ODYSSEY®
BATTERY

AGM² Technical Manual

www.odysseybattery.com

EnerSys®
Power/Full Solutions

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I. INTRODUCTION

ODYSSEY® brand batteries are manufactured by EnerSys® using its unique AGM Thin Plate Pure Lead (TPPL) technology to deliver twice the power and three-times the life of conventional AGM batteries.

The recent integration of ODYSSEY Battery and NorthStar Battery brought together years of intelligence and research and development, resulting in the creation of the next generation of AGM - TPPL batteries. AGM^2 is a unique design of Valve Regulated Lead Acid (VRLA) batteries that combines three major technical advancements in one battery: super high-grade materials + refined chemical formula + Thin Plate Pure Lead (TPPL) technology. This sets AGM^2 batteries apart in terms of power, fast-charge acceptance, shelf-life, durability and most of all exceptional value for your investment.

This technology allows one battery package to provide both excellent cycling life and high-power capability for many applications. AGM^2 batteries excel in both starting and deep cycle applications without compromising lifespan or performance.

Throughout their design cycle life, AGM^2 batteries can provide engine cranking pulses of up to 2700 amps for 5 seconds at 77°F (25°C), while delivering over 400 charge/discharge cycles to 80% Depth of Discharge (DOD). This challenges all typical starting batteries, which are only designed for high current for short durations, so perform poorly when deeply discharged repeatedly.

Likewise, a typical deep cycle battery, which is designed to provide relatively low current for a long duration of time, cannot provide the high current bursts that are needed for starting applications.

AGM^2 batteries can do both tasks, making them an excellent choice for a wide range of applications such as heavy-duty trucks, recreational vehicles, marine, emergency power and much more.

II. WHY USE ODYSSEY® AGM^2 BATTERIES?

- Long service life – design life of 8-12 years in float applications and 3-10 years in non-float applications at 77°F (25°C).
- Fast charging – extremely low internal resistance allows high-current charging, which reduces charge time.
- Excellent cycle life – provide up to 900 cycles when discharged 50%.
- Low temperature performance – even at sub-zero temperatures down to -40°F (-40°C), battery performance allows for quick engine starts or deep discharges.
- Long shelf life – can be stored for up to 2 years at 77°F (25°C) and longer at lower temperatures.
- Deep discharge recovery – it is possible to recover a deeply discharged AGM^2 battery. There is more information on that process later in this manual. However, overall battery life will be affected.
- Virtually maintenance-free – no need to add water to batteries.
- Superior vibration resistance – high compression design and high-strength plastic construction give these batteries extreme shock and vibration resistance.
- Mounting flexibility – can be mounted in any position except inverted/upside down in typical starting applications.
- Easy shipping – approved for shipment as non-hazardous cargo by the U.S. Department of Transportation.
- Made in the U.S. and European manufacturing facilities – the management systems governing the manufacture of this product are IATF 16949, ISO 9001 and ISO 14001 certified.

III. SAFETY

Batteries can deliver a large amount of power which can cause injury or death if not handled safely. Please follow these guidelines any time you are working around batteries.

- Personal protective equipment including gloves and safety glasses should be worn.
  - Insulated tools should be used.
  - Watches, bracelets or other metal objects should be removed.
  - Do not place any objects on top of the battery.
  - Make sure the charging system is set for AGM batteries and in line with advised charging specifications.
  - Do not charge batteries if the temperature is above 104°F (40°C).

IV. GETTING STARTED

A. INSTALLATION

ODYSSEY® AGM² batteries are shipped from the factory at a full State of Charge (SOC) and should be ready for installation out of the box. In typical starting applications, measure the battery's voltage; if it is 12.65 volts or higher, the battery can be installed. If the voltage is lower than 12.65 volts, the battery should be charged. Multiple battery configurations should be matched voltage. Refer to the Charging section in this manual if needed.

To replace an existing battery, follow the steps below:

1. Be sure to wear the appropriate personal protective equipment.
2. Note the orientation of the existing battery's positive and negative terminals.
3. Disconnect the cables, negative first, from the old battery following vehicle manufacturer guidelines if applicable. The old battery should be returned to a battery dealer for proper recycling.
4. Inspect the battery cables for corrosion, acid damage or insulation deterioration and replace if needed.
5. Position the new ODYSSEY AGM² battery in the battery tray and secure it properly to the vehicle – height adapters may be needed and are available for some sizes
6. Connect the positive cable from the ignition to the Positive (+) terminal of the battery.
7. Connect the negative cable from the ignition or chassis to the Negative (-) terminal of the battery.
8. Properly torque the connection per the specification in Table 2 on page 7.

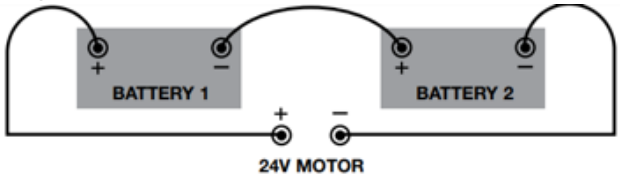
The steps above apply to a single, 12-volt battery. There are other applications that may require batteries to be connected in parallel or series. It is important to take note of the battery's required configuration before the existing batteries are removed. If there is any question about the battery configuration, refer to the documentation that was supplied with the device being powered. ODYSSEY AGM² batteries can be installed on their side or end if needed due to space constraints.

B. BATTERY CONNECTIONS

Here are some general guidelines regarding different types of battery connections:

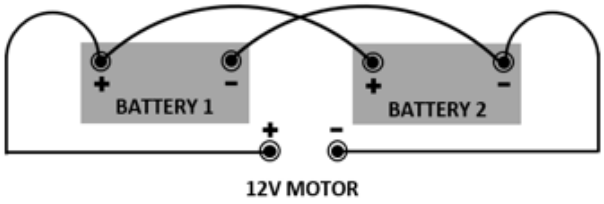
- Series connections are used to increase battery voltage by connecting the positive terminal of one battery to the negative battery of another battery. In this configuration, the overall capacity of the battery is equal to the capacity of one battery. Series systems are wired as shown in Battery Sketch 1.

  PLEASE NOTE: When replacing multiple batteries, each battery should be of a similar state of charge (SOC).



Battery Sketch 1

- Parallel Connections are used to increase the battery capacity by connecting the positive terminal of one battery to the positive terminal of a second battery. Likewise, the negative terminals are connected. In this configuration, the system voltage is the voltage of one battery. Parallel systems are wired as shown below:



Battery Sketch 2

C. BATTERY CABLING

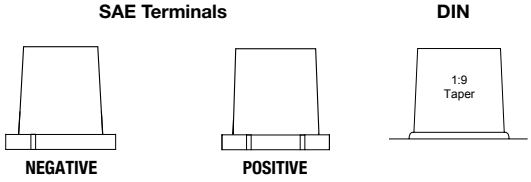
Since battery cables are the connection between the battery, the charging system and the device being powered, it is important that they are properly installed. Improperly installed cables can result in poor battery performance, terminal damage or even fire. Cables should be sized based on the amount of current they are expected to carry in the application. Refer to Table 1 for cable current ratings according to NEC Table 310.15(B)16 for copper cables rated at 167°F (75°C). If it is necessary for a cable to be longer than six feet, a heavier gauge wire should be considered to avoid excessive voltage drop.

AWG	mm2	Amps
14	2.5	20
12	4	25
10	6	35
8	10	50
6	16	65
4	25	85
2	35	115
1	50	130
1/0	55	150
2/0	70	175
4/0	120	230

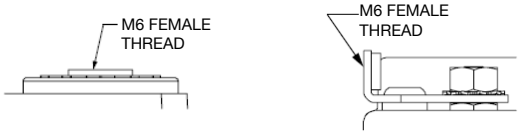
Table 1

PLEASE REFER TO THE ILLUSTRATIONS BELOW FOR TERMINAL DETAILS.

SAE and DIN Posts
These are posts in the shape of truncated cones with slightly different diameters to indicate polarity. The positive post is larger than the negative post.

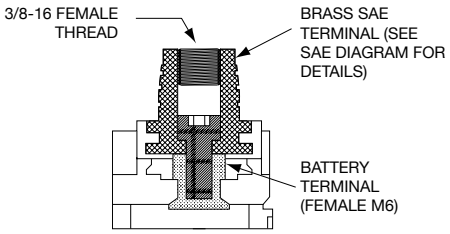


Female Thread
This type of terminal consists of a female thread which can take various adapters/terminals with an M6 or M4 thread as specified for each battery. Please refer to the product label for torque specifications.

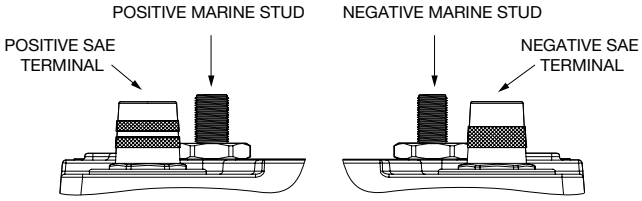


Stud Posts
These terminals have a stud post with various threads as specified for each battery

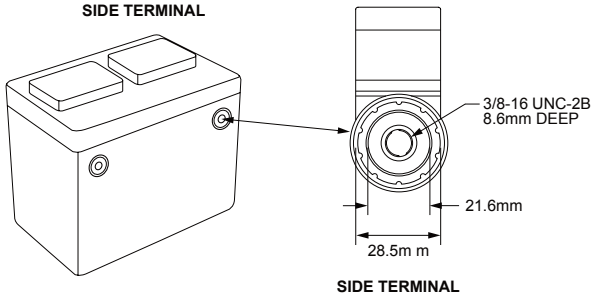
SAE 3/8 -16” Female Thread
This is an SAE post which can be installed on female M6 terminals. The SAE post has a 3/8-16” female threaded post.



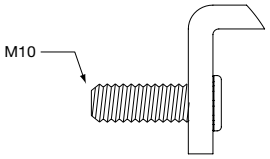
Dual Terminal Posts
These terminals have a stud post and SAE post.



Side 3/8 -16” Female Thread
Side terminals are sometimes supplied in addition to top terminals. In this case, top terminals allow the fixing of other connections to power accessories.



Front Terminal Adapters
These connect to female inserts on the top of the battery to allow for connections on the front of the battery.



D. TORQUE SPECIFICATIONS

Each terminal type has a different torque specification. Under-tightening of connections can lead to short circuit and electrical damage. Over-tightening can cause physical damage to the battery terminal. Refer to Table 2 below for the recommended torque specification based on the terminal type.

Terminal Type	Details	Maximum Torque [in-pounds]	Maximum Torque [Nm]
Stud 3/8-16” HD	All G31, Marine, and 8D	200	22.6
Stud 3/8-16”	ODS-AGM6M	100	11.3
Stud 5/16-18”	All Marine	100	11.3
Side Terminal 3/8-16” Receptical	G75 G78	60	6.8
M4 Receptacle	ODS-AGM8E (PC310)	8.9	1
M6 Receptacle	ODS-AGM16B,16CL	40	4.5
M6 Receptacle	ODS-AGM15L, 16L	50	5.6
M6 Receptacle	ODS-AGM28*,42*,70*	60	6.8
M6 Receptacle	ODS-AGM***FT	35	3.9

* For SAE torque specification refer to vehicle manufacturer’s specification.

Table 2

V. TECHNICAL DETAILS

A. OPERATING TEMPERATURE RANGE

Temperature impacts the life and performance of AGM² batteries, as it does all batteries. In general, higher temperatures reduce battery life while lower temperatures reduce the available capacity that a battery can provide. Refer to Table 3 below for the operating temperature range for each model.

	Battery Model	Maximum Operating Temperature Range
ODP-AGM	All Models	-40°F (-40°C) to 140°F (60°C)
	Except ODP-AGMDIN sizes (with or without ACE)	-40°F (-40°C) to 113°F (45°C)
ODX-AGM	All Models	-40°F (-40°C) to 176°F (80°C)
ODS-AGM	Powersports (without metal jacket)	-40°F (-40°C) to 113°F (45°C)
	Powersports with metal jacket	-40°F (-40°C) to 176°F (80°C)
	Marine and RV	-40°F (-40°C) to 104°F (40°C)
NSB-AGM	All Models	-40°F (-40°C) to 176°F (80°C)

Table 3

B. UNDERSTANDING STATE OF CHARGE

Like all batteries, it is best that AGM² batteries be kept at a high SOC. It is important to understand how to determine the SOC of AGM² batteries correctly. The approximate SOC value is found by measuring the battery's Open Circuit Voltage (OCV) with a high-quality voltmeter. The voltage reading must be taken at least four hours after the battery finishes charging or at least 30 minutes after it finishes a discharge. Measurements will not be accurate if adequate rest time is not allowed. Table 4 below shows the typical relationship between OCV and SOC.

SOC	OCV
100%	12.9
75%	12.6
50%	12.2
25%	11.9
0%	11.5

Table 4

C. STORAGE AND SELF-DISCHARGE

Even if batteries are not installed in an application and are being stored, their SOC declines over time. The rate at which a battery loses charge depends on the temperature. The warmer the temperature the shorter the storage time before a freshening charge is required. Cooler temperatures slow down the rate of self-discharge. A good rule of thumb to use is that for every 18°F (10°C) rise in temperature the storage time is cut in half. This means that the storage time at 95°F (35°C) is half the storage time at 77°F (25°C).

If stored at 77°F (25°C) or lower, ODYSSEY® AGM² batteries should be given a freshening charge a minimum of at least once every two years or when the OCV drops to about 12.2V, whichever comes first. This OCV corresponds to a SOC of about 50%. Batteries should always be fully charged before they are stored. The warmer the temperature the more frequently OCV should be monitored. Table 5 below shows how temperature impacts the rate of self-discharge.

Storage Temperature	Storage time (Months)
41°F (5°C)	48
59°F (15°C)	36
77°F (25°C)	24
95°F (35°C)	12
113°F (45°C)	6

Table 5

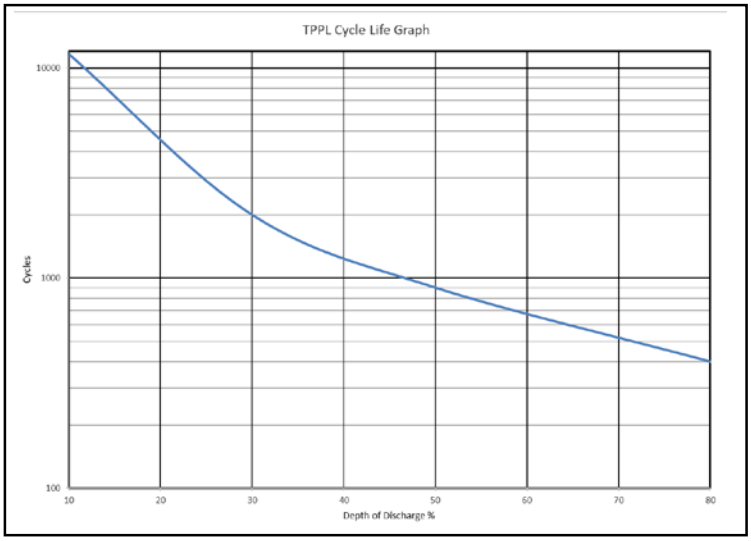
D. BATTERY LIFE EXPECATIONS

Cycling Applications and Depth of Discharge (DOD)

Applications in which the battery is frequently discharged and recharged are called cyclic. A complete cycle starts with a charged battery that is discharged and then brought back to a full charge. Design battery life in these applications is stated as the number of cycles the battery will deliver before its capacity drops to 80% of its rated value. For example, suppose a battery is rated at 100 amp-hours (Ah) and has a published cycle life of 400. This means that the battery can be cycled 400 times before its delivered capacity drops to 80Ah.

DOD is one of the main factors that determines how many cycles a battery can provide. The DOD is simply the ratio of capacity extracted from the battery to its rated capacity expressed as a percentage. If a 100Ah battery delivers 65Ah and is then recharged, it is said to have delivered a 65% DOD cycle.

The general relationship between DOD and number of cycles is shown below in Figure 1. Higher DODs results in longer cycle life.



*Data based on laboratory testing

Figure 1

E. FLOAT APPLICATIONS

Batteries that are primarily used as a source of backup or emergency power are not frequently cycled. The life of these types of applications is referred to as float life. Emergency lighting, security alarms and Uninterruptible Power Systems (UPS) are good examples of batteries in float applications. In each of these applications the battery is discharged only if the main utility power is lost; otherwise the battery remains on continuous float or trickle charge.

Since ODYSSEY® AGM² batteries are dual purpose by design, they offer a long-life battery option in float applications. At room temperature (77°F (25°C), these batteries have a design life of 10+ years in float applications. At end of life, an AGM² battery will still deliver 80% of its rated capacity.

F. CHARGING

The relationship between cycle life and DOD shown in Figure 1 holds only if the battery is properly charged after each discharge. This means that each time the battery is discharged, between 103-105% of the discharged amp hours (Ah) should be returned. For example, if 100Ah were discharged from the battery between 103-105Ah must be returned to the battery for a full recharge. Failure to do so (over or under charging) will result in a loss of cycle life and ultimately a loss of capacity. There are

several ways to recharge batteries and the best way depends on how the battery is being used.

Charging with an Alternator

When used in starting applications, ODYSSEY® AGM² 12V batteries will be charged on-board using a standard automotive alternator that generates anywhere between 14.2-14.5V at 77ºF (25ºC). We recommend a temperature compensation of the charge voltage at ±18 mv per battery per ºC variation in temperature from 25ºC. The warmer the temperature the lower the charge voltage and the cooler the temperature the higher the charge voltage.

Charging with an A/C Powered Charger

When used in cycling or stand-by power applications, an A/C powered charger can be used to recharge ODYSSEY AGM² batteries. There are two main types of A/C powered battery chargers on the market: full recharging ability or maintaining a full SOC.

In order to recharge a battery that has been discharged, it is best to use an automatic charger with an AGM setting that has the appropriate charge voltage and current per recommendations. For optimum charging, the current output should at least 40% of the battery's C10 rating. This means a battery that has a 10-hour rating of 100 amp hours should be charged with 40 amps. Charge current should never be less than 10% of the battery's C10 rating. Voltages higher than 15.0 volts will cause irreversible damage to the battery. Please refer to Figure 2 below for a graphical representation of the recommended charge profile for ODYSSEY AGM² batteries used in non-starting applications.

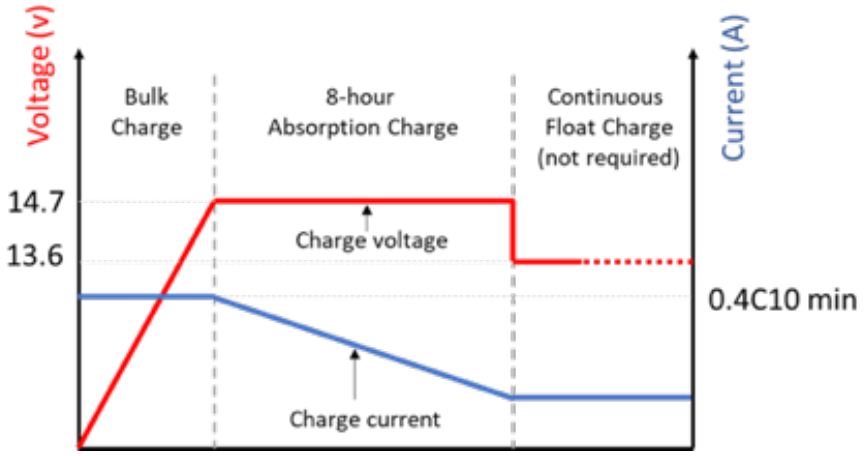


Figure 2

Chargers that are designed for maintaining a full SOC are often called "float" or "trickle" chargers and generally supply current in the 0.5 amp to 1.5 amp range. These chargers might also be called maintenance chargers and are often used to maintain batteries that are used in seasonal applications such as boats or RVs. These chargers are not suitable for recharging ODYSSEY AGM² batteries that have been deeply discharged. However, they are suitable for maintaining batteries at a full state of charge, provided the float voltage setting is appropriate. The recommended float voltage for ODYSSEY AGM² batteries is 13.6 volts for a 12-volt battery 77°F (25°C).

There are also chargers available that charge using constant current. These chargers do not have multiple charge phases as shown above in Figure 2. They simply supply current to the battery which causes the battery voltage to rise. Once the battery voltage reaches the setpoint for a fully charged battery, the charging will terminate. How long it takes to charge a battery with this method depends on how deeply the battery is discharged and how much current the charger provides. See the Table 6

below as an example of recharging a battery rated at 100 amp-hours from various depths of discharge using a 10-amp constant current charger.

Open Circuit Voltage	Depth of Discharge	Charge Time (hours)
12.6	25%	4
12.2	50%	8
11.9	75%	12
11.5	0%	16

Table 6

Temperature Compensation of Charge Voltages

Proper charging of all AGM[2] batteries requires temperature compensation of the charge voltage. This is especially true in float applications where the batteries are on-charge constantly. The temperature compensation coefficient is approximately ±18 mV per °C variation from 25°C per 12-volt battery. Temperature and charge voltage are inversely related. Therefore, charge voltage must be reduced as temperatures increase and charge voltage must be increased as temperatures decrease. Regardless of temperature, the minimum charge voltage is 13.2 volts as lower voltages will damage the battery grids and shorten life.

Recovering a Severely Discharged Battery

Many commercially available chargers must detect a certain minimum voltage for the charging process to start. This is a common safety feature to prevent using a 12 volt charger on a 6 volt battery. Chargers of this type are unable to charge a battery that has been severely over-discharged. For example, a 12-volt charger might not start the charging process if the battery connected to it has an OCV of 5 volts. Depending on the size of the battery, there are two ways to try to recover the battery.

- For batteries used in starting applications, the alternator can be used to recharge the battery after jump-starting the battery to start the vehicle.

- For batteries not used in starting applications, a second battery that is known to be at a high state of charge can be connected to the discharged battery in parallel. Refer to **Section IV, B (Battery Sketch 2)** for details related to connecting batteries in parallel. Once the low battery's voltage reaches 11.5 volts, the batteries can be disconnected from each other. The standard A/C charger normally used by the system can then be connected to the battery that needs to be charged. Please refer to "Procedure to Recover Deeply Discharged ODYSSEY Batteries" found on the www.odysseybattery.com website for more details.

It is important to understand why the battery became over-discharged, so the situation does not happen again. The most common reasons for batteries to be over-discharged are system issues related to parasitic loads (see page 12) or malfunctioning / non-existent low voltage disconnect equipment.

Unfortunately, this recovery process is not always successful. When batteries are severely discharged, sulfation develops and can be very difficult to remove depending on how deeply the batteries are discharged and how long they have been in that condition. This condition is not a warrantable condition since it is the result of abuse or neglect in the application, rather than a manufacturing defect.

G. PARASITIC LOADS

In many cases batteries that are apparently at rest may be supplying a small amount of current to connected equipment such as radios, clocks and security systems, to name just a few examples. Modern vehicles have multiple on-board computers that require small amounts of power to keep them alive. These small currents are collectively referred to as parasitic loads and may be detrimental to the life of a battery if they are not accounted for in the design of the system.

Over time these small loads – typically tens of milliamps (mA) – will consume significant amp-hours, which results in the battery voltage decreasing. Consider a boat that has a parasitic draw of 20mA and is docked for five months with the battery connected to the load. In that 150-day period that parasitic load will consume more than 70 amp-hours.

There are three ways to ensure that batteries are not being drained by parasitic loads in the system.

1. Physically disconnect the battery from the load after fully charging it. A master disconnect switch is also an effective countermeasure.
2. Periodically give the battery a freshening charge, using the charging and storage guidelines discussed above.
3. Connect a trickle charger for AGM batteries when the battery is stored, using the charging guidelines discussed above.

H. TESTING

There are several different ways to test AGM^2 batteries. Depending on the time and equipment available, one may choose to perform either a capacity test, a ½CCA Load Test or a Conductance Test. These options should help determine whether the battery returned by the customer has reached its end of life or simply needs a full recharge. For all methods, the battery should be as fully-charged before testing. Following are details related to each test method.

RECOMMENDATION: Testing should be completed on a clean/main battery terminal surface, not a steel stud. Testing batteries individually in multiple battery situations is best. At minimum, each battery must be disconnected at one terminal (the same polarity).

1. **Capacity Testing:** This method tests the performance of the battery based on its Reserve Capacity (RC) rating, which means the test may be more time consuming, however it is the preferred test method for a state of health check. The equipment needed to perform this type of testing is called a discharger tester. The battery should be fully charged before using this test method. Discharge testers are designed to apply a constant current load to a fully-charged battery until the battery voltage reaches 1.75 volts per cell (10.5 volts per battery) or other appropriate end point voltage inline with published performance tables, which is 100% discharged. The length of time the discharge tester runs until 1.75 volts per cell is reached should be compared to the battery's rated RC. Batteries which do not provide at least 80% of their rated runtime are considered failed.
2. **½CCA Load Test:** This method tests the performance of the battery based on its CCA rating and is much faster than capacity testing described above. The equipment needed to perform this type of test is called a ½CCA load tester. For accurate testing, the battery must be at least 75% charged, which for AGM^2 batteries means having an OCV of 12.6 volts or higher.

   To perform the test, the CCA rating of the battery must be programmed into the tester. These testers apply half of the battery's CCA rating to the battery for 15 seconds. After 15 seconds, the battery voltage should be above 9.6 volts if the temperature is 70°F (21°C) or warmer; voltage

below 9.6 v indicates a failed battery. For temperatures below 70°F (21°C), refer to Table 7 on the next page for voltage. Most of these testers will specify whether the battery passed or failed the test. This can be an ideal test for batteries used in starter applications.

Temperature	End of Test Voltage
70°F	9.60V
60°F	9.50V
50°F	9.40V
40°F	9.30V
30°F	9.10V
20°F	8.90V
10°F	8.70V
0°F	8.50V

Table 7

3. **Conductance Test:** This method tests the performance of the battery based on its level of conductance. This is a fast test and is generally the type of test that will be used by auto parts shops. The equipment needed to perform this type of test is a hand-held electronic battery tester. There are a variety of hand-held testers on the market and most allow the user to program key battery parameters such as CCA and battery type. If the tester has an option for AGM², it should be used, otherwise AGM is suitable. Like the ½CCA Load Test, the AGM² battery should have an OCV of 12.6 v or higher before testing. After the electronic testing is complete, the tester will indicate whether the battery passed or failed.

I. MAINTENANCE

ODYSSEY® AGM² batteries are very different from standard flooded batteries that are openly vented. These batteries operate as a sealed battery, which depend on internal recombination of battery gasses under normal operating conditions. This means that there should be minimal corrosion of terminals or any part of the surrounding area. It also means there is no need to ever add water to the batteries. Opening the battery cover causes damage to the battery and voids any warranty.

PLEASE NOTE: Perform periodic inspection for case damage, loose battery hold downs, loose connections, corrosion and container swelling.

J. VENTILATION

ODYSSEY AGM² batteries are part of a broader category of lead acid batteries called Valve Regulated Lead Acid (VRLA). This type of battery depends on the internal recombination of battery gasses for proper operation. The internal valve allows for nearly 100% recombination of gasses, which means there is no need to periodically add water.

WARNING: Any battery producing an odor or visibly venting should be removed from service. Physically disconnect only after the area has been ventilated.

The high recombination efficiency of ODYSSEY AGM² batteries makes them safe for installation in human environments. It is not uncommon to see these batteries in aircraft, hospital operating rooms and computer rooms. The only requirement is that these batteries must not be stored, operated or charged in a sealed or gastight enclosure. However, local regulations regarding ventilation must also be followed.

K. WARRANTY CONSIDERATIONS

ODYSSEY AGM^2 batteries are covered by warranty against defects in material and workmanship for at least two years. Some models and applications are covered for longer. Please note that the following actions will void any warranty coverage:

- Removing the labeled cover
- Removing or altering the battery's date code/serial number
- Opening the battery case

The complete warranty statement can be found on our website, www.odysseybattery.com, for more details.

VI. ADDITIONAL INFORMATION

Additional Information? Should you need additional information, please contact your local Sales Representative or battery supplier. Our Technical Support group is also available by phone at +1-800-964-2837 and by submitting a Technical Inquiry through the Contact Us link on our website: https://www.odysseybattery.com/contact/.

VII. FAQS

Are ODYSSEY® AGM^2 batteries the same as Gel batteries?

No, these are not Gel batteries. These are absorbed electrolyte batteries, which means there is no free acid inside the battery; all the acid is absorbed in the glass mat separators. These separators serve to keep the positive and negative plates apart. In Gel batteries, the electrolyte is in a gel form.

What is the Ah rating?

The ampere-hour (Ah) rating defines the capacity of a battery. A battery rated at 100Ah at the 10-hour rate of discharge will deliver 10A for 10 hours before the terminal voltage drops to a standard value such as 10.5V for a 12V battery.

Does mishandling the battery void the warranty?

The warranty applies to manufacturing defects and workmanship issues and does not cover damages caused by customer mishandling.

What is the CCA rating?

Per SAE standard, the Cold Cranking Ampere (CCA) rating is the number of amperes a battery can deliver for 30 seconds at a temperature of 0°F (-18°C) before the voltage drops to 1.2 volts per cell or 7.2V for a 12V battery. A 12V battery that has a rating of 550 CCA will deliver 550 amps for 30 seconds at 0°F (-18°C) before the voltage falls to 7.20V.

What is the MCA rating?

The Marine Cranking Ampere (MCA) rating refers to the number of amperes a battery can deliver for 30 seconds at a temperature of 32°F (0°C) until the battery voltage drops to 7.20V for a 12V battery. A 12V battery that has an MCA rating of 725 will deliver 725 amperes for 30 seconds at 32°F (0°C) before the voltage falls to 7.20V. The MCA is sometimes called the cranking amperes or CA.

What is the HCA rating?

The abbreviation HCA stands for Hot Cranking Amps. It is the same as MCA, CA or CCA, except that the temperature at which the test is conducted is 80°F (26.7°C).

What is the PHCA rating?

Unlike CCA and MCA the Pulse Hot Cranking Ampere (PHCA) rating does not have an "official" definition; however, we suggest that for true automotive and marine purposes, a 30-second discharge is unrealistic. The PHCA, a short duration (about 3-5 seconds) high rate discharge, is more

realistic. Because the discharge is for such a short time, it is more like a pulse. The low impedance of ODYSSEY battery technology allows them to maintain a higher voltage for more starter pulses, resulting in less heating of starter motors and cables. Higher power output results in a faster start.

What is impedance?

The impedance of a battery is a measure of its internal resistance. The lower the battery impedance the more the available power. The impedance of ODYSSEY® AGM² batteries is considerably lower than that of a conventional automotive or marine battery. The high rate discharge capability of ODYSSEY AGM² automotive and marine batteries is significantly higher than that of conventional automotive and marine batteries.

What is Reserve Capacity (RC) rating?

The RC of a battery is the number of minutes it can support a 25-ampere load at 80°F (27°C) before its voltage drops to 10.50V for a 12V battery. A 12V battery with a reserve capacity rating of 100 will deliver 25 amps for 100 minutes at 80°F (27°C) before its voltage drops to 10.5V.

What is the short-circuit current of these batteries?

Typically thousands of amps. As mentioned before, the AGM² batteries have a very low internal resistance, which means that the short circuit current is very high. Precautions should be taken to avoid short circuits as equipment and battery damage will occur.

What is the operating temperature range of these batteries?

The operating range varies based on the battery type. Refer to table 3 on page 7 for details.

Is the battery ruined if it is dropped?

It is possible to damage the internal connections as well as the external container, leading to a damaged the battery. Batteries with visible external damage should not be used. Dropped batteries should be tested prior to use.

VIII. DEFINITIONS OF ACRONYMS

AGM – Absorbed Glass Matt battery. This is a type of VRLA battery in which all the electrolyte in the battery is absorbed into the glass mat separator material.

TPPL – Thin Plate Pure Lead. This refers to the fact that these batteries are made of very thin plates, which do not contain any calcium or other typical impurities which deplete battery voltage over time.

VRLA Battery – Valve Regulated Lead Acid Battery. These lead acid batteries are designed to include pressure relief valves that allow for nearly 100% recombination of the gasses that would vent in traditional flooded batteries. Because of this very efficient recombination process, there is no need to periodically add water to these batteries.

OCV – Open Circuit Voltage. This is a voltage reading obtained from a battery that is not charging or discharging. To get an accurate OCV on AGM² batteries, it is important to wait at least four hours after charging or 30 minutes after discharging to take the voltage reading.

DOD – Depth of Discharge. This is the measure of how many amp hours were taken out of a battery compared to the battery's rating. For example, a 100 amp-hour battery which has 40 amp-hours removed during discharge is said to be at 40% DOD.

SOC – State of Charge. The level of charge of a battery. It can be approximated by evaluating the battery's OCV.

EnerSys World Headquarters
2366 Bernville Road
Reading, PA 19605, USA
Tel: +1-610-208-1991 /
+1-800-538-3627

EnerSys EMEA
EH Europe GmbH
Baarerstrasse 18
6300 Zug, Switzerland

EnerSys Asia
152 Beach Road
#11-08 Gateway East Building
Singapore 189721
Tel: +65 6416 4800

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