

## STATE-OF-THE-ART, COMPUTERIZED TESTING EQUIPMENT



*Armature Tester*

### ***DID YOU KNOW...***

**You have a better chance at winning a lottery than you have of receiving an ARCO unit that doesn't perform!**

**EVERY ARCO unit is load tested with state-of-the-art testing equipment.**



*Permanent Magnet Motor Load Tester*



*Wire Wound Motor Load Tester*

We have invested over a million dollars in fully automated computerized testing equipment for our inboard starters, outboard starters and tilt/trim motors. Each and every unit is tested for performance beyond its normal operating condition. The testers pictured above are specifically designed for testing inboard and outboard starters and are just three of five different testers we have in use today. We also have one designed for testing tilt/trim motors and another for testing hydraulic pump assemblies.

Most manufacturers only perform spot tests or a free run only test. It is impossible to know that every unit is performing to specification without performing an extensive load test on every unit. It is very expensive to test each and every unit, however, our goal is to supply you with the highest quality unit possible at a reasonable price.

After completion of a thorough test procedure, detailed test results are displayed. The tests are so complete that even the resistance of the solenoid contacts are shown on the report. Armature ripple is also shown along with a performance curve. If a unit fails to perform to specification it is rejected and is sent to our quality assurance department for inspection.

**We call this  
VALUE!**

**The next time you install an ARCO part you can have confidence that the part will perform to O.E.M. specifications.**

## IMPORTANT BATTERY FACTS

A good battery can provide four or five years of worry-free service with the right kind of care.

**Bigger is better!** The battery you are replacing does not have to be the same size as the original. **IT IS ALWAYS BETTER TO HAVE EXTRA BATTERY CAPACITY.**

### POINTS TO REMEMBER

-  **The battery is the heart of the electrical system**
-  **Always start troubleshooting at the battery**
-  **Never store a battery in a discharged state**
-  **Never add anything except distilled water to a battery**



### DRY CHARGED BATTERIES MUST BE CHARGED BEFORE USING

Many small batteries are supplied with the electrolyte in a separate container. If you have to fill a new battery with electrolyte, **YOU MUST PLACE THE BATTERY ON A QUICK CHARGER.** The charging system will never bring the battery to a fully charged state. **THE BATTERY CAPACITY WILL NEVER BE ABOVE 80%.** Pulling the battery out later and trying to charge it will not work. **THE BATTERY'S CAPACITY HAS BEEN PERMANENTLY CUT BY 20% AND THERE IS NOTHING YOU CAN DO ABOUT IT.**

### BATTERIES WILL SELF DISCHARGE WHEN STORED

Batteries will self discharge when stored for long periods of time. This is a normal process with all lead acid batteries. **Always charge the battery to full charge before storing.** Also disconnect the negative battery cable. This will keep the small system drains from accelerating the discharge process. The best way to avoid shortened battery life is **use a SMART CHARGER (not a trickle charger)** on the battery when it's not being used. A smart charger is a charging device that will maintain the battery at a full state of charge by only charging the battery when the voltage drops to a specified level without overcharging.



### ELECTROLYTE BECOMES WATER IN A DISCHARGED BATTERY



As a battery becomes discharged the percentage of sulfuric acid in the electrolyte becomes less. The sulfuric acid combines with the lead plates producing lead sulfate. As this happens **the electrolyte solution becomes pure water.** A discharged battery will freeze in cold climates, which will destroy the insulators and plates inside it.

### LOOSE BATTERY TERMINAL ENDS CAN DESTROY A BATTERY

Loose or corroded battery cable lugs can cause all sorts of problems. When the starter is engaged the loose or corroded connection can cause a heavy arc which will melt the post right out of the battery. If the battery is gassing, the arc can cause the battery to explode. Never use the temporary type battery ends. These are only good for emergency use and will become corroded in a short period of time. **Always use a crimped and sealed battery cable end or replace the battery cable.**



Make sure there is a gap between the ends of the terminal when tight.



## BATTERY TESTING PROCEDURES

**WARNING!** Batteries give off hydrogen gas constantly. Hydrogen gas is highly explosive. Always wear safety glasses or goggles and use caution when working with batteries.

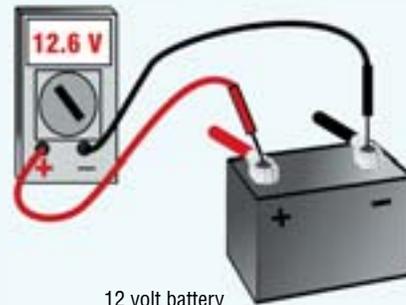
### OPEN CIRCUIT VOLTAGE TEST

**Before you can properly test any battery it must be at FULL CHARGE.**

You can verify the state of charge with the use of a **digital multimeter**.

Connect the digital multimeter to the battery terminals. A fully charged 12 volt battery will read at least 12.6 volts (2.1 volts per cell) on the multimeter. **If your reading is 12.4 OR BELOW you must recharge the battery before testing.**

| Open Circuit Volts | Percent of Charge |
|--------------------|-------------------|
| 11.7 volts or less | 0%                |
| 12.0               | 25%               |
| 12.2               | 50%               |
| 12.4               | 75%               |
| 12.6 or more       | 100%              |



12 volt battery

### LOAD TESTING THE BATTERY

**Before you can properly test any battery it must be at FULL CHARGE.**

The only way you can thoroughly test a battery is to place a high amperage load across the battery terminals.

**Starter motors have very high amperage requirements which can exceed 300 amps on certain engine applications.** If the battery has to be recharged you must first remove the surface charge. This can be done by using the starter. Disable the ignition spark (consult manufacturer's method to avoid electronic ignition) and crank the engine for 10-15 seconds. Once you have removed the surface charge, disconnect the battery cables and connect the battery load tester to the battery posts.

**Determine the cold cranking amperage rating of the battery you are testing.  
If the cold cranking amp rating (CCA) is not known, use 450 CCA for four cylinder engines,  
550 CCA for six cylinder engines and 650 CCA for V-8 engines.**

Adjust current draw on the load tester to 50% of the CCA rating. Continue this for 15 seconds while viewing the voltage reading on the battery tester. The voltage should stay above the specified reading (see chart below) without falling off. If the voltage remains at the specified level or above, the battery would be considered good. If the voltage reading drops below the specified level, replace the battery.

| Load Test Chart |                       |               |
|-----------------|-----------------------|---------------|
| Minimum Voltage | Temperature (degrees) |               |
| 9.6             | 70 F                  | 21C and above |
| 9.5             | 60F                   | 16C           |
| 9.4             | 50F                   | 10C           |
| 9.3             | 40F                   | -1C           |
| 9.1             | 30F                   | -7C           |
| 8.9             | 20F                   | -12C          |
| 8.7             | 10F                   | -18C          |
| 8.5             | 0F                    | -18C          |



*Tech Tip*

**Rust, Corrosion or Submersions are NOT COVERED BY WARRANTY**

## The best offense is a great defense

Moisture is the number one “killer” of marine starters. That is why, from start to finish, we design and manufacture our starters with corrosion protection in mind. In fact, over three million dollars has been invested in totally computerized production and testing machinery. Follow along as we show you how we not only go to war against corrosion, but build quality into each and every **ARCO** part.

First, we start with nickel-plated armature shafts and silicon steel lamination stacks. Add a layer of powder coating, the best insulation and corrosion preventative available, and you are ahead in the battle.

Next, the commutator is attached, computer-wound copper windings are added, and a ground fault test is made on each armature. Strategic testing during the early stages of assembly is an essential maneuver for uncovering and correcting potential weaknesses. The commutator tabs are then crimped and hot stacked. On the lathe, the commutator face is smoothed and polished ensuring the brushes run as friction-free as possible. A computerized 18 point armature check is made at this time.

Now the armature goes onto our automated, state-of-the-art assembly line. The first stop is the polyester trickle varnish “carousel”. The varnish not only assists in holding the windings in place during peak performance, but also dissipates heat—another of the starter’s enemies. Moving along, the armatures are now inserted into the epoxy coated shell. The shells have been previously prepared with high performance magnets bonded to the interior. Nuts, bolts, gaskets, a spring, drive gear, brush kit and end cap are added to complete the assembly of the starter. The high performance magnets are now fully charged. Last, but not least, a computerized full load performance test is conducted on each and every starter. Only by passing this final inspection is an **ARCO** starter certified as ready for battle.

