BATTERY AND CHARGER SELECTOR GUIDE

Clean, fume-free, quiet, safe and dependable battery power is used in many commercial and industrial applications today, including floor cleaning and maintenance. Space age advances in battery design and construction have made batteries a practical means of powering a variety of Nilfisk-Advance mechanized maintenance products.

Through its *APA* sales program, Nilfisk-Advance promotes the use of the proper battery in the appropriate equipment. The intention of this "Selector Guide" is to provide a general explanation on the use and care of today's batteries. This information is intended to help in selecting the right battery for equipment, based on the job that equipment is expected to perform. This Selector Guide is meant only as an aid to Nilfisk-Advance Dealers, their sales personnel and end-users of Nilfisk-Advance equipment.

APA also offers a complete family of battery chargers for the full line of battery-powered Nilfisk-Advance equipment. These heavy-duty chargers are especially matched to the equipment and batteries they are meant to service, ensuring maximum life and performance as well as economical operation and safety.

Important *APA* charger features and benefits:

Feature:	Benefit:
• Automatically tapered charge rate.	Provides good equalization of cells, superior battery life, low water use.
• Automatically compensates for AC supply voltage variations plus or minus 10% from nominal voltage.	Will control spikes in voltage and reduce risk of damage to charger.
• Silicon diodes operating well below service rating.	Provides maximum surge protection and operating reliability.
• Positive shut-off of charger when charging is complete.	No over or under charging that can cause battery damage.
• Automatic shut-off when either AC or DC plug is pulled or when charger time has elapsed.	Safety feature in that it helps prevent personal injury to operator.
• Low current draw, operating only when connected to battery.	Cost/wear savings.
• Charger performance is matched to Nilfisk-Advance machines.	Protect and preserve batteries for optimum performance.
• Convection-cooled design.	Minimum maintenance.
• Built-in Ammeter standard (measures electric current in amperes).	Not necessary to purchase as an additional accessory.

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GENERAL INFORMATION

A battery basically consists of a container with positive and negative plates inside, and a cover with positive and negative terminals. To activate, the container is filled with an electrolyte, a dilute solution of distilled water and sulfuric acid. This electrolyte solution will stay in liquid form, or turn into a gel in the case of gel-cell batteries.

In this business, we deal mostly with two types of batteries. There are **starter batteries**, which provide the current for starting and running internal combustion engines. These batteries must deliver high *cranking currents* at a satisfactory voltage for a few seconds and a portion of the accessory load (10-25 amps) for a minute or two at a time. Power taken from this battery is immediately replaced by the alternator or generator, so the battery is subjected to shallow discharge cycles (2-3% of the battery capacity). These batteries operate in the 90-100% state of charge.

Deep-cycle batteries supply all the current for the electric-powered vehicles in which they are used. The rate of discharge varies with the type of service – what they are used for. The depth of discharge varies with the length of time it is used before being recharged. Once the battery is discharged, it must be recharged to continue operating the vehicle; and it is not recharged by an alternator. These batteries receive "deep" discharges (70-80% or more of their capacity).

Cold Cranking Amps is a rating applied to all starter, lighting, ignition and deep-cycle batteries. It gives the highest discharge level (in amps) that can be sustained by a fully charged battery over 30 seconds without dropping cell voltage below 1.2 volts at 0° Fahrenheit.

Contrary to a popularly held belief, deep-cycle batteries do not have a "memory". It was once believed that unless a deep-cycle battery was discharged to its full amount of use before each recharge, it would not hold as full a charge and working time would be reduced. This is not true, and it is recommended batteries be fully charged after each machine use, whether they were discharged to the maximum or not.

New batteries should be given a "boost" charge prior to their initial use, and a break-in period is recommended. Refer to the manufacturers break-in procedures.

Reserve Capacity at 75 amp is the amount of time in minutes that it takes a battery to go from fully charged to 1.75 volts per cell using a constant 75 amp discharge at 80° Fahrenheit.

Discharged: 5.25 volts for 6 volt and 10.50 volts for 12 volts.
Full Charge: 6.30 volts for 6 volt and 12.60 volts for 12 volts.

20 hour is a rating given in amps, the total amount of amps a fully charged battery can provide in a 20 hour period, reaching a discharge level of 1.75 volts per cell at 80° Fahrenheit. Divide the rating by 20 hours to determine discharge rate.

Example: 1) a 200 AH battery will yield 10 amps for 20 hours.

Example: 2) a 105 AH battery will yield 5.25 amps for 20 hours.

6 hour is a rate given in amps for the total amount of amps a fully charged battery can provide in a six hour period, reaching a discharge level of 1.75 volts per cell at 80° Fahrenheit. Divide the rating by six hours to determine the discharge rate.

Example: 1) a 600 AH battery will yield 100 amps for 6 hours.

To convert 20 hour to 6 hour rate, multiply 20 hour rate by .84.

Example: 450 AH @ 20 hrs. x .84 = 375 AH @ 6 hrs.

Reserve capacity at 25 amps is a rating given in minutes, applied to starter, lighting ignition and deep cycle batteries demonstrating the time it takes for a fully charged battery to reach 1.75 volts per cell using a constant 25 amp discharge at 80° Fahrenheit.

Batteries

SAFETY

Batteries generate volatile gases. Keep open flames or sparks away from them. Battery electrolyte contains sulfuric acid. Keep batteries level to prevent spills, and avoid getting electrolyte solution on skin or clothing. Always wear eye protection when working near batteries. Do not let metal tools contact the positive terminal and a grounded surface at the same time.

When installing a battery always follow the equipment manufacturer's instructions. The battery should be secured firmly in it's own compartment. A coating of non-metallic grease or protective spray on all connections will help minimize future corrosion. Replace old or worn cables. Make sure the terminals and connectors are clean, and then tightly connect the cables to the battery terminals.

CARE AND MAINTENANCE

It's important to follow the charger manufacturer's instructions when charging a battery. New batteries should be given a boost charge prior to initial use, and all batteries should be charged after each use or while in storage.

(Note: If you have a manual charger, avoid overcharging a battery as this could lead to corrosion of the grids and will shorten the battery's life. Conversely, under charging causes a condition called sulfation, which will also shorten a battery's life.)

Maintain the proper fluid level in each cell as needed. Do this by adding distilled water when the fluid level is low. *(High mineral content in most tap water will adversely affect a battery's performance over time.)* Add water after charging (to 1/8" [3mm] over plates), to prevent overflow due to electrolyte expansion. For the same reason, do not over fill the cells, which can cause the loss of electrolyte from overflow, and reduce battery performance. It is equally important not to under fill. Never let the electrolyte level go below the top of the plates, as this can cause permanent damage, and reduce the battery's performance. Replace the vent caps after adding water, and then clean the battery. If there is an accumulation of electrolyte residue, clean it off with a solution of baking soda and water. Clean battery cable ends and battery posts with a wire brush.

The amount of recharge a battery needs can be determined by measuring the specific gravity with a hydrometer. A spot check of the cells should be done between watering to insure the electrolyte level is above the separator. Specific gravity readings on two or more cells should be done once a week after the battery is charged. The reading should be between 1.250 and 1.280.

The chart below shows the approximate "percent charged" of an electric vehicle battery at various specific gravity values, corrected to 80°F (26.7°C).

APPROXIMATE STATE OF CHARGE

Charged	1.300 Initial Full Charge	1.280 Initial Full Charge	1.265 Initial Full Charge
100%	1.300	1.280	1.265
75%	1.255	1.240	1.225
50%	1.215	1.200	1.190
25%	1.180	1.170	1.155
Discharged	1.160	1.140	1.120

Contrary to what many think, heat is more of a problem for batteries than cold. Cold storage of batteries is better. Batteries in storage should be checked periodically and fully charged at these intervals: below 40°F — charge every six months; 40°–60°F — every two months; 60°F and above — once a month.

Several common causes of battery failure which can be prevented are:

- Over charging and under charging
- Over watering and under watering
- Over discharging

CARE AND MAINTENANCE, Continued

Excessive discharging (more than 80%) may lead to the battery's inability to accept a charge and may eventually destroy the battery. Sulfation is a normal end product of a discharge, and is not usually notable or harmful. However, if batteries are left in a discharged state, sulfate can build up on the plates and will lead to reduced performance and shorter battery life. Sulfation can be avoided by charging a battery after it is used. Keeping the battery properly charged at all times will prevent both over discharging and sulfation.

BATTERY RE-CYCLING

Every battery eventually wears out. Old batteries used to be a source of pollution, but today 100% of a lead-acid battery is recyclable. When you go to buy a new battery from your dealer, be sure to bring the old one in to be recycled.
When purchasing *APA* batteries, we do not require our dealers to give us a used battery in return. The old battery is kept by the dealer to be turned in for recycling.

APA TROJAN® BATTERIES

Aftermarket Parts and Accessories (*APA*) is now offering batteries manufactured by *Trojan*, the market leader in deep-cycle batteries.

Trojan Battery Company has produced a special line that features exclusive battery sizes for floor maintenance equipment. This allows customers a choice between a maximum and standard performance model in each battery size, at a reduced cost.

The features of these batteries include new power ranges to fit the needs of floor machines and end users, new designed containers, built-in handles, and more.

The *APA* model will specifically feature new high-tech Polyon case which is sturdier, lighter and more durable than the old rubber cases. These batteries are made with specially formulated Alpha Plus high-density paste, an improved technology which results in more durable positive plates, greater current flow and less shedding. All that means longer battery life, increased run time and greater return on your investment.

Each *Trojan*-made *APA* battery incorporates "love handles". These removable handles make it easy to remove or place the battery, even in "tight fit" areas. No need to hook up the battery posts and risk damaging your battery. (The Battery Council of America recommends never lifting a battery by the posts.) Lifting by the posts could damage the battery or cause personal injury. "Love handles" eliminate that risk.

Identifying the correct *APA Trojan* battery to order should be easier too. Each battery is identified with molded-in graphics, a label or both. In addition, Nilfisk-Advance places a decal on the battery with an "800" number that you can call if you need help finding a source for a replacement battery. There should be no question as to what battery to order for your Nilfisk-Advance product.

Batteries

ADVANCE BRAND MACHINE	BATTERIES USED	QUANTITY FOR MACHINE	WET PART #	DRY PART #
CARPET EQUIPMENT				
AquaMAX™	6 volt/195 amp hour	6 required	56 206 117	56 206 118
	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Aquamatic™ 20B*	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Aquamatic™ 26B*	6 volt/220 amp hour	6 required	56 206 077	N/A
	6 volt/238 amp hour	6 required	56 026 200	56 637 973
	6 volt/250 amp hour	6 required	56 206 079	56 206 071
Aquamatic™ 26BF	6 volt/220 amp hour	6 required	56 206 077	N/A
	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/250 amp hour	6 required	56 026 200	56 637 973
WALK-BEHIND SWEEPERS				
SW 700B	6 volt/238 amp hour	2 required	56 206 079	56 206 071
SW 850B	6 volt/238 amp hour	2 required	56 206 079	56 206 071
Retriever™ 134B	12 volt/105 amp hour	2 required	56 206 962	56 206 964
Retriever™ 300B & Retriever™ 350B	12 volt/105 amp hour	1 required	56 206 962	56 206 964
	6 volt/238 amp hour	2 required	56 206 079	56 206 071
Retriever™ 360G*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 360P*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 360B* & Retriever™ 3600B*	6 volt/238 amp hour	4 required	56 206 079	56 206 071
RIDER SWEEPERS				
SR 1000B	12 volt/130 amp hour	2 required	56 025 782	56 025 789
SR 1005B	12 volt/130 amp hour	2 required	56 025 782	56 0250 789
SR 1100B	6 volt/238 amp hour	4 required	56 206 079	56 206 071
SR 1100ECO	12 volt/85 amp hour	2 required	56 203 069	N/A
SR 1300B	6 volt/305 amp hour	4 required	56 391 391	56 206 073
SR 1300ECO	12 volt/105 amp hour	2 required	56 206 962	56 206 964
Retriever™ 3600B*	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Retriever™ 4000B	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Retriever™ 4600B	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/250 amp hour	6 required	56 026 200	56 637 973
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
	6 volt/395 amp hour	6 required	56 388 582	56 206 074
Retriever™ 5200G*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 5200P*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 5200D*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 5100G & 5100G PS*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 5100P & 5100P PS*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 5100D*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Retriever™ 5800B*	36 volt/665 amp hour	1 required	56 482 366	N/A
Retriever™ 5800G*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Retriever™ 5800P*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Retriever™ 5800D*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Retriever™ 6600G*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Retriever™ 6600P*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Retriever™ 6600D*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
BURNISHERS				
Whirlamatic™ 2000B*/2500B*	12 volt/185 amp hour	3 required	56 206 078	56 206 072
Whirlamatic™ 20UHSBD*	12 volt/185 amp hour	3 required	56 206 078	56 206 072
	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Whirlamatic™ 20UHSB	12 volt/185 amp hour	3 required	56 206 078	56 206 072
	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Whirlamatic™ VS20	12 volt/185 amp hour	3 required	56 206 078	56 206 072
	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Whirlamatic™Pro 21H,21K,27K,27N	12 volt/15 amp hour	1 required	56 102 522	
Whirlamatic™ T2000*	6 volt/395 amp hour	6 required	56 388 582	56 206 074
Whirlamatic™ 2700	6 volt/395 amp hour	6 required	56 388 582	56 206 074
WET DRY VACUUM				
Sprite Battery Air Scoop™ 12*	12 volt/105 amp hour	2 required	56 206 962	56 206 964

* No longer in production. ** Starter ignition battery

Batteries

ADVANCE BRAND MACHINE	BATTERIES USED	QUANTITY FOR MACHINE	WET PART #	DRY PART #
WALK-BEHIND AUTOMATIC SCRUBBERS				
Convertamatic™ 17B*/20B* (before S/N 0510105) Micromatic™ 17B, BA 5321, BA5321D	12 volt/105 amp hour	2 required	56 206 962	56 206 964
ConvertaMAX™ 20	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
	6 volt/250 amp hour	4 required	56 026 200	56 637 973
Convertamatic™ 20B*, 200B*, 200LX* (or BD) & Hydro-Retriever™ 200HD*	12 volt/105 amp hour	2 required	56 206 962	56 206 964
	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Convertamatic™ 21B*/210B*	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Convertamatic™ 24B*	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Convertamatic Trac™ 240*	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Convertamatic™ 240LX* & Hydro-Retriever™ 240HD*	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
	6 volt/305 amp hour	4 required	56 391 391	56 206 073
ConvertaMAX™ 26	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
	6 volt/250 amp hour	4 required	56 026 200	56 637 973
Convertamatic™ 26B* & Convertamatic™ 260B & Hydro-Retriever™ 260BHD*	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
Convertamatic™ 265LX* & Hydro-Retriever™ 265HD*	6 volt/195 amp hour	4 required	56 206 117	56 206 118
	6 volt/238 amp hour	4 required	56 206 079	56 206 071
	6 volt/305 amp hour	4 required	56 391 391	56 206 073
ConvertaMAX™ 28	6 volt/238 amp hour	4 required	56 206 079	56 206 071
	6 volt/250 amp hour	4 required	56 026 200	56 637 973
	6 volt/305 amp hour	4 required	56 391 391	56 206 073
I-MAX™28HD	6 volt/238 amp hour	4 required	56 206 079	56 206 071
	6 volt/250 amp hour	4 required	56 026 200	56 637 973
	6 volt/305 amp hour	4 required	56 391 391	56 206 073
Convertamatic Trac™ 280*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Convertamatic™ 285LX*,28LX*& Hydro-Retriever™ 285HD*, 280HD*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
Convertamatic™ 32BD & 32B*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Hydro-Retriever™ 320BHD*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Convertamatic Trac™ 320*, 325LX*, & Hydro-Retriever™ 325HD*	6 volt/395 amp hour	6 required	56 388 582	56 206 074
Convertamatic™ 32LX*, Hydro-Retriever™ 320HD*	6 volt/ 238 amp hour	6 required	56 206 079	56 206 071
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
	6 volt/395 amp hour	6 required	56 388 582	56 206 074
ConvertaMAX™ 34	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/250 amp hour	6 required	56 026 200	56 637 973
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
I-Max™ 34HD	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/250 amp hour	6 required	56 026 200	56 637 973
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
Convertamatic™ 38BD*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Convertamatic Trac™ 380*, 385LX*& Hydro-Retriever™ 385HD*	6 volt/395 amp hour	6 required	56 388 582	56 206 074
Hydro-Retriever™ 380BHD*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
Convertamatic™ 38LX* & Hydro-Retriever™ 380HD*	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
	6 volt/395 amp hour	6 required	56 388 582	56 206 074

* No longer in production. ** Starter ignition battery

Batteries

ADVANCE BRAND MACHINE	BATTERIES USED	QUANTITY FOR MACHINE	WET PART #	DRY PART #
RIDER AUTOMATIC SCRUBBERS				
Hydro-Retriever™ 2800 & 2800C	6 volt/395 amp hour	4 required	56 388 582	56 206 074
Hydro-Retriever™ 3200 & 3200C	6 volt/238 amp hour	6 required	56 206 079	56 206 071
	6 volt/250 amp hour	6 required	56 026 200	56 637 973
	6 volt/305 amp hour	6 required	56 391 391	56 206 073
	6 volt/395 amp hour	6 required	56 388 582	56 206 074
Hydro-Retriever™ 3800	6 volt/395 amp hour	6 required	56 388 582	56 206 074
All Models	12 volt/370 amp hour	3 required	56 409 392	N/A
	36 volt/370 amp hour	1 required	56 409 691	N/A
RIDER AUTOMATIC SCRUBBER/SWEEPERS				
Hydro-Retriever™ 2067G/P/D	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Hydro-Retriever™ 4500G/P/D*	12 volt/740 cold cranking amps	1 required	56 491 902**	N/A
Hydro-Retriever™ 5000B*/HM	36 volt/475 amp hour	1 required	56 454 400	N/A
Hydro-Retriever™ 5010B*/HM	36 volt/475 amp hour	1 required	56 454 400	N/A
Hydro-Retriever™ 5000G*/HM	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Hydro-Retriever™ 5000P*/HM	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Hydro-Retriever™ 2052B/HM	36 volt/395 amp hour	6 required	56 388 582	56 206 074
	36 volt/475 amp hour	1 required	56 454 400	N/A
Hydro-Retriever™ 2052G/HM	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Hydro-Retriever™ 2052P/HM	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Hydro-Retriever™ 5015B/HM*	36 volt/395 amp hour	6 required	56 388 582	56 206 074
	36 volt/475 amp hour	1 required	56 454 400	N/A
Hydro-Retriever™ 5015G/HM*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Hydro-Retriever™ 5015P/HM*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
OTHER EQUIPMENT				
Turfomatic™*	12 volt/450 cold cranking amps	1 required	56 441 511**	N/A
Roamer™ 320B*	6 volt/238 amp hour	4 required	56 206 079	56 206 071

* No longer in production. ** Starter ignition battery

GENERAL INFORMATION

The *APA* automatic tapering-type chargers use a ferroresonant transformer, which provides for automatic line voltage compensation while limiting output current. The timer is set automatically to control charge time. A low finish rate charges the batteries fully without excessive gassing, resulting in lower water use and longer battery life.

Trouble-shooting the *APA* automatic charger is easy because of simplified design. Each component is replaceable with basic hand tools. The *APA* automatic chargers have proven themselves to be highly reliable in widely varying climatic conditions and environments.

The *APA* automatic chargers eliminate over or under charging batteries, regardless of age or temperature. Charging is precise, due to a patented *Compu-Time* electronic timer, with state-of-the-art CMOS integrated circuits.

The charger turns on automatically by simply connecting the output cord to the batteries. The charge rate, indicated on the ammeter, tapers gradually to a finish rate of 5 to 10 amps.

The electronic timer monitors the rate of voltage rise during the charge period. When the rate levels off, the *APA* automatic charger senses it and shuts off. The measurement of the rate of voltage rise, rather than the actual battery voltage, has proven to be an extremely accurate method of determining full charge, regardless of battery condition. This patented circuitry makes all *APA* automatic chargers unique from other automatic chargers.

The advantages of electronic timing on automatic chargers is more than just convenience and simplicity. The elimination of over and under charging prolongs the life of your batteries by better than 30%. Over charging damages battery plates, causes gassing and wastes water. In addition, *APA* automatic chargers have a built-in higher finish-charge rate. They can fully charge a battery in 20% less time than manual chargers with lower finish-charge rates. With a fully charged battery, you get more range and working time from your Nilfisk-Advance machine, while increasing battery life more than 30%.

HOW THEY WORK

Automatic battery chargers, when connected to a discharged battery and energized, deliver maximum rated output current. As battery voltage rises, output charge current decreases in proportion to increasing battery voltage. When the battery becomes nearly full, the charger reduces output current to a pre-established finish rate. This ensures proper mixing of electrolyte.

SAFETY

Battery chargers are safe when properly operated for their intended use. Improper application of battery chargers can result in extensive and costly damage to batteries and equipment. Only trained operators and service personnel that are familiar with the chargers should install, operate or trouble-shoot the charger.

CARE AND MAINTENANCE

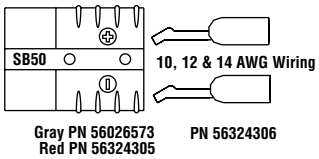
- The charger should be an output voltage size equivalent to the batteries, and be capable of charging the batteries in an eight to twelve hour period.
- Automatic chargers should be unplugged and the terminals reconnected to the battery after completing each charge cycle.
- Match batteries to the correct charger. Do not use a 12-volt charger on a 36-volt pack, or a 36-volt charger on a 24-volt pack.
- Chargers should be kept in proper operating condition including fundamental controls.

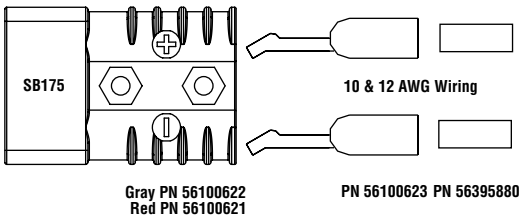
WARRANTY

Battery chargers have a limited warranty of three years from date of registration on the warranty card or forty-two months from factory shipment date, whichever comes first. If not registered, warranty expires three years after it leaves the factory.

APA warrants each new battery charger against defects in material and workmanship under normal use and service. Our obligation under this warranty is limited to make good at our factory or authorized Dealer service station, any part or parts thereof which, within the warranty period is returned to our factory or authorized service station, transportation prepaid, and after examination disclosed it to have been thus defective.

Warranty shall not apply to any charger repaired or altered outside of our own factory or authorized dealer service station. Warranty shall not apply to any charger which has been subjected to misuse, negligence, accident or abuse. Warranty shall not apply to diodes, which are vulnerable to electrical overloads beyond the control of the manufacturer. *APA* reserves the right to inspect and make the final decision on any warranty that may be questionable.



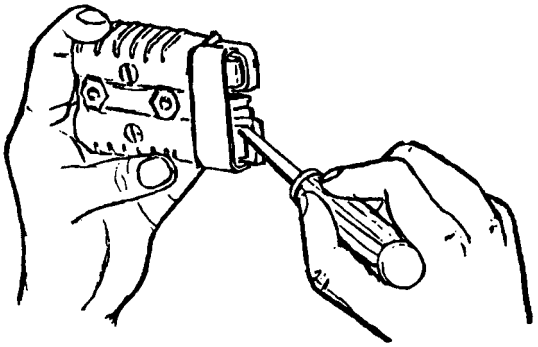


Charger plug replacement parts.

CHARGING PROCEDURES

NOTE: Improper procedures may shorten battery life.

- Become familiar with instructions issued with the charger or equipment manual.
- Batteries are to be charged after each period of use. Charging between short intervals of non-use is permissible. In cold weather, batteries should come off charge just prior to use.
- Do not allow batteries to set in a state of discharge.
- Always be sure batteries are fully charged each day prior to use of equipment.
- No smoking near batteries. Avoid flames and sparks which may cause an explosion and serious injury.
- Use of battery additives can shorten the life of batteries. **DO NOT** use them.



The Charger and battery machine wire terminals can be easily removed from the connector housing. CAUTION! To service charger plugs disconnect battery cables at machine and the charger input AC line cord.(to prevent possible short circuit)

1. Depress the spring clip with a screw driver as illustrated above.
2. Insert the wire terminals into the new connector housing.

U.S. & Canadian Chargers

MACHINE USED WITH	PN †	INPUT RATING	OUTPUT RATING	BATTERY RATING	PLUG
AquaMAX™	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/195 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
Aquamatic™ 20B*	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/225 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
Aquamatic™ 26B*	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/195 amp hour	56 100 622 Brad Harrison-Grey
Aquamatic™ 26BF	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/225 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101*	115 v/60Hz	36 vDC/20 amp	6 v/244 amp hour	56 100 622 Brad Harrison-Grey
Micromatic™ 17B, BA 5321, BA5321D	56 205 983	115 v/60 Hz	24 vDC/12 amp	12 v/105 amp hour	56 324 305 Anderson-Red
Convertamatic™ 17B*	56 206 980	115 v/60 Hz	24 vDC/10 amp	12 v/105 amp hour	56 386 119 Lester-Yellow
ConvertaMAX™ 20, ConvertMAX™ 26	56 372 947	115 v/60 Hz	24 vDC/20 amp	6v/195 amp hour	56 100 621 Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6v/238 amp hour	56 100 621 Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6v/250 amp hour	56 100 621 Red
Convertamatic™ 20B* (before S/N 0510105)	56 206 980	115 v/60 Hz	24 vDC/10 amp	12 v/105 amp hour	56 386 119 Lester-Yellow
Convertamatic™ 20B, 200B*	56 205 983	115 v/60 Hz	24 vDC/12 amp	12 v/105 amp hour	56 324 305 Anderson-Red
Convertamatic™ 200LX (or BD)*, &	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
Hydro-Retriever™ 200HD*	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/225 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
Convertamatic™ 21B*/210B*	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
Convertamatic™ 24B*/Trac 240*/Trac 280*	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
Convertamatic™ 240 LX* &	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
Hydro-Retriever™ 240HD*	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/225 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
	56 388 109	115 v/60 Hz	24 vDC/25 amp	6 v/305 amp hour	56 100 621 Brad Harrison-Red
Convertamatic™ 26B*/260B &	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
Hydro-Retriever™ 260BHD*	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/225 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
Convertamatic™ 265LX* &	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
Hydro-Retriever™ 265HD*	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/225 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
	56 388 109	115 v/60 Hz	24 vDC/25 amp	6 v/305 amp hour	56 100 621 Brad Harrison-Red
ConvertaMAX™ 28, I-MAX 28HD™	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/250 amp hour	56 100 621 Red
	56 372 109	115 v/60 Hz	24 vDC/25 amp	6 v/305 amp hour	56 100 621 Red
Convertamatic™ 285LX*/28LX* &	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 285HD*/280HD*	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/244 amp hour	56 100 622 Brad Harrison-Grey
	56 388 502	115 v/60 Hz	36 vDC/25 amp	6 v/305 amp hour	56 100 622 Brad Harrison-Grey
Convertamatic™ 32B*& 32BD*	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/195 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/225 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/244 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 320BHD*	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/195 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/225 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/244 amp hour	56 100 622 Brad Harrison-Grey
Convertamatic Trac™ 320*, 325LX* &	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 325HD*					
Convertamatic™ 32LX/38LX*,	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 320HD/380HD*	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/244 amp hour	56 100 622 Brad Harrison-Grey
	56 388 502	115 v/60 Hz	36 vDC/25 amp	6 v/305 amp hour	56 100 622 Brad Harrison-Grey
	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/360 amp hour	56 100 622 Brad Harrison-Grey
	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Brad Harrison-Grey
ConvertaMAX™ 34, I-MAX™ 34HD	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Gray
	56 388 502	115 v/60 Hz	36 vDC/25 amp	6 v/250 amp hour	56 100 622 Gray
	56 388 502	115 v/60 Hz	36 vDC/25 amp	6 v/305 amp hour	56 100 622 Gray
Convertamatic Trac™ 380*, 385LX* &	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 385HD*					
Convertamatic™ 38BD* &	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/195 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 380BHD*	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/225 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101*	115 v/60 Hz	36 vDC/20 amp	6 v/244 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 2800 & 2800C	56 412 272	115 v/60 Hz	24 vDC/36 amp	6 v/395 amp hour	56 100 621 Red
Hydro-Retriever™ 3200 & 3200C	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Gray
	56 388 502	115 v/60 Hz	36 vDC/25 amp	6 v/250 amp hour	56 100 622 Gray
	56 388 502	115 v/60 Hz	36 vDC/25 amp	6 v/305 amp hour	56 100 622 Gray
	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Gray

* No longer in production.

† Part numbers 372 947, 395 101, 206 980, 206 981, 388 109, 388 502, 388 120 are listed by a U.S. and a Canadian testing laboratory such as UL, ETL or CSA.

U.S. & Canadian Chargers

MACHINE USED WITH	PN †	INPUT RATING	OUTPUT RATING	BATTERY RATING	PLUG
Hydro-Retriever™ 3800	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Brad Harrison-Grey
All Models	56 409 788	200-220 or 221-250v/50-60 Hz	36 vDC/38 amp	12 v/370 amp hour	56 100 622 Brad Harrison-Grey
	56 409 788	200-220 or 221-250 v/50-60 Hz	36 vDC/38 amp	36 v/370 amp hour	56 100 622 Brad Harrison-Grey
	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Gray
	56 388 788	230 v/60 Hz	36 vDC/38 amp	12 v/450 amp hour	56 100 622 Gray
	56 388 788	230 v/60 Hz	36 vDC/38 amp	36 v/450 amp hour	56 100 622 Gray
Hydro-Retriever™ 2052B, 2052BHM	56 448 135	208-240-480 v/60 Hz	36 vDC/90 amp	36 v/475 amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 5000B*, 5010B*, BHM*	56 448 135	208-240-480 v/60 Hz	36 vDC/90 amp	36 v/475amp hour	56 100 622 Brad Harrison-Grey
Hydro-Retriever™ 5015B*, BHM II*	56 448 135	208-240-480 v/60 Hz	36 vDC/90 amp	36 v/475 amp hour	56 100 622 Brad Harrison-Grey
Sprite Battery Air Scoop™ 12*	56 205 983	115 v/60 Hz	24 vDC/12 amp	12 v/105 amp hour	56 56 324 305 Anderson-Red
Retriever™ SW 700B	56 411643	115 v/60 Hz	12 vDC/20 amp	6v/238 amp hour	56 026 573 sm Gray
Retriever™ SW 850B	56 411643	115 v/60 Hz	12 vDC/20 amp	6 v/238 amp hour	56 026 573 sm Gray
Retriever™ 134B	56 205 983	115 v/60 Hz	24 vDC/12 amp	12 v/105 amp hour	56 324 305 Red
Retriever™ 300B* &	56 411 058	115 v/60 Hz	12 vDC/10 amp	12 v/105 amp hour	(56 411 089 cord) Anderson SB50-Grey
Retriever™ 350B*	56 411 643	115 v/60 Hz	12 vDC/20 amp	6 v/195 amp hour	(56 411 654 cord) Anderson SB50 -Grey
Roamer™ 320B*	56 372 947	115 V/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
Retriever™ 360B*	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
Retriever™ 3600*	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/225 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947*	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
SR 1000B	56 638 431	115 v/60 Hz	24 vDC/20 amp	12 v/130 amp hour	56 324 305 sm Red
SR 1005B	56 638 431	115 v/60 Hz	24 vDC/20 amp	12 v/130 amp hour	56 324 305 sm Red
SR 1100B	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Red
SR 1100ECO#	56 205 983	115 v/60 Hz	24 vDC/12 amp	12 v/85 amp hour	56 324 305 sm Red
SR 1300B	56 388 109	115 v/60 Hz	24 vDC/25 amp	6 v/305 amp hour	56 100 621 Red
SR 1300ECO#	56 205 983	115 v/60 Hz	24 vDC/12 amp	12 v/105 amp hour	56 324 305 sm Red
Retriever™ 4000B*	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/195 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/238 amp hour	56 100 621 Brad Harrison-Red
	56 372 947	115 v/60 Hz	24 vDC/20 amp	6 v/244 amp hour	56 100 621 Brad Harrison-Red
Retriever™ 4600B	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/305 amp hour	56 100 622 Brad Harrison-Grey
	56 388 120*	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Brad Harrison-Grey
Retriever™ 5800B	56 448 135	208-240-480 v/60 Hz	36 vDC/90 amp	36 v/655 amp hour	56 100 622 Brad Harrison-Grey
Whirlamatic™ 2000B*/2500*	56 395 101	115 v/60 Hz	36 vDC/20 amp	12 v/185 amp hour	56 100 622 Brad Harrison-Grey
Whirlamatic™ 20UHSBD* &	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/220 amp hour	56 100 622 Brad Harrison-Grey
Whirlamatic™ 20UHSB/VS20	56 395 101	115 v/60 Hz	36 vDC/20 amp	6 v/238 amp hour	56 100 622 Brad Harrison-Grey
Whirlamatic™ T2000*	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395 amp hour	56 100 622 Brad Harrison-Grey
Whirlamatic™ 2700	56 388 120	115 v/60 Hz	36 vDC/36 amp	6 v/395amp hour	56 100 622 Brad Harrison-Grey

* No longer in production.

Note: This machine also needs adapter plug assembly PN 56324307 to connect the charger to machine battery connection.

† Part numbers 372 947, 395 101, 206 980, 206 981, 388 109, 388 502, 388 120 are listed by a U.S. and a Canadian testing laboratory such as UL, ETL or CSA.

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