

***Maintenance of a generator set's starter battery is critical to ensuring sufficient ampere capacity to start the engine. As a precaution generator users routinely change out the batteries every 2 years.***

**The importance of battery maintenance:** EGSA and other bodies associated with generator set standards report about half of emergency generator set failures are due to battery problems. Choosing the correct battery and maintaining it properly can prevent the majority of battery failures.

*Consult IEEE standards for battery sizing and installation before choosing a battery.*

**Battery condition indicators:** The following are key signs of existing or pending battery failure:

**Local action:** A slow chemical reaction between a battery's plates and trace impurities will slowly discharge a standing battery. Manufacturers recommend charging any wet lead batteries shipped three months before installation and any NiCd batteries shipped 12 months earlier. Battery chargers should be connected to standby generator set to maintain a minimum float charge that compensates for local action discharges.

**Cell voltage:** Cell voltage is critical to correct battery operation. Any deterioration from recommended levels in any cell should be recorded and tracked on battery maintenance charts. Just one cell with low voltage will drop overall battery voltage, which can harm equipment and result in too little power to start an engine.

**Cell balance:** One cell that fails to charge equally with others also indicates a problem. An undercharging will cause gradual sulfation of negative plates and reduce battery life or capacity of lead acid batteries. Overcharging corrodes the grids of the positive plates. NiCd batteries are not affected like lead acid batteries.

**Specific gravity (SG):** SG indicates electrolyte weight. Heavier electrolyte means a heavier charge. Low SG indicates plate sulfation, cell deterioration and reduced battery capacity.

**Water use:** All batteries other than valve regulated types use water. Using the maintenance chart to track the rate at which water is added will identify excessive use. Reasons for any increased usage must be identified.

**Battery connections:** Terminal connections over time can loosen causing excessive heat.

**Dirty battery:** Dirt on the top of the battery can lead to conductivity between the poles. Dirt will also mask other problems such as leakage and loose connections.

**Reduced capacity:** Reduced capacity will degrade a battery's ability to crank the engine during start.

**Tests and checks to maintain correct battery operation:** Maintenance schedules (Chart 1) should carry out the following checks and tests to ensure the battery remains within the required specifications:

**Reading specific gravity:** SG levels are tested with a hydrometer. Levels normally are an SG of 1.265 at 80°F which means 1.265 times that of water, but exact levels should be confirmed with the battery supplier. Before testing the battery has to be rested with no charge or discharge for 24 hours. (Chart 3)

After removing the cell vents, a hydrometer is inserted to draw liquid into the syringe several times until enough liquid is withdrawn to support the float and take a reading. This ensures the float has a uniform electrolyte temperature for a more accurate reading. The electrolyte is returned to the cell after a reading is taken. This is repeated for each cell.

*Cell-to-cell differences of no more than 30 points can be adjusted by equalization. However, differences of more than 50 points indicate a bad battery. The battery should be charged if SG is below 1.215 at 80°F.*

**Equalize charge:** This position on the charger ensures that every plate in each cell reaches a full state of charge. *Equalizing charging is not recommended to be used on a routine basis.*

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**Battery capacity testing:** Before testing, fully charge the battery. Use a resistive battery tester to place a load of about 5% of battery capacity. Attach the tester's clamps to the battery terminals. The battery can be tested while connected, but each battery should be tested individually. All loads and charger inputs should be shut off. After closing the tester's toggle switch, the voltmeter should fall slightly for a few seconds.

However, if the tester reads close to battery voltage at no load but drops significantly when the load is applied, it is a strong indication the battery needs replacing.

**Electrolyte level:** Visually check the fluid level in each battery cell. Fluids should never be allowed to fall below the top level of the separator. If the level is low, add distilled water to cover the plates.

**Connections:** Make sure all cable connections are tight. A thermal image tool will show whether heat is being generated by a poor connection. Loose connections may affect starting.

**Visual check for corrosion and dirt:** Dirt can block current flow in connectors and cause resistance between terminals. Dirty or corroded terminals and connectors should be cleaned with a wire brush dipped in a solution of one pound of baking soda mixed with one gallon of water. After cleaning, rinse with clean water and coat terminals with a thin coat of petroleum jelly or a corrosion inhibitor.

**Leakages:** Visually check for leakages that could result from a cracked battery casing or spilled electrolyte. If the battery cannot be repaired, it should be replaced.

**Chart 1 - Typical Battery Maintenance Schedule for Diesel Generator Set**

Starter Battery Maintenance Items		Method of Checking and Action to Take					Frequency of Check
		Visual	Charge	Top up	Clean	Measure	
1	Specific gravity					X	Monthly
2	Equalize charge		X				Annually
3	Battery capacity test					X	Monthly
4	Electrolyte level	X		X			Weekly
5	Connections				X		Monthly
6	Clean battery surfaces	X			X		Monthly
7	Leakages and spillage	X					Weekly
8	Battery charger	X					Weekly

**Chart 2 - State of Charge vs Open Circuit Voltage**

State of charge Level	Voltage	
	12 V Battery	6 V Battery
100%	12.65	6.32
75%	12.45	6.21
50%	12.24	6.12
25%	12.06	6.02
Discharged	11.89	5.93

Compare these voltage standards with the open circuit voltages recorded with a resistive battery tester.

*(The chart assumes a fully charged specific gravity of 1.265)*

If tests of a fully charged battery give lower voltage readings than these, the battery should be further tested by a battery specialist.

**Chart 3- Specific Gravity Temperature Correction**

