used, how it is maintained and charged, temperature, and other factors. In extreme cases, it can vary to extremes**

### Amp-Hour Capacity

All deep cycle batteries are rated in amp-hours. An amp-hour is one amp for one hour, or 10 amps for 1/10 of an hour and so forth. It is **amps x hours**. If you have something that pulls 20 amps, and you use it for 20 minutes, then the amp-hours used would be 20 (amps) x .333 (hours), or 6.67 AH. The generally accepted AH rating time period for batteries used in solar electric and backup power systems (and for nearly all deep cycle batteries) is the "**20 hour rate**". This means that it is discharged down to 10.5 volts over a 20 hour period while the total actual amp-hours it supplies is measured. Sometimes ratings at the **6 hour rate** and **100 hour rate** are also given for comparison and for different applications. Sometimes the 100 hour rate is given just to make the battery look better than it really is, but it is also useful for figuring battery capacity for long-term backup amp-hour requirements.

This means that the faster a battery is used (discharged), the **LOWER**, the AH capacity. Conversely, if it is drained slower, the AH capacity is higher.

("State of Charge", "Why 10.5 volts?", and "Cycles of Life", "Lifespan of Batteries", "Amp-hour Capacity", info was provided by Northern Arizona Wind and Sun)

## ISOLATING COACH AND CHASSIS BATTERY BANKS

In the past and present Newmar has used 2 different isolators:

Prior to 2009 the B.I.R.D. (bi-directional isolator relay delay-diesel 2) was used. It is manufactured by Intelletic.

After 2009 the B.I.M.(battery isolation manager) is being used. It is manufactured by Precision Circuits Inc.

See following pages/handouts by manufacturers for detailed specs and operation.

## BATTERY DISCONNECT

Newmar uses Intellitec's disconnect relay (Newmar P/N – 52989) on the coach battery bank to disconnect loads in case of storage **(see additional pages from manufacturer for function and diagnostics)**. Keep in mind that not all loads are disconnected. There some loads (radio memory, entry steps, LP detectors, etc.) that are connected to the "hot" side of the disconnect relay. This is very important to remember when a coach is put into storage and is not plugged into shore power.

NOTE: when an older coach is being stored, and is plugged into shore power....DO NOT use the "battery disconnect". If the "battery disconnect" is used, the chassis batteries will not receive a charge from the converter. This is due to the coach battery sense wire being "disconnected", meaning the B.I.M. or the B.I.R.D. will not engage.



## THINGS TO REMEMBER

- There are too many variables that come into play when dealing with the lifespan of a battery.
- There is only 1 “usable” volt in a 12 VDC system
- D.O.D.** = Depth-Of-Discharge: The percent of rated capacity to which a cell or battery is discharged. It is the reciprocal of a battery’s state of charge. Example: a battery that has a depth of discharge of 45% has a state of charge of 55%.
- S.O.C.** = State Of Charge. (The condition of a battery in terms of rated capacity remaining at a given point in time.)
- Ampere** (amp) = a unit that defines the rate of flow of electricity (current) in a circuit.
- **VDC** = volts direct current
- VPC** = volts per individual cell (approx. 2.10 vdc)
- AH** = amp hours: The unit of measure for a battery’s electrical storage capacity, obtained by multiplying the current in amps by the time in hours of discharge.
- RC** = Reserve Capacity. BCI(Battery Council International) defines it as “the number of minutes a new; fully-charged battery at 80°F (27°C) can be discharged at 25 amps and maintain a voltage equal to or higher than 1.75 volts per cell” (i.e., 10.5 volts for a 12-volt battery). This rating represents the time the battery will continue to operate essential accessories in the event of a charging system failure.
- OCV** = Open-Circuit Voltage: The no-load voltage of a cell or battery measured with a voltmeter.
- CCV** = Closed-Circuit Voltage: The voltage of a battery when the cell or battery is under a specific discharge load and time interval.





# EVGC6A-A

## Absorbed Glass Mat VRLA Industrial Battery Block

Discover® Clean & Green™ Series EV Traction Dry Cell Industrial Batteries provide superior high integrity and reliability for environmentally sensitive areas, commercial, industrial and private applications. The maintenance-free, valve regulated lead acid (VRLA) construction makes Discover® EV Traction Batteries the definitive choice for Mobility and Home Medical Equipment (HME); Broadband and Cable TV (CATV); Uninterruptible Power Supplies (UPS); Telecommunication; Photovoltaic, Solar and Renewable Energy Storage; Electronic and Security; Marine and RV; Golf and Electric Vehicle; Aerial Lifts and Fork Lifts; Floor Machines and Robotics.

### Features & Benefits

### EV Traction Dry Cell

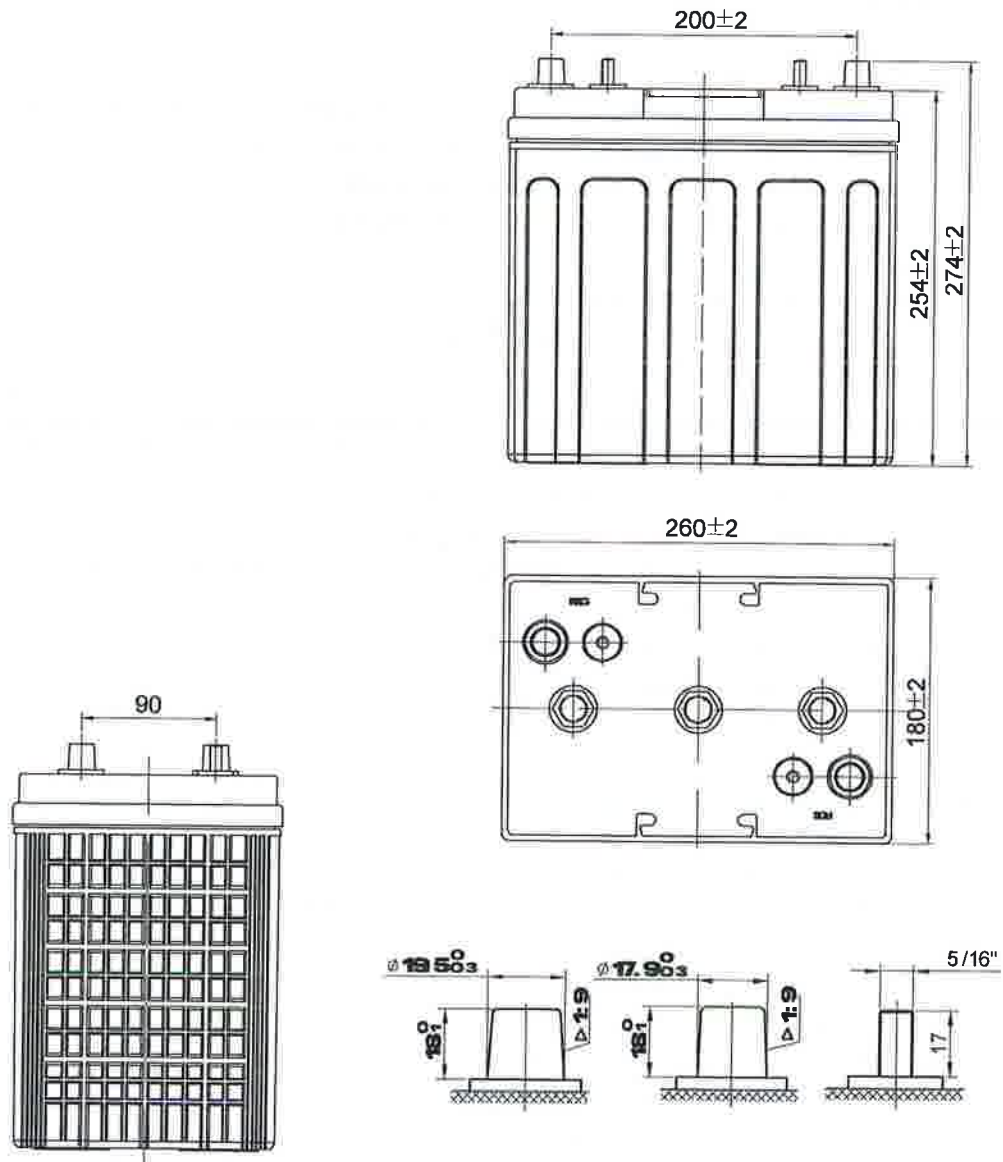
- Completely sealed valve regulated construction.
- Flame arresting pressure regulated safety sealing valves for safety, operating pressure management and protection against atmospheric contamination (excess oxygen being absorbed by negative plates).
- Computer-aided 99.994% pure heavy-duty lead calcium grid designs.
- Tank formed plates guarantees evenly formed and capacity matched plates.
- Discover® proprietary Vision Max® Paste Formula.
- Anchored plate groups to guard against vibration.
- Double insulating Micro porous glass fiber separators.
- Measured and Immobilized electrolyte.
- Vacuum filling and weighing processes.
- Advanced technology for efficient gas recombination of up to 99.9% and freedom from electrolyte maintenance.
- Wide range of operating temperatures (-40°C to 60°C).
- Low self discharge rates (Approx. 1%-3% monthly at 20 °C-25°C / 68°F-77°F).
- High impact reinforced strength copolymer polypropylene cases and flat top designed covers that are rugged and vibration resistant.
- Thermally welded case to cover bonds that eliminate leakage.
- Copper and stainless steel alloy terminals and hardware.
- Multi-terminal options.
- Terminal protectors.
- Removable carry handles.
- Industry leading size and performance options.
- Classified as "NON-SPILLABLE BATTERY" Not restricted for Air (IATA/ICAO) Provision 67, Surface (DOT-CFR-HMR49) or Water (Classified as non-hazardous per IMDG amendment 27) transportation.
- Can be used in multiple orientations (upside down is not recommended).
- Compatible with sensitive electronic equipment.
- Quality Assurance processes with ISO (4400/992579), QS and TUV Certification EMC tested, CE, ETTS Germany (G4M19906-9202-E-16). UL recognized and approved components (MH29050).
- Telcordia and Bellcore compliant.



Complies with DOT provisions listed in 49CFR173.159 (d). Special provision A57

## Mechanical Characteristics

Industry Type No.	Volts	Standard (optional) Terminals	Dimensions in Inches (mm)				Approx. Weight in Lbs (Kgs)
			L in(mm)	W in(mm)	H in(mm)	TH in(mm)	
GC6	6	AM	10.2 (260)	7.1 (180)	10 (254)	10.8 (274)	69.2(31.4)





# EVGC6A-A

## Electrical Specifications

Ampere Hour Capacity			Minutes of Discharge					R/C	Cranking Amps	
20HR	10HR	5HR	@25A	@56A	@75A	@85A	@100A	@25A	32°F/ 0°C	0°F/ -18°C
* - Performance averages after 25 cycles										
213	198	185	475	182	124	104	79	404	1000	750

Constant current discharge ratings-amperes at 20°C(68°F)

End Point Volts/Cell	5min	10min	15min	30min	45min	1h	3h	5h	10h
1.60V	--	--	--	--	148	122	57.4	38	20.4
1.65V	--	--	--	--	145	121	56.9	37.7	20.2
1.70V	--	--	--	--	142	119	56.3	37.4	20.0
1.75V	--	--	--	--	139	117	55.7	37.0	19.8
1.80V	--	--	--	--	136	115	55.1	36.6	19.6

Constant power discharge ratings-watts per cell at 20°C(68°F)

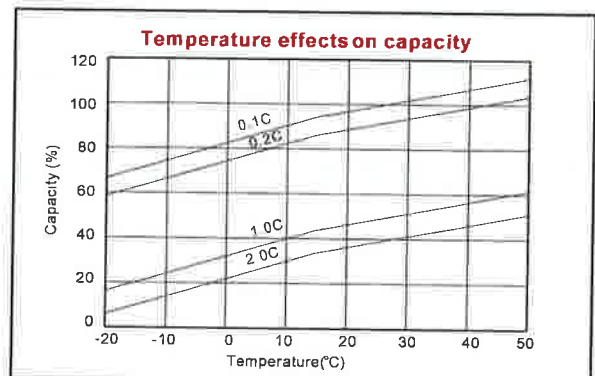
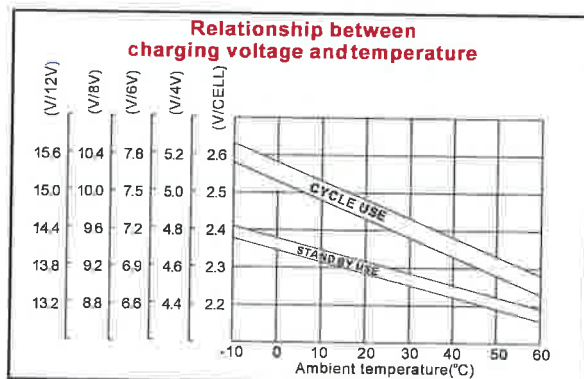
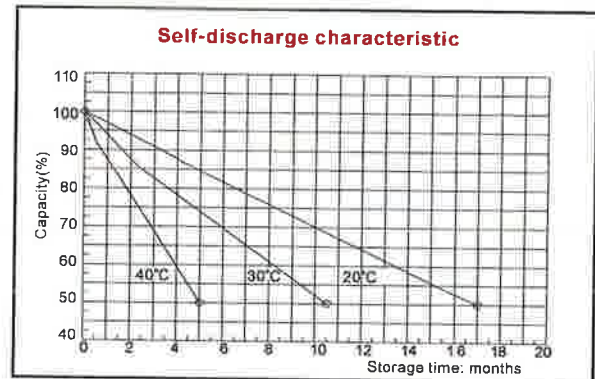
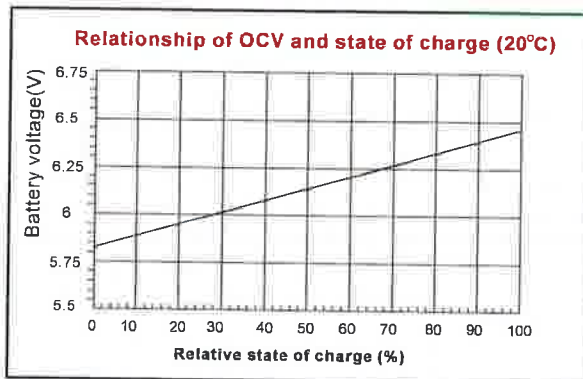
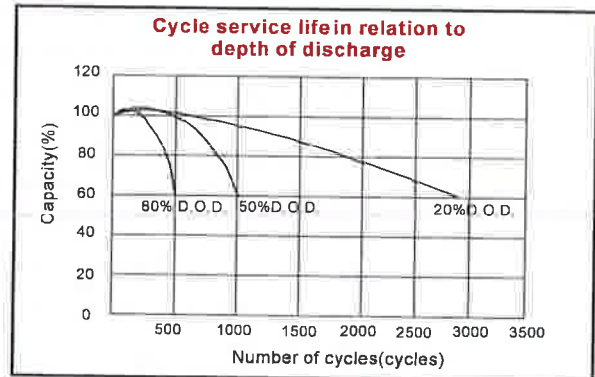
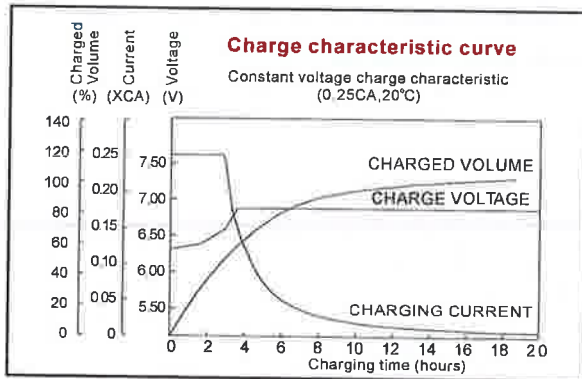
End Point Volts/Cell	5min	10min	15min	30min	45min	1h	2h	3h	5h
1.60V	--	--	--	--	289	241	146	105	64.9
1.65V	--	--	--	--	285	238	145	104	64.4
1.70V	--	--	--	--	281	235	144	103	63.9
1.75V	--	--	--	--	276	232	142	102	63.4
1.80V	--	--	--	--	271	228	140	101	62.9

Internal resistance	Fully charged at 20°C: 2.6 mOhms		
Self discharge	<3% of capacity per month at 20°C		
Operating temperature range	Discharge	Charge	Storage
	-20~60°C	-10~50°C	-20~60°C
Short circuit current (20°C)	2300A		

CHARGE METHODS: Constant voltage charge at 20°C(68°F)	Charge voltage	Temperature compensation	Maximum Current	Peak 5 seconds	Peak 10 seconds	Maximum continuous	Recommended maximum continuous
Standby use	6.8-6.9V	-10mV/°C	Maximum charge current	1C10A	0.75C10A	0.5C10A	0.3C10A
Cyclic use	7.2-7.35V	-15mV/°C	Maximum discharge current	2C10A	1.5C10A	1C10A	0.5C10A

Contact Discover Engineering for OEM specific charging algorithms!

## Charge / Discharge Tables & Graphs



# Bi-Directional Isolator Relay Delay-Diesel 2

Intellitec's **Bi-Directional Isolator Relay Delay-Diesel 2™** offers a new approach to charging batteries in an vehicle which uses a diesel engine with up to a 200 Amp alternator. Adding a small dash-mounted switch will allow emergency starts of diesel engines, requiring up to 1200 Amps of starter current. Unlike prior systems that only allowed charging the auxiliary battery from the engine's alternator, the **Bi-Directional Isolator Relay Delay-Diesel 2™** charges *both* batteries when *either* one is being charged. When the vehicle is being driven, *both* batteries will be charged from the engine's alternator. When the vehicle is plugged into shore power, *both* batteries will be charged from the converter or battery charger. If neither battery is being charged, the batteries are fully isolated. The controller also senses heavy loads on either battery to prevent the wrong battery from being inadvertently discharged.

The unit is housed in a plastic enclosure for mounting in an engine compartment, out of direct water spray. To connect the two batteries together under proper conditions, it operates in combination with an intermittent duty solenoid, similar to ones used as diesel starter solenoids. In order to use this type solenoid for continuous duty, the controller will engage it with full voltage and then reduce the coil voltage to approximately 4 volts to hold it in.



P/N 00-00839-000

It operates by sensing the voltages on both batteries. When either of these voltages exceeds 13.1 volts for approximately 2-½ minutes, which happens when either battery is being charged, the control will close the isolator solenoid, connecting the two batteries together, charging them both. (Normal charging voltages are from approximately 13.8 to 14.4 volts.)

After the solenoid has been closed, the system continues to sense the voltage. If the ignition switch is off and the battery voltage drops below 12.5 volts for approximately 1 minute, the solenoid is opened to prevent the chassis battery from being discharged by the auxiliary loads. This might occur when the converter is heavily loaded.

If the ignition switch is on, the control allows the voltage to drop below 12.0 volts for approximately 1 minute, before the solenoid is opened to insure the alternator's full output is available for important chassis functions.



**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408  
FAX 630.916.7890

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

P/N 53-00839-100 Rev. 072005

*Intelligent Use of Technology*



# Bi-Directional Isolator Relay Delay-Diesel 2

## How Does It Work?

The **Bi-Directional Isolator Relay Delay-Diesel 2™** constantly senses the voltage on the auxiliary and chassis batteries. If either voltage is above 13.1 volts, which indicates the batteries are being charged, the control closes the isolator relay. This parallels the batteries, charging them both. If the ignition is **off** and the voltage falls below 12.5 volts for approximately 1 minute, the relay will open to prevent the auxiliary loads from discharging the chassis battery. When the voltage goes back above 13.1 volts, the relay will close again.

If the ignition is **on** and the voltage falls below 12.0 volts for approximately 1 minute, the relay will open to prevent the auxiliary loads from over-loading the alternator and discharging the chassis battery. When the voltage on the chassis goes back above 13.1 volts, the relay will close again. Allowing the batteries to stay connected together to a lower voltage helps charge a heavily discharged auxiliary battery more quickly with the varying output of the alternator.

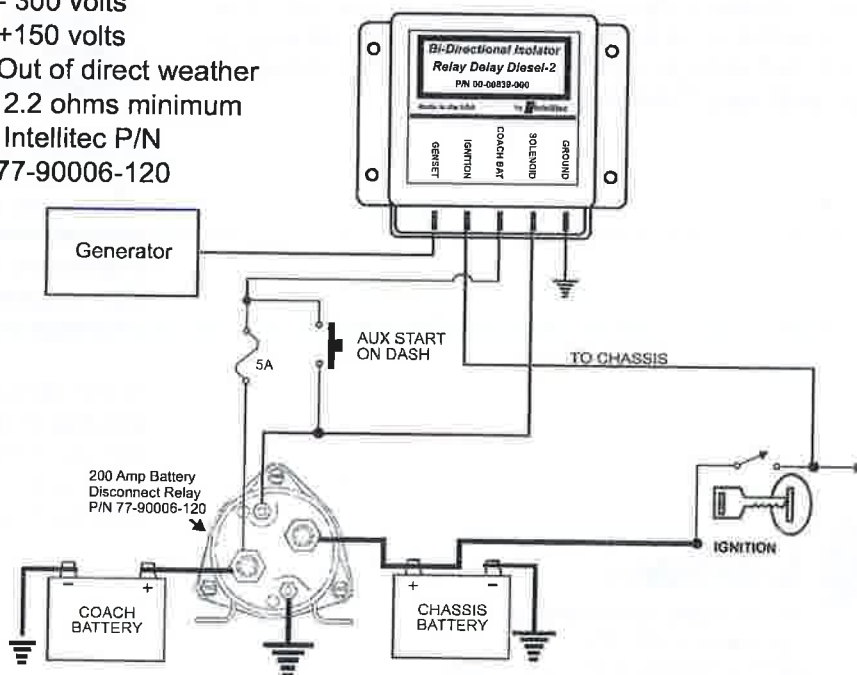
A Gen Set lock-out input is provided to isolate the batteries to prevent conflicts if both the converter/gen-set and alternator are trying to charge the batteries at the same time. When this conflict occurs, it can cause the dash alternator indicator light to illuminate in error and may cause 120 volt circuit breakers to trip.

If the Gen Set is running, the chassis battery and coach battery will be isolated. In this case the chassis battery will be charged by the alternator and the coach battery will be charged by the Gen Set. In the event that the chassis engine is not running, the chassis battery is isolated and will not be discharged by auxiliary loads.

## SPECIFICATIONS

Part Number	00-00839-100
Standby Current	Less than 2 milliamps
Ambient Temperature Range	-40C to +85C
Normal Input Voltage Range	10 to 18 volts
Short Term Over Voltage Protection	+26 volts
Reverse Voltage Protection	- 300 volts
Positive Voltage Spike Protection	+150 volts
Operating Environment	Out of direct weather
Coil Resistance	2.2 ohms minimum
Solenoid Type	Intellitec P/N 77-90006-120

## SYSTEM CONNECTIONS



**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408  
FAX 630.916.7890

P/N 53-00839-100 Rev. 072005

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

Intelligent Use of Technology

# PRECISION CIRCUITS INC

## Battery Isolation Manager Operation

### Overview:

The Battery Isolation Manager (BIM) monitors the Battery Voltage of both the Chassis and Coach Batteries over long periods of time. If it senses a charging voltage, it connects the two batteries together. If the charging system is drastically overburdened, the batteries will be isolated, however, if the BIM sees a long term charging of both batteries it will allow the batteries to remain connected and allow the charging system to do its job. Once the batteries have reached a Float Charge state for one hour, the BIM will isolate the batteries to prevent overcharging, and will only reconnect the batteries for charging if one of the Battery drops to approximately 80% charge, and the other is being charged. If the batteries are not being charged, BIM isolates the two batteries to prevent an electrical draw in one system from depleting the other battery. The long term monitoring of the batteries prevents the annoying Relay clicking that exists in simpler Isolation Modules today.



### Key Features:

1. Control is integral to Isolator Relay for simpler installation
  - a. Waterproof, IEC 60529, IP66 IP67, Salt Spray ASTM B 117 96 Hours Salt Spray
  - b. Approved for use in Battery Compartments
  - c. 225 Amps Continuous
2. Microprocessor based
  - a. Monitors battery state over long periods of time
  - b. Not just simply voltage dependent
3. Bi-Directional Charging
  - a. Charge Coach Battery when Alternator is charging Chassis Battery
  - b. Charge Chassis Battery when Converter is charging Coach Battery
4. Isolate Batteries to prevent discharging or overcharging of Batteries, or when neither battery is being charged
5. Prevents
  - a. Equalization cycles from Damaging Chassis Battery, by isolating at voltages over 15.5Volts
  - b. Annoying clicking of Isolator Relay by monitoring battery state over longer periods of time, not just simply voltage dependent. (Present controls that turn on at 13.3V and turn off at 12.8V cycle every 20 seconds when the charger goes into float mode)
  - c. Overcharging of Coach Battery during long drives by shutting down every hour and only turning back on when Coach Battery needs charging
  - d. Overcharging of Chassis Battery during long periods of Shore Power by shutting down every hour and only turning back on when Chassis Battery needs charging.
  - e. Generator/Charger and Alternator Interference by shutting down when Ignition and Generator are sensed.
6. Provides Emergency Start with Dash Switch
7. Runs Cooler using Less Power.
  - a. 100°F cooler than competition.
  - b. Uses only 4Watts of power versus 25Watts.

## Detailed Operation:

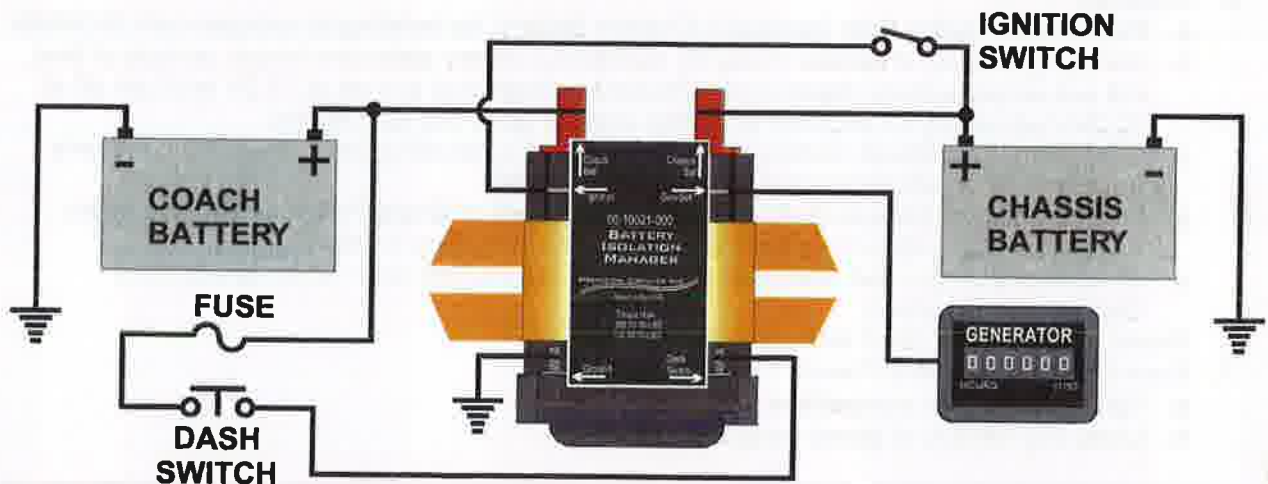
### 1) Relay is turned on if:

- a) Ignition is on for 20 seconds &
  - i) 2 minutes have passed since Relay last turned off & Coach Battery less than 12.6V & Chassis Battery is greater than 13.2 & Chassis Battery is Less than 15.5V & Generator is off
- b) Ignition is off &
  - i) 10 minutes have passed since Relay last turned off & Chassis Battery less than 12.6V, & Coach Battery is greater than 13.0V & Coach Battery is less than 15.5V
- c) Generator is On & Ignition is On then the Alternator and Battery charger are fighting each other and Relay should be turned off.

### 2) Relay is turned off if:

- a) Ignition goes from on to off state
- b) Relay has been on for 1 hour  
(prevent overcharging and allow to view separate voltages)
- c) Anytime Ignition and Generator are both on.
- d) Anytime either Battery goes above 15.5 volts for 30 seconds
- e) (Coach battery charge can drop to support the engine, in start and stop situations)  
While the Ignition is on, the time the Relay will remain on is Voltage dependent
  - i) High end of time 12.8volts = 40 minutes
  - ii) Time is scaled between above and below values
  - iii) Low end of time 11.8 volts = 5 seconds
- f) (Thou shalt never discharge Chassis battery for Coach functions)  
While the Ignition is off, the time the Relay will remain on is Voltage dependent and shorter than while the Ignition is On
  - i) High end of time 12.8 volts = 10 minutes
  - ii) Time is scaled between above and below values
  - iii) Low end of time 11.8 volts = 5 seconds

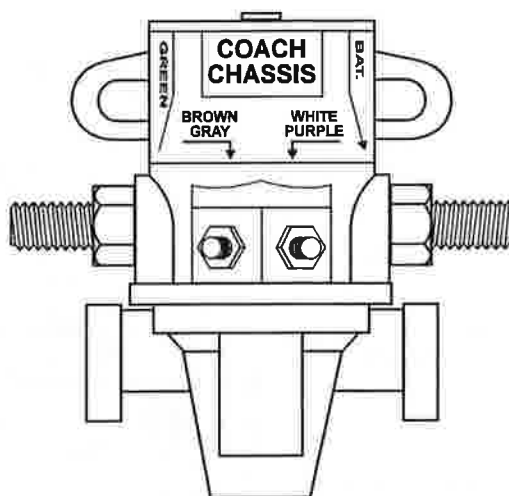
- 3) Relay Coil will be driven with approximately 4Volts DC. The Solenoid will be turned on hard with full battery voltage, and then the voltage will be throttled back to reduce battery power and Relay heat.





# BATTERY DISCONNECT

## SERVICE MANUAL



**Battery Disconnect** provides a simple and safe means of remotely disconnecting batteries of an RV or boat. With a touch of a remote switch, the batteries will be completely disconnected, preventing unwanted drain when the RV or boat are put into storage.

The heart of the system is a unique latching relay developed specifically for this purpose. While this relay is capable of carrying heavy currents, it requires **NO** power to stay open or closed. It only draws power during activation. The relay is sealed against the environments and is designed to withstand the shock and vibration experienced in the most severe RV or boat applications.

### THE RELAY - How It Works

The Battery Disconnect Relay is a mechanically latching switch that operates by the momentary application of battery voltage to the coil terminals in one direction for latching (closed) or the other direction for unlatching (open).

To close the relay, +12 volts is applied to the "I" terminal and ground to the "S" terminal of the relay. When this is done, the plunger is pulled into the coil and the contacts are connected. While this happens, the rod magnet suspended above the plunger is attracted (opposite poles attract) to the top of the plunger by the magnetic field. See FIGURE 1

When the voltage is removed from the coil, the plunger gets pushed upward by the return spring, but cannot move because the rod magnet is in the way. See FIGURE 2

**Warning:** The Battery Disconnect system connects directly to the vehicle's positive battery terminal. Inadvertent shorts across the battery or to ground, may cause severe damage and injury. Use extreme caution when working with these wires. Always wear safety glasses when working with the battery connections.

**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408

# BATTERY DISCONNECT

## SERVICE MANUAL

### Relay Closing

Positive polarity applied to coil.  
Current flowing in coil.  
Plunger pulled in to coil.  
Rod magnet attracted to plunger by opposite polarity.

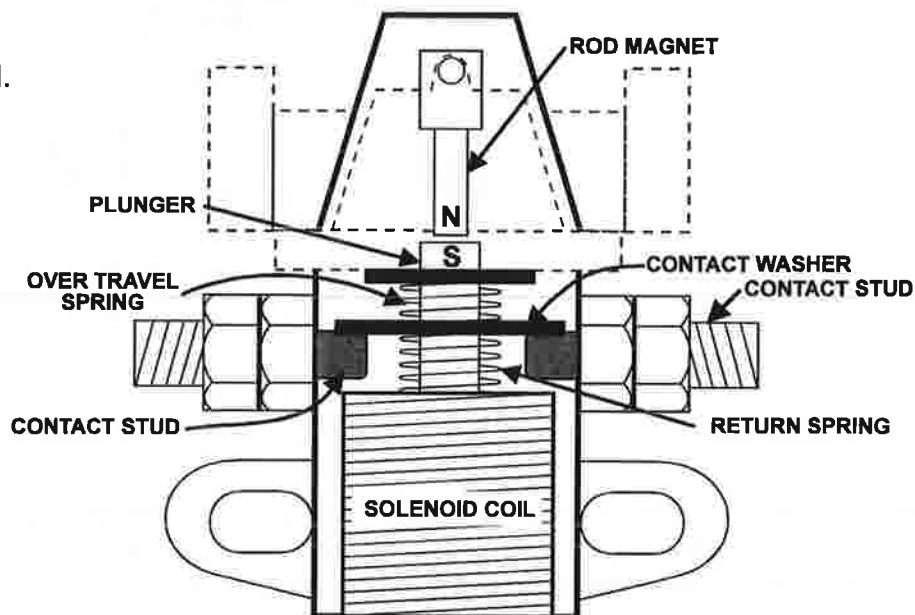


FIGURE 1

### Relay Closed

Power removed from coil.  
Magnet blocks plunger from coming up, maintaining contact.

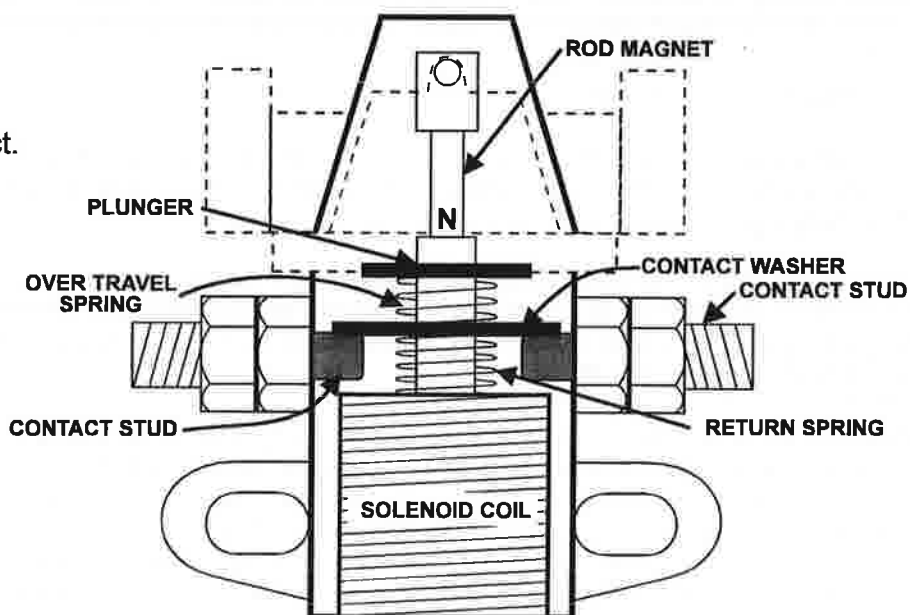


FIGURE 2

**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408

# **BATTERY DISCONNECT**

## **SERVICE MANUAL**

To open the relay, +12 volts is applied to the "S" terminal and ground on the "I" terminal. When this is done, the plunger is again pulled into the coil. However, since the magnetic polarity of the coil is reversed, the rod magnet is repelled (like poles oppose), and swings out of the way. See FIGURE 3

When the voltage is removed from the coil, the plunger gets pushed upwards by the return spring, breaking the connection between the two large terminals. See FIGURE 4.

**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408

# BATTERY DISCONNECT

## SERVICE MANUAL

### Relay Opening

Negative polarity applied to coil.  
Current flowing in coil.  
Plunger pulled in.  
Rod magnet opposed by plunger  
same polarity magnetic field,  
swings out to side of housing.

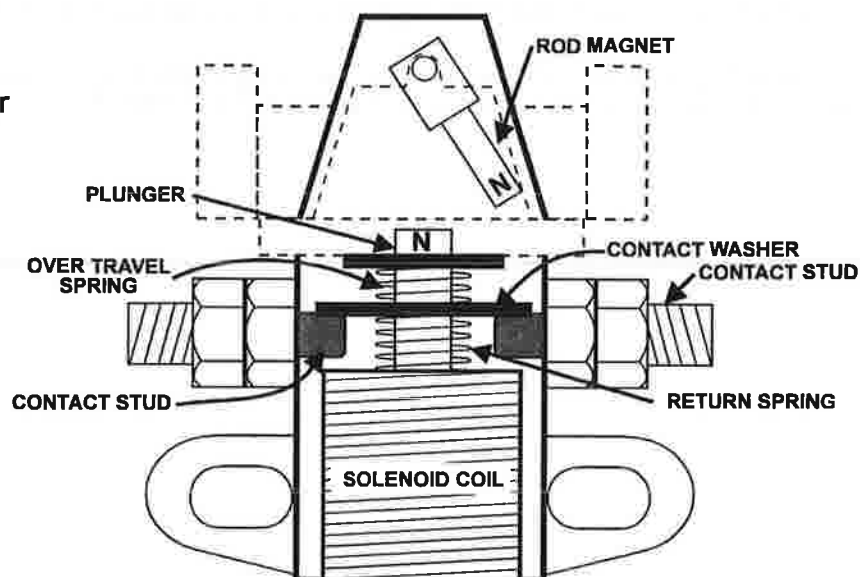


FIGURE 3

### Relay Open

Power removed.  
No current flowing in coil.  
Plunger pushed up by return spring  
while magnet is off to the side.  
Contacts open. Magnet comes  
to rest at side of plunger.

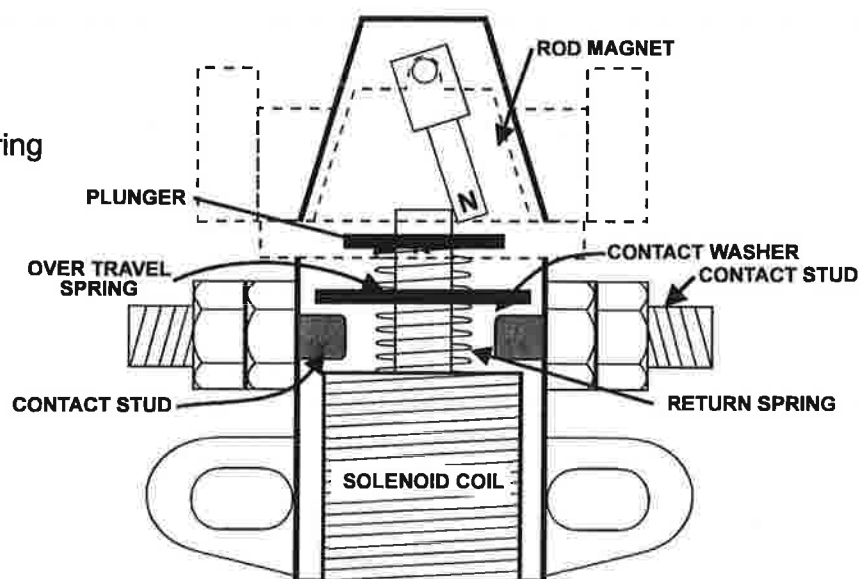


FIGURE 4

**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408

# BATTERY DISCONNECT

## SERVICE MANUAL

### THE SYSTEM

A typical motor home may use one or two relays to disconnect the batteries. These relays are usually independent and operate from a switch panel located inside the coach. A harness is used to connect from the panel to the relays. The Intellitec/Nuvatec panels are offered in four models. They are:

BD0 - Single battery system, with a cable and monitor panel with an on/off indicator

BD1 - Single battery system, with a cable and monitor panel with an on/off indicator and digital voltmeter

BD2 - Dual battery system, with cable and monitor panel with two on/off indicators and ignition interlock relay.

BD3 - Dual battery system, with cable and monitor panel with two on/off indicators, digital voltmeter, and ignition interlock relay.

*Note: BD1 panel can be interchanged with BD0, and BD3 can be interchanged with BD2*

The dual relay panels include an ignition interlock relay that opens the power circuit to the chassis battery relay when the ignition is turned on, to prevent the battery from being accidentally opened when the engine is running.

A typical circuit is shown in FIGURE 5 and FIGURE 6. The switches are each double pole, double throw, momentary, center off. Operating the switch in either direction will cause the relays to open or close, depending on the polarity of the voltage applied.

### FUSES

There are two 5 Amp fuses for the system, mounted on each relay. Looking at the relay with cap at the top, the fuse on the right feeds the LED indicator and if so equipped, the digital voltmeter. The fuse on the left feeds the power to the switch that operates the solenoid.

**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408

# BATTERY DISCONNECT

## SERVICE MANUAL

### Problem

Relay won't engage

### Possible Cause/Solution

Check fuses on relay

Check battery voltage, must be greater than 10.5 volts.

While switch is engaged, check for voltage across the coil terminals (+ on the "I" terminal and ground on the "S" terminal), If 0 volts, replace panel, if + voltage, replace relay.

Check wiring

Relay won't disengage

Check fuses on relay

Check battery voltage, must be greater than 10.5 volts

While switch is engaged, check voltage across the coil terminals (+ on the "S" terminal and ground on the "I" terminal) If 0 volts, replace panel, if + voltage, replace relay.

Light on panel remains on although relay is off.

Check wiring

Is coach plugged in, unplug coach

Is engine running, turn engine off

Check wiring

Check fuses on relay

Light is off although relay is on

Check wiring

Replace panel assembly

Check fuses on relay

BD1 or BD3 No voltmeter reading

Check wiring

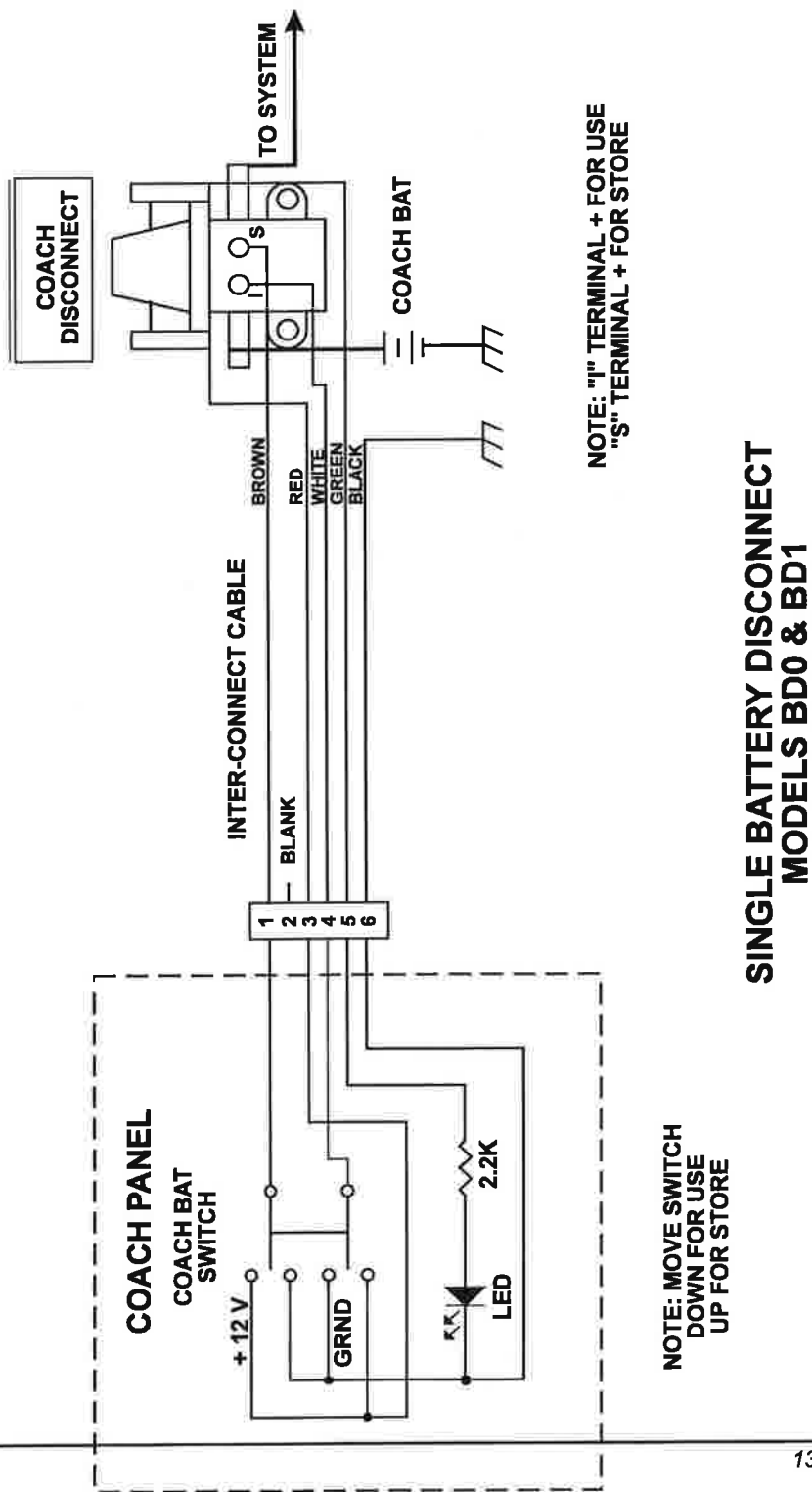
Check voltage on yellow/green wire, If + voltage, replace panel

**Intellitec**

131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408

## ***BATTERY DISCONNECT***

# SERVICE MANUAL



**NOTE: MOVE SWITCH  
DOWN FOR USE  
UP FOR STORE**

# SINGLE BATTERY DISCONNECT MODELS BD0 & BD1

**Intellitec**

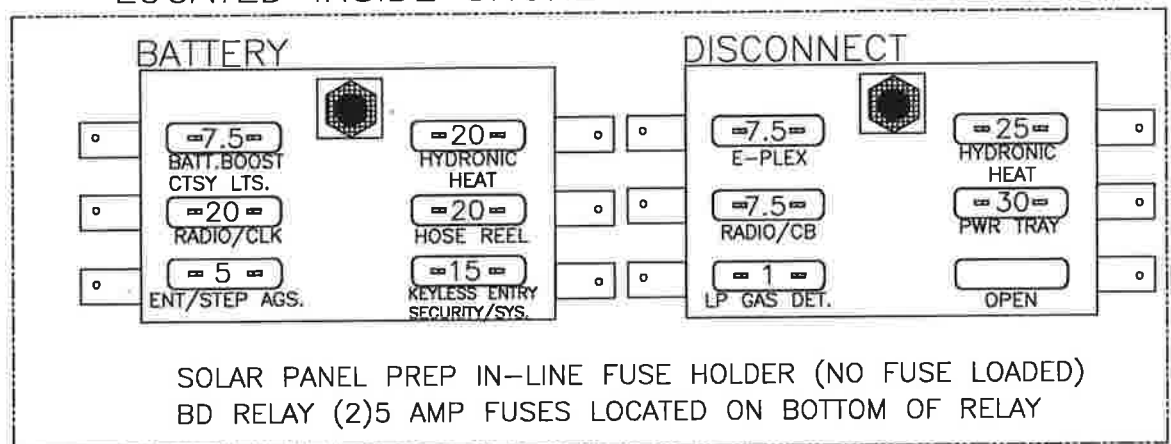
**131 Eisenhower Lane North  
Lombard, IL 60148  
630.268.0010 / 1.800.251.2408**





# EXTERIOR FUSE LOC

LOCATED INSIDE SHORE CORD COMPARTMENT

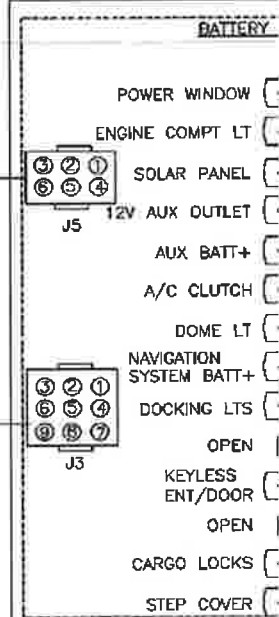


<b>NEWMAR CORP</b> P.O. Box 30, Nappanee, IN. 46550  Title block--5TB	Model:	Sheet	Drawn by:
	2009 SPARTAN CHASSIS	1 OF 1	B. M.
Title:	FUSE LABELS AND LOCATION	I.D. # ELECT RICAL MISC_DP\ NWMR_EXT_DP_FUSE_POS	Date: 2/26/08



**J5**  
 1) 16 RED (F27) SOLAR PANEL  
 2) 16 PNK (F26) ENGINE COMPT LT  
 3) 12 ORG (F25) POWER WINDOW  
 4) 12 BLU (F28) 12V AUX OUTLET  
 5) 16 BLK/YEL  
 6) 16 BLK (F29) AUX BATT+

**J3**  
 1) 14 RED (F18) NAV SYS/BATT 12+  
 2) 16 WHT/BLU(F17) DOME LT  
 3) OPEN  
 4) 14 ORG (F19) DOCKING LT SW  
 5) 14 PUR (F24) STEP COVER  
 6) 10 YEL (23) CARGO LOCKS  
 7) OPEN  
 8) 12 RED (F21) KYLSS ENT/DOOR  
 9) OPEN



DIESEL PUSHER:  
 FUSE PANEL LOCATED IN FRONT  
 CARGO COMPARTMENT DRIVER SIDE

EXCEPTION: LONDON AIRE DIESEL BUS  
 LOCATED IN FRONT COMPARTMENT PASSENGER SIDE)

**NEWMAR CORP**  
 P.O. Box 30,  
 Nappanee, IN. 46550

Title block--1TB

Model:  
**DIESEL PUSHER**

Title: NEWMAR FUSE PANEL  
 (DASH- DRIVER FRT COMPT)

Sheet  
**1 OF**

I.D. # ELEC  
 RICA\_ MISC\_  
 DASH\_KIB\_DRA

