



Outrageously Dependable®



Marine/RV Battery Maintenance

MAXIMIZING
CYCLING PERFORMANCE

Marine/RV Deep-Cycle Batteries



HD24-DP



SRM-24



SRM-27



GC2-XHD



SRM-29

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An Introduction to Marine/RV Deep-Cycle Batteries

There are many misunderstandings regarding Marine/RV deep-cycle batteries. This booklet is designed to clarify terminology and misconceptions and to assist you, the customer, in

1. making an informed decision regarding proper usage,
2. extending overall battery service life, and
3. maintaining battery performance at optimum levels.

Deep-Cycle Batteries

The term “deep cycle” refers, in general, to a battery that has the capability of deeply discharging hundreds of times. Deep-cycle batteries are either liquid electrolyte or sealed lead acid. How do they differ from other batteries? An automotive starting battery is manufactured specifically to provide a quick burst of energy thousands of times in its lifetime, while only being able to **deeply** discharge less than 50 cycles during its life.

Sealed Lead-Acid Versus Flooded Lead-Acid

Marine/RV deep-cycle batteries are available in two different lead-acid types. A flooded or liquid-electrolyte battery has vent caps to allow maintenance, and a sealed lead-acid battery is completely sealed or maintenance-free. Each is available in common battery group sizes and has similar ratings (CCA, RC, and Ah). The SLA battery is used where the battery or battery bank is not easily accessible. Maintenance on the flooded battery includes checking electrolyte and adding distilled water.

Deep-Cycle Sealed Lead-Acid Batteries (SLA)

Interstate offers a wide selection of Sealed Lead-Acid (SLA) batteries for Marine/RV use, including both Gel Cell and Absorbed Glass Mat (AGM) types. Because they do not require maintenance, many consumers prefer them. And, for applications with hard-to-reach batteries, SLA batteries are ideal.

AGM and Gel batteries are completely sealed so absolutely NO corrosion occurs. While both AGM and Gel types are lead-acid batteries, neither will expel external gasses, such as hydrogen and oxygen during recharge. They combine gasses internally.

Note that AGM technology has advanced in recent years and is now available in Marine/RV deep-cycle and automotive starting batteries.

Important: Please remember, both AGM and Gel batteries should be recharged with a charger that is specifically designed for SLA batteries. When AGM or Gel batteries are used to replace liquid electrolyte batteries, always check with the vehicle or battery manufacturer for information about charging requirements.

Proper Deep-Cycle Application

A Marine/RV deep-cycle battery can be used for various applications including boats, motorhomes, sailboats, travel trailers, tent campers, etc. Anytime an application indicates a need for batteries that can provide repeated deep discharge, you need Marine/RV deep-cycle batteries.

What Is a Cycle?

A cycle refers to **one** battery discharge and recharge of any depth (See Figure 1). The amount of battery discharge (in percent) compared to its full capacity determines the need for a shallow, moderate or deep cycle. This is appropriately called battery depth of discharge (DOD) and is measured in percentages.

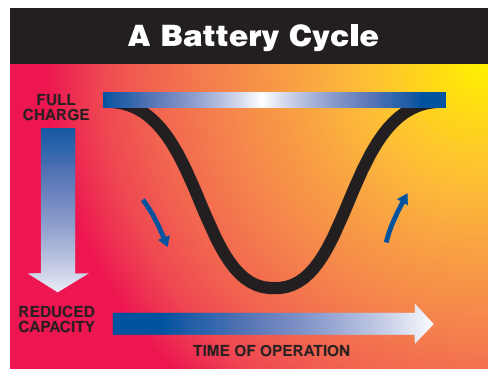


FIGURE 1

For example, 40% DOD indicates that a battery has been discharged by 40% of its total capacity and has a 60% state of charge remaining.

Types of Cycles

There are three primary types of battery discharge cycles: **shallow**, **moderate** and **deep**. These terms help us understand the type of cycling that batteries experience. To clarify, let's take a look at all three types. **Shallow** cycles occur when only a small percentage of the total battery capacity is discharged. Following that

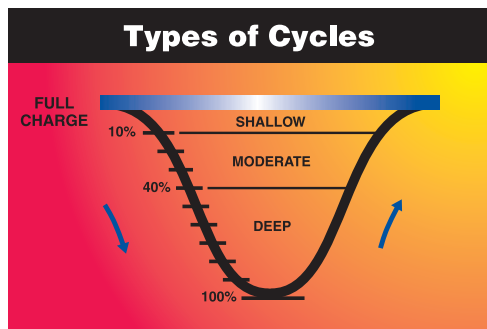


FIGURE 2

same line of thought, **moderate** or **deep** cycles are discharged by a higher percentage of the battery's total capacity (See Figure 2).

Cycle Life

How many cycles should a Marine/RV deep-cycle battery produce in its life? Battery cycle life is difficult to calculate and is dependent on multiple variables, including battery maintenance, proper recharge, battery depth of discharge, battery temperature, cycling use, vibration, and overall care and consideration.

One of the more important factors is the battery's depth of discharge (DOD) level per cycle. As the amount of DOD is increased per cycle, there is a resulting decrease in the amount of total cycle life and available performance retention (See Figure 3). If, for example, a battery is discharged consistently to 100% DOD (considering all other variables are consistent), the battery's total cycle life can be reduced to much less than one-half of a battery discharged to only 50%.

Approximate Life Cycle Performance (Deep-Cycle Battery)

% DEPTH OF DISCHARGE	CYCLES TO 50% CAPACITY
25	2200
50	1000
75	550
100	250

Typical performance at 80°F (cycles halved per 18°F rise). Discharged to 1.75 volts/cell. End of life at 50% capacity.

FIGURE 3

Therefore, to optimize performance of a Marine/RV deep-cycle battery, it is recommended that the consistent discharge level not fall below 50%. Remember, many other factors affect battery cycle life. If the battery is operating in a high heat environment (consistently above 90°F), the typical number of cycles could be drastically reduced.

Battery State of Charge vs. Voltage/Specific Gravity

VOLTAGE	SPECIFIC GRAVITY	STATE OF CHARGE	DEPTH OF DISCHARGE
12.75	1.275	100%	0%
12.45	1.225	75%	25%
12.25	1.190	50%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

FIGURE 4

Determining Battery Depth of Discharge/State of Charge

Battery DOD (in percent) is the opposite of battery state of charge. For example, if the battery has a 70% state of charge, the depth of discharge is 30% since the total must be 100% (See Figure 4). The most efficient means of determining the battery's state of charge/depth of discharge on removable-filler-cap batteries is by using a hydrometer. On maintenance-free batteries, an accurate digital voltmeter is the best method.

Surface Charge

Surface charge, in general terms, refers to an inflated charge level immediately after the battery has been charged. Surface charge affects a voltmeter test of the battery's state-of-charge level more than a hydrometer test. As an example, even hours after a charge, testing the battery voltage and reading 12.66–12.75 volts may not be a true indicator that the battery is fully charged. To remove battery surface charge, apply a load to the battery for a period of time. For example, apply 10–15 amps for two to three minutes, then allow the battery to sit for one minute before retesting.

Ratings and Specifications

Marine/RV deep-cycle batteries have rating specifications that include cold cranking amps (CCA), marine cranking amps (MCA), reserve capacity (RC) and ampere hours (Ah). RC and approximate Ah ratings may not be listed on the battery decal. However, they are available through your local Interstate Batteries Distributor. Unless specified, the Ah ratings are based on a 20-hour discharge.

Cold Cranking Amps (CCA) CCA is the amount of current (amps) a battery at 0°F (-17.8°C) can deliver for 30 seconds while maintaining at least 1.2 volts per cell (7.2 volts for a 12-volt battery).

Marine Cranking Amps (MCA)

MCA is the amount of discharge current a battery tested at 32°F (0°C) can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts on a 12-volt battery).

Note: Interstate Batteries uses the RC rating established by Battery Council International (BCI). Some manufacturers use a 15 or 23-amp discharge rate rather than 25-amp discharge. The lower discharge level allows a higher number of minutes to be displayed (on the battery label) which does not reflect the true RC minutes at a 25-amp discharge.

Reserve Capacity (RC) RC is the amount of time a battery can deliver 25 amps at 80°F (26.7°C) without falling below 1.75 volts per cell (10.5 volts on a 12-volt battery).

Approx. Hours at Ampere Load					
	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
HD-24-DP	11.6	5.0	3.2	2.4	1.7
SRM-24	16.4	7.4	4.6	3.5	2.5
SRM-27	19.4	8.5	5.4	3.8	3.0
SRM-27B	20.4	9.0	5.7	4.0	3.1
SRM-29	21.4	9.4	5.9	4.3	3.2
SRM-4D	38.0	18.2	11.5	8.5	6.5
U2200	45.0	22	12.5	9.1	7.0

FIGURE 5

Ampere hours (Ah) tested at 80°F. It is the amount of current (in amps) that a battery can deliver, multiplied by the amount of hours, without falling below 1.75 volts per cell (10.5 volts on a 12-volt). Most Marine/RV deep-cycle batteries are rated on a 20-hour discharge rate. Example: A 100Ah battery can deliver five amps for 20 hours (amps x hours = Ah).

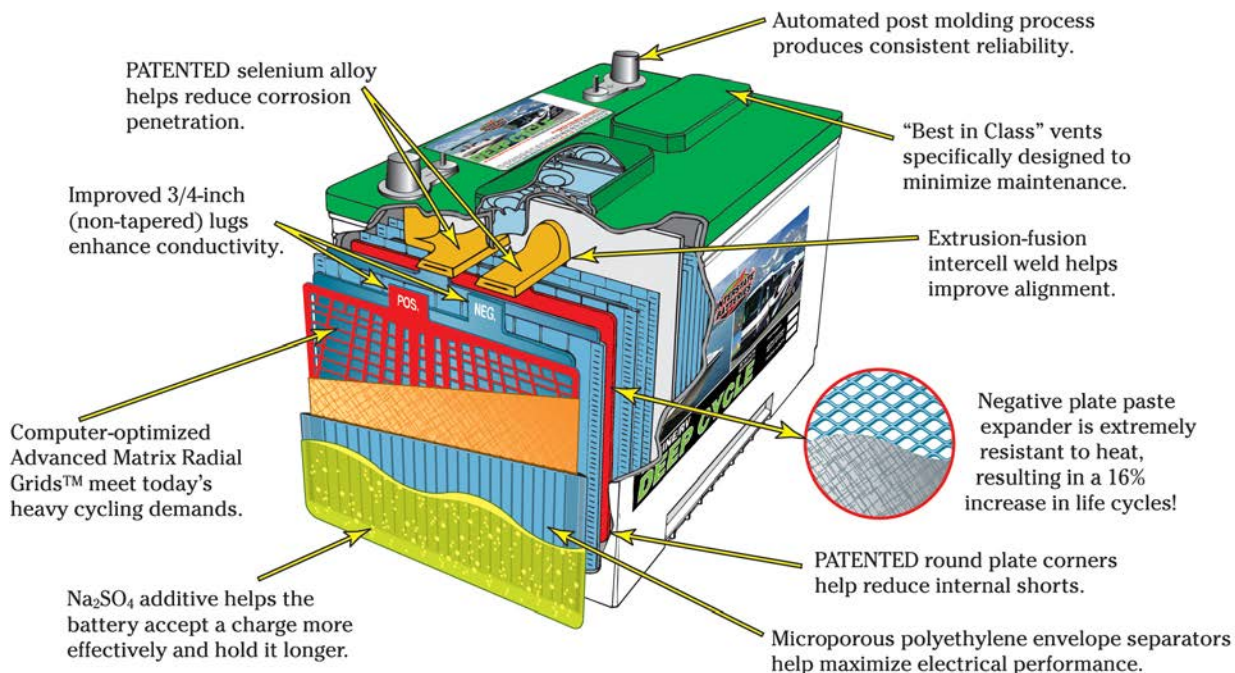
Battery Charging

Utilizing the correct charger and following proper charging methods is one of the **primary** keys to enhancing battery service life and performance. Always choose a charger specifically designed to match the charging requirements (voltage and current) of the battery or battery pack. If the charger unit is an on-board charger unit (i.e., alternator, generator, converter), validate its compatibility and proper operation before or immediately after installation of a new battery. Never allow a battery to become overcharged or overheated. If the battery becomes “hot to the touch” on the outside casing, immediately disconnect the charger and allow the battery to cool down before continuing.



The Interstate Batteries Cycling Lineup

Superior Quality Product Advantages:



What Makes a Deep-Cycle Battery Distinctive?

Several qualities separate deep-cycle batteries from starting types: thicker plates, denser active chemical plate material and a specially formulated grid alloy. These and other added features allow the Interstate Marine/RV deep-cycle batteries to withstand the severe, repeated stress deep cycling creates.

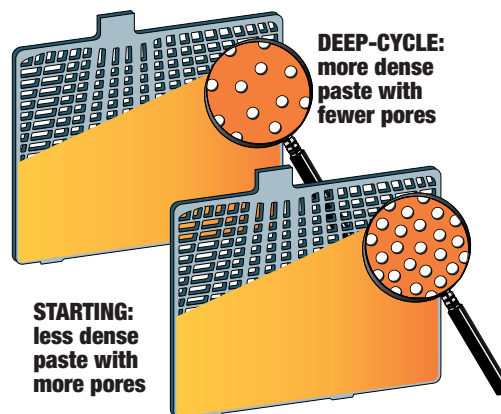


FIGURE 6

General Charger Information

Various types of chargers may be used on Marine/RV deep-cycle batteries. Most chargers, both onboard and external, are parallel-type chargers that have the capacity of reducing or tapering the current (in amps) while regulating voltage.

Although almost any type of charger will recharge a Marine/RV deep-cycle battery to some degree, short-term performance and long-term service life are directly proportional to proper recharging. It is recommended that you:

- Choose the correct charger that matches the type of battery you intend to recharge, i.e., liquid electrolyte, Marine/RV, deep cycle, automotive, maintenance-free or AGM.

- Match the proper battery voltage (6-, 12-, 24- or 36-volt).

- Choose the correct charger size in amps.

A good rule of thumb: A charger should provide a **maximum** of 20 amps for each 100 Ah of the battery.

- Select a charger with a capacity sufficient to fully recharge the batteries within eight to 12 hours.

- For optimum results, choose a maintenance-free type charger that is timed or automatically shuts off when the battery reaches a full state of charge.

- Always read and follow the charger instruction manual's safety and procedural recommendations. Different manufacturers offer various features that may influence charging parameters.



Charging Tip: Do not delay charging your batteries after use. Recharge as soon as possible after one day's use. Allowing the battery to sit discharged for several days may hamper its recharge acceptance and ultimately its performance.

Trickle Charging

The term *trickle charger* is often used to describe a low-current, inexpensive charger. Some trickle-type chargers may lack the

sophisticated electronic integrated circuitry to properly regulate current and/or voltage. A charger that lacks accurate voltage/current regulation should not be used for prolonged battery charging, or damage could occur. Some chargers have manual timers to allow a battery charge to be set for a few minutes up to several hours. **Always monitor a battery during charge, whether it is on an automatic or manual setting.**

Frequently Asked Questions

1. How important is an Ah rating?

The Ah rating is important when determining the type and amount of battery or batteries required to meet your specific component loads. The battery's RC rating is in direct correlation with Ah. An approximate Ah rating can be attained by multiplying the battery's RC rating by 0.6. Example: 180 RC x 0.6 = 108 Ah.

2. Should I completely discharge a deep-cycle battery the first few times I use it?

No! A Marine/RV deep-cycle battery does not require a complete discharge at any time in its service life. In fact, for best results, it is recommended to shallow or moderately discharge the first five to 20 cycles.

3. Do Marine/RV deep-cycle batteries develop a memory?

No! Lead-acid batteries do not develop a memory. What does this mean to you? Lead-acid batteries have the ability to cycle to various amounts of DOD anytime during their service life without a memory developing inside the battery.

4. Which is the most detrimental to a battery, heat or cold?

Both extremes create battery problems. Extreme heat will allow the battery to increase its short-term performance level. However, heat internally accelerates corrosion and other deterioration factors that reduce a battery's life. Extreme cold battery temperatures result in an immediate reduction of battery efficiency level, which reduces short-term performance. For example, a fully charged battery at 80°F

(26°C) should operate with 100% efficiency, at 32°F (0°C) with 65% efficiency, and at 0°F (-17.8°C) with 40% efficiency.

Estimating Battery Needs

LIGHTS	5 AMPS	5 HOURS =	25 Ah
FISH LOCATOR	1 AMP	5 HOURS =	5 Ah
TROLLING MOTOR	10 AMPS	5 HOURS =	50 Ah
MINIMUM REQUIREMENT			80 Ah

80 Ah will supply the minimum requirements at 80°F. To assure acceptable battery cycle life and performance, divide 80 Ah by 0.50 = 160 Ah. Use a battery system rated for 160 Ah @ 20 hour discharge rate.

FIGURE 7

Typical Power Consumption



TYPE OF APPLIANCE	AC WATTS	APPROXIMATE BATTERY Ah (@12V)	
		30 MIN.	(1 HOUR)
13" COLOR TV	50	2.3	4.6
3 cu.ft. REFRIG.	150	7	14
COFFEE MAKER	1000	46	92
VCR	50	2.3	4.6
LIGHT BULB	100	4.6	9.2
BLOW DRYER	1200	55	110

DC amp hours = [(AC watts) / 12] x 1.1 x (hours of use).

FIGURE 8

5. How do I select the proper type and amount of batteries to fit my needs?

- Determine your total power requirements.
- Determine approximate time of use.
- Multiply hours by amps.
- Divide total ampere hours by 0.50 (50% DOD) to maximize battery cycle life.

Tip: When choosing a battery or batteries for trolling motors, know that a 12-volt system requires a minimum of 1.1 to 1.2 amps per pound of thrust. A 24-volt system requires 0.85 to 0.95 amps per pound of thrust. And a 36-volt system requires 0.5 to 0.55 amps per pound of thrust.

6. When do I need additional batteries? When your power requirements exceed the Ah your battery system can provide, you will need to connect additional batteries to your system or increase the individual battery size (capacity). If you are consistently replacing the battery or batteries before the warranty has expired, the capacity in your system may not be adequate to supply your needs.

Tip: Once a year, re-evaluate your total battery needs and vehicle load requirements. If you have added any accessories over the past year or the hours of usage have increased, increase your total battery capacity.

7. As a battery ages, does efficiency decrease? Normally, a properly charged, Marine/RV deep-cycle battery's efficiency improves slightly after the first 10 to 20 cycles. As a battery ages, its maintenance requirements change. Near the end of useful service life, however, the battery will start to lose efficiency, decreasing performance and increasing maintenance.

8. Is it best to slow charge a Marine/RV deep-cycle battery?

Yes! As previously mentioned, a Marine/RV deep-cycle battery should be charged at a slow current rate. Typically, a 10- to 20-amp charger is normally large enough to recharge a battery of 100 Ah within eight to 12 hours. A charge level of one to two amps is often acceptable, however, the battery should be monitored periodically due to the extended charge time. It is best to choose a charger that has an automatic shut-off capability. This type of charger normally monitors the battery's charge level electronically, then shuts off completely, or maintains the battery's state of charge.

9. Are the Interstate flooded Marine/RV deep-cycle batteries maintenance-free?

Interstate Marine/RV, deep-cycle, liquid-electrolyte batteries are "low maintenance." This means that maintenance can be performed, but under normal conditions is seldom needed. Interstate also offers sealed lead-acid batteries which are maintenance-free.

10. How do I know if my charger is correct for the battery's charging needs? Check and/or test the battery or batteries every four to six weeks. This action will determine whether your onboard or external charger is operating in harmony with your battery system. For example, if your batteries are using an excessive amount of water (additional water needed every two to three weeks), the charger may be overheating and/or overcharging your batteries. If your batteries are not meeting the performance expected, the charger may be undercharging the batteries. If the batteries are low-maintenance, test with a hydrometer. A low state of charge will hamper the performance and service life of the battery.

11. Do I need to equalize my batteries? When the specific gravity of individual cells in a battery or bank of batteries become unequal by more than 15 points or when the battery will not come up to full charge using normal charging methods, an equalization charge is needed. An equalization charge is a battery charge at a slightly higher voltage than normal. On a 12-volt battery system, this may be 15.5 volts to 16.2 volts.

So how do you know if your batteries need an equalization charge? It depends on the battery type and manufacturer. With normal use, starting (or chassis) batteries do not require any equalization throughout their service life. In some household or deep-cycle applications, an equalization charge may be necessary. Sealed lead-acid batteries do not require an equalization charge.

Caution: Due to the higher-charge voltage required when equalizing, it is necessary to consult and follow vehicle and battery manufacturer's guidelines. Some vehicle manufacturers require complete battery disconnection from the vehicle's electrical/electronic system prior to an equalization charge. Always monitor the batteries during an equalization charge. If the batteries become "hot-to-the-touch" or spew acid, disconnect immediately!

12. When do I need to add water to my batteries? If the vehicle's charging system is working well with the batteries and adequate time is allowed to properly recharge, additional water may not be necessary. It is important to remember that all flooded, lead-acid batteries gas H_2O during charging, so you should never add premixed electrolyte to your battery! Add water, preferably distilled, when the electrolyte level falls below **1/2" above the plates**. Do not overfill. Do not fill the cell higher than **1/8" below the battery's internal vent-well**. Overfilling the battery can result in increased water loss and post corrosion. Remember, as batteries near their end of life, they often require more maintenance.

13. Will it damage my batteries to sit for weeks or months? A battery sitting unused can deteriorate faster than a battery that is used (recharged) daily. As a battery sits, the chemicals inside the battery react, discharging the battery. This process is called battery self-discharging.

Depending on the battery type and temperature, the rate of self-discharge varies. For example, a typical liquid-electrolyte Marine/RV battery kept at a constant 80°F (26.7°C) may self-discharge approximately 25% of its capacity in three to four months. If the battery has any type of vehicle electrical discharge, like maintaining sensor voltage, the battery will discharge more quickly. The battery will not be damaged if it is recharged properly.

Tip: If the battery is used seasonally or sporadically, place a fully-automatic charger on the battery for a few hours each week. Please remember to monitor batteries during recharge.

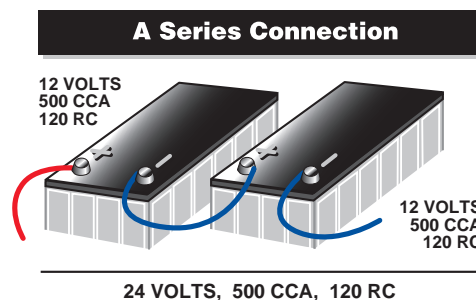
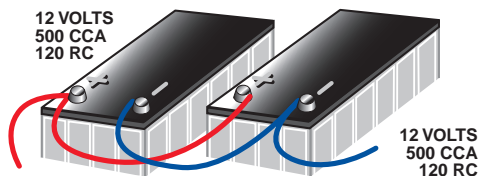


FIGURE 9

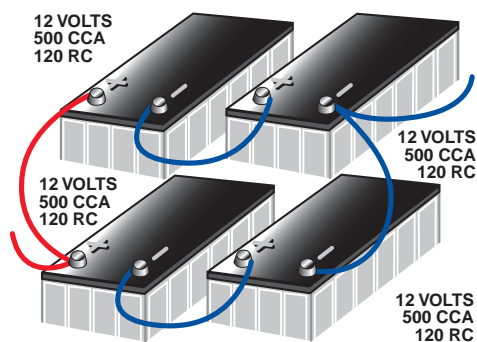
A Parallel Connection



12 VOLTS, 1000 CCA, 240 RC

FIGURE 10

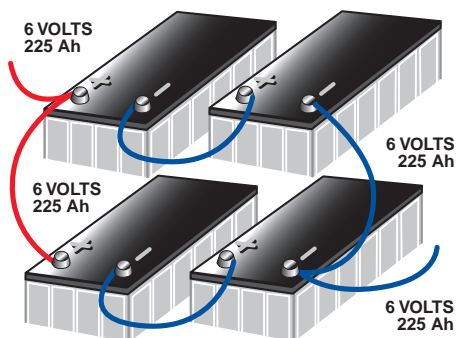
A Series/Parallel 24-Volt Connection Using 12-Volt Batteries



24 VOLTS, 1000 CCA, 240 RC

FIGURE 11

A Series/Parallel 12-Volt Connection Using 6-Volt Batteries



12 VOLTS, 450 Ah

FIGURE 12

Interstate's Marine/RV Starting Batteries

These batteries are used primarily in the marine industry for starting purposes only. They are built "Interstate-tough" to withstand the most rugged conditions and have these quality features:

- Four-post design
- Carrying handles
- Calcium/calcium chemistry
- Vibration-resistant technology
- High density active chemical material
 - Na₂SO₄ additive
 - Negative plate paste expander

Typical Applications

Choose the Correct Interstate® Product to Fit Your Needs

IBS PART NO.	APPLICATION	CCA	MCA	RC@25A
24M-RD	Engine starting	400	500	75
24M-HD	Engine starting	500	625	95
24M-XHD	Engine starting	800	1000	135
27M-XHD	Engine starting	800	1000	180
SRM-24	Engine starting, trolling motors (24/36-volt), power accessories*	550	690	140
SRM-27	Engine starting (over 7000 watts at 0°F) trolling motors (12; 24-, 24/36-volt), full line power accessory options	600	750	160
SRM-29	Engine starting (over 8000 watts at 0°F), trolling motors (12; 24-, 24/36-volt), full line power accessory options	675	845	210
GC2-XHD	Deep Cycle use only. Designed to operate full line power accessory options in 12-, 24- or 36-volt combinations	-	-	475

*Power accessories include fish finders, auto pilot, invertors, safety systems, blowers and lighting.

FIGURE 13

Interstate Batteries offers a complete line of sealed AGM, Marine/RV deep-cycle batteries. Contact your local Interstate distributor for more information about various product lines.

#1 Selling Marine/RV Battery

Interstate's high-quality product, unparalleled service, nationwide distribution and overall value make it the top-selling Marine/RV battery. Interstate deep-cycle and cranking Marine/RV batteries are built by the industry's leading manufacturer, who has more than 80 years experience in research, design and technology. With Interstate, you and your customers have the power to go anywhere.



Outrageously Dependable®



Call 1-800 Crank-It for a dealer near you.
InterstateBatteries.com