### Note: This information applies <u>ONLY</u> to 12 volt single lead acid batteries of the types listed.

WARNING: Data is not necessarily valid for conditions where multiple 12 volt batteries are connected in strings (series or parallel)

#### See notes below the data table for battery strings.



Lead Acid BatteryTypes	Bulk Charging (Constant Current) 12 volt Battery	Absorption Charging (Constant Voltage) 12 volt Battery	Float Charging (Constant Voltage) 12 volt Battery	Trickle Charging (charge maintenance during extended storage)	Temperature Compensation	Open Circuit Voltage (OCV) @ 20% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 50% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 60% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 70% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 90% State of Charge (SOC)	Special notes	Other Guidelines
Standard Flooded/W et Automotive SLI (Calcium) Exide Select Exide Classic Exide Commercial Exide Cuttin Edge Exide Marine Startine, Flooded SuperCrank Flooded Flows/Sport	Charge at a constant current rate of no more than 10 times I <sub>20</sub> to a value of 41.89 (example; For C20=100Mr; the max charge current is 106A or 50A).	Charge with 14.8V - 15.0V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example, C20-1000/hr, the low current shut dif is 1%x 100 or 1A).	13.5v - 13.8	Charge voltage on point - 12.60v Charge voltage off point - 13.5v Limit current to 0.4 times I <sub>20</sub>	Charging Temperature Compensations. All the fitted charging to higher are propriete for a temperature anged 15.52×0.687-TP). For exercing operating temperatures below this range collect than the maximum voltage set point attendable compounded with an increase at rate of 0.05 Volts. For Cell (0.38 Volts for a 12 v battery) for every 10°C 18°F. 19°C warren (18°F. 19°C warren poerating temperatures showe this range (or warren 18°F. 19°C warren poerating temperatures showe this trange to warren (18°F. 19°C warren poerating temperatures showe this trange to warren (18°F. 19°C warren 18°C warren 18	Not recommended	12.44v	12.52v	12.60v	12.77	Battery Temperature: Batterie a should be brought to a temperature of a least OFT (18%) for more distinct suggesting batteries. SEV (1997) in their over beating effects. A E Ringle Clarge Limitations: Som Dc Charges will have what in referred to a san AC replies wave-from the charging in put. Essensive ripple can come between the charging and gassing resulting in reduced like. Ripple current executions during the foot charging phase should not exceed 5 Augus for every 100 AH of normal questiy (Europhe 1 and pas 500 AH battery). A consideration of the control of the cont	Nurage: For open circuit storage it is recommended that the battery be stored indoors in a clean, day location. Never store (or openate) in an atripht enclosure. Keep new homolitects that sources. Notages temperatures build be between 5099.7-779 (107.)  **The Commission of the Comm
Flooded/W et Extreme Cycling (Caldium) Exide Extreme Exide Marine Dual Purpose	Charge at a constant current rate of no more than 10 times I <sub>20</sub> to a value of 41.89 (example; For C20=100Mr; the max charge current is 106A or 50A).	Charge with 14.8V - 15.0V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example, C20-100Ahr, the low current shut dfl is 1%x 100 or 1A).	13.5v - 13.8	Charge voltage on point - 12.60v Charge voltage off point - 13.5v Limit current to 0.4 times I <sub>20</sub>	Charging Temperature Componentions. All the United charging shallows are supporting for a stemperature ange of 15.52% (0.87 °TP). For everage operating temperatures below this range colder than 19 meanimmun/large perions should be compounded with an increase at a rate of 0.083 Volts. For Cell (0.38 Volts for a 12 v battery) for every 10°C (18°TV). The component of the production of the component of the contract of the component of the component of the contract of the component	Not recommended	12.44v	12.52v	12.60v	12.77	hattery Temperature Batterio should be brought to attemperature of a loss OFF (18%) for more distinct designs and bear SEV (1970) in this over beating effect. AC Ringle Clarge Limitations: Som DC charges will have what is referred to as an AC region wave from the charging in put. Essexi regipte can once between the penting and gassing resulting in reduced life. Rippic current executions during the floor charging planes should not council 5 Augs for every 100 AH of nominal capacity (Insupel et almay for 90 AH battery) council 5 Augs for every 100 AH of nominal capacity (Insupel et almay for 90 AH battery) via 0.70 ovils at 13.3 volts.) Operating Temperature The recommend operating interpretate gas is 10°C -30°C 97-80°F for optimal operation. Lower temperatures will limit capacity output. Higher temperatures may reduce life. Maximumoperating temperatures is 50°C (12.27°).	Norage: For open circuit storage it is recommended that the battery be stored indoors in a clean, day location. Never store (or openate) in an attripht enclosure. Keep new James indicate hosts works. Sorage temperature should be between SVP. 779F (107C.) and the storage of th
FloodedW et Deep Cycle & Marine (Antimony) Exide Marine Deep Cycle Exide Space Heavy Duty and Floor Scrubbe		Charge with 14.7V - 14.9V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example: C20-1000/hr; the low current shut dif is 1%x 100 or 1A).	13.2v · 13.4v	Charge voltage on point - 12.60v Charge voltage off point - 13.2v Limit current to 0.4 times I <sub>20</sub>	Charging Temperature Compensations, All the United America, voltages are expression for a temperature ange of 15.5.2% (Gr8.7*P). For a verage operating temperatures below this range (colder than the amazimmvollage are point should be composed with an increase at rate of 0.05 Volts. For Cell (0.38 Volts for a 12 v battery) for every 10°C. If F. F. For average operating temperatures showe this range (colder than the colder than the colder of the co	12.1v	12.44v	12.52v	12.60v	12.77	hattery Temperature Batteries about le Novaght to a temperature of a less OFF (15%) for most efficient designing and below SFF (10%) in linit over beauting offers. AC Ripple Charge Limitations: Some DC charges will have what in referred to a san AC replies wave-fromto the charging in put. Essexis replies can essent bestime the gain and gassing resulting in reduced like. Ripple current executions during the float charging phase should not exceed 5 Aups for every 100 AH of nominal questip (Europhe 1 and pas 500 AH battery of the country of the control of the "co.0." On volta at 13.3 volts.) Operating Temperature The recommend operating interportant anges in 10°C. 30°C off "8-679 for optimal operation. Lower temperatures will limit capacity output. Higher temperatures may reduce it. Et Austransportant generatures in 50°C (122°C).	Shurage: For open circuit storage it is recommended that the battery be stored indoors in a clean Ary location. Never store (or openate) in an airight enclosure. Keep new plannificant heat sources. Assign temperatures bould be between 5097-7797 (107. CP. T. 197. CP. CP. CP. CP. CP. CP. CP. CP. CP. CP
Gel cell Exide Prevaller	Charge at a constant current rate of no more than 10 times I <sub>20</sub> to a value of 41.4 V (example; For C20=100Mr; the max charge current is 106A or 50A).	Charge with 14.1V - 14.4V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example, C20-1000/hr, the low current shut dif is 1%x 100 or 1A).	13.5v- 13.8vwith current limited to 4 times I <sub>20</sub> .	Charge voltage on point - 12.75v Charge voltage off point - 13.5v Limit current to 0.4 times I <sub>20</sub>	Charging Temperature Compensation: All the listed charging voltages are appropriate for a temperature range of 15.27°C (68-77°F) for a verage operating temperatures below this range (coldest that) the foreaverage operating temperatures when this range (coldest that) the OSS Volts Fur Cell (0.3 Volts for 12's battery) for every 10°C (18°F) for wavege operating temperatures show this range (warmer thank) the voltages or point should be compensated with a decrease at a rate of 0.05 Volts Fer Cell (0.3 Volts for every 10°C 10°F). While the Cell (0.3 Volts for every 10°C 10°F) and the voltage of 10°F (1.3 Volts Fer Cell (0.3 Volts for every 10°C 10°F).	12.0v	12.40 v	12.50v	12.60v	12.90v	hattery Temperature: Bastices about It belongs in to attemperature of a lens OFF (18%) for more distinct charging and lenes WSF (1970) in this over-basting effects. A C Ripple Clarge Limitations: Some DC charges will have what is referred to as an AC ripple wave form to the charging in put. Excessive ripple can consent behative heating and gassing resulting in reduced like. Ripple current executions during the float charging phase should not exceed 5 Aups for every 100 AH of normal questive (Interple 4 may be 50 AH battery). **c.0.70 outs at 13.3 volts.** Operating Temperature The recommend operating temperature anges in 10°C. 30°C off-8-6°E for optimal greaters. Lower temperatures will limit capacity output. Higher temperatures may reduce it. B. Autsimmorporating temperature is \$5°C (13.79).	Storage: For open circuit storage it is recommended that the battery be stored indoors in a clean Apl postation. Never store (or openate) in an airight enclosure. Keep newly homeline that ourse. Storage temperatures build be between 5097-7797 (107. CP. 107. CP. 10
Flat Plate and Spiral AGM Exide Edge Evide Vortex Exide Roadforce Exide MegaCyde AGM SuperCrank AGM PowerSport	Charge at a constant current rate of no more than 10 times I <sub>20</sub> to a valtage of 14.1V (example; For C20=100Mr.; the max charge current is 106A or 50A).	Charge with 14.1V - 14.4V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example, C20-100Ahr, the low current shut diff is 11%x 100 or 1A).	13.8v- 13.8vwith current limited to 4 times I <sub>20</sub> .	Charge voltage on point - 12.75v Charge voltage off point - 13.6v Limit current to 0.4 times I <sub>20</sub>	Charging Temperature Compensation: All the listed charging valuage are based on a temperature of 7°F (2°C). For average operating temperatures below this range (color thras) the numerical color of the	12.0v	12.40v	12.50v	12.60v	12.90v	Battery Temperature: Batteries should be brought to a temperature of at least 60°F (15°C) for most efficient charging and below 8°F (30°C) to limit over heating effects.  Arc Ripple Charge (limitations Some Charges will have which is referencined as as AC and Epiple Charge (limitations some Charges will have which is referencined as as AC and the control of the co	Shurage: For open circuit storage it is recommended that the battery be stored indoors in a clean, dry location. Never store (or openate) in an airight enclosure. Keep newy homolitica the sources. Notage temperatures build be between 5097-7797 (107. CPC).  Batteries should be fully charged prior to storage. Batteries should be foot outgrade every 6 months or when the battery voltage reaches 127 volts. Sonage at deviated temperatures will result in a evel reacher and of self-discharge. A general rule of thism bit is that or every 187 (17) shower 77% (257%) their batteries build charging will be desired to the storage of the source of the s

#### Helpful explanations

- 1) Calcium and Adminonyrotations refer to metal alloy addrines used in battery grids. These alloys have small effects on the charge vallages.

  2) Bulk review grids the regular demand suggestessive end-use periods. It is pically virtual in applications that meet regular income by the despit scale based of each grid and the suggested an

### For 24 vist systems that are comprised of the C/3 12 vist butleries compared in the right that are sharped with 54 visit sharpers (with no parallel buttery connections). 1) All drapping outpress from incident on 12 visit numbers as it listed alone (also the series convention) all listed press (and outpress remains indexed to 12 visit numbers as it listed alone (also the series convention). 3) All drapping outpress remains indexed to 12 visit numbers as it listed alone (also the series convention).

### For 48 volt systems that are comprising of For (61 Stock hasteries connected in entire that are changed with 48 volt chapter (with no parallel battery connections) 1) All darging outments remain identical to 12 cell numbers as idented these loss between connection) 2) All darging ourments remain identical to 12 cell numbers as idented dates (due to the series connection) 3) All darging intermental indentical to 12 cell numbers as idented dates (due to the series connection)

### Note: This information applies ONLY to 8 volt single lead acid batteries of the types listed.

WARNING: Data is not necessarily valid for conditions where multiple 12 volt batteries are connected in strings (series or parallel)

#### See notes below the data table for battery strings.



Lead Acid Battery Types	Bulk Charging (Constant Current) 8 volt Battery	Absorption Charging (Constant Voltage) 8 volt Battery	Float Charging (Constant Voltage) 8 v olt Battery	Trickle Charging (charge maintenance during extended storage)	Temperature Compensation	Open Circuit Voltage (OCV) @ 10% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 50% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 60% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 70% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 90% State of Charge (SOC)	Special notes	Other Guidelines
Flooded/Wet Deep Cycle (Antimony) Exide Golf Cart Exide Special Heavy Duty	current rate of no more than 10 times I <sub>20</sub> to a voltage of 9.78V (example; For	Charge with 9.78V - 9.91V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example; C20=100Ahr, the low current shut off is 1%x 100 or 1A).	8.78v - 8.91v	point - 8.25v Charge voltage off point - 8.78v Limit current to 0.4	Charging Temperature Compensation: All the listed charging voltages are appropriate for a temperature range of 15-25°C (68-77°P). For average operating temperatures below this range (colder than) the maximum voltage set point should be compensated with an increase at a rate of 0.063 Volts Per Cell (0.25 Volts for a 8 v battery) for every 10°C (18°F; ) For average operating temperatures above this range (vournet than) the maximum voltage set point should be compensated with a decrease at a rate of 0.063 Volts Per Cell (0.25 Volts for a 8 v battery) for every 10°C (18°F.)  Example: a (55°F and 9.4 volt set point Corrected Voltage = 9.4 - (((95-77)18) x (0.25)) = 9.15 volts		8.04v	8.16v	8.25v	8.45	temperature of at least 60°F (13°C) for most efficient charging and below 85°C (20°C) to limit over heating effects. AC Ripple Charge Limitations: Some DC chargers will have shad is referred to sa an AC ripple wave-form to the charging input. Excessive ripple can cause battery heating and gassing resulting in reduced life. Ripple current excursions during the Holar charging phase should not exceed 5 Amps for every 100 AH of nominal capacity (Example: 4 amps for 80 AH battery) Ripple voltage excursions during float should not exceed 4°–5% of the float voltage. Example: 40°C 40°C obts at 9.2 volts. Operating Temperature: The recommend operating temperature are is 10°C-30°C (20°F-36°F) for optimal	Storage: For open circuit storage it is recommended that the buttery be stored indoors in a clean, dry location. Never store (or operate) in an airtiple neclosure. Keep away from direct heat sources. Storage temperature should be between 507° - 77° I (10°C - 25°C). Batteries should be felly changed prior to storage. Batteries should be folly changed prior to storage. Batteries should be flow changed prior to storage. Batteries should be flow changed prior to storage. Batteries should be flow changed every 6 months of when the storage changed and the storage development of the storage of the storage development of the storage with the sto

#### Helpful explanations

- 1) Calcium and Antimony notations refer to metal alloy additives used in battery grids. These alloys have small effects on the charge voltages.

- 1) Calcium and Antimony notations refer to metal alloy additives used in battery grids. These alloys have small effects on the charge voltages.

  2) Butk charging is the rapid and most aggressive ex-barge method. It is typically only used in applications that need rapid received for deeply discharged batteries. Battery cooling may be required.

  3) Absorption charge is an aggressive method where current is allowed to diminish as the battery in antimal to the part of a lightly discharged battery.

  4) Float charge is a stage where the battery is charged at lower voltage to dowly 'top of' a 'diphly' discharged battery.

  5) Trickle charging is used to maintain charge during a long storage period. Charge voltage on/off points are very important to hold charge without damaging battery life.

  6) State of Charge (SOC) is a highly variable number. Data should be taken as reflective of the chaloper's lated, but actual performance (SOC) is a highly variable number. Data should be taken as reflective of the charge voltage of the charge of the charge
- 8) To estimate  $C_{20}$  capacity for 8 volt GC batteries multiply RC minutes at 56 amps times  $1.35 = C_{20}$  capacity. For example, RC minutes at 56 amps is rated at 110 minutes. The  $C_{20}$  estimate is 110 times 1.35 = 149 Ahr.

## For 16 volt systems that are comprised of two (2) 8 volt batteries connected in series that are charged with 16 volt chargers (with no parallel battery connections) 1) All charging voltages double (due to series connection) as listed in the above table. 2) All charging currents remain identical to 8 volt numbers as listed above (due to the series connection.) 3) All charging times remain identical to 8 volt numbers as listed above (due to the series connection.)

## For 24 volt systems that are comprised of four (3) 8 volt batteries connected in series that are charged with 24 volt chargers (with no parallel battery connections) 1) All charging voltages increase X 3 (due to series connection) as listed at how et able. 2) All charging currents remain identical to 8 volt numbers as listed above (due to the series connection.) 3) All charging times remain identical to 8 volt numbers as listed above (due to the series connection.)

### For 8 volt battery strings using two batteries in parallel connection (positive to positive and negative to negative)

- All chargins are imparted to inspare the control of the control of

### Note: This information applies ONLY to 6 volt single lead acid batteries of the types listed.

WARNING: Data is not necessarily valid for conditions where multiple 6 volt batteries are connected in strings (series or parallel)

### See notes below the data table for battery strings.



Lead Acid Battery Types	Bulk Charging (Constant Current) 6 volt Battery	Absorption Charging (Constant Voltage) 6 volt Battery	Float Charging (Constant Voltage) 6 volt Battery	Trickle Charging (charge maintenance during extended storage)	Temperature Compensation	Open Circuit Voltage (OCV) @ 10% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 50% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 60% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 70% State of Charge (SOC)	Open Circuit Voltage (OCV) @ 90% State of Charge (SOC)	Special notes	Other Guidelines
Flooded/Wet Golf Cart, Dee; Cycle & Marine (Antimony) Exide Golf Cart Exide Floor Scrubber	constant current rate of no more than 10 times I <sub>20</sub> to a voltage of	Charge with 7.35V 7.45V limit for 12 to 24 hrs or when current drops below 1% of the C20 rating (example; C20=100Ahr, the low current shut off is 1%x 100 or 1A).		Charge voltage on point - 6.2v Charge voltage off point - 6.6v Limit current to 0.4 times I <sub>20</sub>	Charging Temperature Compensation: All the listed charging voltages are appropriate for a superparture range of 15-227C (68-777). For or average operating temperatures below this range colder than the maximum voltage set point should be compensated with an increase at a rate of 0.063 Volts Per Cell (0.19 Volts for a 6 v battery) for every 10°C (18°F.) For average operating temperatures above this range (warmer than) the maximum voltage set point should be compensated with a decrease at a rate of 0.063 Volts Per Cell (0.19 Volts for a 6 v battery) for every 10°C (18°F.) Example: at 95°F and 7.1 volt set point Corrected Voltage = 7.1 - (((95-77)/18) x (0.19)) = 6.91 Volts (0.19)	5.75v	6.04v	6.13v	6.20v	6.33	temperature of at least 60°F (15°C) for most efficient charging and below 85°F (20°C) to limit over heating effects.  AC Ripple Charge Limitations: Some DC chargers will have what is referred to sa an AC ripple wave-form to the charging input. Excessive ripple can cause battery heating and gassing resulting in reduced life. Ripple current excursions during the float charging phase should not exceed 5 Amps for every 100 AH of nominal capacity (Example: 4 amps for 80 AH battery) Ripple voltage excursions during float should not exceed 4°-5% of the float voltage. (Example: 4*-0.35 volts at 6.9 volts)  Operating Temperature: The recommend operating temperature raise is 10°C -30° (50°F-86°F) for optimal operation. Lower temperatures will limit capacity output. Higher temperatures my reduce life. Mustumm operating temperature.	Storage: For open circuit storage it is recommended that the buttery be stored indoors in a clean, day location. Never store (or operate) in an airtight enclosure. Keep away from direct heat sources. Storage temperature should be between 50°F - 77°F (10°C - 25°C). Batteries should be disconnected from all potential load sources during storage. Batteries should be fully charged prior to storage at elevated temperatures will result in section and the full storage of the storage and the storage at elevated temperatures will result in accelerated rates of self discharge. A general rule of thumb is that for every 18°F (10°) above 77°F (25°C) the time before boost charging will be halved. Sorage without proper charge can result in excessive sulfation and can be detrimental to buttery performance and life.

#### Helpful explanations

- 1) Calcium and Antimony notations refer to metal alloy additives used in battery grids. These alloys have small effects on the charge voltages.
- 2) Bulk charging is the rapid and most aggressive re-charge method. It is typically only used in applications that need rapid recovery for deeply discharged batteries. Battery cooling may be required.

  3) Absorption charge is an aggressive method where current is allowed to diminish as the battery naturally comes to full charge. It can be used for deeply or less deeply discharged batteries. Battery cooling may be required.
- 4) Float charge is a stage where the battery is charged at a lower voltage to slow by "top off" a slightly discharged battery.

  5) Trickle charging is used to maintain charge during a long storage period. Charge voltage on/off points are very important to hold charge w ithout damaging battery life.
- 6) State of Charge (SOC) is a highly variable number. Data should be taken as reflective of technology listed, but actual performance may be plus/minus 0.10 volts.

  7) The reference to C<sub>00</sub> in the table above means 20 hour capacity as measured in amp-hours (Ahr). Similarly, I<sub>30</sub> refers to the current discharge rate for 20 hour capacity. For example, a C<sub>30</sub> of 100 Ahr would have an I<sub>30</sub> of 5 amps (5 amps times 20 hours = 100 Ahr).
- 8) To estimate  $C_{20}$  capacity for 6 volt GC batteries multiply RC minutes at 75 amps times  $1.68 = C_{20}$  capacity. For example, RC minutes at 75 amps is rated at 110 minutes. The  $C_{20}$  estimate is 110 times 1.68 = 185 Ahr.

### For 12 volt systems that are comprised of two (2) 6 volt batteries connected in series that are charged with 12 volt chargers (with no parallel battery connections) 1) All charging voltages double (due to series connection) as listed in the above table.

- 2) All charging currents remain identical to 6 volt numbers as listed above (due to the series connection.)

  3) All charging times remain identical to 6 volt numbers as listed above (due to the series connection.)

### For 24 volt systems that are comprised of four (4) 6 volt batteries connected in series that are charged with 24 volt chargers (with no parallel battery connections). 1) All charging voltages increase X 4 (due to series connection) as isled in the above table. 2) All charging currents remain identical to be volt numbers as listed above (due to the series connection.)

- All charging times remain identical to 6 volt numbers as listed above (due to the series connection.)

# For 6 volt battery strings using two batteries in parallel connection (positive to positive and negative to negative) 1) All charging voltages remain the same as listed in above table. 2) All charging currents double as listed above in order to charge in same amount of time as listed in above table. 3) All charging times double as listed in above table if current stays as listed in the above table.